APPENDIX H

Screening Level Ecological Risk Assessment

Mashapaug Cove
333 Adelaide Avenue
Providence, RI

Prepared by MACTEC

July 2006

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1.0 INTRODUCTION

This Screening Level Ecological Risk Assessment (SLERA) evaluates Mashapaug Cove as required by the April 5, 2006 Amended Notice of Responsibility issued by the Rhode Island Department of Environmental Management (RIDEM) to Textron, Inc. and the City of Providence (RIDEM, 2006). The Amended Notice of Responsibility requires that a Site Investigation Report (SIR) be prepared for Mashapaug Cove. The ecological risk assessment is a component of the Supplemental SIR (MACTEC, 2006).

This SLERA is being performed in accordance with the following regulations and guidelines:

- Rhode Island Department of Environmental Management Remediation Regulations, as amended, February 2004
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006. June 1997
- Framework for Ecological Risk Assessment. EPA-630-R-92-001. February, 1992
- Guidance for Ecological Risk Assessment. EPA-630-R-95-002F. April, 1998

This SLERA addresses surface water and sediment within Mashapaug Cove.
In accordance with §8.05 of the Rhode Island Remediation Regulation (RIDEM, 2004) and following the definition of "environmentally sensitive areas" in §3.16, this SLERA does not evaluate soil in upland areas surrounding the Cove. These upland areas are not "environmentally sensitive areas" for which an ecological risk assessment would be required.

As described in the 1997 USEPA Guidance, the purpose of the SLERA is to identify all complete exposure pathways and to conduct a conservative assessment of all chemicals of potential concern (COPCs), and carry to a Baseline Ecological Risk Assessment

(BERA) only those site related chemicals for which risk cannot be ruled out. The results of the SLERA are used to determine whether the available information is adequate to make risk management decisions. Based on the SLERA, it may be concluded either:

- There is a negligible ecological risk and therefore the Site or components of the site require no further study
- There is (or might be) a risk of adverse ecological effects, and the ecological risk assessment process will continue with a baseline ecological risk assessment
- The information is not adequate to make a decision, but the ecological assessment process will continue.

Thus, in accordance with the 1997 USEPA guidance, this SLERA:

- Summarizes site data
- Characterizes the site conditions
- Provides screening level problem formulation, screening level effects evaluation, exposure estimate, and risk calculation
- Identifies which contaminants found at the site can be eliminated from further consideration and which should be evaluated further, as part of a BERA

2.0 PROBLEM FORMULATION

2.1 Site Background

The former Gorham Manufacturing Facility is situated on a 37 acre parcel at 333 Adelaide Avenue in Providence, Rhode Island (Figure 1) Between 1890 and 1986, sterling silver and plated silverware, as well as bronze castings, were manufactured on-site. Operations including casting, rolling, polishing, lacquering, forging, plating, annealing, soldering, degreasing, machining, and melting.

The former manufacturing facility has been improved with a retail complex on Parcel A, a high school is under construction on Parcel B, and the Greater Providence YMCA is planning to construct a facility on Parcel C. The former manufacturing site is bordered by a parking lot and supermarket to the east and Adelaide Avenue and a residential neighborhood to the south. The 333 Adelaide Avenue property slopes downward toward Mashapaug Cove and Mashapaug Pond. Figure 2 shows the location of Mashapaug Cove.

The 2006 Amended Notice of Responsibility requires an assessment of Mashapaug Cove. Mashapaug Cove has an area slightly larger than four acres and is within the property line of 333 Adelaide Avenue as shown on Figure 2. The southern half of Mashapaug Cove is herein referred to as the Inner Cove and the northern half up to the property line referred to as the Outer Cove. Mashapaug Cove is located in the northeast corner of Mashapaug Pond.

2.2 Environmental Setting

2.2.1 Methodology

On June 20, 2006, a MACTEC biologist visited the Cove to conduct a reconnaissance level habitat assessment. The habitat assessment occurred following a prolonged period of rain thus recorded observations reflect high water conditions. Wetland and shore-line habitats were qualitatively characterized in terms of their dominant plant species, vegetative strata, presence of invasive species, and presence of human disturbance or alteration. During the field visit, mammals, birds, herpetiles, and benthic organisms observed by direct observation (sight) or sign were recorded. Along the Cove shoreline, a dip net was used to collect aquatic macroinvertebrates from sediment and from habitat provided by submerged plants and logs. Specimens were sorted and identified in the field down to the lowest possible taxa.

2.2.2 Natural Communities and Wildlife

Terrestrial Shoreline. The shoreline along the Cove is characterized by a deciduous woodland community. The tree canopy is dominated by black birch (*Betula lenta*) and red maple (*Acer rubrum*), and also contains cottonwood (*Populus deltoides*), grey birch (*Betula populifolia*), oak (*Quercus* sp.), black locust (*Robinia pseudoacacia*), catalpa (*Catalpa* sp.), and mulberry (*Morus* sp.). The tree canopy reaches approximately 30 feet in height, and provides 100 percent cover. The largest trees have a diameter at breast height (dbh) of approximately 7 inches. The shrub slayer is dominated by poison ivy (*Toxicodendron radicans*), highbush blueberry (*Vaccinium corymbosum*), lowbush blueberry (*Vaccinium angustifolium*), greenbrier (*Smilax rotundifolia*), arrowwood (*Vibermun dentatum*), mountain laurel (*Kalmia latifolia*), honeysuckle (*Lonicera japonica*), and knotweed (*Polygonum cuspidatum*). The herbaceous layer is dominated by poison ivy, with frequent occurrences of Japanese barberry (*Berberis thunbergii*) and sweet-pepper bush (*Clethra alnifoliaea*). Although vegetation along the shoreline is relatively dense, there are occasional small breaks which give direct access to the water.

Tree cavities, logs, brush piles, and pond overhangs provide nesting and perching habitat for redwing blackbirds (*Agelaius phoeniceus*), black capped chickadee (*Poecile atricapillus*), goldfinch (*Carduelis tristis)*, and mourning doves (*Zenaida macroura*), which were observed on-site. A pair of swans (*Cygnus* sp.) were observed nesting on the western peninsula. Raccoon (*Procyon lotor*) tracks were also observed along the shoreline and eastern grey squirrels (*Sciurus carolinensis*) were observed in the woods.

Topography along the western peninsula slopes up gently from the water's edge, rising to approximately 5 feet above the high water line. Topography along the eastern side of the

Cove is steeper, with a hill rising approximately thirty feet to overlook the Cove and Pond. Soil is covered by a thin organic leafy layer less than 1 cm in thickness. Soil is sandy, and is classified by the Natural Resource Conservation Service (NRCS) as Hinckley gravelly sandy loam (HkC). This soil series is excessively drained soil occurring on terraces, outwash plains, kames, and eskers. Typically the surface layer is dark brown gravelly sandy loam about 6 inches thick. The subsoil is 11 inches thick; the upper 4 inches of the subsoil is yellowish brown gravelly sandy loam, and the lower 7 inches is light yellowish brown gravelly loamy sand. The substratum is light brownish gray very gravelly sand to a depth of 60 inches or more (NRCS, 2006). The permeability of this soil is rapid in the surface layer and subsoil and very rapid in the substratum. Available water capacity is low, and runoff is slow. The soil is extremely acid through medium acid (NRCS, 2006).

Portions of the shoreline habitat show signs of anthropogenic disturbance, but there are no visible signs of plant stress. Exotic invasive plants species, such as honeysuckle, barberry, and knotweed are common within the terrestrial shoreline community. The nesting swans are also exotic and invasive species. The ground surface is heavily littered. Approximately five concrete structures (former groundwater wells) occur near the pond. The shoreline habitat is segmented by an overgrown or abandoned dirt road/pathway adjacent to the Cove perimeter along the western shoreline. Bordering the terrestrial shoreline community to the south is a shopping mall parking lot.

Groundwater beneath the terrestrial area is classified by RIDEM as GB. GB groundwater is designated to be not suitable for public or private drinking water use. GB groundwater areas are typically located beneath highly urbanized areas, permanent waste disposal areas, and the area immediately surrounding the permanent waste disposal areas (RIDEM, 1996 cited in Fuss & O'Neil, 2006).

<u>Aquatic community</u>. The Cove consists largely of open water, approximately 4 acres in area, and is characterized as eutrophic. At the time of the habitat survey water temperature was 26 C and the water column was turbid with visibility to approximately

1-foot depth. There are no emergent plant communities except very close to shore during periods of floods or high water when the waterline rises to encompass terrestrial shoreline plants. Rooted vegetation, consisting of water lilies (*Nymphaea odorata*), were observed in several groupings within the Cove. Submerged logs and branches also create habitat stratification suitable for fish cover. In the summer, massive amounts of rooted and floating aquatic vegetation choke the water column.

Substrate along the shoreline is typically sand with trace gravel overlain by a thin (less than 1 inch) detrital layer. Water boatmen (*Cymatia* sp.), backswimmers (*Notonecta* sp.), and water striders (*Limnogonus fossarum*) were observed in the water column. Dragon fly and damselfly larvae (Odonata), amphipods, and oligocheates were identified in dip net samples collected from substrate in sandier areas. Amphipods, leaches, chironomids, and dragonfly larva were observed in the center of the shoreline among rooted vegetation and thicker detrital layer. Away from the shoreline but still within the Inner Cove the substrate is an organic silt layer approximately 3 feet deep.

Juvenile fish were observed along the shoreline but could not be identified, and fish observed jumping in the center of the Cove were tentatively identified as carp. No amphibians were observed and none were heard calling. Mallard ducks, as well as one of the nesting pairs of swans were observed foraging within the Cove.

Water depth in the Cove appears to be shallower than in the rest of the pond. Bathymetric data collected in June 2006 (MACTEC, 2006) show that within the Inner Cove, water depth averages between 3 feet and 3.5 feet under high water conditions (Figure 3). In the Outer Cove, water depth increases to approximately 10 feet to 11 feet in the vicinity of the property line.

Mashapaug Pond has been classified as Class B surface water (RIDEM, 2006). Class B waters are designated for fish and wildlife habitat and primary and secondary contact recreational activities. They should be suitable for compatible industrial process and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters should have good aesthetic value.

2.2.3 Threatened and Endangered Species

The RIDEM Geographic Data Viewer was used to determine the presence of rare species habitat. Based on the available maps, no rare species habitat were identified in the vicinity of the project site.

2.3 Exposure Pathways

Investigations of the former Gorham Manufacturing Facility and the remainder of the property at 333 Adelaide Avenue have identified evidence of releases of hazardous materials to soils and groundwater. Many of the sources have been addressed though remedial actions, and no longer represent a source from which hazardous material could migrate.

The 1995 RI Report indicated that six categories of release, or potential release had been identified. These include: oil from removed and out-of-service underground storage tanks (USTs); volatile organic compounds (VOCs) in soil and groundwater from above-ground storage tanks (ASTs), production activities (particularly in the areas of Buildings W and T), or incidental disposal; fill material of the West Parking and North Bank Areas; surface soils containing PCBs near the transformer pad and Building N; releases of oil from machines to building basements; and possible contaminants conveyed from the site in stormwater runoff. Subsequent to the RI Report, an additional source was identified; a slag pile located immediately south of Mashapaug Cove appears to have been accumulated from smelter operations that were performed in Building V of the former facility. The slag pile consisted of very dense, metals-containing solid material that was present in chunks ranging in diameter between one inch and ten inches. The slag pile was excavated and removed from the property in July 2006.

Bronze casting, silverware manufacturing, and plating activities have resulted releases of metals (especially lead and copper) to soils on Parcels A, B, and C. Chlorinated VOCs have been detected in groundwater in the areas of former Buildings W and T. The Building W area is a probable source area for tetrachloroethylene (PCE) in groundwater. However, the specific source or point of release of PCE in the vadose zone soil or in the shallow groundwater has not been identified. Free floating product (fuel oil) and petroleum contaminated soils were identified at the former location of the two former 19,000-gallon USTs.

The specific source of the dioxins and furans is not known. However, the distribution of dioxin and furan homolog groups in soil and sediment appears to be consistent with the signature associated with municipal waste incineration (MACTEC, 2006).

Investigations to date indicate that metals and polycyclic aromatic hydrocarbons (PAHs) and other persistent materials in surficial soils and fill material have the potential to migrate with soil material via overland flow during and immediately after precipitation events. It appears that historically and recently, soils from the former facility area and along the filled area immediately to the south of Mashapaug Cove have been subjected to this mechanism and a number of drainage swales have been identified between the higher elevation former facility area and the shoreline of Mashapaug Cove. Leachate containing metals from the former slag pile might have discharged directly into the Cove, or it may have first infiltrated into groundwater and been subsequently transported into the Cove.

There is a plume of chlorinated VOCs in groundwater which flows in a northerly direction from the higher elevation former facility area in the direction of Mashapaug Cove. The groundwater appears to discharge into Mashapaug Cove, passing through the sediments of the cove in the process. Available data indicate that minimal transfer of chlorinated VOCs from groundwater to surface water is occurring. The available sediment quality data suggest that the highly organic sediments of the Cove may be acting as a sink for VOCs in groundwater that passes through the sediment. This has not been confirmed, and direct historical discharge of VOC-containing materials to the Cove has also not been ruled out as a possible explanation of sediment quality.

2.4 Historical Investigations and Data Used in the SLERA

The Supplemental Site Investigation Report (MACTEC, 2006) provides a full description of historical site investigations as well as recent (2005 and 2006) investigations of the Cove. Data used in the SLERA are summarized below, and sampling locations are shown on Figure 2.

Five sediment locations (SD-1001 through SD-1005) were sampled by RIDEM in December 2005. Samples were analyzed for priority pollutant metals plus barium (Method 6010B/7470A), pesticides (Method 8081A), PCBs (Method 8082), total petroleum hydrocarbons (TPH) (Method 8100), VOCs (Method 8260B), SVOCs (Method 8270C), dioxins and furans (Method 8290), and total cyanide (Method 9012A). Samples were collected from the 0-foot to 2-foot sediment interval. Data were validated using a modified Tier II protocol. Metals, some VOCs (acetone, 1,1-dichloroethene, cis-1,2-dichloroethene, naphthalene, 1,1,1,2-trichloroethane, trichloroethylene (TCE), and vinyl chloride), PAHs (acenapthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, di-n-butylphthalate, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene), and dioxins and furans were detected in the RIDEM sediment samples.

Supplemental SI surface water and sediment samples were collected by MACTEC from the Cove and along the property line in June 2006 (locations SED-10 through SED-32 and SW-10 through SW-27). Surface water samples were analyzed for VOCs (Method 8260b), PAHs (Method 8270c; 3 samples), total and dissolved Priority Pollutant Metals (Methods 6010B, 7041, 7060a, 7421, and 7470A), dioxins and furans (Method 8290; 3 samples), pesticides/PCBs (Method 8081A/8082; 3 samples), and hardness (Method 6010B). Chemicals identified in surface water included trace VOCs, trace PAHs, trace pesticides, and dioxins. No metals were detected in the filtered samples; chromium, copper, lead, silver, and zinc were detected in trace amounts in the unfiltered samples.

Supplemental SI surficial sediment samples were analyzed for VOCs (Method 8260b), PAHs (Method 8270c), priority pollutant metals (Methods 6010B, 7060a, SW7471a, and 7841), dioxins and furans (Method 8290), pesticides/PCBs (Method 8081A/8082), TPH (Method M8100), AVS-SEM (Allen and Fu), and total organic carbon (TOC) (Method 9060). Deeper sediment samples were analyzed for VOCs, PAHs, and priority pollutant metals. Chemicals identified in sediments included VOCs, PAHs, metals, trace pesticides, trace PCBs, dioxins, and metals, and were similar to chemicals identified in the RIDEM data set.

Supplemental SI and RIDEM samples described above were pooled for evaluation in this SLERA. Historical data collected by HLA (now MACTEC) in 1999 and the University of Rhode Island (URI) in 1986 were not included in the SLERA because they may not be representative of current site conditions. Data from sediment samples collected in the Cove by Mr. Robert Dorr in 2005 were also not included in the SLERA. However, the Supplemental SI data appear to be consistent with data from Mr. Dorr's samples.

2.5 Ecotoxicity

Toxicological profiles of the families of compounds subject to evaluation in this SLERA (VOCs, SVOCs, metals, and dioxins and furans) are summarized in Attachment A.

2.6 Initial Ecological Conceptual Model

The initial ecological conceptual model illustrates initial estimates of contaminant fate and transport mechanisms, complete exposure pathways, and primary and secondary receptors. Generic assessment and measurement endpoints were used, as discussed in Section 2.7. The initial ecological conceptual model is based on the current understanding of the site conditions, and serves as a framework for evaluating ecological exposure and risk.

The initial ecological conceptual model for the site is shown in Figure 4 and illustrates:

- The source area (i.e. the former facility area and potentially the slag pile)

- Transport mechanisms (processes that partition chemicals among various environmental media or move chemicals within a medium)

- Exposure to media (those environmental media from which organisms may be exposed to chemicals).

Based on site information, it appears complete exposure pathways exist for organisms inhabiting surface water and sediment habitats in Mashapaug Cove. Fauna feeding on aquatic plants, benthic macroinvertebrates, and fish may also be exposed.

2.7 Assessment and Measurement Endpoints

Endpoints are used in the ecological risk assessment to define the ecological attributes to be protected (assessment endpoints) and to define measurable characteristics of those attributes that can be used to gauge the degree of impact that may occur (measurement endpoints). Assessment endpoints most often relate to attributes of biological populations or communities. They contain an entity (e.g., invertebrate population) and an attribute of that entity (e.g., survival rate).

Assessment endpoints for the SLERA are based on generic assessment endpoints associated with screening ecotoxicity endpoints. The endpoints are considered generic because they are based on a variety of organisms and are therefore considered to be representative of entire communities.

Assessment and measurement endpoints for the SLERA are:

SLERA Assessment and Measurement Endpoints

Assessment Endpoint	Measurement Endpoint
Sustainability (survival, growth, reproduction) of local populations of aquatic organisms (e.g. aquatic plants, invertebrates, fish, aquatic birds and mammals) in surface water	Comparison of surface water concentrations to surface water quality benchmarks
Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates in sediment	Comparison of sediment concentrations to sediment quality benchmarks

3.0 SCREENING BENCHMARKS

Screening benchmarks (also called screening values or benchmark values) represent conservative thresholds for adverse ecological effects. Screening values were based on conservative assumptions and represent no-observed-adverse-effect-levels (NOAELs) for chronic exposures to a toxicant when available. The screening level assessment used ecotoxicological screening benchmarks from various sources to assess the potential for ecological risk due to exposure of receptors in surface water, and sediment.

3.1 Surface Water Screening Criteria

Surface water benchmarks are summarized in Table 3.1. The following sources were used in the order presented as benchmarks for screening surface water for potential ecotoxicity:

- Rhode Island Ambient Water Quality Criteria (RI AWQC) (RIDEM, 2006)
- National Ambient Water Quality Criteria (NAWQC) (USEPA, 2002; 2004)
- Secondary Chronic Values (SCVs) for aquatic biota developed by Oak Ridge National Laboratory (Suter & Tsao, 1996)
- USEPA Region V Ecological Screening Levels (USEPA, 2003a)

The RI AWQC are the preferred surface water benchmarks for aquatic organisms because they are based on single chemical chronic toxicity tests with numerous species. RI AWQC for arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc are published as dissolved metal concentrations because the dissolved fraction represents the most bioavailable form. Benchmarks for these metals were identified but were not used because these metals were not identified in filtered samples. RI AWQC for antimony, beryllium, selenium, and thallium are published as total concentrations. Because antimony, beryllium, selenium, and thallium were not detected in either the filtered or unfiltered samples, benchmarks for these metals were not used. Benchmarks for metals were therefore not presented on Table 3.1.

NAWQC were used for chemicals if RI AWQC were not identified. NAWQC are also based on single chemical chronic toxicity tests with numerous species.

Oak Ridge National Laboratory (ORNL) Secondary Chronic Values (SCVs) are derived using methods similar to the AWQC but using a fewer number of species. These are used only when no RI AWQC or NAWQC are available.

Ecological screening benchmarks were also selected from USEPA Region V Ecological Screening Levels (ESLs) for surface water (USEPA, 2003a). Region V ESLs are appropriate for screening because they are based on chronic no-observed-adverse-effect-levels (NOAELs).

3.2 Sediment Screening Criteria

Sediment benchmarks are summarized in Table 3.2. The following sources were used in the order presented as benchmarks for screening sediment for potential ecotoxicity:

- MacDonald *et al.* (2000) Threshold Effects Concentrations (TECs)
- Oak Ridge National Laboratory Tier II Secondary Chronic Screening Values (Jones, Suter, and Hull, 1997)
- Ontario Ministry of Environment and Energy (OMEE) Lowest Effects Levels (LELs) (Persaud *et al.*, 1993)
- Washington State Sediment Quality Values (SQVs) (Cubbage, *et al.*, 1997)
- USEPA Region V Ecological Screening Levels (USEPA, 2003a)

Threshold Effects Concentrations (TECs) are sediment quality assessment values that were developed using matching biological and chemical data (i.e. sediment chemistry and toxicity data provided for the same samples) from modeling, laboratory, and field studies performed with freshwater sediment throughout North America (MacDonald, 1994); MacDonald, *et al.*, 2000). The authors used the matching data to associate chemical concentrations in sediment with the absence or occurrence of adverse effects. They established an “effect” and “no effect” data set and based their derivation of the TECs on both of these datasets. The TECs represent chemical concentrations above which effects frequently occurred in the laboratory tests. TECs were derived for 8 metals, 10 PAHs, total PCBs, and 8 pesticides.

Oak Ridge National Laboratory (ORNL) developed sediment screening benchmarks for nonionic organics (such as acetone) called secondary chronic values (SCVs) which are protective of sediment communities. SCVs are normalized to 1% TOC.

Ontario Ministry of the Environmental (OMOE) Provincial Sediment Quality Guideline Lowest Effect Levels (LELs) indicate a level of sediment contaminant at which most benthic organisms are unaffected. OMOE benchmarks are also normalized to 1% TOC.

Washington State Sediment Quality Values (SQVs) for sediment were created based on toxicity studies used to derive probable apparent effects thresholds (PAETs). Test organisms conducted *Hyalella azteca*, a sensitive sediment receptor. WA SCVs are normalized to 1% TOC.

Ecological screening benchmarks were also selected from USEPA Region V Ecological Screening Levels (ESLs) for sediment (USEPA, 2003a). Region V ESLs are appropriate for screening because they are based on chronic no-observed-adverse-effect-levels (NOAELs).

4.0 SCREENING LEVEL EXPOSURE ESTIMATE AND RISK CALCULATION

For the SLERA, maximum detected concentrations of pooled Supplemental RI and RIDEM data were used as exposure point concentrations. Maximum concentrations were compared to medium-specific screening values for surface water and sediment. Analytes with a frequency of detection (FOD) of 5 percent or less (by exposure area and medium) were eliminated from further screening. Analytes with maximum concentrations exceeding benchmark screening values were identified as chemicals of potential concern

(COPCs). Analytes that did not have screening benchmarks were also identified as COPCs.

Calcium, magnesium, potassium, and sodium, which are nutrients and occur naturally at high concentrations and are not site related, were eliminated from further consideration.

The SLERA divided the Cove into two exposure areas in order to facilitate risk characterization. One exposure area, herein referred to as the Cove Study Area included the Inner Cove and the portion of the Outer Cove within the 333 Adelaide Avenue property boundary and consisted of sample locations SD-1001 though SD-1005, SED13 through SED32, and SW16 through SW27. The second exposure area consisted of sample locations near the property line (SW/SED-10, SW/SED-11, and SW/SED-12.) and is herein referred to as the Property Boundary Study Area.

4.1 Hazard Quotients

A hazard quotient (HQ) was used to calculate screening level risk estimate for each COPC:

$$\text{Hazard Quotient} = \frac{\text{Maximum Concentration}}{\text{Benchmark Value}} \qquad \text{(Equation 1)}$$

Table 4.1 through Table 4.4 summarize the screening process, present analytes which were identified as COPCs, and show the HQ calculated for each COPC. An HQ could not be calculated for COPCs which lacked benchmark values. An HQ less than or equal to 1 indicates that the analyte alone is unlikely to cause adverse ecological effects. However, an HQ > 1 does not in itself represent an unacceptable risk; an HQ >1 in the SLERA indicates the *potential* for adverse ecological risks. Other site-specific factors (e.g., bioavailability) present at the site may affect actual risk.

Because the screening-level risk calculation is meant to be a conservative estimate, the calculation assumes an area-use factor of 100 percent, bioavailability of 100 percent, that the exposed receptor life stage is the most sensitive stage, dietary composition is 100 percent, and that body weight and food ingestion rates are conservative.

4.2 Screening Results

4.2.1 Cove Study Area

Surface Water

One VOC (1,2,4-trimethyl benzene) was identified as a COPC because it lacked a benchmark (Table 4.1). Two SVOCs (benzo(a)anthracene and benzo(a)pyrene) were identified as COPCs because they exceeded benchmarks. The HQ for benzo(a)anthracene was 7 and the HQ for benzo(a)pyrene was 17. Two SVOCs (chrysene and dibenz(a,h)anthracene) were identified as COPCs because they lacked benchmarks. Dioxins were identified as COPCs using the TEQ calculation (see Section 4.3.3). No pesticides, PCBs, or dissolved or total metals were identified as COPCs in Cove Study Area surface water. Maximum detected concentrations generally occurred within the eastern part of the Inner Cove.

Sediment

Ten VOCs were identified as COPCs in the Inner Cove Study Area sediment because maximum concentrations exceeded benchmarks (Table 4.2); HQs for VOCs were generally 100 or more. One VOC (s-butylbenzene) was identified as a COPC because it lacked a benchmark. Seventeen PAHs were identified as COPCs in sediment because maximum concentrations exceeded benchmarks; HQs were generally between 10 and 100. One pesticide (DDD) and one PCB (Arcolor-1254) were identified as COPCs because maximum concentrations exceeded screening benchmarks. The HQ for DDD was 6 and the HQ for Aroclor-1254 was 9. Dioxins were identified as COPCs using the TEQ calculation (see Section 4.3.3). Nine inorganics were identified as COPCs because they exceeded benchmarks, and four were retained because they lacked benchmarks. HQs for inorganics were generally one order of magnitude above benchmarks. Maximum concentrations generally occurred within the eastern part of the Inner Cove, except dioxins for which maximum concentrations occurred most frequently at SD-18.

4.2.2 Property Line

Surface Water

No VOCs or SVOCs were detected in surface water samples collected from the Property Line Study Area and thus were not identified as COPCs (Table 4.3). DDT was identified as a COPC because it exceeded its screening benchmark (HQ=80). No total or dissolved metals were identified as surface water COPCs along the property line area. Dioxins were identified as COPCs using the TEQ calculation (see Section 4.3.3).

Sediment

One VOC (acetone) was identified as a COPC in sediment samples collected from the property line (Table 4.4) because it exceeded its benchmark; the HQ for acetone was 75. No other VOCs were detected in property line sediment samples. Thirteen PAHs were identified as COPCs because they exceeded benchmarks; HQs ranged from 1 to 6. DDD was identified as a COPC in property line sediment because it exceeded its benchmark, with an HQ of 4. No PCBs were detected in property line sediment samples. Dioxins were identified as COPCs using the TEQ calculation (see Section 4.3.3). Seven metals were identified as COPCs because they exceeded screening benchmarks; two metals were identified as COPCs because they lacked screening benchmarks. Inorganic HQs ranged between of 3 to 59. Maximum detections of PAHs occurred at SED12 and maximum detections of metals and most dioxins occurred at SD11.

4.3 Additional Evaluations

This section uses additional tools to evaluate COPCs. AVS-SEM data were evaluated to better understand bioavailability of metals in sediment. Bioavailability of PAHs was also further evaluated using the ΣPAH method. Dioxins and furans were evaluated using the toxicity equivalents (TEQ) calculation.

4.3.1 AVS-SEM

In June 2006, acid-volatile sulfide-simultaneously extractable metals (AVS-SEM) analysis was conducted for samples within Mashapaug Cove at locations SED15, SED20, SED22, SED24, and SED26 (USEPA, 2005; *Procedures for the Derivation of*

Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures).

The bioavailability of metals in sediment can significantly affect their potential toxicity to benthic organisms. Bioavailability of certain divalent metals (antimony, copper, lead, silver, and zinc) is influenced by the amount of sulfide contained within the substrate. If the amount of acid-volatile sulfide (AVS) exceeds the amount of simultaneously extracted metals (SEM), then the divalent metals are considered unavailable for leaching from the substrate into pore water or the overlying water column. The comparison between SEM and AVS consisted of calculating the amount of SEM and AVS in units of umol/g, subtracting the AVS value from the SEM value, and then normalizing this difference by the amount of organic carbon (expressed as a fraction) in the sediment (USEPA, 2005):

$$\text{Normalized Value} = \frac{(\text{SEM-AVS})}{F_{oc}} \qquad \text{(Equation 2)}$$

Where

Normalized Value = umol/g_{OC}
SEM=measured concentration of SEM metals (umol/g)
AVS=measured concentrations of AVS (umol/g)
F_{oc}=fraction of organic carbon in sediment (g_{OC}/g_{sed})

Per USEPA Guidance (USEPA, 2005), if the normalized value is less than 130 umol/g_{OC}, then divalent metals in the sample are unlikely to be bioavailable. If the normalized value is between 130 umol/g_{OC} and 3,000 umol/g_{OC}, then sample bioavailability is uncertain. If the normalized value exceeds 3,000 umol/g_{OC}, then samples are likely to be bioavailable. A negative value indicates that AVS exceeds SEM, thus the divalent metals are unavailable for leaching into pore water or the overlying water column. Examination of AVS-SEM data normalized to sediment organic carbon content (Table 4.5) indicates that at SED15, located between the Outer Cove and the property line, the normalized value (107 umol/g_{OC}) is below 130 umol/g_{OC}, and thus divalent metals in sediment from this sample are categorized as unlikely to be bioavailable. The remaining sediment samples were between 130 umol/g_{OC} and 3,000 umol/g_{OC}, indicating that bioavailability is uncertain. Based on one sample, the data suggest that metals beyond the Inner Cove could be unlikely to be bioavailable. Within the Inner Cove, bioavailability of metals is uncertain. Additional evaluation is required to evaluate bioavailability and toxicity of the divalent metals in sediment more conclusively.

4.3.2 Sum-PAH (ΣPAH) Method

The bioavailability of PAHs in sediment can significantly affect their potential toxicity to benthic organisms. Bioavailability of PAHs is influenced by the amount of total organic carbon within the substrate and depends on the properties of the individual PAH constituents. The bioavailability of PAHs was further assessed using the ΣPAH method (USEPA, 2003b; *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*). This model calculates equilibrium partitioning sediment benchmarks (ESBs) using individual toxicity quotients based on measured sediment concentrations of 34 individual PAHs and site-specific TOC concentrations. The individual toxicity quotients are summed to calculate the sediment benchmark toxic unit ($\Sigma ESBTU_{fcv}$). Freshwater sediments with a $\Sigma ESBTU_{fcv} \leq 1.0$ are considered protective of benthic organisms. If the $\Sigma ESBTU_{fcv} > 1.0$, sensitive benthic organisms may be potentially affected. Thus, the ΣPAH model is useful for predicting lack of toxicity. This method cannot be applied to sediment having ≤ 0.2% TOC by dry weight.

ΣPAH calculations are summarized in Table 4.6 and shown in detail in Attachment B. Because only a subset of the 34 recommended PAHs were analyzed, a correction factor was applied to the calculation to achieve a 90^{th} confidence percentile in accordance with USEPA guidance (USEPA, 2003b). When an individual PAH was not detected, one-half of the detection limit was used in the calculation. Samples SD-1001 though SD-1005 were not evaluated because site specific TOC data were not available for these samples. Location SED10 was not evaluated because the TOC associated with that samples was less than 0.2 percent.

The ΣPAH calculations indicate that PAH concentrations in the western part of the Inner Cove (SED16, SED18, SED21, SED22, SED23) plus SED17, SED19, SED24, SED26, and SED27 in the eastern part of the Inner Cove would be unlikely to be toxic to benthic organisms. The ΣPAH calculations could not rule out PAH toxicity at the eastern end of the Inner Cove (SED20, SED25, SED28, SED29, SED30, SED31, and SED32). In the Outer Cove and along the property line (SED11, SED12, SED14, and SED15), ΣPAH calculations also indicate a likely lack of toxicity to benthic organisms. Although Table 4.6 shows a $\Sigma ESBTU_{fcv}$ >1.0 for SED13, toxicity may be ruled out because no PAHs were detected at this location (the calculated value is based entirely on one-half detection limit for all PAHs).

4.3.3 TEQ Evaluation

Most dioxins, furans, and dioxin-like compounds lack individual screening benchmarks. However, the congener-specific dioxin and furan data can be consolidated into a single measure, called the toxic equivalence (TEQ) of the sample. The TEQ is calculated by multiplying the concentrations of each congener or congener containing chlorine at the 2,3,7, and 8 positions in a sample by a toxicity equivalence factor (TEF) and summing those products. The TEF normalizes the toxicity of those congeners to the toxicity of the 2,3,7,8-TCDD congener, generally considered to be the most toxic of the dioxin, furan, and dioxin-like compounds. In effect, the TEQ indicates the concentration of 2,3,7,8-TCDD that would have the same toxicity as the mixture of dioxins and furans being evaluated. Congeners that do not contain chlorine at the 2,3,7 and 8 positions are not assigned a TEF because they do not have the same stereochemistry as the 2,3,7,8-TCDD congener. All OCDD and OCDF congeners have chlorine at the 2,3,7, and 8 positions. The TEFs used in this SELRA reference the World health Organization values for mammals, birds, and fish (Van den Berg *et al.*, 1998).

TEQ calculations are summarized in Table 4.7 (sediment) and Table 4.8 (surface water) and presented in full in Attachment C. The TEQ for each exposure area (i.e. the Cove Study Area and the Property Line Study Area) was compared to the ecological screening benchmarks of 0.0000072mg/kg for sediment (Cubbage, 1997) and 0.00000001mg/L for surface water (USEPA, 2004) to calculate a hazard quotient.

In Cove Study Area sediment samples dioxin TEQs for mammals, birds, or fish exceeded screening benchmarks at SD-1001 though SD-1005, SED14, SED16 through SED20, SED22, and SED24 through SED32. The highest HQ (944, for birds) occurred at SED18, which also corresponds to the highest TOC concentrations (115,000 mg/kg). Only two Cove Study Area surface water samples were analyzed for dioxin (SW19 and SW27) and TEQs at both locations exceeded the benchmarks for mammals, birds and fish with the maximum HQ (7.1) occurring at SW27, for birds.

In Property Line Study Area sediment samples, dioxin TEQs for mammals, birds, or fish exceeded screening benchmarks at SD11, with a maximum HQ of 66, for birds, and at SD12, with a maximum HQ of 1.6 for mammals and birds. In the one property line surface water sample which was analyzed for dioxin (SW11), the dioxin TEQ exceeded the screening benchmark with a maximum HQ of 1.6, for birds.

5.0 RISK CHARACTERIZATION, UNCERTAINTY, AND CONCLUSIONS

This section evaluates the results of the screening level exposure estimates and other lines of evidence used to identify and to eliminate chemicals from further review, considers uncertainties, and summarizes final conclusions and recommendations.

5.1 Risk Characterization

5.1.1 Cove Study Area

One VOC (1,2,4-trimethyl benzene) was identified as a COPC in the inner cove surface water because it lacked a benchmark; however it was not identified as a site related chemical in soil or groundwater in the vicinity of the Cove and thus not considered to be a site related chemical (MACTEC, 2006). Because it was detected in only two of twelve samples, does not bioaccumulate, and is not site related, it is recommended that 1,2,4-trimethyl benzene be eliminated from further review in surface water in the Cove Study Area.

Benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene were identified as surface water COPCs. However, each of these PAHs were detected only once in twelve samples, and all occurred at SW19. Additionally, SW19 is associated with SED19; the ΣPAH model concluded that at SED19 PAHs are likely bound to sediment and are not likely to be bioavailable in the water column(ΣPAH <1). It is therefore recommended that PAHs be eliminated from further review of surface water in the Cove Study Area.

In the two surface water samples collected from the Cove Study Area and analyzed for dioxin (SED19, SED27), the TEQ exceeded the screening benchmark with a maximum HQ of 7 (for birds), suggesting that dioxins in surface water cannot be ruled out using screening tools and should receive further investigation.

No dissolved or total metals were identified as COPCs in surface water from the Cove Study Area. Thus, no further evaluation of metals in surface water is recommended.

One pesticide (DDD) and one PCB (Aroclor-1254) were identified as sediment COPCs from the Cove Study Area. However, there is no evidence that DDD is site-related. Furthermore, DDD commonly occurs in the environment. Given the low concentration at which it was detected (0.03 mg/kg), is likely consistent with background concentrations, since it was detected in only two of twenty-five samples, and is not site related (MACTEC, 2006), DDT should be eliminated from further evaluation. Likewise, Arochlor-1254 was detected in only two of twenty-five samples at relatively low concentrations, and is not a site-related compound (MACTEC, 2006) and thus Arochlor-1254 should also be eliminated from further evaluation.

Eleven VOCs, seventeen PAHs, nine inorganics, and dioxins were identified as COPCs in sediment from the Cove Study Area. However, acetone, s-butylbenzene, and carbon disulfide are not considered site-related (MACTEC, 2006) and should be eliminated from further evaluation. Maximum detected concentrations of VOCs and metals generally occurred within the eastern portion of the Inner Cove; a majority of the maximum concentrations occurred at SED19. Maximum PAH concentrations appear to correlate with the discharge point for the stormwater retention pond near SED20. The highest concentrations of VOCs, SVOCs, and metals therefore appear to be located in the eastern portion of the inner cove sediment.

Further examination of patters within the data suggest that VOCs, PAHs, and metals in sediment could pose less risk to ecological receptors in the western part of the Inner Cove than the eastern part of the Inner Cove. The ΣPAH data indicate that sediment PAHs in the eastern part of the Inner Cove cannot be ruled out as COPCs, but in the western part of the Inner Cove and in the Outer Cove, measured PAH concentrations are unlikely to be associated with toxicity to benthic communities. With the exception of acetone (which is not considered a site-specific chemical) and one low detection of PCE (1.0 mg/kg versus a benchmark of 0.99 mg/kg), VOCs were not detected in sediment samples collected in the western part of the inner cove (Table 5.1). VOCs tend to occur in the center of the Inner Cove in the vicinity of SED19, where many of the maximum detections occur, and at SED27. AVS-SEM data were generally inconclusive but suggest that metals may not be bioavailable in the Outer Cove, but could be limited to the shoreline within the Inner Cove.

Dioxin TEQs exceeded screening benchmarks throughout the Cove Study Area. The highest dioxin concentrations are generally associated with sediment samples with high TOC, which indicates that dioxins are sorbed to organic material in depositional areas.

Based on the available lines of evidence, risk to aquatic receptors from dioxins in surface water could not be ruled out for the Cove Study Area. Risk to benthic invertebrates from VOCs, PAHs, metals, and dioxins in sediment could not be ruled out for the Cove Study Area. Based on patterns in the data, COPCs could pose less of a risk to benthic and aquatic receptors in the Outer Cove and western part of the Inner Cove than in the eastern part of the Inner Cove.

5.2.2 Property Line

DDT and dioxins were identified as COPCs in Property Line Study Area surface water. DDT had an HQ of 80. However, there is no evidence that DDT is a site-related chemical. Furthermore, DDT commonly occurs in the environment as a persistent remnant of historical use in the ambient environment. Given the low concentration at which it was detected (0.080 ug/l), it is likely consistent with background concentrations and should be eliminated from further review. In the one property line surface water sample which was analyzed for dioxin (SW11), the dioxin TEQ exceeded the screening benchmark with a maximum HQ of 1.6, for birds and mammals, suggesting that risk from dioxins is almost negligible, but given the small sample size should receive further investigation in surface water near the property line.

One VOC (acetone), thirteen PAHs, DDD, nine metals, and dioxins were identified as COPCs in property line sediment. Acetone and DDD are not considered site-related (MACTEC, 2006) and should not be eliminated from further evaluation. Although individual PAHs exceeded benchmarks, the ΣPAH models indicate that sediment samples along the property line are unlikely to be toxic.

No AVS-SEM analyses were conducted with samples collected from along the property line. Although priority pollutant metals occurred at low detection frequencies, and except for silver (HQ=52 but detected in only 1 of 3 samples) had relatively low HQs (below 5 for zinc, nickel, chromium, and cadmium; 13 for copper, and 16 for lead; barium and beryllium lacked benchmarks), metals could not be ruled out using screening tools

Based on the available lines of evidence, risk to aquatic receptors from dioxins in surface water could not be ruled to for the Property Line Study Area. Risk to benthic invertebrates from metals could not be conclusively ruled out, and risk from dioxin could not be ruled out in property line sediment.

5.2 Uncertainties

Although there are some clear concentration gradients for a number of COPCs in sediment, background concentrations for sediments of Mashapaug Pond have not been determined. Therefore, the horizontal extent of sediment impacts in the Cove have not been completely delineated. In addition, for some COPCs, it has not been established definitively that observed concentration in the Cove are site-related.

Based on the AVS-SEM data in the Inner Cove, the potential bioavailability and toxicity of metals in sediments at several locations requires further evaluation. In addition, AVS-SEM data may also vary seasonally, with AVS concentrations typically higher in the warmer seasons and lower in colder months.

Risk associated with some chemicals could not be ruled out based on ecological screening because they lacked benchmarks. However, chemicals which lacked benchmarks, such as some individual PAHs and dioxins, were evaluated by other tools, such as ΣPAH models and TEQs.

Organic carbon content of sediment is important because it binds organic COPCs, making them less bioavailable. A higher TOC value means less COPC bioavailability. TOC values throughout the study areas generally ranged between 1 and 11 percent. However, sediment ecological screening benchmarks do not incorporate site-specific levels of organic carbon, and were normalized to 1 percent TOC. Although adjusting the benchmarks to site-specific concentrations would not change the list of sediment COPCs, the HQs associated with these COPCs are likely overestimated.

RIDEM sediment samples were collected from the 0-foot to 2-foot interval. Typically, the zone of biological activity is limited to the top six inches in sediment. Sediment samples collected from intervals deeper than six inches may not represent bioavailable concentrations.

Conservative assumptions were made about exposure factors. The screening level risk calculation assumes an area-use factor of 100 percent, bioavailability of 100 percent, that the receptor life stage is the most sensitive stage, dietary composition is 100 percent, and that body weight and food ingestion rates are conservative. This likely overestimates risk.

TPH data were not assessed for ecological risk for several reasons. First, a review of the scientific literature did not produce a suitable screening level benchmark for these data. Additionally, chemical compositions vary considerably from site to site and study to study, and analytical methods and targeted analytes vary between laboratories (Irwin, 1997). Even if a benchmark were identified, comparison to concentrations detected at the Adelaide Avenue site would be impeded by unquantifiable uncertainty. However, the primary hazards from TPH typically relate to PAHs or BTEX (Irwin, 1997), thus any risk from PAHs or BTEX would have been evaluated against individual chemical benchmarks or the ΣPAH model.

The TEQ methodology provides a mechanism to estimate potential health or ecological effects of exposure to a complex mixture of dioxins and dioxin-like compounds. However, the TEQ method must be used with an understanding of its limitations. This methodology estimates the dioxin-like effects of a mixture by assuming dose-additivity and describes the mixture in terms of an equivalent mass of 2,3,7,8-TCDD. Although the mixture may have the toxicological potential of 2,3,7,8-TCDD it should not be assumed that individual congeners follow the same environmental fate and transport mechanisms as 2,3,7,8-TCDD. Different congeners have different physical properties such as rate of photolysis, binding affinity to organic mater, and water solubility. Consequently, the makeup of the mixture will change as the congeners move through the environment (USEPA, 2000).

5.3 Conclusions

As summarized in the table below, the SLERA concludes that in Mashapaug Cove surface water, VOCs, PAHs, pesticides, PCBs, and metals pose negligible risk and thus do not require further evaluation. However, potential risk from dioxins in surface water cannot be ruled out using screening tools and should be further investigated.

The SLERA also concludes that in Mashapaug Cove sediment, pesticides and PCBs pose negligible risk and thus do not require further evaluation. However, potential risk from VOCs, PAHs, metals and dioxins in sediment cannot be ruled out using screening tools and should be further investigated.

Based on patterns in the data, COPCs could pose less of a risk to benthic and aquatic receptors along the property boundary, in the Outer Cove and in the western part of the Inner Cove than in the eastern part of the Inner Cove.

The source of PAHs appears to be the stormwater discharge from the stormwater retention pond near SED20. VOCs may be associated with a groundwater plume discharging into the pond.

This SLERA finally recommends that because there might be a risk of adverse ecological effects, the ecological risk assessment process continue, and that a workplan be developed to address future investigation.

SLERA Conclusions for Surface Water and Sediment in Mashapaug Pond

Conclusion	**Surface Water**	**Sediment**
Eliminate from further investigation	VOC, PAHs, pesticides, PCBs, metals	Pesticides, PCBs
Retain for further investigation	dioxins	VOCs, PAHs, metals, dioxins

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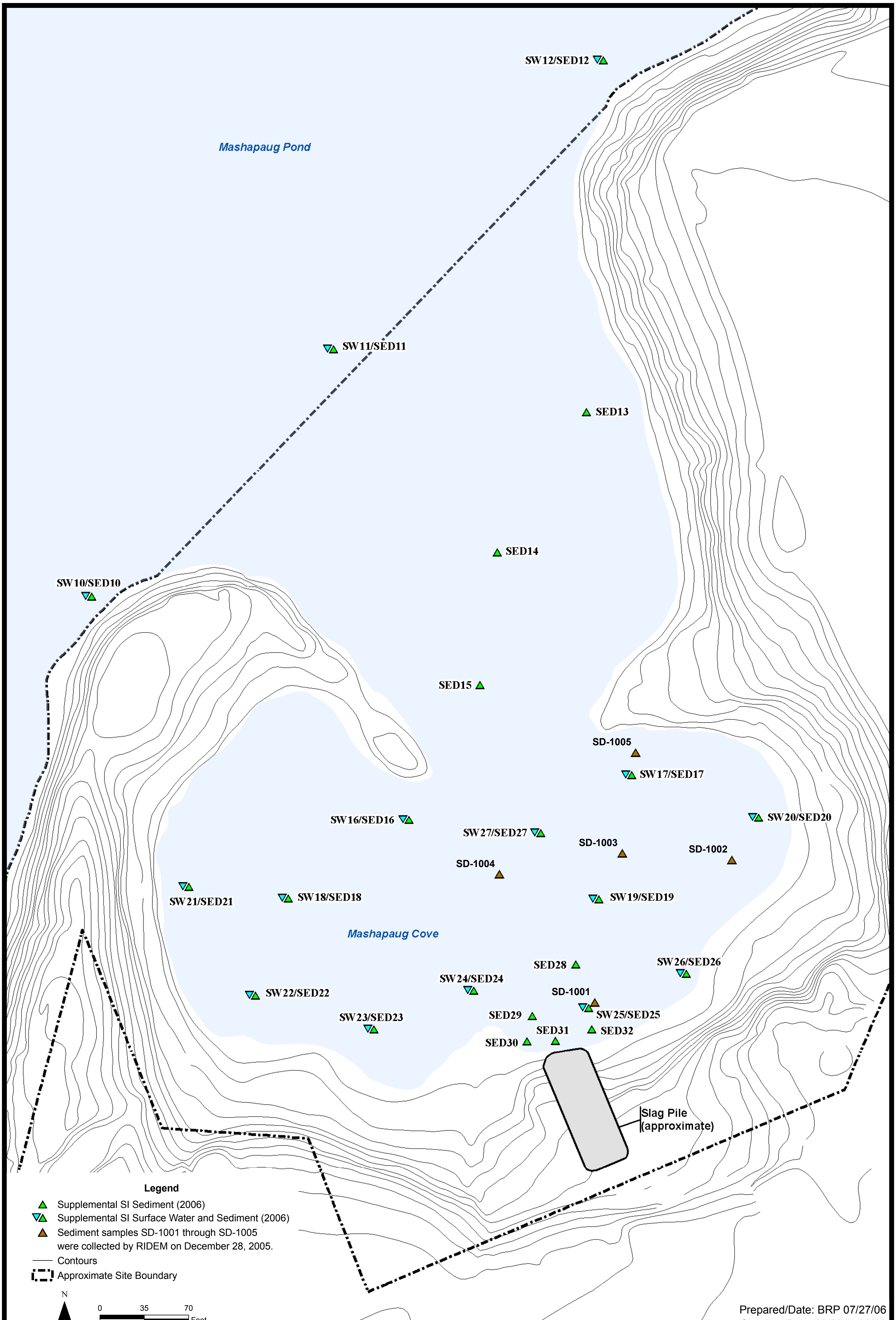
FIGURES

Supplemental SI
Former Gorham Manufacturing Site
Providence, Rhode Island

MACTEC

Site Location Map
Project 3650-05-0041
Figure 1



Prepared/Date: BRP 07/27/06
Checked/Date: MJM 07/28/06

Supplemental SI
Former Gorham Manufacturing Site
Providence, Rhode Island

MACTEC

Supplemental SI
Pond Sample Locations
Project 3650-05-0041
Figure 2

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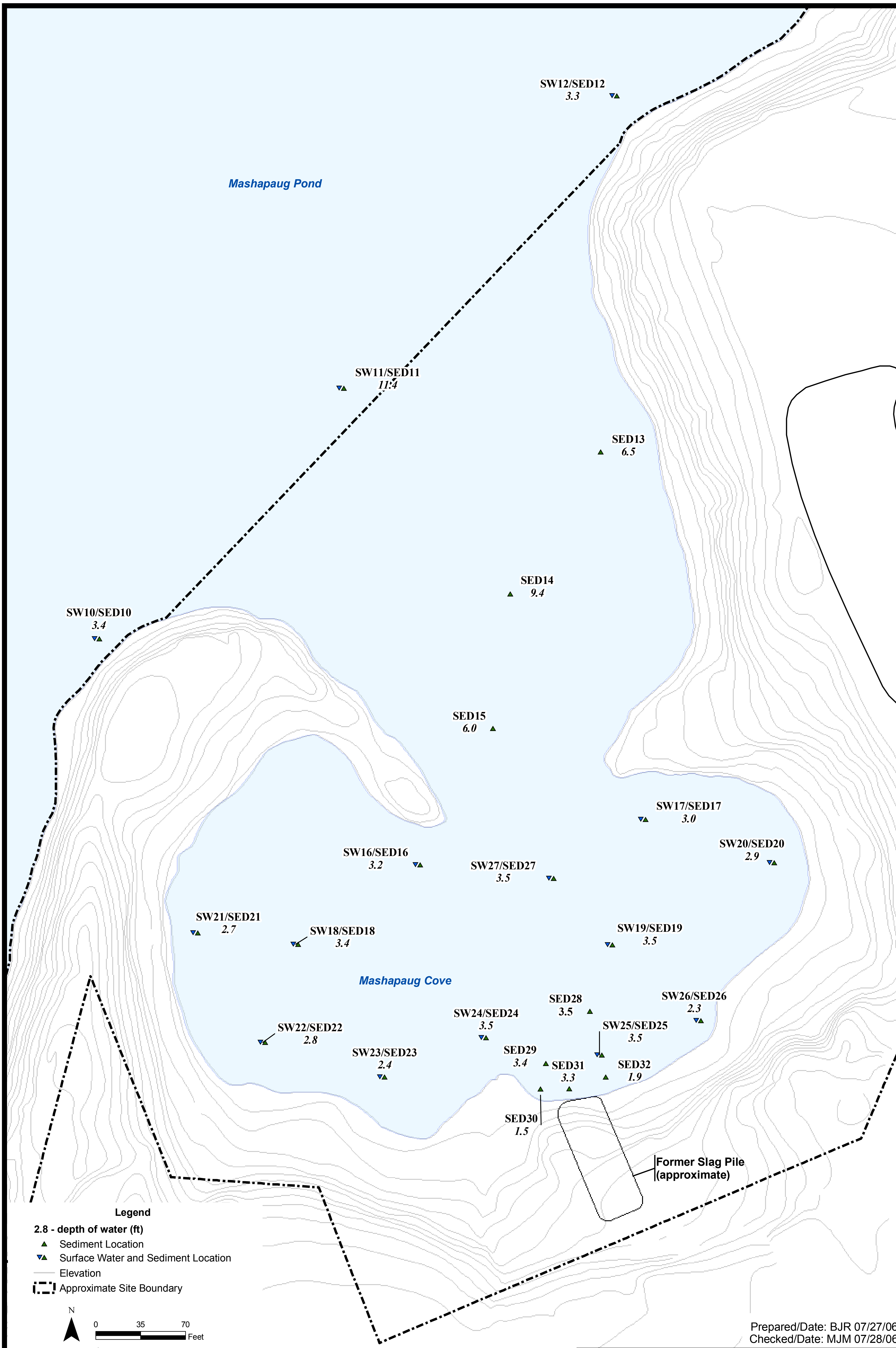

Prepared/Date: BJR 07/27/06
Checked/Date: MJM 07/28/06

Supplemental Site Investigation Report
333 Adelaide Avenue
Providence, RI

MACTEC

Measured Water Depths at Sediment Sample Locations in Mashapaug Cove June 21 and 22

Project 3650-05-0041 Figure 3

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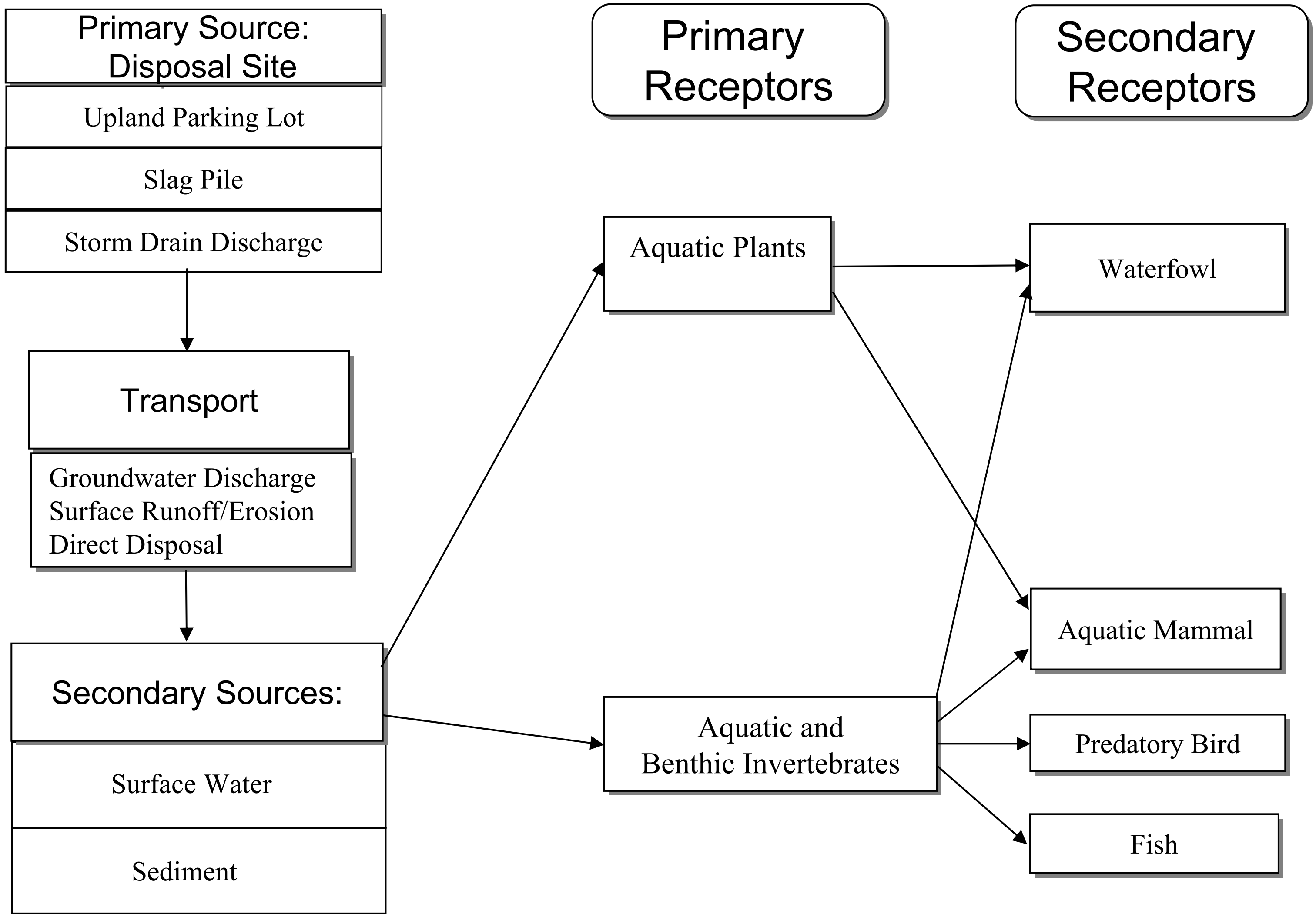

FIGURE 4
Site Ecological Conceptual Model
333 Adelaide Avenue
Providence, MA

TABLES

Table 3.1
Surface Water Screening Values

333 Adelaide Avenue
Providence, Rhode Island

Parameter	RIDEM AWQC [a]	NAWQC [b]	ORNL Tier II SCV [c]	Region V ESLs [d]	Final Selected Benchmark
Volatile Organics (mg/L)					
1,1,1-Trichloroethane	0.043				0.043
1,1-Dichloroethane	0.131				0.131
1,2,4-Trimethylbenzene					NA
cis-1,2-Dichloroethene			0.59		0.59
Ethylbenzene	0.036				0.036
Tetrachloroethene	0.0053				0.0053
Toluene	0.014				0.014
Trichloroethene	0.043				0.043
Vinyl chloride				0.93	0.93
Xylene, M&P-	0.003				0.003
Xylene, O-	0.003				0.003
Xylenes, Total	0.003				0.003
Semivolatile Organics (mg/L)					
Benzo(a)anthracene			0.000027		0.000027
Benzo(a)pyrene			0.000014		0.000014
Benzo(g,h,i)perylene				0.00764	0.00764
Chrysene					NA
Dibenz(a,h)anthracene					NA
Naphthalene	0.0026				0.0026
Pesticides/PCBs (mg/L)					
4,4'-DDT	0.000001				0.000001
Inorganics (mg/L) [e, f]					
Chromium					NA
Copper					NA
Lead					NA
Silver			0.00036		0.00036
Zinc					NA
Metals, Dissolved (mg/L) [e]					
Dioxins/Furans (mg/L)					
Dioxin TEQ as 2,3,7,8-TCDD		0.00000001 [1]			0.00000001

Table 3.1
Surface Water Screening Values

333 Adelaide Avenue
Providence, Rhode Island

Parameter	RIDEM AWQC [a]	NAWQC [b]	ORNL Tier II SCV [c]	Region V ESLs [d]	Final Selected Benchmark

Benchmarks selected from the following sources in the order presented:

[a] Rhode Island Department of Environmental Managements. 2006. RIDEM Ambient Water Quality Criteria and Guidelines for Toxic Pollutants. July, 2006.

[b] Federal Chronic Ambient Water Quality Criteria for Freshwater (AWQC) (USEPA, 2004). An estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. Value is equal to the 4-day average concentration that should not be exceeded more than once every 3 years.

1. Chronic Lowest Observed Effect Level.

[c] Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Screening Potential Contaminants of Concern (COCs) for effects on aquatic biota (Suter and Tsao, 1996). Value presented is secondary chronic value.

[d] USEPA. 2003. Region V Ecological Screening Levels. August 22. (www.epa.gov/Region5/rcraca/edql.htm)

[e] Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, and Zinc benchmarks are based on the dissolved fraction. Because no dissolved metals were detected in surface water samples, no benchmarks were needed and therefore are not shown.

[f] Benchmarks for Antimony, Beryllium, Selenium, and Thallium are based on the total fraction. Because these metals were not detected in either the dissolved or total fraction, no benchmarks were needed and therefore are not shown.

mg/L = milligrams per liter

Table 3.2
Sediment Screening Values

333 Adelaide Avenue
Providence, Rhode Island

Parameter	TEC [a]	ORNL SCV [b]	OMOE LEL [c]	WA SCV [d]	USEPA Region V ESL [e]	Final Selected Benchmark
Volatile Organics (mg/kg)						
1,1,1-Trichloroethane		0.03				0.03
1,1-Dichloroethane		0.027				0.027
1,1-Dichloroethene		0.031				0.031
Acetone		0.0087				0.0087
Carbon Disulfide		0.00085				0.00085
cis-1,2-Dichloroethene		0.4				0.4
Isopropyl Benzene						NA
s-Butylbenzene						NA
Tetrachloroethene					0.99	0.99
Toluene		0.05				0.05
trans-1,2-Dichloroethene		0.4				0.4
Trichloroethene		0.22				0.22
Vinyl chloride					0.202	0.202
Semivolatile Organics (mg/kg)						
Acenaphthene			0.19 [1]			0.19
Acenaphthylene			0.19 [1]			0.19
Anthracene	0.0572					0.0572
Benzo(a)anthracene	0.108					0.108
Benzo(a)pyrene	0.15					0.15
Benzo(b)fluoranthene			0.24			0.24
Benzo(g,h,i)perylene			0.17			0.17
Benzo(k)fluoranthene			0.24			0.24
Chrysene	0.166					0.166
Dibenzo(a,h)anthracene			0.06			0.06
Di-n-butylphthalate			0.1			0.1
Fluoranthene	0.423					0.423
Fluorene	0.0774					0.0774
Indeno(1,2,3-cd)pyrene			0.2			0.2
Naphthalene	0.176					0.176
Phenanthrene	0.204					0.204
Pyrene	0.195					0.195
Pesticides/PCBs (mg/kg)						
4,4'-DDD	0.00488					0.00488
4,4'-DDE	0.00316					0.00316
4,4'-DDT	0.00416					0.00416
Endrin ketone			0.003			0.003
Aroclor-1254			0.06			0.06
Aroclor-1260			0.005			0.005
Inorganics (mg/kg)						
Antimony						NA
Arsenic	9.79					9.79
Barium						NA
Beryllium						NA
Cadmium	0.99					0.99
Chromium	43.4					43.4
Copper	31.6					31.6
Lead	35.8					35.8
Mercury	0.18					0.18
Nickel	22.7					22.7
Selenium						NA
Silver			0.5			0.5
Zinc	121					121
Dioxins/Furans (mg/kg)						
Dioxin TEQ as 2,3,7,8-TCDD				0.0000072		0.0000072

Table 3.2
Sediment Screening Values

333 Adelaide Avenue
Providence, Rhode Island

Parameter	TEC [a]	ORNL SCV [b]	OMOE LEL [c]	WA SCV [d]	USEPA Region V ESL [e]	Final Selected Benchmark

Notes:
Units in mg/kg (milligram per kilogram [dry weight]).

Benchmarks selected from the following sources in the order presented:

[a] TEC - Threshold Effect Concentrations, levels below which harmful effects are unlikely to be observed; values as presented in MacDonald, et al., 2000a,b.
[b] Sediment screening benchmarks derived using equilibrium partitioning assumptions and based on Chronic Tier II values; values as summarized in Jones et al., 1997. Normalized to 1% TOC.
[c] Ontario Ministry of the Environment Lowest Effect Level (LELs) Provincial Sediment Quality Guidelines as presented in Persaud et al., 1993.
LELs are levels of sediment contamination that can be tolerated by the majority of benthic organisms. For organic compounds, generally based on the 5th percentile of the Screening Level Concentration (SLC). Normalized to 1% TOC.
[1] Value for fluorene used as a surrogate for acenaphthene and acenaphthylene. Value for benzo(k)fluoranthene used as a surrogate for benzo(b)fluoranthene.
[d] Washington State Sediment Qualty Values (SCVs) probable apparent effects thresholds (PAETs) for *Hyalella azteca* normalized to 1% TOC, as presented in Cubbage, et al. 1997.
[e] USEPA. 2003. Region V Ecological Screening Levels. August 22. (www.epa.gov/Region5/rcraca/edql.htm)

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Table 4.1
Selection of Chemicals of Potential Concern - Cove Study Area Surface Water

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [c]	Maximum HQ [d]
Volatile Organics (mg/L)										
1,1,1-Trichloroethane	11 / 12	0.001 - 0.001	0.001 - 0.0018	SW17	0.0014	0.043		No	BSL	
1,1-Dichloroethane	5 / 12	0.001 - 0.001	0.001 - 0.0014	SW17	0.00079	0.131		No	BSL	
1,2,4-Trimethylbenzene	2 / 12	0.001 - 0.001	0.001 - 0.0011	SW27	0.00059	NA		Yes	NSL	NA
cis-1,2-Dichloroethene	12 / 12		0.0025 - 0.0062	SW19	0.0046	0.59		No	BSL	
Ethylbenzene	3 / 12	0.001 - 0.001	0.001 - 0.001	SW17	0.00063	0.036		No	BSL	
Tetrachloroethene	1 / 12	0.001 - 0.001	0.0012 - 0.0012	SW19	0.00056	0.0053		No	BSL	
Toluene	12 / 12		0.0011 - 0.0043	SW17	0.0027	0.014		No	BSL	
Trichloroethene	10 / 12	0.001 - 0.001	0.001 - 0.0029	SW19	0.0013	0.043		No	BSL	
Vinyl chloride	10 / 12	0.001 - 0.001	0.001 - 0.0021	SW19	0.0013	0.93		No	BSL	
Xylene, M&P-	5 / 12	0.002 - 0.002	0.002 - 0.0028	SW27	0.0016	0.003		No	BSL	
Xylene, O-	3 / 12	0.001 - 0.001	0.001 - 0.0012	SW27	0.00065	0.003		No	BSL	
Xylenes, Total	3 / 12	0.003 - 0.003	0.0034 - 0.004	SW27	0.0021	0.003		No	BSL	
Semivolatile Organics (mg/L)										
Benzo(a)anthracene	1 / 12	0.0002 - 0.0002	0.0002 - 0.0002	SW19	0.00011	0.000027	1	Yes	ASL	7
Benzo(a)pyrene	1 / 12	0.0002 - 0.0002	0.00024 - 0.00024	SW19	0.00011	0.000014	1	Yes	ASL	17
Benzo(g,h,i)perylene	1 / 12	0.0002 - 0.0002	0.00038 - 0.00038	SW19	0.00012	0.00764		No	BSL	
Chrysene	1 / 12	0.0002 - 0.0002	0.00023 - 0.00023	SW19	0.00011	NA		Yes	NSL	NA
Dibenz(a,h)anthracene	1 / 12	0.0002 - 0.0002	0.00031 - 0.00031	SW19	0.00012	NA		Yes	NSL	NA
Naphthalene	4 / 12	0.0002 - 0.0002	0.0002 - 0.0003	SW24	0.00015	0.0026		No	BSL	
Pesticides/PCBs (mg/L)										
4,4'-DDT	0 / 2	0.000050 - 0.000050			0.000025	0.000001		No	ND	
Inorganics (mg/L) [e, f]										
Dioxins/Furans (mg/L)										
1,2,3,4,6,7,8-HpCDD	2 / 2		4.3E-08 - 4.3E-08	SW19 SW27	0.000000043	TEQ				
1,2,3,6,7,8-HxCDD	1 / 2	1E-08 - 1E-08	1.3E-08 - 1.3E-08	SW27	0.0000000090	TEQ				
1,2,3,7,8,9-HxCDD	1 / 2	1E-08 - 1E-08	5.1E-08 - 5.1E-08	SW27	0.000000028	TEQ				
1,2,3,7,8-PeCDD	1 / 2	1E-08 - 1E-08	4.6E-08 - 4.6E-08	SW27	0.000000026	TEQ				
2,3,7,8-TCDD	1 / 2	2E-09 - 2E-09	3.1E-09 - 3.1E-09	SW27	0.0000000021	TEQ				
2,3,7,8-TCDF	1 / 2	2E-09 - 2E-09	8.9E-09 - 8.9E-09	SW27	0.0000000050	TEQ				
OCDD	2 / 2		3.2E-07 - 3.5E-07	SW27	0.00000034	TEQ				
Total HpCDD	2 / 2		6.1E-08 - 7.2E-08	SW19	0.000000067	TEQ				
Total HpCDF	2 / 2		1.3E-08 - 2.1E-08	SW19	0.000000017	TEQ				
Total HxCDD	1 / 2	1E-08 - 1E-08	6.4E-08 - 6.4E-08	SW27	0.000000035	TEQ				
Total PeCDD	1 / 2	1E-08 - 1E-08	4.6E-08 - 4.6E-08	SW27	0.000000026	TEQ				
Total PeCDF	1 / 2	1E-08 - 1E-08	2.9E-08 - 2.9E-08	SW27	0.000000017	TEQ				
Total TCDD	1 / 2	2E-09 - 2E-09	3.1E-09 - 3.1E-09	SW27	0.0000000021	TEQ				
Total TCDF	2 / 2		3.4E-09 - 3.2E-08	SW27	0.000000018	TEQ				
TEQ-Mammal			1.29E-08 - 6.22E-08	SW27		3E-12	2	Yes	ASL	6
TEQ-Bird			1.55E-08 - 7.12E-08	SW27		3E-12	2	Yes	ASL	7
TEQ-Fish			1.36E-08 - 5.76E-08	SW27		3E-12	2	Yes	ASL	6

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.1
Selection of Chemicals of Potential Concern - Cove Study Area Surface Water

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [c]	Maximum HQ [d]

Notes:
[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmarks can be found on Table 33 .1
TEQ - Dioxin-related compounds evaluated as 2,3,7,8-TCDD using Toxicity Equivalence (TEQs) for mammals, birds, and fish.
[c] Chemical is selected as a contaminant of potential concern (COPC) if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable, unless the frequency of detection (FOD) is less than 5%.
ASL - Above Screening Level
BSL - Below Screening Level
NSL - No Screening Level
ND - Not Detected
[d] Hazard quotient (HQ) is the maximum detected concentration divided by the screening benchmark. HQs are only calculated for COPCs.
NA - Hazard quotient not calculated because benchmark not available.
[e] Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, and Zinc benchmarks are based on the dissolved fraction. Because no dissolved metals were detected in surface water samples, no benchmarks were needed and therefore are not shown.
[f] Benchmarks for Antimony, Beryllium, Selenium, and Thallium are based on the total fraction. Because these metals were not detected in either the dissolved or total fraction, no benchmarks were needed and therefore are not shown.

mg/L - milligrams per liter

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.2
Selection of Chemicals of Potential Concern - Cove Study Area Sediment

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [d]	Maximum HQ [e]
Volatile Organics (mg/kg)										
1,1,1-Trichloroethane	5 / 25	0.0041 - 0.15	0.3 - 1.3	SD-1003	0.16	0.03	5	Yes	ASL	43
1,1-Dichloroethane	9 / 25	0.0041 - 1.1	0.011 - 7.92	SED19	0.72	0.027	7	Yes	ASL	293
1,1-Dichloroethene	5 / 25	0.0041 - 1.1	0.014 - 11.3	SED19	0.58	0.031	4	Yes	ASL	365
Acetone	12 / 25	0.039 - 4.6	0.0856 - 1.9	SED18	0.33	0.0087	12	Yes	ASL	218
Carbon Disulfide	6 / 25	0.0041 - 1.1	0.0046 - 0.0576	SED19	0.036	0.00085	6	Yes	ASL	68
cis-1,2-Dichloroethene	9 / 25	0.0043 - 1.1	0.0091 - 175	SED19	12.1	0.4	5	Yes	ASL	438
Isopropyl Benzene	1 / 25	0.0041 - 1.1	0.0514 - 0.0514	SED28	0.033	NA		No	FOD	
s-Butylbenzene	2 / 25	0.0041 - 1.1	0.0197 - 0.0303	SED28	0.033	NA		Yes	NSL	NA
Tetrachloroethene	4 / 25	0.0043 - 1.1	0.0081 - 18.1	SED19	0.80	0.99	2	Yes	ASL	18
Toluene	1 / 25	0.0041 - 1.1	1.92 - 1.92	SED31	0.108	0.05		No	FOD	
trans-1,2-Dichloroethene	3 / 25	0.0041 - 1.1	0.0053 - 3.62	SED27	0.29	0.4	2	Yes	ASL	9.1
Trichloroethene	9 / 25	0.0043 - 0.15	0.176 - 58.4	SED19	3.3	0.22	7	Yes	ASL	265
Vinyl chloride	7 / 25	0.0081 - 2.3	0.0218 - 24.8	SED25	1.9	0.202	4	Yes	ASL	123
Semivolatile Organics (mg/kg)										
Acenaphthene	5 / 25	0.03 - 0.183	0.024 - 0.26	SD-1002	0.063	0.19	2	Yes	ASL	1
Acenaphthylene	3 / 25	0.0079 - 0.183	0.026 - 0.781	SED20	0.067	0.19	1	Yes	ASL	4
Anthracene	12 / 25	0.0315 - 0.183	0.04 - 3.09	SED20	0.26	0.0572	11	Yes	ASL	54
Benzo(a)anthracene	17 / 25	0.0315 - 0.183	0.0896 - 15.1	SED20	0.95	0.108	15	Yes	ASL	140
Benzo(a)pyrene	16 / 25	0.0315 - 0.183	0.0707 - 7.87	SED20	0.60	0.15	12	Yes	ASL	52
Benzo(b)fluoranthene	19 / 25	0.0315 - 0.183	0.0378 - 14.8	SED20	1.0	0.24	14	Yes	ASL	62
Benzo(g,h,i)perylene	13 / 25	0.0315 - 0.183	0.046 - 2.54	SED20	0.22	0.17	6	Yes	ASL	15
Benzo(k)fluoranthene	11 / 25	0.0315 - 0.183	0.065 - 5.1	SED20	0.37	0.24	7	Yes	ASL	21
Chrysene	16 / 25	0.0315 - 0.183	0.0896 - 8.94	SED20	0.71	0.166	13	Yes	ASL	54
Dibenzo(a,h)anthracene	5 / 25	0.0079 - 0.183	0.0404 - 1.45	SED20	0.104	0.06	4	Yes	ASL	24
Di-n-butylphthalate	2 / 5	0.2 - 0.74	0.48 - 1.1	SD-1003	0.44	0.1	2	Yes	ASL	11
Fluoranthene	21 / 25	0.0315 - 0.035	0.0833 - 28.8	SED20	2.0	0.423	12	Yes	ASL	68
Fluorene	8 / 25	0.018 - 0.183	0.022 - 0.863	SED20	0.083	0.0774	5	Yes	ASL	11
Indeno(1,2,3-cd)pyrene	12 / 25	0.03 - 0.183	0.046 - 2.47	SED20	0.22	0.2	6	Yes	ASL	12
Naphthalene	5 / 25	0.03 - 0.183	0.0342 - 0.28	SD-1002	0.056	0.176	2	Yes	ASL	2
Phenanthrene	18 / 25	0.0315 - 0.183	0.0333 - 11.8	SED20	1.1	0.204	13	Yes	ASL	58
Pyrene	20 / 25	0.0315 - 0.0794	0.0513 - 15.2	SED20	1.3	0.195	16	Yes	ASL	78
Pesticides/PCBs (mg/kg)										
4,4'-DDD	2 / 25	0.00081 - 0.0481	0.0292 - 0.0301	SED32	0.010	0.00488	2	Yes	ASL	6
4,4'-DDE	1 / 25	0.00081 - 0.0481	0.0109 - 0.0109	SED32	0.0084	0.00316		No	FOD	
4,4'-DDT	1 / 25	0.00081 - 0.0481	0.0635 - 0.0635	SED32	0.010	0.00416		No	FOD	
Endrin ketone	1 / 25	0.00081 - 0.0481	0.0431 - 0.0431	SED19	0.0093	0.003		No	FOD	
Aroclor-1254	2 / 25	0.016 - 0.404	0.207 - 0.528	SED30	0.093	0.06	2	Yes	ASL	9
Aroclor-1260	1 / 25	0.016 - 0.404	0.605 - 0.605	SED19	0.086	0.005		No	FOD	

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.2
Selection of Chemicals of Potential Concern - Cove Study Area Sediment

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [d]	Maximum HQ [e]
Inorganics (mg/kg)										
Antimony	2 / 25	0.54 - 25.7	1.6 - 2.7	SD-1001	5.8	NA		Yes	NSL	NA
Arsenic	21 / 25	0.4 - 1.8	2.1 - 47.6	SED14	18.6	9.79	17	Yes	ASL	5
Barium	25 / 25		9.7 - 466	SED26	130	NA		Yes	NSL	NA
Beryllium	20 / 25	0.07 - 0.13	0.075 - 3.5	SD-1004	0.58	NA		Yes	NSL	NA
Cadmium	19 / 25	0.66 - 1.31	0.14 - 7.11	SED19	2.7	0.99	15	Yes	ASL	7
Chromium	25 / 25		2.9 - 640	SED18	206	43.4	16	Yes	ASL	15
Copper	25 / 25		5.3 - 2670	SED32	1052	31.6	19	Yes	ASL	84
Lead	22 / 25	6.6 - 7.4	12.2 - 1120	SED31	383	35.8	18	Yes	ASL	31
Mercury	17 / 25	0.04 - 0.12	0.031 - 2.52	SED19	0.45	0.18	10	Yes	ASL	14
Nickel	23 / 25	3.7 - 6.6	5.7 - 853	SED27	144	22.7	16	Yes	ASL	38
Selenium	3 / 25	0.54 - 25.7	1.8 - 17.9	SED26	6.4	NA		Yes	NSL	NA
Silver	21 / 25	0.66 - 1.31	2.77 - 227	SED18	74.2	0.5	21	Yes	ASL	454
Zinc	25 / 25		9.5 - 1940	SED18	850	121	18	Yes	ASL	16
Dioxins/Furans (mg/kg)										
1,2,3,4,6,7,8-HpCDD	23 / 25	0.00000068 - 0.0000008	0.0000022 - 0.00064	SED18	0.000157	TEQ				
1,2,3,4,6,7,8-HpCDF	22 / 25	0.00000068 - 0.0000008	0.0000059 - 0.001	SED18	0.00023	TEQ				
1,2,3,4,7,8,9-HpCDF	21 / 25	0.00000068 - 0.0000014	0.0000012 - 0.00017	SED18	0.000042	TEQ				
1,2,3,4,7,8-HxCDD	16 / 25	0.00000068 - 0.000021	0.0000013 - 0.000074	SED18	0.0000157	TEQ				
1,2,3,4,7,8-HxCDF	21 / 25	0.00000068 - 0.0000017	0.0000024 - 0.00067	SED18	0.000133	TEQ				
1,2,3,6,7,8-HxCDD	22 / 25	0.00000068 - 0.0000008	0.0000013 - 0.00019	SED18	0.000044	TEQ				
1,2,3,6,7,8-HxCDF	21 / 25	0.00000068 - 0.0000014	0.0000073 - 0.0013	SED18	0.00022	TEQ				
1,2,3,7,8,9-HxCDD	19 / 25	0.00000068 - 0.000018	0.0000017 - 0.000097	SED18	0.000022	TEQ				
1,2,3,7,8,9-HxCDF	17 / 25	0.00000068 - 0.0000071	0.0000024 - 0.00042	SED31	0.0000809	TEQ				
1,2,3,7,8-PeCDD	20 / 25	0.00000068 - 0.000003	0.00000095 - 0.00012	SED31	0.000028	TEQ				
1,2,3,7,8-PeCDF	12 / 25	0.00000068 - 0.000018	0.0000023 - 0.00023	SED31	0.000021	TEQ				
2,3,4,6,7,8-HxCDF	21 / 25	0.00000068 - 0.0000014	0.000012 - 0.00091	SED18	0.00018	TEQ				
2,3,4,7,8-PeCDF	23 / 25	0.00000068 - 0.0000008	0.00000086 - 0.0062	SED18	0.000917	TEQ				
2,3,7,8-TCDD	20 / 25	0.00000014 - 2.8E-07	0.00000052 - 0.000033	SED31	0.0000083	TEQ				
2,3,7,8-TCDF	19 / 25	0.00000014 - 0.0000042	0.00000019 - 0.00012	SED18	0.000026	TEQ				
OCDD	25 / 25		0.0000035 - 0.0029	SED28	0.00075	TEQ				
OCDF	23 / 25	0.0000014 - 0.0000016	0.0000016 - 0.0003	SED18	0.00009	TEQ				
TOTAL HpCDD	23 / 25	0.00000068 - 0.0000008	0.0000039 - 0.0013	SED18	0.00032	TEQ				
TOTAL HpCDF	23 / 25	0.00000068 - 0.0000008	0.0000011 - 0.0028	SED18	0.00059	TEQ				
TOTAL HxCDD	22 / 25	0.00000068 - 0.0000008	0.000013 - 0.0026	SED18	0.00056	TEQ				
TOTAL HxCDF	25 / 25		0.0000011 - 0.025	SED31	0.0055	TEQ				
TOTAL PeCDD	22 / 25	0.00000068 - 0.0000008	0.0000081 - 0.002	SED18	0.00041	TEQ				
TOTAL PeCDF	25 / 25		0.0000031 - 0.04	SED31	0.0066	TEQ				

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.2
Selection of Chemicals of Potential Concern - Cove Study Area Sediment

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [d]	Maximum HQ [e]
TOTAL TCDD	22 / 25	0.00000014 - 1.6E-07	0.0000036 - 0.0008	SED18	0.000178	TEQ				
TOTAL TCDF	25 / 25		0.0000012 - 0.015	SED31	0.00296	TEQ				
TEQ-Mammal			8.5E-07 - 3.6E-03	SED18		7.2E-06	25	Yes	ASL	503
TEQ-Bird			1.1E-06 - 6.8E-03	SED18		7.2E-06	25	Yes	ASL	945
TEQ-Fish			9.2E-07 - 3.6E-03	SED18		7.2E-06	25	Yes	ASL	502

Notes:
[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmarks can be found on Table 3.2
TEQ - Dioxin-related compounds evaluated as 2,3,7,8-TCDD using Toxicity Equivalence (TEQs) for mammals, birds, and fish.
[c] Chemical is selected as a contaminant of potential concern (COPC) if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable, unless the frequency of detection (FOD) is less than 5%.
ASL - Above Screening Level
BSL - Below Screening Level
NSL - No Screening Level
FOD - Frequency of Detection is less than 5%
[d] Hazard quotient (HQ) is the maximum detected concentration divided by the screening benchmark. HQs are only calculated for COPCs.
NA - HQ not calculated because no screening level benchmark was available.

mg/Kg - milligrams per kilogram

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.3
Selection of Chemicals of Potential Concern - Property Line Study Area Surface Water

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [c]	Maximum HQ [d]
Volatile Organics (mg/L)										
1,1,1-Trichloroethane	0 / 3	0.001 - 0.001			0.0005	0.043		No	ND	
1,1-Dichloroethane	0 / 3	0.001 - 0.001			0.00050	0.131		No	ND	
1,2,4-Trimethylbenzene	0 / 3	0.001 - 0.001			0.00050	NA		No	ND	
cis-1,2-Dichloroethene	3 / 3		0.0015 - 0.0108	SW11	0.0048	0.59		No	BSL	
Ethylbenzene	0 / 3	0.0005 - 0.0005			0.00025	0.036		No	ND	
Tetrachloroethene	0 / 3	0.001 - 0.001			0.00050	0.0053		No	ND	
Toluene	0 / 3	0.001 - 0.001			0.0005	0.014		No	ND	
Trichloroethene	0 / 3	0.001 - 0.001			0.0005	0.043		No	ND	
Vinyl chloride	0 / 3	0.001 - 0.001			0.0005	0.93		No	ND	
Xylene, M&P-	0 / 3	0.002 - 0.002				0.003		No	ND	
Xylene, O-	0 / 3	0.001 - 0.001				0.003		No	ND	
Xylenes, Total	0 / 3	0.003 - 0.003			0.0030	0.003		No	ND	
Semivolatile Organics (mg/L)										
Benzo(a)anthracene	0 / 3	0.0002 - 0.0002			0.00010	0.000027		No	ND	
Benzo(a)pyrene	0 / 3	0.0002 - 0.0002			0.00010	0.000014		No	ND	
Benzo(g,h,i)perylene	0 / 3	0.0002 - 0.0002			0.00010	0.00764		No	ND	
Chrysene	0 / 3	0.0002 - 0.0002			0.00010	NA		No	ND	
Dibenz(a,h)anthracene	0 / 3	0.0002 - 0.0002			0.00010	NA		No	ND	
Naphthalene	0 / 3	0.0002 - 0.0002			0.0001	0.0026		No	ND	
Pesticides/PCBs (mg/L)										
4,4'-DDT	1 / 1		0.000080 - 0.000080	SW11	0.000080	0.000001	1	Yes	ASL	80
Inorganics (mg/L) [e, f]										
Dioxins/Furans (mg/L)										
1,2,3,4,6,7,8-HpCDD	1 / 1		2.4E-08 - 2.4E-08	SW11	0.000000024	TEQ				
1,2,3,6,7,8-HxCDD	0 / 1	1E-08 - 1E-08			0.0000000050	TEQ				
1,2,3,7,8,9-HxCDD	0 / 1	1E-08 - 1E-08			0.0000000050	TEQ				
1,2,3,7,8-PeCDD	0 / 1	1E-08 - 1E-08			0.0000000050	TEQ				
2,3,7,8-TCDD	0 / 1	2.1E-09 - 2.1E-09			0.0000000011	TEQ				
2,3,7,8-TCDF	0 / 1	2.1E-09 - 2.1E-09			0.0000000011	TEQ				
OCDD	1 / 1		1.8E-07 - 1.8E-07	SW11	0.00000018	TEQ				
Total HpCDD	1 / 1		4.3E-08 - 4.3E-08	SW11	0.000000043	TEQ				
Total HpCDF	1 / 1		1.2E-08 - 1.2E-08	SW11	0.000000012	TEQ				
Total HxCDD	0 / 1	1E-08 - 1E-08			0.0000000050	TEQ				
Total PeCDD	0 / 1	1E-08 - 1E-08			0.0000000050	TEQ				
Total PeCDF	0 / 1	1E-08 - 1E-08			0.0000000050	TEQ				
Total TCDD	0 / 1	2.1E-09 - 2.1E-09			0.0000000011	TEQ				
Total TCDF	0 / 1	2.1E-09 - 2.1E-09			0.000000001	TEQ				
TEQ-Mammal			1.3E-08	SW11		3E-12	1	Yes	ASL	1
TEQ-Bird			1.6E-08	SW11		3E-12	1	Yes	ASL	2
TEQ-Fish			1.4E-08	SW11		3E-12	1	Yes	ASL	1

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.3
Selection of Chemicals of Potential Concern - Property Line Study Area Surface Water

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [c]	Maximum HQ [d]

Notes:

[a] Average (arithmethic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmarks can be found on Table 3.1
TEQ - Dioxin-related compounds evaluated as 2,3,7,8-TCDD using Toxicity Equivalence (TEQs) for mammals, birds, and fish.
[c] Chemical is selected as a contaminant of potential concern (COPC) if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable, unless the frequency of detection (FOD) is less than 5%.
ASL - Above Screening Level
BSL - Below Screening Level
FOD - Frequency of Detection is less than 5%
ND - Not Detected
[d] Hazard quotient (HQ) is the maximum detected concentration divided by the screening benchmark. HQs are only calculated for COPCs.
NA - Hazard quotient not calculated because benchmark not available.
[e] Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, and Zinc benchmarks are based on the dissolved fraction. Because no dissolved metals were detected in surface water samples, no benchmarks were needed and therefore are not shown.
[f] Benchmarks for Antimony, Beryllium, Selenium, and Thallium are based on the total fraction. Because these metals were not detected in either the dissolved or total fraction, no benchmarks were needed and therefore are not shown.

mg/L - milligrams per liter

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.4
Selection of Chemicals of Potential Concern - Property Line Study Area Sediment

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [d]	Maximum HQ [e]
Volatile Organics (mg/kg)										
1,1,1-Trichloroethane	0 / 3	0.004 - 0.0427			0.0088	0.03		No	ND	
1,1-Dichloroethane	0 / 3	0.004 - 0.0427			0.0088	0.027		No	ND	
1,1-Dichloroethene	0 / 3	0.004 - 0.0427			0.0088	0.031		No	ND	
Acetone	2 / 3	0.0403 - 0.0403	0.0757 - 0.649	SED11	0.25	0.0087	2	Yes	ASL	75
Carbon Disulfide	0 / 3	0.004 - 0.0427			0.0088	0.00085		No	ND	
cis-1,2-Dichloroethene	0 / 3	0.004 - 0.0427			0.0088	0.4		No	ND	
Isopropyl Benzene	0 / 3	0.004 - 0.0427			0.0088	NA		No	ND	
s-Butylbenzene	0 / 3	0.004 - 0.0427			0.0088	NA		No	ND	
Tetrachloroethene	0 / 3	0.004 - 0.0427			0.0088	0.99		No	ND	
Toluene	0 / 3	0.004 - 0.0427			0.0088	0.05		No	ND	
trans-1,2-Dichloroethene	0 / 3	0.004 - 0.0427			0.0088	0.4		No	ND	
Trichloroethene	0 / 3	0.004 - 0.0427			0.0088	0.22		No	ND	
Vinyl chloride	0 / 3	0.0081 - 0.0855			0.018	0.202		No	ND	
Semivolatile Organics (mg/kg)										
Acenaphthene	1 / 3	0.0305 - 0.163	0.0564 - 0.0564	SED12	0.051	0.19		No	BSL	
Acenaphthylene	0 / 3	0.0305 - 0.163			0.041	0.19		No	ND	
Anthracene	1 / 3	0.0305 - 0.163	0.276 - 0.276	SED12	0.12	0.0572	1	Yes	ASL	5
Benzo(a)anthracene	1 / 3	0.0305 - 0.163	0.685 - 0.685	SED12	0.26	0.108	1	Yes	ASL	6
Benzo(a)pyrene	1 / 3	0.0305 - 0.163	0.862 - 0.862	SED12	0.32	0.15	1	Yes	ASL	6
Benzo(b)fluoranthene	2 / 3	0.0305 - 0.0305	0.245 - 1.41	SED12	0.56	0.24	2	Yes	ASL	6
Benzo(g,h,i)perylene	1 / 3	0.0305 - 0.163	0.244 - 0.244	SED12	0.11	0.17	1	Yes	ASL	1
Benzo(k)fluoranthene	1 / 3	0.0305 - 0.163	0.636 - 0.636	SED12	0.24	0.24	1	Yes	ASL	3
Chrysene	1 / 3	0.0305 - 0.163	0.625 - 0.625	SED12	0.24	0.166	1	Yes	ASL	4
Dibenzo(a,h)anthracene	1 / 3	0.0305 - 0.163	0.0807 - 0.0807	SED12	0.059	0.06	1	Yes	ASL	1
Di-n-butylphthalate						0.1		No	ANP	
Fluoranthene	2 / 3	0.0305 - 0.0305	0.327 - 1.92	SED12	0.75	0.423	1	Yes	ASL	5
Fluorene	1 / 3	0.0305 - 0.163	0.107 - 0.107	SED12	0.068	0.0774	1	Yes	ASL	1
Indeno(1,2,3-cd)pyrene	1 / 3	0.0305 - 0.163	0.259 - 0.259	SED12	0.12	0.2	1	Yes	ASL	1
Naphthalene	0 / 3	0.0305 - 0.163			0.041	0.176		No	ND	
Phenanthrene	1 / 3	0.0305 - 0.163	1.14 - 1.14	SED12	0.41	0.204	1	Yes	ASL	6
Pyrene	2 / 3	0.0305 - 0.0305	0.258 - 1.01	SED12	0.43	0.195	2	Yes	ASL	5
Pesticides/PCBs (mg/kg)										
4,4'-DDD	1 / 3	0.0056 - 0.0351	0.0214 - 0.0214	SED12	0.014	0.00488	1	Yes	ASL	4
4,4'-DDE	0 / 3	0.0056 - 0.0351			0.0087	0.00316		No	ND	
4,4'-DDT	0 / 3	0.0056 - 0.0351			0.0087	0.00416		No	ND	
Endrin ketone	0 / 3	0.0056 - 0.0351			0.0087	0.003		No	ND	
Aroclor-1254	0 / 3	0.056 - 0.351			0.087	0.06		No	ND	
Aroclor-1260	0 / 3	0.056 - 0.351			0.087	0.005		No	ND	

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.4
Selection of Chemicals of Potential Concern - Property Line Study Area Sediment

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [d]	Maximum HQ [e]
Inorganics (mg/kg)										
Antimony	0 / 3	6.5 - 25.7			7.4	NA		No	ND	
Arsenic	1 / 3	0.3 - 3	4.8 - 4.8	SED11	2.2	9.79	0	No	BSL	
Barium	3 / 3		10.2 - 156	SED11	66.4	NA		Yes	NSL	NA
Beryllium	2 / 3	0.07 - 0.07	0.31 - 0.47	SED11	0.27	NA		Yes	NSL	NA
Cadmium	1 / 3	0.65 - 1.19	3.24 - 3.24	SED11	1.4	0.99	1	Yes	ASL	3
Chromium	3 / 3		3 - 213	SED11	74.3	43.4	1	Yes	ASL	5
Copper	3 / 3		4.1 - 423	SED11	147	31.6	1	Yes	ASL	13
Lead	2 / 3	6.5 - 6.5	20.7 - 590	SED11	205	35.8	1	Yes	ASL	16
Mercury	0 / 3	0.035 - 0.208			0.052	0.18	0	No	ND	
Nickel	2 / 3	5.9 - 5.9	3.6 - 85.7	SED11	30.8	22.7	1	Yes	ASL	4
Selenium	0 / 3	6.5 - 25.7			7.4	NA		No	ND	
Silver	1 / 3	0.65 - 1.19	29.7 - 29.7	SED11	10.2	0.5	1	Yes	ASL	59
Zinc	3 / 3		28.1 - 620	SED11	228	121	1	Yes	ASL	5
Dioxins/Furans (mg/kg)										
1,2,3,4,6,7,8-HpCDD	2 / 3	0.00000075 - 0.00000075	0.0000074 - 0.00028	SED11	0.000096	TEQ				
1,2,3,4,6,7,8-HpCDF	2 / 3	0.00000075 - 0.00000075	0.000002 - 0.00014	SED11	0.00005	TEQ				
1,2,3,4,7,8,9-HpCDF	1 / 3	0.00000071 - 0.00000075	0.000018 - 0.000018	SED11	0.000006	TEQ				
1,2,3,4,7,8-HxCDD	1 / 3	0.00000071 - 0.00000075	0.0000095 - 0.0000095	SED11	0.0000034	TEQ				
1,2,3,4,7,8-HxCDF	1 / 3	0.00000071 - 0.00000075	0.000036 - 0.000036	SED11	0.000012	TEQ				
1,2,3,6,7,8-HxCDD	1 / 3	0.00000071 - 0.00000075	0.000025 - 0.000025	SED11	0.000009	TEQ				
1,2,3,6,7,8-HxCDF	1 / 3	0.00000071 - 0.00000075	0.000086 - 0.000086	SED11	0.00003	TEQ				
1,2,3,7,8,9-HxCDD	1 / 3	0.00000071 - 0.00000075	0.000017 - 0.000017	SED11	0.000006	TEQ				
1,2,3,7,8,9-HxCDF	1 / 3	0.00000071 - 0.00000075	0.00003 - 0.00003	SED11	0.0000102	TEQ				
1,2,3,7,8-PeCDD	1 / 3	0.00000071 - 0.00000075	0.000011 - 0.000011	SED11	0.000004	TEQ				
1,2,3,7,8-PeCDF	1 / 3	0.00000071 - 0.00000075	0.000032 - 0.000032	SED11	0.000011	TEQ				
2,3,4,6,7,8-HxCDF	1 / 3	0.00000071 - 0.00000075	0.00008 - 0.00008	SED11	0.00003	TEQ				
2,3,4,7,8-PeCDF	2 / 3	0.00000075 - 0.00000075	0.00000073 - 0.00043	SED11	0.000144	TEQ				
2,3,7,8-TCDD	1 / 3	0.00000014 - 0.00000015	0.0000042 - 0.0000042	SED11	0.0000014	TEQ				
2,3,7,8-TCDF	1 / 3	0.00000015 - 0.00000057	0.00000024 - 0.00000024	SED12	0.000000	TEQ				
OCDD	3 / 3		0.0000044 - 0.0018	SED11	0.00062	TEQ				
OCDF	2 / 3	0.0000015 - 0.0000015	0.0000031 - 0.000087	SED11	0.00003	TEQ				
TOTAL HpCDD	2 / 3	0.00000075 - 0.00000075	0.000013 - 0.00063	SED11	0.00021	TEQ				
TOTAL HpCDF	2 / 3	0.00000075 - 0.00000075	0.000002 - 0.00033	SED11	0.00011	TEQ				
TOTAL HxCDD	2 / 3	0.00000075 - 0.00000075	0.0000011 - 0.0003	SED11	0.00010	TEQ				
TOTAL HxCDF	2 / 3	0.00000075 - 0.00000075	0.0000039 - 0.0023	SED11	0.0008	TEQ				
TOTAL PeCDD	1 / 3	0.00000071 - 0.00000075	0.00014 - 0.00014	SED11	0.00005	TEQ				
TOTAL PeCDF	2 / 3	0.00000075 - 0.00000075	0.0000056 - 0.0055	SED11	0.0018	TEQ				

Prepared by: KJC
Checked by: AMR
7/28/2006

Table 4.4
Selection of Chemicals of Potential Concern - Property Line Study Area Sediment

333 Adelaide Avenue
Providence, Rhode Island

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Location of Maximum Detection	Average (arithmetic mean) [a]	Final Selected Benchmark [b]	Number of Benchmark Exceedances	COPC? [c]	Rationale [d]	Maximum HQ [e]
TOTAL TCDD	2 / 3	0.00000015 - 0.00000015	0.00000031 - 0.000089	SED11	0.000030	TEQ				
TOTAL TCDF	2 / 3	0.00000015 - 0.00000015	0.0000037 - 0.0016	SED11	0.00053	TEQ				
TEQ-Mammal			9.4E-07 - 2.6E-04	SED11		7.2E-06	3	Yes	ASL	37
TEQ- Bird			1.2E-06 - 4.8E-04	SED11		7.2E-06	3	Yes	ASL	66
TEQ-Fish			1.0E-06 - 2.6E-04	SED11		7.2E-06	3	Yes	ASL	36

Notes:
[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.
[b] Screening benchmarks can be found on Table 3
TEQ - Dioxin-related compounds evaluated as 2,3,7,8-TCDD using Toxicity Equivalence (TEQs) for mammals, birds, and fish.
[c] Chemical is selected as a contaminant of potential concern (COPC) if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable, unless the frequency of detection (FOD) is less than 5%.
ASL - Above Screening Level
BSL - Below Screening Level
NSL - No Screening Level
[d] Hazard quotient (HQ) is the maximum detected concentration divided by the screening benchmark. HQs are only calculated for COPCs.
NA - HQ not calculated because no screening level benchmark was available.

mg/Kg - milligrams per kilogram
ANP - Analysis Not Performed

Prepared by: KJC
Checked by: AMR
7/28/2006

TABLE 4.5
AVS-SEM DATA
333 Adelaide Avenue
Providence, Rhode Island

Location	Sample Date	SEM (umol/g)	AVS (umol/g)	SEM-AVS (umol/g)	Foc	(SEM-AVS)/F_{oc}
SED15	June, 2006	0.80	0.04	0.76	0.0070	108
SED20	June, 2006	7.63	0.24	7.39	0.0260	284
SED22	June, 2006	23.66	0.09	23.56	0.0240	982
SED24	June, 2006	16.67	0.09	16.59	0.0230	721
SED26	June, 2006	32.44	0.59	31.84	0.0296	1076

If (SEM-AVS)/F_{oc} <130 umol/g_{OC} then divalent metlas unlikely to be bioavailable.
130-3,000 umol/g_{OC} then divalent metal bioavailability is uncertain.
> 3,000 umol/g_{OC} then divelent metals likely to be bioavailable.
<0 umol/g_{OC} indicates AVS > SEM, and divalent metals are unavailable for leaching into pore water.

AVS - acid volatile sulfides (umol/g)
SEM - simultaneously extractable metals (umol/g)
F_{oc} - fraction organic carbon (g_{OC} / g_{sed})

Table 4.6
Summary of Sediment ΣPAH Calculations
333 Adelaide Avenue
Providence, Rhode Island

Location	Calculated $\Sigma ESBTU_{FCV}$ [a]	Notes
SD-1001	--	[b]
SD-1002	--	[b]
SD-1003	--	[b]
SD-1004	--	[b]
SD-1005	--	[b]
SED10	--	[c]
SED11	0.32	
SED12	42.34	
SED13	1.64	[d]
SED14	0.39	
SED15	0.39	
SED16	0.29	
SED17	0.52	
SED18	0.17	
SED19	0.40	
SED20	48.19	
SED21	0.53	
SED22	0.55	
SED23	0.99	
SED24	0.57	
SED25	2.76	
SED26	0.78	
SED27	0.40	
SED28	2.97	
SED29	1.59	
SED30	6.03	
SED31	1.67	
SED32	12.69	

Notes

A $\Sigma ESBTU_{FCV}$ value < 1.0 indicates that samples PAH concentrations are protective of benthic organisms

[a] 1/2 the detection limit was used for PAHs reported as non detect.
[b] ΣPAH was not calculated for SED-1001 through SED-1005 because these samples did not include TOC concentrations
[c] ΣPAH was not calculated for SD10 because TOC < 0.20 %
[d] Although the ΣPAH >1 for SED13, PAHs were not detected and thus calculations are based entirely on 1/2 detection limits.

Table 4.7
Summary of Sediment TEQ Calculations
333 Adelaide Avenue
Providence, Rhode Island

Location	TEQ Mammal (mg/kg)	HQ	TEQ Bird (mg/kg)	HQ	TEQ Fish (mg/kg)	HQ
SD-1001	5.1E-05	7.1	8.3E-05	12	4.9E-05	6.8
SD-1002	5.6E-05	7.8	9.1E-05	13	5.5E-05	7.7
SD-1003	2.0E-04	27	3.0E-04	42	2.0E-04	27
SD-1004	2.0E-04	28	3.1E-04	43	2.0E-04	27
SD-1005	2.4E-05	3.3	3.9E-05	5.4	2.3E-05	3.2
SED10	9.4E-07	0.1	1.2E-06	0.2	1.0E-06	0.1
SED11	2.6E-04	37	4.8E-04	66	2.6E-04	36
SED12	1.1E-05	1.6	1.1E-05	1.6	3.6E-06	0.5
SED13	1.2E-06	0.2	1.8E-06	0.2	1.3E-06	0.2
SED14	9.4E-05	13	1.7E-04	24	9.3E-05	13
SED15	1.0E-06	0.1	1.2E-06	0.2	1.1E-06	0.2
SED16	1.7E-03	231	3.1E-03	433	1.7E-03	230
SED17	1.2E-04	16	2.1E-04	29	1.1E-04	16
SED18	3.6E-03	503	6.8E-03	945	3.6E-03	502
SED19	2.1E-03	286	3.8E-03	534	2.1E-03	286
SED20	1.6E-04	23	2.4E-04	33	1.6E-04	23
SED21	2.6E-05	3.7	4.8E-05	6.7	2.6E-05	3.7
SED22	7.3E-04	102	1.4E-03	195	7.3E-04	101
SED23	8.5E-07	0.1	1.1E-06	0.1	9.2E-07	0.1
SED24	5.7E-05	7.9	1.0E-04	14	5.7E-05	7.9
SED25	1.3E-03	184	2.5E-03	342	1.3E-03	184
SED26	3.2E-06	0.4	5.0E-06	0.7	2.7E-06	0.4
SED27	5.6E-04	78	1.0E-03	141	5.6E-04	77
SED28	1.8E-03	255	3.4E-03	478	1.8E-03	254
SED29	2.4E-04	34	3.4E-04	47	2.4E-04	33
SED30	5.3E-05	7.4	9.4E-05	13	5.2E-05	7.2
SED31	1.2E-03	170	2.1E-03	290	1.2E-03	170
SED32	2.4E-05	3.3	4.2E-05	5.8	2.3E-05	3.1

TCDD Screening Value = 7.2E-06 mg/kg (WA SCV; Cubbage, 1997)
TEQ - Toxic Equivalence was calculated from toxicity equivalence factors published
by the World Health Organization (Van den Berg et al., 1998)
HQ - Hazard Quotient

Table 4.8
Summary of Surface Water TEQ Calculations
333 Adelaide Avenue
Providence, Rhode Island

Location	TEQ Mammal (mg/L)	HQ	TEQ Bird (mg/Lg)	HQ	TEQ Fish (mg/Lg)	HQ
SW11	1.3E-08	1.3	1.6E-08	1.6	1.4E-08	1.4
SW19	1.3E-08	1.3	1.5E-08	1.5	1.4E-08	1.4
SW27	6.2E-08	6.2	7.1E-08	7.1	5.8E-08	5.8

TCDD Screening Value = 1.0E-08 mg/L (USEPA, 2004)
TEQ - Toxic Equivalence was calculated from toxicity equivalence factors published by the World Health Organization (Van den Berg et al., 1998)
HQ - Hazard Quotient

Table 5.1
Comparison of VOCs COPCs between the Eastern and Western Portions of the Inner Cove
333 Adelaide Avenue
Providence, RI

			Western Part of Inner Cove				
Parameter	Range of Non Detects	Range of Detected Concentrations	SED16	SED18	SED2	SED22	SED23
Volatile Organics (mg/kg)							
1,1,1-Trichloroethane	0.004 - 0.15	0.3 - 1.3	< 0.0235	< 0.0506	< 0.0044	< 0.0126	< 0.0041
1,1-Dichloroethane	0.004 - 1.1	0.011 - 7.92	< 0.0235	< 0.0506	< 0.0044	< 0.0126	< 0.0041
1,1-Dichloroethene	0.004 - 1.1	0.014 - 11.3	< 0.0235	< 0.0506	< 0.0044	< 0.0126	< 0.0041
Acetone	0.039 - 4.6	0.0757 - 1.9	< 0.235	1.9	< 0.0445	0.294	< 0.0406
Carbon Disulfide	0.004 - 1.1	0.0046 - 0.0576	< 0.0235	< 0.0506	< 0.0044	< 0.0126	< 0.0041
cis-1,2-Dichloroethene	0.004 - 1.1	0.0091 - 175	< 0.0235	< 0.0506	< 0.0044	< 0.0126	0.0091
s-Butylbenzene	0.004 - 1.1	0.0197 - 0.0303	< 0.0235	< 0.0506	< 0.0044	< 0.0126	< 0.0041
Tetrachloroethene	0.004 - 1.1	0.0081 - 18.1	< 0.0235	< 0.0506	< 0.0044	< 0.0126	1.0
Toluene	0.004 - 1.1	1.92 - 1.92	< 0.0235	< 0.0506	< 0.0044	< 0.0126	< 0.0041
Trichloroethene	0.004 - 0.15	0.176 - 58.4	< 0.0235	< 0.0506	< 0.0044	< 0.0126	0.176
Vinyl chloride	0.0081 - 2.3	0.0218 - 24.8	< 0.047	< 0.101	< 0.0089	< 0.0253	< 0.0081

mg/Kg - milligrams per kilogram

Table 5.1
Comparison of VOCs COPCs between the Eastern and Western Portions of the Inner Cove
333 Adelaide Avenue
Providence, RI

	Eastern Part of Inner Cove							
Parameter	SD-1001	SD-1002	SD-1003	SD-1004	SD-1005	SED17	SED19	SED20
Volatile Organics (mg/kg)								
1,1,1-Trichloroethane	< 0.013	< 0.0098	< 0.15	1.3	0.3	0.732	0.635	< 0.0149
1,1-Dichloroethane	< 0.013	< 0.0098	1.4	< 1.1	< 0.012	0.137	7.92	< 0.0149
1,1-Dichloroethene	< 0.013	< 0.0098	< 0.15	< 1.1	0.014	0.0555	11.3	< 0.0149
Acetone	< 0.052	< 0.039	0.87	< 4.6	< 0.048	< 0.0463	0.242	0.421
Carbon Disulfide	< 0.013	< 0.0098	< 0.15	< 1.1	< 0.012	0.007	0.0576	< 0.0149
cis-1,2-Dichloroethene	< 0.013	< 0.0098	0.42	< 1.1	0.016	0.0298	175	< 0.0149
s-Butylbenzene	< 0.013	< 0.0098	< 0.15	< 1.1	< 0.012	< 0.0046	0.0197	< 0.0149
Tetrachloroethene	< 0.013	< 0.0098	< 0.15	< 1.1	< 0.012	0.0081	18.1	< 0.0149
Toluene	< 0.013	< 0.0098	< 0.15	< 1.1	< 0.012	< 0.0046	< 0.017	< 0.0149
Trichloroethene	< 0.013	< 0.0098	< 0.15	5.6	0.21	1.22	58.4	< 0.0149
Vinyl chloride	< 0.026	< 0.02	5	< 2.3	< 0.024	< 0.0093	0.148	< 0.0298

mg/Kg - milligrams per kilogram

Table 5.1
Comparison of VOCs COPCs between the Eastern and Western Portions of the Inner Cove
333 Adelaide Avenue
Providence, RI

	Eastern Part of Inner Cove (continued)								
Parameter	SED24	SED25	SED26	SED27	SED28	SED29	SED30	SED31	SED32
Volatile Organics (mg/kg)									
1,1,1-Trichloroethane	< 0.0079	< 0.0088	< 0.008	< 0.0198	< 0.0226	< 0.025	< 0.0043	< 0.0289	< 0.005
1,1-Dichloroethane	0.011	1.09	< 0.008	4.67	0.0266	< 0.025	< 0.0043	1.92	< 0.005
1,1-Dichloroethene	< 0.0079	< 0.0088	< 0.008	2.34	< 0.0226	< 0.025	< 0.0043	< 0.0289	< 0.005
Acetone	< 0.0791	0.128	0.0856	< 0.198	0.384	0.27	< 0.0434	0.522	< 0.0496
Carbon Disulfide	< 0.0079	0.0111	< 0.008	0.0398	< 0.0226	< 0.025	< 0.0043	< 0.0289	< 0.005
cis-1,2-Dichloroethene	< 0.0079	11.5	< 0.008	103	< 0.0226	< 0.025	< 0.0043	10.6	< 0.005
s-Butylbenzene	< 0.0079	< 0.0088	< 0.008	< 0.0198	0.0303	< 0.025	< 0.0043	< 0.0289	< 0.005
Tetrachloroethene	< 0.0079	< 0.0088	< 0.008	< 0.0198	< 0.0226	< 0.025	< 0.0043	< 0.0289	< 0.005
Toluene	< 0.0079	< 0.0088	< 0.008	< 0.0198	< 0.0226	< 0.025	< 0.0043	1.92	< 0.005
Trichloroethene	< 0.0079	0.276	< 0.008	15.1	< 0.0226	< 0.025	< 0.0043	0.797	< 0.005
Vinyl chloride	0.0218	24.8	< 0.016	5.42	0.0499	< 0.05	< 0.0087	11.7	< 0.0099

mg/Kg - milligrams per kilogram

ATTACHMENT A

ECOTOXICOLOGICAL PROFILES

ECOTOXICOLOGICAL PROFILES

1.0 Volatile Organic Compounds (VOCs). VOCs rapidly dissociate from a liquid into a gaseous state, and exhibit varying degrees of solubility in water. Many VOCs, such as carbon tetrachloride, react with light to form highly unstable free-radicals. VOCs can range from low to high toxicity to aquatic and terrestrial life (Crosby, 1998). Acute damage to vertebrates typically involves damage to liver and kidneys (e.g. tetrachloroethylene and perchloroethylene), while chronic toxicity typically involves cancer (1,2-dichloroethane). Effects on invertebrates involve reduced growth and mortality. For example, the LC50 of 1,2,4-trichlorobenzene after fourteen days of exposure to earthworms is as low as 127 ppm. Because of their reactive and volatile nature, VOCs generally do not accumulate in plant and animal tissue.

2.0 Semi Volatile Organic Compounds (SVOCs). In aquatic environments, SVOCs (including polyaromatic hydrocarbons, or PAHs) rapidly become adsorbed to organic and inorganic particulate materials and are deposited in sediments (Neff, 1985). Sediment associated SVOCs can be accumulated by bottom-dwelling invertebrates and fish (Eisler 1987) and can be toxic to benthic invertebrates (Lotufo and Fleeger, 1996).

SVOC-induced phytotoxic effects are rare, however toxicological data are limited. Some higher plants can catabolize SVOCs, but this metabolic pathway is not well defined. Certain plants contain substances that can protect against SVOC effects, inactivating their cancer-causing and mutation-causing potential. Additionally, SVOCs synthesized by plants may act as growth hormones.

Most animals and microorganisms (shellfish and algae are notable exceptions) can metabolize and transform SVOCs to breakdown products that may ultimately completely degrade (Eisler, 1987). Biodegradation probably occurs more slowly in aquatic systems (especially under anaerobic systems) than soil (USEPA, 1985).

Some SVOCs rapidly bioaccumulate in animals because of their high lipid solubility (Eisler, 1987). The rate of bioaccumulation is inversely related to the rate of SVOC metabolism and is also influenced by the concentration of SVOC to which an organism is exposed. Both rates are dependent on the size of the specific SVOC molecule; for example PAHs with less than four rings are readily metabolized and not bioaccumulated, while PAHs with more than four rings are more slowly metabolized and tend to bioaccumulate on a short-term basis (USEPA, 1985; Eisler, 1987). Other effects in terrestrial organisms are poorly characterized, but may include adverse effects on reproduction, development, and immunity (ATSDR, 1995).

PAHs are highly potent carcinogens that can produce tumors in some organisms as well as other non-cancer-causing effects (Eisler, 1987). Effects have been found in many types of organisms, including mammals, birds, invertebrates, plants, amphibians, and fish. Effects on benthic invertebrates include inhibited reproduction, delayed emergence, sediment avoidance, and mortality. Fish exposed to PAH contamination have exhibited fin erosion, liver abnormalities, cataracts, and immune system impairments leading to increased susceptibility to disease (Fabacher *et al*., 1991; Weeks and Warinner 1984; O'Conner and Huggett 1988).

3.0 Polychlorinated Biphenyls (PCBs)

PCBs are the family of chemicals formed by attaching one or more chlorine atoms to a pair of connected benzene rings. Depending on the number and position of chlorine atoms attached to the biphenyl ring structure, 209 different PCB congeners can be formed. No known natural sources of PCBs exist. The chemical and toxicological properties of PCBs vary from one congener to the next (ASTDR, 2000).

PCBs are mutation-causing, cancer-causing, and teratogenic. They are readily absorbed through the gut, respiratory system, and skin in mammals and will concentrate in the liver, blood, muscle, adipose tissue, and skin (Eisler, 1986). Mutagenic activity tents to decrease with increasing chlorination.

In aquatic systems, increased toxicity is generally associated with increasing exposure, younger developmental stages, and lower chlorinated biphenyls (Eisler, 1986). Effects on algae include growth reduction. Effects on fish may include reduced egg survival and reduced fertilization success, and complete reproductive failure in brook trout. Carcinogenic and biochemical perturbations have been observed in trout liver cells and marine teleosts, with anemia, hyperglycemia, and altered cholesterol metabolism in brown trout fed diets with 10 ppm PCBs.

Toxic effects in avian species include morbidity, tremors, upward pointing beaks, muscular uncoordination, and hemorrhagic areas in the liver (Eisler, 1986). Other sub-lethal effects include delayed reproduction and chromosomal aberrations, courtship and nest building behavioral impairments, reduced hatchability, and decline in sperm concentrations. However, birds tend to be more resistant to acute exposure than other groups.

4.0 Pesticides

Pesticides may be very persistent in aquatic systems, absorbing strongly to sediments, and bioconcentrating in aquatic organisms, including fish and other organisms (HSDB, 2000). Pesticides may be toxic to many types of aquatic organisms, even at low concentrations. Birds show a wide range of susceptibility to pesticides including dieldrin (less toxic than in aquatic organisms), heptachlor (moderately to high toxicity), gamma-BHC (slightly to moderately toxic), and DDT (slightly to non-toxic). However, DDT causes eggshell thinning and embryo mortality, especially in predatory birds. DDT also changes courtship behavior and induces other reproductive impairments.

Many pesticides are highly persistent and lipophilic compounds subject to pronounced biomagnification. The extremely low water solubilities result in strong adsorption to soil particles and very low leaching losses. Microbes biodegrade DDT to DDE and DDD under aerobic and anaerobic conditions, respectively. Both metabolites are more persistent than DDT. Plants adsorb DDT and its metabolites form soil, but they are poorly translocated and remain primarily in the roots. Foliar herbivory is therefore not a significant route of exposure to soil DDT. The toxicity of DDT to earthworms is low (Edwards and Bolgen, 1992), so bioaccumulation by earthworms is a significant route of exposure to vermivores and can results in lethal doses (Barker, 1958).

5.0 Dioxins/Furans

Dioxins and furans belong to a family of compounds divided into groups based on the number of chlorine atoms in the compound. (USEPA, 2003). They are typically produced from the incomplete combustion of fossil fuels or waste, but area also associated with several smelting and manufacturing processes. Dioxins do not dissolve easily in water; aquatic forms will attach strongly to small particles of soil or organic matter and eventually settle to the bottom. Dioxins may also attach to microscopic plants and animals (plankton) which serve as prey for other organisms. Concentrations of chemicals such as the most toxic form, 2,3,7,8-TCDD, are difficult for organisms to metabolize, and thus biomagnify. In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure to small amounts. Exposure to non-lethal doses can cause a variety of adverse effects in animals, such as weight loss, biochemical and degenerative changes in the liver, and chloracne (USEPA, 2003). At relatively low levels 2,3,7,8-TCDD can also weaken the immune system. Exposure to 2,3,7,8-TCDD can cause reproductive damage and birth defects in animals. Less is known about other, less toxic forms of dioxins.

4.0 Metals.

Many inorganic compounds occur naturally in the environment (Shacklette *et al*, 1971). Assessing the mobility and persistence of metals in environmental media is complicated and often difficult because of the many inorganic and organic complexes and salts they form. In addition, metals undergo a variety of processes in soils and water, which included hydrolysis, reduction, oxidation, and adsorption. These reactions are highly dependant on factors such as pH, salinity, sulfides, oxygen, ionic strength, particle-surface reactions, and the presence of anions and natural organic acids (humics and fulvics). Adsorption of metals through cation exchange, specific adsorption, coprecipitation, or organic complexation by oils and sediments is the dominant fate mechanisms in natural systems. Consequently, metals transported to surface water via runoff, groundwater, or suspended sediment derived from soil erosion would be predicted to accumulate. Metals vary in the extent to which they are adsorbed, and the adsorbents range in selectivity for metals.

5.0 References

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ATTACHMENT B

CALCULATIONS FOR ΣPAH MODELS

TABLE B-1
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED11

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0815	1.25	0.003
Acenaphthylene	452	2400	0.0815	1.25	0.003
Anthracene	594	1300	0.0815	1.25	0.002
Benz(a)anthracene	841	4153	0.0815	1.25	0.001
Benzo(a)pyrene	965	3840	0.0815	1.25	0.001
Benzo(b)fluoranthene	979	2169	0.245	3.77	0.004
Benzo(k)fluoranthene	981	1220	0.0815	1.25	0.001
Chrysene	844	826	0.0815	1.25	0.001
Fluoranthene	707	23870	0.327	5.03	0.007
Fluorene	538	26000	0.0815	1.25	0.002
Naphthalene	385	61700	0.0815	1.25	0.003
Phenanthrene	596	34300	0.0815	1.25	0.002
Pyrene	697	9090	0.258	3.97	0.006
$\Sigma ESBTU_{FCV,13}$					0.037
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.316**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 6.50%

TABLE B-2
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED12

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.0564	24.52	0.050
Acenaphthylene	452	2400	0.0276	12.00	0.027
Anthracene	594	1300	0.276	120.00	0.202
Benz(a)anthracene	841	4153	0.685	297.83	0.354
Benzo(a)pyrene	965	3840	0.862	374.78	0.388
Benzo(b)fluoranthene	979	2169	1.41	613.04	0.626
Benzo(k)fluoranthene	981	1220	0.636	276.52	0.282
Chrysene	844	826	0.625	271.74	0.322
Fluoranthene	707	23870	1.92	834.78	1.181
Fluorene	538	26000	0.107	46.52	0.086
Naphthalene	385	61700	0.02765	12.02	0.031
Phenanthrene	596	34300	1.14	495.65	0.832
Pyrene	697	9090	1.01	439.13	0.630
$\Sigma ESBTU_{FCV,13}$					5.011
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**42.344**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.23%

TABLE B-3
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED13

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.01605	5.94	0.012
Acenaphthylene	452	2400	0.01605	5.94	0.013
Anthracene	594	1300	0.01605	5.94	0.010
Benz(a)anthracene	841	4153	0.01605	5.94	0.007
Benzo(a)pyrene	965	3840	0.01605	5.94	0.006
Benzo(b)fluoranthene	979	2169	0.0378	14.00	0.014
Benzo(k)fluoranthene	981	1220	0.01605	5.94	0.006
Chrysene	844	826	0.01605	5.94	0.007
Fluoranthene	707	23870	0.0833	30.85	0.044
Fluorene	538	26000	0.01605	5.94	0.011
Naphthalene	385	61700	0.01605	5.94	0.015
Phenanthrene	596	34300	0.0333	12.33	0.021
Pyrene	697	9090	0.0513	19.00	0.027
$\Sigma ESBTU_{FCV,13}$					0.194
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**1.639**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.27%

TABLE B-4
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED14

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.04715	1.52	0.003
Acenaphthylene	452	2400	0.04715	1.52	0.003
Anthracene	594	1300	0.04715	1.52	0.003
Benz(a)anthracene	841	4153	0.04715	1.52	0.002
Benzo(a)pyrene	965	3840	0.04715	1.52	0.002
Benzo(b)fluoranthene	979	2169	0.04715	1.52	0.002
Benzo(k)fluoranthene	981	1220	0.04715	1.52	0.002
Chrysene	844	826	0.04715	1.52	0.002
Fluoranthene	707	23870	0.204	6.58	0.009
Fluorene	538	26000	0.04715	1.52	0.003
Naphthalene	385	61700	0.04715	1.52	0.004
Phenanthrene	596	34300	0.0999	3.22	0.005
Pyrene	697	9090	0.153	4.94	0.007
$\Sigma ESBTU_{FCV,13}$					0.046
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.388**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 3.10%

TABLE B-5
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED15

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.01575	2.25	0.005
Acenaphthylene	452	2400	0.01575	2.25	0.005
Anthracene	594	1300	0.01575	2.25	0.004
Benz(a)anthracene	841	4153	0.01575	2.25	0.003
Benzo(a)pyrene	965	3840	0.01575	2.25	0.002
Benzo(b)fluoranthene	979	2169	0.01575	2.25	0.002
Benzo(k)fluoranthene	981	1220	0.01575	2.25	0.002
Chrysene	844	826	0.01575	2.25	0.003
Fluoranthene	707	23870	0.01575	2.25	0.003
Fluorene	538	26000	0.01575	2.25	0.004
Naphthalene	385	61700	0.01575	2.25	0.006
Phenanthrene	596	34300	0.01575	2.25	0.004
Pyrene	697	9090	0.01575	2.25	0.003
$\Sigma ESBTU_{FCV,13}$					0.046
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.387**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.70%

TABLE B-6

EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES

333 Adelaide Avenue

Providence, Rhode Island

SED16

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0895	1.23	0.002
Acenaphthylene	452	2400	0.0895	1.23	0.003
Anthracene	594	1300	0.0895	1.23	0.002
Benz(a)anthracene	841	4153	0.0895	1.23	0.001
Benzo(a)pyrene	965	3840	0.0895	1.23	0.001
Benzo(b)fluoranthene	979	2169	0.201	2.75	0.003
Benzo(k)fluoranthene	981	1220	0.0895	1.23	0.001
Chrysene	844	826	0.0895	1.23	0.001
Fluoranthene	707	23870	0.33	4.52	0.006
Fluorene	538	26000	0.0895	1.23	0.002
Naphthalene	385	61700	0.0895	1.23	0.003
Phenanthrene	596	34300	0.0895	1.23	0.002
Pyrene	697	9090	0.244	3.34	0.005
$\Sigma ESBTU_{FCV,13}$					0.034
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.289**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 7.30%

TABLE B-7

EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES

333 Adelaide Avenue

Providence, Rhode Island

SED17

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0175	3.02	0.006
Acenaphthylene	452	2400	0.0175	3.02	0.007
Anthracene	594	1300	0.0175	3.02	0.005
Benz(a)anthracene	841	4153	0.0175	3.02	0.004
Benzo(a)pyrene	965	3840	0.0175	3.02	0.003
Benzo(b)fluoranthene	979	2169	0.0175	3.02	0.003
Benzo(k)fluoranthene	981	1220	0.0175	3.02	0.003
Chrysene	844	826	0.0175	3.02	0.004
Fluoranthene	707	23870	0.0175	3.02	0.004
Fluorene	538	26000	0.0175	3.02	0.006
Naphthalene	385	61700	0.0175	3.02	0.008
Phenanthrene	596	34300	0.0175	3.02	0.005
Pyrene	697	9090	0.0175	3.02	0.004
$\Sigma ESBTU_{FCV,13}$					0.061
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.519**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.58%

TABLE B-8
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED18

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0915	0.80	0.002
Acenaphthylene	452	2400	0.0915	0.80	0.002
Anthracene	594	1300	0.0915	0.80	0.001
Benz(a)anthracene	841	4153	0.0915	0.80	0.001
Benzo(a)pyrene	965	3840	0.0915	0.80	0.001
Benzo(b)fluoranthene	979	2169	0.0915	0.80	0.001
Benzo(k)fluoranthene	981	1220	0.0915	0.80	0.001
Chrysene	844	826	0.0915	0.80	0.001
Fluoranthene	707	23870	0.267	2.32	0.003
Fluorene	538	26000	0.0915	0.80	0.001
Naphthalene	385	61700	0.0915	0.80	0.002
Phenanthrene	596	34300	0.0915	0.80	0.001
Pyrene	697	9090	0.187	1.63	0.002
$\Sigma ESBTU_{FCV,13}$					0.020
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.165**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 11.50%

TABLE B-9
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED19

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.062	0.89	0.002
Acenaphthylene	452	2400	0.062	0.89	0.002
Anthracene	594	1300	0.062	0.89	0.001
Benz(a)anthracene	841	4153	0.218	3.13	0.004
Benzo(a)pyrene	965	3840	0.151	2.17	0.002
Benzo(b)fluoranthene	979	2169	0.32	4.60	0.005
Benzo(k)fluoranthene	981	1220	0.062	0.89	0.001
Chrysene	844	826	0.201	2.89	0.003
Fluoranthene	707	23870	0.533	7.66	0.011
Fluorene	538	26000	0.062	0.89	0.002
Naphthalene	385	61700	0.062	0.89	0.002
Phenanthrene	596	34300	0.218	3.13	0.005
Pyrene	697	9090	0.35	5.03	0.007
$\Sigma ESBTU_{FCV,13}$					0.048
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.402**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 6.96%

TABLE B-10
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED20

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.153	5.88	0.012
Acenaphthylene	452	2400	0.781	30.04	0.066
Anthracene	594	1300	3.09	118.85	0.200
Benz(a)anthracene	841	4153	15.1	580.77	0.691
Benzo(a)pyrene	965	3840	7.87	302.69	0.314
Benzo(b)fluoranthene	979	2169	14.8	569.23	0.581
Benzo(k)fluoranthene	981	1220	5.1	196.15	0.200
Chrysene	844	826	8.94	343.85	0.407
Fluoranthene	707	23870	28.8	1107.69	1.567
Fluorene	538	26000	0.863	33.19	0.062
Naphthalene	385	61700	0.0306	1.18	0.003
Phenanthrene	596	34300	11.8	453.85	0.761
Pyrene	697	9090	15.2	584.62	0.839
$\Sigma ESBTU_{FCV,13}$					5.703
Correction Factor for 90th Percentile					8.5
Calculated SESBTU$_{FCV,34}$					**48.193**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 2.60%

TABLE B-11
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED21

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.0164	3.09	0.006
Acenaphthylene	452	2400	0.0164	3.09	0.007
Anthracene	594	1300	0.0164	3.09	0.005
Benz(a)anthracene	841	4153	0.0164	3.09	0.004
Benzo(a)pyrene	965	3840	0.0164	3.09	0.003
Benzo(b)fluoranthene	979	2169	0.0164	3.09	0.003
Benzo(k)fluoranthene	981	1220	0.0164	3.09	0.003
Chrysene	844	826	0.0164	3.09	0.004
Fluoranthene	707	23870	0.0164	3.09	0.004
Fluorene	538	26000	0.0164	3.09	0.006
Naphthalene	385	61700	0.0164	3.09	0.008
Phenanthrene	596	34300	0.0164	3.09	0.005
Pyrene	697	9090	0.0164	3.09	0.004
$\Sigma ESBTU_{FCV,13}$					0.063
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.533**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.53%

TABLE B-12
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED22

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0397	1.65	0.003
Acenaphthylene	452	2400	0.0397	1.65	0.004
Anthracene	594	1300	0.0397	1.65	0.003
Benz(a)anthracene	841	4153	0.108	4.50	0.005
Benzo(a)pyrene	965	3840	0.102	4.25	0.004
Benzo(b)fluoranthene	979	2169	0.144	6.00	0.006
Benzo(k)fluoranthene	981	1220	0.0397	1.65	0.002
Chrysene	844	826	0.119	4.96	0.006
Fluoranthene	707	23870	0.235	9.79	0.014
Fluorene	538	26000	0.0397	1.65	0.003
Naphthalene	385	61700	0.0397	1.65	0.004
Phenanthrene	596	34300	0.121	5.04	0.008
Pyrene	697	9090	0.0397	1.65	0.002
$\Sigma ESBTU_{FCV,13}$					0.065
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.552**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 2.40%

TABLE B-13
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED23

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0161	5.75	0.012
Acenaphthylene	452	2400	0.0161	5.75	0.013
Anthracene	594	1300	0.0161	5.75	0.010
Benz(a)anthracene	841	4153	0.0161	5.75	0.007
Benzo(a)pyrene	965	3840	0.0161	5.75	0.006
Benzo(b)fluoranthene	979	2169	0.0161	5.75	0.006
Benzo(k)fluoranthene	981	1220	0.0161	5.75	0.006
Chrysene	844	826	0.0161	5.75	0.007
Fluoranthene	707	23870	0.0161	5.75	0.008
Fluorene	538	26000	0.0161	5.75	0.011
Naphthalene	385	61700	0.0161	5.75	0.015
Phenanthrene	596	34300	0.0161	5.75	0.010
Pyrene	697	9090	0.0161	5.75	0.008
$\Sigma ESBTU_{FCV,13}$					0.117
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.990**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.28%

TABLE B-14
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED24

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.03155	1.37	0.003
Acenaphthylene	452	2400	0.03155	1.37	0.003
Anthracene	594	1300	0.03155	1.37	0.002
Benz(a)anthracene	841	4153	0.0896	3.90	0.005
Benzo(a)pyrene	965	3840	0.0707	3.07	0.003
Benzo(b)fluoranthene	979	2169	0.0732	3.18	0.003
Benzo(k)fluoranthene	981	1220	0.03155	1.37	0.001
Chrysene	844	826	0.0896	3.90	0.005
Fluoranthene	707	23870	0.211	9.17	0.013
Fluorene	538	26000	0.03155	1.37	0.003
Naphthalene	385	61700	0.03155	1.37	0.004
Phenanthrene	596	34300	0.169	7.35	0.012
Pyrene	697	9090	0.177	7.70	0.011
$\Sigma ESBTU_{FCV,13}$					0.068
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.572**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 2.30%

TABLE B-15

EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES

333 Adelaide Avenue

Providence, Rhode Island

SED25

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.04145	0.90	0.002
Acenaphthylene	452	2400	0.04145	0.90	0.002
Anthracene	594	1300	0.163	3.54	0.006
Benz(a)anthracene	841	4153	0.541	11.74	0.014
Benzo(a)pyrene	965	3840	0.483	10.48	0.011
Benzo(b)fluoranthene	979	2169	0.516	11.19	0.011
Benzo(k)fluoranthene	981	1220	0.04145	0.90	0.001
Chrysene	844	826	0.534	11.58	0.014
Fluoranthene	707	23870	3.17	68.76	0.097
Fluorene	538	26000	0.04145	0.90	0.002
Naphthalene	385	61700	0.04145	0.90	0.002
Phenanthrene	596	34300	2.46	53.36	0.090
Pyrene	697	9090	2.4	52.06	0.075
$\Sigma ESBTU_{FCV,13}$					0.326
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**2.756**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 4.61%

TABLE B-16
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED26

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.02315	0.78	0.002
Acenaphthylene	452	2400	0.02315	0.78	0.002
Anthracene	594	1300	0.02315	0.78	0.001
Benz(a)anthracene	841	4153	0.241	8.14	0.010
Benzo(a)pyrene	965	3840	0.273	9.22	0.010
Benzo(b)fluoranthene	979	2169	0.256	8.65	0.009
Benzo(k)fluoranthene	981	1220	0.02315	0.78	0.001
Chrysene	844	826	0.227	7.67	0.009
Fluoranthene	707	23870	0.419	14.16	0.020
Fluorene	538	26000	0.02315	0.78	0.001
Naphthalene	385	61700	0.02315	0.78	0.002
Phenanthrene	596	34300	0.158	5.34	0.009
Pyrene	697	9090	0.348	11.76	0.017
$\Sigma ESBTU_{FCV,13}$					0.092
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.777**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 2.96%

TABLE B-17
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED27

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.062	1.35	0.003
Acenaphthylene	452	2400	0.062	1.35	0.003
Anthracene	594	1300	0.062	1.35	0.002
Benz(a)anthracene	841	4153	0.134	2.91	0.003
Benzo(a)pyrene	965	3840	0.062	1.35	0.001
Benzo(b)fluoranthene	979	2169	0.285	6.20	0.006
Benzo(k)fluoranthene	981	1220	0.062	1.35	0.001
Chrysene	844	826	0.062	1.35	0.002
Fluoranthene	707	23870	0.354	7.70	0.011
Fluorene	538	26000	0.062	1.35	0.003
Naphthalene	385	61700	0.062	1.35	0.004
Phenanthrene	596	34300	0.062	1.35	0.002
Pyrene	697	9090	0.196	4.26	0.006
$\Sigma ESBTU_{FCV,13}$					0.047
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**0.401**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 4.60%

TABLE B-18

EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES

333 Adelaide Avenue

Providence, Rhode Island

SED28

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.0456	1.11	0.002
Acenaphthylene	452	2400	0.0456	1.11	0.002
Anthracene	594	1300	0.403	9.83	0.017
Benz(a)anthracene	841	4153	1.29	31.46	0.037
Benzo(a)pyrene	965	3840	0.993	24.22	0.025
Benzo(b)fluoranthene	979	2169	1.49	36.34	0.037
Benzo(k)fluoranthene	981	1220	0.668	16.29	0.017
Chrysene	844	826	1.16	28.29	0.034
Fluoranthene	707	23870	2.31	56.34	0.080
Fluorene	538	26000	0.135	3.29	0.006
Naphthalene	385	61700	0.0456	1.11	0.003
Phenanthrene	596	34300	1.14	27.80	0.047
Pyrene	697	9090	1.29	31.46	0.045
$\Sigma ESBTU_{FCV,13}$					0.352
Correction Factor for 90th Percentile					8.5
Calculated SESBTU$_{FCV,34}$					**2.970**

Source:

USPEA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 4.10%

TABLE B-19
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED29

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.0505	1.12	0.002
Acenaphthylene	452	2400	0.0505	1.12	0.002
Anthracene	594	1300	0.169	3.76	0.006
Benz(a)anthracene	841	4153	0.687	15.27	0.018
Benzo(a)pyrene	965	3840	0.543	12.07	0.013
Benzo(b)fluoranthene	979	2169	0.882	19.60	0.020
Benzo(k)fluoranthene	981	1220	0.396	8.80	0.009
Chrysene	844	826	0.617	13.71	0.016
Fluoranthene	707	23870	1.34	29.78	0.042
Fluorene	538	26000	0.0505	1.12	0.002
Naphthalene	385	61700	0.0505	1.12	0.003
Phenanthrene	596	34300	0.689	15.31	0.026
Pyrene	697	9090	0.874	19.42	0.028
$\Sigma ESBTU_{FCV,13}$					0.188
Correction Factor for 90^{th} Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**1.586**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 4.50%

TABLE B-20
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED30

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.01555	2.32	0.005
Acenaphthylene	452	2400	0.01555	2.32	0.005
Anthracene	594	1300	0.0852	12.72	0.021
Benz(a)anthracene	841	4153	0.376	56.12	0.067
Benzo(a)pyrene	965	3840	0.239	35.67	0.037
Benzo(b)fluoranthene	979	2169	0.433	64.63	0.066
Benzo(k)fluoranthene	981	1220	0.137	20.45	0.021
Chrysene	844	826	0.299	44.63	0.053
Fluoranthene	707	23870	0.535	79.85	0.113
Fluorene	538	26000	0.0802	11.97	0.022
Naphthalene	385	61700	0.0342	5.10	0.013
Phenanthrene	596	34300	0.466	69.55	0.117
Pyrene	697	9090	0.81	120.90	0.173
$\Sigma ESBTU_{FCV,13}$					0.713
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**6.027**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.67%

TABLE B-21
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED31

PAH	**FCV (ug/g_{oc})**	**Maxi (ug/g_{oc})**	**Measured Conc. (ug/g dry wt.)**	**C_{OC} (ug/g_{oc})**	**ESBTU**
Acenaphthene	491	33400	0.0545	1.18	0.002
Acenaphthylene	452	2400	0.0545	1.18	0.003
Anthracene	594	1300	0.171	3.72	0.006
Benz(a)anthracene	841	4153	0.671	14.59	0.017
Benzo(a)pyrene	965	3840	0.503	10.93	0.011
Benzo(b)fluoranthene	979	2169	1.18	25.65	0.026
Benzo(k)fluoranthene	981	1220	0.326	7.09	0.007
Chrysene	844	826	0.579	12.59	0.015
Fluoranthene	707	23870	1.51	32.83	0.046
Fluorene	538	26000	0.0545	1.18	0.002
Naphthalene	385	61700	0.0545	1.18	0.003
Phenanthrene	596	34300	0.757	16.46	0.028
Pyrene	697	9090	0.953	20.72	0.030
$\Sigma ESBTU_{FCV,13}$					0.197
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**1.668**

Source:
USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 4.60%

TABLE B-22
EVALUATION OF PAH ESBs FOR BENTHIC INVERTEBRATES
333 Adelaide Avenue
Providence, Rhode Island

SED32

PAH	FCV (ug/g_{oc})	Maxi (ug/g_{oc})	Measured Conc. (ug/g dry wt.)	C_{OC} (ug/g_{oc})	ESBTU
Acenaphthene	491	33400	0.12	17.14	0.035
Acenaphthylene	452	2400	0.017	2.43	0.005
Anthracene	594	1300	0.438	62.57	0.105
Benz(a)anthracene	841	4153	0.64	91.43	0.109
Benzo(a)pyrene	965	3840	0.497	71.00	0.074
Benzo(b)fluoranthene	979	2169	0.892	127.43	0.130
Benzo(k)fluoranthene	981	1220	0.43	61.43	0.063
Chrysene	844	826	0.551	78.71	0.093
Fluoranthene	707	23870	1.56	222.86	0.315
Fluorene	538	26000	0.156	22.29	0.041
Naphthalene	385	61700	0.0456	6.51	0.017
Phenanthrene	596	34300	1.23	175.71	0.295
Pyrene	697	9090	1.07	152.86	0.219
$\Sigma ESBTU_{FCV,13}$					1.502
Correction Factor for 90th Percentile					8.5
Calculated $SESBTU_{FCV,34}$					**12.689**

Source:

USEPA (2003) Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. November 2003.

Assumes TOC of : 0.70%

ATTACHMENT C

TEQ CALCULATIONS

TABLE C-1
MAMMAL TEQ CALCULATIONS
SEDIMENT

Parameter	TEF Mammal		SD-1001 12/28/2005 0-2	Sample*TEF		SD-1002 12/28/2005 0-2	Sample*TEF		SD-1003 12/28/2005 0-2	Sample*TEF		SD-1004 12/28/2005 0-2	Sample*TEF
1,2,3,4,6,7,8-HpCDD	0.01		0.00011	0.0000011		0.000059	0.00000059		0.00013	0.0000013		0.00014	0.0000014
1,2,3,4,6,7,8-HpCDF	0.01		0.000092	0.00000092		0.00016	0.0000016		0.00027	0.0000027		0.00021	0.0000021
1,2,3,4,7,8,9-HpCDF	0.01		0.0000099	0.000000099		0.000014	0.00000014		0.000049	0.00000049		0.000047	0.00000047
1,2,3,4,7,8-HxCDD	0.1		0.0000049	0.00000049		0.0000061	0.00000061		0.000016	0.0000016	<	0.000014	0.0000007
1,2,3,4,7,8-HxCDF	0.1		0.00003	0.000003		0.000057	0.0000057		0.00017	0.000017		0.00011	0.000011
1,2,3,6,7,8-HxCDD	0.1		0.000013	0.0000013		0.000012	0.0000012		0.000042	0.0000042		0.000039	0.0000039
1,2,3,6,7,8-HxCDF	0.1		0.000037	0.0000037		0.000059	0.0000059		0.00023	0.000023		0.00026	0.000026
1,2,3,7,8,9-HxCDD	0.1		0.0000082	0.00000082		0.000008	0.0000008		0.000021	0.0000021		0.00002	0.000002
1,2,3,7,8,9-HxCDF	0.1	<	0.0000031	0.000000155	<	0.0000028	0.00000014		0.0000086	0.00000086	<	0.0000071	0.000000355
1,2,3,7,8-PeCDD	1		0.0000097	0.0000097		0.0000074	0.0000074		0.000031	0.000031		0.000033	0.000033
1,2,3,7,8-PeCDF	0.05		0.000016	0.0000008		0.000028	0.0000014		0.00006	0.000003		0.000055	0.00000275
2,3,4,6,7,8-HxCDF	0.1		0.000036	0.0000036		0.000051	0.0000051		0.00018	0.000018		0.00022	0.000022
2,3,4,7,8-PeCDF	0.5		0.000036	0.000018		0.000043	0.0000215		0.00016	0.00008		0.00017	0.000085
2,3,7,8-TCDD	1		0.0000053	0.0000053		0.0000025	0.0000025		0.0000095	0.0000095		0.0000092	0.0000092
2,3,7,8-TCDF	0.1		0.000018	0.0000018		0.000015	0.0000015		0.000027	0.0000027		0.000029	0.0000029
OCDD	0.0001		0.00075	0.000000075		0.00024	0.000000024		0.00042	0.000000042		0.00048	0.000000048
OCDF	0.0001		0.000075	7.5E-09		0.00019	0.000000019		0.00019	0.000000019		0.00007	0.000000007
Total HpCDD			0.0002			0.00012			0.00027			0.00026	
Total HpCDF			0.00018			0.00024			0.00062			0.00055	
Total HxCDD			0.00012			0.00013			0.00049			0.00042	
Total HxCDF			0.00078			0.001			0.0055			0.0058	
Total PeCDD			0.000074			0.000056			0.00031			0.00029	
Total PeCDF			0.00068			0.00088			0.0051			0.0054	
Total TCDD			0.000077			0.000045			0.00012			0.00011	
Total TCDF			0.00029			0.00029			0.0013			0.0013	
TEQ				5.09E-05			5.61E-05			1.98E-04			2.03E-04

TABLE C-1
MAMMAL TEQ CALCULATIONS
SEDIMENT

Parameter		SD-1005 12/28/2005 0-2	Sample*TEF		SED10 6/22/2006 0_5-1	Sample*TEF		SED11 6/22/2006 0-1	Sample*TEF		SED12 6/22/2006 0_5-1	Sample*TEF		SED13 6/22/2006 0-0_5	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000017	0.00000017	<	7.5E-07	3.75E-09		0.00028	0.0000028		0.000068	0.00000068		0.0000022	0.000000022
1,2,3,4,6,7,8-HpCDF		0.00003	0.0000003	<	7.5E-07	3.75E-09		0.00014	0.0000014		0.000079	0.00000079	<	7.6E-07	3.8E-09
1,2,3,4,7,8,9-HpCDF		0.0000041	0.000000041	<	7.5E-07	3.75E-09		0.000018	0.00000018		0.000079	0.00000079	<	7.6E-07	3.8E-09
1,2,3,4,7,8-HxCDD	<	0.0000018	0.00000009	<	7.5E-07	3.75E-08		0.0000095	0.00000095	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,4,7,8-HxCDF		0.000017	0.0000017	<	7.5E-07	3.75E-08		0.000036	0.0000036	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,6,7,8-HxCDD		0.0000047	0.00000047	<	7.5E-07	3.75E-08		0.000025	0.0000025	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,6,7,8-HxCDF		0.000033	0.0000033	<	7.5E-07	3.75E-08		0.000086	0.0000086	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,7,8,9-HxCDD	<	0.0000027	0.000000135	<	7.5E-07	3.75E-08		0.000017	0.0000017		0.00008	0.000008	<	7.6E-07	0.000000038
1,2,3,7,8,9-HxCDF	<	9.1E-07	4.55E-08	<	7.5E-07	3.75E-08		0.00003	0.000003	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,7,8-PeCDD	<	0.000003	0.0000015	<	7.5E-07	0.000000375		0.000011	0.000011	<	7.1E-07	0.000000355	<	7.6E-07	0.00000038
1,2,3,7,8-PeCDF		0.0000083	0.000000415	<	7.5E-07	1.875E-08		0.000032	0.0000016	<	7.1E-07	1.775E-08	<	7.6E-07	0.000000019
2,3,4,6,7,8-HxCDF		0.000028	0.0000028	<	7.5E-07	3.75E-08		0.00008	0.000008	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
2,3,4,7,8-PeCDF		0.000023	0.0000115	<	7.5E-07	1.875E-07		0.00043	0.000215		7.3E-07	0.000000365		8.6E-07	0.00000043
2,3,7,8-TCDD		9.8E-07	0.00000098	<	1.5E-07	0.000000075		0.0000042	0.0000042	<	1.4E-07	0.00000007	<	1.5E-07	0.000000075
2,3,7,8-TCDF		0.0000043	0.00000043	<	1.5E-07	7.5E-09	<	5.7E-07	2.85E-08		2.4E-07	0.000000024		1.9E-07	0.000000019
OCDD		0.000077	7.7E-09		0.0000044	4.4E-10		0.0018	0.00000018		0.00015	0.000000015		0.000016	1.6E-09
OCDF		0.0000076	7.6E-10	<	0.0000015	7.5E-11		0.000087	8.7E-09		0.00012	0.000000012		0.0000016	1.6E-10
Total HpCDD		0.000036		<	7.5E-07			0.00063		<	0.0000007			0.0000039	
Total HpCDF		0.000073		<	7.5E-07			0.00033		<	0.0000007			0.0000011	
Total HxCDD		0.000048		<	7.5E-07			0.0003		<	0.0000007		<	7.6E-07	
Total HxCDF		0.00079		<	7.5E-07			0.0023		<	0.0000007			0.000003	
Total PeCDD		0.000022		<	7.5E-07			0.00014		<	7.1E-07		<	7.6E-07	
Total PeCDF		0.00075		<	7.5E-07			0.0055		<	0.0000007			0.0000074	
Total TCDD		0.000011		<	1.5E-07			0.000089		<	1.4E-07		<	1.5E-07	
Total TCDF		0.00017		<	1.5E-07			0.0016		<	1.4E-07			0.0000031	
TEQ			2.39E-05			9.38E-07			2.65E-04			1.13E-05			1.22E-06

TABLE C-1
MAMMAL TEQ CALCULATIONS
SEDIMENT

Parameter		SED14 6/22/2006 0-1	Sample*TEF		SED15 6/22/2006 0-1	Sample*TEF		SED16 6/22/2006 0-1	Sample*TEF		SED17 6/22/2006 0_5-1	Sample*TEF		SED18 6/22/2006 0-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000071	0.00000071	<	0.0000008	0.000000004		0.00048	0.0000048		0.000021	0.00000021		0.00064	0.0000064
1,2,3,4,6,7,8-HpCDF		0.000037	0.00000037	<	0.0000008	0.000000004		0.00057	0.0000057		0.000035	0.00000035		0.001	0.00001
1,2,3,4,7,8,9-HpCDF		0.0000044	0.000000044	<	0.0000008	0.000000004		0.000092	0.00000092		0.0000065	0.000000065		0.00017	0.0000017
1,2,3,4,7,8-HxCDD		0.0000033	0.00000033	<	0.0000008	0.00000004		0.000041	0.0000041		0.0000022	0.00000022		0.000074	0.0000074
1,2,3,4,7,8-HxCDF	<	0.0000017	0.000000085	<	0.0000008	0.00000004		0.00033	0.000033		0.000017	0.0000017		0.00067	0.000067
1,2,3,6,7,8-HxCDD		0.0000068	0.00000068	<	0.0000008	0.00000004		0.00012	0.000012		0.0000057	0.00000057		0.00019	0.000019
1,2,3,6,7,8-HxCDF		0.000026	0.0000026	<	0.0000008	0.00000004		0.00057	0.000057		0.00003	0.000003		0.0013	0.00013
1,2,3,7,8,9-HxCDD		0.0000034	0.00000034	<	0.0000008	0.00000004		0.000056	0.0000056		0.0000033	0.00000033		0.000097	0.0000097
1,2,3,7,8,9-HxCDF		0.0000084	0.00000084	<	0.0000008	0.00000004		0.00019	0.000019		0.000013	0.0000013		0.00039	0.000039
1,2,3,7,8-PeCDD		0.0000048	0.0000048	<	0.0000008	0.0000004		0.000056	0.000056		0.0000033	0.0000033		0.000098	0.000098
1,2,3,7,8-PeCDF		0.0000084	0.00000042	<	0.0000008	0.00000002	<	0.0000034	0.000000085		0.0000081	0.000000405	<	0.0000032	0.00000008
2,3,4,6,7,8-HxCDF		0.000051	0.0000051	<	0.0000008	0.00000004		0.0004	0.00004		0.000075	0.0000075		0.00091	0.000091
2,3,4,7,8-PeCDF		0.00015	0.000075	<	0.0000008	0.0000002		0.0028	0.0014		0.00019	0.000095		0.0062	0.0031
2,3,7,8-TCDD		0.0000014	0.0000014	<	1.6E-07	0.00000008		0.000016	0.000016		0.0000011	0.0000011		0.00003	0.00003
2,3,7,8-TCDF		0.0000076	0.00000076	<	1.6E-07	0.000000008		0.000082	0.0000082	<	1.4E-07	0.000000007		0.00012	0.000012
OCDD		0.00047	0.000000047		0.0000044	4.4E-10		0.0023	0.00000023		0.00007	0.000000007		0.0027	0.00000027
OCDF		0.000036	3.6E-09	<	0.0000016	8E-11		0.00025	0.000000025		0.000008	8E-10		0.0003	0.00000003
Total HpCDD		0.00014		<	0.0000008			0.00097			0.000044			0.0013	
Total HpCDF		0.000089		<	0.0000008			0.0014			0.000087			0.0028	
Total HxCDD		0.000087		<	0.0000008			0.0014			0.00007			0.0026	
Total HxCDF		0.00051			0.0000011			0.016			0.0009			0.023	
Total PeCDD		0.000047		<	0.0000008			0.001			0.000041			0.002	
Total PeCDF		0.0013			0.0000031			0.0073			0.0021			0.0096	
Total TCDD		0.000029		<	1.6E-07			0.00038			0.000023			0.0008	
Total TCDF		0.00042			0.0000013			0.0069			0.0006			0.012	
TEQ			9.35E-05			1.00E-06			1.66E-03			1.15E-04			3.62E-03

TABLE C-1
MAMMAL TEQ CALCULATIONS
SEDIMENT

Parameter		SED19 6/22/2006 0-1	Sample*TEF		SED20 6/22/2006 0_5-1	Sample*TEF		SED21 6/22/2006 0-1	Sample*TEF		SED22 6/22/2006 0-1	Sample*TEF		SED23 6/22/2006 0-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.00027	0.0000027		0.00009	0.0000009		0.0000045	0.000000045		0.00011	0.0000011	<	6.8E-07	3.4E-09
1,2,3,4,6,7,8-HpCDF		0.00051	0.0000051		0.0002	0.000002		0.0000065	0.000000065		0.00016	0.0000016	<	6.8E-07	3.4E-09
1,2,3,4,7,8,9-HpCDF		0.00011	0.0000011		0.000041	0.00000041		0.0000012	0.000000012		0.000025	0.00000025	<	6.8E-07	3.4E-09
1,2,3,4,7,8-HxCDD		0.000051	0.0000051		0.000015	0.0000015	<	8.4E-07	0.000000042	<	0.000018	0.0000009	<	6.8E-07	0.000000034
1,2,3,4,7,8-HxCDF		0.00039	0.000039		0.00014	0.000014		0.0000034	0.00000034		0.000068	0.0000068	<	6.8E-07	0.000000034
1,2,3,6,7,8-HxCDD		0.00012	0.000012		0.000035	0.0000035		0.0000013	0.00000013		0.000028	0.0000028	<	6.8E-07	0.000000034
1,2,3,6,7,8-HxCDF		0.00062	0.000062		0.00014	0.000014		0.0000073	0.00000073		0.00016	0.000016	<	6.8E-07	0.000000034
1,2,3,7,8,9-HxCDD		0.000059	0.0000059		0.000016	0.0000016	<	8.4E-07	0.000000042	<	0.000018	0.0000009	<	6.8E-07	0.000000034
1,2,3,7,8,9-HxCDF		0.00025	0.000025		0.000052	0.0000052		0.0000024	0.00000024		0.000062	0.0000062	<	6.8E-07	0.000000034
1,2,3,7,8-PeCDD		0.000069	0.000069		0.00003	0.00003		9.5E-07	0.00000095		0.000018	0.000018	<	6.8E-07	0.00000034
1,2,3,7,8-PeCDF	<	0.0000027	6.75E-08	<	0.0000012	0.00000003		0.0000023	0.000000115		0.000041	0.00000205	<	6.8E-07	0.000000017
2,3,4,6,7,8-HxCDF		0.00054	0.000054		0.00012	0.000012		0.000016	0.0000016		0.00015	0.000015	<	6.8E-07	0.000000034
2,3,4,7,8-PeCDF		0.0035	0.00175		0.00014	0.00007		0.000044	0.000022		0.0013	0.00065	<	6.8E-07	0.00000017
2,3,7,8-TCDD		0.000021	0.000021		0.0000073	0.0000073	<	1.7E-07	0.000000085		0.0000068	0.0000068	<	1.4E-07	0.00000007
2,3,7,8-TCDF		0.000058	0.0000058		0.0000093	0.00000093	<	1.7E-07	8.5E-09		0.000027	0.0000027	<	1.4E-07	0.000000007
OCDD		0.00093	0.000000093		0.00024	0.000000024		0.000025	2.5E-09		0.0005	0.00000005		0.0000035	3.5E-10
OCDF		0.0001	0.00000001		0.000082	8.2E-09		0.0000022	2.2E-10		0.000044	4.4E-09	<	0.0000014	7E-11
Total HpCDD		0.00058			0.00019			0.0000088			0.00024		<	6.8E-07	
Total HpCDF		0.0014			0.0005			0.000017			0.00042		<	6.8E-07	
Total HxCDD		0.0016			0.00047			0.000013			0.00031		<	6.8E-07	
Total HxCDF		0.012			0.0046			0.0002			0.0055			0.0000017	
Total PeCDD		0.0014			0.00039			0.0000081			0.0002		<	6.8E-07	
Total PeCDF		0.0088			0.0069			0.00046			0.014			0.0000044	
Total TCDD		0.00051			0.00016			0.0000036			0.00015		<	1.4E-07	
Total TCDF		0.0065			0.0014			0.00014			0.0045			0.0000012	
TEQ			2.06E-03			1.63E-04			2.64E-05			7.31E-04			8.53E-07

TABLE C-1
MAMMAL TEQ CALCULATIONS
SEDIMENT

Parameter		SED24 6/22/2006 0-1	Sample*TEF		SED25 6/22/2006 0-1	Sample*TEF		SED26 6/22/2006 0-1	Sample*TEF		SED27 6/22/2006 0-1	Sample*TEF		SED28 6/21/2006 0_5-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000029	0.00000029		0.00032	0.0000032		0.00002	0.0000002		0.00018	0.0000018		0.00049	0.0000049
1,2,3,4,6,7,8-HpCDF		0.000029	0.00000029		0.00044	0.0000044		0.0000059	0.000000059		0.00023	0.0000023		0.00064	0.0000064
1,2,3,4,7,8,9-HpCDF		0.0000045	0.000000045		0.000079	0.00000079	<	0.0000014	0.000000007		0.000036	0.00000036		0.000099	0.00000099
1,2,3,4,7,8-HxCDD		0.0000013	0.00000013		0.00003	0.000003	<	0.0000014	0.00000007	<	0.000021	0.00000105		0.000039	0.0000039
1,2,3,4,7,8-HxCDF		0.000012	0.0000012		0.00031	0.000031		0.0000024	0.00000024		0.00013	0.000013		0.0003	0.00003
1,2,3,6,7,8-HxCDD		0.0000054	0.00000054		0.000083	0.0000083		0.0000036	0.00000036		0.000037	0.0000037		0.00011	0.000011
1,2,3,6,7,8-HxCDF		0.000016	0.0000016		0.00038	0.000038	<	0.0000014	0.00000007		0.00015	0.000015		0.00052	0.000052
1,2,3,7,8,9-HxCDD		0.0000028	0.00000028		0.000038	0.0000038		0.0000017	0.00000017		0.000022	0.0000022		0.000068	0.0000068
1,2,3,7,8,9-HxCDF		0.000007	0.0000007		0.00018	0.000018	<	0.0000014	0.00000007		0.000075	0.0000075		0.0002	0.00002
1,2,3,7,8-PeCDD		0.0000024	0.0000024		0.000063	0.000063	<	0.0000014	0.0000007		0.000029	0.000029		0.000076	0.000076
1,2,3,7,8-PeCDF		0.0000055	0.000000275	<	0.0000049	1.225E-07	<	0.0000014	0.000000035		0.000035	0.00000175	<	0.000018	0.00000045
2,3,4,6,7,8-HxCDF		0.000012	0.0000012		0.00031	0.000031	<	0.0000014	0.00000007		0.00018	0.000018		0.00042	0.000042
2,3,4,7,8-PeCDF		0.000095	0.0000475		0.0022	0.0011		0.0000017	0.00000085		0.00091	0.000455		0.0031	0.00155
2,3,7,8-TCDD		7.2E-07	0.00000072		0.000018	0.000018	<	2.8E-07	0.00000014		0.0000081	0.0000081		0.000022	0.000022
2,3,7,8-TCDF	<	2.6E-07	0.000000013		0.000053	0.0000053		0.0000016	0.00000016	<	0.0000042	0.00000021		0.000084	0.0000084
OCDD		0.00017	0.000000017		0.0019	0.00000019		0.000043	4.3E-09		0.00083	0.000000083		0.0029	0.00000029
OCDF		0.000017	1.7E-09		0.00017	0.000000017		0.0000062	6.2E-10		0.00013	0.000000013		0.00021	0.000000021
Total HpCDD		0.000058			0.00065			0.000033			0.00038			0.001	
Total HpCDF		0.000066			0.0011			0.0000059			0.00051			0.0016	
Total HxCDD		0.00005			0.0011			0.000064			0.00045			0.0014	
Total HxCDF		0.00049			0.012			0.0000054			0.0048			0.01	
Total PeCDD		0.000029			0.00091			0.000022			0.00024			0.00095	
Total PeCDF		0.0011			0.012			0.0000061			0.0098			0.024	
Total TCDD		0.000017			0.0005			0.000021			0.00013			0.00042	
Total TCDF		0.00032			0.0069			0.000021			0.003			0.0088	
TEQ			5.72E-05			1.33E-03			3.21E-06			5.59E-04			1.84E-03

TABLE C-1
MAMMAL TEQ CALCULATIONS
SEDIMENT

Parameter		SED29 6/21/2006 0_5-1	Sample*TEF		SED30 6/21/2006 0_5-1	Sample*TEF		SED31 6/21/2006 0_5-1	Sample*TEF		SED32 6/21/2006 0_5-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.00018	0.0000018		0.000066	0.00000066		0.00043	0.0000043		0.000074	0.00000074
1,2,3,4,6,7,8-HpCDF		0.00035	0.0000035		0.000036	0.00000036		0.00071	0.0000071		0.00004	0.0000004
1,2,3,4,7,8,9-HpCDF		0.000069	0.00000069		0.0000061	0.000000061		0.00017	0.0000017		0.0000051	0.000000051
1,2,3,4,7,8-HxCDD		0.000018	0.0000018		0.0000034	0.00000034		0.000055	0.0000055		0.0000018	0.00000018
1,2,3,4,7,8-HxCDF		0.00021	0.000021		0.000018	0.0000018		0.00032	0.000032		0.000011	0.0000011
1,2,3,6,7,8-HxCDD		0.00007	0.000007		0.000012	0.0000012		0.00015	0.000015		0.0000048	0.00000048
1,2,3,6,7,8-HxCDF		0.00029	0.000029		0.000014	0.0000014		0.00075	0.000075		0.000012	0.0000012
1,2,3,7,8,9-HxCDD		0.000031	0.0000031		0.0000072	0.00000072		0.000078	0.0000078		0.0000028	0.00000028
1,2,3,7,8,9-HxCDF		0.00014	0.000014		0.0000096	0.00000096		0.00042	0.000042		0.0000053	0.00000053
1,2,3,7,8-PeCDD		0.000041	0.000041		0.0000052	0.0000052		0.00012	0.00012		0.0000022	0.0000022
1,2,3,7,8-PeCDF	<	0.0000018	0.000000045	<	0.0000007	1.75E-08		0.00023	0.0000115	<	7.3E-07	1.825E-08
2,3,4,6,7,8-HxCDF		0.00023	0.000023		0.000013	0.0000013		0.00064	0.000064		0.000012	0.0000012
2,3,4,7,8-PeCDF		0.00016	0.00008		0.000076	0.000038		0.0016	0.0008		0.000028	0.000014
2,3,7,8-TCDD		0.000012	0.000012		6.2E-07	0.00000062		0.000033	0.000033		5.2E-07	0.00000052
2,3,7,8-TCDF		0.000032	0.0000032		0.0000047	0.00000047		0.000076	0.0000076		0.000006	0.0000006
OCDD		0.00084	0.000000084		0.00054	0.000000054		0.0016	0.00000016		0.00081	0.000000081
OCDF		0.00017	0.000000017		0.000037	3.7E-09		0.00019	0.000000019		0.00008	0.000000008
Total HpCDD		0.0004			0.00013			0.00094			0.00017	
Total HpCDF		0.00087			0.000094			0.002			0.00012	
Total HxCDD		0.0009			0.00013			0.002			0.000051	
Total HxCDF		0.0083			0.00038			0.025			0.00032	
Total PeCDD		0.00053			0.000055			0.0016			0.000025	
Total PeCDF		0.014			0.00059			0.04			0.0005	
Total TCDD		0.00027			0.000021			0.00064			0.000012	
Total TCDF		0.0037			0.00017			0.015			0.00016	
TEQ			2.41E-04			5.32E-05			1.23E-03			2.36E-05

TABLE C-2
BIRD TEQ CALCULATIONS
SEDIMENT

Parameter	TEF Bird		SD-1001 12/28/2005 0-2	Sample*TEF		SD-1002 12/28/2005 0-2	Sample*TEF		SD-1003 12/28/2005 0-2	Sample*TEF		SD-1004 12/28/2005 0-2	Sample*TEF
1,2,3,4,6,7,8-HpCDD	0.001		0.00011	0.00000011		0.000059	0.000000059		0.00013	0.00000013		0.00014	0.00000014
1,2,3,4,6,7,8-HpCDF	0.01		0.000092	0.00000092		0.00016	0.0000016		0.00027	0.0000027		0.00021	0.0000021
1,2,3,4,7,8,9-HpCDF	0.01		0.0000099	0.000000099		0.000014	0.00000014		0.000049	0.00000049		0.000047	0.00000047
1,2,3,4,7,8-HxCDD	0.05		0.0000049	0.000000245		0.0000061	0.000000305		0.000016	0.0000008	<	0.000014	0.00000035
1,2,3,4,7,8-HxCDF	0.1		0.00003	0.000003		0.000057	0.0000057		0.00017	0.000017		0.00011	0.000011
1,2,3,6,7,8-HxCDD	0.01		0.000013	0.00000013		0.000012	0.00000012		0.000042	0.00000042		0.000039	0.00000039
1,2,3,6,7,8-HxCDF	0.1		0.000037	0.0000037		0.000059	0.0000059		0.00023	0.000023		0.00026	0.000026
1,2,3,7,8,9-HxCDD	0.1		0.0000082	0.00000082		0.000008	0.0000008		0.000021	0.0000021		0.00002	0.000002
1,2,3,7,8,9-HxCDF	0.1	<	0.0000031	0.000000155	<	0.0000028	0.00000014		0.0000086	0.00000086	<	0.0000071	0.000000355
1,2,3,7,8-PeCDD	1		0.0000097	0.0000097		0.0000074	0.0000074		0.000031	0.000031		0.000033	0.000033
1,2,3,7,8-PeCDF	0.1		0.000016	0.0000016		0.000028	0.0000028		0.00006	0.000006		0.000055	0.0000055
2,3,4,6,7,8-HxCDF	0.1		0.000036	0.0000036		0.000051	0.0000051		0.00018	0.000018		0.00022	0.000022
2,3,4,7,8-PeCDF	1		0.000036	0.000036		0.000043	0.000043		0.00016	0.00016		0.00017	0.00017
2,3,7,8-TCDD	1		0.0000053	0.0000053		0.0000025	0.0000025		0.0000095	0.0000095		0.0000092	0.0000092
2,3,7,8-TCDF	1		0.000018	0.000018		0.000015	0.000015		0.000027	0.000027		0.000029	0.000029
OCDD	0.0001		0.00075	0.000000075		0.00024	0.000000024		0.00042	0.000000042		0.00048	0.000000048
OCDF	0.0001		0.000075	7.5E-09		0.00019	0.000000019		0.00019	0.000000019		0.00007	0.000000007
Total HpCDD			0.0002			0.00012			0.00027			0.00026	
Total HpCDF			0.00018			0.00024			0.00062			0.00055	
Total HxCDD			0.00012			0.00013			0.00049			0.00042	
Total HxCDF			0.00078			0.001			0.0055			0.0058	
Total PeCDD			0.000074			0.000056			0.00031			0.00029	
Total PeCDF			0.00068			0.00088			0.0051			0.0054	
Total TCDD			0.000077			0.000045			0.00012			0.00011	
Total TCDF			0.00029			0.00029			0.0013			0.0013	
TEQ				8.35E-05			9.06E-05			2.99E-04			3.12E-04

TABLE C-2
BIRD TEQ CALCULATIONS
SEDIMENT

Parameter		SD-1005 12/28/2005 0-2	Sample*TEF		SED10 6/22/2006 0_5-1	Sample*TEF		SED11 6/22/2006 0-1	Sample*TEF		SED12 6/22/2006 0_5-1	Sample*TEF		SED13 6/22/2006 0-0_5	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000017	0.000000017	<	7.5E-07	3.75E-10		0.00028	0.00000028		0.000068	0.000000068		0.0000022	2.2E-09
1,2,3,4,6,7,8-HpCDF		0.00003	0.0000003	<	7.5E-07	3.75E-09		0.00014	0.0000014		0.000079	0.00000079	<	7.6E-07	3.8E-09
1,2,3,4,7,8,9-HpCDF		0.0000041	0.000000041	<	7.5E-07	3.75E-09		0.000018	0.00000018		0.000079	0.00000079	<	7.6E-07	3.8E-09
1,2,3,4,7,8-HxCDD	<	0.0000018	0.000000045	<	7.5E-07	1.875E-08		0.0000095	0.000000475	<	7.1E-07	1.775E-08	<	7.6E-07	0.000000019
1,2,3,4,7,8-HxCDF		0.000017	0.0000017	<	7.5E-07	3.75E-08		0.000036	0.0000036	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,6,7,8-HxCDD		0.0000047	0.000000047	<	7.5E-07	3.75E-09		0.000025	0.00000025	<	7.1E-07	3.55E-09	<	7.6E-07	3.8E-09
1,2,3,6,7,8-HxCDF		0.000033	0.0000033	<	7.5E-07	3.75E-08		0.000086	0.0000086	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,7,8,9-HxCDD	<	0.0000027	0.000000135	<	7.5E-07	3.75E-08		0.000017	0.0000017		0.00008	0.000008	<	7.6E-07	0.000000038
1,2,3,7,8,9-HxCDF	<	9.1E-07	4.55E-08	<	7.5E-07	3.75E-08		0.00003	0.000003	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,7,8-PeCDD	<	0.000003	0.0000015	<	7.5E-07	0.000000375		0.000011	0.000011	<	7.1E-07	0.000000355	<	7.6E-07	0.00000038
1,2,3,7,8-PeCDF		0.0000083	0.00000083	<	7.5E-07	3.75E-08		0.000032	0.0000032	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
2,3,4,6,7,8-HxCDF		0.000028	0.0000028	<	7.5E-07	3.75E-08		0.00008	0.000008	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
2,3,4,7,8-PeCDF		0.000023	0.000023	<	7.5E-07	0.000000375		0.00043	0.00043		7.3E-07	0.00000073		8.6E-07	0.00000086
2,3,7,8-TCDD		9.8E-07	0.00000098	<	1.5E-07	0.000000075		0.0000042	0.0000042	<	1.4E-07	0.00000007	<	1.5E-07	0.000000075
2,3,7,8-TCDF		0.0000043	0.0000043	<	1.5E-07	0.000000075	<	5.7E-07	0.000000285		2.4E-07	0.00000024		1.9E-07	0.00000019
OCDD		0.000077	7.7E-09		0.0000044	4.4E-10		0.0018	0.00000018		0.00015	0.000000015		0.000016	1.6E-09
OCDF		0.0000076	7.6E-10	<	0.0000015	7.5E-11		0.000087	8.7E-09		0.00012	0.000000012		0.0000016	1.6E-10
Total HpCDD		0.000036		<	7.5E-07			0.00063		<	0.0000007			0.0000039	
Total HpCDF		0.000073		<	7.5E-07			0.00033		<	0.0000007			0.0000011	
Total HxCDD		0.000048		<	7.5E-07			0.0003		<	0.0000007		<	7.6E-07	
Total HxCDF		0.00079		<	7.5E-07			0.0023		<	0.0000007			0.000003	
Total PeCDD		0.000022		<	7.5E-07			0.00014		<	7.1E-07		<	7.6E-07	
Total PeCDF		0.00075		<	7.5E-07			0.0055		<	0.0000007			0.0000074	
Total TCDD		0.000011		<	1.5E-07			0.000089		<	1.4E-07		<	1.5E-07	
Total TCDF		0.00017		<	1.5E-07			0.0016		<	1.4E-07			0.0000031	
TEQ			3.90E-05			1.16E-06			4.76E-04			1.13E-05			1.77E-06

TABLE C-2
BIRD TEQ CALCULATIONS
SEDIMENT

Parameter		SED14 6/22/2006 0-1	Sample*TEF		SED15 6/22/2006 0-1	Sample*TEF		SED16 6/22/2006 0-1	Sample*TEF		SED17 6/22/2006 0_5-1	Sample*TEF		SED18 6/22/2006 0-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000071	0.000000071	<	0.0000008	4E-10		0.00048	0.00000048		0.000021	0.000000021		0.00064	0.00000064
1,2,3,4,6,7,8-HpCDF		0.000037	0.00000037	<	0.0000008	0.000000004		0.00057	0.0000057		0.000035	0.00000035		0.001	0.00001
1,2,3,4,7,8,9-HpCDF		0.0000044	0.000000044	<	0.0000008	0.000000004		0.000092	0.00000092		0.0000065	0.000000065		0.00017	0.0000017
1,2,3,4,7,8-HxCDD		0.0000033	0.000000165	<	0.0000008	0.00000002		0.000041	0.00000205		0.0000022	0.00000011		0.000074	0.0000037
1,2,3,4,7,8-HxCDF	<	0.0000017	0.000000085	<	0.0000008	0.00000004		0.00033	0.000033		0.000017	0.0000017		0.00067	0.000067
1,2,3,6,7,8-HxCDD		0.0000068	0.000000068	<	0.0000008	0.000000004		0.00012	0.0000012		0.0000057	0.000000057		0.00019	0.0000019
1,2,3,6,7,8-HxCDF		0.000026	0.0000026	<	0.0000008	0.00000004		0.00057	0.000057		0.00003	0.000003		0.0013	0.00013
1,2,3,7,8,9-HxCDD		0.0000034	0.00000034	<	0.0000008	0.00000004		0.000056	0.0000056		0.0000033	0.00000033		0.000097	0.0000097
1,2,3,7,8,9-HxCDF		0.0000084	0.00000084	<	0.0000008	0.00000004		0.00019	0.000019		0.000013	0.0000013		0.00039	0.000039
1,2,3,7,8-PeCDD		0.0000048	0.0000048	<	0.0000008	0.0000004		0.000056	0.000056		0.0000033	0.0000033		0.000098	0.000098
1,2,3,7,8-PeCDF		0.0000084	0.00000084	<	0.0000008	0.00000004	<	0.0000034	0.00000017		0.0000081	0.00000081	<	0.0000032	0.00000016
2,3,4,6,7,8-HxCDF		0.000051	0.0000051	<	0.0000008	0.00000004		0.0004	0.00004		0.000075	0.0000075		0.00091	0.000091
2,3,4,7,8-PeCDF		0.00015	0.00015	<	0.0000008	0.0000004		0.0028	0.0028		0.00019	0.00019		0.0062	0.0062
2,3,7,8-TCDD		0.0000014	0.0000014	<	1.6E-07	0.00000008		0.000016	0.000016		0.0000011	0.0000011		0.00003	0.00003
2,3,7,8-TCDF		0.0000076	0.0000076	<	1.6E-07	0.00000008		0.000082	0.000082	<	1.4E-07	0.00000007		0.00012	0.00012
OCDD		0.00047	0.000000047		0.0000044	4.4E-10		0.0023	0.00000023		0.00007	0.000000007		0.0027	0.00000027
OCDF		0.000036	3.6E-09	<	0.0000016	8E-11		0.00025	0.000000025		0.000008	8E-10		0.0003	0.00000003
Total HpCDD		0.00014		<	0.0000008			0.00097			0.000044			0.0013	
Total HpCDF		0.000089		<	0.0000008			0.0014			0.000087			0.0028	
Total HxCDD		0.000087		<	0.0000008			0.0014			0.00007			0.0026	
Total HxCDF		0.00051			0.0000011			0.016			0.0009			0.023	
Total PeCDD		0.000047		<	0.0000008			0.001			0.000041			0.002	
Total PeCDF		0.0013			0.0000031			0.0073			0.0021			0.0096	
Total TCDD		0.000029		<	1.6E-07			0.00038			0.000023			0.0008	
Total TCDF		0.00042			0.0000013			0.0069			0.0006			0.012	
TEQ			1.74E-04			1.23E-06			3.12E-03			2.10E-04			6.80E-03

TABLE C-2
BIRD TEQ CALCULATIONS
SEDIMENT

Parameter		SED19 6/22/2006 0-1	Sample*TEF		SED20 6/22/2006 0_5-1	Sample*TEF		SED21 6/22/2006 0-1	Sample*TEF		SED22 6/22/2006 0-1	Sample*TEF		SED23 6/22/2006 0-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.00027	0.00000027		0.00009	0.00000009		0.0000045	4.5E-09		0.00011	0.00000011	<	6.8E-07	3.4E-10
1,2,3,4,6,7,8-HpCDF		0.00051	0.0000051		0.0002	0.000002		0.0000065	0.000000065		0.00016	0.0000016	<	6.8E-07	3.4E-09
1,2,3,4,7,8,9-HpCDF		0.00011	0.0000011		0.000041	0.00000041		0.0000012	0.000000012		0.000025	0.00000025	<	6.8E-07	3.4E-09
1,2,3,4,7,8-HxCDD		0.000051	0.00000255		0.000015	0.00000075	<	8.4E-07	0.000000021	<	0.000018	0.00000045	<	6.8E-07	0.000000017
1,2,3,4,7,8-HxCDF		0.00039	0.000039		0.00014	0.000014		0.0000034	0.00000034		0.000068	0.0000068	<	6.8E-07	0.000000034
1,2,3,6,7,8-HxCDD		0.00012	0.0000012		0.000035	0.00000035		0.0000013	0.000000013		0.000028	0.00000028	<	6.8E-07	3.4E-09
1,2,3,6,7,8-HxCDF		0.00062	0.000062		0.00014	0.000014		0.0000073	0.00000073		0.00016	0.000016	<	6.8E-07	0.000000034
1,2,3,7,8,9-HxCDD		0.000059	0.0000059		0.000016	0.0000016	<	8.4E-07	0.000000042	<	0.000018	0.0000009	<	6.8E-07	0.000000034
1,2,3,7,8,9-HxCDF		0.00025	0.000025		0.000052	0.0000052		0.0000024	0.00000024		0.000062	0.0000062	<	6.8E-07	0.000000034
1,2,3,7,8-PeCDD		0.000069	0.000069		0.00003	0.00003		9.5E-07	0.00000095		0.000018	0.000018	<	6.8E-07	0.00000034
1,2,3,7,8-PeCDF	<	0.0000027	0.000000135	<	0.0000012	0.00000006		0.0000023	0.00000023		0.000041	0.0000041	<	6.8E-07	0.000000034
2,3,4,6,7,8-HxCDF		0.00054	0.000054		0.00012	0.000012		0.000016	0.0000016		0.00015	0.000015	<	6.8E-07	0.000000034
2,3,4,7,8-PeCDF		0.0035	0.0035		0.00014	0.00014		0.000044	0.000044		0.0013	0.0013	<	6.8E-07	0.00000034
2,3,7,8-TCDD		0.000021	0.000021		0.0000073	0.0000073	<	1.7E-07	0.000000085		0.0000068	0.0000068	<	1.4E-07	0.00000007
2,3,7,8-TCDF		0.000058	0.000058		0.0000093	0.0000093	<	1.7E-07	0.000000085		0.000027	0.000027	<	1.4E-07	0.00000007
OCDD		0.00093	0.000000093		0.00024	0.000000024		0.000025	2.5E-09		0.0005	0.00000005		0.0000035	3.5E-10
OCDF		0.0001	0.00000001		0.000082	8.2E-09		0.0000022	2.2E-10		0.000044	4.4E-09	<	0.0000014	7E-11
Total HpCDD		0.00058			0.00019			0.0000088			0.00024		<	6.8E-07	
Total HpCDF		0.0014			0.0005			0.000017			0.00042		<	6.8E-07	
Total HxCDD		0.0016			0.00047			0.000013			0.00031		<	6.8E-07	
Total HxCDF		0.012			0.0046			0.0002			0.0055			0.0000017	
Total PeCDD		0.0014			0.00039			0.0000081			0.0002		<	6.8E-07	
Total PeCDF		0.0088			0.0069			0.00046			0.014			0.0000044	
Total TCDD		0.00051			0.00016			0.0000036			0.00015		<	1.4E-07	
Total TCDF		0.0065			0.0014			0.00014			0.0045			0.0000012	
TEQ			3.84E-03			2.37E-04			4.84E-05			1.40E-03			1.05E-06

TABLE C-2
BIRD TEQ CALCULATIONS
SEDIMENT

Parameter		SED24 6/22/2006 0-1	Sample*TEF		SED25 6/22/2006 0-1	Sample*TEF		SED26 6/22/2006 0-1	Sample*TEF		SED27 6/22/2006 0-1	Sample*TEF		SED28 6/21/2006 0_5-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000029	0.000000029		0.00032	0.00000032		0.00002	0.00000002		0.00018	0.00000018		0.00049	0.00000049
1,2,3,4,6,7,8-HpCDF		0.000029	0.00000029		0.00044	0.0000044		0.0000059	0.000000059		0.00023	0.0000023		0.00064	0.0000064
1,2,3,4,7,8,9-HpCDF		0.0000045	0.000000045		0.000079	0.00000079	<	0.0000014	0.000000007		0.000036	0.00000036		0.000099	0.00000099
1,2,3,4,7,8-HxCDD		0.0000013	0.000000065		0.00003	0.0000015	<	0.0000014	0.000000035	<	0.000021	0.000000525		0.000039	0.00000195
1,2,3,4,7,8-HxCDF		0.000012	0.0000012		0.00031	0.000031		0.0000024	0.00000024		0.00013	0.000013		0.0003	0.00003
1,2,3,6,7,8-HxCDD		0.0000054	0.000000054		0.000083	0.00000083		0.0000036	0.000000036		0.000037	0.00000037		0.00011	0.0000011
1,2,3,6,7,8-HxCDF		0.000016	0.0000016		0.00038	0.000038	<	0.0000014	0.00000007		0.00015	0.000015		0.00052	0.000052
1,2,3,7,8,9-HxCDD		0.0000028	0.00000028		0.000038	0.0000038		0.0000017	0.00000017		0.000022	0.0000022		0.000068	0.0000068
1,2,3,7,8,9-HxCDF		0.000007	0.0000007		0.00018	0.000018	<	0.0000014	0.00000007		0.000075	0.0000075		0.0002	0.00002
1,2,3,7,8-PeCDD		0.0000024	0.0000024		0.000063	0.000063	<	0.0000014	0.0000007		0.000029	0.000029		0.000076	0.000076
1,2,3,7,8-PeCDF		0.0000055	0.00000055	<	0.0000049	0.000000245	<	0.0000014	0.00000007		0.000035	0.0000035	<	0.000018	0.0000009
2,3,4,6,7,8-HxCDF		0.000012	0.0000012		0.00031	0.000031	<	0.0000014	0.00000007		0.00018	0.000018		0.00042	0.000042
2,3,4,7,8-PeCDF		0.000095	0.000095		0.0022	0.0022		0.0000017	0.0000017		0.00091	0.00091		0.0031	0.0031
2,3,7,8-TCDD		7.2E-07	0.00000072		0.000018	0.000018	<	2.8E-07	0.00000014		0.0000081	0.0000081		0.000022	0.000022
2,3,7,8-TCDF	<	2.6E-07	0.00000013		0.000053	0.000053		0.0000016	0.0000016	<	0.0000042	0.0000021		0.000084	0.000084
OCDD		0.00017	0.000000017		0.0019	0.00000019		0.000043	4.3E-09		0.00083	0.000000083		0.0029	0.00000029
OCDF		0.000017	1.7E-09		0.00017	0.000000017		0.0000062	6.2E-10		0.00013	0.000000013		0.00021	0.000000021
Total HpCDD		0.000058			0.00065			0.000033			0.00038			0.001	
Total HpCDF		0.000066			0.0011			0.0000059			0.00051			0.0016	
Total HxCDD		0.00005			0.0011			0.000064			0.00045			0.0014	
Total HxCDF		0.00049			0.012			0.0000054			0.0048			0.01	
Total PeCDD		0.000029			0.00091			0.000022			0.00024			0.00095	
Total PeCDF		0.0011			0.012			0.0000061			0.0098			0.024	
Total TCDD		0.000017			0.0005			0.000021			0.00013			0.00042	
Total TCDF		0.00032			0.0069			0.000021			0.003			0.0088	
TEQ			1.04E-04			2.46E-03			4.99E-06			1.01E-03			3.44E-03

TABLE C-2
BIRD TEQ CALCULATIONS
SEDIMENT

Parameter		SED29 6/21/2006 0_5-1	Sample*TEF		SED30 6/21/2006 0_5-1	Sample*TEF		SED31 6/21/2006 0_5-1	Sample*TEF		SED32 6/21/2006 0_5-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.00018	0.00000018		0.000066	0.000000066		0.00043	0.00000043		0.000074	0.000000074
1,2,3,4,6,7,8-HpCDF		0.00035	0.0000035		0.000036	0.00000036		0.00071	0.0000071		0.00004	0.0000004
1,2,3,4,7,8,9-HpCDF		0.000069	0.00000069		0.0000061	0.000000061		0.00017	0.0000017		0.0000051	0.000000051
1,2,3,4,7,8-HxCDD		0.000018	0.0000009		0.0000034	0.00000017		0.000055	0.00000275		0.0000018	0.00000009
1,2,3,4,7,8-HxCDF		0.00021	0.000021		0.000018	0.0000018		0.00032	0.000032		0.000011	0.0000011
1,2,3,6,7,8-HxCDD		0.00007	0.0000007		0.000012	0.00000012		0.00015	0.0000015		0.0000048	0.000000048
1,2,3,6,7,8-HxCDF		0.00029	0.000029		0.000014	0.0000014		0.00075	0.000075		0.000012	0.0000012
1,2,3,7,8,9-HxCDD		0.000031	0.0000031		0.0000072	0.00000072		0.000078	0.0000078		0.0000028	0.00000028
1,2,3,7,8,9-HxCDF		0.00014	0.000014		0.0000096	0.00000096		0.00042	0.000042		0.0000053	0.00000053
1,2,3,7,8-PeCDD		0.000041	0.000041		0.0000052	0.0000052		0.00012	0.00012		0.0000022	0.0000022
1,2,3,7,8-PeCDF	<	0.0000018	0.00000009	<	0.0000007	0.000000035		0.00023	0.000023	<	7.3E-07	3.65E-08
2,3,4,6,7,8-HxCDF		0.00023	0.000023		0.000013	0.0000013		0.00064	0.000064		0.000012	0.0000012
2,3,4,7,8-PeCDF		0.00016	0.00016		0.000076	0.000076		0.0016	0.0016		0.000028	0.000028
2,3,7,8-TCDD		0.000012	0.000012		6.2E-07	0.00000062		0.000033	0.000033		5.2E-07	0.00000052
2,3,7,8-TCDF		0.000032	0.000032		0.0000047	0.0000047		0.000076	0.000076		0.000006	0.000006
OCDD		0.00084	0.000000084		0.00054	0.000000054		0.0016	0.00000016		0.00081	0.000000081
OCDF		0.00017	0.000000017		0.000037	3.7E-09		0.00019	0.000000019		0.00008	0.000000008
Total HpCDD		0.0004			0.00013			0.00094			0.00017	
Total HpCDF		0.00087			0.000094			0.002			0.00012	
Total HxCDD		0.0009			0.00013			0.002			0.000051	
Total HxCDF		0.0083			0.00038			0.025			0.00032	
Total PeCDD		0.00053			0.000055			0.0016			0.000025	
Total PeCDF		0.014			0.00059			0.04			0.0005	
Total TCDD		0.00027			0.000021			0.00064			0.000012	
Total TCDF		0.0037			0.00017			0.015			0.00016	
TEQ			3.41E-04			9.36E-05			2.09E-03			4.18E-05

TABLE C-3
FISH TEQ CALCULATIONS
SEDIMENT

Parameter	TEF Fish		SD-1001 12/28/2005 0-2	Sample*TEF		SD-1002 12/28/2005 0-2	Sample*TEF		SD-1003 12/28/2005 0-2	Sample*TEF		SD-1004 12/28/2005 0-2	Sample*TEF
1,2,3,4,6,7,8-HpCDD	0.001		0.00011	0.00000011		0.000059	0.000000059		0.00013	0.00000013		0.00014	0.00000014
1,2,3,4,6,7,8-HpCDF	0.01		0.000092	0.00000092		0.00016	0.0000016		0.00027	0.0000027		0.00021	0.0000021
1,2,3,4,7,8,9-HpCDF	0.01		0.0000099	0.000000099		0.000014	0.00000014		0.000049	0.00000049		0.000047	0.00000047
1,2,3,4,7,8-HxCDD	0.5		0.0000049	0.00000245		0.0000061	0.00000305		0.000016	0.000008	<	0.000014	0.0000035
1,2,3,4,7,8-HxCDF	0.1		0.00003	0.000003		0.000057	0.0000057		0.00017	0.000017		0.00011	0.000011
1,2,3,6,7,8-HxCDD	0.01		0.000013	0.00000013		0.000012	0.00000012		0.000042	0.00000042		0.000039	0.00000039
1,2,3,6,7,8-HxCDF	0.1		0.000037	0.0000037		0.000059	0.0000059		0.00023	0.000023		0.00026	0.000026
1,2,3,7,8,9-HxCDD	0.01		0.0000082	0.000000082		0.000008	0.00000008		0.000021	0.00000021		0.00002	0.0000002
1,2,3,7,8,9-HxCDF	0.1	<	0.0000031	0.000000155	<	0.0000028	0.00000014		0.0000086	0.00000086	<	0.0000071	0.000000355
1,2,3,7,8-PeCDD	1		0.0000097	0.0000097		0.0000074	0.0000074		0.000031	0.000031		0.000033	0.000033
1,2,3,7,8-PeCDF	0.05		0.000016	0.0000008		0.000028	0.0000014		0.00006	0.000003		0.000055	0.00000275
2,3,4,6,7,8-HxCDF	0.1		0.000036	0.0000036		0.000051	0.0000051		0.00018	0.000018		0.00022	0.000022
2,3,4,7,8-PeCDF	0.5		0.000036	0.000018		0.000043	0.0000215		0.00016	0.00008		0.00017	0.000085
2,3,7,8-TCDD	1		0.0000053	0.0000053		0.0000025	0.0000025		0.0000095	0.0000095		0.0000092	0.0000092
2,3,7,8-TCDF	0.05		0.000018	0.0000009		0.000015	0.00000075		0.000027	0.00000135		0.000029	0.00000145
OCDD	0.0001		0.00075	0.000000075		0.00024	0.000000024		0.00042	0.000000042		0.00048	0.000000048
OCDF	0.0001		0.000075	7.5E-09		0.00019	0.000000019		0.00019	0.000000019		0.00007	0.000000007
Total HpCDD			0.0002			0.00012			0.00027			0.00026	
Total HpCDF			0.00018			0.00024			0.00062			0.00055	
Total HxCDD			0.00012			0.00013			0.00049			0.00042	
Total HxCDF			0.00078			0.001			0.0055			0.0058	
Total PeCDD			0.000074			0.000056			0.00031			0.00029	
Total PeCDF			0.00068			0.00088			0.0051			0.0054	
Total TCDD			0.000077			0.000045			0.00012			0.00011	
Total TCDF			0.00029			0.00029			0.0013			0.0013	
TEQ				4.90E-05			5.55E-05			1.96E-04			1.98E-04

TABLE C-3
FISH TEQ CALCULATIONS
SEDIMENT

Parameter		SD-1005 12/28/2005 0-2	Sample*TEF		SED10 6/22/2006 0_5-1	Sample*TEF		SED11 6/22/2006 0-1	Sample*TEF		SED12 6/22/2006 0_5-1	Sample*TEF		SED13 6/22/2006 0-0_5	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000017	0.000000017	<	7.5E-07	3.75E-10		0.00028	0.00000028		0.000068	0.000000068		0.0000022	2.2E-09
1,2,3,4,6,7,8-HpCDF		0.00003	0.0000003	<	7.5E-07	3.75E-09		0.00014	0.0000014		0.000079	0.00000079	<	7.6E-07	3.8E-09
1,2,3,4,7,8,9-HpCDF		0.0000041	0.000000041	<	7.5E-07	3.75E-09		0.000018	0.00000018		0.000079	0.00000079	<	7.6E-07	3.8E-09
1,2,3,4,7,8-HxCDD	<	0.0000018	0.00000045	<	7.5E-07	1.875E-07		0.0000095	0.00000475	<	7.1E-07	1.775E-07	<	7.6E-07	0.00000019
1,2,3,4,7,8-HxCDF		0.000017	0.0000017	<	7.5E-07	3.75E-08		0.000036	0.0000036	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,6,7,8-HxCDD		0.0000047	0.000000047	<	7.5E-07	3.75E-09		0.000025	0.00000025	<	7.1E-07	3.55E-09	<	7.6E-07	3.8E-09
1,2,3,6,7,8-HxCDF		0.000033	0.0000033	<	7.5E-07	3.75E-08		0.000086	0.0000086	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,7,8,9-HxCDD	<	0.0000027	1.35E-08	<	7.5E-07	3.75E-09		0.000017	0.00000017		0.00008	0.0000008	<	7.6E-07	3.8E-09
1,2,3,7,8,9-HxCDF	<	9.1E-07	4.55E-08	<	7.5E-07	3.75E-08		0.00003	0.000003	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
1,2,3,7,8-PeCDD	<	0.000003	0.0000015	<	7.5E-07	0.000000375		0.000011	0.000011	<	7.1E-07	0.000000355	<	7.6E-07	0.00000038
1,2,3,7,8-PeCDF		0.0000083	0.000000415	<	7.5E-07	1.875E-08		0.000032	0.0000016	<	7.1E-07	1.775E-08	<	7.6E-07	0.000000019
2,3,4,6,7,8-HxCDF		0.000028	0.0000028	<	7.5E-07	3.75E-08		0.00008	0.000008	<	7.1E-07	3.55E-08	<	7.6E-07	0.000000038
2,3,4,7,8-PeCDF		0.000023	0.0000115	<	7.5E-07	1.875E-07		0.00043	0.000215		7.3E-07	0.000000365		8.6E-07	0.00000043
2,3,7,8-TCDD		9.8E-07	0.00000098	<	1.5E-07	0.000000075		0.0000042	0.0000042	<	1.4E-07	0.00000007	<	1.5E-07	0.000000075
2,3,7,8-TCDF		0.0000043	0.000000215	<	1.5E-07	3.75E-09	<	5.7E-07	1.425E-08		2.4E-07	0.000000012		1.9E-07	9.5E-09
OCDD		0.000077	7.7E-09		0.0000044	4.4E-10		0.0018	0.00000018		0.00015	0.000000015		0.000016	1.6E-09
OCDF		0.0000076	7.6E-10	<	0.0000015	7.5E-11		0.000087	8.7E-09		0.00012	0.000000012		0.0000016	1.6E-10
Total HpCDD		0.000036		<	7.5E-07			0.00063		<	0.0000007			0.0000039	
Total HpCDF		0.000073		<	7.5E-07			0.00033		<	0.0000007			0.0000011	
Total HxCDD		0.000048		<	7.5E-07			0.0003		<	0.0000007		<	7.6E-07	
Total HxCDF		0.00079		<	7.5E-07			0.0023		<	0.0000007			0.000003	
Total PeCDD		0.000022		<	7.5E-07			0.00014		<	7.1E-07		<	7.6E-07	
Total PeCDF		0.00075		<	7.5E-07			0.0055		<	0.0000007			0.0000074	
Total TCDD		0.000011		<	1.5E-07			0.000089		<	1.4E-07		<	1.5E-07	
Total TCDF		0.00017		<	1.5E-07			0.0016		<	1.4E-07			0.0000031	
TEQ			2.33E-05			1.01E-06			2.62E-04			3.62E-06			1.27E-06

TABLE C-3
FISH TEQ CALCULATIONS
SEDIMENT

Parameter		SED14 6/22/2006 0-1	Sample*TEF		SED15 6/22/2006 0-1	Sample*TEF		SED16 6/22/2006 0-1	Sample*TEF		SED17 6/22/2006 0_5-1	Sample*TEF		SED18 6/22/2006 0-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000071	0.000000071	<	0.0000008	4E-10		0.00048	0.00000048		0.000021	0.000000021		0.00064	0.00000064
1,2,3,4,6,7,8-HpCDF		0.000037	0.00000037	<	0.0000008	0.000000004		0.00057	0.0000057		0.000035	0.00000035		0.001	0.00001
1,2,3,4,7,8,9-HpCDF		0.0000044	0.000000044	<	0.0000008	0.000000004		0.000092	0.00000092		0.0000065	0.000000065		0.00017	0.0000017
1,2,3,4,7,8-HxCDD		0.0000033	0.00000165	<	0.0000008	0.0000002		0.000041	0.0000205		0.0000022	0.0000011		0.000074	0.000037
1,2,3,4,7,8-HxCDF	<	0.0000017	0.000000085	<	0.0000008	0.00000004		0.00033	0.000033		0.000017	0.0000017		0.00067	0.000067
1,2,3,6,7,8-HxCDD		0.0000068	0.000000068	<	0.0000008	0.000000004		0.00012	0.0000012		0.0000057	0.000000057		0.00019	0.0000019
1,2,3,6,7,8-HxCDF		0.000026	0.0000026	<	0.0000008	0.00000004		0.00057	0.000057		0.00003	0.000003		0.0013	0.00013
1,2,3,7,8,9-HxCDD		0.0000034	0.000000034	<	0.0000008	0.000000004		0.000056	0.00000056		0.0000033	0.000000033		0.000097	0.00000097
1,2,3,7,8,9-HxCDF		0.0000084	0.00000084	<	0.0000008	0.00000004		0.00019	0.000019		0.000013	0.0000013		0.00039	0.000039
1,2,3,7,8-PeCDD		0.0000048	0.0000048	<	0.0000008	0.0000004		0.000056	0.000056		0.0000033	0.0000033		0.000098	0.000098
1,2,3,7,8-PeCDF		0.0000084	0.00000042	<	0.0000008	0.00000002	<	0.0000034	0.000000085		0.0000081	0.000000405	<	0.0000032	0.00000008
2,3,4,6,7,8-HxCDF		0.000051	0.0000051	<	0.0000008	0.00000004		0.0004	0.00004		0.000075	0.0000075		0.00091	0.000091
2,3,4,7,8-PeCDF		0.00015	0.000075	<	0.0000008	0.0000002		0.0028	0.0014		0.00019	0.000095		0.0062	0.0031
2,3,7,8-TCDD		0.0000014	0.0000014	<	1.6E-07	0.00000008		0.000016	0.000016		0.0000011	0.0000011		0.00003	0.00003
2,3,7,8-TCDF		0.0000076	0.00000038	<	1.6E-07	0.000000004		0.000082	0.0000041	<	1.4E-07	3.5E-09		0.00012	0.000006
OCDD		0.00047	0.000000047		0.0000044	4.4E-10		0.0023	0.00000023		0.00007	0.000000007		0.0027	0.00000027
OCDF		0.000036	3.6E-09	<	0.0000016	8E-11		0.00025	0.000000025		0.000008	8E-10		0.0003	0.00000003
Total HpCDD		0.00014		<	0.0000008			0.00097			0.000044			0.0013	
Total HpCDF		0.000089		<	0.0000008			0.0014			0.000087			0.0028	
Total HxCDD		0.000087		<	0.0000008			0.0014			0.00007			0.0026	
Total HxCDF		0.00051			0.0000011			0.016			0.0009			0.023	
Total PeCDD		0.000047		<	0.0000008			0.001			0.000041			0.002	
Total PeCDF		0.0013			0.0000031			0.0073			0.0021			0.0096	
Total TCDD		0.000029		<	1.6E-07			0.00038			0.000023			0.0008	
Total TCDF		0.00042			0.0000013			0.0069			0.0006			0.012	
TEQ			9.29E-05			1.08E-06			1.65E-03			1.15E-04			3.61E-03

TABLE C-3
FISH TEQ CALCULATIONS
SEDIMENT

Parameter		SED19 6/22/2006 0-1	Sample*TEF		SED20 6/22/2006 0_5-1	Sample*TEF		SED21 6/22/2006 0-1	Sample*TEF		SED22 6/22/2006 0-1	Sample*TEF		SED23 6/22/2006 0-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.00027	0.00000027		0.00009	0.00000009		0.0000045	4.5E-09		0.00011	0.00000011	<	6.8E-07	3.4E-10
1,2,3,4,6,7,8-HpCDF		0.00051	0.0000051		0.0002	0.000002		0.0000065	0.000000065		0.00016	0.0000016	<	6.8E-07	3.4E-09
1,2,3,4,7,8,9-HpCDF		0.00011	0.0000011		0.000041	0.00000041		0.0000012	0.000000012		0.000025	0.00000025	<	6.8E-07	3.4E-09
1,2,3,4,7,8-HxCDD		0.000051	0.0000255		0.000015	0.0000075	<	8.4E-07	0.00000021	<	0.000018	0.0000045	<	6.8E-07	0.00000017
1,2,3,4,7,8-HxCDF		0.00039	0.000039		0.00014	0.000014		0.0000034	0.00000034		0.000068	0.0000068	<	6.8E-07	0.000000034
1,2,3,6,7,8-HxCDD		0.00012	0.0000012		0.000035	0.00000035		0.0000013	0.000000013		0.000028	0.00000028	<	6.8E-07	3.4E-09
1,2,3,6,7,8-HxCDF		0.00062	0.000062		0.00014	0.000014		0.0000073	0.00000073		0.00016	0.000016	<	6.8E-07	0.000000034
1,2,3,7,8,9-HxCDD		0.000059	0.00000059		0.000016	0.00000016	<	8.4E-07	4.2E-09	<	0.000018	0.00000009	<	6.8E-07	3.4E-09
1,2,3,7,8,9-HxCDF		0.00025	0.000025		0.000052	0.0000052		0.0000024	0.00000024		0.000062	0.0000062	<	6.8E-07	0.000000034
1,2,3,7,8-PeCDD		0.000069	0.000069		0.00003	0.00003		9.5E-07	0.00000095		0.000018	0.000018	<	6.8E-07	0.00000034
1,2,3,7,8-PeCDF	<	0.0000027	6.75E-08	<	0.0000012	0.00000003		0.0000023	0.000000115		0.000041	0.00000205	<	6.8E-07	0.000000017
2,3,4,6,7,8-HxCDF		0.00054	0.000054		0.00012	0.000012		0.000016	0.0000016		0.00015	0.000015	<	6.8E-07	0.000000034
2,3,4,7,8-PeCDF		0.0035	0.00175		0.00014	0.00007		0.000044	0.000022		0.0013	0.00065	<	6.8E-07	0.00000017
2,3,7,8-TCDD		0.000021	0.000021		0.0000073	0.0000073	<	1.7E-07	0.000000085		0.0000068	0.0000068	<	1.4E-07	0.00000007
2,3,7,8-TCDF		0.000058	0.0000029		0.0000093	0.000000465	<	1.7E-07	4.25E-09		0.000027	0.00000135	<	1.4E-07	3.5E-09
OCDD		0.00093	0.000000093		0.00024	0.000000024		0.000025	2.5E-09		0.0005	0.00000005		0.0000035	3.5E-10
OCDF		0.0001	0.00000001		0.000082	8.2E-09		0.0000022	2.2E-10		0.000044	4.4E-09	<	0.0000014	7E-11
Total HpCDD		0.00058			0.00019			0.0000088			0.00024		<	6.8E-07	
Total HpCDF		0.0014			0.0005			0.000017			0.00042		<	6.8E-07	
Total HxCDD		0.0016			0.00047			0.000013			0.00031		<	6.8E-07	
Total HxCDF		0.012			0.0046			0.0002			0.0055			0.0000017	
Total PeCDD		0.0014			0.00039			0.0000081			0.0002		<	6.8E-07	
Total PeCDF		0.0088			0.0069			0.00046			0.014			0.0000044	
Total TCDD		0.00051			0.00016			0.0000036			0.00015		<	1.4E-07	
Total TCDF		0.0065			0.0014			0.00014			0.0045			0.0000012	
TEQ			2.06E-03			1.64E-04			2.64E-05			7.29E-04			9.21E-07

TABLE C-3
FISH TEQ CALCULATIONS
SEDIMENT

Parameter		SED24 6/22/2006 0-1	Sample*TEF		SED25 6/22/2006 0-1	Sample*TEF		SED26 6/22/2006 0-1	Sample*TEF		SED27 6/22/2006 0-1	Sample*TEF		SED28 6/21/2006 0_5-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.000029	0.000000029		0.00032	0.00000032		0.00002	0.00000002		0.00018	0.00000018		0.00049	0.00000049
1,2,3,4,6,7,8-HpCDF		0.000029	0.00000029		0.00044	0.0000044		0.0000059	0.000000059		0.00023	0.0000023		0.00064	0.0000064
1,2,3,4,7,8,9-HpCDF		0.0000045	0.000000045		0.000079	0.00000079	<	0.0000014	0.000000007		0.000036	0.00000036		0.000099	0.00000099
1,2,3,4,7,8-HxCDD		0.0000013	0.00000065		0.00003	0.000015	<	0.0000014	0.00000035	<	0.000021	0.00000525		0.000039	0.0000195
1,2,3,4,7,8-HxCDF		0.000012	0.0000012		0.00031	0.000031		0.0000024	0.00000024		0.00013	0.000013		0.0003	0.00003
1,2,3,6,7,8-HxCDD		0.0000054	0.000000054		0.000083	0.00000083		0.0000036	0.000000036		0.000037	0.00000037		0.00011	0.0000011
1,2,3,6,7,8-HxCDF		0.000016	0.0000016		0.00038	0.000038	<	0.0000014	0.00000007		0.00015	0.000015		0.00052	0.000052
1,2,3,7,8,9-HxCDD		0.0000028	0.000000028		0.000038	0.00000038		0.0000017	0.000000017		0.000022	0.00000022		0.000068	0.00000068
1,2,3,7,8,9-HxCDF		0.000007	0.0000007		0.00018	0.000018	<	0.0000014	0.00000007		0.000075	0.0000075		0.0002	0.00002
1,2,3,7,8-PeCDD		0.0000024	0.0000024		0.000063	0.000063	<	0.0000014	0.0000007		0.000029	0.000029		0.000076	0.000076
1,2,3,7,8-PeCDF		0.0000055	0.000000275	<	0.0000049	1.225E-07	<	0.0000014	0.000000035		0.000035	0.00000175	<	0.000018	0.00000045
2,3,4,6,7,8-HxCDF		0.000012	0.0000012		0.00031	0.000031	<	0.0000014	0.00000007		0.00018	0.000018		0.00042	0.000042
2,3,4,7,8-PeCDF		0.000095	0.0000475		0.0022	0.0011		0.0000017	0.00000085		0.00091	0.000455		0.0031	0.00155
2,3,7,8-TCDD		7.2E-07	0.00000072		0.000018	0.000018	<	2.8E-07	0.00000014		0.0000081	0.0000081		0.000022	0.000022
2,3,7,8-TCDF	<	2.6E-07	6.5E-09		0.000053	0.00000265		0.0000016	0.00000008	<	0.0000042	0.000000105		0.000084	0.0000042
OCDD		0.00017	0.000000017		0.0019	0.00000019		0.000043	4.3E-09		0.00083	0.000000083		0.0029	0.00000029
OCDF		0.000017	1.7E-09		0.00017	0.000000017		0.0000062	6.2E-10		0.00013	0.000000013		0.00021	0.000000021
Total HpCDD		0.000058			0.00065			0.000033			0.00038			0.001	
Total HpCDF		0.000066			0.0011			0.0000059			0.00051			0.0016	
Total HxCDD		0.00005			0.0011			0.000064			0.00045			0.0014	
Total HxCDF		0.00049			0.012			0.0000054			0.0048			0.01	
Total PeCDD		0.000029			0.00091			0.000022			0.00024			0.00095	
Total PeCDF		0.0011			0.012			0.0000061			0.0098			0.024	
Total TCDD		0.000017			0.0005			0.000021			0.00013			0.00042	
Total TCDF		0.00032			0.0069			0.000021			0.003			0.0088	
TEQ			5.67E-05			1.32E-03			2.75E-06			5.56E-04			1.83E-03

TABLE C-3
FISH TEQ CALCULATIONS
SEDIMENT

Parameter		SED29 6/21/2006 0_5-1	Sample*TEF		SED30 6/21/2006 0_5-1	Sample*TEF		SED31 6/21/2006 0_5-1	Sample*TEF		SED32 6/21/2006 0_5-1	Sample*TEF
1,2,3,4,6,7,8-HpCDD		0.00018	0.00000018		0.000066	0.000000066		0.00043	0.00000043		0.000074	0.000000074
1,2,3,4,6,7,8-HpCDF		0.00035	0.0000035		0.000036	0.00000036		0.00071	0.0000071		0.00004	0.0000004
1,2,3,4,7,8,9-HpCDF		0.000069	0.00000069		0.0000061	0.000000061		0.00017	0.0000017		0.0000051	0.000000051
1,2,3,4,7,8-HxCDD		0.000018	0.000009		0.0000034	0.0000017		0.000055	0.0000275		0.0000018	0.0000009
1,2,3,4,7,8-HxCDF		0.00021	0.000021		0.000018	0.0000018		0.00032	0.000032		0.000011	0.0000011
1,2,3,6,7,8-HxCDD		0.00007	0.0000007		0.000012	0.00000012		0.00015	0.0000015		0.0000048	0.000000048
1,2,3,6,7,8-HxCDF		0.00029	0.000029		0.000014	0.0000014		0.00075	0.000075		0.000012	0.0000012
1,2,3,7,8,9-HxCDD		0.000031	0.00000031		0.0000072	0.000000072		0.000078	0.00000078		0.0000028	0.000000028
1,2,3,7,8,9-HxCDF		0.00014	0.000014		0.0000096	0.00000096		0.00042	0.000042		0.0000053	0.00000053
1,2,3,7,8-PeCDD		0.000041	0.000041		0.0000052	0.0000052		0.00012	0.00012		0.0000022	0.0000022
1,2,3,7,8-PeCDF	<	0.0000018	0.000000045	<	0.0000007	1.75E-08		0.00023	0.0000115	<	7.3E-07	1.825E-08
2,3,4,6,7,8-HxCDF		0.00023	0.000023		0.000013	0.0000013		0.00064	0.000064		0.000012	0.0000012
2,3,4,7,8-PeCDF		0.00016	0.00008		0.000076	0.000038		0.0016	0.0008		0.000028	0.000014
2,3,7,8-TCDD		0.000012	0.000012		6.2E-07	0.00000062		0.000033	0.000033		5.2E-07	0.00000052
2,3,7,8-TCDF		0.000032	0.0000016		0.0000047	0.000000235		0.000076	0.0000038		0.000006	0.0000003
OCDD		0.00084	0.000000084		0.00054	0.000000054		0.0016	0.00000016		0.00081	0.000000081
OCDF		0.00017	0.000000017		0.000037	3.7E-09		0.00019	0.000000019		0.00008	0.000000008
Total HpCDD		0.0004			0.00013			0.00094			0.00017	
Total HpCDF		0.00087			0.000094			0.002			0.00012	
Total HxCDD		0.0009			0.00013			0.002			0.000051	
Total HxCDF		0.0083			0.00038			0.025			0.00032	
Total PeCDD		0.00053			0.000055			0.0016			0.000025	
Total PeCDF		0.014			0.00059			0.04			0.0005	
Total TCDD		0.00027			0.000021			0.00064			0.000012	
Total TCDF		0.0037			0.00017			0.015			0.00016	
TEQ			2.36E-04			5.20E-05			1.22E-03			2.27E-05

TABLE C-4
MAMMAL TEQ CALCULATIONS
SURFACE WATER

Parameter	TEF Mammals		SW11 6/21/2006	Sample*TEF		SW19 6/21/2006	Sample*TEF		SW27 6/22/2006	Sample*TEF
1,2,3,4,6,7,8-HpCDD	0.01		2.4E-08	2.4E-10		4.3E-08	4.3E-10		4.3E-08	4.3E-10
1,2,3,4,6,7,8-HpCDF	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11	<	0.00000001	5E-11
1,2,3,4,7,8,9-HpCDF	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11	<	0.00000001	5E-11
1,2,3,4,7,8-HxCDD	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,4,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,6,7,8-HxCDD	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10		1.3E-08	1.3E-09
1,2,3,6,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,7,8,9-HxCDD	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10		5.1E-08	5.1E-09
1,2,3,7,8,9-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,7,8-PeCDD	1	<	0.00000001	0.000000005	<	0.00000001	0.000000005		4.6E-08	0.000000046
1,2,3,7,8-PeCDF	0.05	<	0.00000001	2.5E-10	<	0.00000001	2.5E-10	<	0.00000001	2.5E-10
2,3,4,6,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
2,3,4,7,8-PeCDF	0.5	<	0.00000001	2.5E-09	<	0.00000001	2.5E-09	<	0.00000001	2.5E-09
2,3,7,8-TCDD	1	<	2.1E-09	1.05E-09	<	2E-09	0.000000001		3.1E-09	3.1E-09
2,3,7,8-TCDF	0.1	<	2.1E-09	1.05E-10	<	2E-09	1E-10		8.9E-09	8.9E-10
OCDD	0.0001		0.00000018	1.8E-11		0.00000032	3.2E-11		0.00000035	3.5E-11
OCDF	0.0001	<	2.1E-08	1.05E-12	<	0.00000002	1E-12	<	0.00000002	1E-12
Total HpCDD			4.3E-08			7.2E-08			6.1E-08	
Total HpCDF			1.2E-08			2.1E-08			1.3E-08	
Total HxCDD		<	0.00000001		<	0.00000001			6.4E-08	
Total HxCDF		<	0.00000001		<	0.00000001		<	0.00000001	
Total PeCDD		<	0.00000001		<	0.00000001			4.6E-08	
Total PeCDF		<	0.00000001		<	0.00000001			2.9E-08	
Total TCDD		<	2.1E-09		<	2E-09			3.1E-09	
Total TCDF		<	2.1E-09			3.4E-09			3.2E-08	
TEQ				**1.28E-08**			**1.29E-08**			**6.22E-08**

TABLE C-5
BIRD TEQ CALCULATIONS
SURFACE WATER

Parameter	TEF Bird		SW11 6/21/2006	Sample*TEF		SW19 6/21/2006	Sample*TEF		SW27 6/22/2006	Sample*TEF
1,2,3,4,6,7,8-HpCDD	0.001		2.4E-08	2.4E-11		4.3E-08	4.3E-11		4.3E-08	4.3E-11
1,2,3,4,6,7,8-HpCDF	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11	<	0.00000001	5E-11
1,2,3,4,7,8,9-HpCDF	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11	<	0.00000001	5E-11
1,2,3,4,7,8-HxCDD	0.05	<	0.00000001	2.5E-10	<	0.00000001	2.5E-10	<	0.00000001	2.5E-10
1,2,3,4,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,6,7,8-HxCDD	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11		1.3E-08	1.3E-10
1,2,3,6,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,7,8,9-HxCDD	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10		5.1E-08	5.1E-09
1,2,3,7,8,9-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,7,8-PeCDD	1	<	0.00000001	0.000000005	<	0.00000001	0.000000005		4.6E-08	0.000000046
1,2,3,7,8-PeCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
2,3,4,6,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
2,3,4,7,8-PeCDF	1	<	0.00000001	0.000000005	<	0.00000001	0.000000005	<	0.00000001	0.000000005
2,3,7,8-TCDD	1	<	2.1E-09	1.05E-09	<	2E-09	0.000000001		3.1E-09	3.1E-09
2,3,7,8-TCDF	1	<	2.1E-09	1.05E-09	<	2E-09	0.000000001		8.9E-09	8.9E-09
OCDD	0.0001		0.00000018	1.8E-11		0.00000032	3.2E-11		0.00000035	3.5E-11
OCDF	0.0001	<	2.1E-08	1.05E-12	<	0.00000002	1E-12	<	0.00000002	1E-12
Total HpCDD			4.3E-08			7.2E-08			6.1E-08	
Total HpCDF			1.2E-08			2.1E-08			1.3E-08	
Total HxCDD		<	0.00000001		<	0.00000001			6.4E-08	
Total HxCDF		<	0.00000001		<	0.00000001		<	0.00000001	
Total PeCDD		<	0.00000001		<	0.00000001			4.6E-08	
Total PeCDF		<	0.00000001		<	0.00000001			2.9E-08	
Total TCDD		<	2.1E-09		<	2E-09			3.1E-09	
Total TCDF		<	2.1E-09			3.4E-09			3.2E-08	
TEQ				1.55E-08			1.55E-08			7.12E-08

TABLE C-6
FISH TEQ CALCULATIONS
SURFACE WATER

chemical_name	TEF Fish	SW11 6/21/2006		Sample*TEF	SW19 6/21/2006		Sample*TEF	SW27 6/22/2006		Sample*TEF
1,2,3,4,6,7,8-HpCDD	0.001		2.4E-08	2.4E-11		4.3E-08	4.3E-11		4.3E-08	4.3E-11
1,2,3,4,6,7,8-HpCDF	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11	<	0.00000001	5E-11
1,2,3,4,7,8,9-HpCDF	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11	<	0.00000001	5E-11
1,2,3,4,7,8-HxCDD	0.5	<	0.00000001	2.5E-09	<	0.00000001	2.5E-09	<	0.00000001	2.5E-09
1,2,3,4,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,6,7,8-HxCDD	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11		1.3E-08	1.3E-10
1,2,3,6,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,7,8,9-HxCDD	0.01	<	0.00000001	5E-11	<	0.00000001	5E-11		5.1E-08	5.1E-10
1,2,3,7,8,9-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
1,2,3,7,8-PeCDD	1	<	0.00000001	0.000000005	<	0.00000001	0.000000005		4.6E-08	0.000000046
1,2,3,7,8-PeCDF	0.05	<	0.00000001	2.5E-10	<	0.00000001	2.5E-10	<	0.00000001	2.5E-10
2,3,4,6,7,8-HxCDF	0.1	<	0.00000001	5E-10	<	0.00000001	5E-10	<	0.00000001	5E-10
2,3,4,7,8-PeCDF	0.5	<	0.00000001	2.5E-09	<	0.00000001	2.5E-09	<	0.00000001	2.5E-09
2,3,7,8-TCDD	1	<	2.1E-09	1.05E-09	<	2E-09	0.000000001		3.1E-09	3.1E-09
2,3,7,8-TCDF	0.05	<	2.1E-09	5.25E-11	<	2E-09	5E-11		8.9E-09	4.45E-10
OCDD	0.0001		0.00000018	1.8E-11		0.00000032	3.2E-11		0.00000035	3.5E-11
OCDF	0.0001	<	2.1E-08	1.05E-12	<	0.00000002	1E-12	<	0.00000002	1E-12
Total HpCDD			4.3E-08			7.2E-08			6.1E-08	
Total HpCDF			1.2E-08			2.1E-08			1.3E-08	
Total HxCDD		<	0.00000001		<	0.00000001			6.4E-08	
Total HxCDF		<	0.00000001		<	0.00000001		<	0.00000001	
Total PeCDD		<	0.00000001		<	0.00000001			4.6E-08	
Total PeCDF		<	0.00000001		<	0.00000001			2.9E-08	
Total TCDD		<	2.1E-09		<	2E-09			3.1E-09	
Total TCDF		<	2.1E-09			3.4E-09			3.2E-08	
TEQ-Fish				1.36E-08			1.36E-08			5.76E-08