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Water Protection Division
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Atlanta, GA

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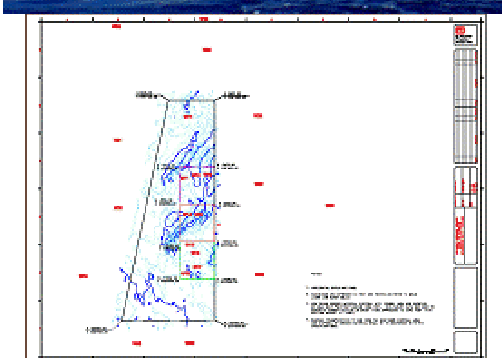
# Wilmington ODMDS Close-Out
# May 2010

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## ACKNOWLEDGEMENTS

Samples were collected May 10 - 11, 2010 from the Wilmington Ocean Dredged Material Disposal Site (ODMDS) and the surrounding environs [Gary W. Collins, Chief Scientist]. Philip Payonk and Morris Flexner jointly served as Principal Investigators. Coordination of sediment samples for macroinvertebrate analysis was handled by Don Norris, while Doug Johnson performed the same role for chemical analysis; water samples were coordinated by Megan Holton. Sample tracking and custody were performed by Phyllis Meyer. Drew Kendall led deck operations while Rosemary Hall kept careful data records of all survey activity. Invaluable assistance was provided by Captain Doug Brown and the entire crew of the Ocean Survey Vessel (OSV) Bold.

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## INTRODUCTION

Ocean disposal of dredged materials can affect the environment of a disposal site by disturbing the benthic community and potentially causing long-term reduction of oxygen in the pore waters of the sediments and the overlying waters. Natural oceanographic processes can also be responsible for transporting disposed materials offsite into nearby habitats.

As part of Region 4's strategy to monitor the effects of dredged material disposal within the marine environment, routine surveys of the benthos and water column within and adjacent to our sites are conducted so that their status may be assessed.

The present study being discussed was conducted aboard the Ocean Survey Vessel (OSV) Bold on May 10-11, 2010.

## BACKGROUND

The original Wilmington ODMDS was designated by the U. S. Environmental Protection Agency (USEPA) in August 1987. For many years the site received both new work and maintenance material from the Federally-authorized navigation channels of the Cape Fear River basin. In addition, new work and routine maintenance of the Military Ocean Terminal, Sunny Point (MOTSU) has utilized ocean dumping to satisfy disposal needs.

In September 1992, USEPA conducted a site assessment study of the ODMDS to determine if any adverse effects from ocean dumping at the Wilmington ODMDS could be discerned. Conclusions drawn from analyses of the data collected were that no effects could be seen (USACE, 1993).

During the mid 1990's, the U. S. Army Corps of Engineers (USACE) determined the need for a site with more capacity and out of the path of the required newly-aligned entrance channel for the upcoming deepening project for the federal project. Beginning in 1998, the USEPA and USACE went about the process of finding a suitable ODMDS to replace the site currently being used.

The process to locate and characterize a new ODMDS that would replace the original ODMDS was completed in 2002, with the Final Rule to designate the New Wilmington ODMDS. Use of the original Wilmington ODMDS was halted shortly thereafter.

The current study was used to serve as a "Close-Out" study of the older Wilmington ODMDS. Even though the older site is no longer being used and will not be authorized for ocean dumping of dredged material for any future projects, it remains on the list of designated sites (40 CFR 228.15(h)(2). As part of USEPA 'house-cleaning' efforts to remove inactive sites from the regulations, Region 4 will be promulgating rulemaking in the near future to de-designate three ODMDSs that no longer meet the ocean dumping criteria for authorization. The older Wilmington ODMDS is one of the three to be de-designated. The timing of the Status and Trends study for the New Wilmington ODMDS provided an opportunity for the USEPA to be able to draw some conclusions as to the current condition of the previously used site before the area is removed from the list of designated ODMDSs.

## ***Survey Area and Location***

The study area is within and surrounding the Wilmington, NC ODMDS located offshore Bald Head and Oak Islands. The ODMDS is approximately 9.4 square nautical miles (nmi) in area. Ten stations were selected in order to analyze the sediment grain size, chemical, and biological characteristics of areas inside the ODMDS where disposal once occurred, and outside the ODMDS. In addition, three (3) stations were selected to receive water quality sampling. Depths in this area ranged from 25 to 39 feet. The ODMDS boundary corner coordinates (NAD 27) are:

33°49'30"N 78°03'06"W
33°48'18"N 78°01'39"W
33°47'19"N 78°02'48"W
33°48'30"N 78°04'16"W

The ODMDS, survey area and station locations are shown in Figure 1.

## METHODS AND MATERIALS

Method Rationale: Characterization of the benthic community and sediment size/chemistry at selected stations, followed by analysis of community parameters via statistical treatment, allows for identification and interpretation of changes in the community structure. Such community statistics can be used to draw inferences regarding perturbations to the benthic macroinvertebrate community and subsequently allow for judgments regarding the likelihood of impact from dredged material disposal.

## ***Sampling Stations***

Ten stations (see Table 1 and Figure 1) were established to create two separate treatment areas (five stations/treatment) to assess the benthic environment. The two treatments were "Inside the ODMDS" and "Outside the ODMDS". Due to the absence of a soft sediment substrate, samples were not collected at one of the stations inside the older ODMDS (W08). Three separate stations were selected to assess the water quality for the study area (see Figure 1).

***Water Quality***

To characterize the general water quality associated with the dump site and its surrounding waters, the following water column parameters were measured: conductivity, dissolved oxygen (DO), salinity, temperature, density, turbidity, and % light transmission (utilizing PAR). All measurements were collected utilizing a Sea-Bird SBE 9 CTD maintained aboard the OSV Bold. Data was post processed utilizing the Sea-Bird Data Processing Software.

Go Flow® bottles attached to the CTD/rosette frame were tripped approximately one to three meters above the bottom and one to two meters just below the surface to obtain water samples for laboratory analyses. Once the rosette was back aboard the ship, the bottles were emptied directly into the appropriate sample containers, labeled, and refrigerated until demobilization. Processing and handling of water samples were according to established Region 4 protocols (USEPA, 2007b). Laboratory analyses of the water include nutrients, metals, PAHs, PCBs and pesticides.

***Seafloor Sampling***

Bottom sampling at all stations was accomplished by a minimum of two deployments of a Young grab (surface area = 0.04 $m^2$ ; depth of 10 cm) from the stern of the ship. After retrieval of the grab and confirmation of an adequate sample, the sediments were removed from the grab and placed into either a pre-cleaned glass pan or dumped directly into a stainless steel tray. The stainless steel tray was used for transfer of sediments that would be processed for benthic macroinvertebrate identification. The glass pan was transferred to the ship's wet lab for sediments that would be sub-sampled in order to obtain discrete samples for sediment particle size analyses and sediment chemical analyses. All sampling procedures and sample preservation for analyses were according to the SESD Standard Operating Procedures (SOP), (US EPA, 2007b).

The sampling device and handling/preservative protocol for each type of sample follows below:

Sediment Particle Size

After thorough mixing, quartering, and further mixing of the sediments in the glass pan, a 3/4-cup mixing cup was used to scoop out the appropriate amount of sediments needed for sediment particle size analysis. The subsamples were placed into whirl packs, labeled, and frozen for return to the lab.

Sediment texture is determined at half-phi intervals using the ASTM method D-422 to determine the silt-clay and sand content by combination of sieve analysis (for the +230 mesh [sand] fraction) and Boyocous (hydrometer) analysis for the –230 mesh [silt – clay] fraction and nested sieves for larger particle fractions. Texture parameters that are computed included percent gravel, sand, and silt /clay, median particle size, sorting coefficient and percent moisture.

Total organic carbon (TOC) content is measured using the standard gravimetric carbon analytical procedure carried out using a LECO induction furnace (ASTM method E-354-97).

Sediment Chemistry

Sediment chemistry analyses were not conducted at each individual station sampled as part of this study. Sediments from a varying number of stations were composited for further analyses, allowing for results to be viewed on a zoned basis. In addition, the use of composited samples allowed the study to reduce the number of samples sent back to the laboratory without the need for excluding any part of the vast study area. Station ID's W27 – W29 were used to identify the composited sediments for laboratory analyses (see Table 2). After removal of the sediment particle size sample, the remainder of the sample was left in the pan and covered with aluminum foil. Upon completion of sample collection at all the stations that made up each composite, the sediments were placed into the same pan and thoroughly mixed before transfer to the approximate sample containers.

The sample was transferred to a glass pan and thoroughly mixed. The sample was alloquated into two 236.6 ml. glass containers and preserved by storing at 4 $^{o}$C until analyzed. One container was analyzed for extractable organic compounds and the other was analyzed for metals. Analyses for the following parameters were conducted at the SESD lab in Athens, Georgia: heavy metals scan, extractable organic compounds (PAH's, pesticides, and PCBs).

Benthic Macroinvertebrate Infauna

Sediments from a separate deployment of the grab were collected to obtain benthic macroinvertebrate organisms. On-board processing involved washing the sample through a #35 screen (0.5mm). The sample retained on the screen after washing was preserved with 100% NoToXhisto®. Benthic containers were labeled both internally and externally and stored for transfer to contract lab facilities. The details of sorting and identification of infaunal taxa, as well as discussions of statistical analyses of the data, are described in Vittor, 2010.

## RESULTS AND DISCUSSION

### ***Water Quality***

The results of the water quality profiles are summarized in Table 3, and visually demonstrated by Figures 2 and 3. All stations sampled showed the absence of any layering, revealing that the water column throughout the entire study area was extremely well-mixed.

Temperatures recorded ranged from 20.66 to 21.02 ºC, while salinity ranged from 33.58 to 34.49 ppt (see Table 3, Figure 2).

Dissolved oxygen (DO) readings, ranging from 6.92 to 7.04 mg/L, also showed the presence of well-mixed waters (see Table 3, Figure 3).

Chemical analyses of the water samples collected as part of this study showed all analytes, with the exception of iron, to be at or below the detection limit (see Appendix D). The levels of iron ranged from 2200 to 3000 ug/L. These concentrations are not high enough to warrant any concern or the need for further investigation.

### ***Seafloor Sampling***

#### *Sediment Particle Size*

The results of the sediment particle size analyses are summarized in Table 4 and shown by Figure 4. All stations, both inside and outside the ODMDS, are predominantly sand. The only station with a silt/clay fraction greater than 2.5 % was W09, which had silts and clays of 30.3% and 10.3%, respectively (see Table 4). The only other interesting aspect of this data is the high gravel content seen at Station W03 (19.2 %).

#### *Sediment Chemistry*

Results of metals analyses for the sediments are summarized in Table 5, while the individual composite values can be found in Table C1. As the data in Table 5 demonstrates, the higher concentrations of all metals detected are seen outside the ODMDS. At first glance, one would attribute these higher values to the larger fraction of silt/clays found at W09. However, this station was part of the composite identified as W29, and for most analytes detected, the highest values were seen in composite W27 (stations W01, W02 and W03). Because the levels seen inside the ODMDS are universally lower than the levels seen outside, no statistical analysis is needed to determine if they are significantly different.

All other contaminants of concern were not detected at or above the laboratory's reporting limits (see Tables C2, C3 and C4). Results were the same for preservative and rinse blanks run as part of the Quality Assurance/Quality Control protocols.

*Benthic Macroinvertebrate Infauna*

The benthic infauna data is detailed and summarized in "Wilmington, North Carolina 2010 ODMDS Status and Trends Benthic Community Assessment " (Vittor, 2010). The data from the stations collected inside the ODMDS showed the bivalve *Petricola pholadiformis* to be the dominate taxon, representing 21.1% of the total number of individuals. Other dominant taxa included the amphipod, *Protohaustorius wigleyi*, the oligochaete Family, Tubificidae (LPIL), and the polychaete *Goniadides carolinae*, representing 13.3%, 8.4%, and 7.2% of the total assemblage, respectively.

The dominant taxon collected from outside the ODMDS was the polychaete Family, Maldanidae (LPIL), representing 7.5% of the total number of individuals. Other dominant taxa included the peanut worm, Sipunculidea (LPIL), the amphipod, *Ampelisca macrocephala*, and the polychaetes, *Magelona* sp. H and *Mediomastus* (LPIL), representing 7.1%, 5.7%, 5.5% and 5.5% of the total assemblage, respectively.

Taxa richness and density data for stations inside and outside the ODMDS are given in Table 6, and summarized in Table 7. For stations inside the ODMDS, taxa richness averaged 13.3 taxa/station (SD = 8.7), and densities averaged 1037.5 organisms/$m^2$ (SD = 610.5). For stations outside the ODMDS, taxa richness averaged 27.6 taxa/station (SD = 13.5), and densities averaged 2465 organisms/$m^2$ (SD = 2080.9). Statistical analyses showed that there was no significant difference between stations inside and outside the ODMDS in either taxa richness or density (see Vittor, 2010).

Taxa diversity (H') and taxa evenness (J') for stations inside and outside the ODMDS are given in Table 6, and summarized in Table 7. Taxa diversity averaged 1.81 (SD = 0.63) inside the site, and 2.78 (SD = 0.47) at those stations outside the site. Taxa evenness inside the site averaged 0.75 (SD = 0.10), while outside the site averaged 0.88 (SD = 0.06).

The results of cluster, MDS, ANOSIM and SIMPLER analyses are discussed in detail within Vittor, 2010. The results of both cluster and MDS analyses showed that the nine stations fell into one of five major groups. These data indicate that there were appreciable differences in the macroinvertebrate assemblages between stations inside and outside the ODMDS. Results of the ANOSIM analysis indicated that there was no significant difference between the assemblages found inside the ODMDS and those outside the ODMDS. As noted by Vittor, 2010, this analysis is very sensitive to sample size and replication, and results may not be reliable.

Because the Cluster and MDS analyses look for differences in the taxanomic make-up of the communities, the difference indicated by these analyses are not as concerning as differences seen in communities parameters such as taxa richness and density. These parameters are more associated with community health, especially when comparing between two communities. The lack of a significant difference in these parameters indicate that while the two communities may look different (when comparing the species that make up each community), they appear to be just as viable and in relatively the same health as one another.

## CONCLUSIONS

The benthic environment of the Wilmington ODMDS, as well as that found just outside the site, was sampled in order to determine its status and allow EPA to proceed with de-designating the site with the knowledge that historical dumping did not result in long-term environmental impacts. While the present study design will not allow for any type of rigorous impact assessment, it should indicate whether such a labor-intensive effort is warranted.

In conclusion, the data collected in May 2010 shows that the benthic community of the Wilmington ODMDS is viable, healthy and showing no indication that any type of adverse impact has occurred due to the historical dumping of dredged material. Even the re-alignment of the entrance channel through the site does not appear to have had any such impact on the benthic community of the site. Despite the fact that several analyses indicate that a significant difference exists between the community inside the old ODMDS and the surrounding environs, the viability and health of both areas are not statistically different.

# REFERENCES


ASTM D-422. Standard Test Method for Particle Size Analysis of Soils. American Society for Testing and Materials. Pennsylvania. 1994.

ASTM E-354-97: Gravimetric Determinations of Carbon. American Society For Testing and Materials. Pennslyvania. 1997.

USACE, 1993. Wilmington Harbor, North Carolina, ODMDS Benthic Communities. U.S. Army Corps of Engineers, Waterways Experimental Station, Vicksburg, MS. Prepared by Barry A. Vittor & Associates, Inc. Mobile, AL.

USACE, 1999. Wilmington, North Carolina ODMDS 1998 Biological Assessment. U.S. Army Corps of Engineers, Wilmington District, Wilmington, NC. Prepared by Barry A. Vittor & Associates, Inc. Mobile, AL.

USEPA 1996. Site Management and Monitoring Plan (SMMP) for the Wilmington Ocean Dredged Material Disposal Site (ODMDS). November 1996

USEPA. 2000. Wilmington Harbor, North Carolina, New Ocean Dredged Material Disposal Site Characterization Study, Draft Report, June 2000. Draft report prepared by EPA Science and Ecosystem Support Division (SESD), Athens, GA.

USEPA. 2002. Site Management and Monitoring Plan (SMMP) for the New Wilmington Ocean Dredged Material Disposal Site (ODMDS). August 2002

USEPA. 2007a. Operating Procedure for Surface Water Sampling, SESDPROC-201-R1, Region 4, SESD, Athens, GA.

USEPA. 2007b. Operating Procedure for Sediment Sampling, SESDPROC-200-R1, Region 4, SESD, Athens, GA.

USEPA. 2007c. Marine Macroinvertebrate Field Sampling Operating Procedures SESDPROC-511-R1, Region 4, SESD, Athens, Georgia.

USEPA. 2007d. Operating Procedure for Field Sampling Quality Control, SESDPROC-011-R2, Region 4, SESD, Athens, Georgia.

USEPA 2009. US-EPA, Region 4, SESD Analytical Support Branch (ASB) Laboratory Operations and Quality Assurance Manual, January 2007, Athens, Georgia.

USEPA/USACE 2008. Southeast Regional Implementation Manual (SERIM) for Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters. EPA 904-B-08-001. US EPA Region 4 and US ACOE, South Atlantic Division, Atlanta, GA. August 2008, 447 pgs.

Vittor. 2010. Wilmington, North Carolina 2010 ODMDS Status and Trends Benthic Community Assessment. Barry A. Vittor & Associates, Inc., Mobile, Alabama.

Table 1. Wilmington ODMDS Close-Out Stations – May 2010.

| Station ID | Latitude(N) (Degrees, minutes) | Longitude(W) | Depth(m) | Young Grabs(y/n) | CTD Casts(y/n) |
|---|---|---|---|---|---|
| W01 | 33° 48.97′ | 78° 04.01′ | 12.9 | y | n |
| W02 | 33° 48.49′ | 78° 05.01′ | 13.8 | y | n |
| W03 | 33° 47.51′ | 78° 03.98′ | 13.8 | y | n |
| W04 | 33° 48.51′ | 78° 03.98′ | 10.2 | y | n |
| W05 | 33° 48.69′ | 78° 03.49′ | 9.5 | y | n |
| W06 | 33° 48.50′ | 78° 02.99′ | 9.2 | y | n |
| W07 | 33° 48.37′ | 78° 03.01′ | 8.8 | y | n |
| W08 | no soft sediments, rubble/rock only | | | | |
| W09 | 33° 49.01′ | 78° 01.49′ | 11.5 | y | n |
| W10 | 33° 47.72′ | 78° 01.53′ | 12.6 | y | n |
| W35 | 33° 48.38′ | 78° 02.99′ | 8.9 | n | y |
| W38 | 33° 50.29′ | 78° 03.01′ | 9.8 | n | y |
| W40 | 33° 48.56′ | 78° 01.99′ | 11.5 | n | y |

Note: coordinates are interpolated from the recorded coordinates of both grab samples used to collect the sediments and macroinvertebrates for each stations (see Table A2)

Table 2. Station Groupings for Chemistry Composites.

| Inside/Outside | Sample ID | Stations Used to Make up Composite |
|---|---|---|
| **Outside** | **W27** | 01, 02, 03 |
| **Inside** | **W28** | 04, 05, 06, 07* |
| **Outside** | **W29** | 09, 10 |

Table 3. Wilmington ODMDS Water Quality Data – May 2010.

| | W35 | W38 | W40 |
|---|---|---|---|
| Conductivity (S/m) | | | |
| *minimum* | 4.81 | 4.80 | 4.79 |
| *maximum* | 4.82 | 4.80 | 4.81 |
| Density (kg/m3) | | | |
| *minimum* | 23.895 | 23.902 | 24.076 |
| *maximum* | 23.898 | 23.907 | 24.212 |
| Temperature © | | | |
| *minimum* | 21.12 | 21.00 | 20.66 |
| *maximum* | 21.14 | 21.02 | 20.87 |
| Salinity (ppt) | | | |
| *minimum* | 34.26 | 33.58 | 34.40 |
| *maximum* | 34.26 | 34.23 | 34.49 |
| Diss. Oxy. (mg/L) | | | |
| *minimum* | 6.96 | 6.92 | 6.95 |
| *maximum* | 7.01 | 7.00 | 7.04 |
| Turbidity (ntu's) | | | |
| *minimum* | 0.76 | 0.85 | 0.56 |
| *maximum* | 2.71 | 1.21 | 3.84 |

Table 4. Wilmington ODMDS Sediment Particle Size – May 2010.

| Sta. ID | % gravel | % sand | % silts | % clays | description |
|---|---|---|---|---|---|
| *Inside the ODMDS* | | | | | |
| **W04** | 2.68 | 96.74 | 0.39 | 0.19 | sand |
| **W05** | 0.25 | 98.77 | 0.36 | 0.61 | sand |
| **W06** | 7.80 | 91.78 | 0.33 | 0.10 | gravelly sand |
| **W07** | 0.10 | 99.51 | 0.06 | 0.32 | sand |
| **Mean** | **2.71** | **96.70** | **0.29** | **0.31** | |
| *Outside the ODMDS* | | | | | |
| **W01** | 0.54 | 97.06 | 1.83 | 0.57 | sand |
| **W02** | 5.99 | 93.47 | 0.10 | 0.45 | gravelly sand |
| **W03** | 19.18 | 79.49 | 0.93 | 0.40 | gravelly sand |
| **W09** | 0.96 | 58.45 | 30.27 | 10.32 | silty sand |
| **W10** | 7.24 | 91.80 | 0.10 | 0.86 | gravelly sand |
| **Mean** | **6.78** | **84.05** | **6.65** | **2.52** | |

Table 5. Sediment Metals Analyses – Wilmington ODMDS, May 2010.

| | (concentrations are expressed as mg/kg) | | | | |
|---|---|---|---|---|---|
| Aluminum | INSIDE | **340.0** | Arsenic | INSIDE | **1.80** |
| | OUTSIDE | **1350.0** | | OUTSIDE | **8.85** |
| Chromium | INSIDE | **1.7** | Copper | INSIDE | **0.50 U** |
| | OUTSIDE | **5.8** | | OUTSIDE | **0.80** |
| Iron | INSIDE | **1700** | Lead | INSIDE | **0.67** |
| | OUTSIDE | **5900** | | OUTSIDE | **2.65** |
| Manganese | INSIDE | **25.0** | Nickel | INSIDE | **0.96** |
| | OUTSIDE | **98.5** | | OUTSIDE | **2.40** |
| Zinc | INSIDE | **2.40** | | | |
| | OUTSIDE | **8.25** | | | |

Table 6. Infaunal Community Parameters – Wilmington ODMDS, May 2010.

| Station | Taxa Richness | Density | Diversity | Evenness |
|---|---|---|---|---|
| *Inside the ODMDS* | | | | |
| **W04** | 9 | 575 | 2.26 | 0.71 |
| **W05** | 14 | 1500 | 2.38 | 0.62 |
| **W06** | 25 | 1625 | 3.95 | 0.85 |
| **W07** | 5 | 450 | 1.88 | 0.81 |
| Mean | 13.3 | 1037.5 | | 0.75 |
| Std. Dev. | 8.7 | 610.5 | | 0.10 |
| *Outside the ODMDS* | | | | |
| **W01** | 36 | 2775 | 4.53 | 0.88 |
| **W02** | 29 | 1325 | 4.44 | 0.91 |
| **W03** | 43 | 5800 | 4.41 | 0.81 |
| **W09** | 22 | 2125 | 3.76 | 0.84 |
| **W10** | 8 | 300 | 2.92 | 0.97 |
| Mean | 27.6 | 2465 | | 0.88 |
| Std. Dev. | 13.5 | 2080.9 | | 0.06 |

Table 7. Comparative Summary – Wilmington ODMDS, May 2010.

| | Inside | | Outside | |
|---|---|---|---|---|
| | 2010 | 1992 | 2010 | 1992 |
| **Grain Size** | | | | |
| **% gravel** | 2.71 | 1.93 | 6.78 | 10.12 |
| **% sand** | 96.70 | 88.94 | 84.05 | 68.05 |
| **% silt** | 0.29 | 6.69 | 6.65 | 11.38 |
| **% clay** | 0.31 | 2.41 | 2.52 | 2.76 |
| **Sediment Chemistry** | | | | |
| **Arsenic** | 1.80 | 3.56 | 8.85 | 17.06 |
| **Chromium** | 1.70 | 5.20 | 5.75 | 15.50 |
| **Lead** | 0.67 | 2.80 | 2.65 | 6.62 |
| **Manganese** | 25.0 | 61.2 | 98.5 | 160.6 |
| **Nickel** | 0.96 | 4.80 U | 2.40 | 10.00 U |
| **Zinc** | 2.40 | 6.80 | 8.25 | 17.52 |
| **Infaunal Community Parameters** | | | | |
| **Total taxa** | 13.3 | 57.6 | 27.6 | 68.6 |
| **Mean density** | 1037.5 | 2138.4 | 2465.0 | 2769.6 |
| **H’** | 1.81 | 3.25 | 2.78 | 3.34 |
| **J’** | 0.75 | 0.81 | 0.88 | 0.80 |
| **D** | 3.22 | 10.39 | 5.95 | 11.82 |

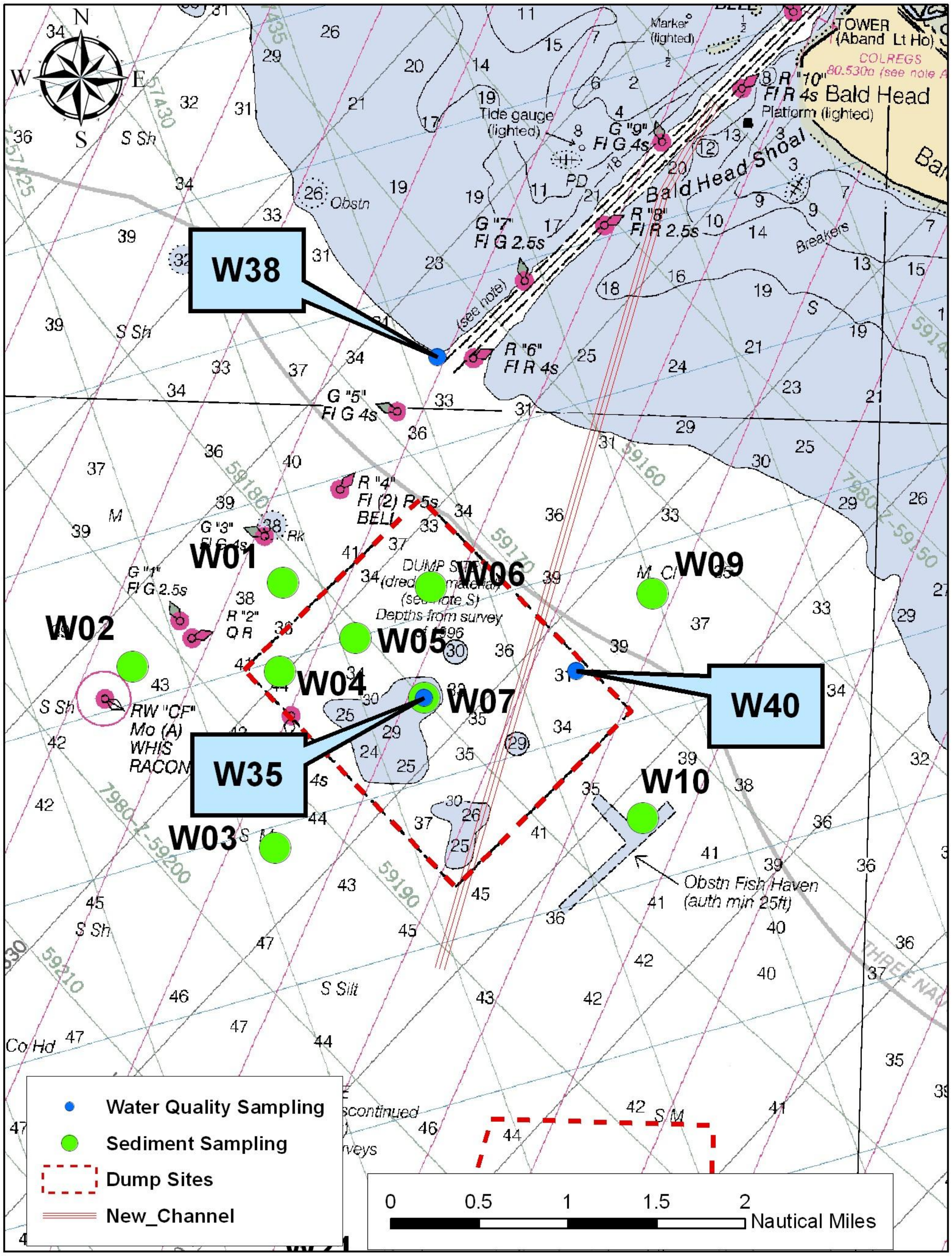
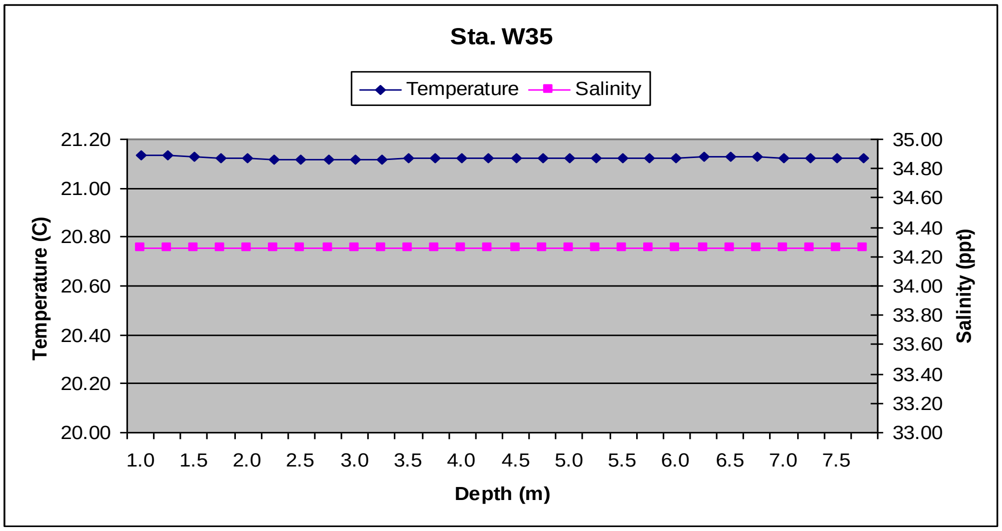
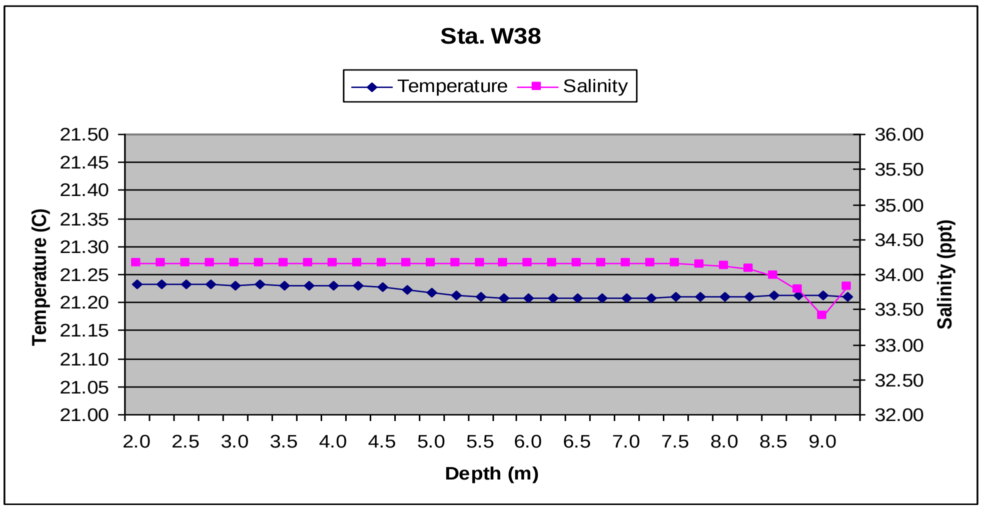



Figure 1. Wilmington sample stations, May, 2010.



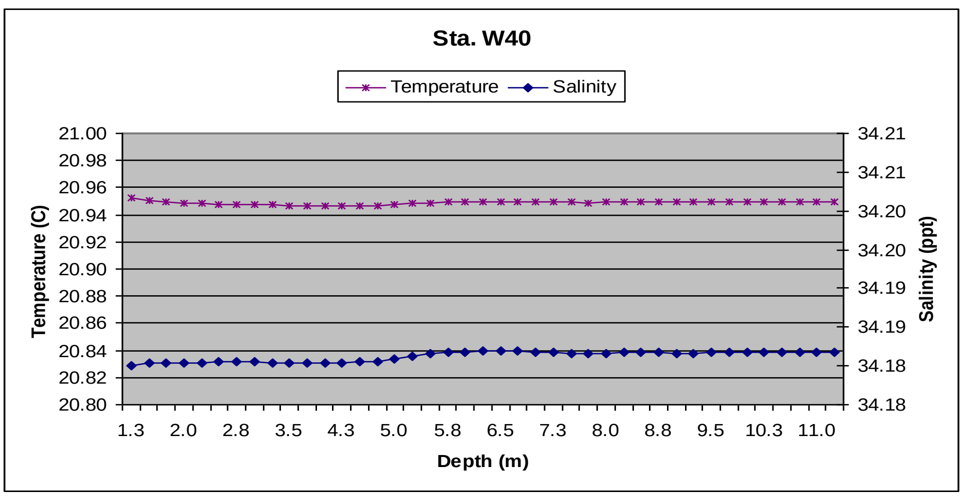
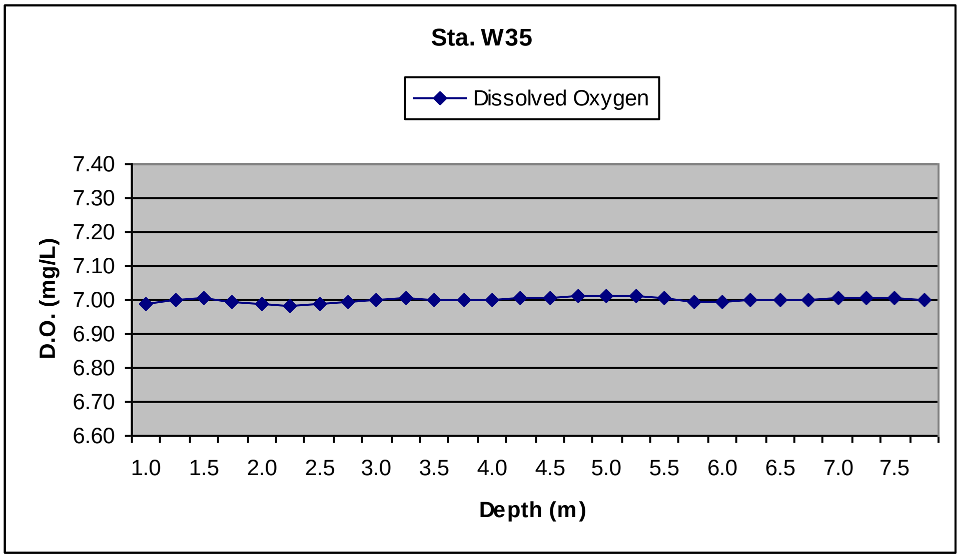
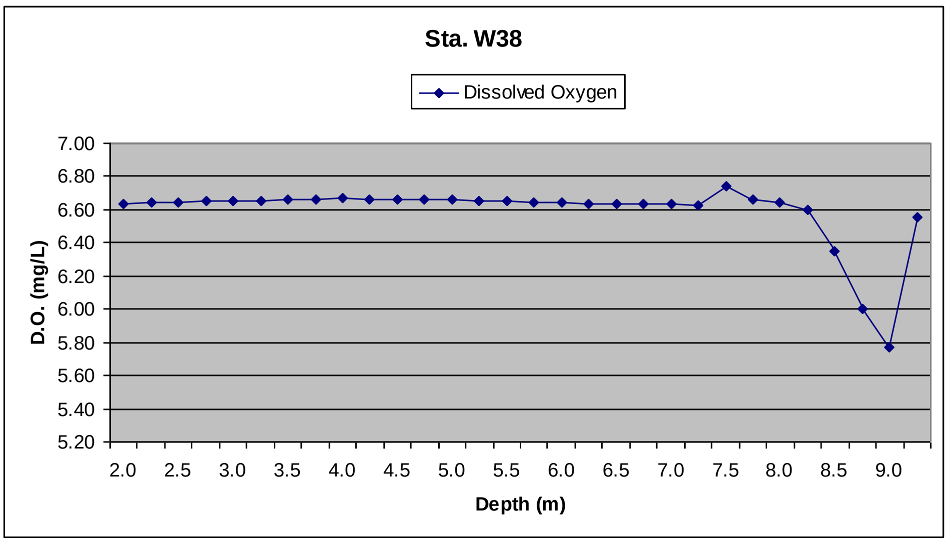




Figure 2. Temperature & Salinity, Wilmington ODMDS, May 2010.



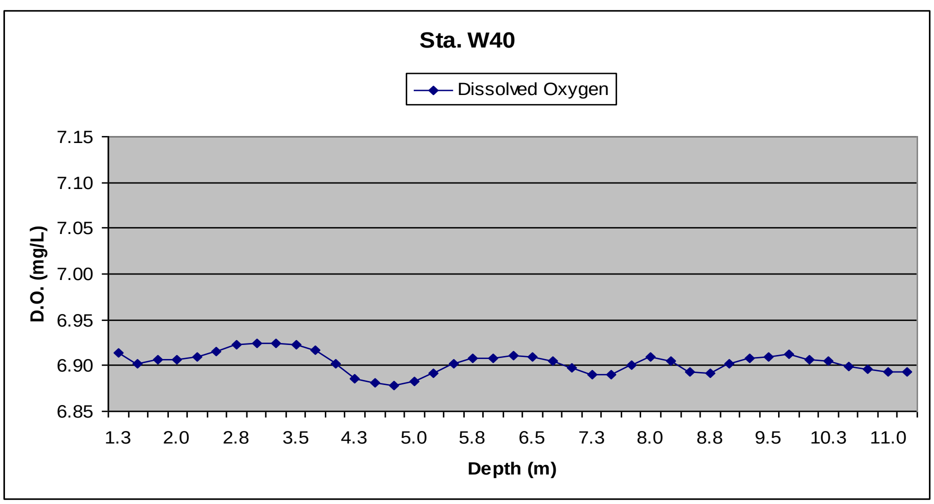




Figure 3. Dissolved Oxygen, Wilmington ODMDS, May 2010.

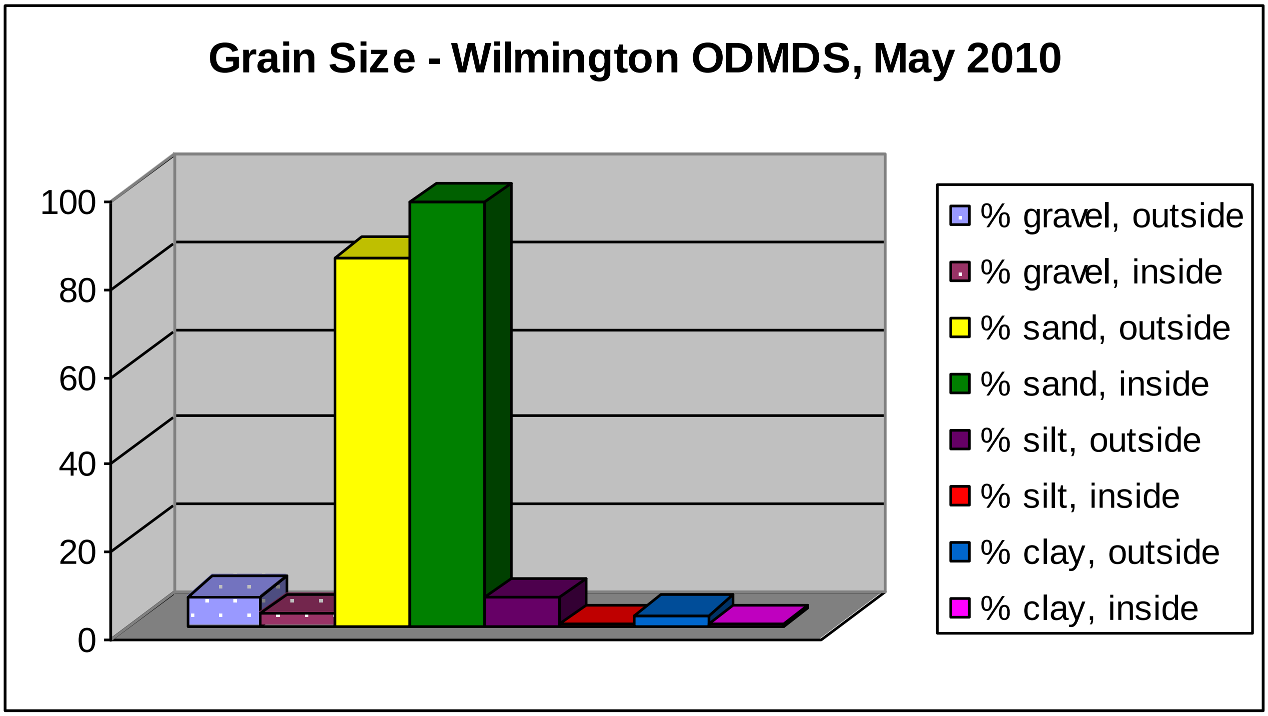



Figure 4. Grain Size, Wilmington ODMDS, May 2010.

# APPENDIX A

SURVEY METADATA

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Table A1. Scientific Party – Wilmington ODMDS Close-Out Study, May 2010.

| Name | Survey Responsibility | Organization |
|---|---|---|
| Gary W Collins | Chief Scientist | EPA/R4/Atlanta |
| Morris Flexner | Principal Investigator | EPA/R4/Athens |
| Phyllis Meyer | Chain-of-custody | EPA/R4/Athens |
| Philip Payonk | Station Coordinator | USACE/Wilmington |
| Doug Johnson | Chemistry Coordinator | EPA/R4/Atlanta |
| Drew Kendall | Deck ops | EPA/R4/Atlanta |
| Rosemary Hall | Data Recorder | EPA/R4/Atlanta |
| Don Norris | Macroinvertebrate Coordinator | EPA/R4/Athens |
| Megan Holton | Sample Coordinator | EPA/R4/Athens |

Table A2. Benthic Grabs.

| Station ID | Drop # | Date | Time (24hr) | Dept h (m) | Latitude [33o] | Longitude [78o] | Target Analysis | Description |
|---|---|---|---|---|---|---|---|---|
| W01 | 1 | 05/10/10 | 0800 | 12.8 | | | None | |
| W01 | 2 | 05/10/10 | 0804 | 12.9 | 48.973 | 4.003 | macroinvert | |
| W01 | 3 | 05/10/10 | 0808 | 12.9 | 48.977 | 4.024 | PSD/chem. | |
| W02 | 1 | 05/10/10 | 0825 | 13.7 | | | None | |
| W02 | 2 | 05/10/10 | 0829 | 14.1 | 48.506 | 5.024 | macroinvert | |
| W02 | 3 | 05/10/10 | 0836 | 13.8 | | | None | |
| W02 | 4 | 05/10/10 | 0841 | 13.9 | | | None | |
| W02 | 5 | 05/10/10 | 0844 | 13.7 | | | None | added weights |
| W02 | 6 | 05/10/10 | 0849 | 13.7 | | | None | added weights |
| W02 | 7 | 05/10/10 | 0857 | 13.8 | | | None | taped up shackles to prevent hang-up |
| W02 | 8 | 05/10/10 | 0904 | 13.6 | 48.476 | 4.995 | PSD/chem. | |
| W03 | 1 | 05/10/10 | 0921 | 13.8 | 47.505 | 3.978 | macroinvert | |
| W03 | 2 | 05/10/10 | 0926 | 13.9 | 47.513 | 3.986 | PSD/chem. | |
| W04 | 1 | 05/10/10 | 0942 | 10.1 | 48.530 | 3.991 | macroinvert | |
| W04 | 2 | 05/10/10 | 0947 | 10.3 | 48.502 | 3.978 | PSD/chem. | |
| W05 | 1 | 05/10/10 | 1018 | 9.4 | 48.717 | 3.484 | macroinvert | |
| W05 | 2 | 05/10/10 | 1027 | 9.4 | | | None | Rock rubble; did not close completely |
| W05 | 3 | 05/10/10 | 1030 | 9.6 | 48.678 | 3.498 | PSD/chem. | |
| W06 | 1 | 05/10/10 | 1048 | 9.1 | 48.019 | 2.994 | macroinvert | |
| W06 | 2 | 05/10/10 | 1053 | 9.3 | 49.006 | 2.987 | PSD/chem. | |
| W07 | 1 | 05/10/10 | 1119 | 8.6 | | | None | did not trigger |
| W07 | 2 | 05/10/10 | 1121 | 8.9 | 48.372 | 3.000 | macroinvert | |
| W07 | 3 | 05/10/10 | 1126 | 8.7 | 48.365 | 3.017 | PSD/chem. | |
| W08 | 1 | 05/10/10 | 1146 | 9.2 | | | None | small rocks only |
| W08 | 2 | 05/10/10 | 1149 | 9.3 | | | None | did not trigger |

Table A2 cont.

| Station ID | Drop # | Date | Time (24hr) | Depth (m) | Latitude [33o] | Longitude [78o] | Target Analysis | Description |
|---|---|---|---|---|---|---|---|---|
| W08 | 3 | 05/10/10 | 1151 | 9.2 | | | None | large rock in jaws |
| W08 | 4 | 05/10/10 | 1159 | 9.4 | | | None | just small rocks |
| W09 | 1 | 05/10/10 | 1252 | 11.5 | 49.018 | 1.509 | macroinvert | |
| W09 | 2 | 05/10/10 | 1259 | 11.4 | 48.998 | 1.481 | PSD/chem. | |
| W10 | 1 | 05/10/10 | 1318 | 11.6 | 47.642 | 1.485 | None | rubble/rocks |
| W10 | 2 | 05/10/10 | 1321 | 11.7 | 47.648 | 1.479 | None | rubble/rocks |
| W10 | 3 | 05/10/10 | 1333 | 12.3 | 47.714 | 1.524 | None | rubble, rocks; moved north @ 200 yds? |
| W10 | 4 | 05/10/10 | 1340 | 12.5 | 47.730 | 1.519 | macroinvert | Moved north again |
| W10 | 5 | 05/10/10 | 1344 | 12.8 | 47.718 | 1.546 | PSD/chem. | |

Table A3. CTD Casts.

| Station ID | Date | Time | Depth (m) | Latitude (33..) | Longitude (78..) | Bottom Sample Time | Bottom Sample Depth (m) | Top Sample Time | Top Sample Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| W35 | 05/11/10 | 1403 | 8.9 | 48.376' | 2.985' | 1404 | 6.8 | 1405 | 1.0 |
| W38 | 05/11/10 | 1434 | 9.8 | 50.287' | 3.008' | 1435 | 8.3 | 1436 | 1.0 |
| W40 | 05/11/10 | 1329 | 11.5 | 48.557' | 1.987' | 1330 | 10.5 | 1331 | 1.0 |

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# Appendix B

Sediment Particle Size Distribution

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**Table B1. Grain Size Distribution – Wilmington ODMDS, May 2010.**

| Station | % gravel | % sand | % silt | % clay | Sorting Coefficient |
|---|---|---|---|---|---|
| W01 | 0.54 | 97.06 | 1.83 | 0.57 | 2.498 |
| W02 | 5.99 | 93.47 | 0.1 | 0.1 | 0.714 |
| W03 | 19.18 | 79.49 | 0.93 | 0.4 | 0.203 |
| W09 | 0.96 | 58.45 | 30.27 | 10.32 | 4.193 |
| W10 | 7.24 | 91.8 | 0.1 | 0.86 | 0.634 |
| W04 | 2.68 | 96.74 | 0.39 | 0.19 | 1.705 |
| W05 | 0.25 | 98.77 | 0.36 | 0.61 | 2.331 |
| W06 | 7.8 | 91.78 | 0.33 | 0.1 | 0.704 |
| W07 | 0.1 | 99.51 | 0.06 | 0.32 | 2.176 |

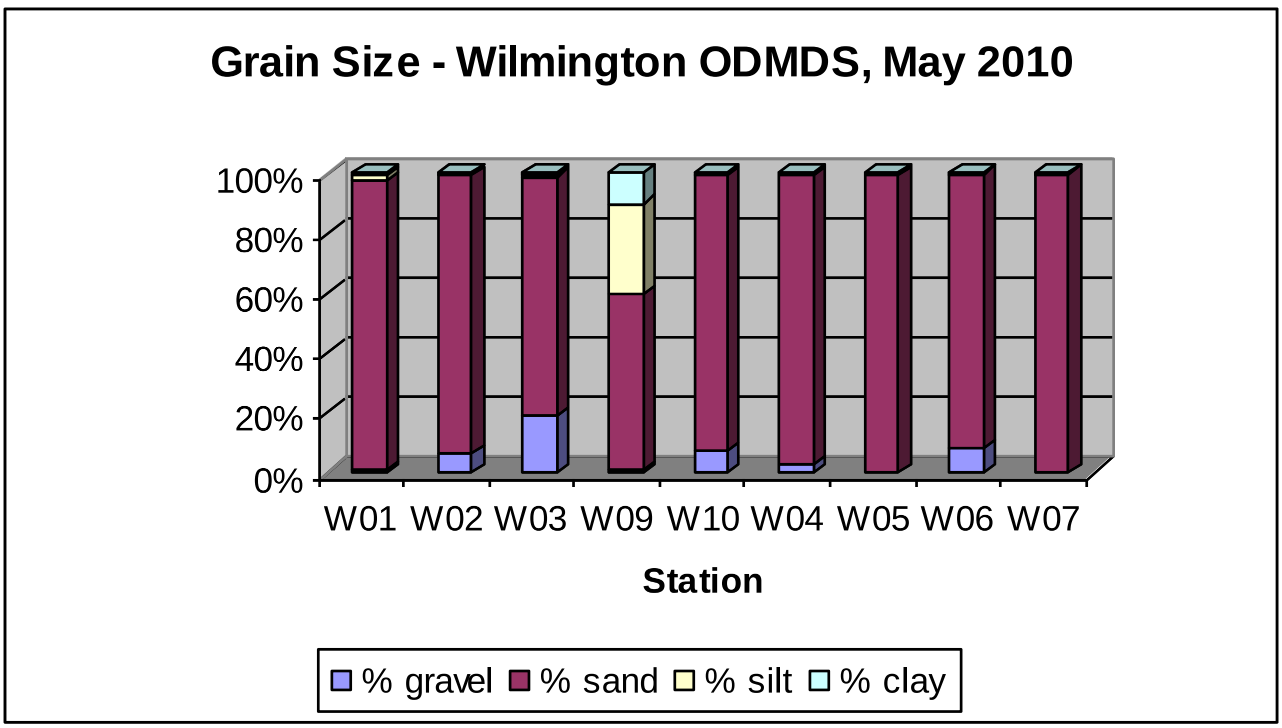


**Figure B1. Grain Size Distribution – Wilmington ODMDS, May 2010.**

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# APPENDIX C

Sediment Chemistry – Metals, PAHs, Pesticides, and PCBs

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**For the following analytical results, the following NOTE applies:**

NOTE: Flag "U" denotes analyte was not detected at or above the reporting limit; "J" denotes reported value is an estimate.

All values reported as mg/kg.

**Table C1. Sediment Chemistry, Metals – Wilmington ODMDS, May 2010.**

| Analyte | *W27* | *W28* | *W29* |
|---|---|---|---|
| **Aluminum** | 1000 | 340 | 1700 |
| **Arsenic** | 13.0 | 1.8 | 4.7 |
| **Beryllium** | 0.60 U | 0.30 U | 0.30 U |
| **Cadmium** | 0.050 U | 0.050 U | 0.050 U |
| **Chromium** | 4.3 | 1.7 | 7.2 |
| **Copper** | 0.50 U | 0.50 U | 1.1 |
| **Iron** | 6500 | 1700 | 5300 |
| **Lead** | 2.5 | 0.67 | 2.8 |
| **Manganese** | 130 | 25 | 67 |
| **Mercury** | 0.020 U | 0.015 U | 0.018 U |
| **Nickel** | 2.6 | 0.96 | 2.2 |
| **Selenium** | 1.0 U | 1.0 U | 0.99 U |
| **Silver** | 0.025 U | 0.025 U | 0.025 U |
| **Zinc** | 7.3 | 2.4 | 9.2 |
| **TOC** | 12000 U | 11000 U | 11000 U |
| **% solids** | | | |

**Table C2. Sediment Chemistry, PAHs – Wilmington ODMDS, May 2010.**

| Analyte | W27 | W28 | W29 |
|---|---|---|---|
| **2-Methylnaphthalene** | 4.8 U | 4.8 U | 5.4 U |
| **Acenaphthene** | 4.8 U | 4.8 U | 5.4 U |
| **Acenaphthylene** | 4.8 U | 4.8 U | 5.4 U |
| **Anthracene** | 4.8 U | 4.8 U | 5.4 U |
| **Benzo(a)anthracene** | 4.8 U | 4.8 U | 5.4 U |
| **Benzo(a)pyrene** | 4.8 U | 4.8 U | 5.4 U |
| **Benzo(b/k)fluoranthene** | 4.8 U | 4.8 U | 5.4 U |
| **Benzo(g,h,i)perylene** | 4.8 U | 4.8 U | 5.4 U |
| **Chrysene** | 4.8 U | 4.8 U | 5.4 U |
| **Dibenz(a,h)anthracene** | 4.8 U | 4.8 U | 5.4 U |
| **Fluoranthene** | 4.8 U | 4.8 U | 5.4 U |
| **Fluorene** | 4.8 U | 4.8 U | 5.4 U |
| **Indeno(1,2,3,c,d)pyrene** | 4.8 U | 4.8 U | 5.4 U |
| **Naphthalene** | 4.8 U | 4.8 U | 5.4 U |
| **Pentacholorophenol** | 9.7 U | 9.7 U | 11 U |
| **Phenanthrene** | 4.8 U | 4.8 U | 5.4 U |
| **Pyrene** | 4.8 U | 4.8 U | 5.4 U |

**Table C3. Sediment Chemistry, PCBs – Wilmington ODMDS, May 2010.**

| PCB congenger | W27 | W28 | W29 |
|---|---|---|---|
| 8 | 1.4 U | 0.48 U | 2.8 U |
| 18 | 0.49 U | 0.48 U | 0.54 U |
| 28 | 0.49 U | 0.48 U | 0.54 U |
| 44 | 0.49 U | 0.48 U | 0.54 U |
| 49 | 0.49 U | 0.48 U | 0.54 U |
| 52 | 0.49 U | 0.48 U | 0.54 U |
| 66 | 0.49 U | 0.48 U | 0.54 U |
| 77 | 0.49 U | 0.48 U | 0.54 U |
| 87 | 0.49 U | 0.48 U | 0.54 U |
| 101 | 0.49 U | 0.48 U | 0.54 U |
| 105 | 0.49 U | 0.48 U | 0.54 U |
| 118 | 0.49 U | 0.48 U | 0.54 U |
| 126 | 0.49 U | 0.48 U | 0.54 U |
| 128 | 0.49 U | 0.48 U | 0.54 U |
| 138 | 0.49 U | 0.48 U | 0.54 U |
| 153 | 0.49 U | 0.48 U | 0.54 U |
| 156 | 0.49 U | 0.48 U | 0.54 U |
| 169 | 0.49 U | 0.48 U | 0.54 U |
| 170 | 0.49 U | 0.48 U | 0.54 U |
| 180 | 0.49 U | 0.48 U | 0.54 U |
| 183 | 0.49 U | 0.48 U | 0.54 U |
| 184 | 0.49 U | 0.48 U | 0.54 U |
| 187 | 0.49 U | 0.48 U | 0.54 U |
| 195 | 0.49 U | 0.48 U | 0.54 U |
| 206 | 0.49 U | 0.48 U | 0.54 U |
| 209 | 0.49 U | 0.48 U | 0.54 U |

**Table C4. Sediment Chemistry, Pesticides – Wilmington ODMDS, May 2010.**

| ANALYTE | W27 | W28 | W29 |
|---|---|---|---|
| 4,4'-DDD | 0.98 U | 0.97 U | 1.1 U |
| 4,4'-DDE | 0.49 U | 0.48 U | 0.54 U |
| 4,4'-DDT | 1.2 U | 1.2 U | 1.4 U |
| Aldrin | 0.49 U | 0.48 U | 0.54 U |
| alpha BHC (Lindane Derivative) | 0.25 U | 0.24 U | 0.27 U |
| alpha Chlordane | 0.49 U | 0.48 U | 0.54 U |
| beta BHC (Lindane Derivative) | 0.49 U | 0.48 U | 0.54 U |
| delta BHC (Lindane Derivative) | 0.49 U | 0.48 U | 0.54 U |
| Dieldrin | 0.49 U | 0.48 U | 0.54 U |
| Endosulfan I (alpha) | 0.49 U | 0.48 U | 0.54 U |
| Endosulfan II (beta) | 0.98 U | 0.97 U | 1.1 U |
| Endosulfan Sulfate | 1.2 U | 1.2 U | 1.4 U |
| Endrin | 0.98 U | 0.97 U | 1.1 U |
| Endrin Aldehyde | 1.2 U | 1.2 U | 1.4 U |
| Endrin Ketone | 1.2 U | 1.2 U | 1.4 U |
| gamma-BHC (Lindane) | 0.25 U | 0.24 U | 0.27 U |
| gamma Chlordane | 0.49 U | 0.48 U | 0.54 U |
| Heptachlor | 0.37 U | 0.36 U | 0.41 U |
| Heptachlor Epoxide | 0.49 U | 0.48 U | 0.54 U |
| Methoxychlor | 2.5 U | 2.4 U | 2.7 U |
| Toxaphene | 25 U | 24 U | 27 U |

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# APPENDIX D

Water Quality/CTD Data/Water Chemistry - Metals, PAHs, Pesticides, and PCBs.

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# Table D1. CTD Data – Station W35, May 2010.

| Depth (m) | Conductivity (S/m) | Density (kg/m3) | Turbidity (ntu's) | Dissolved Oxygen (mg/L) | Temperature © | Salinity (ppt) | Pressure (psi) | Surface PAR | PAR |
|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 4.82 | 23.895 | 0.821 | 6.99 | 21.14 | 34.26 | 1.463 | 1472 | 1407 |
| 1.3 | 4.81 | 23.896 | 0.954 | 7.00 | 21.13 | 34.26 | 1.811 | 1472 | 684 |
| 1.5 | 4.81 | 23.896 | 0.836 | 7.01 | 21.13 | 34.26 | 2.179 | 1475 | 839 |
| 1.8 | 4.81 | 23.897 | 0.897 | 6.99 | 21.12 | 34.26 | 2.578 | 1476 | 679 |
| 2.0 | 4.81 | 23.897 | 0.903 | 6.99 | 21.12 | 34.26 | 2.94 | 1476 | 618 |
| 2.3 | 4.81 | 23.897 | 0.936 | 6.98 | 21.12 | 34.26 | 3.283 | 1476 | 570 |
| 2.5 | 4.81 | 23.897 | 0.911 | 6.99 | 21.12 | 34.26 | 3.632 | 1476 | 528 |
| 2.8 | 4.81 | 23.898 | 1.025 | 6.99 | 21.12 | 34.26 | 3.999 | 1476 | 504 |
| 3.0 | 4.81 | 23.897 | 1.135 | 7.00 | 21.12 | 34.26 | 4.385 | 1476 | 477 |
| 3.3 | 4.81 | 23.897 | 0.982 | 7.00 | 21.12 | 34.26 | 4.751 | 1476 | 446 |
| 3.5 | 4.81 | 23.897 | 0.995 | 7.00 | 21.12 | 34.26 | 5.125 | 1476 | 420 |
| 3.8 | 4.81 | 23.897 | 0.882 | 7.00 | 21.12 | 34.26 | 5.475 | 1476 | 405 |
| 4.0 | 4.81 | 23.896 | 0.979 | 7.00 | 21.12 | 34.26 | 5.849 | 1476 | 370 |
| 4.3 | 4.81 | 23.896 | 0.892 | 7.00 | 21.12 | 34.26 | 6.2 | 1476 | 335 |
| 4.5 | 4.81 | 23.897 | 0.867 | 7.01 | 21.12 | 34.26 | 6.571 | 1476 | 304 |
| 4.8 | 4.81 | 23.896 | 0.889 | 7.01 | 21.12 | 34.26 | 6.93 | 1476 | 283 |
| 5.0 | 4.81 | 23.896 | 1.275 | 7.01 | 21.12 | 34.26 | 7.301 | 1476 | 272 |
| 5.3 | 4.81 | 23.896 | 0.878 | 7.01 | 21.13 | 34.26 | 7.644 | 1476 | 262 |
| 5.5 | 4.81 | 23.896 | 0.845 | 7.00 | 21.13 | 34.26 | 8.014 | 1476 | 250 |
| 5.8 | 4.81 | 23.897 | 0.858 | 6.99 | 21.12 | 34.26 | 8.409 | 1476 | 234 |
| 6.0 | 4.81 | 23.896 | 0.929 | 7.00 | 21.13 | 34.26 | 8.765 | 1476 | 218 |
| 6.3 | 4.81 | 23.896 | 1.624 | 7.00 | 21.13 | 34.26 | 9.125 | 1478 | 201 |
| 6.5 | 4.81 | 23.896 | 2.708 | 7.00 | 21.13 | 34.26 | 9.491 | 1478 | 189 |
| 6.8 | 4.81 | 23.896 | 0.918 | 7.00 | 21.13 | 34.26 | 9.861 | 1479 | 178 |
| 7.0 | 4.81 | 23.896 | 0.851 | 7.01 | 21.13 | 34.26 | 10.229 | 1481 | 168 |
| 7.3 | 4.81 | 23.896 | 0.872 | 7.00 | 21.12 | 34.26 | 10.591 | 1481 | 160 |
| 7.5 | 4.81 | 23.897 | 0.871 | 7.00 | 21.12 | 34.26 | 10.941 | 1481 | 150 |
| 7.8 | 4.81 | 23.896 | 1.029 | 7.00 | 21.12 | 34.26 | 11.308 | 1482 | 143 |
| 7.5 | 4.81 | 23.897 | 1.299 | 6.99 | 21.12 | 34.26 | 10.963 | 1487 | 159 |
| 7.3 | 4.81 | 23.897 | 0.761 | 6.99 | 21.12 | 34.26 | 10.614 | 1490 | 169 |
| 7.0 | 4.81 | 23.897 | 1.199 | 7.00 | 21.12 | 34.26 | 10.218 | 1490 | 182 |
| 6.8 | 4.81 | 23.897 | 0.988 | 7.00 | 21.12 | 34.26 | 9.862 | 1492 | 200 |
| 6.5 | 4.81 | 23.897 | 0.963 | 7.00 | 21.12 | 34.26 | 9.507 | 1490 | 211 |
| 6.3 | 4.81 | 23.897 | 1.007 | 6.99 | 21.12 | 34.26 | 9.121 | 1488 | 219 |
| 6.0 | 4.81 | 23.897 | 0.972 | 6.99 | 21.12 | 34.26 | 8.753 | 1487 | 230 |
| 5.8 | 4.81 | 23.897 | 0.934 | 6.99 | 21.12 | 34.26 | 8.378 | 1487 | 247 |
| 5.5 | 4.81 | 23.897 | 0.978 | 7.00 | 21.12 | 34.26 | 8.026 | 1489 | 264 |
| 5.3 | 4.81 | 23.896 | 1.067 | 7.00 | 21.12 | 34.26 | 7.673 | 1490 | 283 |
| 5.0 | 4.81 | 23.896 | 1.135 | 7.00 | 21.12 | 34.26 | 7.321 | 1489 | 310 |
| 4.8 | 4.81 | 23.896 | 0.914 | 6.99 | 21.12 | 34.26 | 6.94 | 1489 | 337 |
| 4.5 | 4.81 | 23.896 | 0.906 | 7.00 | 21.12 | 34.26 | 6.595 | 1489 | 357 |
| 4.3 | 4.81 | 23.896 | 0.931 | 7.00 | 21.12 | 34.26 | 6.221 | 1491 | 383 |
| 4.0 | 4.81 | 23.896 | 0.94 | 7.00 | 21.12 | 34.26 | 5.851 | 1491 | 423 |
| 3.8 | 4.81 | 23.896 | 1.044 | 7.01 | 21.12 | 34.26 | 5.47 | 1491 | 454 |
| 3.5 | 4.81 | 23.896 | 1.018 | 7.00 | 21.12 | 34.26 | 5.112 | 1492 | 471 |
| 3.3 | 4.81 | 23.896 | 0.946 | 7.00 | 21.12 | 34.26 | 4.757 | 1491 | 522 |
| 3.0 | 4.81 | 23.896 | 0.877 | 7.00 | 21.12 | 34.26 | 4.389 | 1490 | 552 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.8 | 4.81 | 23.896 | 0.86 | 7.00 | 21.13 | 34.26 | 4.002 | 1489 | 598 |
| 2.5 | 4.81 | 23.896 | 0.825 | 7.00 | 21.13 | 34.26 | 3.648 | 1489 | 663 |
| 2.3 | 4.81 | 23.896 | 0.898 | 6.99 | 21.13 | 34.26 | 3.304 | 1489 | 668 |
| 2.0 | 4.81 | 23.896 | 0.912 | 6.99 | 21.13 | 34.26 | 2.91 | 1491 | 763 |
| 1.8 | 4.81 | 23.896 | 1.044 | 6.98 | 21.13 | 34.26 | 2.574 | 1492 | 824 |
| 1.5 | 4.81 | 23.896 | 1.492 | 6.97 | 21.13 | 34.26 | 2.199 | 1492 | 817 |
| 1.3 | 4.81 | 23.896 | 0.934 | 6.96 | 21.13 | 34.26 | 1.851 | 1492 | 1111 |
| 1.0 | 4.81 | 23.896 | 0.852 | 6.96 | 21.13 | 34.26 | 1.503 | 1492 | 2331 |
| 0.8 | 4.81 | 23.896 | 1.09 | 7.01 | 21.13 | 34.26 | 1.145 | 1497 | 2127 |
| 0.5 | 4.81 | 23.896 | 0.991 | 7.01 | 21.13 | 34.26 | 0.757 | 1496 | 2208 |
| 0.3 | 4.81 | 23.896 | 1.345 | 7.00 | 21.13 | 34.26 | 0.355 | 1497 | 2286 |
| 0.0 | 4.81 | 23.8951 | 1.288 | 0.00 | 21.13 | 34.26 | 0.002 | 1497 | 2302 |

## Table D2. CTD Data – Station W38, May 2010.

| Depth (m) | Conductivity (S/m) | Density (kg/m3) | Turbidity (ntu's) | Dissolved Oxygen (mg/L) | Temperature © | Salinity (ppt) | Pressure (psi) | Surface PAR | PAR |
|---|---|---|---|---|---|---|---|---|---|
| 2.0 | 4.81 | 23.794 | 4.928 | 6.64 | 21.23 | 34.16 | 3.035 | 1894 | 666 |
| 2.3 | 4.81 | 23.794 | 4.903 | 6.64 | 21.23 | 34.16 | 3.285 | 1894 | 535 |
| 2.5 | 4.81 | 23.795 | 4.801 | 6.65 | 21.23 | 34.16 | 3.646 | 1894 | 410 |
| 2.8 | 4.81 | 23.795 | 4.995 | 6.65 | 21.23 | 34.16 | 4.015 | 1894 | 347 |
| 3.0 | 4.81 | 23.795 | 4.992 | 6.65 | 21.23 | 34.16 | 4.388 | 1894 | 303 |
| 3.3 | 4.81 | 23.795 | 5.068 | 6.65 | 21.23 | 34.16 | 4.756 | 1894 | 242 |
| 3.5 | 4.81 | 23.795 | 4.969 | 6.66 | 21.23 | 34.16 | 5.116 | 1894 | 177 |
| 3.8 | 4.81 | 23.795 | 4.919 | 6.66 | 21.23 | 34.16 | 5.477 | 1892 | 125 |
| 4.0 | 4.81 | 23.796 | 4.821 | 6.67 | 21.23 | 34.16 | 5.841 | 1892 | 89 |
| 4.3 | 4.81 | 23.796 | 4.924 | 6.66 | 21.23 | 34.16 | 6.201 | 1892 | 70 |
| 4.5 | 4.81 | 23.795 | 4.991 | 6.66 | 21.23 | 34.16 | 6.559 | 1891 | 67 |
| 4.8 | 4.81 | 23.796 | 4.943 | 6.66 | 21.22 | 34.16 | 6.944 | 1890 | 67 |
| 5.0 | 4.81 | 23.800 | 5.47 | 6.66 | 21.22 | 34.16 | 7.314 | 1889 | 57 |
| 5.3 | 4.81 | 23.800 | 6.182 | 6.65 | 21.21 | 34.16 | 7.677 | 1888 | 45 |
| 5.5 | 4.81 | 23.802 | 6.626 | 6.65 | 21.21 | 34.16 | 8.039 | 1888 | 33 |
| 5.8 | 4.81 | 23.802 | 7.161 | 6.64 | 21.21 | 34.16 | 8.396 | 1888 | 24 |
| 6.0 | 4.81 | 23.801 | 7.255 | 6.64 | 21.21 | 34.16 | 8.756 | 1888 | 17 |
| 6.3 | 4.81 | 23.801 | 7.586 | 6.64 | 21.21 | 34.16 | 9.12 | 1887 | 13 |
| 6.5 | 4.81 | 23.801 | 7.407 | 6.64 | 21.21 | 34.16 | 9.481 | 1886 | 10 |
| 6.8 | 4.81 | 23.801 | 6.974 | 6.64 | 21.21 | 34.16 | 9.855 | 1886 | 10 |
| 7.0 | 4.81 | 23.800 | 6.384 | 6.63 | 21.21 | 34.16 | 10.23 | 1885 | 9 |
| 7.3 | 4.81 | 23.799 | 6.936 | 6.63 | 21.21 | 34.16 | 10.597 | 1883 | 8 |
| 7.5 | 4.81 | 23.799 | 6.631 | 6.74 | 21.21 | 34.15 | 10.958 | 1883 | 6 |
| 7.8 | 4.81 | 23.799 | 8.94 | 6.66 | 21.21 | 34.14 | 11.328 | 1882 | 5 |
| 8.0 | 4.81 | 23.799 | 11.905 | 6.64 | 21.21 | 34.12 | 11.688 | 1881 | 4 |
| 8.3 | 4.81 | 23.798 | 14.089 | 6.60 | 21.21 | 34.07 | 12.05 | 1881 | 4 |
| 8.5 | 4.81 | 23.795 | 14.943 | 6.35 | 21.21 | 33.98 | 12.423 | 1880 | 3 |
| 8.8 | 4.81 | 23.796 | 16.041 | 6.00 | 21.21 | 33.78 | 12.779 | 1879 | 3 |
| 9.0 | 4.81 | 23.795 | 18.845 | 5.77 | 21.21 | 33.41 | 13.132 | 1879 | 3 |
| 9.3 | 4.72 | 23.230 | 19.918 | 6.56 | 21.21 | 33.82 | 13.482 | 1873 | 3 |
| 9.0 | 4.80 | 23.708 | 23.88 | 6.60 | 21.21 | 34.03 | 13.196 | 1873 | 3 |
| 8.8 | 4.81 | 23.791 | 19.17 | 6.67 | 21.21 | 34.11 | 12.822 | 1873 | 3 |
| 8.5 | 4.81 | 23.797 | 17.477 | 6.69 | 21.21 | 34.14 | 12.429 | 1872 | 3 |
| 8.3 | 4.81 | 23.798 | 15.967 | 6.69 | 21.21 | 34.16 | 12.065 | 1871 | 4 |
| 8.0 | 4.81 | 23.800 | 10.584 | 6.65 | 21.20 | 34.16 | 11.692 | 1840 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7.8 | 4.81 | 23.801 | 8.299 | 6.65 | 21.20 | 34.16 | 11.332 | 1840 | 5 |
| 7.5 | 4.81 | 23.801 | 10.033 | 6.64 | 21.20 | 34.16 | 10.962 | 1840 | 6 |
| 7.3 | 4.81 | 23.800 | 9.502 | 6.64 | 21.20 | 34.16 | 10.592 | 1840 | 6 |
| 7.0 | 4.81 | 23.801 | 7.274 | 6.63 | 21.20 | 34.16 | 10.227 | 1840 | 7 |
| 6.8 | 4.81 | 23.802 | 7.283 | 6.63 | 21.20 | 34.16 | 9.863 | 1839 | 9 |
| 6.5 | 4.81 | 23.801 | 6.472 | 6.63 | 21.20 | 34.16 | 9.495 | 1838 | 11 |
| 6.3 | 4.81 | 23.802 | 6.804 | 6.63 | 21.20 | 34.16 | 9.13 | 1838 | 15 |
| 6.0 | 4.81 | 23.800 | 6.353 | 6.64 | 21.21 | 34.16 | 8.764 | 1838 | 18 |
| 5.8 | 4.81 | 23.799 | 6.212 | 6.65 | 21.21 | 34.16 | 8.399 | 1838 | 22 |
| 5.5 | 4.81 | 23.798 | 5.694 | 6.64 | 21.22 | 34.16 | 8.037 | 1838 | 26 |
| 5.3 | 4.81 | 23.799 | 5.787 | 6.65 | 21.22 | 34.16 | 7.672 | 1838 | 32 |
| 5.0 | 4.81 | 23.798 | 5.607 | 6.66 | 21.22 | 34.16 | 7.302 | 1838 | 41 |
| 4.8 | 4.81 | 23.798 | 6.005 | 6.66 | 21.22 | 34.16 | 6.942 | 1836 | 52 |
| 4.5 | 4.81 | 23.798 | 5.397 | 6.65 | 21.22 | 34.16 | 6.571 | 1836 | 70 |
| 4.3 | 4.81 | 23.799 | 5.465 | 6.62 | 21.22 | 34.16 | 6.214 | 1836 | 94 |
| 4.0 | 4.81 | 23.799 | 5.912 | 6.62 | 21.22 | 34.16 | 5.848 | 1834 | 119 |
| 3.8 | 4.81 | 23.797 | 5.966 | 6.64 | 21.23 | 34.16 | 5.474 | 1833 | 136 |
| 3.5 | 4.81 | 23.793 | 5.389 | 6.65 | 21.23 | 34.16 | 5.11 | 1833 | 152 |
| 3.3 | 4.81 | 23.793 | 5.196 | 6.65 | 21.23 | 34.16 | 4.734 | 1833 | 182 |
| 3.0 | 4.81 | 23.793 | 5.2 | 6.66 | 21.23 | 34.16 | 4.381 | 1833 | 234 |
| 2.8 | 4.81 | 23.793 | 5.197 | 6.66 | 21.23 | 34.16 | 4.004 | 1833 | 324 |
| 2.5 | 4.81 | 23.793 | 5.383 | 6.66 | 21.23 | 34.16 | 3.658 | 1833 | 451 |
| 2.3 | 4.81 | 23.793 | 5.341 | 6.65 | 21.23 | 34.16 | 3.296 | 1833 | 629 |
| 2.0 | 4.81 | 23.793 | 5.243 | 6.65 | 21.23 | 34.16 | 2.937 | 1833 | 857 |
| 1.8 | 4.81 | 23.793 | 6.365 | 6.64 | 21.23 | 34.16 | 2.561 | 1832 | 873 |
| 1.5 | 4.81 | 23.793 | 6.966 | 6.65 | 21.23 | 34.16 | 2.191 | 1831 | 1094 |
| 1.3 | 4.81 | 23.793 | 5.625 | 6.65 | 21.24 | 34.16 | 1.827 | 1831 | 1500 |
| 1.0 | 4.81 | 23.793 | 6.068 | 6.65 | 21.24 | 34.16 | 1.472 | 1831 | 2720 |
| 0.8 | 4.81 | 23.793 | 5.482 | 6.65 | 21.24 | 34.16 | 1.089 | 1830 | 2942 |
| 0.5 | 4.81 | 23.792 | 5.791 | 6.63 | 21.24 | 34.16 | 0.728 | 1829 | 2981 |
| 0.3 | 4.81 | 23.791 | 5.706 | 6.63 | 21.24 | 34.16 | 0.369 | 1829 | 2984 |
| 0.0 | 4.81 | 23.791 | 5.731 | 6.64 | 21.24 | 34.16 | 0.026 | 1826 | 2985 |

## Table D3. CTD Data – Station W40, May 2010.

| Depth (m) | Conductivity (S/m) | Density (kg/m3) | Turbidity (ntu's) | Dissolved Oxygen (mg/L) | Temperature © | Salinity (ppt) | Pressure (psi) | Surface PAR | PAR |
|---|---|---|---|---|---|---|---|---|---|
| 1.3 | 4.79 | 23.883 | 1.968 | 6.91 | 20.95 | 34.18 | 1.827 | 1390 | 1289 |
| 1.5 | 4.79 | 23.883 | 1.989 | 6.90 | 20.95 | 34.18 | 2.197 | 1389 | 831 |
| 1.8 | 4.79 | 23.884 | 1.807 | 6.91 | 20.95 | 34.18 | 2.561 | 1388 | 747 |
| 2.0 | 4.79 | 23.884 | 1.756 | 6.91 | 20.95 | 34.18 | 2.899 | 1387 | 670 |
| 2.3 | 4.79 | 23.884 | 1.924 | 6.91 | 20.95 | 34.18 | 3.274 | 1387 | 579 |
| 2.5 | 4.79 | 23.885 | 1.759 | 6.92 | 20.95 | 34.18 | 3.673 | 1387 | 591 |
| 2.8 | 4.79 | 23.884 | 1.827 | 6.92 | 20.95 | 34.18 | 4.033 | 1387 | 522 |
| 3.0 | 4.79 | 23.885 | 1.818 | 6.92 | 20.95 | 34.18 | 4.393 | 1387 | 444 |
| 3.3 | 4.79 | 23.885 | 1.854 | 6.92 | 20.95 | 34.18 | 4.739 | 1387 | 385 |
| 3.5 | 4.79 | 23.884 | 1.993 | 6.92 | 20.95 | 34.18 | 5.093 | 1386 | 334 |
| 3.8 | 4.79 | 23.885 | 2.616 | 6.92 | 20.95 | 34.18 | 5.449 | 1385 | 288 |
| 4.0 | 4.79 | 23.884 | 2.306 | 6.90 | 20.95 | 34.18 | 5.83 | 1385 | 252 |
| 4.3 | 4.79 | 23.884 | 1.961 | 6.89 | 20.95 | 34.18 | 6.206 | 1385 | 246 |
| 4.5 | 4.79 | 23.885 | 1.887 | 6.88 | 20.95 | 34.18 | 6.576 | 1384 | 231 |
| 4.8 | 4.79 | 23.885 | 1.875 | 6.88 | 20.95 | 34.18 | 6.937 | 1385 | 194 |
| 5.0 | 4.79 | 23.885 | 1.994 | 6.88 | 20.95 | 34.18 | 7.3 | 1385 | 170 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5.3 | 4.79 | 23.885 | 2.15 | 6.89 | 20.95 | 34.18 | 7.676 | 1383 | 151 |
| 5.5 | 4.79 | 23.885 | 2.013 | 6.90 | 20.95 | 34.18 | 8.054 | 1382 | 138 |
| 5.8 | 4.79 | 23.885 | 2.054 | 6.91 | 20.95 | 34.18 | 8.392 | 1383 | 128 |
| 6.0 | 4.79 | 23.885 | 2.09 | 6.91 | 20.95 | 34.18 | 8.771 | 1383 | 115 |
| 6.3 | 4.79 | 23.885 | 2.227 | 6.91 | 20.95 | 34.18 | 9.131 | 1381 | 101 |
| 6.5 | 4.79 | 23.885 | 2.189 | 6.91 | 20.95 | 34.18 | 9.488 | 1381 | 88 |
| 6.8 | 4.79 | 23.885 | 2.151 | 6.91 | 20.95 | 34.18 | 9.88 | 1381 | 76 |
| 7.0 | 4.79 | 23.885 | 2.133 | 6.90 | 20.95 | 34.18 | 10.211 | 1379 | 70 |
| 7.3 | 4.79 | 23.885 | 2.192 | 6.89 | 20.95 | 34.18 | 10.581 | 1378 | 65 |
| 7.5 | 4.79 | 23.885 | 2.192 | 6.89 | 20.95 | 34.18 | 10.957 | 1378 | 61 |
| 7.8 | 4.79 | 23.885 | 2.294 | 6.90 | 20.95 | 34.18 | 11.323 | 1378 | 56 |
| 8.0 | 4.79 | 23.885 | 2.214 | 6.91 | 20.95 | 34.18 | 11.689 | 1378 | 49 |
| 8.3 | 4.79 | 23.885 | 2.222 | 6.91 | 20.95 | 34.18 | 12.045 | 1378 | 42 |
| 8.5 | 4.79 | 23.885 | 2.208 | 6.89 | 20.95 | 34.18 | 12.418 | 1378 | 37 |
| 8.8 | 4.79 | 23.885 | 2.112 | 6.89 | 20.95 | 34.18 | 12.774 | 1378 | 33 |
| 9.0 | 4.79 | 23.885 | 2.364 | 6.90 | 20.95 | 34.18 | 13.142 | 1376 | 30 |
| 9.3 | 4.79 | 23.885 | 2.176 | 6.91 | 20.95 | 34.18 | 13.509 | 1376 | 27 |
| 9.5 | 4.79 | 23.885 | 2.139 | 6.91 | 20.95 | 34.18 | 13.875 | 1376 | 25 |
| 9.8 | 4.79 | 23.885 | 2.085 | 6.91 | 20.95 | 34.18 | 14.252 | 1375 | 22 |
| 10.0 | 4.79 | 23.885 | 2.198 | 6.91 | 20.95 | 34.18 | 14.603 | 1374 | 21 |
| 10.3 | 4.79 | 23.885 | 2.433 | 6.90 | 20.95 | 34.18 | 14.973 | 1374 | 19 |
| 10.5 | 4.79 | 23.885 | 2.529 | 6.90 | 20.95 | 34.18 | 15.342 | 1374 | 17 |
| 10.8 | 4.79 | 23.885 | 3.048 | 6.90 | 20.95 | 34.18 | 15.696 | 1372 | 15 |
| 11.0 | 4.79 | 23.885 | 3.449 | 6.89 | 20.95 | 34.18 | 15.957 | 1372 | 13 |
| 11.5 | 4.79 | 23.885 | 3.602 | 6.89 | 20.95 | 34.18 | 15.947 | 1372 | 14 |
| 10.8 | 4.79 | 23.885 | 3.468 | 6.89 | 20.95 | 34.18 | 15.946 | 1372 | 13 |
| 10.3 | 4.79 | 23.885 | 2.701 | 6.90 | 20.95 | 34.18 | 15.108 | 1326 | 17 |
| 10.0 | 4.79 | 23.885 | 2.88 | 6.89 | 20.95 | 34.18 | 14.617 | 1316 | 19 |
| 9.8 | 4.79 | 23.885 | 2.645 | 6.88 | 20.95 | 34.18 | 14.246 | 1314 | 22 |
| 9.5 | 4.79 | 23.885 | 2.463 | 6.89 | 20.95 | 34.18 | 13.881 | 1313 | 23 |
| 9.3 | 4.79 | 23.885 | 2.321 | 6.91 | 20.95 | 34.18 | 13.509 | 1313 | 25 |
| 9.0 | 4.79 | 23.885 | 2.201 | 6.92 | 20.95 | 34.18 | 13.141 | 1313 | 29 |
| 8.8 | 4.79 | 23.885 | 2.482 | 6.93 | 20.95 | 34.18 | 12.78 | 1313 | 33 |
| 8.5 | 4.79 | 23.885 | 2.195 | 6.93 | 20.95 | 34.18 | 12.411 | 1313 | 38 |
| 8.3 | 4.79 | 23.885 | 2.436 | 6.93 | 20.95 | 34.18 | 12.059 | 1313 | 42 |
| 8.0 | 4.79 | 23.885 | 2.184 | 6.93 | 20.95 | 34.18 | 11.689 | 1313 | 47 |
| 7.8 | 4.79 | 23.885 | 2.017 | 6.92 | 20.95 | 34.18 | 11.319 | 1313 | 51 |
| 7.5 | 4.79 | 23.884 | 1.987 | 6.92 | 20.95 | 34.18 | 10.968 | 1311 | 55 |
| 7.3 | 4.79 | 23.884 | 1.854 | 6.91 | 20.95 | 34.18 | 10.592 | 1311 | 61 |
| 7.0 | 4.79 | 23.884 | 1.872 | 6.91 | 20.95 | 34.18 | 10.227 | 1310 | 70 |
| 6.8 | 4.79 | 23.884 | 1.822 | 6.92 | 20.95 | 34.18 | 9.861 | 1309 | 80 |
| 6.5 | 4.79 | 23.884 | 1.839 | 6.93 | 20.95 | 34.18 | 9.497 | 1307 | 90 |
| 6.3 | 4.79 | 23.884 | 1.75 | 6.92 | 20.95 | 34.18 | 9.129 | 1306 | 98 |
| 6.0 | 4.79 | 23.884 | 1.808 | 6.92 | 20.95 | 34.18 | 8.778 | 1306 | 106 |
| 5.8 | 4.79 | 23.884 | 1.801 | 6.92 | 20.95 | 34.18 | 8.419 | 1306 | 114 |
| 5.5 | 4.79 | 23.884 | 1.79 | 6.93 | 20.95 | 34.18 | 8.08 | 1305 | 124 |
| 5.3 | 4.79 | 23.884 | 1.913 | 6.93 | 20.95 | 34.18 | 7.681 | 1304 | 143 |
| 5.0 | 4.79 | 23.884 | 1.847 | 6.93 | 20.95 | 34.18 | 7.314 | 1304 | 165 |
| 4.8 | 4.79 | 23.884 | 1.835 | 6.94 | 20.95 | 34.18 | 6.938 | 1304 | 187 |
| 4.5 | 4.79 | 23.883 | 1.845 | 6.94 | 20.95 | 34.18 | 6.573 | 1304 | 207 |
| 4.3 | 4.79 | 23.884 | 1.9 | 6.93 | 20.95 | 34.18 | 6.21 | 1305 | 227 |
| 4.0 | 4.79 | 23.884 | 1.853 | 6.93 | 20.95 | 34.18 | 5.845 | 1304 | 248 |
| 3.8 | 4.79 | 23.884 | 1.856 | 6.92 | 20.95 | 34.18 | 5.477 | 1304 | 287 |
| 3.5 | 4.79 | 23.884 | 1.947 | 6.91 | 20.95 | 34.18 | 5.126 | 1304 | 326 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.3 | 4.79 | 23.884 | 1.746 | 6.91 | 20.95 | 34.18 | 4.748 | 1302 | 352 |
| 3.0 | 4.79 | 23.884 | 1.859 | 6.93 | 20.95 | 34.18 | 4.376 | 1302 | 392 |
| 2.8 | 4.79 | 23.884 | 1.841 | 6.94 | 20.95 | 34.18 | 4.019 | 1300 | 420 |
| 2.5 | 4.79 | 23.884 | 1.88 | 6.93 | 20.95 | 34.18 | 3.647 | 1299 | 481 |
| 2.3 | 4.79 | 23.884 | 1.821 | 6.91 | 20.95 | 34.18 | 3.299 | 1298 | 534 |
| 2.0 | 4.79 | 23.883 | 1.849 | 6.91 | 20.95 | 34.18 | 2.924 | 1298 | 604 |
| 1.8 | 4.79 | 23.883 | 1.838 | 6.91 | 20.95 | 34.18 | 2.567 | 1298 | 690 |
| 1.5 | 4.79 | 23.883 | 1.777 | 6.92 | 20.95 | 34.18 | 2.188 | 1298 | 726 |
| 1.3 | 4.79 | 23.883 | 1.885 | 6.92 | 20.95 | 34.18 | 1.848 | 1298 | 809 |
| 1.0 | 4.79 | 23.883 | 1.723 | 6.93 | 20.95 | 34.18 | 1.513 | 1298 | 1458 |
| 0.8 | 4.79 | 23.883 | 1.836 | 6.92 | 20.95 | 34.18 | 1.125 | 1266 | 1879 |
| 0.5 | 4.79 | 23.883 | 1.924 | 0.00 | 20.95 | 34.18 | 0.707 | 1261 | 1900 |
| 0.3 | 4.79 | 23.883 | 1.902 | 0.00 | 20.95 | 34.18 | 0.356 | 1263 | 1862 |
| 0.0 | 4.79 | 23.881 | 1.914 | 0.00 | 20.95 | 34.18 | -0.019 | 1263 | 1864 |

## For the following analytical results, the following NOTE applies:

NOTE: Flag "U" denotes analyte was not detected at or above the reporting limit; "J" denotes reported value is an estimate.

**All values reported as ug/L.**

## Table D4. Water Chemistry, Metals – Wilmington ODMDS, May 2010.

| Analyte | W35top | W35bottom | W38top | W38bottom | W40top | W40bottom |
|---|---|---|---|---|---|---|
| Aluminum | 50 UJ | 50 UJ | 200 J | 440 J | 60 UJ | 80 UJ |
| Arsenic | 1.2 UJ | 1.5 UJ | 1.6 J | 2.2 UJ | 1.6 UJ | 1.7 UJ |
| Beryllium | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 0.50 U |
| Cadmium | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Chromium | 1.0 UJ | 1.0 UJ | 1.0 J | 2.0 J | 1.0 UJ | 1.0 UJ |
| Copper | 13 J | 16 J | 5.1 J | 6.2 J | 7.0 J | 9.5 J |
| Iron | 2300 | 2600 | 2600 | 3000 | 2200 | 2300 |
| Lead | 1.0 UJ | 1.5 UJ | 1.0 UJ | 1.2 UJ | 1.0 UJ | 1.0 UJ |
| Manganese | 5.0 UJ | 5.0 UJ | 16 J | 24 J | 5.0 UJ | 5.0 J |
| Mercury | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U |
| Nickel | 11 J | 11 J | 12 J | 13 J | 12 J | 12 J |
| Selenium | 2.0 UJ | 2.0 UJ | 2.0 UJ | 2.0 UJ | 2.0 UJ | 2.0 UJ |
| Silver | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Zinc | 2.0 UJ | 2.0 UJ | 2.5 UJ | 3.2 UJ | 2.0 UJ | 2.0 UJ |

## Table D5. Water Chemistry, PAHs – Wilmington ODMDS, May 2010.

| Analyte | W35top | W35bottom | W38top | W38bottom | W40top | W40bottom |
|---|---|---|---|---|---|---|
| 2-Methylnaphthalene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Acenaphthene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Acenaphthylene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Anthracene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Benzo(a)anthracene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Benzo(a)pyrene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Benzo(b)fluoranthene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Benzo(g,h,i)perylene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Benzo(k)fluoranthene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Chrysene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Dibenz(a,h)anthracene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Fluoranthene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Fluorene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Indeno(1,2,3,c,d)pyrene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Naphthalene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Pentachlorophenol | 10 U | 9.6 U | 11 U | 10 U | 10 U | 9.9 U |
| Phenanthrene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |
| Pyrene | 2.0 U | 1.9 U | 2.2 U | 2.0 U | 2.1 U | 2.0 U |

## Table D6. Water Chemistry, PCBs – Wilmington ODMDS, May 2010.

| PCB congenger | W35top | W35bottom | W38top | W38bottom | W40top | W40bottom |
|---|---|---|---|---|---|---|
| 8 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 18 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 28 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 44 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 49 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 52 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 66 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 77 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 87 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 101 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 105 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 118 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 126 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 128 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 138 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 153 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 156 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 169 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 170 | 0.016 UJ | 0.015 UJ | 0.017 UJ | 0.016 UJ | 0.015 UJ | 0.017 UJ |
| 180 | 0.016 UJ | 0.015 UJ | 0.017 UJ | 0.016 UJ | 0.015 UJ | 0.017 UJ |
| 183 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 184 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 187 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |
| 195 | 0.016 UJ | 0.015 UJ | 0.017 UJ | 0.016 UJ | 0.015 UJ | 0.017 UJ |
| 206 | 0.016 UJ | 0.015 UJ | 0.017 UJ | 0.016 UJ | 0.015 UJ | 0.017 UJ |
| 209 | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.017 U |

## Table D7. Water Chemistry, Pesticides – ODMDS, May 2010.

| ANALYTE | W35top | W35bottom | W38top | W38bottom | W40top | W40bottom |
|---|---|---|---|---|---|---|
| 4,4'-DDD | **0.0082 u** | **0.0077 u** | **0.0086 u** | **0.008 u** | **0.0077 u** | **0.0085 u** |
| 4,4'-DDE | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| 4,4'-DDT | **0.010 u** | **0.0097 u** | **0.011 u** | **0.010 u** | **0.0096 u** | **0.011 u** |
| Aldrin | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| alpha BHC (Lindane Derivative) | **0.0021 u** | **0.0019 u** | **0.0021 u** | **0.002 u** | **0.0019 u** | **0.0021 u** |
| alpha Chlordane | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| beta BHC (Lindane Derivative) | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| delta BHC (Lindane Derivative) | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| Dieldrin | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| Endosulfan I (alpha) | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| Endosulfan II (beta) | **0.0082 u** | **0.0077 u** | **0.0086 u** | **0.008 u** | **0.0077 u** | **0.0085 u** |
| Endosulfan Sulfate | **0.010 u** | **0.0097 u** | **0.011 u** | **0.010 u** | **0.0096 u** | **0.011 u** |
| Endrin | **0.0082 u** | **0.0077 u** | **0.0086 u** | **0.008 u** | **0.0077 u** | **0.0085 u** |
| Endrin Aldehyde | **0.010 u** | **0.0097 u** | **0.011 u** | **0.010 u** | **0.0096 u** | **0.011 u** |
| Endrin Ketone | **0.010 u** | **0.0097 u** | **0.011 u** | **0.010 u** | **0.0096 u** | **0.011 u** |
| gamma-BHC (Lindane) | **0.0021 u** | **0.0019 u** | **0.0021 u** | **0.002 u** | **0.0019 u** | **0.0021 u** |
| gamma Chlordane | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| Heptachlor | **0.0031 u** | **0.0029 u** | **0.0032 u** | **0.003 u** | **0.0029u** | **0.0032 u** |
| Heptachlor Epoxide | **0.0041 u** | **0.0039 u** | **0.0043 u** | **0.004 u** | **0.0038 u** | **0.0042 u** |
| Methoxychlor | **0.021 u** | **0.019 u** | **0.021 u** | **0.02 u** | **0.019 u** | **0.021 u** |
| Toxaphene | **0.21 u** | **0.19 u** | **0.21 u** | **0.2 u** | **0.19 u** | **0.21 u** |

# APPENDIX E

Benthic Macroinvertebrate Data

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Table E1. Summary of abundance of major benthic macroinfaunal taxonomic groups by station for the Wilmington ODMDS stations, June 2010.

| Location | Station | Taxa | Total No Taxa | % Total | Total No Individuals | % Total |
|---|---|---|---|---|---|---|
| **Outside Old ODMDS** | W01 | Annelida | 23 | 63.9 | 67 | 60.4 |
| | | Mollusca | 7 | 19.4 | 22 | 19.8 |
| | | Arthropoda | 2 | 5.6 | 10 | 9.0 |
| | | Echinodermata | 1 | 2.8 | 1 | 0.9 |
| | | Other Taxa | 3 | 8.3 | 11 | 9.9 |
| | | **Total** | **36** | | **111** | |
| | W02 | Annelida | 16 | 55.2 | 26 | 49.1 |
| | | Mollusca | 4 | 13.8 | 4 | 7.5 |
| | | Arthropoda | 7 | 24.1 | 19 | 35.8 |
| | | Echinodermata | 0 | 0.0 | 0 | 0.0 |
| | | Other Taxa | 2 | 6.9 | 4 | 7.5 |
| | | **Total** | **29** | | **53** | |
| | W03 | Annelida | 28 | 65.1 | 139 | 59.9 |
| | | Mollusca | 5 | 11.6 | 16 | 6.9 |
| | | Arthropoda | 6 | 14.0 | 40 | 17.2 |
| | | Echinodermata | 2 | 4.7 | 7 | 3.0 |
| | | Other Taxa | 2 | 4.7 | 30 | 12.9 |
| | | **Total** | **43** | | **232** | |
| | W09 | Annelida | 9 | 40.9 | 39 | 45.9 |
| | | Mollusca | 5 | 22.7 | 14 | 16.5 |
| | | Arthropoda | 4 | 18.2 | 9 | 10.6 |
| | | Echinodermata | 0 | 0.0 | 0 | 0.0 |
| | | Other Taxa | 4 | 18.2 | 23 | 27.1 |
| | | **Total** | **22** | | **85** | |
| | W10 | Annelida | 4 | 50.0 | 6 | 50.0 |
| | | Mollusca | 1 | 12.5 | 2 | 16.7 |
| | | Arthropoda | 2 | 25.0 | 3 | 25.0 |
| | | Echinodermata | 0 | 0.0 | 0 | 0.0 |
| | | Other Taxa | 1 | 12.5 | 1 | 8.3 |
| | | **Total** | **8** | | **12** | |

*Table E1 continued:*

| Location | Station | Taxa | Total No Taxa | % Total | Total No Individuals | % Total |
|---|---|---|---|---|---|---|
| **Inside Old ODMDS** | W04 | Annelida | 4 | 44.4 | 5 | 21.7 |
| | | Mollusca | 1 | 11.1 | 2 | 8.7 |
| | | Arthropoda | 3 | 33.3 | 15 | 65.2 |
| | | Echinodermata | 1 | 11.1 | 1 | 4.3 |
| | | Other Taxa | 0 | 0.0 | 0 | 0.0 |
| | | **Total** | **9** | | **23** | |
| | W05 | Annelida | 4 | 28.6 | 10 | 16.7 |
| | | Mollusca | 3 | 21.4 | 37 | 61.7 |
| | | Arthropoda | 7 | 50.0 | 13 | 21.7 |
| | | Echinodermata | 0 | 0.0 | 0 | 0.0 |
| | | Other Taxa | 0 | 0.0 | 0 | 0.0 |
| | | **Total** | **14** | | **60** | |
| | W06 | Annelida | 19 | 76.0 | 55 | 84.6 |
| | | Mollusca | 1 | 4.0 | 1 | 1.5 |
| | | Arthropoda | 2 | 8.0 | 2 | 3.1 |
| | | Echinodermata | 1 | 4.0 | 2 | 3.1 |
| | | Other Taxa | 2 | 8.0 | 5 | 7.7 |
| | | **Total** | **25** | | **65** | |
| | W07 | Annelida | 1 | 20.0 | 1 | 5.6 |
| | | Mollusca | 0 | 0.0 | 0 | 0.0 |
| | | Arthropoda | 4 | 80.0 | 17 | 94.4 |
| | | Echinodermata | 0 | 0.0 | 0 | 0.0 |
| | | Other Taxa | 0 | 0.0 | 0 | 0.0 |
| | | **Total** | **5** | | **18** | |

Table E2. Wet-weight biomass of major benthic macroinfaunal taxonomic groups for Wilmington ODMDS stations, June 2010.

| Station | | Biomass (g) | Station | | Biomass (g) |
|---|---|---|---|---|---|
| **W01 - Old Out** | Annelida | 0.5356 | **W04 - Old In** | Annelida | 0.0091 |
| | Mollusca | 0.1221 | | Mollusca | 0.0016 |
| | Arthropoda | 0.0171 | | Arthropoda | 0.0122 |
| | Echinodermata | 0.0418 | | Echinodermata | 0.0561 |
| | Other Taxa | 0.0615 | | Other Taxa | 0.0000 |
| | **Total** | 0.7781 | | **Total** | 0.0790 |
| **W02 - Old Out** | Annelida | 0.0802 | **W05- Old In** | Annelida | 0.0572 |
| | Mollusca | 0.1812 | | Mollusca | 0.6216 |
| | Arthropoda | 0.0465 | | Arthropoda | 0.0884 |
| | Echinodermata | 0.0000 | | Echinodermata | 0.0000 |
| | Other Taxa | 0.0021 | | Other Taxa | 0.0008 |
| | **Total** | 0.3100 | | **Total** | 0.7680 |
| **W03 - Old Out** | Annelida | 0.1842 | **W06 - Old In** | Annelida | 0.0895 |
| | Mollusca | 0.2808 | | Mollusca | 0.0010 |
| | Arthropoda | 0.0432 | | Arthropoda | 0.0000 |
| | Echinodermata | 0.1012 | | Echinodermata | 0.0100 |
| | Other Taxa | 0.1001 | | Other Taxa | 0.0037 |
| | **Total** | 0.7095 | | **Total** | 0.1042 |
| **W09 - Old Out** | Annelida | 0.1318 | **W07 - Old In** | Annelida | 0.0050 |
| | Mollusca | 0.1469 | | Mollusca | 0.0000 |
| | Arthropoda | 0.1480 | | Arthropoda | 0.0850 |
| | Echinodermata | 0.0000 | | Echinodermata | 0.0000 |
| | Other Taxa | 0.0986 | | Other Taxa | 0.0000 |
| | **Total** | 0.5253 | | **Total** | 0.0900 |
| **W10 - Old Out** | Annelida | 0.0122 | | | |
| | Mollusca | 0.0008 | | | |
| | Arthropoda | 0.0542 | | | |
| | Echinodermata | 0.0000 | | | |
| | Other Taxa | 0.0001 | | | |
| | **Total** | 0.0673 | | | |

Table E3. A summary of the macroinfaunal assemblage parameters for the Wilmington ODMDS stations, May 2010.

| Location | Station | Total No. Taxa | Total No. Individuals | Density (nos/m2) | H' Shannon (log e) | d Diversity (log 2) | 1/S Simpson Diversity | J' Pielou Evenness | D Margalef Richness | e Equitability |
|---|---|---|---|---|---|---|---|---|---|---|
| **Outside Old ODMDS** | **W1** | 36 | 111 | 2775.0 | 3.14 | 4.53 | 17.90 | 0.88 | 7.43 | 0.94 |
| | **W2** | 29 | 53 | 1325.0 | 3.08 | 4.44 | 21.87 | 0.91 | 7.05 | 1.10 |
| | **W3** | 43 | 232 | 5800.0 | 3.06 | 4.41 | 14.86 | 0.81 | 7.71 | 0.73 |
| | **W9** | 22 | 85 | 2125.0 | 2.61 | 3.76 | 10.17 | 0.84 | 4.73 | 0.89 |
| | **W10** | 8 | 12 | 300.0 | 2.02 | 2.92 | 16.50 | 0.97 | 2.82 | 1.33 |
| | **Mean** | **27.6** | | **2465.0** | **2.78** | | | **0.88** | | |
| | **SD** | **13.5** | | **2080.9** | **0.47** | | | **0.06** | | |
| **Inside Old ODMDS** | **W4** | 9 | 23 | 575.0 | 1.57 | 2.26 | 3.16 | 0.71 | 2.55 | 0.73 |
| | **W5** | 14 | 60 | 1500.0 | 1.65 | 2.38 | 2.85 | 0.62 | 3.18 | 0.51 |
| | **W6** | 25 | 65 | 1625.0 | 2.74 | 3.95 | 11.30 | 0.85 | 5.75 | 0.90 |
| | **W7** | 5 | 18 | 450.0 | 1.30 | 1.88 | 3.40 | 0.81 | 1.38 | 1.00 |
| | **W8** | – | – | – | – | – | – | – | – | – |
| | **Mean** | **13.3** | | **1037.5** | **1.81** | | | **0.75** | | |
| | **SD** | **8.7** | | **610.5** | **0.63** | | | **0.10** | | |

Table E4. Distribution and abundance of benthic macroinfaunal taxa for stations located inside the Wilmington ODMDS, May 2010.

| Taxa | Phylum | Class | Total No Individuals | % Total | Cumulative % | Station Occurrence | % Station Occurrence |
|---|---|---|---|---|---|---|---|
| *Petricola pholadiformis* | Mol | Biva | 35 | 21.08 | 21.08 | 1 | 25 |
| *Protohaustorius wigleyi* | Art | Mala | 22 | 13.25 | 34.34 | 2 | 50 |
| Tubificidae (LPIL) | Ann | Olig | 14 | 8.43 | 42.77 | 1 | 25 |
| *Goniadides carolinae* | Ann | Poly | 12 | 7.23 | 50.00 | 1 | 25 |
| *Ampelisca abdita* | Art | Mala | 6 | 3.61 | 53.61 | 1 | 25 |
| *Polycirrus eximius* | Ann | Poly | 6 | 3.61 | 57.23 | 1 | 25 |
| *Acanthohaustorius intermedius* | Art | Mala | 4 | 2.41 | 59.64 | 1 | 25 |
| *Acanthohaustorius millsi* | Art | Mala | 4 | 2.41 | 62.05 | 2 | 50 |
| *Mediomastus* (LPIL) | Ann | Poly | 4 | 2.41 | 64.46 | 2 | 50 |
| *Spio filicornis* | Ann | Poly | 4 | 2.41 | 66.87 | 1 | 25 |
| Nemertea (LPIL) | Nem | - | 3 | 1.81 | 68.67 | 1 | 25 |
| *Spiophanes bombyx* | Ann | Poly | 3 | 1.81 | 70.48 | 2 | 50 |
| *Ancistrosyllis hartmanae* | Ann | Poly | 2 | 1.20 | 71.69 | 1 | 25 |
| *Cirrophorus ilvana* | Ann | Poly | 2 | 1.20 | 72.89 | 1 | 25 |
| *Dipolydora socialis* | Ann | Poly | 2 | 1.20 | 74.10 | 1 | 25 |
| Glyceridae (LPIL) | Ann | Poly | 2 | 1.20 | 75.30 | 1 | 25 |
| *Hemipodus roseus* | Ann | Poly | 2 | 1.20 | 76.51 | 1 | 25 |
| *Hesionura coineaui* | Ann | Poly | 2 | 1.20 | 77.71 | 1 | 25 |
| *Leitoscoloplos* (LPIL) | Ann | Poly | 2 | 1.20 | 78.92 | 1 | 25 |
| *Leptosynapta tenuis* | Ech | Holo | 2 | 1.20 | 80.12 | 1 | 25 |
| *Paramphinome* sp. B | Ann | Poly | 2 | 1.20 | 81.33 | 1 | 25 |
| Sipuncula (LPIL) | Sip | - | 2 | 1.20 | 82.53 | 1 | 25 |
| Spionidae (LPIL) | Ann | Poly | 2 | 1.20 | 83.73 | 2 | 50 |
| *Strigilla* (LPIL) | Mol | Biva | 2 | 1.20 | 84.94 | 1 | 25 |
| *Unciola serrata* | Art | Mala | 2 | 1.20 | 86.14 | 1 | 25 |
| *Alpheus* (LPIL) | Art | Mala | 1 | 0.60 | 86.75 | 1 | 25 |
| *Alpheus normanni* | Art | Mala | 1 | 0.60 | 87.35 | 1 | 25 |
| *Bhawania heteroseta* | Ann | Poly | 1 | 0.60 | 87.95 | 1 | 25 |
| *Bowmaniella* (LPIL) | Art | Mala | 1 | 0.60 | 88.55 | 1 | 25 |
| *Brania wellfleetensis* | Ann | Poly | 1 | 0.60 | 89.16 | 1 | 25 |
| Capitellidae (LPIL) | Ann | Poly | 1 | 0.60 | 89.76 | 1 | 25 |
| *Crassinella lunulata* | Mol | Biva | 1 | 0.60 | 90.36 | 1 | 25 |
| Echinoidea (LPIL) | Ech | Echi | 1 | 0.60 | 90.96 | 1 | 25 |
| *Eudevenopus honduranus* | Art | Mala | 1 | 0.60 | 91.57 | 1 | 25 |
| *Glycera* (LPIL) | Ann | Poly | 1 | 0.60 | 92.17 | 1 | 25 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Kalliapseudes macsweenyi* | Art | Mala | 1 | 0.60 | 92.77 | 1 | 25 |
| Maldanidae (LPIL) | Ann | Poly | 1 | 0.60 | 93.37 | 1 | 25 |
| *Mediomastus californiensis* | Ann | Poly | 1 | 0.60 | 93.98 | 1 | 25 |
| *Metatiron* (LPIL) | Art | Mala | 1 | 0.60 | 94.58 | 1 | 25 |
| *Metharpinia floridana* | Art | Mala | 1 | 0.60 | 95.18 | 1 | 25 |
| *Mitrella lunata* | Mol | Gast | 1 | 0.60 | 95.78 | 1 | 25 |
| *Nassarius acutus* | Mol | Gast | 1 | 0.60 | 96.39 | 1 | 25 |
| *Nephtys picta* | Ann | Poly | 1 | 0.60 | 96.99 | 1 | 25 |
| *Onuphis eremita oculata* | Ann | Poly | 1 | 0.60 | 97.59 | 1 | 25 |
| *Oxyurostylis smithi* | Art | Mala | 1 | 0.60 | 98.19 | 1 | 25 |
| *Pinnixa* (LPIL) | Art | Mala | 1 | 0.60 | 98.80 | 1 | 25 |
| *Spiochaetopterus oculatus* | Ann | Poly | 1 | 0.60 | 99.40 | 1 | 25 |
| *Synelmis ewingi* | Ann | Poly | 1 | 0.60 | 100.00 | 1 | 25 |

***Taxa Key***

| | | | |
|---|---|---|---|
| Ann=Annelida | Ech=Echinodermata | Mol=Mollusca | Nem=Nemertea |
| Olig=Oligochaeta | Echi=Echinoidea | Biva=Bivalvia | Sip=Sipuncula |
| Poly=Polychaeta | Echinodermata | Gast=Gastropoda | |
| Art=Arthropoda | Holo=Holothuroidea | | |
| Mala=Malacostraca | | | |

Table E5. Distribution and abundance of benthic macroinfaunal taxa for stations located outside the Wilmington ODMDS, May 2010.

| Taxa | Phylum | Class | No of Individuals | % Total | Cumulative % | Station Occurrence | % Station Occurrence |
|---|---|---|---|---|---|---|---|
| Maldanidae (LPIL) | Ann | Poly | 37 | 7.51 | 7.51 | 3 | 60 |
| Sipuncula (LPIL) | Sip | - | 35 | 7.10 | 14.60 | 3 | 60 |
| *Ampelisca abdita* | Art | Mala | 28 | 5.68 | 20.28 | 2 | 40 |
| *Magelona* sp. H | Ann | Poly | 27 | 5.48 | 25.76 | 2 | 40 |
| Mediomastus (LPIL) | Ann | Poly | 27 | 5.48 | 31.24 | 4 | 80 |
| *Polycirrus eximius* | Ann | Poly | 24 | 4.87 | 36.11 | 2 | 40 |
| *Polygordius* (LPIL) | Ann | Poly | 24 | 4.87 | 40.97 | 2 | 40 |
| *Clymenella torquata* | Ann | Poly | 22 | 4.46 | 45.44 | 2 | 40 |
| Nemertea (LPIL) | Nem | - | 21 | 4.26 | 49.70 | 5 | 100 |
| *Oxyurostylis smithi* | Art | Mala | 18 | 3.65 | 53.35 | 3 | 60 |
| *Bhawania heteroseta* | Ann | Poly | 14 | 2.84 | 56.19 | 2 | 40 |
| *Tellina* (LPIL) | Mol | Biva | 13 | 2.64 | 58.82 | 4 | 80 |
| *Acanthohaustorius millsi* | Art | Mala | 11 | 2.23 | 61.05 | 2 | 40 |
| *Ensis directus* | Mol | Biva | 9 | 1.83 | 62.88 | 1 | 20 |
| *Unciola serrata* | Art | Mala | 9 | 1.83 | 64.71 | 2 | 40 |
| *Mysella planulata* | Mol | Biva | 7 | 1.42 | 66.13 | 2 | 40 |
| Phoronis (LPIL) | Pho | - | 7 | 1.42 | 67.55 | 2 | 40 |
| *Goniadides carolinae* | Ann | Poly | 6 | 1.22 | 68.76 | 2 | 40 |
| Ophiuroidea (LPIL) | Ech | Ophi | 6 | 1.22 | 69.98 | 2 | 40 |
| *Pectinaria gouldii* | Ann | Poly | 6 | 1.22 | 71.20 | 3 | 60 |
| Semelidae (LPIL) | Mol | Biva | 6 | 1.22 | 72.41 | 1 | 20 |
| *Nassarius acutus* | Mol | Gast | 5 | 1.01 | 73.43 | 2 | 40 |
| *Phascolion strombi* | Sip | - | 5 | 1.01 | 74.44 | 1 | 20 |
| *Phyllodoce arenae* | Ann | Poly | 5 | 1.01 | 75.46 | 2 | 40 |
| *Spiophanes bombyx* | Ann | Poly | 5 | 1.01 | 76.47 | 3 | 60 |
| *Acteocina bidentata* | Mol | Gast | 4 | 0.81 | 77.28 | 1 | 20 |
| *Leitoscoloplos robustus* | Ann | Poly | 4 | 0.81 | 78.09 | 2 | 40 |
| *Nephtys picta* | Ann | Poly | 4 | 0.81 | 78.90 | 2 | 40 |
| *Pista palmata* | Ann | Poly | 4 | 0.81 | 79.72 | 1 | 20 |
| *Sabellaria* sp. A | Ann | Poly | 4 | 0.81 | 80.53 | 2 | 40 |
| *Schistomeringos pectinata* | Ann | Poly | 4 | 0.81 | 81.34 | 1 | 20 |
| *Sigambra tentaculata* | Ann | Poly | 4 | 0.81 | 82.15 | 2 | 40 |
| *Aglaophamus verrilli* | Ann | Poly | 3 | 0.61 | 82.76 | 2 | 40 |
| Bivalvia (LPIL) | Mol | Biva | 3 | 0.61 | 83.37 | 2 | 40 |
| Capitellidae (LPIL) | Ann | Poly | 3 | 0.61 | 83.98 | 1 | 20 |
| Cirratulidae (LPIL) | Ann | Poly | 3 | 0.61 | 84.58 | 2 | 40 |
| *Crassinella lunulata* | Mol | Biva | 3 | 0.61 | 85.19 | 2 | 40 |
| *Listriella barnardi* | Art | Mala | 3 | 0.61 | 85.80 | 2 | 40 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Onuphidae (LPIL) | Ann | Poly | 3 | 0.61 | 86.41 | 2 | 40 |
| *Owenia fusiformis* | Ann | Poly | 3 | 0.61 | 87.02 | 2 | 40 |
| Polynoidae (LPIL) | Ann | Poly | 3 | 0.61 | 87.63 | 1 | 20 |
| Amphiuridae (LPIL) | Ech | Ophi | 2 | 0.41 | 88.03 | 1 | 20 |
| *Ancistrosyllis hartmanae* | Ann | Poly | 2 | 0.41 | 88.44 | 1 | 20 |
| *Apoprionospio dayi* | Ann | Poly | 2 | 0.41 | 88.84 | 1 | 20 |
| *Axiothella mucosa* | Ann | Poly | 2 | 0.41 | 89.25 | 2 | 40 |
| *Glycera robusta* | Ann | Poly | 2 | 0.41 | 89.66 | 2 | 40 |
| *Magelona pettiboneae* | Ann | Poly | 2 | 0.41 | 90.06 | 1 | 20 |
| *Metatiron triocellatus* | Art | Mala | 2 | 0.41 | 90.47 | 1 | 20 |
| Nephtyidae (LPIL) | Ann | Poly | 2 | 0.41 | 90.87 | 2 | 40 |
| *Pagurus* (LPIL) | Art | Mala | 2 | 0.41 | 91.28 | 2 | 40 |
| *Paraprionospio pinnata* | Ann | Poly | 2 | 0.41 | 91.68 | 2 | 40 |
| *Pinnixa cylindrica* | Art | Mala | 2 | 0.41 | 92.09 | 1 | 20 |
| *Prionospio cristata* | Ann | Poly | 2 | 0.41 | 92.49 | 1 | 20 |
| *Pythinella cuneata* | Mol | Biva | 2 | 0.41 | 92.90 | 1 | 20 |
| *Spio* (LPIL) | Ann | Poly | 2 | 0.41 | 93.31 | 1 | 20 |
| *Acanthohaustorius intermedius* | Art | Mala | 1 | 0.20 | 93.51 | 1 | 20 |
| *Aricidea* (LPIL) | Ann | Poly | 1 | 0.20 | 93.71 | 1 | 20 |
| *Aricidea catherinae* | Ann | Poly | 1 | 0.20 | 93.91 | 1 | 20 |
| *Balanoglossus* (LPIL) | Hem | Ente | 1 | 0.20 | 94.12 | 1 | 20 |
| *Ceratocephale oculata* | Ann | Poly | 1 | 0.20 | 94.32 | 1 | 20 |
| *Cirrophorus* (LPIL) | Ann | Poly | 1 | 0.20 | 94.52 | 1 | 20 |
| *Cirrophorus ilvana* | Ann | Poly | 1 | 0.20 | 94.73 | 1 | 20 |
| *Cyclaspis pustulata* | Art | Mala | 1 | 0.20 | 94.93 | 1 | 20 |
| *Dipolydora socialis* | Ann | Poly | 1 | 0.20 | 95.13 | 1 | 20 |
| *Drilonereis longa* | Ann | Poly | 1 | 0.20 | 95.33 | 1 | 20 |
| *Erichthonius brasiliensis* | Art | Mala | 1 | 0.20 | 95.54 | 1 | 20 |
| *Euceramus praelongus* | Art | Mala | 1 | 0.20 | 95.74 | 1 | 20 |
| *Glycera dibranchiata* | Ann | Poly | 1 | 0.20 | 95.94 | 1 | 20 |
| *Goniada littorea* | Ann | Poly | 1 | 0.20 | 96.15 | 1 | 20 |
| *Kurtziella atrostyla* | Mol | Gast | 1 | 0.20 | 96.35 | 1 | 20 |
| *Leitoscoloplos* (LPIL) | Ann | Poly | 1 | 0.20 | 96.55 | 1 | 20 |
| *Macrochaeta* sp. A | Ann | Poly | 1 | 0.20 | 96.75 | 1 | 20 |
| *Mesochaetopterus* (LPIL) | Ann | Poly | 1 | 0.20 | 96.96 | 1 | 20 |
| Montacutidae (LPIL) | Mol | Biva | 1 | 0.20 | 97.16 | 1 | 20 |
| *Notomastus latericeus* | Ann | Poly | 1 | 0.20 | 97.36 | 1 | 20 |
| *Olivella floralia* | Mol | Gast | 1 | 0.20 | 97.57 | 1 | 20 |
| Phyllodocidae (LPIL) | Ann | Poly | 1 | 0.20 | 97.77 | 1 | 20 |
| Pinnotheridae (LPIL) | Art | Mala | 1 | 0.20 | 97.97 | 1 | 20 |
| *Prionospio perkinsi* | Ann | Poly | 1 | 0.20 | 98.17 | 1 | 20 |
| *Pseudophilomedes ambon* | Art | Ostr | 1 | 0.20 | 98.38 | 1 | 20 |
| *Semele proficua* | Mol | Biva | 1 | 0.20 | 98.58 | 1 | 20 |
| *Sigambra pettiboneae* | Ann | Poly | 1 | 0.20 | 98.78 | 1 | 20 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Spio filicornis* | Ann | Poly | 1 | 0.20 | 98.99 | 1 | 20 |
| Spionidae (LPIL) | Ann | Poly | 1 | 0.20 | 99.19 | 1 | 20 |
| Syllidae (LPIL) | Ann | Poly | 1 | 0.20 | 99.39 | 1 | 20 |
| *Tectonatica pusilla* | Mol | Gast | 1 | 0.20 | 99.59 | 1 | 20 |
| Terebellidae (LPIL) | Ann | Poly | 1 | 0.20 | 99.80 | 1 | 20 |
| Turridae (LPIL) | Mol | Gast | 1 | 0.20 | 100.00 | 1 | 20 |

**Taxa key**

Ann=Annelida

Poly=Polychaeta

Arthropoda

Mala=Malacostraca

Ostr=Ostracoda

Ech=Echinodermata

Ophi=Ophiuroidea

Hem=Hemichordata

Ente=Enteropneusta

Mol=Mollusca

Biva=Bivalvia

Gast=Gastropoda

Nem=Nemertea

Pho=Phoronida

Sip=Sipuncula

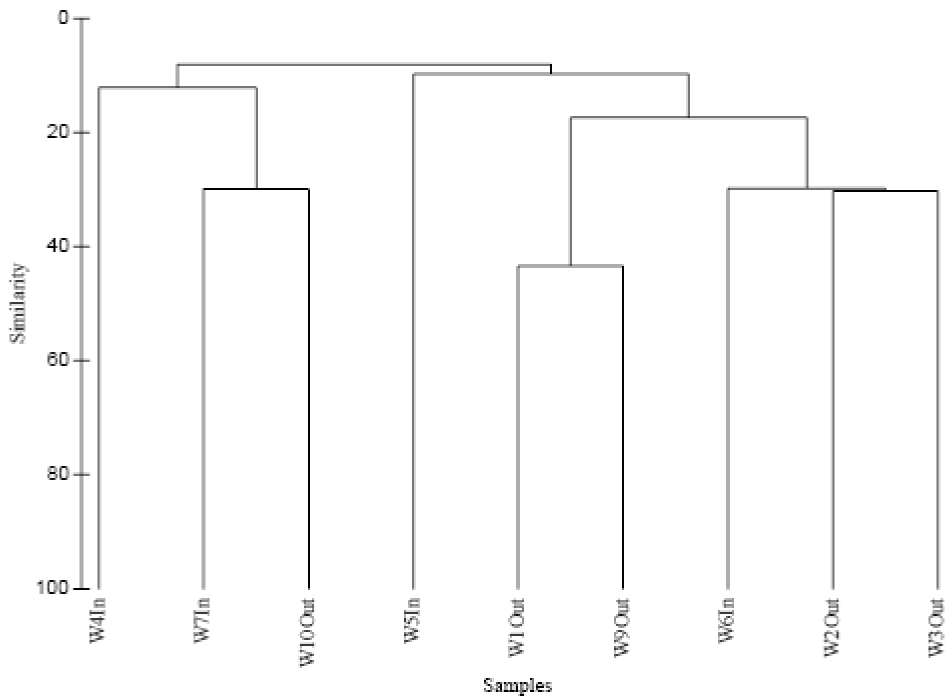


Figure E1. Cluster Analysis for the Wilmington ODMDS stations, May 2010.

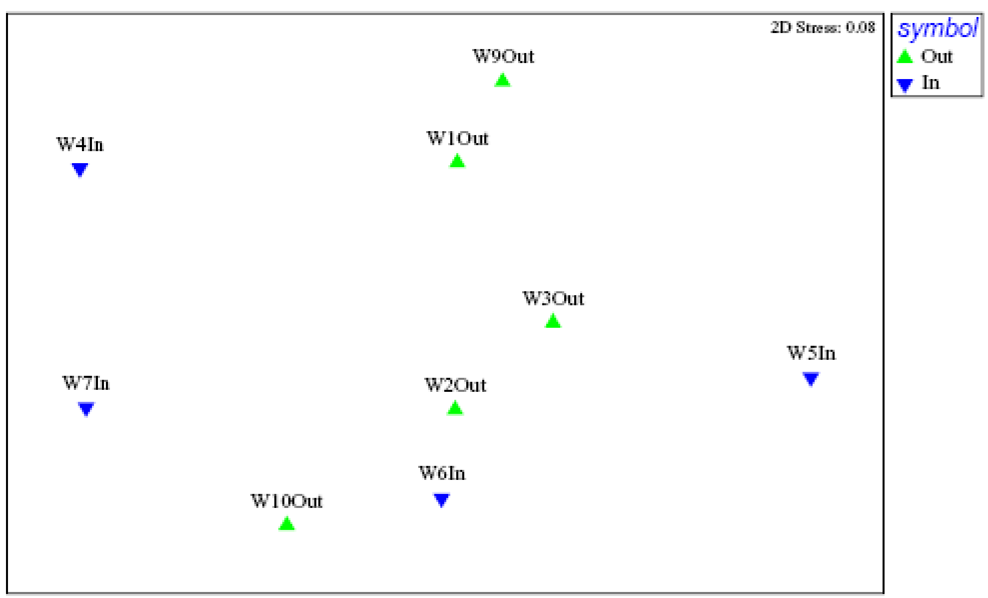


Figure E2. MDS Analysis for the Wilmington ODMDS stations, May 2010.

# APPENDIX F

## Target Detection Limits

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| Ocean Programs Analytical Request Table<br>Nutrients and Classicals Analyte List<br>Minimum Quantitation Limits by Matrices | | |
|---|---|---|
| **ANALYTE** | **Water mg/L (ppm)** | **Soil/Sed mg/kg (ppm)** |
| Total Solids/dry weight | | 1.0% |
| Total Org. Carbon | 5 (0.0005%) | 0.1% |
| Percent Moisture | | |

| Ocean Programs Analytical Request Table<br>Metals Analyte List<br>Minimum Quantitation Limits by Matrices | | | | | |
|---|---|---|---|---|---|
| **ANALYTE** | **Target Water $\mu$g/L (ppb)** | **WQC Saltwater CMC ug/L** | **Sediment mg/kg (ppm)** | **Tissue mg/kg (ppm)** | **Ecological Non-specific Effects Level ug/Kg** |
| Arsenic | 1.0 | 69 | 1.0 | 0.2 | 12.6 |
| Aluminum | 500 | | 50 | | |
| Cadmium | 1.0 | 42 | 0.1 | 0.1 | 0.3 |
| Chromium | 1.0 | 1100 (Cr6+) | 1.0 | 1.0 | 11.8 |
| Copper | 1.0 | 4.8 | 1.0 | 1.0 | 9.6 |
| Iron | 500 | | 25 | | |
| Lead | 1.0 | 210 | 0.5 | 0.2 | 11.9 |
| Mercury | 0.2 | 1.8 | 0.05 | 0.02 | 0.2 |
| Nickel | 1.0 | 74 | 1.0 | 1.0 | 3.8 |
| Selenium | 2.0 | 290 | 1.0 | | |
| Silver | 1.0 | 1.9 | 0.2 | 0.2 | 1.4 |
| Zinc<br>Percent Moisture | 1.0 | 90 | 1.0 | 1.0 | 1517 |

| Ocean Programs Analytical Request Table<br>PCB Congengers Target Analyte List<br>Minimum Quantitation Limits Guidelines by Matrices | | | |
|---|---|---|---|
| **PCB Congenger** | **Water $\mu$g/L (ppb)** | **Sediment $\mu$g/kg (ppb)** | **Tissue mg/kg (ppm)** |
| 8 | 0.02 | 1.0 | 0.0010 |
| 18 | 0.02 | 1.0 | 0.0010 |
| 28 | 0.02 | 1.0 | 0.0010 |
| 44 | 0.02 | 1.0 | 0.0010 |
| 49 | 0.02 | 1.0 | 0.0010 |
| 52 | 0.02 | 1.0 | 0.0010 |
| 66 | 0.02 | 1.0 | 0.0010 |
| 77 | 0.02 | 1.0 | 0.0010 |
| 87 | 0.02 | 1.0 | 0.0010 |
| 101 | 0.02 | 1.0 | 0.0010 |
| 105 | 0.02 | 1.0 | 0.0010 |
| 118 | 0.02 | 1.0 | 0.0010 |
| 126 | 0.02 | 1.0 | 0.0010 |
| 128 | 0.02 | 1.0 | 0.0010 |
| 138 | 0.02 | 1.0 | 0.0010 |
| 153 | 0.02 | 1.0 | 0.0010 |
| 156 | 0.02 | 1.0 | 0.0010 |
| 169 | 0.02 | 1.0 | 0.0010 |
| 170 | 0.02 | 1.0 | 0.0010 |
| 180 | 0.02 | 1.0 | 0.0010 |
| 183 | 0.02 | 1.0 | 0.0010 |
| 184 | 0.02 | 1.0 | 0.0010 |
| 187 | 0.02 | 1.0 | 0.0010 |
| 195 | 0.02 | 1.0 | 0.0010 |
| 206 | 0.02 | 1.0 | 0.0010 |
| 209 | 0.02 | 1.0 | 0.0010 |
| Percent Moisture | | | |

| Ocean Programs Analytical Request Table<br>PAHs (SemiVOAs) Target Analyte List<br>Minimum Quantitation Limits Guidelines by Matrices | | | |
|---|---|---|---|
| **ANALYTE** | **Water $\mu$g/L (ppb)** | **Soil/Sed* $\mu$g/kg (ppb)** | **Tissue* mg/kg (ppm)** |
| 2-Methylnaphthalene | 10. | **20** | **0.02** |
| Acenaphthene | 10. | **20** | **0.02** |
| Acenaphthylene | 10. | **20** | **0.02** |
| Anthracene | 10. | **20** | **0.02** |
| Benzo(a)anthracene | 10. | **20** | **0.02** |
| Benzo(a)pyrene | 10. | **20** | **0.02** |
| Benzo(b/k)fluoranthene | 10. | **20** | **0.02** |
| Benzo(g,h,i)perylene | 10. | **20** | **0.02** |
| Chrysene | 10. | **20** | **0.02** |
| Dibenz(a,h)anthracene | 10. | **20** | **0.02** |
| Fluoranthene | 10. | **20** | **0.02** |
| Fluorene | 10. | **20** | **0.02** |
| Indeno(1,2,3,c,d)pyrene | 10. | **20** | **0.02** |
| Naphthalene | 10. | **20** | **0.02** |
| Phenanthrene | 10. | **20** | **0.02** |
| Pyrene | 10. | **20** | **0.02** |
| Percent Moisture | | | |
| **Ocean Programs Analytical Request Table<br>Semivolatile Organics (Non-PAHs) Target Analyte List<br>Minimum Quantitation Limits Guidelines by Matrices** | | | |
| Pentachlorophenol | 10. | **100** | **0.100** |

| Ocean Programs Analytical Request Table<br>Pesticide Target Analyte List<br>Minimum Quantitation Limits Guidelines by Matrices | | | |
|---|---|---|---|
| **ANALYTE** | **Water<br>μg/L (ppb)** | **Sediment<br>μg/kg (ppb)** | **Tissue<br>mg/kg (ppm)** |
| Aldrin | 0.5 | 10 | 0.002 |
| alpha Chlordane | 0.05 | 10 | 0.002 |
| gamma Chlordane | 0.05 | 10 | 0.002 |
| Dieldrin | 0.5 | 10 | 0.002 |
| 4,4'-DDT | 0.1 | 10 | 0.002 |
| 4,4'-DDD | 0.1 | 10 | 0.002 |
| 4,4'-DDE | 0.1 | 10 | 0.002 |
| Endosulfan I (alpha) | 0.03 | 10 | 0.002 |
| Endosulfan II (beta) | 0.03 | 10 | 0.002 |
| Endosulfan Sulfate | 0.1 | 10 | 0.002 |
| Endrin | 0.03 | 10 | 0.002 |
| Endrin Aldehyde | 0.03 | 10 | 0.002 |
| Endrin Ketone | 0.03 | 10 | 0.002 |
| alpha BHC (Lindane Derivative) | 0.05 | 10 | 0.002 |
| beta BHC (Lindane Derivative) | 0.05 | 10 | 0.002 |
| delta BHC (Lindane Derivative) | 0.05 | 10 | 0.002 |
| gamma-BHC (Lindane) | 0.1 | 10 | 0.002 |
| Heptachlor | 0.05 | 10 | 0.002 |
| Heptachlor Epoxide | 0.05 | 10 | 0.002 |
| Methoxychlor | 0.5 | 10 | 0.002 |
| Toxaphene | 0.2 | 50 | 0.05 |