Initial Mixing Zone Compliance Monitoring Report DuPont Montague Facility Montague, Michigan

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Acronym List

Acronym	Explanation
µg	Micrograms
1H2010	First half of 2010
1Q2010	First quarter of 2010
CFC-113	1,1,2-Trichlorotrifluoroethane
CPT	cone penetrometer test
CRG	DuPont Corporate Remediation Group
DNRE	Michigan Department of Natural Resources and Environment
DuPont	E.I. du Pont de Nemours and Company
ERMD	Environmental Resource Management Division
FAV	Final Acute Value
GWTF	Groundwater Treatment Facility
GSI	Groundwater Surface-Water Interface
IW	Interceptor well
LSD	Lake Shore Drive
MDEQ	Michigan Department Environmental Quality
MSL	Mean sea level
MW	Monitoring well
PCE	Tetrachloroethylene
SG-WL	Staff Gauge – White Lake
UCL	Upper Confidence Limit
VOC	Volatile organic compound
WLP	White Lake Property
WLMZ	White Lake Mixing Zone

1.0 Introduction

E.I. du Pont de Nemours and Company (DuPont) operates a groundwater pump-and-treat system at its Montague, Michigan facility. The purpose of the groundwater pump-and-treat system is to capture groundwater containing constituents that exceed Michigan Department of Environmental Quality (MDEQ) Final Acute Values (FAVs) in the vicinity of Mirror Lake and White Lake. In a letter dated June 5, 2007, the MDEQ approved the DuPont request to implement an enhanced pump-and-treat system. This enhancement included the April 2008 installation of pumping wells IW-06 and IW-07, and new instrumentation and controls for the system. After construction, groundwater extraction was balanced after step-testing and groundwater flow (MODFLOW) modeling.

MDEQ also requested DuPont submit a compliance monitoring program to monitor the effectiveness of the upgraded system and a contingency plan in the event that the system did not achieve the required capture. Construction activities associated with the enhanced groundwater pump-and-treat system were completed in August 2008, and the newly installed pump-and-treat system started operation on August 21, 2008. Compliance monitoring wells were installed in the fourth quarter of 2009 (4Q2009) and have been monitored on a quarterly basis since that time.

This report documents the findings from the first five quarters of compliance monitoring data collected (from 4Q2009 to 4Q2010).

1.1 Site Background

The DuPont Montague property is located in Muskegon County, Michigan, approximately two miles southwest of the city of Montague. The property consists of approximately 1,330 acres and is bounded by forested, residential, and former industrial properties. The Groundwater Treatment Facility (GWTF) is approximately one mile north of White Lake and located approximately 1.5 miles east of Lake Michigan.

The GWTF consists of four groundwater interceptor wells (IW-01, IW-05, IW-06, and IW-07). Groundwater is extracted at a rate of approximately 680 gallons per minute and is treated by air stripper system. Granular activated carbon units are used to capture volatile organic compounds (VOCs) from the air stripper system, and the carbon units are periodically steam regenerated to recover VOCs.

1.2 Regulatory Background

In the *Request to Implement Enhanced Groundwater Pump and Treat System* submitted on October 13, 2006, DuPont proposed modifications to the pump-and-treat system that were based on recommendations from the *Groundwater Flow Model: DuPont Montague Works: Montague, Michigan* (dated September 19, 2006). In addition to the proposed modifications of the system, DuPont requested that MDEQ grant a Mixing Zone Determination for groundwater containing site-related VOCs flowing towards White Lake. MDEQ granted by letter (August 3, 2007), the mixing-zone determination along with groundwater to surface-water interface (GSI) criteria for site-related VOCs. The

mixing zone, allowed by Michigan regulations and granted by MDEQ, allows for groundwater containing VOCs below FAV to discharge, provided the conditions of the mixing-zone determination are met. Specifically, this process entails an evaluation of the concentration and mass flux of VOCs expected to discharge to White Lake.

After receiving the mixing-zone GSI values, DuPont submitted the *Mixing Zone Compliance Monitoring and Contingency Plan*, dated September 11, 2007. This work plan presented the initial program to monitor the mixing zone by installing and performing quarterly sampling of monitoring wells in the mixing zone. In a letter dated August 22, 2008, Michigan Department of Natural Resources and Environment (DNRE) Environmental Resource Management Division (ERMD) requested DuPont clarify how the mixing-zone evaluation would be performed. Specifically, ERMD wanted clarification as to how the mixing-zone concentration would be calculated. DuPont provided the clarification in an October 14, 2008 response letter *Calculation of Flow-Weighted Mean Concentration Groundwater Venting to White Lake.*

After MDEQ approved the evaluation method, DuPont installed the proposed compliance monitoring well system in the 4Q2009. Compliance monitoring includes the sampling of 13 locations. These monitoring wells are plotted in blue in Figure 1-1. Subsequent to the first year of monitoring, MDEQ issued a comment letter on February 1, 2011 providing clarification for how DuPont should implement the evaluation of compliance for the White Lake Mixing Zone (WLMZ). The evaluation presented in this report follows the guidance provided in the February 1, 2011 letter.

1.3 Report Purpose and Organization

The purpose of this document is to present the technical approach and procedures used to evaluate the site VOC plume in the vicinity of White Lake, discuss the quarterly analytical data results, evaluate the significance of the results, and, make recommendations for future evaluation. The remainder of this report is organized as followings:

- Section 2.0 provides the technical approach and data collection methods.
- Section 3.0 details the evaluation of the compliance monitoring well data, including the calculation of the mass flux to the WLMZ.
- Section 4.0 summarizes the findings.
- Section 5.0 lists the references cited in this report.

2.0 Technical Approach

This section describes the approach followed in evaluating the WLMZ and a description of the data collected to confirm compliance.

2.1 Compliance Monitoring Criteria

As previously noted in Section 1.2, MDEQ provided DuPont acceptable concentration limits for discharges to White Lake for the constituents identified in the DuPont October 13, 2006 request. In MDEQ's August 2007 approval letter, MDEQ refers to Table 1 containing "recommended mixing-zone-based GSI values." The mixing-zone-based GSI criteria in the table consisted of two values: acute and chronic.

MDEQ provided clarification to the assessment of the WLMZ in a comment letter dated February 1, 2011 (*Mixing Zone Implementation*). MDEQ noted the following:

1. No single wells can exceed the acute criteria concentration based limits.
2. If the concentration in all compliance monitoring wells is below the chronic criteria concentrations, the WLMZ would be in compliance.
3. If one or more of the GSI compliance wells exceed the chronic criteria concentrations, the concentrations can be evaluated statistically.
4. Compliance with the WLMZ can also be based on meeting the chronic mass loading limits (which were provided in the February 1, 2011 letter).

Mixing-zone-based GSI values and mass flux loading limits are summarized in Table 2-1 for the following three constituents [hereafter referred to as mixing-zone constituents of potential concern (COPCs)]: carbon tetrachloride, tetrachloroethylene (PCE), and 1,1,2-trichlorotrifluoroethane (CFC-113). Generic GSI values (March 2011 version) are also provided in the table as a point of comparison for other VOCs monitored in site groundwater. As noted in MDEQ's August 2007 approval letter, other analytes included in the mixing-zone request were not deemed a concern by MDEQ for the GSI pathway.

2.1.1 Acute GSI Values

Acute GSI criteria are calculated as maximum concentrations that are not to be exceeded at any of the GSI monitoring points to prevent harm to aquatic life. Dilution is not considered with acute criteria.

MDEQ provided acute GSI criteria for two of the three mixing-zone COPCs: PCE and CFC-113. A value was not provided for carbon tetrachloride. The values for PCE and CFC-113 are considered protective of aquatic life and are consistent with those found in the Part 31, Rule 57 Water Quality Values spreadsheet available on the MDEQ web page (http://www.michigan.gov/deq, select Water, Water Quality Monitoring, Assessment of Michigan Waters, Rule 57 Water Quality Values). Therefore, the FAV listed in the May 2010 MDEQ water quality standards table has been referenced in Table 2-1 as an acute mixing-zone-based GSI value for carbon tetrachloride. This was done for completeness

because carbon tetrachloride was detected in three of the White Lake Property (WLP) monitoring wells.

Compliance with GSI criteria that are based on acute toxicity must be demonstrated on a point-by-point basis as emphasized in the February 1, 2011 MDEQ comment letter (i.e., no averaging).

2.1.2 Chronic Mixing-Zone-Based GSI Values

Chronic mixing-zone-based GSI criteria are calculated based on dilution of the maximum discharge flow of venting groundwater and the allocated low flow value of the receiving surface water. GSI values are developed to be protective of aquatic life, human health, or wildlife.

Based on the specific conditions at the site, MDEQ provided chronic mixing-zone-based GSI criteria for all three mixing-zone COPCs: carbon tetrachloride, PCE, and CFC-113. As noted earlier, other analytes included in the mixing-zone request were determined by MDEQ to not be a concern for this pathway.

Chronic mixing-zone-based GSI criteria are to be used to either statistically evaluate the Upper Confidence Limit (UCL) concentration of the plume discharging OR the mass flux of plume constituents that is discharging to White Lake.

2.1.3 Mass Flux Loading Limits

In addition to the chronic mixing-zone-based GSI concentrations, MDEQ also provided mass loading limits to be compared against if any of the compliance monitoring wells exceed the chronic mixing-zone criteria. Chronic mass loading limits for the WLMZ were provided to DuPont by MDEQ in the February 1, 2011 comment letter. These mass loading limits were developed by the DNRE specifically for the WLMZ. In the comment letter, DNRE recommended that the mass flux of each constituent parameter be calculated separately, and DNRE provided an example of the calculation. These chronic mass loading limits are shown in Table 2-1.

2.2 Data Used in the Evaluation

To perform the mass flux calculation discussed in Section 2.1.3, two categories of data were needed: hydrogeologic data to describe the physical dimensions of the flow zones and concentration data across the portion of the plume outside the capture zone. Hydrogeologic data used in the mass flux calculations are detailed in Sections 2.2.1, 2.2.2, and 2.2.3. Concentration data are detailed in Sections 2.2.4 and 2.2.5.

2.2.1 Input from the Groundwater Model

As shown in Figure 1-1 and subsequent figures where applicable, the site groundwater model was used to predict the extent of the pump-and-treat system's hydraulic capture zone. As noted in the February 1, 2011 MDEQ comment letter, groundwater elevation data collected in May 2010 agree with the model-predicted capture zone. The edge of the capture zone is displayed in Figure 1-1 with an orange dashed line and is based on the

particle tracks shown in light gray. The particle tracks each represent the simulated motion of a hypothetical particle traveling with groundwater flow as predicted using MODFLOW and MODPATH.

The capture zone is a result of the hydraulic influence from four interceptor wells: IW-01, IW-05, IW-06, and IW-07. The modeled extent of the capture zone has been used to set the boundaries of the WLMZ because groundwater within the capture zone will not discharge to White Lake. As shown in Figure 1-1, the MWWLP-04 monitoring well cluster is within the capture zone and is therefore not considered part of the mixing zone. The boundaries of the WLMZ are further discussed in Section 3.0.

In the work plan, there was consideration of using modeled flow velocities for the mass flux calculation; however, this report uses the actual, field-measured water elevation data to perform this calculation. This approach is believed to be more accurate because it uses actual, measured potentiometric surface results.

2.2.2 Input from Cone Penetrometer Testing and Monitoring Well Lithology

The geology of the Montague site is generally composed of unconsolidated sand and gravel with occasional silty layers. Conceptually, this is a single aquifer. However, there is some stratification as a result of the variation in these layers. While not barriers to vertical flow, the stratification is believed to have an influence on the migration pathway of site-related constituents in groundwater.

Because the purpose of this monitoring network is to evaluate migration of site-related constituents in groundwater, cone penetrometer tests (CPTs) were performed in the area to determine appropriate screen intervals for the compliance monitoring wells. Based on the CPT data, initial screened intervals were selected to avoid fine-grained zones and screen across gravel zones where CPT sampling had confirmed site-related constituents were present.

During installation of the WLP and Lake Shore Drive (LSD) compliance monitoring wells, the deep well was drilled first and sampled continuously to provide a confirmation of lithology and to allow for the final selection of screened intervals that would best represent a segment of the groundwater flow that is discharging to the WLMZ. Boring logs from the WLP and LSD wells installed in 2009 are included in this report in Appendix A.

2.2.3 Water-Level Measurements

To confirm the groundwater model, groundwater elevations are measured semi-annually. In addition, groundwater elevations are also measured in the compliance monitoring wells and in the White Lake Stilling Well (SG-WL-Intake) during quarterly sampling events. Originally, the staff gauge location measuring White Lake was installed in the lake itself, but the motion of annual ice cover in White Lake destroyed the initial staff gauge during winter 2008-2009. For this reason, in the summer of 2009, a replacement staff gauge (SG-WL-Intake) was installed in the sandy beach sediment next to the site's former surface-water intake sump.

Site-wide groundwater elevations were measured during the first half of 2010 (1H2010) and 2H2010 sampling events. These results are presented in Table 2-2, and the measurements were plotted in Figure 2-1 (1H2010) and Figure 2-2 (2H2010). In general, the groundwater elevations indicate that flow is toward White Lake, and the lines of equal groundwater elevation roughly parallel the shoreline of White Lake. Also notable in both events is a shallow cone-of-depression in the vicinity of the interceptor wells. Although groundwater elevations were measured in IW-06 and IW-07 in 1H2010, these were not directly used for contouring in Figures 2-1 or 2-2 because the water elevation in an operating interceptor well is generally much lower than the elevation of the groundwater in the aquifer adjacent to the well. For that reason, the cone-of-depression is based on nearby monitoring wells.

Most of the well pairs have very similar groundwater elevations (minimal vertical hydraulic gradient). This similarity indicates either a horizontal flow or that the shallow and deep portions of the aquifer are in good hydraulic communication such that the gradient is not measurable. The exception is at MWWLP-03 monitoring well cluster, where the groundwater elevation in the shallow zone is almost a foot lower than the groundwater elevation in the deep zone.

In the 2H2010 event, the elevation of the lake was 578.54 feet, only 0.28 feet lower than the nearby purge performance well (MWWLP-05-100). Groundwater elevations at the two wells in the MWWLP-04 monitoring well cluster were also quite close (578.97 feet and 578.92 feet) to the elevation in MWWLP-05-100 (578.86 feet), indicating that the hydraulic gradient is nearly flat. This flat gradient is assumed to be a result of the effect of interceptor well IW-07, which has induced the cone-of-depression measured by MWWLP-01-125. The groundwater elevation measured at MWWLP-01-125 was 577.33 feet, more than a foot and a half lower than in the above-listed monitoring wells. Likewise, the groundwater elevations from MW-228-80, MW-229-125, and MW-305-135 are all lower than the elevation measured in the White Lake Stilling Well (SG-WL-Intake). These potentiometric elevation data suggest that the natural gradient is reversed and groundwater flow is from White Lake toward the interceptor wells.

As detailed in Figures 2-1 and 2-2, the elevation data collected during the events discussed above support the groundwater model prediction that the modifications made to the pump-and-treat system have improved the capture of the groundwater containing site-related constituents. In addition, the capture zone that was predicted by MODFLOW and MODPATH modeling is accurate based on field-collected data. No adjustments to the groundwater model are needed.

2.2.4 Quarterly Compliance Well and Semiannual Sampling

Compliance groundwater monitoring includes the sampling of 10 compliance monitoring wells, the two MWWLP-04 monitoring wells, and one purge performance well. The proposed initial frequency of the sampling was quarterly for the first two years (until the end of 2011).

Since the installation of the compliance monitoring wells in 4Q2009, these wells have been sampled each quarter for VOCs. Table 2-3 presents the analytical results for the mixing-zone COPCs (carbon tetrachloride, PCE, and CFC-113) to be evaluated further in

Section 3.0. Appendix B presents a table of results for the past five quarters of data (4Q2009 to 4Q2010) for the other VOCs included in the monitoring program and their comparison to the generic GSI values listed in Table 2-1. As detailed in Appendix B, none of these VOCs were detected above generic GSI values. Laboratory reports from the five quarterly sampling events are included as Appendix C.

In addition to the quarterly compliance well sampling, the site-wide semiannual data have also been used to better understand the plumes characteristics. Table 2-3 includes VOC results from MW-225-60, MWWLP-01-125, and MWWLP-05-100 (the purge performance well). Results from these wells are included as a reference because of their proximity to the mixing zone. Results from Table 2-3 were posted in Figures 2-3 through 2-8 (post maps) and in Figures 2-9 through 2-14 (cross sections), which are discussed below.

Constituent Post Maps

Figures 2-3 and 2-4 display the results for carbon tetrachloride in groundwater near White Lake for the 2Q2010 and 4Q2010 sampling events (these events included the 1H2010 and 2H2010 semiannual data). As shown in the figures, carbon tetrachloride was detected in wells along the western edge of the plume (IW-07, MWWLP-01-125, MWWLP-03-80, and the MWWLP-04 cluster).

Figures 2-5 and 2-6 display the results for PCE. Groundwater containing PCE extends further east than the carbon tetrachloride, which is still detectable in the LSD wells. The highest concentration was in groundwater from monitoring well MWWLP-01-125, immediately next to IW-07. The western edge of detectable PCE is between the MWWLP-03 and MWWLP-04 well clusters. The eastern edge of the PCE is near the MWLSD-02 well cluster.

Figures 2-7 and 2-8 display the results for CFC-113. Concentrations of CFC-113 were detectable in both events across the plume area from the MWWLP-02 well cluster to the MW-LSD-03 cluster. The fact that CFC-113 is detectable across both flow gates confirms that the layout of the monitoring network is adequate for evaluating the WLMZ.

Constituent Cross Sections

Figure 1-1 displays the location of two cross sections that were constructed using boring logs from the 2009 compliance wells, neighboring monitoring wells, and previously performed CPTs. Figures 2-9 through 2-11 present the cross sections constructed across the WLP side of the WLMZ for carbon tetrachloride, PCE, and CFC-113. Similarly, Figures 2-12 through 2-14 present the cross sections constructed across the LSD side of the WLMZ for the same constituents. Results from quarterly groundwater sampling events are plotted next to each well's screen interval. In addition to the results from the monitoring well samples, the results from the September 2009 CPTs are shown for comparison on the WLP cross sections, and data from CPTs conducted in October 2007 are shown on the cross sections for the LSD side.

The primary purpose of these cross sections is to graphically display the vertical relationship of depth-discrete samples and to display lithology from the boring logs. On each cross section, the lithology and screened intervals at each well cluster are included

along with the approximate groundwater elevation. Based on the cross sections (see Figures 2-9 through 2-14), the following observations have been made:

- The upper 150 feet of the subsurface is predominantly sand, but occasional silts and clays are present. Concentration data from the CPTs and wells show noticeable variation with depth indicating possible stratification of groundwater flow.
- Concentrations of VOCs in the WLP cross sections tended to decrease with depth. VOC results from CPTs and wells showed that the highest concentrations detected were at ~520 feet mean sea level (MSL) near the MWWLP-03 and MWWLP-04 well clusters. VOC concentrations decrease to the west on the WLP cross sections.
- CFC-113 concentrations on the LSD cross sections increase with depth until about 500 to 520 feet MSL. CFC-113 concentrations decrease to the east. Carbon tetrachloride is not detected on the LSD side, and all of the PCE results have been 38 micrograms per liter (μg/L) or lower.

2.2.5 Results from the MWWLP-04 Well Cluster

As noted in Section 2.2.1, the MWWLP-04 well cluster is within the limits of the capture zone of the pump-and-treat system. This occurred because at the time of location selection, the only available potentiometric surface information to confirm the model prediction was from IW-07 and WLP-01-125 (too far north). For that reason, the location was primarily based on the CPT analytical results, which indicated that the edge of the groundwater containing constituents above the acute criteria was further east than the model had predicted.

After the WLP wells were installed and sampled, the well data revealed differences between the CPT data and the well results. The most notable difference was that concentrations of PCE in samples from MWWLP-04-70 (ranging 580 to 930 μg/L) are higher than the results from the CPT sample data (one detection of 1.2 μg/L).

Because the MWWLP-04 cluster is within the capture zone, it is not unexpected that the VOC concentrations detected at this cluster are higher than in the compliance monitoring wells.

2.3 Mass Flux Loading Calculation Method

Section 2.1 described the criteria provided by MDEQ with which the WLMZ should comply. In the event that one or more of the compliance wells exceed chronic mixing-zone-based GSI values (but none exceed acute criteria), DuPont is permitted to evaluate the well data statistically comparing a UCL against the chronic criteria (provided more than nine results are available) or may use a mass flux approach. This subsection conceptually describes the mass flux calculation.

For the WLMZ mass flux calculation, the plume is conceptually comprised of two sections: a central section and the margins.

- The central section, which is contained by the groundwater pump-and-treat system, has higher VOC concentrations (MW-201-125, MW-225-60, MW-226-120,

MW-229-125, WLP-01-125, MWWLP-04-70, MWWLP-04-105, MWWLP-05-100, and IW-01, IW-05, IW-06, and IW-07).

- The margins, which are not contained by the groundwater pump-and-treat system, have lower VOC concentrations. These plume margins are referred to collectively as the WLMZ. The four WLP wells (well clusters MWWLP-02 and MWWLP-03) comprise the western side of the mixing zone, and the six LSD wells (clusters MWLSD-01, MWLSD-02, and MWLSD-03) comprise the eastern side of the mixing zone.

The calculation of the mass flux to the WLMZ was performed as follows:

1. The WLMZ was sub-divided into cross-sectional areas perpendicular to groundwater flow (see Figure 2-15). Each of these areas is referred to as a well segment (shown in medium blue). Each well segment is represented by a single monitoring well that is screened in that interval. Samples collected from that well represent the groundwater quality of that well segment.
2. Based on the lithology and groundwater elevation, the top and bottom elevation of each sub-section was determined for each well segment (see Figure 2-16). Some gaps are present between the well segments where silty zones were identified in the boring logs. Width of the well segments were determined by constructing a flow net using the particle tracks from the MODPATH model and using the particle track midway between the wells as the boundary of the well segment. Figure 2-15 displays the well segments as designed using the flow net approach. This approach bounds each well segment with an upgradient and downgradient boundaries that are the potentiometric surface lines intercepting two of the compliance monitoring wells. The width of each well segment is determined across the yellow lines in Figure 2-15; these lines run mid-way through each segment.
3. The cross-sectional flow of each well segment was then calculated (expressed first in cubic feet per day, then converted to liters per day). Flow is calculated using the hydraulic gradient for individual well segments based on groundwater elevations measurements, an assumed hydraulic conductivity of 110 feet per day (this estimate is from historic pump testing and is comparable to the value used in the calibrated groundwater model), and the cross-sectional area for the well segment. Hydraulic gradient was determined along each of the orange lines in Figure 2-15. The length of the orange line is Δl, and the difference in groundwater elevation (Δh) is determined at the upgradient and downgradient boundary of the well segment – from the wells at those boundaries. The cross-sectional area for each well segment is shown in Figure 2-16. Note that for the evaluation of Δh, groundwater elevations from four deep cluster wells are used to estimate the hydraulic gradient on each side of the mixing zone. The data from the deeper wells have been used assuming that the potentiometric surface in the deeper portion of the aquifer is less subject to fluctuations. As additional potentiometric data are collected from these wells, this assumption will be revisited.

Well ID	Description
MWWLP-02-145	Upgradient groundwater elevation for the WLP side
MWWLP-03-120	Downgradient groundwater elevation for the WLP side
MWLSD-03-124	Upgradient groundwater elevation for the LSD side
MWLSD-01-130	Downgradient groundwater elevation for the LSD side

4. The cross-sectional flow from each well segment is then multiplied by the associated groundwater concentration for that well segment. After each of these terms is added together, the resulting value is the mass flux (expressed initially in units of μg per day, converted to pounds per day).

Results of the mixing-zone calculations are presented in Section 3.3.

3.0 Evaluation of Compliance Well Data

This section describes the results of the compliance well monitoring data evaluation.

3.1 Evaluation - Acute Criteria

According to the evaluation flow chart provided by MDEQ in the February 1, 2011 comment letter, the first step in evaluating the results from the compliance monitoring wells is to confirm that none of the results has exceeded the acute mixing-zone-based GSI criteria (the acute criteria were discussed in Section 2.1.1 and are displayed in Table 2-1). Table 3-1 presents a summary of the data evaluation and is divided into three sections. The uppermost section displays maximum concentrations from the compliance monitoring wells by constituent for each of the five quarterly sampling events conducted to date. Acute mixing-zone-based GSI criteria are listed for comparison. As shown in Table 3-1, none of the results from the compliance monitoring wells have exceeded the acute criteria; therefore, the evaluation proceeds to the comparison against the chronic criteria.

3.2 Evaluation – Chronic Criteria

The second step in evaluating the compliance monitoring well results is to compare the results against the chronic mixing-zone-based GSI criteria. The middle section of Table 3-1 compares the maximum detected concentrations to the chronic mixing-zone-based GSI criteria. In reviewing Table 3-1, only one constituent (carbon tetrachloride) exceeded the chronic criteria in one sampling event – 4Q2010. According to the flow chart, this indicates that the results from the other quarters demonstrate compliance of the WLMZ and only the 4Q2010 event data need further evaluation.

3.3 Evaluation – Chronic Mass Loading

Based on the evaluation presented in Section 3.2, further evaluation of the compliance well data is only needed for the 4Q2010 event data. Data from the 4Q2010 were therefore evaluated for mass flux following the process described in Section 2.3 and the February 1, 2011 MDEQ letter.

Appendix D presents the calculations for mass flux. The cross sectional area of each well segment is calculated, and hydraulic gradient calculations are performed using groundwater elevations from Table 2-2. After the groundwater flux is estimated through each well segment, the mass flux is determined and summarized for each constituent (labeled as "Total Mass Fluxes:" on the spreadsheet).

Based on the data calculated in Appendix D, the following observations have been made:

- Most of the calculated CFC-113 contribution is from the well segments represented by MWLSD-01-130 and MWLSD-02-127. Minor contribution comes from MWWLP-03-80 and MWLSD-03-124.

- MWWLP-03-80 is the only compliance monitoring well that has detectable carbon tetrachloride (MWWLP-04 is excluded for reasons stated in Section 2.2.1). The calculated contributions from other well segments are based on one-half the detection limit.
- Most of the calculated contribution of PCE is from the well segment represented by compliance monitoring well MWLSD-01-130. Minor calculated contributions are from well segments MWLSD-01-80 and MWLSD-02-127.

The lowermost section of Table 3-1 presents the summary of the mass loading calculations. Mass loading results for all three mixing-zone COPCs are below the chronic mass loading criteria confirming that the WLMZ is in compliance.

4.0 Summary of Findings

As detailed in this report, quarterly groundwater sampling conducted since 4Q2009 has demonstrated that the WLMZ is in compliance. None of the results for the three mixing-zone COPCs (carbon tetrachloride, PCE, and CFC-113) from the WLMZ compliance monitoring wells exceeded the acute mixing-zone-based GSI criteria. Only one mixing-zone COPC (carbon tetrachloride) exceeded the chronic mixing-zone-based GSI criteria. The exceedance was observed in one location (MWWLP-03-80) during one sampling event (4Q2010). However, chronic mass loading criteria were not exceeded.

Additional findings from this report are as follows:

- Groundwater elevation measurements have confirmed that the model-predicted capture zone is accurate. No adjustments are needed.
- Sampling of groundwater using CPTs and monitoring wells has confirmed the plume margins for each of the three mixing-zone COPCs.
- Well cluster MWWLP-04 is within the demonstrated capture zone of the groundwater pump-and-treat system and is not part of the WLMZ. Data from this well cluster have shown that PCE-containing groundwater may be constrained on the western (or WLP side) of the plume to the interval monitored by MWWLP-04-70.
- Other VOCs detected (as detailed in Appendix B) in the compliance monitoring wells were below generic GSI values and do not need further evaluation.

4.1 Recommendations

As concluded above, data collected during the first five quarterly monitoring events support mixing-zone compliance. It is recommended that quarterly monitoring continue to complete the planned two years of monitoring. Following the eighth quarterly monitoring event in 3Q2011, a follow-up evaluation of the mixing-zone concentrations will be conducted to determine if any trends are present or if the mixing-zone concentrations are stable. Based on that evaluation, the compliance monitoring well sampling frequency may be adjusted.

5.0 References

DuPont Corporate Remediation Group (CRG). 2008. *Calculation of Flow-Weighted Mean Concentration Groundwater Venting to White Lake.* October 14, 2008.

DuPont CRG. 2007. *Mixing Zone Compliance Monitoring and Contingency Plan,* September 11, 2007.

DuPont CRG. 2006a *Groundwater Flow Model: DuPont Montague Works: Montague Michigan* dated September 17, 2006.

DuPont CRG. 2006b *Request to Implement Enhanced Groundwater Pump and Treat System.*, dated October 13, 2006.

MDEQ. 2011. Comment Letter *Mixing Zone Implementation.* February 1, 2011.

MDEQ. May 2010. Part 31, Rule 57 Water Quality Values, MDEQ web page (http://www.michigan.gov/deq), May 2010.

MDEQ. 2008. Comment Letter *re: Mixing Zone Compliance Monitoring and Contingency Plan.* August 22, 2008.

MDEQ. 2007a. *Groundwater Flow Model and Request to Implement Enhanced Groundwater Pump and Treat System; DuPont Montague Facility*, June 5, 2007.

MDEQ. 2007b. *Mixing Zone Implementation; DuPont Montague Works, White Lake,* August 3, 2007.

Tables

Table 2-1
Summary of Compliance Monitoring Criteria
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

Analyte	Acute GSI		Chronic Mixing-Zone Based GSI		
	Concentration (ug/L)	Mass Flux Loading Limit (lbs per day)	Concentration (ug/L)	Mass Flux Loading Limit (lbs per day)	Generic GSI Value**
Constituents with Mixing-Zone GSIs from MDEQ					
1,1,2-TRICHLOROTRIFLUOROETHANE	570	0.28	350	0.17	-
CARBON TETRACHLORIDE	1400 *	nr	45	0.02	-
TETRACHLOROETHYLENE	2900	1.4	60	0.03	-
Other Consitituents Detected					
1,1,1-TRICHLOROETHANE	-	-	-	-	200
1,1-DICHLOROETHANE	-	-	-	-	740
BENZENE	-	-	-	-	200
CHLOROFORM	-	-	-	-	170
CIS-1,2 DICHLOROETHENE	-	-	-	-	620
DICHLORODIFLUOROMETHANE	-	-	-	-	ID
METHYLENE CHLORIDE	-	-	-	-	940
TOLUENE	-	-	-	-	140
TRANS-1,2-DICHLOROETHENE	-	-	-	-	1500
TRICHLOROETHENE	-	-	-	-	200
TRICHLOROFLUOROMETHANE	-	-	-	-	-

Units in ug/L
*: Based on Final Acute Value provided in May 2010 2010 Rule 57 Water Quality Values spreadsheet available on the MDEQ web page http://www.michigan.gov/deq.
**: Generic GSI values are from March 2011. Water Quality Values web page, maintained by MDEQ.
ID: Insufficient data to derive value
-: Not available.
nr: No reasonable potential to exceed water quality stanards.

Table 2-2
Groundwater Elevations for 2010
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

Location	Top of Casing Elv (ft MSL)	Depth to Water (1H2010)	Groundwater Elevation (1H2010)	Depth to Water (2H2010)	Groundwater Elevation (2H2010)
IW-6	628.24	61.60	566.64	NA: well operating	NA
IW-7	625.89	67.30	558.59	NA: well operating	NA
MW-201-125	632.21	53.54	578.67	52.51	579.70
MW-206-40	641.77	40.30	601.47	40.85	600.92
MW-210-120	639.76	42.28	597.48	42.76	597.00
MW-210-80	639.77	40.39	599.38	40.85	598.92
MW-211-60	643.06	42.59	600.47	42.59	600.47
MW-211-80	642.73	42.15	600.58	42.51	600.22
MW-212-120	638.03	41.67	596.36	42.00	596.03
MW-214-60	636.13	40.01	596.12	40.42	595.71
MW-220-60	633.45	46.89	586.56	47.28	586.17
MW-225-60	629.92	49.41	580.51	49.60	580.32
MW-226-120	629.75	50.75	579.00	51.14	578.61
MW-228-80	629.61	52.77	576.84	53.03	576.58
MW-229-125	627.67	49.49	578.18	49.95	577.72
MW-301-125	633.68	49.69	583.99	50.14	583.54
MW-302-130	632.83	50.63	582.20	51.09	581.74
MW-303-125	632.03	51.45	580.58	51.85	580.18
MW-304-123	629.15	50.20	578.95	50.65	578.50
MW-305-135	629.59	51.46	578.13	51.99	577.60
MW-595	635.14	49.51	585.63	49.81	585.33
MWLSD-01-130	630.48	48.92	581.56	49.39	581.09
MWLSD-01-80	630.49	49.10	581.39	49.39	581.10
MWLSD-02-127	630.23	48.57	581.66	49.05	581.18
MWLSD-02-80	629.86	48.44	581.42	48.44	581.42
MWLSD-03-124	631.10	48.91	582.19	49.41	581.69
MWLSD-03-80	630.67	48.84	581.83	48.94	581.73
MWWLP-02-145	624.55	44.56	579.99	44.88	579.67
MWWLP-02-85	625.16	45.32	579.84	45.67	579.49
MWWLP-03-120	594.53	14.88	579.65	15.27	579.26
MWWLP-03-80	593.80	14.86	578.94	15.47	578.33
MWWLP-04-105	594.64	15.21	579.43	15.72	578.92
MWWLP-04-70	594.58	15.09	579.49	15.61	578.97
MWWLP-05-100	587.34	7.92	579.42	8.48	578.86
OCT-1	631.30	48.43	582.87	48.80	582.50
WLP-1-125	626.67	48.89	577.78	49.34	577.33
SG-WL-Intake	590.39	NA (not collected)	NA	11.85	578.54

NA: measurement not available

Table 2-3
VOC Results for Mixing Zone Compliance and Nearby Wells
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

	Analyte Units		CARBON TETRACHLORIDE UG/L	TETRACHLORO ETHYLENE UG/L	1,1,2-TRICHLORO TRIFLUOROETHANE UG/L
Location	**Date**		UG/L	UG/L	UG/L
MW-225-60	10/20/09	FS	< 1	< 0.8	< 2
MW-225-60	5/10/10	FS	< 1	< 0.8	< 2
MW-225-60	11/3/10	FS	< 1	< 0.8	< 2
MW-LSD-01-80	12/14/09	FS	< 1	5	< 2
MW-LSD-01-80	2/23/10	FS	< 1	8	< 2
MW-LSD-01-80	5/14/10	FS	< 1	8	< 2
MW-LSD-01-80	8/6/10	FS	< 1	6	< 2
MW-LSD-01-80	11/2/10	FS	< 1	7	< 2
MW-LSD-01-130	12/14/09	FS	< 1	26	160
MW-LSD-01-130	2/23/10	FS	< 1	34	160
MW-LSD-01-130	5/14/10	FS	< 1	38	210
MW-LSD-01-130	8/6/10	FS	< 1	23	180
MW-LSD-01-130	11/2/10	FS	< 1	27	170
MW-LSD-02-80	12/14/09	FS	< 1	< 0.8	< 2
MW-LSD-02-80	2/23/10	FS	< 1	< 0.8	< 2
MW-LSD-02-80	5/14/10	FS	< 1	< 0.8	< 2
MW-LSD-02-80	8/6/10	FS	< 1	< 0.8	< 2
MW-LSD-02-80	11/2/10	FS	< 1	< 0.8	< 2
MW-LSD-02-127	12/14/09	FS	< 1	4 J	110
MW-LSD-02-127	2/23/10	FS	< 1	5	130
MW-LSD-02-127	5/14/10	FS	< 1	5	120
MW-LSD-02-127	8/6/10	FS	< 1	4 J	160
MW-LSD-02-127	11/2/10	FS	< 1	5	200
MW-LSD-03-80	12/14/09	FS	< 1	< 0.8	< 2
MW-LSD-03-80	2/23/10	FS	< 1	< 0.8	< 2
MW-LSD-03-80	5/14/10	FS	< 1	< 0.8	< 2
MW-LSD-03-80	8/6/10	FS	< 1	< 0.8	< 2
MW-LSD-03-80	11/2/10	FS	< 1	< 0.8	< 2
MW-LSD-03-124	12/14/09	FS	< 1	< 0.8	21
MW-LSD-03-124	2/23/10	FS	< 1	< 0.8	16
MW-LSD-03-124	5/14/10	FS	< 1	< 0.8	17
MW-LSD-03-124	8/6/10	FS	< 1	< 0.8	18
MW-LSD-03-124	11/2/10	FS	< 1	< 0.8	12
MW-WLP-02-85	12/15/09	FS	< 1	< 0.8	3 J
MW-WLP-02-85	2/24/10	FS	< 1	< 0.8	< 2
MW-WLP-02-85	5/14/10	FS	< 1	< 0.8	3 J
MW-WLP-02-85	8/5/10	FS	< 1	< 0.8	< 2
MW-WLP-02-85	11/1/10	FS	< 1	< 0.8	2 J
MW-WLP-02-145	12/15/09	FS	< 1	< 0.8	< 2
MW-WLP-02-145	2/24/10	FS	< 1	< 0.8	2 J
MW-WLP-02-145	5/14/10	FS	< 1	< 0.8	< 2
MW-WLP-02-145	8/5/10	FS	< 1	< 0.8	< 2
MW-WLP-02-145	11/1/10	FS	< 1	< 0.8	< 2
MW-WLP-03-80	12/15/09	DUP	28	< 0.8	95
MW-WLP-03-80	12/15/09	FS	28	< 0.8	100
MW-WLP-03-80	2/24/10	FS	27	< 0.8	84

Table 2-3
VOC Results for Mixing Zone Compliance and Nearby Wells
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

	Analyte		CARBON TETRACHLORIDE	TETRACHLORO ETHYLENE	1,1,2-TRICHLORO TRIFLUOROETHANE
	Units		UG/L	UG/L	UG/L
Location	Date		UG/L	UG/L	UG/L
MW-WLP-03-80	5/14/10	FS	44	< 0.8	120
MW-WLP-03-80	8/5/10	FS	31	< 0.8	110
MW-WLP-03-80	11/1/10	FS	48	< 0.8	190
MW-WLP-03-120	12/15/09	FS	< 1	< 0.8	< 2
MW-WLP-03-120	2/24/10	FS	< 1	< 0.8	< 2
MW-WLP-03-120	5/14/10	FS	2 J	< 0.8	11
MW-WLP-03-120	8/5/10	FS	< 1	< 0.8	7 J
MW-WLP-03-120	11/1/10	FS	< 1	< 0.8	5 J
MW-WLP-04-70	12/15/09	FS	190	930	490
MW-WLP-04-70	2/24/10	DUP	180	1000	440
MW-WLP-04-70	2/24/10	FS	180	960	430
MW-WLP-04-70	5/14/10	DUP	190	890	410
MW-WLP-04-70	5/14/10	FS	190	850	390
MW-WLP-04-70	8/5/10	DUP	120	610	290
MW-WLP-04-70	8/5/10	FS	120	580	270
MW-WLP-04-70	11/1/10	DUP	150	590	410
MW-WLP-04-70	11/1/10	FS	160	620	400
MW-WLP-04-105	12/15/09	FS	35	< 0.8	230
MW-WLP-04-105	2/24/10	FS	17	1 J	110
MW-WLP-04-105	5/14/10	FS	38	0.9 J	190
MW-WLP-04-105	8/5/10	FS	24	< 0.8	140
MW-WLP-04-105	11/1/10	FS	44	< 0.8	160
MW-WLP-05-100	12/15/09	FS	< 1	< 0.8	11
MW-WLP-05-100	2/24/10	FS	< 1	< 0.8	6 J
MW-WLP-05-100	5/14/10	FS	< 1	< 0.8	20
MW-WLP-05-100	8/5/10	FS	< 1	< 0.8	18
MW-WLP-05-100	11/1/10	FS	< 1	< 0.8	23
WLP-1	4/14/09	FS	64	2200	450
WLP-1	12/15/09	FS	67	2200	480
WLP-1	5/11/10	FS	93	3500	720
WLP-1	11/2/10	FS	59	2200	390

Table 3-1
Mixing Zone Compliance Evaluation
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

Evaluation - Acute Criteria			
	Carbon tetrachloride (ug/L)	Tetrachloroethene (ug/L)	1,1,2-trichloro, trifluoroethane (ug/L)
Acute GSI	*1400* [1]	*2900*	*570*
Maximum concentration in mixing zone wells (excludes wells within capture zone) (expressed in ug/L).			
2009 Q4	28	26	160
2010 Q1	27	34	160
2010 Q2	44	38	210
2010 Q3	31	23	180
2010 Q4	48	27	200

Results shown in **bold** exceed the criteria.
RESULT: No wells exceed Acute GSI concentration.
Triggers: evalution of data against Chronic Criteria; site is not in non-compliance.

Evaluation - Chronic Criteria			
	Carbon tetrachloride (ug/L)	Tetrachloroethene (ug/L)	1,1,2-trichloro, trifluoroethane (ug/L)
Chronic Mixing-Zone Based GSI	*45*	*60*	*350*
Maximum concentration in mixing zone wells (excludes wells within capture zone) (expressed in ug/L).			
2009 Q4	28	26	160
2010 Q1	27	34	160
2010 Q2	44	38	210
2010 Q3	31	23	180
2010 Q4	**48**	27	200

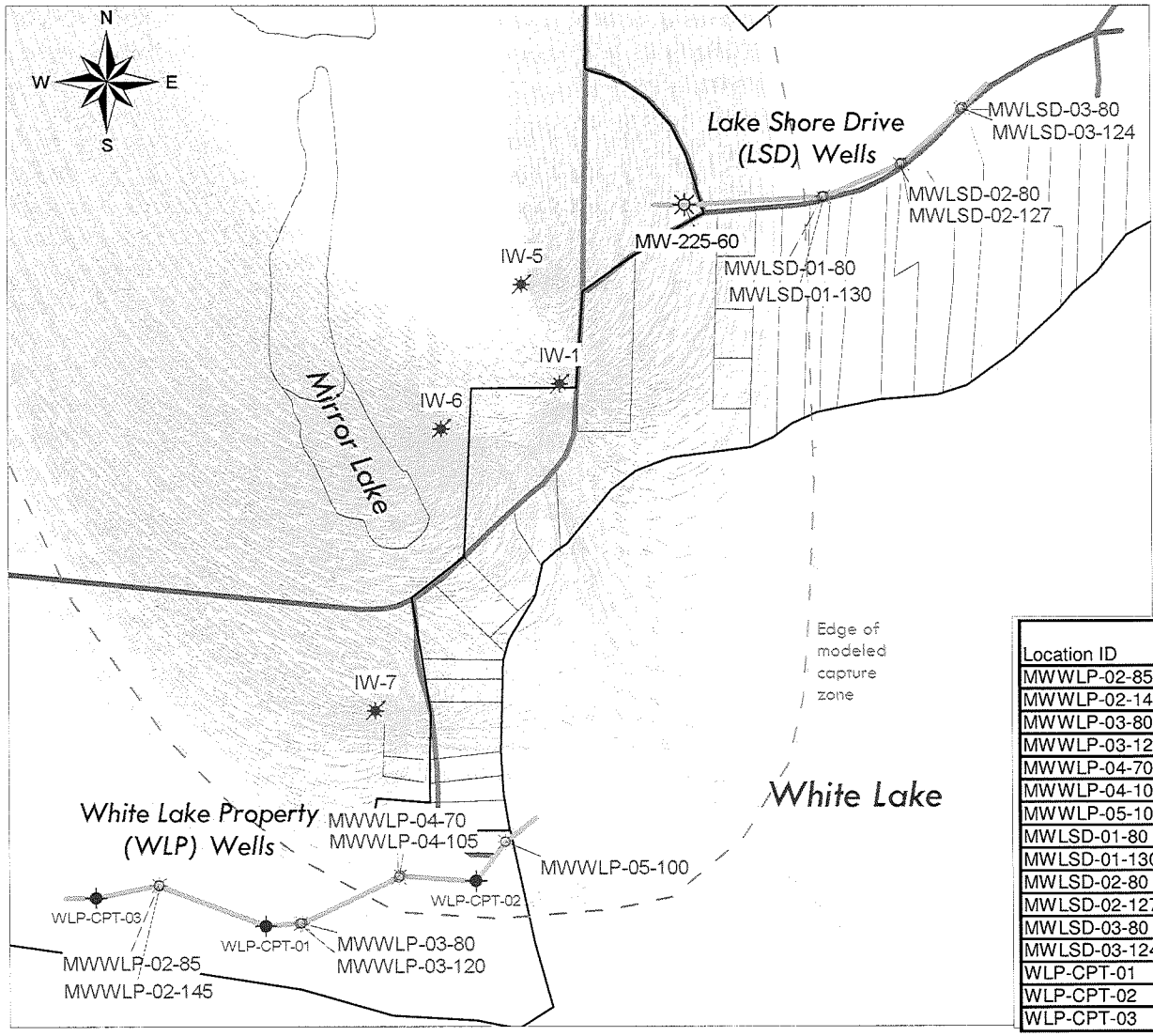
Results shown in **bold** exceed the criteria.
RESULT: Chronic Mixing-Zone Based GSI concentration were exceeded for carbon tetrachloride in Q4 2010.
Triggers Evaluation of Chronic Mass Loading for Q4 2010 event.

Evaluation - Chronic Mass Loading Criteria			
	Carbon tetrachloride (lbs/day)	Tetrachloroethene (lbs/day)	1,1,2-trichloro, trifluoroethane (lbs/day)
Chronic Mass Loading Criteria	*0.020*	*0.030*	*0.170*
Mass loading to White Lake Mixing Zone (expressed in lbs/day)[2]			
2009 4Q	N/A	N/A	N/A
2010 1Q	N/A	N/A	N/A
2010 2Q	N/A	N/A	N/A
2010 3Q	N/A	N/A	N/A
2010 4Q	0.009	0.011	0.132

Results shown in **bold** exceed the criteria.
N/A: Not applicable - Chronic Mixing-Zone Based GSI concentration were not exceeded.
Note: Only the Q4 2010 data set triggered the mass loading evaluation.
RESULT: Chronic Mass Loading criteria have not been exceeded.
Triggers: no further evaluation needed; site is in compliance.

Notes:
Most Mixing Zone criteria were provided by MDEQ, August 1, 2007 (single exception was carbon tetrachloride acute GSI).
[1]: Carbon tetrachloride acute GSI is based on Final Acute Value provided in May 2010 Rule 57 Water Quality Values
[2]: For nondetect results, one-half of the reporting limit is used.
Tetrachloroethene: PCE
1,1,2-trichloro, trifluoroethane: CFC-113

Figures



Legend

- 2009 CPT Location
- Mixing Zone Compliance Monitoring Well
- Interceptor Wells
- Other Monitoring Wells
- Cross Section Locations
- Groundwater Pathlines (MODPATH)

Location ID	Date Installed	X-coordinate	Y-coordinate	Top of casing (elv)	Ground surface (elv)
MWWLP-02-85	11/3/209	12582494.14	691469.4557	625.16	622.44
MWWLP-02-145	11/3/209	12582497.96	691467.1263	624.55	622.13
MWWLP-03-80	10/29/2009	12582968.59	691343.9965	593.8	591.64
MWWLP-03-120	10/27/2009	12582964.3	691340.9367	594.53	591.48
MWWLP-04-70	10/29/2009	12583290.96	691495.4073	594.58	591.78
MWWLP-04-105	10/28/2009	12583295.23	691500.8775	594.64	591.78
MWWLP-05-100	10/28/2009	12583646.75	691613.642	587.34	584.44
MWLSD-01-80	11/10/2009	12584708.66	693760.6678	630.49	630.82
MWLSD-01-130	11/10/2009	12584715.26	693761.7921	630.48	630.85
MWLSD-02-80	11/11/2009	12584968.44	693869.0342	629.86	630.87
MWLSD-02-127	11/11/2009	12584974.13	693872.5914	630.23	630.58
MWLSD-03-80	11/12/2009	12585171.15	694052.9512	630.67	631.34
MWLSD-03-124	11/12/2009	12585175.98	694057.9773	631.1	631.38
WLP-CPT-01	9/10/2009	12582849.54	691333.4819	-	591.15
WLP-CPT-02	9/11/209	12583547.27	691482.4856	-	595.87
WLP-CPT-03	9/14/2009	12582286.84	691428.1049	-	623.55

Note: Groundwater pathlines shown in gray are from Figure 12 of GROUNDWATER FLOW MODEL, September 2006

0' 500' 1000' 1500' 2000'

Base Map from site ARC GIS shapefiles: //Shared/Montague/_GIS/SHPs/InGDB/

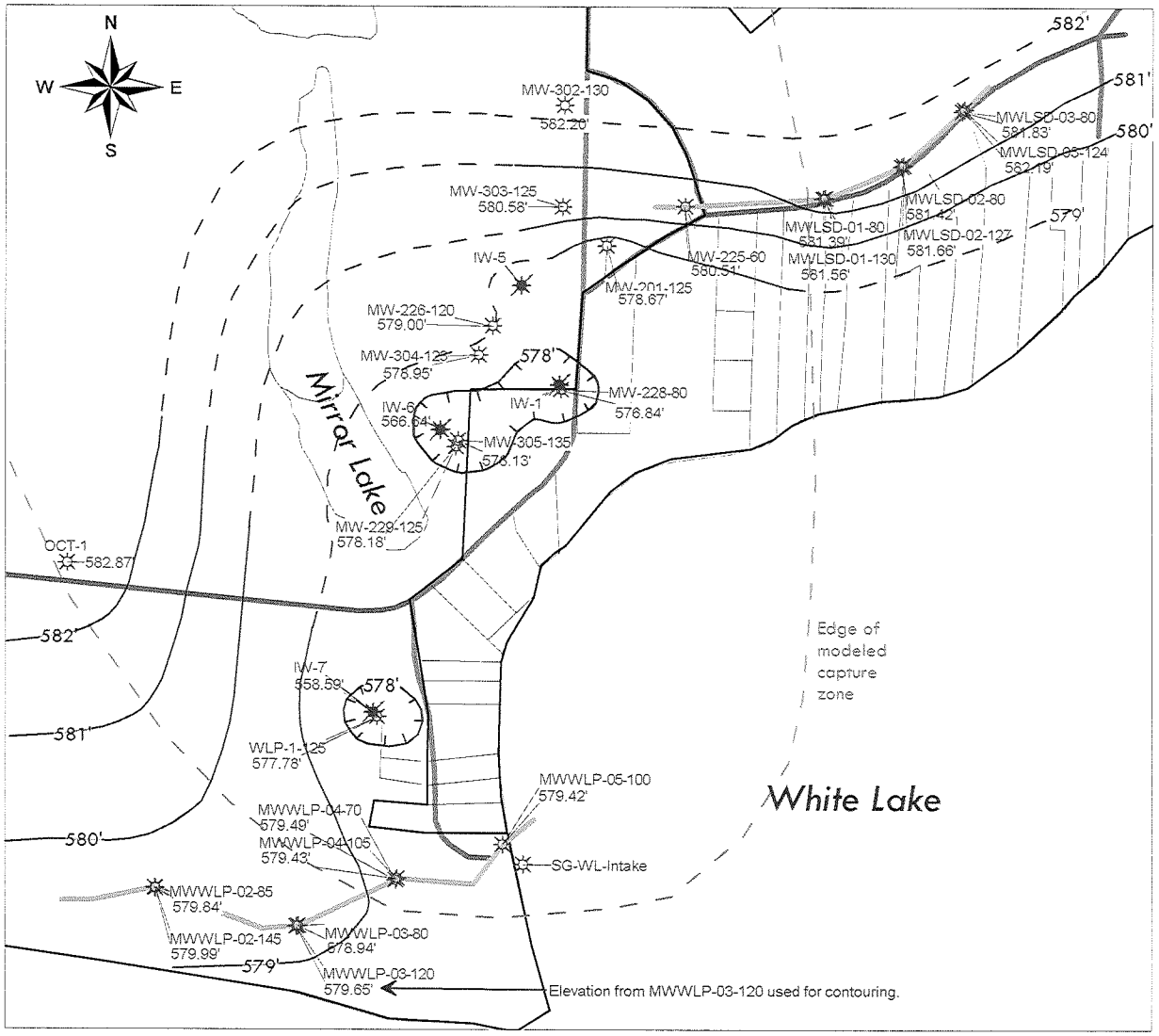
URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
Compliance Monitoring Wells
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:
CHKD:	REV:
DATE: 06/10/2011	

PROJECT NO: 18986005

FIGURE NO: 1-1



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

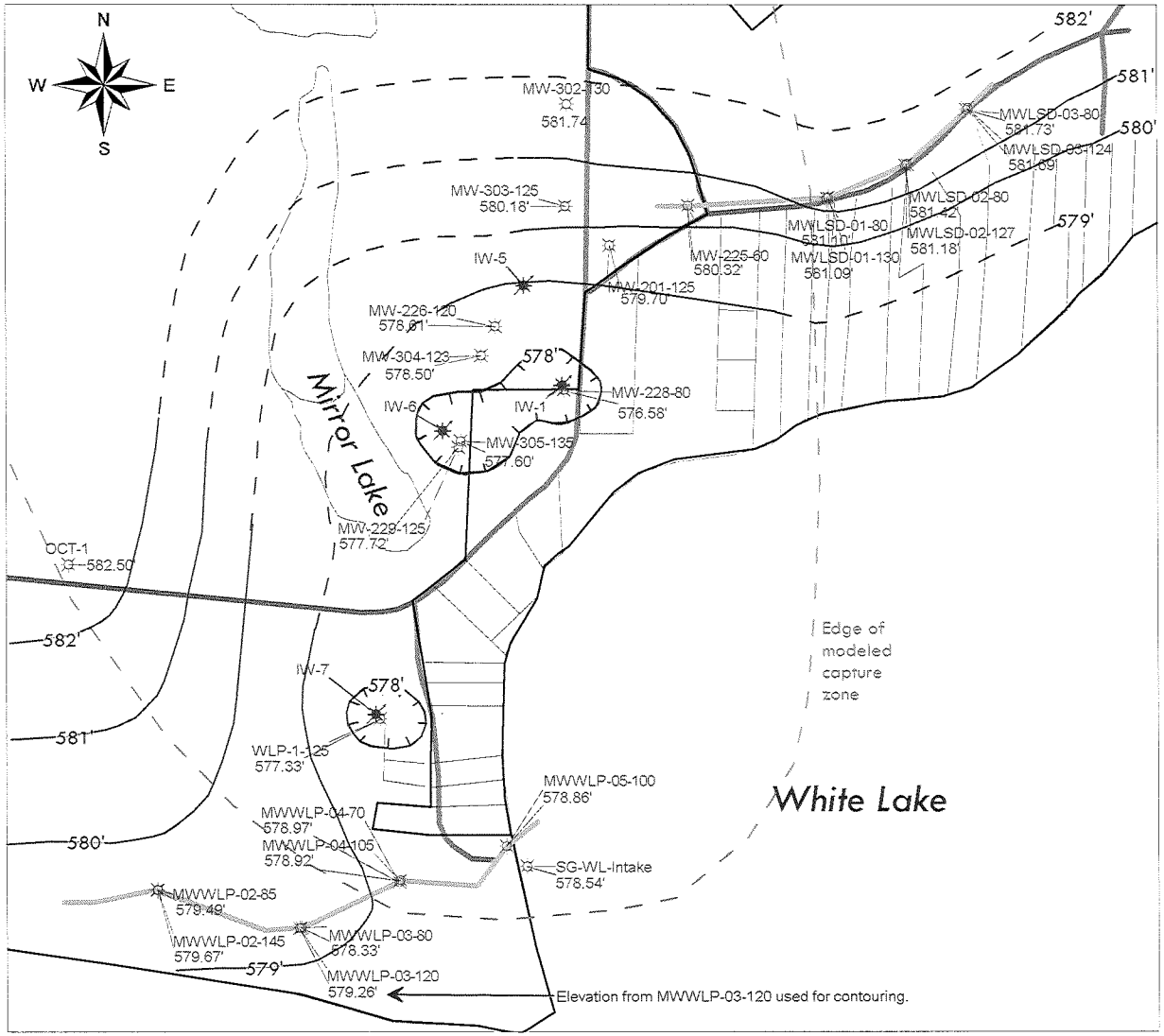
Notes:
Groundwater elevations from IWs are not used for contouring.
Dashed blue lines represent approximated groundwater elevation contours.

Base Map from site ARC GIS shapefiles: //Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
Groundwater Elevations (1H2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-1
DATE: 06/10/2011		



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

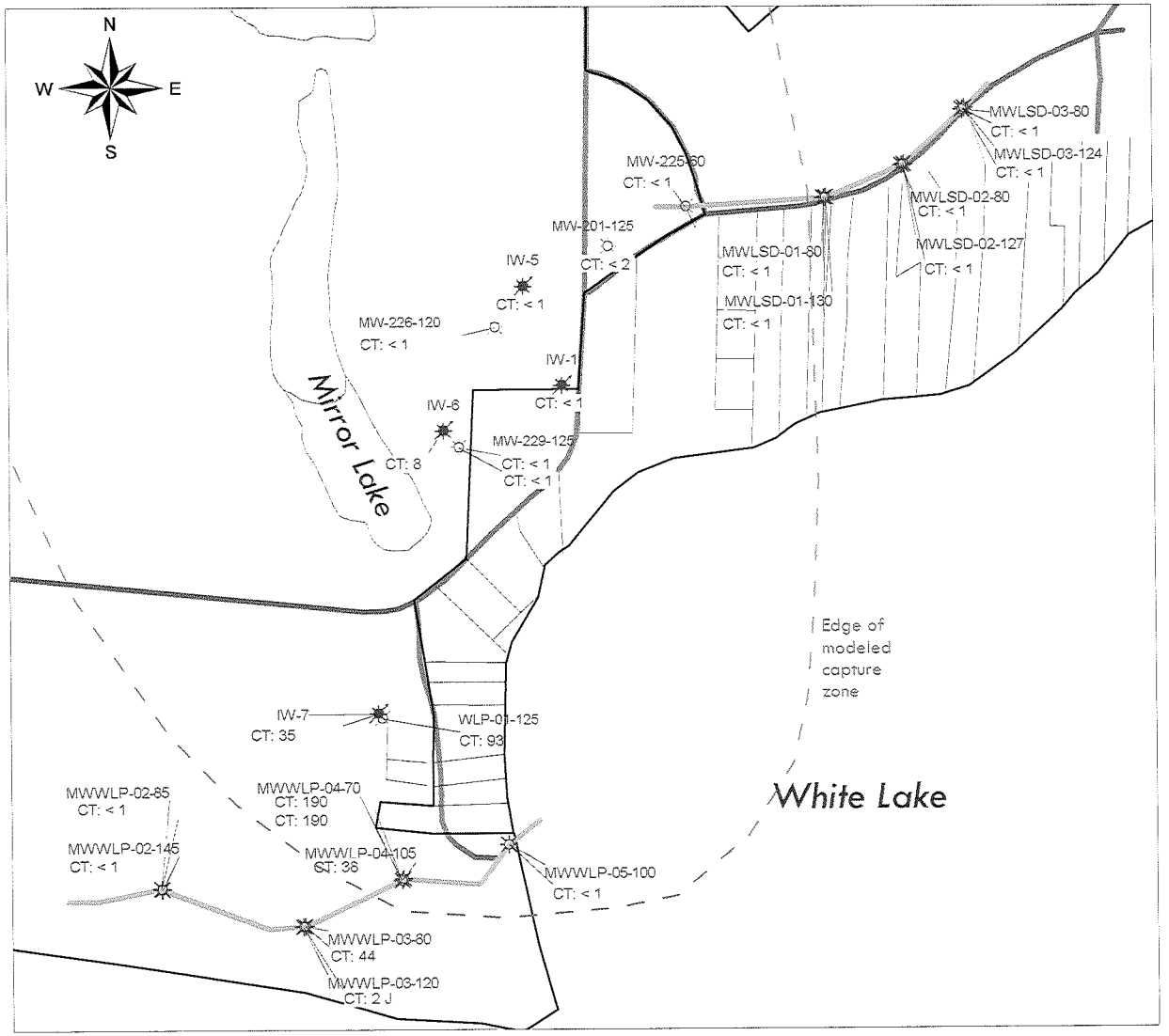
Notes:
Groundwater elevations from IWs are not used for contouring.
Dashed blue lines represent approximated groundwater elevation contours.

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
Groundwater Elevations (2H2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-2
DATE: 06/10/2011		



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

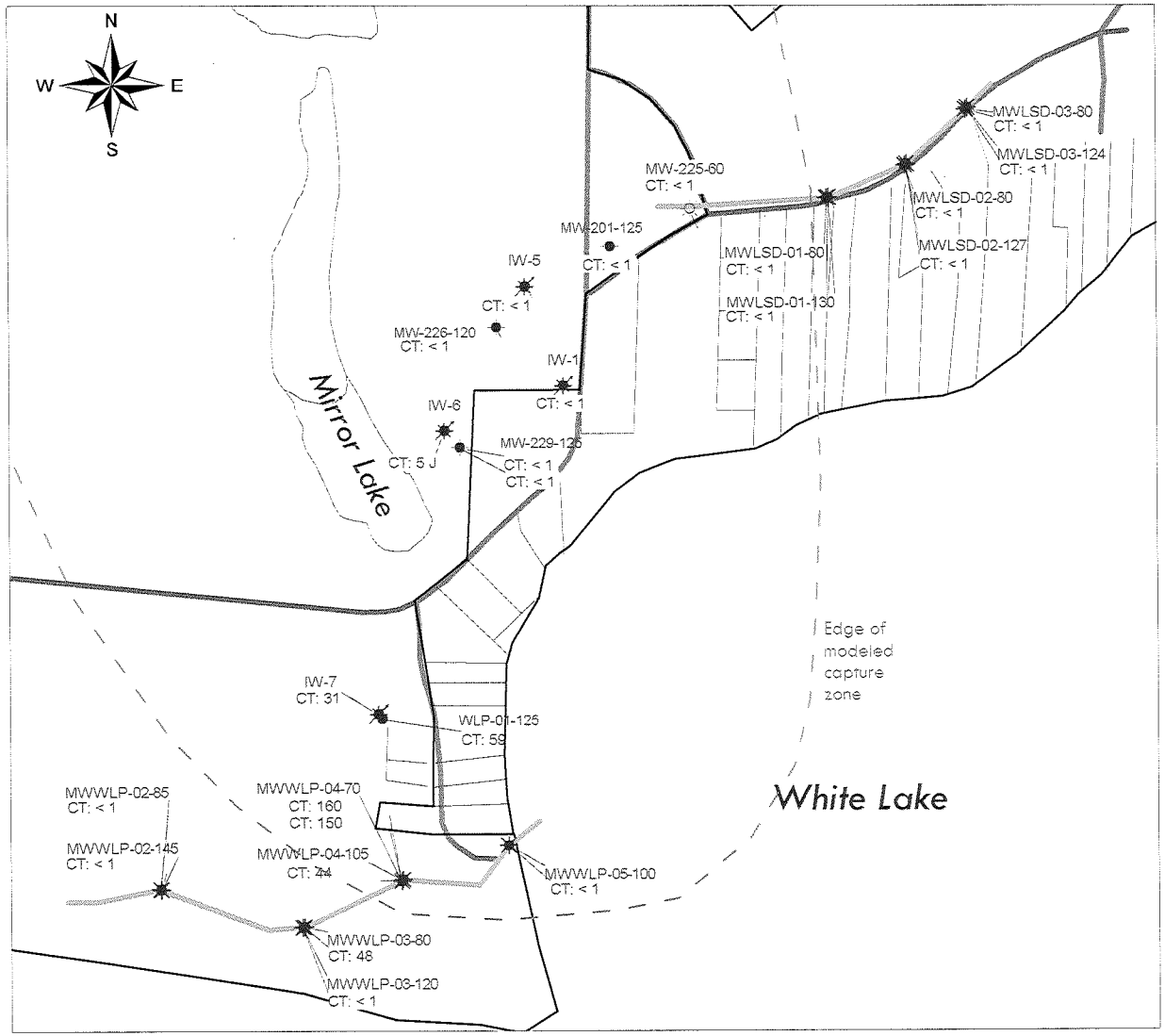
Notes:
Results posted are from May 2010.
Results posted are in ug/L.
CT: Carbon tetrachloride

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
Carbon Tetrachloride Results (2Q2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-3
DATE: 06/10/2011		



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

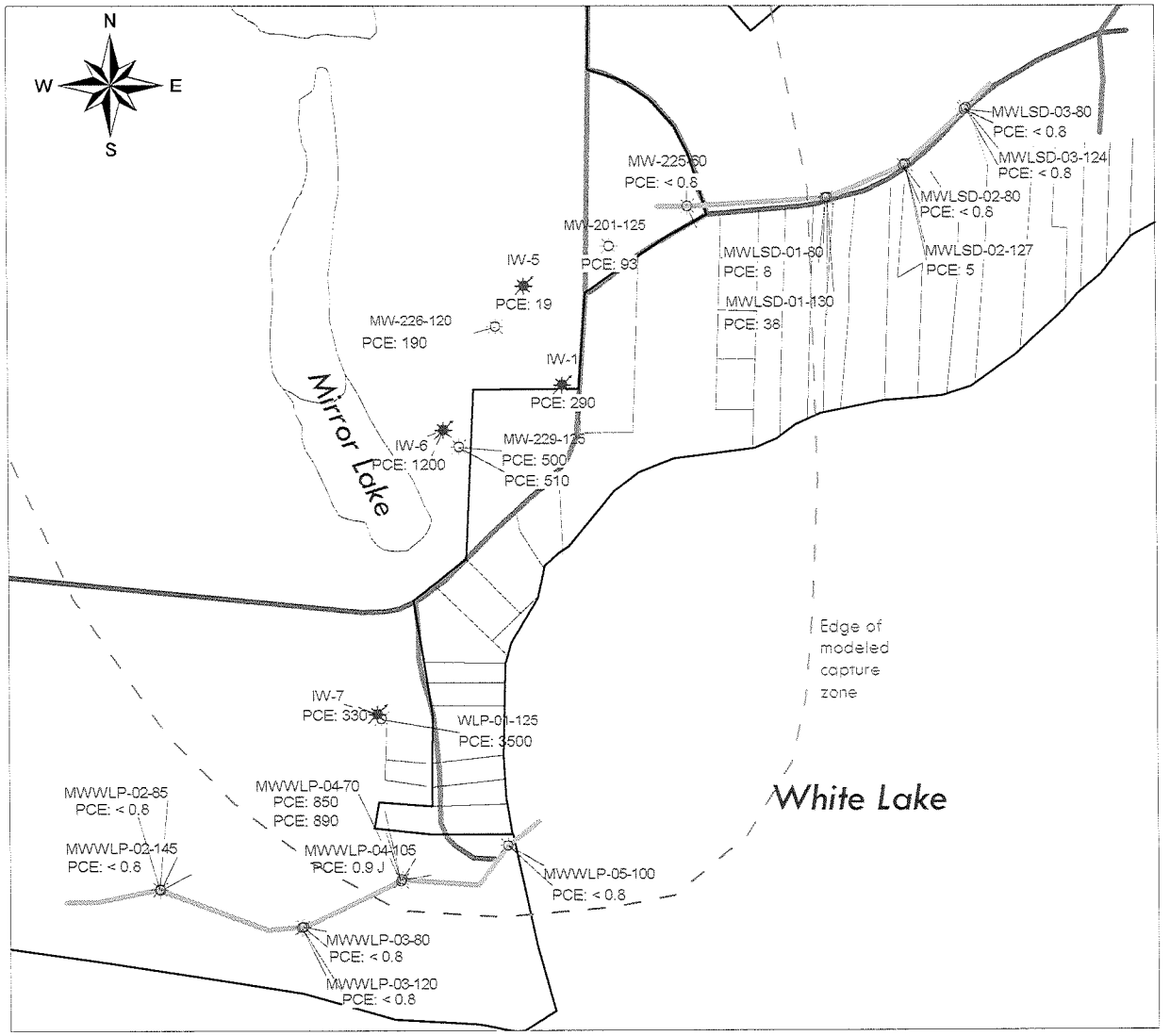
Notes:
Results posted are from November 2010.
Results posted are in ug/L.
CT: Carbon tetrachloride

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
Carbon Tetrachloride Results (4Q2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-4
DATE: 06/10/2011		



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

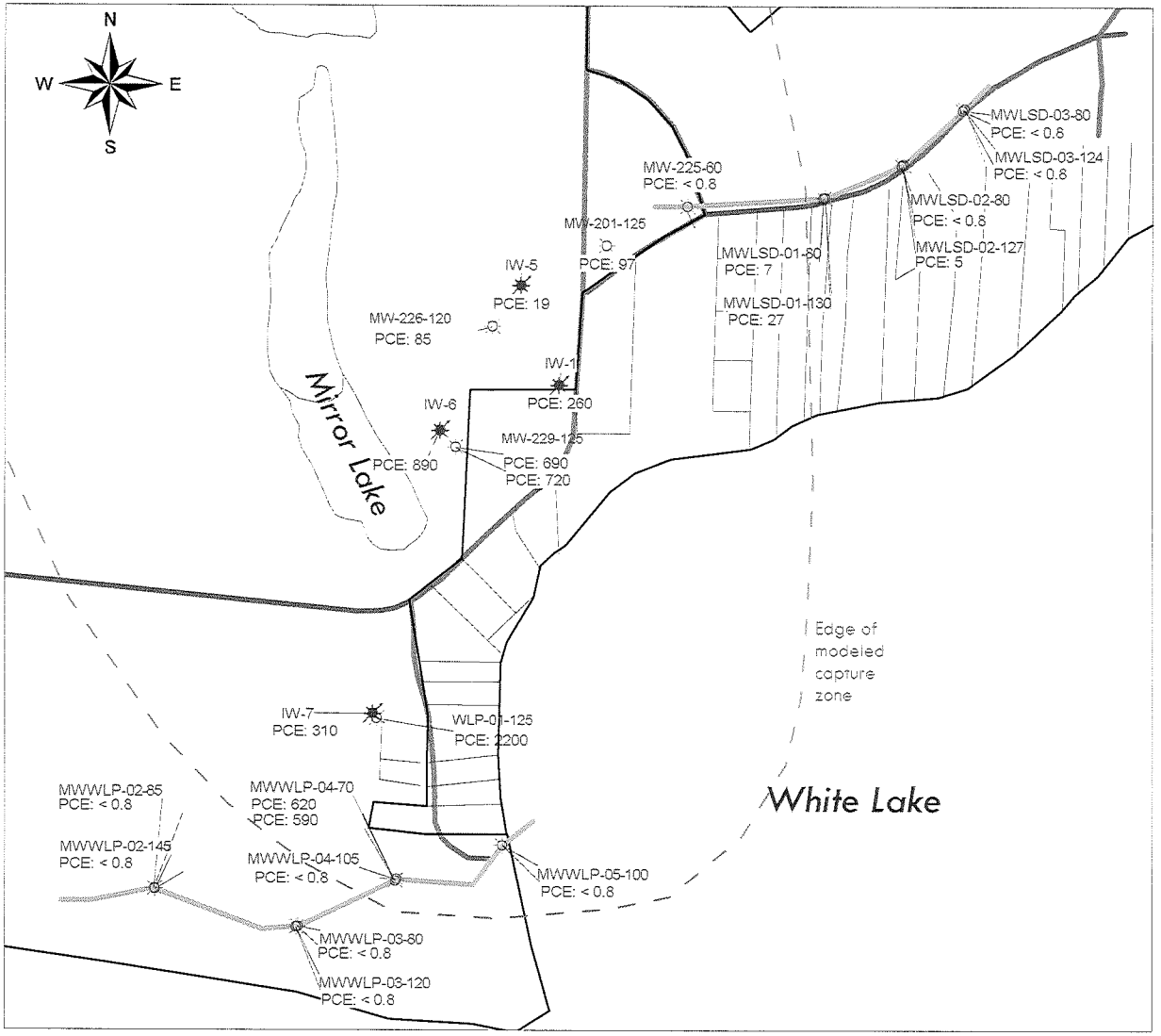
Notes:
Results posted are from May 2010.
Results posted are in ug/L.
PCE: Tetrachloroethene

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
PCE Results (2Q2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-5
DATE: 06/10/2011		



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

Notes:
Results posted are from November 2010.
Results posted are in ug/L.
PCE: Tetrachloroethene

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

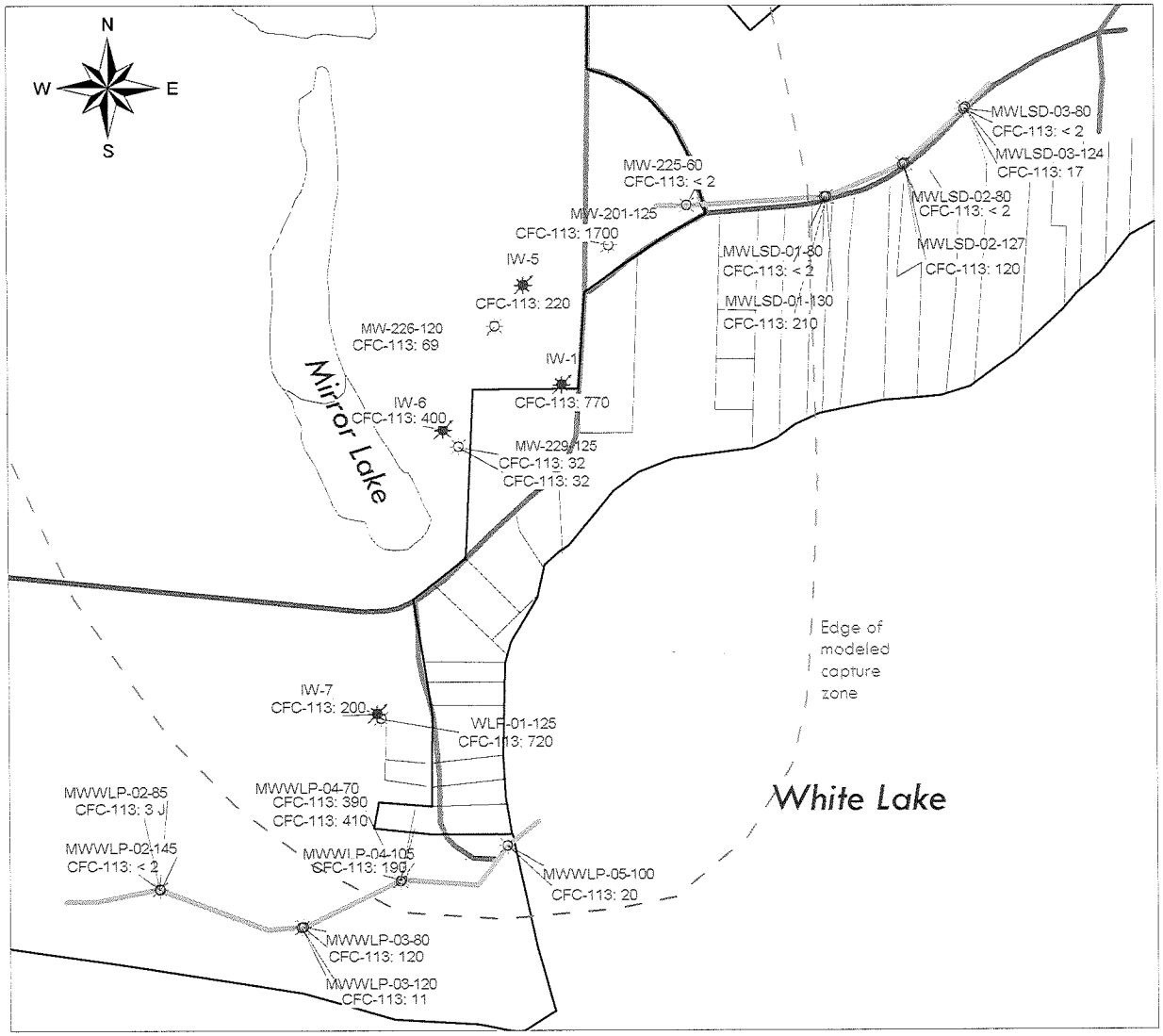
URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
PCE Results (4Q2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:
CHKD:	REV:
DATE: 06/10/2011	

PROJECT NO: 18986005

FIGURE NO: 2-6



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

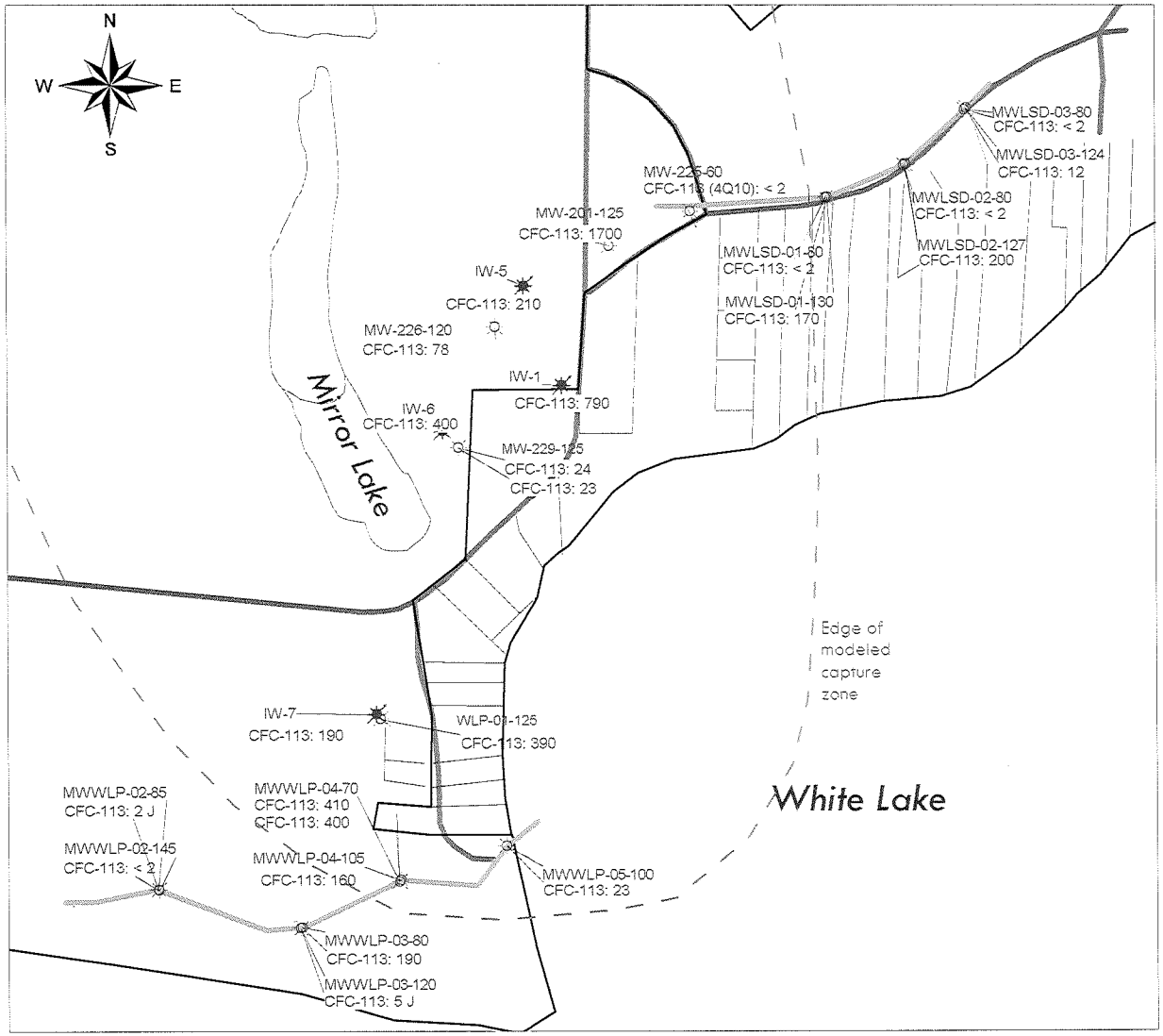
Notes:
Results posted are from May 2010.
Results posted are in ug/L.
CFC-113: Trichlorotrifluoroethane

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
CFC-113 Results (2Q2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-7
DATE: 06/10/2011		



Legend

- Monitoring Wells
- Interceptor Wells
- Cross Section Locations

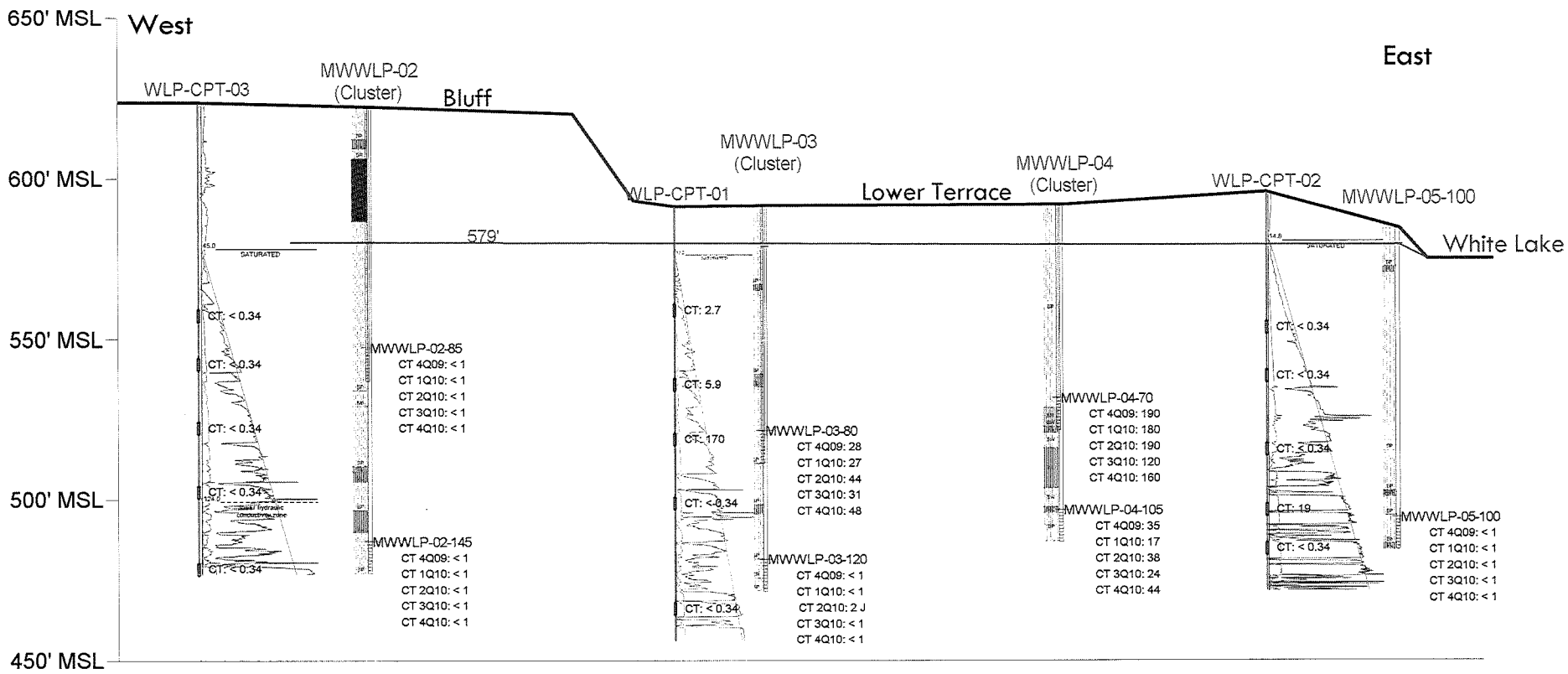
Notes:
Results posted are from November 2010.
Results posted are in ug/L.
CFC-113: Trichlorotrifluoroethane

Base Map from site ARC GIS shapefiles:
//Shared/Montague/_GIS/SHPs/InGDB/

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
CFC-113 Results (4Q2010)
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-8
DATE: 06/10/2011		

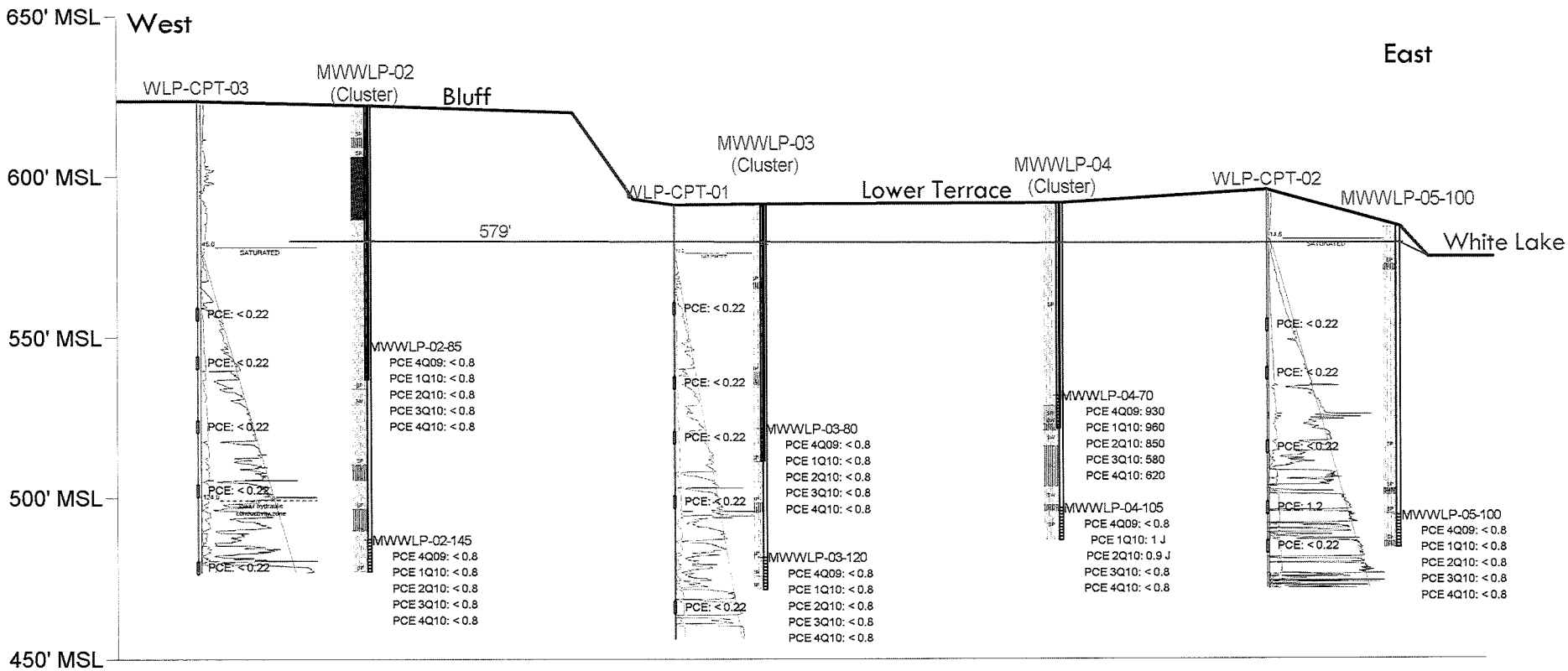


Notes:
Vertical exageration: 4x.
CPT data are from Sep 2009.
Results posted are in ug/L.
CT: Carbon tetrachloride

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
WLP Monitoring Wells - Carbon Tetrachloride Results
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-9
DATE: 06/10/2011		

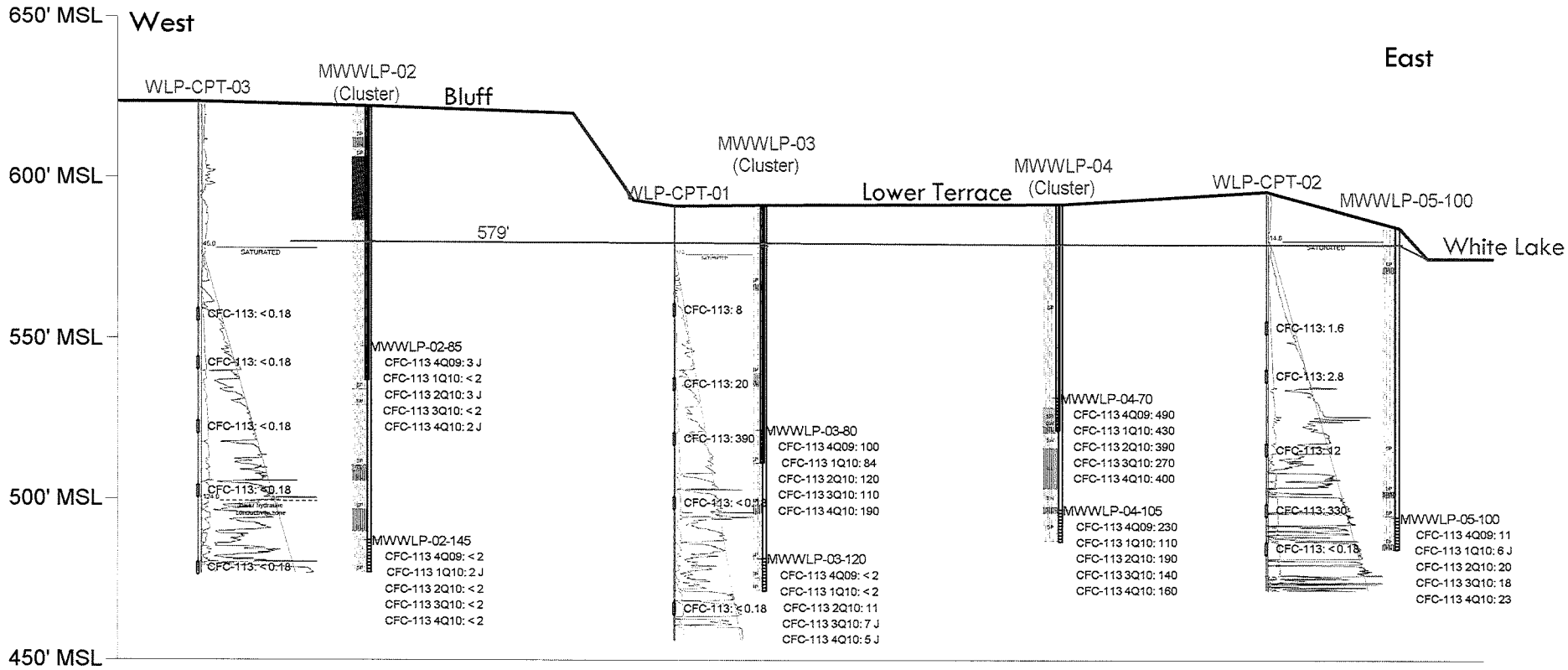


Notes:
Vertical exageration: 4x.
CPT data are from Sep 2009.
Results posted are in ug/L.
PCE: Tetrachloroethene

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
WLP Monitoring Wells - PCE Results
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-10
DATE: 06/10/2011		

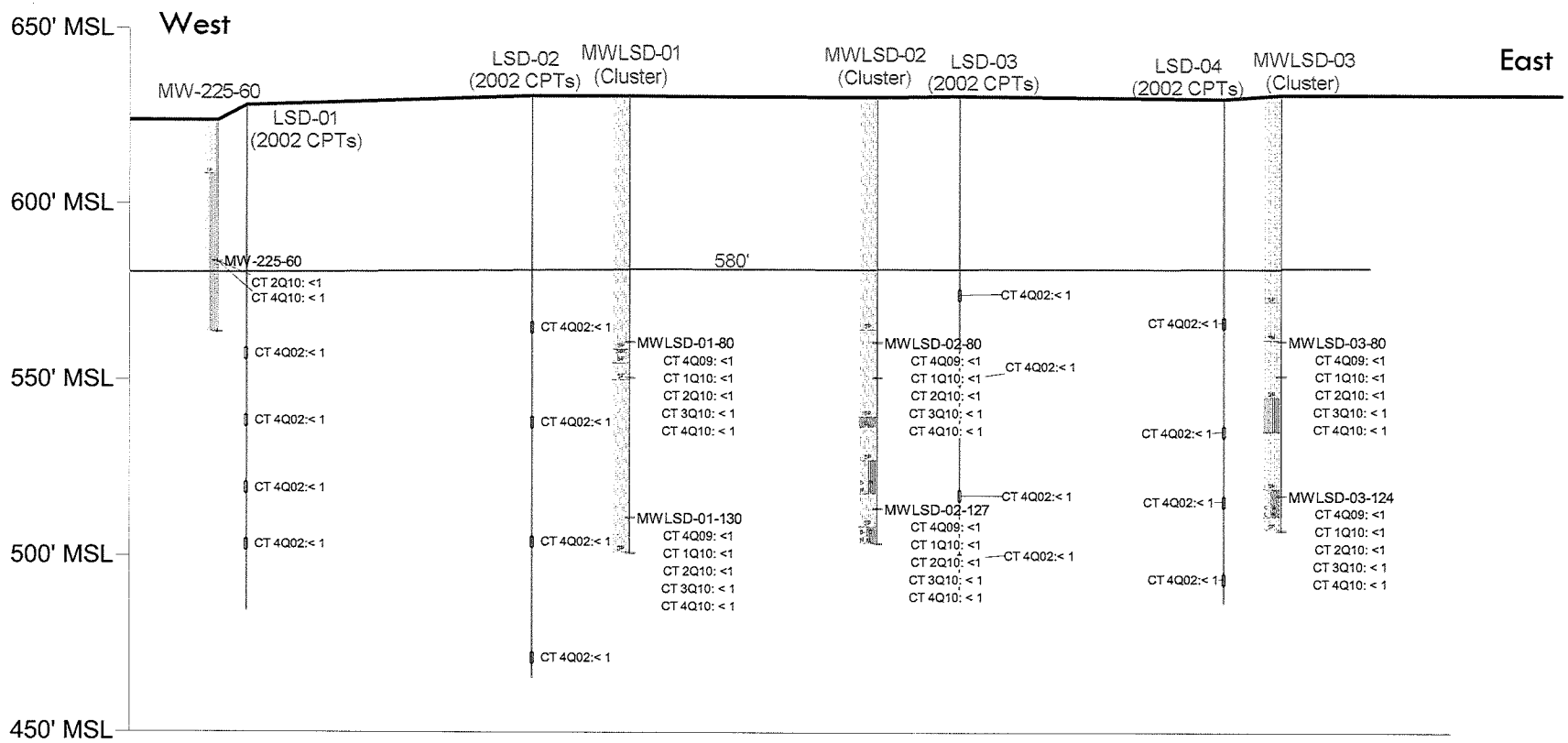


Notes:
Vertical exageration: 4x.
CPT data are from Sep 2009.
Results posted are in ug/L.
CFC-113: Trichlorotrifluoroethane

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
WLP Monitoring Wells - CFC-113 Results
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-11
DATE: 06/10/2011		



Notes:
Vertical exageration: 4x
CPT data are from 4Q 2002.
Results posted are in ug/L.
CT: Carbon tetrachloride

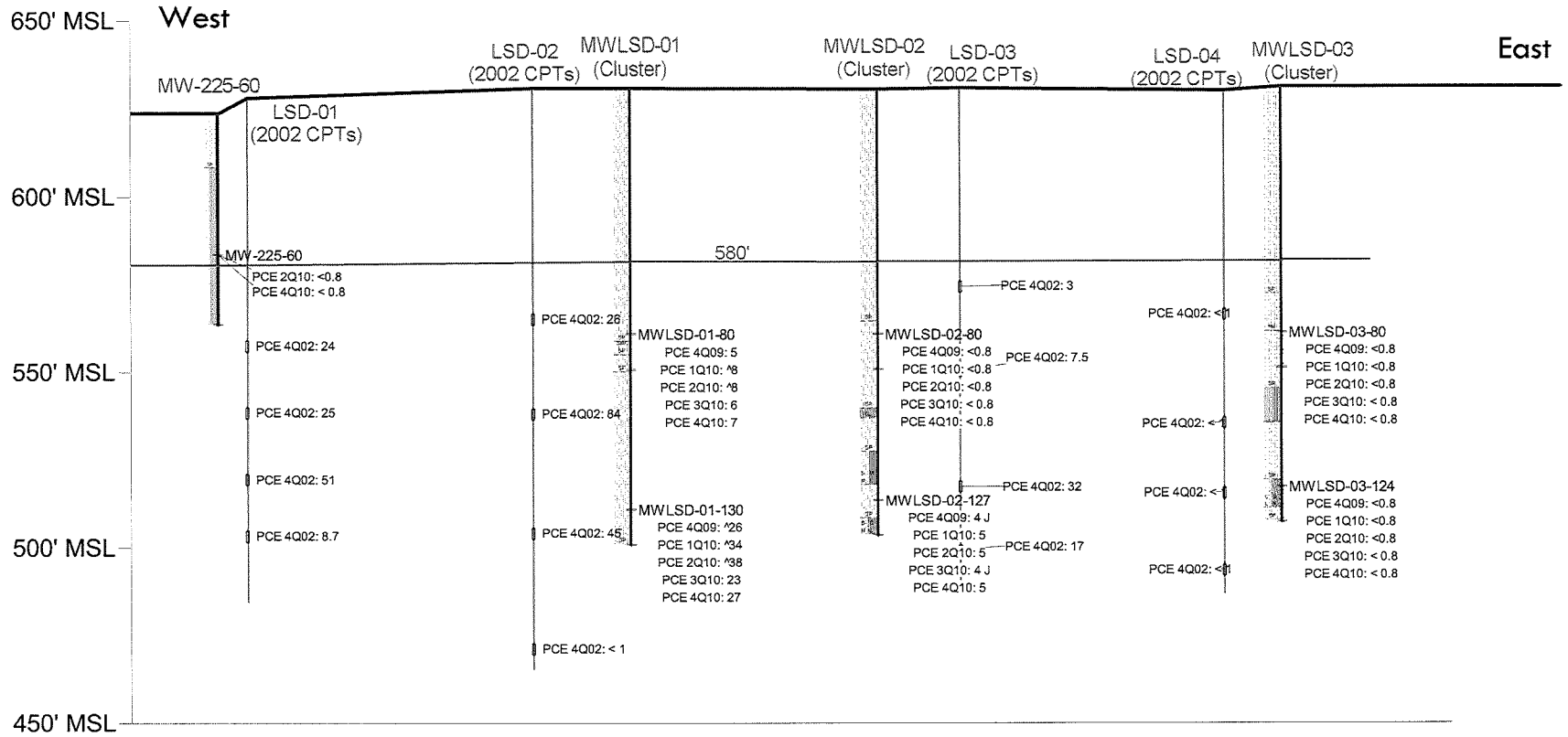
URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
LSD Monitoring Wells - Carbon Tetrachloride Results
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:
CHKD:	REV:
DATE: 06/11/2011	

PROJECT NO: 18986005

FIGURE NO: 2-12



Fine-Med Sand
Silt
Clay-Silty Clay
Coarse Sand-Gravel
Sandstone

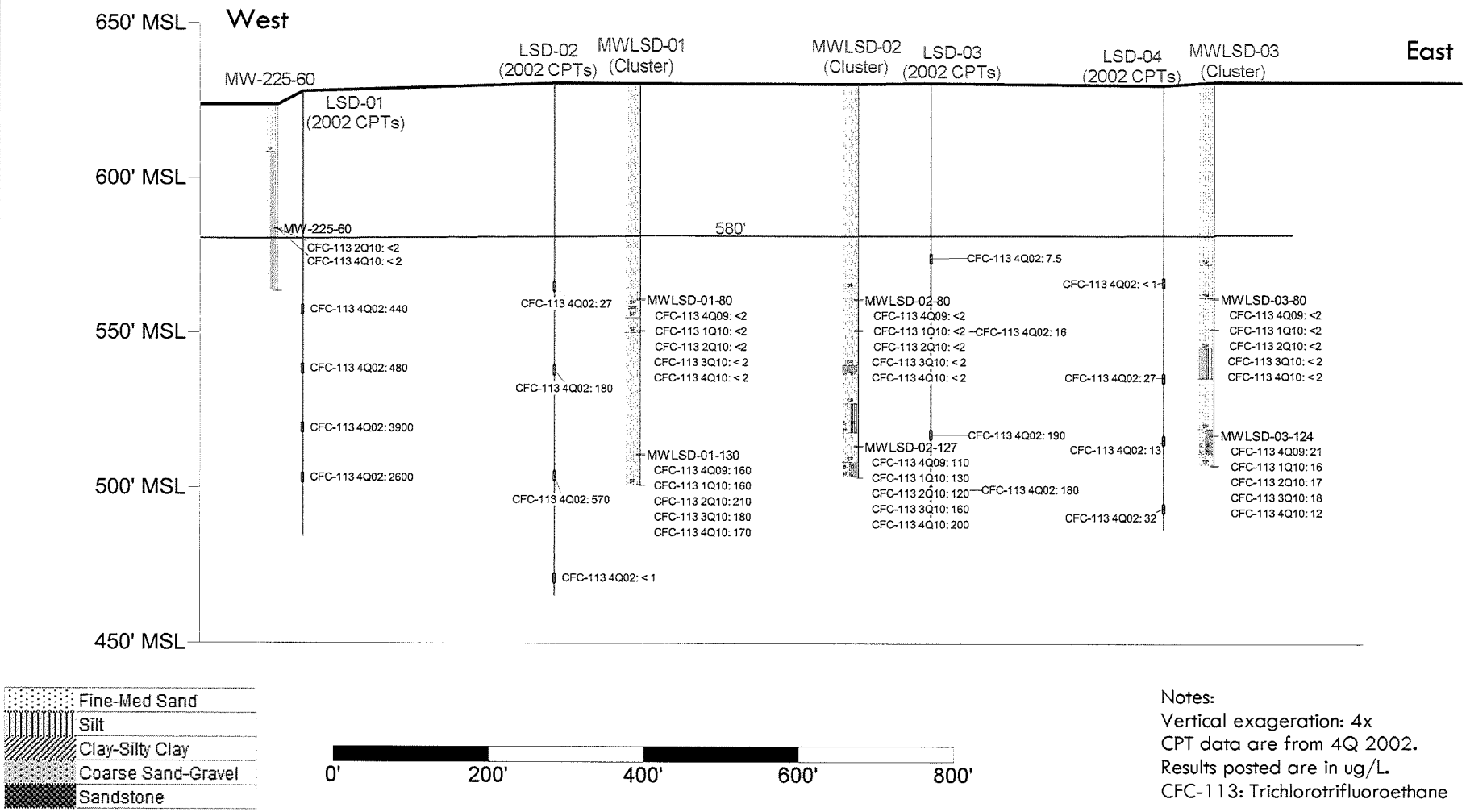
0' 200' 400' 600' 800'

Notes:
Vertical exageration: 4x
CPT data are from 4Q 2002.
Results posted are in ug/L.
PCE: Tetrachloroethene

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
LSD Monitoring Wells - PCE Results
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-13
DATE: 06/11/2011		

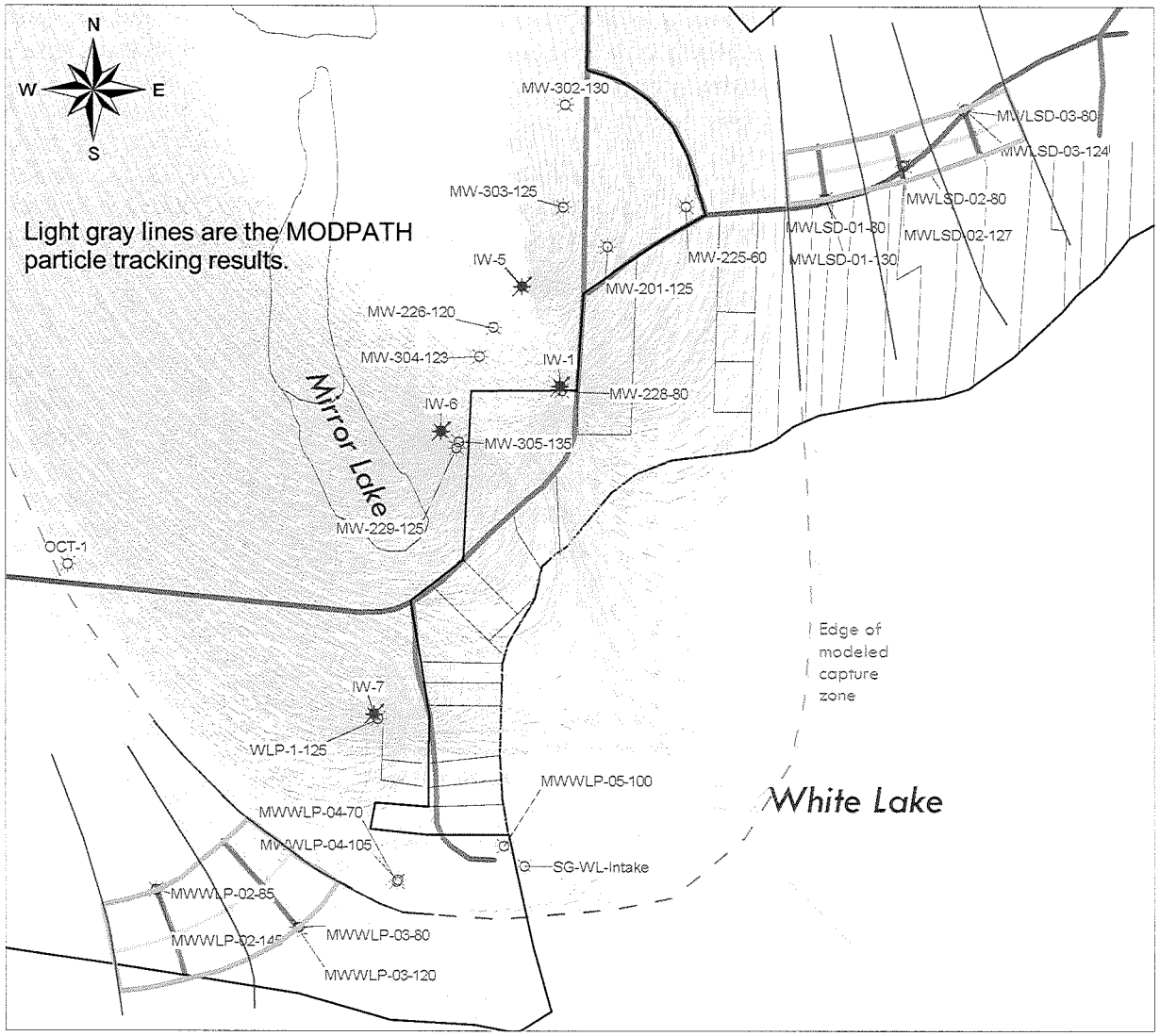


Notes:
Vertical exageration: 4x
CPT data are from 4Q 2002.
Results posted are in ug/L.
CFC-113: Trichlorotrifluoroethane

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
LSD Monitoring Wells - CFC-113
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-14
DATE: 06/11/2011		



Legend

- Monitoring Well
- Interceptor Wells
- Well Segment
- Width of Well Segment
- Length of Well Segment

Base Map from site ARC GIS shapefiles: //Shared/Montague/_GIS/SHPs/InGDB/

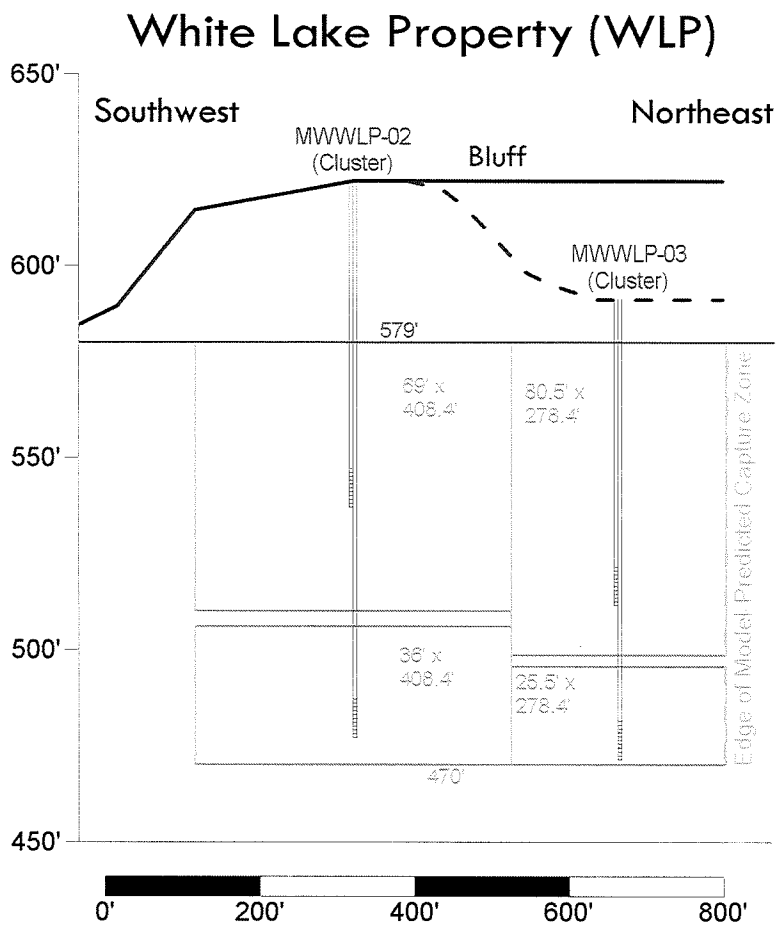
URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

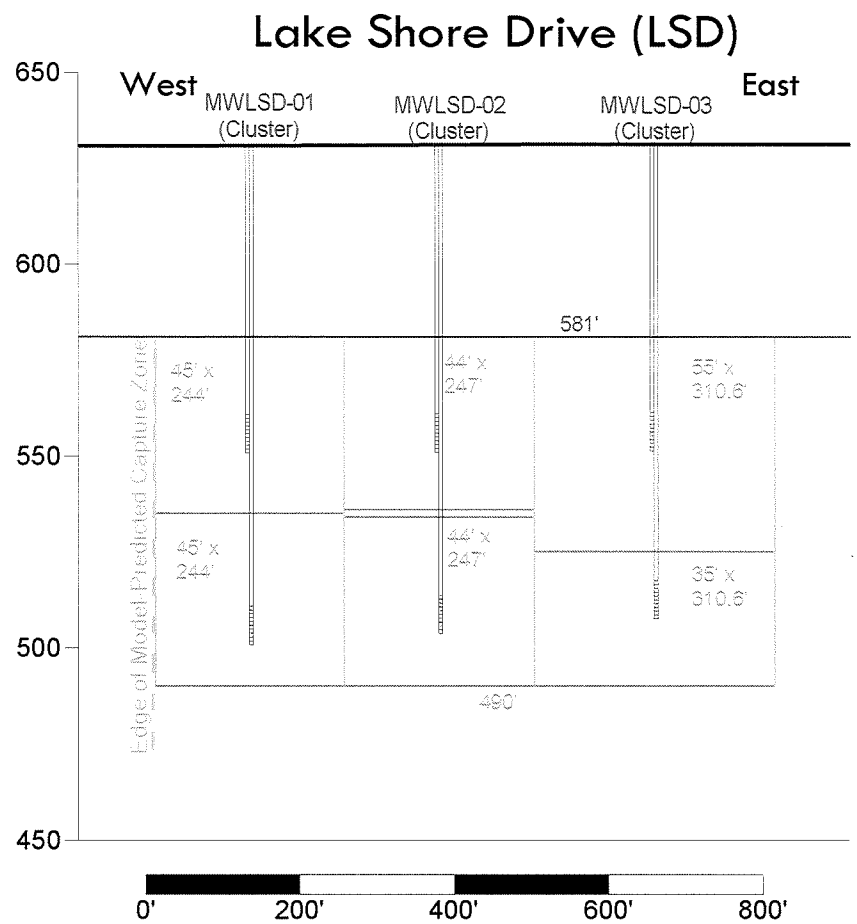
TITLE:
Mixing Zone Well Segments – Map View
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:
CHKD:	REV:
DATE: 06/11/2011	

PROJECT NO: 18986005

FIGURE NO: 2-15





Notes:
Dimensions of each flux window are shown in feet.
Elevations expressed in feet mean sealevel
Vertical exageration: 5x.

URS
10550 Richmond Ave., Suite 155
Houston, Texas 77042

TITLE:
Mixing Zone Well Segments – Cross Section View
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site

DWN: GEG	APPD:	PROJECT NO: 18986005
CHKD:	REV:	FIGURE NO: 2-16
DATE: 06/11/2011		

Appendices

Appendix A

Boring Logs from WLP and LSD Wells

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWWLP-02-85	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Compliance well		
Elevation:	622.44	Datum:	feet MSL (approx)
X Coordinate:	12582494.14	Y Coordinate:	691469.46
Date(s):	11/3/209	-	11/3/2009
TOC Elev:	625.16		

Lithologic logging performed on MWWLP-02-145.

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	85.0	Completed Depth	85.0
Borehole Dia.:	6"	Static Water Level:	

Well Casing

type:	PVC	dia:	2"	from:	0	to:	75
type:		dia:		from:		to:	

Screens

type:	PVC	size:	0.01	dia:	2"	from:	75	to: 85.0

Annular Fill:

type:	grout	from:	0	to: 70
type:	bentonite	from:	70	to: 73
type:	fine sand	from:		to:
type:	sand pack	from:	73	to: 85.0

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description			

URS

10550 Richmond Ave., Suite 165 Houston, TX 77042

Site ID:	MWWLP-02-145	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Compliance well		
Elevation:	622.13	Datum:	feet MSL (approx)
X Coordinate:	12582497.96	Y Coordinate:	691467.13
Date(s):	11/2/2009 - 11/3/2009		
TOC Elev:	624.55		

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	145.0	Completed Depth	145
Borehole Dia.:	6"	Static Water Level:	

Well Casing
type: PVC dia: 2" from: 0 to: 110
type: dia: from: to:

Screens
type: PVC size: 0.01 dia: 2" from: 135 to: 145

Annular Fill:
type: grout from: 0 to: 128
type: bentonite from: 128 to: 131
type: fine sand from: to:
type: sand pack from: 131 to: 145

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description
622.1	10.0		0.0 10.0		SP	SAND (SP): 0'-1': Dark brown sand, medium grained, damp, lots of roots to 1' 1'-10': light brown grading to tan medium grained sand, very loose, damp, minimal roots
612.1	3.0		10.0 13.0		ML	SILT (ML): 10'-13': Tan clayey silt, damp, very firm, roots
609.1	3.0		13.0 16.0		SP	SAND (SP): 13'-16': Tan fine sand, loose, damp
606.1	20.0		16.0 36.0		BR	SANDSTONE (BR): 16'- 36': Light tan, fine-grained, damp sandstone (drills with great difficulty), most of core comes up broken/pulverized, very hot, moisture driven from core (steam off corebarrel when driller cools it with stray of water)
586.1	53.0		36.0 89.0		SP	SAND (SP) 36'-52': Fine tan sand, loose, very damp, core no longer hot 52'-56': Fine tan sand, very loose, wet, watertable @52' 56'-76': no recovery - assume wet sand 76'-89': tan-gray medium grained sand, wet, rounded gravels in 85'-86'
533.1	4.0		89.0 93.0		SM	SAND (SM) 89'-92': Tan silty sand, wet w/ silt layers, moderately firm to firm plastic silt
529.1	19.0		93.0 112.0		SP	SAND (SP) 92'-96': Gray-tan medium sand, wet, loose 96'-112': Tan sand, medium grained, wet loose
510.1	1.0		112.0 113.0		CL	CLAY (CL) 112'-113': Tan silty clay
509.1	3.0		113.0 116.0		ML	SILT (ML)113'-116': Medium gray, very firm silt
506.1	9.0		116.0 125.0		SP	SAND (SP) 116'-125': Tan medium grained sand, wet, slightly loose
497.1	7.0		125.0 132.0		ML	SILT (ML): 125'-132': Gray, very firm silt, wet
490.1	13.0		132.0 145.0		SP	SAND (SP) 132'-136': Tan medium grained sand, wet, loose, orange-brown staining (132'-134') 136'-145': Gray-tan medium grained sand, one 1" thick tan silt layer at 144'.
477.1			145.0			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Site ID: MWWLP-03-80	Project Number: 18985203	Total Depth: 80.0	Completed Depth 80.0
Location: DuPont Montague (White Lake Property)		Borehole Dia.: 6"	Static Water Level:
Purpose: Compliance well		Well Casing	
Elevation: 593.8	Datum: feet MSL (approx)	type: PVC dia: 2" from: 0 to: 70	
X Coordinate: 12582968.59	Y Coordinate: 691344.00	type: dia: from: to:	
Date(s): 10/29/2009	- 10/29/2009	Screens	
TOC Elev: 593.8		type: PVC size: 0.01 dia: 2" from: 70 to: 80.0	
Lithologic logging performed on MWWLP-03-120.		Annular Fill:	
		type: grout from: 0 to: 63	
		type: bentonite from: 63 to: 68	
		type: fine sand from: to:	
		type: sand pack from: 68 to: 80.0	

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWWLP-03-120	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Compliance well		
Elevation:	591.48	Datum:	feet MSL (approx)
X Coordinate:	12582964.30	Y Coordinate:	691340.94
Date(s):	10/26/2009	-	10/27/2009
TOC Elev:	594.53		

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	120.0	Completed Depth	120
Borehole Dia.:	6"	Static Water Level:	

Well Casing
type: PVC dia: 2" from: 0 to: 110
type: dia: from: to:

Screens
type: PVC size: 0.01 dia: 2" from: 110 to: 120

Annular Fill:
type: grout from: 0 to: 101
type: bentonite from: 101 to: 107
type: fine sand from: to:
type: sand pack from: 107 to: 120

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)		Blow Count	Graphic Log	Lithologic Description
591.5	24.0		0.0	24.0		SP	SAND (SP): 0'-1': Dark brown sandy topsoil 1'-8': Brown medium grained silica sand dry, rounded 8'-12': Medium silica sand, dry 12'-24': Firm, tan sand w/ rounded gravels
567.5	2.0		24.0	26.0		ML	SILT (ML): 24'-26': Tan silt, dry
565.5	26.0		26.0	52.0		SP	SAND (SP): 26'-32: Tan fine sand grading to medium grained sand 32'-36': Tan medium-grained sand w/ gravel, wet @ 32' 36'-43': Tan fine sand, loose, tan, wet 43'-52': Tan fine to medium sand, loose, wet
539.5	4.0		52.0	56.0		CL	CLAY (CL): 24'-26': Tan silty clay, firm
535.5	24.0		56.0	80.0		SP	SAND (SP): 56'-80': Tan medium and fine sand, wet loose
511.5	13.0		80.0	93.0		SP	SAND (SP): 80'-85': Gray-tan sand, wet, loose 85'-93': Tan silty sand, wet flowing
498.5	3.0		93.0	96.0		ML	SILT (ML): 93-96': Gray-tan silt, hard, damp, no plasticity
495.5	14.0		96.0	110.0		SP	SAND (SP): 96'-98': Tan fine sand, loose 98'-100': Gray-tan fine sand, loose 100'-101': Gray-tan very fine sand, firm 101'-105': Gray-tan very fine sand, silty, slightly hard 105'-110': medium-coarse sand, clean, loose
481.5	6.0		110.0	116.0		SP	110'-116': as above
475.5	4.0		116.0	120.0		SP	No recovery - assume sand
471.5			120.0				

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Site ID: MWWLP-04-70	Project Number: 18985203	Total Depth: 70.0	Completed Depth 70.0
Location: DuPont Montague (White Lake Property)		Borehole Dia.: 6"	Static Water Level:
Purpose: Compliance well		Well Casing	
Elevation: 594.58	Datum: feet MSL (approx)	type: PVC dia: 2" from: 0 to: 60	
X Coordinate: 12583290.96	Y Coordinate: 691495.41	type: dia: from: to:	
Date(s): 10/29/2009 - 10/29/2009		Screens	
TOC Elev: 594.58		type: PVC size: 0.01 dia: 2" from: 60 to: 70.0	
Lithologic logging performed on MWWLP-04-105.		Annular Fill:	
		type: grout from: 0 to: 52	
		type: bentonite from: 52 to: 58	
		type: fine sand from: to:	
		type: sand pack from: 58 to: 70.0	

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWWLP-04-105	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Compliance well		
Elevation:	591.78	Datum:	feet MSL (approx)
X Coordinate:	12583295.23	Y Coordinate:	691500.88
Date(s):	10/27/2009	-	10/28/2009
TOC Elev:	594.64		

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	105.0	Completed Depth	105
Borehole Dia.:	6"	Static Water Level:	

Well Casing
type: PVC dia: 2" from: 0 to: 110
type: dia: from: to:

Screens
type: PVC size: 0.01 dia: 2" from: 95 to: 105

Annular Fill:
type: grout from: 0 to: 87.5
type: bentonite from: 87.5 to: 92.5
type: fine sand from: to:
type: sand pack from: 92.5 to: 105

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description
591.8	64.0		0.0 64.0		SP	SAND (SP): 0'-1.5': Dark brown sandy topsoil, moist 1.5'-16': Tan medium grained sand, clean, damp grading to gray medium sand 16'-22': Tan fine sand, firm, slightly silty, moist 22'-36': Fine tan medium sand, grades into medium, tan-gray sand, saturated 36'-64': Gray-tan to tan-gray medium-grained silica sand, loose, very well rounded grains
527.8	6.0		64.0 70.0		SP/GW	SAND (SP/GW): 64'-70': Gravelly sand grading to sandy gravel; gravels are rounded silica-chert clasts
521.8	1.0		70.0 71.0		ML	SILT (ML): 70'-71': Tan silt, very firm, clayey
520.8	5.0		71.0 76.0		SW	SAND (SW): 71'-76': Tan, very fine sand, slightly loose
515.8	13.0		76.0 89.0		ML	SILT (ML): 76'-89': Tan, wet silt, firm to very firm
502.8	6.0		89.0 95.0		SW	SAND (SW): 89'-95': Gray-tan, fine sand, loose
496.8	1.0		95.0 96.0		ML	SILT (ML): 95'-96': Tan silt, very firm
495.8	9.0		96.0 105.0		SP	No recovery - assume sand
486.8			105.0			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWWLP-05-100	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Purge Performance well		
Elevation:	584.44	Datum:	feet MSL (approx)
X Coordinate:	12583646.75	Y Coordinate:	691613.64
Date(s):	10/28/2009	-	10/28/2009
TOC Elev:	587.34		

Stick up mounted well near former surface water intake.

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	100.0	Completed Depth	100
Borehole Dia.:	6"	Static Water Level:	

Well Casing
type: PVC dia: 2" from: 0 to: 90
type: dia: from: to:

Screens
type: PVC size: 0.01 dia: 2" from: 90 to: 100

Annular Fill:
type: grout from: 0 to: 80
type: bentonite from: 80 to: 87
type: fine sand from: to:
type: sand pack from: 87 to: 100

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)		Blow Count	Graphic Log	Lithologic Description
584.4	12.0		0.0	12.0		SP	SAND (SP): 0'-5': Black to dark brown silica sand, with lots of organic material (decaying plant matter) 5'-12': Grades into medium grained, tan-gray sand
572.4	1.0		12.0	13.0		ML	SILT (ML): 12'-13': Tan silt, very moist, slt firm, wood fragments
572.4	57.0		12.0	69.0		SP	SAND (SP): 13'-22': Gray-tan medium-grained sand, loose 22'-29': Fine tan sand, slightly loose 29-35': Tan-gray coarse sand, loose, very well rounded and very well sorted. 35'-42': Tan fine-medium sand, well sorted 42'-55': Gray-tan medium-coarse grained sand, very well sorted and rounded (photographed 53'-55') 55'-69': as above w/ white, fragile, chalky gastropod shells @ 60' and 62'
515.4	13.0		69.0	82.0		SP	SAND (SP): 69'-69.25': Dark brown, fine sand with peat layer and wood fragments 69.25'-82': Gray-tan medium-coarse grained sand
502.4	2.0		82.0	84.0		SM/ML	SILT (SM/ML): 82'-84': Tan, very fine sand, w/ tan silt
500.4	6.0		84.0	90.0		SP	SAND (SP): 84'-90': Gray-tan medium sand, loose, rounded, very wet
494.4	9.0		90.0	99.0		Sp	SAND (SP): 90'-99': as above with minor pebbles from 95'-99'
485.4	1.0		99.0	100.0		ML	SILT (ML): 99'-100': Gray silt w/ fine gray sand, very thin gray clay
484.4			100.0				

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWLSD-01-80	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Compliance well		
Elevation:	630.49	Datum:	feet MSL (approx)
X Coordinate:	12584708.66	Y Coordinate:	693760.67
Date(s):	11/10/2009	-	11/10/2009
TOC Elev:	630.49		

Lithologic logging performed on MWLSD-01-130

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	80.0	Completed Depth	80.0
Borehole Dia.:	6"	Static Water Level:	

Well Casing

type:	PVC	dia:	2"	from:	0	to:	70
type:		dia:		from:		to:	

Screens

type:	PVC	size:	0.01	dia:	2"	from:	70	to:	80.0

Annular Fill:

type:	grout	from:	0	to:	63
type:	bentonite	from:	63	to:	67
type:	fine sand	from:		to:	
type:	sand pack	from:	67	to:	80.0

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWLSD-01-130	Project Number:	18985203
Location:	DuPont Montague (Lake Shore Drive)		
Purpose:	Compliance well		
Elevation:	630.85	Datum:	feet MSL (approx)
X Coordinate:	12584715.26	Y Coordinate:	693761.79
Date(s):	11/9/2009 - 11/10/2009		
TOC Elev:	630.48		

Flush-mount on north side of road at southeast corner of garden.

Logged by:	A. Hanna	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	132.0	Completed Depth	130
Borehole Dia.:	6"	Static Water Level:	

Well Casing
type: PVC dia: 2" from: 0 to: 120
type: dia: from: to:

Screens
type: PVC size: 0.01 dia: 2" from: 120 to: 130

Annular Fill:
type: grout from: 0 to: 113
type: bentonite from: 113 to: 117
type: fine sand from: to:
type: sand pack from: 117 to: 130

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description
630.9						
	73.0		0.0 73.0		SP	SAND (SP): 0'-1': Sandy topsoil w/silt and subrounded to subangular, dark brown, fine gravel 1'-3': Brown sand, fine to medium grained, moist 3'-17': Pale yellow sand, fine to medium grained, moist 17'-37': Pale yellow sand, fine to medium grained (predominantly medium), trace shells, wet to saturated (6' recovery) 37'-57': as above w/ 7' recovery (flapper malfunctioning) 57'-73': as above w/ 15' recovery (note that recoveries are possibly due to 6" core being delivered in 8" bags)
557.9	4.0		73.0 77.0		SM/ SP	SAND (SM/SP): 73'-77': Interbedded fine sand & silty sand, pale yellow, 6" silt layer @75' w/ trace of fine subang gravel
553.9	5.0		77.0 82.0		SP	SAND (SP): 77'-82': Pale yellow fine grained sand, wet, dense to loose
548.9						
	50.0		82.0 132.0		SP	SAND (SP): 82'-97': Pale yellow fine to medium grained sand, wet, loose with some dense zones 97'-112': Pale yellow fine to medium sand, wet, loose 112'-113': Pale brown gravelly sand, fine to coarse gravel, subangular to sub rounded, chert, 30-35% gravel, 2" silt seam 113'-117': Pale yellow fine to medium sand, trace fine gravel and shells, wet 117'-132': Pale yellow fine to medium sand, trace fine gravel, wet
498.9			132.0			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Site ID: MWLSD-02-80	Project Number: 18985203	Total Depth: 80.0	Completed Depth 80.0
Location: DuPont Montague (White Lake Property)		Borehole Dia.: 6"	Static Water Level:
Purpose: Compliance well		Well Casing	
Elevation: 629.86	Datum: feet MSL (approx)	type: PVC dia: 2" from: 0 to: 70	
X Coordinate: 12584968.44	Y Coordinate: 693869.03	type: dia: from: to:	
Date(s): 11/11/2009 - 11/11/2009		Screens	
TOC Elev: 629.86		type: PVC size: 0.01 dia: 2" from: 70 to: 80.0	
Lithologic logging performed on MWLSD-02-127		Annular Fill:	
		type: grout from: 0 to: 63	
		type: bentonite from: 63 to: 67	
		type: fine sand from: to:	
		type: sand pack from: 67 to: 80.0	

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Logged by:	A. Hanna	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Site ID: MWLSD-02-127	Project Number: 18985203	Total Depth: 132.0	Completed Depth 127
Location: DuPont Montague (Lake Shore Drive)		Borehole Dia.: 6"	Static Water Level:
Purpose: Compliance well		Well Casing	
Elevation: 630.58	Datum: feet MSL (approx)	type: PVC dia: 2"	from: 0 to: 117
X Coordinate: 12584974.13	Y Coordinate: 693872.59	type: dia:	from: to:
Date(s): 11/10/2009	- 11/11/2009	Screens	
TOC Elev: 630.23		type: PVC size: 0.01 dia: 2"	from: 117 to: 127
Flush-mount on north side of road across from Mailboxes #6015 and 6027.		Annular Fill:	
		type: grout	from: 0 to: 110
		type: bentonite	from: 110 to: 114
		type: fine sand	from: to:
		type: sand pack	from: 114 to: 127

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description
630.6	69.0		0.0 69.0		SP	SAND (SP): 0'-1': Sandy topsoil w/ 10-15% silt, dark brown with trace fine gravel 1'-3': Brown fine to medium grained sand, moist 3'-47': Pale yellow fine to medium grained sand, trace fine gravel, moist 47'-69': Pale yellow fine to medium grained sand, trace fine gravel, wet to saturated
561.6	26.0		69.0 95.0		SP	Sand (SP): 69'-72': Pale yellow, fine grained sand w/ trace silt; two 4-6 mm silt layers from 71.5'-72' 72'-95': Pale yellow, fine to medium grained sand; trace of coarse sand to fine gravel and shell fragments 92'-95'
535.6	2.0		95.0 97.0		CL	CLAY (CL): 95'-97': Dense, pinkish-brown silty clay, wet
533.6	10.0		97.0 107.0		SP	SAND (SP): 97'-101': Pale yellow, fine to medium grained sand, trace of coarse sand and shell, wet 101'-107': as above with 20-30% fine gravel and trace of silt w/ silty clay seams (1"-2" thick)
523.6	10.0		107.0 117.0		SM ML	INTERBEDDED SAND/SILT (SM/ML): 107'-117: Pale yellow fine to medium grained sand w/ 10-15% fine gravel; interbedded with pinking-bown silt and silty clay, wet
513.6	10.0		117.0 127.0		SP	SAND (SP): 117'-127': Pale yellow, fine to medium grained sand, wet
503.6	5.0		127.0 132.0		SM CL	INTERBEDDED SAND/CLAY (SM/CL): 127'-132': Pale yellow sand interbedded with light pinkish-brown silt and silty clay, wet
498.6			132.0			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWLSD-03-80	Project Number:	18985203
Location:	DuPont Montague (White Lake Property)		
Purpose:	Compliance well		
Elevation:	630.67	Datum:	feet MSL (approx)
X Coordinate:	12585171.15	Y Coordinate:	694052.95
Date(s):	11/12/2009	-	11/12/2009
TOC Elev:	630.67		

Lithologic logging performed on MWLSD-03-124

Logged by:	G. Gregory	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	80.0	Completed Depth	80.0
Borehole Dia.:	6"	Static Water Level:	

Well Casing

type:	PVC	dia:	2"	from:	0	to:	70
type:		dia:		from:		to:	

Screens

type:	PVC	size:	0.01	dia:	2"	from:	70	to: 80.0

Annular Fill:

type:	grout	from:	0	to:	63
type:	bentonite	from:	63	to:	67
type:	fine sand	from:		to:	
type:	sand pack	from:	67	to:	80.0

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description			

URS

10550 Richmond Ave., Suite 155 Houston, TX 77042

Site ID:	MWLSD-03-124	Project Number:	18985203
Location:	DuPont Montague (Lake Shore Drive)		
Purpose:	Compliance well		
Elevation:	631.38	Datum:	feet MSL (approx)
X Coordinate:	12585175.98	Y Coordinate:	694057.98
Date(s):	11/11/2009 - 11/12/2009		
TOC Elev:	631.10		

Flush-mount on north side of road not far from Mailbox #5995.

Logged by:	A. Hanna	Certified by:	
Contractor	Boart Longyear		
Drilling Method	rotosonic		
Total Depth:	137.0	Completed Depth	124
Borehole Dia.:	6"	Static Water Level:	

Well Casing
type: PVC dia: 2" from: 0 to: 117
type: dia: from: to:

Screens
type: PVC size: 0.01 dia: 2" from: 114 to: 124

Annular Fill:
type: grout from: 0 to: 58
type: bentonite from: 58 to: 111
type: fine sand from: to:
type: sand pack from: 111 to: 137

Elevation (ft)	Thickness (ft)	Recovery (%)	Depth Interval (ft)	Blow Count	Graphic Log	Lithologic Description
631.4	65.0		0.0 65.0		SP	SAND (SP): 0'-1': Sandy topsoil w/ 10-15% silt, dark brown, moist 1'-3': Brown fine to medium grained sand, moist 3'-65': Pale yellow, fine to medium sand; moist to 52', saturated at 56'; trace of shell fragments 15'-19'; 20-25% fine gravel 15'-30'
566.4	12.0		65.0 77.0		SM	SAND (SM): 65'-69': Pale yellow, fine grained sand, 20-25% silt; 1-2 cm silty clay/silt seams, saturated 69'-71': Pale yellow fine to medium grained sand, wet 71'-77': Pale yellow, fine grained sand, 20-25% silt;1"-2" silty clay/silt seams, saturated
554.4	18.0		77.0 95.0		SP	SAND (SP): 77'-95': Pale yellow fine to medium grained sand, loose, saturated
536.4	11.0		95.0 106.0			SILT/SAND/GRAVEL: 95'-97': Pale yellow fine grained sand (SM), 20-25% silt, 1-4 cm silt to silty clay seams, saturated 97'-103': Pale yellow, fine to medium grained sand (SP), wet 103'-104': Pinkish-brown silt (ML) with 15-20% gravel 104'-106': Pale yellow fine to medium grained sand (SW) w/ 25-30% chert gravel w/ shell fragments
525.4	18.0		106.0 124.0		SP	SAND (SP): 106'-124': Pale yellow fine to medium grained sand, wet, loose
507.4	9.0		124.0 133.0		C L S M	INTERBEDDED CLAY/SILT/SAND (CL/SM): 124'-133': Pale yellow fine grained sand, sandy silt, and silty clay, wet to saturated
498.4	4.0		133.0 137.0		SP	SAND (SP): Pale yellow fine to medium grained sand, wet
494.4			137.0			

Appendix B

All VOCs Results from Monitoring Wells Near White Lake

Appendix B
All VOCs Results from Monitoring Wells Near White Lake
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

Analyte Units Generic GSI Value:		FS/DUP	1,1,1-TRICHLOROETHANE UG/L 200	1,1,2-TRICHLOROTRIFLUOROETHANE UG/L NA	1,1-DICHLOROETHANE UG/L 740	BENZENE UG/L 200	CARBON TETRACHLORIDE UG/L NA	CHLOROFORM UG/L 170	CIS-1,2 DICHLOROETHENE UG/L 620
Location	**Date**								
IW-1	10/22/09	FS	< 0.8	690	< 1	< 0.5	< 1	8	26
IW-1	5/11/10	FS	< 0.8	770	< 1	< 0.5	< 1	5	23
IW-1	11/1/10	FS	< 0.8	790	< 1	0.5 J	< 1	3 J	22
IW-6	10/22/09	FS	2 J	270	< 1	< 0.5	7	17	< 0.8
IW-6	5/11/10	FS	3 J	400	< 1	< 0.5	8	14	< 0.8
IW-6	11/1/10	FS	< 2	400	< 2	< 1	5 J	8 J	< 2
IW-7	10/22/09	FS	1 J	190	< 1	< 0.5	38	1 J	< 0.8
IW-7	5/11/10	FS	1 J	200	< 1	< 0.5	35	1 J	< 0.8
IW-7	11/1/10	FS	< 0.8	190	< 1	< 0.5	31	0.8 J	< 0.8
MW-201-125	10/19/09	FS	< 0.8	1500	< 1	< 0.5	< 1	< 0.8	3 J
MW-201-125	5/11/10	FS	< 2	1700	< 2	< 1	< 2	< 2	< 2
MW-201-125	11/2/10	FS	< 0.8	1700	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-225-60	10/20/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-225-60	5/10/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-225-60	11/3/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-226-120	10/20/09	FS	< 0.8	47	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-226-120	5/10/10	FS	< 0.8	69	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-226-120	11/3/10	FS	< 0.8	78	1 J	< 0.5	< 1	< 0.8	< 0.8
MW-228-80	10/20/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-228-80	5/10/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-228-80	11/3/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-302-130	12/14/09	FS	< 0.8	53	< 1	< 0.5	< 1	< 0.8	47
MW-302-130	5/12/10	FS	< 0.8	48	< 1	< 0.5	< 1	< 0.8	7
MW-302-130	11/4/10	FS	< 0.8	190	< 1	0.7 J	< 1	1 J	4 J
MW-303-125	12/14/09	FS	< 0.8	5 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-303-125	5/12/10	FS	< 0.8	4 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-303-125	11/4/10	FS	< 0.8	7 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-304-123	10/21/09	FS	< 0.8	110	< 1	< 0.5	< 1	4 J	36
MW-304-123	5/12/10	FS	< 0.8	110	< 1	< 0.5	< 1	2 J	150
MW-304-123	11/4/10	FS	< 0.8	29	< 1	< 0.5	< 1	< 0.8	15
MW-305-135	10/21/09	FS	< 0.8	26	< 1	< 0.5	< 1	2 J	< 0.8
MW-305-135	5/12/10	FS	< 0.8	20	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-305-135	11/4/10	FS	< 0.8	60	< 1	< 0.5	< 1	1 J	< 0.8
MW-LSD-01-130	12/14/09	FS	< 0.8	160	< 1	1 J	< 1	< 0.8	0.9 J

Appendix B
All VOCs Results from Monitoring Wells Near White Lake
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

Analyte		FS/DUP	1,1,1-TRICHLOROETHANE	1,1,2-TRICHLOROTRIFLUOROETHANE	1,1-DICHLOROETHANE	BENZENE	CARBON TETRACHLORIDE	CHLOROFORM	CIS-1,2 DICHLOROETHENE
Units			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Generic GSI Value:			200	NA	740	200	NA	170	620
Location	Date								
MW-LSD-01-130	2/23/10	FS	< 0.8	160	< 1	2 J	< 1	< 0.8	0.9 J
MW-LSD-01-130	5/14/10	FS	< 0.8	210	< 1	2 J	< 1	< 0.8	1 J
MW-LSD-01-130	8/6/10	FS	< 0.8	180	< 1	2 J	< 1	< 0.8	0.9 J
MW-LSD-01-130	11/2/10	FS	< 0.8	170	< 1	1 J	< 1	< 0.8	0.9 J
MW-LSD-01-80	12/14/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-01-80	2/23/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-01-80	5/14/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-01-80	8/6/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-01-80	11/2/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-02-127	12/14/09	FS	< 0.8	110	1 J	1 J	< 1	< 0.8	1 J
MW-LSD-02-127	2/23/10	FS	< 0.8	130	1 J	1 J	< 1	0.9 J	1 J
MW-LSD-02-127	5/14/10	FS	< 0.8	120	2 J	1 J	< 1	0.9 J	1 J
MW-LSD-02-127	8/6/10	FS	< 0.8	160	2 J	2 J	< 1	1 J	2 J
MW-LSD-02-127	11/2/10	FS	< 0.8	200	2 J	1 J	< 1	1 J	0.9 J
MW-LSD-02-80	12/14/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-02-80	2/23/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-02-80	5/14/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-02-80	8/6/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-02-80	11/2/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-03-124	12/14/09	FS	< 0.8	21	< 1	0.8 J	< 1	< 0.8	< 0.8
MW-LSD-03-124	2/23/10	FS	< 0.8	16	< 1	0.6 J	< 1	< 0.8	< 0.8
MW-LSD-03-124	5/14/10	FS	< 0.8	17	< 1	0.8 J	< 1	< 0.8	< 0.8
MW-LSD-03-124	8/6/10	FS	< 0.8	18	< 1	0.6 J	< 1	< 0.8	< 0.8
MW-LSD-03-124	11/2/10	FS	< 0.8	12	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-03-80	12/14/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-03-80	2/23/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-03-80	5/14/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-03-80	8/6/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-LSD-03-80	11/2/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-145	12/15/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-145	2/24/10	FS	< 0.8	2 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-145	5/14/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-145	8/5/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-145	11/1/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8

Appendix B
All VOCs Results from Monitoring Wells Near White Lake
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

	Analyte	FS/DUP	1,1,1-TRICHLOROETHANE	1,1,2-TRICHLOROTRIFLUOROETHANE	1,1-DICHLOROETHANE	BENZENE	CARBON TETRACHLORIDE	CHLOROFORM	CIS-1,2 DICHLOROETHENE
	Units		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
	Generic GSI Value:		200	NA	740	200	NA	170	620
Location	Date								
MW-WLP-02-85	12/15/09	FS	< 0.8	3 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-85	2/24/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-85	5/14/10	FS	< 0.8	3 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-85	8/5/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-02-85	11/1/10	FS	< 0.8	2 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-03-120	12/15/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-03-120	2/24/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-03-120	5/14/10	FS	< 0.8	11	< 1	< 0.5	2 J	< 0.8	< 0.8
MW-WLP-03-120	8/5/10	FS	< 0.8	7 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-03-120	11/1/10	FS	< 0.8	5 J	< 1	< 0.5	< 1	1 J	< 0.8
MW-WLP-03-80	12/15/09	DUP	1 J	95	< 1	< 0.5	28	2 J	< 0.8
MW-WLP-03-80	12/15/09	FS	1 J	100	< 1	< 0.5	28	2 J	< 0.8
MW-WLP-03-80	2/24/10	FS	1 J	84	< 1	< 0.5	27	2 J	< 0.8
MW-WLP-03-80	5/14/10	FS	1 J	120	< 1	< 0.5	44	2 J	< 0.8
MW-WLP-03-80	8/5/10	FS	1 J	110	< 1	< 0.5	31	2 J	< 0.8
MW-WLP-03-80	11/1/10	FS	2 J	190	< 1	< 0.5	48	2 J	< 0.8
MW-WLP-04-105	12/15/09	FS	5	230	< 1	< 0.5	35	9	< 0.8
MW-WLP-04-105	2/24/10	FS	2 J	110	< 1	< 0.5	17	4 J	< 0.8
MW-WLP-04-105	5/14/10	FS	3 J	190	< 1	< 0.5	38	5	< 0.8
MW-WLP-04-105	8/5/10	FS	2 J	140	< 1	< 0.5	24	4 J	< 0.8
MW-WLP-04-105	11/1/10	FS	2 J	160	< 1	< 0.5	44	3 J	< 0.8
MW-WLP-04-70	12/15/09	FS	4 J	490	< 1	< 0.5	190	6	< 0.8
MW-WLP-04-70	2/24/10	DUP	4 J	440	< 1	< 0.5	180	3 J	< 0.8
MW-WLP-04-70	2/24/10	FS	4 J	430	< 1	< 0.5	180	3 J	< 0.8
MW-WLP-04-70	5/14/10	DUP	3 J	410	< 1	< 0.5	190	2 J	< 0.8
MW-WLP-04-70	5/14/10	FS	3 J	390	< 1	< 0.5	190	2 J	< 0.8
MW-WLP-04-70	8/5/10	DUP	2 J	290	< 1	< 0.5	120	1 J	< 0.8
MW-WLP-04-70	8/5/10	FS	2 J	270	< 1	< 0.5	120	1 J	< 0.8
MW-WLP-04-70	11/1/10	DUP	3 J	410	< 1	< 0.5	150	1 J	< 0.8
MW-WLP-04-70	11/1/10	FS	3 J	400	< 1	< 0.5	160	< 0.8	< 0.8
MW-WLP-05-100	12/15/09	FS	< 0.8	11	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-05-100	2/24/10	FS	< 0.8	6 J	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-05-100	5/14/10	FS	< 0.8	20	< 1	< 0.5	< 1	< 0.8	< 0.8
MW-WLP-05-100	8/5/10	FS	< 0.8	18	< 1	< 0.5	< 1	< 0.8	< 0.8

Appendix B
All VOCs Results from Monitoring Wells Near White Lake
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

Analyte		FS/DUP	1,1,1-TRICHLOROETHANE	1,1,2-TRICHLOROTRIFLUOROETHANE	1,1-DICHLOROETHANE	BENZENE	CARBON TETRACHLORIDE	CHLOROFORM	CIS-1,2 DICHLOROETHENE
Units			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Generic GSI Value:			200	NA	740	200	NA	170	620
Location	Date								
MW-WLP-05-100	11/1/10	FS	< 0.8	23	< 1	< 0.5	< 1	< 0.8	< 0.8
OCT-1	10/20/09	FS	< 0.8	< 2	< 1	< 0.5	< 1	5	< 0.8
OCT-1	5/11/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	1 J	< 0.8
OCT-1	11/3/10	FS	< 0.8	< 2	< 1	< 0.5	< 1	2 J	< 0.8
WLP-01-125	12/15/09	FS	< 4	480	< 5	< 3	67	< 4	< 4
WLP-01-125	5/11/10	FS	4 J	720	< 3	< 1	93	< 2	< 2
WLP-01-125	11/2/10	FS	3 J	390	< 2	< 1	59	< 2	< 2

Units in ug/L
*: Based on Final Acute Value provided in May 2010 2010 Rule 57 Water Quality Values spreadsheet available on the MDEQ web page http://www.michigan.gov/deq.
**: Generic GSI values are from March 2011. Water Quality Values web page, maintained by MDEQ.
ID: Insufficient data to derive value.
NA: Not applicable - use MDEQ criteria for mixing zone
-: Not available
nr: No reasonable potential to exceed water quality stanards.

FS/DUP: Field sample (primary) or duplicate sample.

Appendix B
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DuPont Montague, Site

Analyte Units Generic GSI Value:		FS/DUP	DICHLORODIFLUORO METHANE UG/L ID	METHYLENE CHLORIDE UG/L 940	TETRACHLOROETHY LENE UG/L NA	TOLUENE UG/L 140	TRANS-1,2-DICHLOROETHENE UG/L 1500	TRICHLOROETHENE UG/L 200	TRICHLOROFLUORO METHANE UG/L -
Location	**Date**								
IW-1	10/22/09	FS	< 2	< 2	290	3 J	< 0.8	35	3 J
IW-1	5/11/10	FS	6	< 2	290	2 J	< 0.8	30	2 J
IW-1	11/1/10	FS	< 2	< 2	260	2 J	< 0.8	29	< 2
IW-6	10/22/09	FS	< 2	< 2	910	9	< 0.8	3 J	6
IW-6	5/11/10	FS	2 J	< 2	1200	8	< 0.8	3 J	7
IW-6	11/1/10	FS	< 4	< 4	890	6 J	< 2	2 J	< 4
IW-7	10/22/09	FS	< 2	< 2	320	< 0.7	< 0.8	< 1	< 2
IW-7	5/11/10	FS	< 2	< 2	330	< 0.7	< 0.8	< 1	< 2
IW-7	11/1/10	FS	< 2	< 2	310	< 0.7	< 0.8	< 1	< 2
MW-201-125	10/19/09	FS	< 2	< 2	130	0.7 B	< 0.8	68	< 2
MW-201-125	5/11/10	FS	< 4	< 4	93	< 1	< 2	38	< 4
MW-201-125	11/2/10	FS	< 2	< 2	97	< 0.7	< 0.8	21	< 2
MW-225-60	10/20/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-225-60	5/10/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-225-60	11/3/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-226-120	10/20/09	FS	< 2	< 2	180	1 B	< 0.8	2 J	< 2
MW-226-120	5/10/10	FS	2 J	< 2	190	< 0.7	< 0.8	< 1	< 2
MW-226-120	11/3/10	FS	< 2	< 2	85	< 0.7	< 0.8	2 J	< 2
MW-228-80	10/20/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-228-80	5/10/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-228-80	11/3/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-302-130	12/14/09	FS	< 2	< 2	2 J	< 0.7	< 0.8	16	< 2
MW-302-130	5/12/10	FS	< 2	< 2	8	< 0.7	< 0.8	53	< 2
MW-302-130	11/4/10	FS	3 J	< 2	6	< 0.7	< 0.8	39	< 2
MW-303-125	12/14/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	20	< 2
MW-303-125	5/12/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	25	< 2
MW-303-125	11/4/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	23	< 2
MW-304-123	10/21/09	FS	3 J	< 2	170	1 B	< 0.8	16	6
MW-304-123	5/12/10	FS	< 2	< 2	1 J	0.8 J	< 0.8	< 1	6
MW-304-123	11/4/10	FS	< 2	< 2	100	< 0.7	< 0.8	10	< 2
MW-305-135	10/21/09	FS	< 2	< 2	270	< 0.7	< 0.8	3 J	< 2
MW-305-135	5/12/10	FS	< 2	< 2	200	< 0.7	< 0.8	< 1	< 2
MW-305-135	11/4/10	FS	< 2	< 2	550	< 0.7	< 0.8	< 1	< 2
MW-LSD-01-130	12/14/09	FS	< 2	< 2	26	< 0.7	< 0.8	5	< 2

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Analyte		FS/DUP	DICHLORODIFLUORO METHANE	METHYLENE CHLORIDE	TETRACHLOROETHY LENE	TOLUENE	TRANS-1,2-DICHLOROETHENE	TRICHLOROETHENE	TRICHLOROFLUORO METHANE
Units			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Generic GSI Value:			ID	940	NA	140	1500	200	-
Location	Date								
MW-LSD-01-130	2/23/10	FS	< 2	< 2	34	< 0.7	< 0.8	7	< 2
MW-LSD-01-130	5/14/10	FS	< 2	< 2	38	< 0.7	< 0.8	8	< 2
MW-LSD-01-130	8/6/10	FS	< 2	< 2	23	< 0.7	< 0.8	8	< 2
MW-LSD-01-130	11/2/10	FS	< 2	< 2	27	< 0.7	< 0.8	8	< 2
MW-LSD-01-80	12/14/09	FS	< 2	< 2	5	< 0.7	< 0.8	< 1	< 2
MW-LSD-01-80	2/23/10	FS	< 2	< 2	8	< 0.7	< 0.8	< 1	< 2
MW-LSD-01-80	5/14/10	FS	< 2	< 2	8	< 0.7	< 0.8	< 1	< 2
MW-LSD-01-80	8/6/10	FS	< 2	< 2	6	< 0.7	< 0.8	< 1	< 2
MW-LSD-01-80	11/2/10	FS	< 2	< 2	7	< 0.7	< 0.8	< 1	< 2
MW-LSD-02-127	12/14/09	FS	3 J	< 2	4 J	< 0.7	< 0.8	5	< 2
MW-LSD-02-127	2/23/10	FS	< 2	< 2	5	< 0.7	< 0.8	5	< 2
MW-LSD-02-127	5/14/10	FS	3 J	< 2	5	< 0.7	< 0.8	5	< 2
MW-LSD-02-127	8/6/10	FS	4 J	< 2	4 J	< 0.7	< 0.8	5	< 2
MW-LSD-02-127	11/2/10	FS	< 2	< 2	5	< 0.7	< 0.8	5	< 2
MW-LSD-02-80	12/14/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-02-80	2/23/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-02-80	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-02-80	8/6/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-02-80	11/2/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-03-124	12/14/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	1 J	< 2
MW-LSD-03-124	2/23/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	1 J	< 2
MW-LSD-03-124	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	1 J	< 2
MW-LSD-03-124	8/6/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	1 J	< 2
MW-LSD-03-124	11/2/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-03-80	12/14/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-03-80	2/23/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-03-80	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-03-80	8/6/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-LSD-03-80	11/2/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-145	12/15/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-145	2/24/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-145	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-145	8/5/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-145	11/1/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2

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DuPont Montague, Site

Analyte Units Generic GSI Value:		FS/DUP	DICHLORODIFLUORO METHANE UG/L ID	METHYLENE CHLORIDE UG/L 940	TETRACHLOROETHY LENE UG/L NA	TOLUENE UG/L 140	TRANS-1,2-DICHLOROETHENE UG/L 1500	TRICHLOROETHENE UG/L 200	TRICHLOROFLUORO METHANE UG/L -
Location	**Date**								
MW-WLP-02-85	12/15/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-85	2/24/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-85	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-85	8/5/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-02-85	11/1/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-120	12/15/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-120	2/24/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-120	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-120	8/5/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-120	11/1/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-80	12/15/09	DUP	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-80	12/15/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-80	2/24/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-80	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-80	8/5/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-03-80	11/1/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-105	12/15/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-105	2/24/10	FS	< 2	< 2	1 J	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-105	5/14/10	FS	< 2	< 2	0.9 J	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-105	8/5/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-105	11/1/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-70	12/15/09	FS	< 2	< 2	930	< 0.7	< 0.8	2 J	< 2
MW-WLP-04-70	2/24/10	DUP	< 2	< 2	1000	< 0.7	< 0.8	2 J	< 2
MW-WLP-04-70	2/24/10	FS	< 2	< 2	960	< 0.7	< 0.8	2 J	< 2
MW-WLP-04-70	5/14/10	DUP	< 2	< 2	890	< 0.7	< 0.8	2 J	< 2
MW-WLP-04-70	5/14/10	FS	< 2	< 2	850	< 0.7	< 0.8	1 J	< 2
MW-WLP-04-70	8/5/10	DUP	< 2	< 2	610	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-70	8/5/10	FS	< 2	< 2	580	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-70	11/1/10	DUP	< 2	< 2	590	< 0.7	< 0.8	< 1	< 2
MW-WLP-04-70	11/1/10	FS	< 2	< 2	620	< 0.7	< 0.8	1 J	< 2
MW-WLP-05-100	12/15/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-05-100	2/24/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-05-100	5/14/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
MW-WLP-05-100	8/5/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2

Appendix B
All VOCs Results from Monitoring Wells Near White Lake
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague, Site

Analyte Units Generic GSI Value:		FS/DUP	DICHLORODIFLUORO METHANE UG/L ID	METHYLENE CHLORIDE UG/L 940	TETRACHLOROETHY LENE UG/L NA	TOLUENE UG/L 140	TRANS-1,2-DICHLOROETHENE UG/L 1500	TRICHLOROETHENE UG/L 200	TRICHLOROFLUORO METHANE UG/L -
Location	**Date**								
MW-WLP-05-100	11/1/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
OCT-1	10/20/09	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
OCT-1	5/11/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
OCT-1	11/3/10	FS	< 2	< 2	< 0.8	< 0.7	< 0.8	< 1	< 2
WLP-01-125	12/15/09	FS	< 10	< 10	2200	< 4	< 4	< 5	< 10
WLP-01-125	5/11/10	FS	< 5	< 5	3500	< 2	< 2	< 3	< 5
WLP-01-125	11/2/10	FS	< 4	< 4	2200	< 1	< 2	< 2	< 4

Units in ug/L
*: Based on Final Acute Value provided in May 2010 2010 Rule 57 Water Quality Values spreadsheet available on the MDEQ web page http://www.michigan.gov/deq.
**: Generic GSI values are from March 2011. Water Quality Values web page, maintained by MDEQ.
ID: Insufficient data to derive value.
NA: Not applicable - use MDEQ criteria for mixing zone
-: Not available
nr: No reasonable potential to exceed water quality stanards.

FS/DUP: Field sample (primary) or duplicate sample.

Appendix C

Laboratory Analytical Reports
(on CD)

Appendix D

Mixing Zone Mass Flux Calculations

Ap ix D
Mixing Zone Mass Flux Ca tion - Mixing Zone 2010 4Q
Initial Mixing Zone Compliance Monitoring Report
DuPont Montague Site, Michigan

Monitoring Well Segment	Physical Dimensions: top of well segment (ft MSL)	bottom of well segment (ft MSL)	width of well segment (ft)	Cross Sectional Area of Gates (sq ft)	Assumed Hydraulic Conductivity 110 ft/day: Δh	ΔL	Hydraulic Gradient for Well Segment (ft/ft)	Groundwater Flux for Well Segment (cuft/d)	Concentrations, Conversion: 28.32 L/cuft: Groundwater flux through each well sedment (L/day)	Concentration (CFC-113) (ug/L)	Mass Flux (CFC-113) (ug/d)	Concentration (Carbon Tetrachloride) (ug/L)	Mass Flux (Carbon Tetrachloride) (ug/d)	Concentration (PCE) (ug/L)	Mass Flux (PCE) (ug/d)
MW-WLP-02-085	579	510	408.4	28,176	0.41	317.95	0.00129	3,997	113,186	2	226,372	0.5	56,593	0.4	45,274
MW-WLP-02-145	506	470	408.4	14,701	0.41	317.95	0.00129	2,085	59,054	1	59,054	0.5	29,527	0.4	23,621
MW-WLP-03-080	579	498.5	278.4	22,407	0.41	380.07	0.00108	2,659	75,299	190	14,306,837	48	3,614,359	0.4	30,120
MW-WLP-03-120	495.5	470	278.4	7,098	0.41	380.07	0.00108	842	23,853	5	119,263	0.5	11,926	0.4	9,541
MW-WLP-04-070	579	515.8	NA	NA	NA	NA	NA	NA	NA	400	NA	160	NA	620	NA
MW-WLP-04-105	515.8	470	NA	NA	NA	NA	NA	NA	NA	160	NA	44	NA	0.4	NA
MW-LSD-01-080	580	535	244.0	10,980	0.60	174.90	0.00343	4,143	117,341	1	117,341	0.5	58,671	7	821,390
MW-LSD-01-130	535	490	244.0	10,980	0.60	174.90	0.00343	4,143	117,341	170	19,948,047	0.5	58,671	27	3,168,219
MW-LSD-02-080	580	536	247.0	10,867	0.60	173.18	0.00346	4,142	117,291	1	117,291	0.5	58,646	0.4	46,916
MW-LSD-02-127	534	490	247.0	10,867	0.60	173.18	0.00346	4,142	117,291	200	23,458,228	0.5	58,646	5	586,456
MW-LSD-03-080	580	525	310.6	17,082	0.60	164.03	0.00366	6,873	194,655	1	194,655	0.5	97,327	0.4	77,862
MW-LSD-03-124	525	490	310.6	10,871	0.60	164.03	0.00366	4,374	123,871	12	1,486,456	0.5	61,936	0.4	49,549

	Mass Flux (CFC-113) (ug/d)	Mass Flux (Carbon Tetrachloride) (ug/d)	Mass Flux (PCE) (ug/d)
	60,033,544 ug/day	4,106,301 ug/day	4,858,949 ug/day
Conversion	1000000000 ug/kg	1000000000 ug/kg	1000000000 ug/kg
Conversion	2.205 lb/kg	2.205 lb/kg	2.205 lb/kg
Total Mass Fluxes	**0.132 lb/day**	**0.009 lb/day**	**0.011 lb/day**
Chronic Mass-Loading Criteria	**0.17 lb/day**	**0.02 lb/day**	**0.03 lb/day**

Groundwater Elevations (ft MSL)

date of data:	1H2010	2H2010	
MW-WLP-02-145	579.99	579.67	upgradient WLP elev.
MW-WLP-03-120	579.65	579.26	downgradient WLP elev.
MW-LSD-01-130	581.56	581.09	downgradient LSD elev.
MW-LSD-03-124	582.19	581.69	upgradient LSD elev.

Notes:
PCE: Tetrachloroethene
For Δh, this sheet uses 1H2010 groundwater elevations.