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**FIRE FIGHTING TRAINING UNIT**

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**REMEDIAL INVESTIGATION REPORT**

**NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS**

**JULY 1998**

**Prepared by:**

**BELING CONSULTANTS  
UNDER CONTRACT #N68950-95-D-9021**

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# **BELING CONSULTANTS**

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*Professional Engineering and Environmental Services*

July 31, 1998

Illinois Environmental Protection Agency  
Bureau of Land  
UST Section – Federal Facility  
1021 North Grand Avenue East  
P.O. Box 19276  
Springfield, IL 62794-9276

Attention: Donald Harrison, Environmental Protection Specialist

**SUBJECT REMEDIAL INVESTIGATION REPORT  
FIRE FIGHTING TRAINING UNIT  
GREAT LAKES NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS**

Dear Mr. Harrison:

On behalf of our Client, the Department of the Navy, please find the enclosed Remedial Investigation Report for the referenced project.

The Report summarizes the subsurface investigation work performed at the site. The results of the laboratory analyses indicate that the contamination at the site is petroleum related and some residue contamination remains on site.

The Report also includes a Tier 1 and Tier 2 analysis according to the Tiered Approach to Corrective Action Objectives (TACO), 35 IAC Part 742. The analytical results at the site were compared to the residential remediation objectives in TACO. The Tier 1 Remediation Objectives were exceeded for the following routes of exposure:

- Groundwater ingestion for benzene and naphthalene
- Soil migration to groundwater for benzene, ethylbenzene and toluene and xylene

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The Tier 2 analysis includes modeling of the groundwater ingestion and the soil migrating to groundwater routes of exposure. The modeling indicates that the contamination will not migrate off site, and will not impact the nearest receptor, the headwaters of Skokie Ditch. Since the Tier 1 Remediation Objectives were exceeded, Great Lakes Naval Training Center proposes an institutional control to prohibit the installation and use of potable water supply wells.

An engineering barrier to prevent potential inhalation exposure is not recommended since contaminated soil, although detected in excess of the inhalation objective for benzene, is below 3 feet of depth and is (or will be) below the water table. The soil leaching to groundwater model clearly covers the likely exposure route, if any, for the residual soil contamination.

Great Lakes Naval Training Center will be submitting a separate request for site closure. That submittal will include a copy of the institutional control and a description of the procedures for implementation.

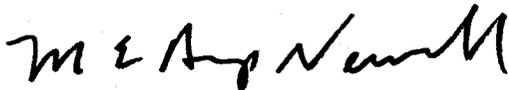
Thank you for your assistance with this project.

Sincerely,

BELING CONSULTANTS, INC.



Fred W. Lawrence, CPG  
Senior Hydrogeologist



Molly E. Arp Newell, PG, CHMM  
Manager, Environmental Compliance

cc: Job #29886

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## 1.0 INTRODUCTION

The location and site history of the Fire Fighting Training Unit at the Great Lakes Naval Training Center was described in the Trench Activity Report dated July 1998. For purposes of the remedial investigation the site is defined by the fenced area of the former FFTU, extending to the west to the headwaters of Skokie Ditch. All stormwater runoff from the site leaves the site at the headwaters shown on Figure 1.

The subsurface investigation at the site was conducted in three phases. In the first phase soil samples were collected from the trenches made during demolition of the piping and other subsurface structures at the site. This is described in the Trench Activity Report. The locations of the trench soil samples are shown on Figure 2.

The second phase of the subsurface investigation utilized cone penetrometer testing to describe the geologic framework at the site and collect deep soil and groundwater samples. The second and third phases of the subsurface investigation involved the use of direct-push technology to provide better coverage of the site at a lower cost. The third phase of the investigation was a shallow direct push investigation to evaluate the soil and groundwater contamination in the shallow strata at the site. Surface water and sediment samples were also collected. Surface water samples were collected from the east and north ditches and from both of the lagoons at the site. Sediment samples were taken at approximately the same location near the edge of water.

As with the trench sampling, two (2) types of sampling protocols were employed. The CERCLA protocol was utilized for surface water and sediment samples and for areas near the oil/water separator and former sludge pit. These samples were analyzed for the target compound list volatiles, semi-volatiles, pesticides, PCBs, and herbicide compounds.

The leaking underground storage tank (LUST) protocols were used for samples in areas near USTs, fuel piping, burn pits and the carrier compartments. These samples were concentrated in the areas where the trench sampling revealed petroleum contamination. The samples were analyzed for benzene, ethylbenzene, toluene, xylene, and the polynuclear aromatics compounds.

## 2.0 SUBSURFACE SAMPLING

### 2.1 Cone Penetrometer Investigation

The CPT portion of the direct push investigation was completed in June 1997. CPT soundings were conducted with continuous pore pressure and electrical conductance measurements at nine (9) locations. The CPT sounding locations are shown in Figure 3.

The CPT soundings were made to total depths of 50 to 75 feet. In general the CPT soundings indicate that the material beneath site consists of a shallow sandy fill material to an average depth of approximately 15 feet. From 15 feet to approximately 35 feet, a hard, clay till or diamicton of the Wadsworth Formation was encountered. Sand layers or sandy silt layers were found between 35 and 45 feet. A second diamicton was encountered between 45 and 70 feet. Most of the CPT soundings terminated on refusal at approximately 70 to 75 feet. The unit at that depth is believed to be a hard gravel unit at the top of the Lemont Formation.

Groundwater samples were collected at five (5) of the sounding locations identified in Figure 3 as CP001, CP002, CP003, CP005, and CP008. The groundwater samples were collected according to the methodology outlined in the Appendix A of the QAPP. All the groundwater samples were collected from the sandy or silty layer between the first and second diamictons at depths between 33 and 47 feet.

The diamicton units are relatively impermeable. Unsaturated layers, as indicated by negative pore pressures in the CPT soundings, were encountered within the diamicton units. The sand and sandy silt layers between 33 and 47 feet were saturated.

Five (5) groundwater samples were collected from below the first diamicton unit. Those samples were collected at the locations of CPT soundings CP001, CP002, CP003, CP005, and CP008. The analytical data indicated that contamination did not reach to that depth. For that reason the remainder of the remedial investigation concentrated on the shallow units above the first diamicton.

## **2.2 Soil Investigation**

In the first phase of subsurface investigation, samples were collected from the trench as demolition of the piping and USTs was completed. Samples were collected at one hundred sixty-four (164) locations. These locations are shown on the map in Figure 2. A total of eighty-three (83) of the samples were collected and analyzed according to the CERCLA protocols. A total of eighty-one (81) of the samples were collected and analyzed according to the LUST protocols. Sampling procedures and results are discussed in the Trench Activity Report dated July 1998.

The third phase of the subsurface investigation was conducted utilizing a Geoprobe direct push unit. Direct push borings were made at the forty-one (41) locations shown on the map in Figure 3. At each location continuous soil samples were collected from the surface down to the top of the first diamicton unit. Samples were collected utilizing a 4-foot core barrel with an acetate liner. A composite of the 4-foot interval was submitted for field screening analysis in accordance with the sample handling documentation and collection procedures are described in Appendix A of the QAPP. The boring logs for the shallow direct push investigation can be found in Appendix 1.

For field screening, the soil samples from all Phase 2 and Phase 3 locations were analyzed (on site) for benzene, ethylbenzene, toluene, xylene and selected polynuclear aromatic compounds (PNAs). The field screening analysis is described in Section 3.1. Approximately 20 percent of the samples were submitted for laboratory confirmation. A total of ten (10) of the soil samples were submitted for analysis utilizing the CERCLA protocols. A total of fourteen (14) samples were submitted to the laboratory for analysis utilizing the LUST protocols. The locations where soil samples were submitted to the laboratory, and the depth interval of the samples are shown on Figure 3.

## **2.3 Monitoring Well Installation and Development**

A total of twenty-one (21) monitoring wells were installed in the direct push borings at the site. Seventeen (17) of the monitoring wells were installed in the shallow (Geoprobe) borings above the first diamicton. Four (4) of the monitoring wells were installed in the silt and sandy units immediately below the first diamicton during the CPT phase. The monitoring well locations are shown on the map in Figure 4. The well construction details are shown on the Well Completion Report forms in Appendix 2.

The monitoring well construction was performed as described in Section 8.2 of Appendix A of the QAPP. The deeper monitoring wells installed with the CPT unit were constructed of 3/4" ID Schedule 80 PVC in lieu of Schedule 40. All of the monitoring wells were completed with the protective steel cover at the surface, installed either flush with grade or stick-up.

Following well completion, each monitoring well was developed to remove residual drilling fluids and fine-grained materials near the screen. This was accomplished by removing water from the well, and drawing water through the filter pack and well screen. Well development was performed one (1) to two (2) days following completion of the well, in order to allow sufficient time for the bentonite seal to hydrate. The wells were pumped during development until the turbidity was significantly reduced in water removed from the well. This generally occurred after approximately five (5) borehole volumes of water were removed from the well.

#### **2.4 Hydraulic Testing and Groundwater Flow**

Hydraulic testing was performed to evaluate the hydraulic properties of the shallow water bearing units (approximately 6-16' below grade). Slug tests were performed on monitoring wells MW-30-98 and MW-41-98. The hydraulic conductivities calculated as a result of the tests were 800 centimeters per day and 256 centimeters per day respectively. The slug test data and analysis are provided in Appendix 3.

All monitoring wells were surveyed in order to establish AMSL elevations at the top of riser for each well. Water level measurements were made in all of the monitoring wells on May 7, 1998. The resulting potentiometric surface based on those measurements is shown in Figure 5. Groundwater flow is from east to west across the site. The potentiometric contours converge at the West Side of the site indicating discharge to the headwaters of Skokie Ditch. The average horizontal gradient at the site is approximately .01. Measurements in the deep monitoring wells, in the sand below the first diamicton, indicate a downward vertical gradient.

#### **2.5 Groundwater Sampling**

Groundwater samples were collected during the direct push investigation at the time of the direct push installation and later through the slim 1" pvc well points. Groundwater sampling at each direct push boring location, was conducted as discussed in Appendix A of the QAPP. In instances where a 1" pvc monitoring well was installed, subsequent groundwater sampling may have been conducted. Samples from the 1" pvc monitoring wells were collected during well development (Section 2.3). Prior to well sampling, each well was purged by slowly pumping with an inertia pump to remove at least three (3) borehole volumes of water prior to sample collection. The sampling documentation and collection procedures were conducted as described in Appendix A of the QAPP.

A total of fifty-three (53) groundwater samples were collected from forty-four (44) locations. This includes field-screening samples, as well as samples submitted to the laboratory for analysis of CERCLA or LUST constituents. All sample results were utilized to define "hot spots", because lab confirmation samples correlated nicely to the field screening samples. The field screening analysis is described in Section 3.1. The twenty (20) groundwater sampling locations where samples were submitted to the laboratory for analysis are shown on the map in Figure 6. The monitoring well numbers correspond directly to the direct push boring numbers (i.e. MW-30-98 was installed in direct push boring DP030).

## **2.6 Decontamination**

Decontamination of sampling equipment was performed as described Appendix A, Section 7 of the QAPP.

## **2.7 Investigation Derived Wastes**

Investigation derived wastes were disposed according to the procedures outlined in Appendix A, Section 15 of the QAPP.

### 3.0 SAMPLE ANALYTICAL RESULTS

The results of the samples collected during trenching activities were discussed in the Trench Activity Report dated July 1998. All soil and groundwater samples collected during the direct push portion of the subsurface investigation, were analyzed on site. The field-screening analysis is described in Section 3.1 below. Approximately 20 percent of the samples analyzed in the field were submitted to the laboratory for analysis of either the CERCLA or LUST constituents. Quality control samples were also collected during both the trenching and the direct push portion of the subsurface investigation.

#### 3.1 Field Screening Analysis

Soil and groundwater samples collected during the direct portion of the subsurface investigation were analyzed in a field laboratory for benzene, ethylbenzene, toluene, xylene and selected polynuclear aromatic compounds (PNAs). The PNAs included acenaphthene, anthracene, fluoranthene, fluorene, naphthalene and pyrene. The volatile organic constituents including BETX and naphthalene were analyzed using a GC with a purge and trap injection port. The PNAs were analyzed using a GC with a thermal desorption injection port. The field screening methodologies are discussed below:

##### 3.1.1 BETX and Naphthalene Analysis

A SRI 9300A gas chromatograph with a purge and trap injection port and a flame ionization detector was used to analyze for the volatile hydrocarbons including BETX and naphthalene. To analyze soil using an EPA style Purge & Trap a 1-gram or less soil sample was weighed into a new factory cleaned test tube and covered with 5ml of clean water. The sample was dispersed by vigorous shaking or ultrasonic vibration in different cases. The test tube was connected to the GC and the analysis is initiated. A chromatography data acquisition and control system, such as SRI's PeakSimple Data System controlled the sequence of operations by which the purge and trap extracts the volatile hydrocarbon molecules in the soil.

First, the wet purge gas, which was typically the same helium used for the GCs carrier gas, bubbles up through the soil and water for 4 to 10 minutes. Volatile/purgeable hydrocarbons but not semi-volatile hydrocarbons were evaporated off into the bubbling helium and were carried through a series of two traps. With the traps at room temperature, the hydrocarbons stick to the absorbent inside of the trap tube while the helium and water vapor continue through the tap and out to vent. After 4 to 10 minutes, all of the volatile/purgeable petroleum hydrocarbons were removed from the waster and were absorbed on the trap. Under the control of the PeakSimple Data System, the traps were heated and automatically placed in line with the GCs carrier gas. When the traps were hot, the previously trapped petroleum molecules break free and were swept by the carrier gas onto the GC column where they separate into the respective peaks. Because all of the purgeable volatiles in the 1 gram soil sample were injected into the GC, and not mostly discarded as it would have been in the solvent extraction method, detection limits were much lower than the solvent extraction method. Detection limits were often down to 1 part per billion and below. In some cases, where the actual hydrocarbon contamination in the soil was at a high level, the purge and trap method was actually too sensitive without dilution of the sample. At the end of the analysis, the software output a hardcopy report with sample ID, type of analyses, concentration values, and the chromatogram.

### 3.1.2 PNA Analysis

A SRI 9300A gas chromatograph with a thermal desorption injection port and a flame ionization detector was used for PNA analysis. The GC was configured with a non-polar 0.53 mm x 15-meter capillary column. The field GC system was made to withstand the shock and vibration of field conditions. A built-in air compressor and a single small tank of hydrogen supplied the gas necessary for the whole process.

The temperature of the GC oven was programmed from 50 to 310 degrees centigrade to elute the hydrocarbon peaks in boiling point order. The whole process, from desorption to data acquisition was controlled by a SRI's PeakSimple for Windows operating system software. At the end of the analysis, the software output a hardcopy report with sample ID, type of analyses, concentration values, and the chromatogram.

### 3.1.3 Field Screening Calibration

The quantification of the components was based on the standards run previously on the GC system at various concentrations. BETX and PNAs standards in various solvents were used to calibrate the GC system. The PNA compounds for which calibration standards were run were:

Acenaphthene  
Acenaphthalene  
Anthracene  
Fluoranthene  
Fluorene  
Naphthalene  
Phenanthrene  
Pyrene

Instrument calibration was also controlled by the PeakSimple software.

## 3.2 "CERCLA" Samples

Selected soil and groundwater samples were submitted to ARDL laboratories, in Mt. Vernon, Illinois, for analysis of the target compound list (TCL) constituents. ARDL, Inc. is a CLP laboratory and performed the analyses according to the Level 3 protocol. Six (6) groundwater samples collected during the CPT phase of subsurface investigation, were analyzed for the TCL compounds but were not submitted to the CLP lab.

The CERCLA samples were concentrated in areas where results of the trench sampling indicated possible "hot spot". The suspected "hot spot" areas included the carrier compartment areas on the northeast side of the site and the oil/water separator and lagoon areas on the West Side of the site. The locations where the CERCLA soil and groundwater samples were collected are shown in Figures 3 and 6 respectively. The samples were analyzed and reported as described in the QAPP.

### 3.2.1 Analytical Results of CERCLA Soil Samples

A total of 14 solid matrix samples, ten soil and four sediment samples, in addition to the samples discussed in the Trench Activity Report, were analyzed for volatile organic, semi-volatile organic, Pesticides/PCBs, and Chlorinated Herbicide compounds.

For the **volatile organic compounds** none of the 14 samples indicated concentrations in excess of the practical quantitation limit for the methods used.

For the **semi-volatile organic compounds** one (1) of the 14 sample locations indicated concentrations in excess of the practical quantitation limit for the methods used. The sample number was DPO20, which was converted to a 1" pvc well MW-20-98. Benzo(a)pyrene and Dibenzo(a,h)anthracene were detected in soil in a composite from 0 to 4 feet in depth, at concentrations of 360 and 140 ug/kg respectively.

For the pesticide/PCB organic compounds none of the 14 samples indicated concentrations in excess of the practical quantitation limit for the methods used.

For the Chlorinated Herbicide organic compounds none of the 14 samples indicated concentrations of in excess of the practical quantitation limit for the methods used.

### 3.2.2 Analytical Results of CERCLA Water Samples

A total of 21 liquid matrix samples, 17 groundwater and four surface water samples were analyzed for volatile organic, semi-volatile organic, Pesticides/PCBs, and Chlorinated Herbicide compounds.

For the volatile organic compounds one (1) of the 21 samples indicated concentrations in excess of the practical quantitation limit for the methods used. Methylene Chloride was detected at one location, in Monitoring Well MW-39-98, at a concentration of 5.3 ug/L. Monitoring Well MW-39-98 is located upgradient of the site. Methylene Chloride and Acetone were frequently detected in the method blanks for samples analyzed at the CLP laboratory and are believed to be laboratory contaminants., therefore, the presence of methylene chloride at MW-39-98 is discounted as insignificant (see data validation.)

For the semi-volatile organic compounds none of the 21 samples indicated concentrations in excess of the practical quantitation limit for the methods used.

For the pesticide/PCB organic compounds none of the 21 samples indicated concentrations in excess of the practical quantitation limit for the methods used.

For the Chlorinated Herbicide organic compounds none of the 21 samples indicated concentrations of in excess of the practical quantitation limit for the methods used.

### 3.3 "LUST" Samples

Selected soil and groundwater samples were designated as "confirmation" samples and submitted to Beling Laboratories for analysis of the BETX constituents and to First Environmental Laboratories for analysis of the PNA constituents. These samples were concentrated in areas where the trench sampling results indicated possible "hot spots". These areas included the underground storage tank and fuel line areas in the south and southwest sides of the site. The locations where the LUST soil and groundwater samples were collected are shown in Figures 3 and 6 respectively. Samples were collected and reported as described in the QAPP.

### 3.3.1 Analytical Results of LUST Soil Samples

A total of 14 "confirmation" soil samples were analyzed, in addition to the samples discussed in the Trench Activity Report, for BETX and PNA compounds. Nine (9) of the 14 samples indicated concentrations of BETX or PNAs in excess of the detection limit and/or practical quantitation limit for the methods used. Table 1 provides the quantitation results with the IEPA TACO (Tiered Approach to Clean-up Objectives) Residential, Tier 1 remediation objectives for the significant pathways at the bottom for reference. The pathways include soil ingestion, soil inhalation, and soil leaching to Class I groundwater. Table 1 also includes the USEPA Region IX Preliminary Remediation Goals (PRGs) for cross-reference to federal guidelines are germane to closure, and IEPA maintains purview for review and closure of this site.

The samples indicating the highest concentrations of BETX and PNA compounds were collected from a depth of 4 to 8 feet and were located near the USTs and fuel lines associated with the southernmost training area. The concentration and distribution of these contaminants is discussed further in Section 4.0.

### 3.3.2 Analytical Results of LUST Groundwater Samples

A total of 10 "confirmation" groundwater samples were sent to a laboratory and analyzed for BETX and PNA compounds. Four (4) of the 10 samples indicated concentrations of BETX or PNAs in excess of the detection limit and/or practical quantitation limit for the methods used. Table 2 provides the quantitation results with the IEPA TACO Residential, Tier 1 remediation objectives for Class I groundwater.

The samples indicating the highest concentrations of BETX and PNA compounds were located downgradient of the USTs and fuel lines associated with the southernmost training area. All of these samples are from the shallow sands above the first diamicton. The concentration and distribution of these contaminants is discussed further in Section 4.0.

### 3.4 QA/QC Samples

Quality control samples were routinely collected during the subsurface investigation as part of the data validation process. The quality control samples included trip blanks, temperature blanks and field duplicates. For the CERCLA groundwater samples some matrix spike and matrix spike duplicate samples were also collected. Temperature and trip blanks accompanied every cooler submitted to the laboratory. Field duplicates were collected on approximately 10 percent of the soil and groundwater samples collected. The QA/QC samples were collected, analyzed and documented as described in the QAPP.

### **3.5 Data Validation**

Data validation was performed in accordance with the QAPP document previously referenced in this Report. Per project requirements, ten percent of all CERCLA samples submitted to the CLP lab underwent data review. CLP Samples were grouped into two sets, regardless of their submission date to the laboratory, then the sample for validation was selected using a random number table (see the Trench Activity Report for soil sample validation). A total of 26 samples (10 soil and 14 groundwater, and 2 sediment), were submitted to the CLP lab. The six (6) groundwater samples collected during the CPT phase of subsurface investigation were analyzed for the TCL compounds but were not submitted to the CLP lab. The data sets for samples subsequent to the trench activity soil samples were broken up as indicated below, to ensure a random ten percent were examined for QA/QC purposes.

Groundwater Samples MW- [25,26,30,35,36,39] -98 and  
DP- [002,006,017,020] Validation examination:  
MW-25-98

Soil Samples DP- [002-2,005-2,007-2,008-2,008-2,008-3,017-1,020-1,] and  
DP- [020-2,033-2,034-2] Validation examination: DP-008-2

Sediment and Surface Water Samples SED001-004, SW001-004 and  
DP- [025,026] Validation examination: SED003

ARDL, Inc performed the Lab analyses and Beling Consultants performed the sample validation. Each of the 28 samples (including the 2 duplicates) were analyzed for Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOAs or BNA Extractable Compounds), Organochlorine Pesticides/PCBs and Chlorinated Herbicides. Beling prepared a data validation report for each sample set identified above. Each report was prepared according to the Contract Lab Program Statement of Work OLM03.0 methods for Volatile Organic Compounds, Semi-volatile Organic Compounds and Organochlorine Pesticides/PCBs as published by the USEPA and a Laboratory specific adaptation of SW-846 Method 8151 for Chlorinated Herbicides that was included in the project's approved QAPP. Additional technical guidance was obtained from the Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (USEPA EPA/540/R/082 December 1994).

### 3.5.1 Summary of Data Qualifiers

Review of **MW-25-98** indicated that no qualifiers were necessary for that sample.

Review of **DP-008-2** indicated that the internal standard performance QC criteria for semivolatile analyses were met for this sample, however the internal standard recovery was out of range for the original analyses and the re-analysis required the following quantifications:

Fluorene and acenaphthene- Qualifier "J" for this sample means "results are estimated and the data are valid for limited purposes. The results are qualitatively acceptable"

Review of **SED003** indicated that the internal standard performance QC criteria for volatile analyses were met for this sample, however the internal standard was out of range for the original analyses and the re-analysis required the following quantifications: Qualifier "UJ" was applied for nine compounds due to the re-analysis of the Internal Standard. UJ means "the reported quantification limit is estimated because Quality Control criteria were not met. Compound was not detected".

### 3.5.2 Technical Holding Times

Technical holding time criteria were met for all sample analyses associated with the validation process.

### 3.5.3 Instrument Calibration (Initial)

All initial calibration criteria for VOCs, SVOCs, and Pesticide/PCBs as specified in the CLP Statement of Work OLM03.0 were met. Calibration criteria for the Herbicide fraction were met as specified in the laboratory specific method found in the QAPP for this sampling program. Slight differences in the lab calculation for % relative standard of deviation (RSD) and the reviewer's calculations are considered to be due to rounding and are not significant.

### 3.5.4 Instrument Calibration (Continuing)

All continuing calibration criteria for VOCs, SVOCs, Pesticide/PCBs and Herbicides were evaluated. The data as reported by ARDL are acceptable without modifications or additional qualifiers based on the evaluation prescribed in the CLP SOW.

### 3.5.5 Instrument Tuning

GC/MS and GC tuning criteria, as specified in the CLP SOW OLM03.0, were met for all soil samples evaluated during the data validation process for VOCs, SVOCs, and Pesticide/PCB fractions. In addition, GC tuning as specified in the laboratory specific analysis method for Herbicides as specified in the project QAPP was also met.

#### 3.5.6 Blank Sample Analyses

The method blanks for each data set were evaluated for concentrations above the RL. Concentrations above the RL were noted for common laboratory contaminants as discussed above. No target compound list (TCL) compounds were detected in the extraction blank analyses for SVOCs, Pesticide/PCBs or Herbicide fractions.

#### 3.5.7 Surrogate Spike Performance

Surrogate spike recovery QC criteria for CLP SOW OLM03.0 and the laboratory specific method were met for VOC, SVOC, Pesticide/PCB and Herbicide analyses associated with the validation process. The Volatile analysis of the original sample and rerun of **SED003** had a surrogate recovery for Chlorobenzene-d5 outside of acceptance range.

The data are not qualified since the rerun had adequate recovery for the internal standard

#### 3.5.8 Internal Standard

Internal Standard performance QC criteria for CLP SOW OLM03.0 for VOCs and SVOCs were met. Re-analyses were necessary in a few instances, with minor qualifications necessary as provided in 4.1 above. In one case, a transcription error was also noted between raw data for VOCs and the summary-reporting sheet, but there was no effect on the acceptability of the recoveries.

#### 3.5.9 Matrix Spike/Matrix Spike Duplicate Analyses

MS/MSDS were not required for soil samples, biopile samples, sediment or derived waste samples. The laboratory utilized was required to perform QA/QC analysis of this type on 5 % of the groundwater samples submitted for analysis. One MS/MSD was submitted to the CLP lab, however, analysis of the MS/MSD was not completed. No explanation was offered by the lab.

#### 3.5.10 Compound Identification and Quantification

No problems were observed or noted for compound identification with the designated samples for VOCs, SVOCs, Pesticide/PCB or Herbicide analyses.

#### 3.5.11 System Performance

No problems with system performance were noted.

#### 3.5.12 Compound Quantitation/System Log Tables/Preparation Logs

The data packages from ARDL included compound quantitation reports, system logging reports and preparation logs for all VOC, SVOC, Pesticide/PCB and Herbicide analyses performed.

### 3.5.13 Duplicate Groundwater Samples

Duplicate groundwater samples were collected at the prescribed ratio of 10% as required by the QAPP. The following pairs of samples provide the duplicate groundwater sample:

CPT97-3	duplicate sample	CPT97-3dup (not submitted to the CLP lab)
MW-35-98	duplicate sample	MS35

The Data validation checklist includes review of duplicates for instances where duplicates correspond with the samples selected for validation review.

### 3.6 Soil Geotechnical Analysis

Seven (7) soil samples were collected at six (6) locations in an attempt to represent the soils across the site. The sample depths selected were determined by the lithology at that boring location. The samples were tested for geotechnical parameters, which include, in part, hydrometer analysis, classification moisture content, moist and dry bulk density, total organic carbon, and porosity. Please refer to Appendix 4 for the complete Geotechnical Laboratory Reports. Also, refer to Figure 3 for the boring locations.

At the boring location identified as CP-001, three (3) soil samples were collected: (SS-001-1, SS-001-2, and SS-001-3). SS-001-1 was collected between 22 and 23.5 feet below the surface and taken from the first diamicton layer encountered. The soil classification was determined to be that of a Lean Clay with sand (CL). Soil sample SS-001-2 was collected between 36 and 37 feet below the surface and taken at the interface between the first diamicton and a sandy layer above the second diamicton.

The soil classification was determined to be a silty clay (CL-CM). Soil Sample SS-001-3 was collected between 37 and 37.5 feet below the surface. This sandy sample was taken below the first diamicton layer. The soil classification was determined to silt with sand (ML).

At the boring location CP-005, one (1) soil sample, CP-005-1, was collected between 42 and 43.5 feet below the surface. This sample was taken from the sandy unit on top of the second diamicton layer. The soil classification was determined to be a silty sand (SM).

The remaining three (3) soil samples were collected in the stratigraphic units above the first diamicton unit encountered at the site. At boring DP-012, a soil sample from 4 to 8 feet below the surface was collected. The soil classification was determined to be silty sand (SM). At boring DP-029, two (2) soil samples were collected. The samples were collected from depths of 1 to 5 feet and 7 to 11 feet below the surface. The soil classifications were determined to be silty clay (CL-ML), and poorly graded sand (SP-SM), respectively. Percent porosity was determined to .4310 in the silty clay, while porosity varied between silty sand (DP-012) at .3661, and poorly graded sand (DP-029) at .3014. Dry bulk density was found to be 95.1 (PCF) in the silty clay sample. The silty sand had a dry bulk density of 106.1, while the poorly graded sand was 116.8.

## 4.0 TIER 1 TACO

The remediation objectives for the site with respect to the contaminants of concern are the TACO, Tier 1 Remediation Objectives for Residential Properties (35 IAC Part 742, Appendix B). The FFTU Site is currently surrounded by a golf course and the proposed future land use for the site is as a driving range. The Tier 1 analysis consists of an evaluation of the constituents of concern with respect to the remediation objectives, and evaluation of the potential for free product, and an evaluation of the routes of exposure. The Tier 1 evaluation for the project encompasses all of the samples collected including the trench and the subsurface investigation samples.

### **4.1 Contaminants of Concern**

For suspect areas, the preliminary contaminants of concern were the full TCL Volatile Organics, Semi-volatile Organics, pesticides, PCBs and chlorinated herbicides. The CERCLA samples were concentrated in the area surrounding the carrier compartment, storm drains, oil/water separator, and the lagoons. For the areas where petroleum contamination was suspected, the preliminary contaminants of concern were the LUST contaminants, BETX and PNAs.

The final contaminants of concern are those constituents that exceeded a TACO Tier 1 Objective. Table 3 lists the contaminants of concern and the maximum exceedances for both soil and groundwater. The final contaminants of concern are the BETX constituents and naphthalene.

The groundwater ingestion pathway remediation objective was exceeded only for benzene and naphthalene. The approximate area where benzene exceeds the remediation objective is shown in Figure 7. The approximate area where naphthalene exceeds the remediation objective is shown in Figure 8.

The soil migration to Class 1 groundwater route of exposure was exceeded only for benzene, ethylbenzene, toluene, and xylene. The approximate areas where the BETX constituents exceed the respective remediation objectives are shown on Figures 9 through 12.

### **4.2 Contaminant Source/Free Product Evaluation**

#### **4.2.1 Attenuation Capacity**

While strong petroleum vapors were observed in soil borings, no free product was observed. The sum of the organic contaminant residual concentrations analyzed in soil samples collected at the site did not exceed 6,000 milligrams per kilogram for soils in the top one meter, or 2,000 milligrams per kilogram for soils below a depth of one meter at any of the sampling locations.

#### 4.2.2 Soil Saturation Limits

The soil saturation limits for the contaminants of concern are provided on Table 4. The chemicals in which the melting point is less than 30°C were obtained from 35 IAC Part 742, Table A. None of the soil samples collected at the site exceeded the soil saturation limits for the volatile organic contaminants. For the semi-volatile organic contaminant, Naphthalene, saturation limits were calculated according to 35 IAC 742.220. None of the samples collected exceeded the calculated soil saturation limit for naphthalene.

#### 4.2.3 Reactivity

Specific laboratory analysis for the purpose of evaluating the soil characteristic for reactivity as determined by 35 IAC 721.123 were not performed. Based on knowledge of the practices conducted at the site, the presence of sulfide or water reactive or explosive substances is not suspected.

#### 4.2.4 pH

Specific field or laboratory analyses for soil pH were not performed. The range of pH in natural soils based on published data is expected to be between 6.0 and 8.0. Based on knowledge of practices conducted at the site, pH ranges less than 2, or greater than 12.5 are not suspected.

#### 4.2.5 Toxicity

TCLP analysis of arsenic, barium, cadmium, chromium, lead, silver, selenium, and mercury were not performed. The soils at the site are not expected to exhibit the characteristics of toxicity for hazardous waste as determined by 35 IAC Part 721.124.

### 4.3 Exposure Route Evaluation

#### 4.3.1 Inhalation Exposure Route Evaluation

The inhalation exposure route can not be totally excluded from further consideration at the FFTU site, since "inhalation" exposure technically applies to everything <10 ft below grade [Part 732.1105 (c)(3)(C)] and four (4) LUST samples (L023, L026, L030, and L032) exceed the residential inhalation standard of 800 mg/kg for Benzene. Two soil samples (L026 and L030) also exceed the construction worker inhalation standard of 2100 mg/kg for Benzene.

Table 3 lists the maximum soil and groundwater concentrations detected for the contaminants of concern. The Tier 1 remediation objectives for the inhalation exposure route for residential and construction worker sites are provided for analysis in soil. The remediation objectives for the inhalation exposure route were exceeded for benzene only. The samples exceeding the remediation objective for soil inhalation were from depths greater than 3 feet, may be below groundwater during part or most of the upcoming years since the subsurface drainage system was removed in 1997.

#### 4.3.2 Soil Ingestion Exposure Route Evaluation

The soil ingestion exposure route can be excluded from further consideration at the FFTU site. Table 3 lists the maximum soil concentrations detected for the contaminants of concern and the Tier 1 remediation objectives for the soil ingestion exposure route for both residential sites and for protection of construction workers. The remediation objective for soil ingestion at residential sites was not exceeded for the contaminants of concern.

#### 4.3.3 Groundwater Ingestion Exposure Route

The groundwater ingestion exposure route cannot be excluded from Tier 2 consideration.

While no free product was encountered at the site, Tier 1 remediation objectives were exceeded for benzene and naphthalene. No existing water supply wells are known to be located within 2500 feet. The estimated areas where the groundwater concentrations exceed the groundwater ingestion exposure route remediation objectives are shown on Figures 7 and 8 respectively. Refer to the Tier 2 discussion Section 5.0 of this Report.

#### 4.3.4 Groundwater Discharge to Surface Water

Groundwater from the FFTU area site flows to a point of discharge in the headwaters of Skokie Ditch. No surface water quality standards are available under 35 IAC Part 302 for the contaminants of concern. As previously stated, the concentration of benzene and naphthalene exceed the groundwater ingestion remediation objectives, which is further discussed in Section 5.0 of this Report. Benzene is the most restrictive of the contaminants of concern at the FFTU site with respect to remediation objectives. The U.S. EPA Superfund Ecotox threshold for benzene in fresh water is 46 micrograms per liter.

#### 4.3.5 Soil Migration to Groundwater Exposure Route

The most restrictive soil exposure route is the soil migration to groundwater exposure route. The most restrictive of the contaminants of concern for that exposure route is benzene. The estimated areas where the soil concentrations exceed the soil migration to groundwater exposure route remediation objectives are shown on Figures 9 to 12. The estimated migration distance to contaminant attenuation is discussed in 5.0 of this Report.

## 5.0 TACO TIER 2 ANALYSIS

The results of the subsurface investigation indicate that the Tier 1 remediation objectives were exceeded for the soil inhalation, groundwater ingestion, and the soil migrating to groundwater routes of exposure. The extent of the soil and groundwater contamination were determined to be limited to the site. The purpose of the Tier 2 analysis is to evaluate if remediation is necessary for the protection of human health and the environment. The Tier 2 evaluation includes modeling to predict the concentrations of the constituents of concern at the point of compliance. For this site, the point of compliance is the only actual receptor, the headwaters of Skokie ditch on the West Side of the site. This is the point of groundwater discharge for contaminants migrating from the site.

### 5.1 Physical and Chemical Properties of the Constituent of Concern

The physical and chemical properties for the constituents of concern used in model calculations were taken from 35 IAC 742, Appendix C, Table E.

### 5.2 Soil Properties

Soil properties used for the model calculations was the default values in 35 IAC 742, Appendix C, Table D, with the exception of porosity. The most significant portion of groundwater migration will take place in the shallow sandy units, beneath the FFTU site. Porosity's measured in the geotechnical soils analysis for these units varied from .03 to .36. A value of .33 was used for the model calculations.

### 5.3 Exposure Route Evaluation

The soil ingestion route of exposure was eliminated in the Tier 1 evaluation. The soil inhalation, groundwater ingestion and soil migrating to groundwater routes of exposure were not eliminated in the Tier 1 evaluation and are discussed below.

#### 5.3.1 Groundwater Ingestion

The model calculations for the groundwater ingestion route of exposure are provided in Appendix 5. The model calculations were performed according to 35 IAC 742, Appendix C, Table C. A steady-state attenuation model is used to calculate the concentrations of groundwater contaminants of concern downgradient of the source area. The source area is defined by the contour of the contaminant concentration equivalent to 1/2 of the maximum groundwater concentration detected.

The distribution of groundwater contaminants and the respective source areas closest to the point of compliance are shown in Figures 7 and 8. The model calculations predict that the concentrations of benzene and naphthalene will not exceed the Tier 1 remediation objectives for groundwater at the point of compliance. The contamination will therefore, not leave the site.

### 5.3.2 Soil Migrating Route of Exposure

The model calculations for soil migrating to groundwater route of exposure are provided in Appendix 5. The model calculations were performed according to 35 IAC 742, Appendix C, Table C. A soil leaching factor was calculated based on the soil physical properties and the width of the soil source area. Leaching factor was then applied to the soil concentrations in order to predict the resulting concentration of the groundwater source. The groundwater source was then modeled as in the groundwater ingestion pathway to predict the groundwater concentrations down gradient of the source.

The contamination source area is defined by the contour of the contaminant concentration equivalent to  $\frac{1}{2}$  of the maximum contaminant concentration detected for each constituent. The distribution of contaminants and their relative source areas closest to the point of compliance are shown in Figures 9 through 12. The model calculations predict that the concentrations of benzene, ethylbenzene, toluene and xylene in groundwater will not exceed the Tier 1 remediation objectives at the point of compliance. The contamination therefore, will not leave the site.

### 5.3.3 Soil Inhalation Route of Exposure

The remediation objectives for the inhalation exposure route were exceeded for benzene. The distribution of benzene in soil is shown on Figure 9. The samples exceeding the remediation objective for soil inhalation coincided with the exceedances for the soil migrating to groundwater route of exposure. The samples were collected near the former USTs and fuel lines associated with the southernmost training area from depths greater than 3 feet.

Prior to the piping demolition activities, the uppermost near-surface water table at the FFTU site was between 3 and 13 feet below grade. Current indications of water table depth are between 3 and 6 feet below grade. The removal of the subsurface drainage system has encouraged greater infiltration of rain water, and a higher detention time on site. The water table, in our estimation, will continue to rise to approximately 3 feet below grade or less, because the surrounding golf course has a groundwater level of 0 to 2 feet below grade (year round) except where specialty drainage has been employed. Because the water table is or will be above the soil contamination discussed above, an institutional control is not applicable for inhalation of benzene from soil below 3 feet of depth at the FFTU site.

Part 742 is not clear regarding inhalation standard for soil contamination below the groundwater, but it is reasonable to assume that migration soil contamination at or below the water table would be fully accounted for in the "soil leaching to groundwater" model/exposure route. An institutional control as described in 742.1105 c)3)C) would appear to be applicable only if the water table remained 10 feet below grade.

#### **5.4 Institutional Controls**

Since the Tier 1 remediation objectives for groundwater ingestion and soil migrating to groundwater routes of exposure were exceeded on-site, Great Lakes Naval Training Center proposes institutional controls for site closure. The institutional controls will include a prohibition on the use of potable water supply wells and the drilling of new potable water supply wells on-site.

The institutional controls will cover the former FFTU site and portions of the golf course. The proposed institutional control areas are shown in Figure 13. The potable water supply well prohibition will extend to approximately 200' west of the stormwater discharge point on the headwaters of Skokie Ditch. The engineered barrier will be maintained in the future driving range area of the former FFTU Site. A copy of the proposed institutional control will be submitted to the IEPA for review prior to finalization. The current plan includes submittal of the final institutional control document to the Office of The Recorder in Lake County, with copies on file with the Public Works Center, Southern Division Real Estate, Environmental n45, Utilities C600, NTC Facilities and Planning N41, and MWR (golf course operator). The institutional control document will be submitted as part of the request for site closure. Preparation of the final closure document is pending IEPA review of this Report.

## 6.0 SUMMARY AND CONCLUSIONS

A subsurface investigation was performed at the subject site to evaluate the extent of soil and groundwater contamination. Investigation included cone penetrometer testing, soil and groundwater sampling and installation and testing of monitoring wells. Over two hundred fifty (250) soil samples, fifty-three (53) groundwater samples, four (4) sediment samples and four (4) surface water samples were collected as part of the investigation.

The results of the CPT and shallow direct push soil sample investigation indicate that the site is covered by a shallow sandy soil or fill materials averaging approximately 15' in depth. Beneath the shallow sand is an impermeable clay till or diamicton unit. The CPT data indicates that the diamicton units have very low permeability. The potentiometric data for the monitoring wells at the site indicate that the groundwater flow is from east to west, discharging to the headwaters of Skokie Ditch. The water level has been rising due to the removal of the subsurface drainage system.

One hundred eighty-four (184) soil samples, seventeen (17) groundwater samples, four (4) sediment samples and four (4) surface water samples were submitted to the laboratory for analysis. The analytical results were compared to the TACO Tier 1 remediation objectives. The Tier 1 remediation objectives for groundwater ingestion were exceeded for benzene and naphthalene; and the Tier 1 remediation objectives for migration to groundwater were exceeded for benzene, ethylbenzene, toluene and xylene. The contamination appeared to be associated with the former underground storage tank (UST) area and product fuel line areas on-site. The contamination was limited to the shallow sands above the first diamicton.

A Tier 2 analysis was performed in order to evaluate the potential for contamination to migrate off-site. Model calculations in the Tier 2 analysis predicted that contamination will not migrate off-site and will not exceed the Tier 1 remediation objectives at the headwaters of Skokie ditch.

Since the contamination will not migrate off-site, no remediation is proposed. Since the Tier 1 remediation objectives were exceeded, Great Lakes Naval Training Center intends to impose an institutional control and prohibit the installation and use of potable water supply wells on the former FFTU site and portions of the golf course. The institutional control documents will be submitted as part of the request for site closure, pending IEPA review of this Report.

**Table 1**  
**Soil Samples Results -**  
**BETX and PNAs**  
**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

Depth to Bottom of Sample	Sample ID	Date Sampled	BETX (ug/kg)				Polynuclear Aromatics (ug/kg)																	
			Benzene	Ethylbenzene	Toulene	Xylenes, Total	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene		
8	DP010-2	1/26/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	DP012-2	1/27/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	DP013-2	1/27/98	-	-	-	-	-	-	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	DP014-2	1/27/98	-	-	620	-	1800	-	1720	2210	4510	454	65	150	-	-	-	-	-	-	-	-	-	-
8	DP015-2	1/27/98	-	-	-	360	8410	-	1450	1790	3410	318	59	110	-	-	-	-	-	-	-	-	-	-
8	DP016-2	1/27/98	1950	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	DP018-1	1/28/98	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	DP019-1	1/28/98	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	DP019-2	1/28/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	DP023-2	1/29/98	-	-	-	-	837	-	107	120	214	-	-	-	-	-	-	-	-	-	-	-	-	-
4	DP040-1	2/5/98	-	-	-	-	30	-	-	-	60	-	-	61	17	-	21	23	26	-	-	-	-	-
8	DP040-2	2/5/98	-	560	-	270	2660	-	1880	3700	3670	508	491	1530	292	360	423	224	428	372	118	-	394	-
4	DP041-1	2/5/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	DP041-2	2/5/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<b>R-X TACO</b>	Soil Ingestion	22000	7800000	1.6E+07	160000	3100000	2300000	4700000	3100000	2300000	2.3E+07	3100000	2300000	900	88000	900	9000	90	900	90	2300000	
	Soil Inhalation	800	400000	650000	410000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA							
	Soil to GW	30	13000	12000	150000	84000	30000	570000	560000	280000	1.2E+07	4300000	4200000	2000	160000	5000	49000	8000	14000	2000	3.2E+07	
	PRGs Res	632	230000	792729	320000	240000	100000	110000	90000	100000	5700	2607000	100000	609	7200	609	6087	61	609	61	100000	
PRGs Ind/Com	1374	230000	880000	320000	240000	100000	110000	90000	100000	5700	2.7E+07	100000	2613	7200	2613	26131	261	2613	261	100000		

**TACO Tier 1 Remediation Objectives**

**Soil Ingestion:** Residential soil remediation objective for the soil ingestion exposure route ( 35 IAC Part 742, Appendix B, Table A)  
**Soil Inhalation:** Residential soil remediation objective for the soil inhalation exposure route ( 35 IAC Part 742, Appendix B, Table A)  
**Soil to GW:** Soil remediation objective for the soil component of groundwater ingestion exposure route ( 35 IAC Part 742, Appendix B, Table A)

**USEPA Region IX Preliminary Remediation Goals (PRGs) August 1, 1996**

**PRGs Res:** Risk-Based Remediation Goals for soil in Residential Land Use areas.  
**PRGs Ind/Com:** Risk-Based Remediation Goals for soil in Industrial/Commercial Land Use areas.

NA indicates Remediation Objectives have not been specified.

- indicates practical quantitation limit was not exceeded

All Units are ug/kg or parts per billion

Shading indicates limit exceeded

location where soil ingestion or inhalation remediation objectives were exceeded were not within 3 feet of ground surface.

**Table 2**  
**Groundwater Samples Results - BETX and PNAs**  
**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

Sample ID	Date Sampled	BETX (ug/L)				Polynuclear Aromatics (ug/L)																
		Benzene	Ethylbenzene	Toluene	Xylenes, Total	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	
DP010-G	1/26/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DP012-G	1/27/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DP013-G	1/27/98	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
DP014-G	1/27/98	-	-	-	-	31	-	-	9	14	-	-	-	-	-	-	-	-	-	-	-	-
DP016-G	1/27/98	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DP018-G	1/28/98	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DP040-G	2/5/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DP041-G	2/5/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW-29-98	2/19/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW-38-98	2/19/98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Class I GW		5	700	1000	10000	25	210	420	280	210	2100	280	210	700	1.5	0.18	0.17	0.2	0.43	0.3	210	
Class II GW		25	1000	2500	10000	39	1050	2100	1400	1050	10500	1400	1050	3500	7.5	0.9	0.85	2	2.15	1.5	1050	

**TACO Tier 1 Remediation Objectives**  
Class I GW: Groundwater remediation objective for Class I groundwater component of groundwater ingestion exposure route ( 35 IAC Part 742, Appendix B, Table E)  
Class II GW: Groundwater remediation objective for Class II groundwater component of groundwater ingestion exposure route ( 35 IAC Part 742, Appendix B, Table E)

NA indicates Remediation Objectives have not been specified.  
- indicates practical quantitation limit was not exceeded  
All Units are ug/L or parts per billion  
Shading indicates limit exceeded

**TABLE 3  
COMPARISON OF MAXIMUM CONTAMINANT CONCENTRATIONS  
TO TIER 1 REMEDIATION OBJECTIVES**

ORGANIC ANALYTE	GROUNDWATER			SOIL						
	Maximum Groundwater Concentration (ug/L)	Well or Direct-Push Designation	Class I Groundwater Remediation Objectives (1) (ug/L)	Maximum Soil Concentration (ug/kg)	Soil Sampling Location Designation	Soil Migration To Class I Groundwater Remediation Objectives (2) (ug/kg)	Exposure Route-Specific Values for Soils(2)			
							Residential		Construction Worker	
							Ingestion (ug/kg)	Inhalation (ug/kg)	Ingestion (ug/kg)	Inhalation (ug/kg)
Benzene	73	DP016	25	4,870	L026	30	22,000	800*	4,300,000	2100*
Ethylbenzene	<700	-	1,000	41,500	L030	13,000	7,800,000	400,000	20,000,000	58,000
Toluene	<1000	-	1,000	29,800	L026	12,000	16,000,000	650,000	410,000	42,000
Xylenes, Total	<10000	-	10,000	216,000	L030	150,000	160,000,000	410,000	410,000,000	410000
Naphthalene	31	DP014	25	<84000	-	84,000	82,000,000	NA	8,200,000	NA

(1) TACO Tier 1 Groundwater Remediation Objectives (35IAC742, Appendix B, Table E)

(2) Soil Remediation Objectives for Residential Properties (35IAC742, Appendix B, Table A)

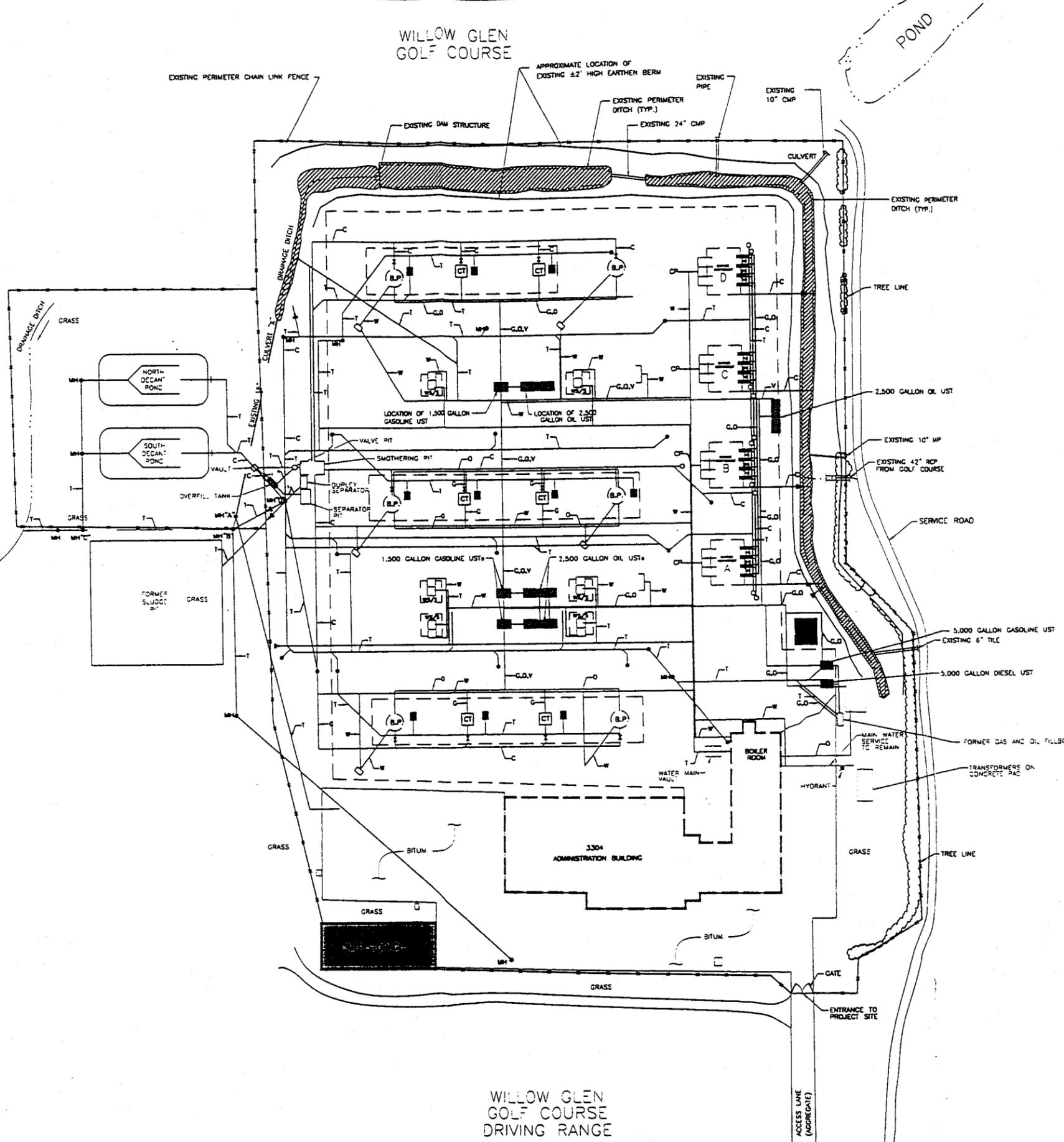
N/A Limit or value not available.

Shading indicates limit exceeded

\* location where soil ingestion or inhalation remediation objectives were exceeded were not within 3 feet of ground surface.

**LEGEND**

W	WATER PIPES
C	CAST IRON DRAIN PIPES
T	NON-METALLIC CLAY TILE DRAIN PIPES
G	G = GAS SUPPLY PIPE
O	O = OIL SUPPLY PIPE
V	V = VENT PIPE
B.P.	BURN PIT (Removed)
CT	CHRISTMAS TREE ENCLOSURE (Removed)
WS/E	WATER SUMP (Removed)
X	GATE VALVE (Removed)
◇	CONTROL TOWER (Removed)
CP	CONTROL PANEL WITH MULTIPLE CONNECTIONS TO SPRINKLERS
●	CATCH BASIN
○	CLEANOUT
MH●	MANHOLE
■	PILET
■	UNDERGROUND STORAGE TANKS
▨	APPROXIMATE AREA OF JURISDICTIONAL WETLANDS
—	CHAIN LINK FENCE
----	INDICATES STRUCTURE HAS BEEN REMOVED
CMP	CORRUGATED METAL PIPE
MP	SMOOTH METAL PIPE
RCP	REINFORCED CONCRETE PIPE

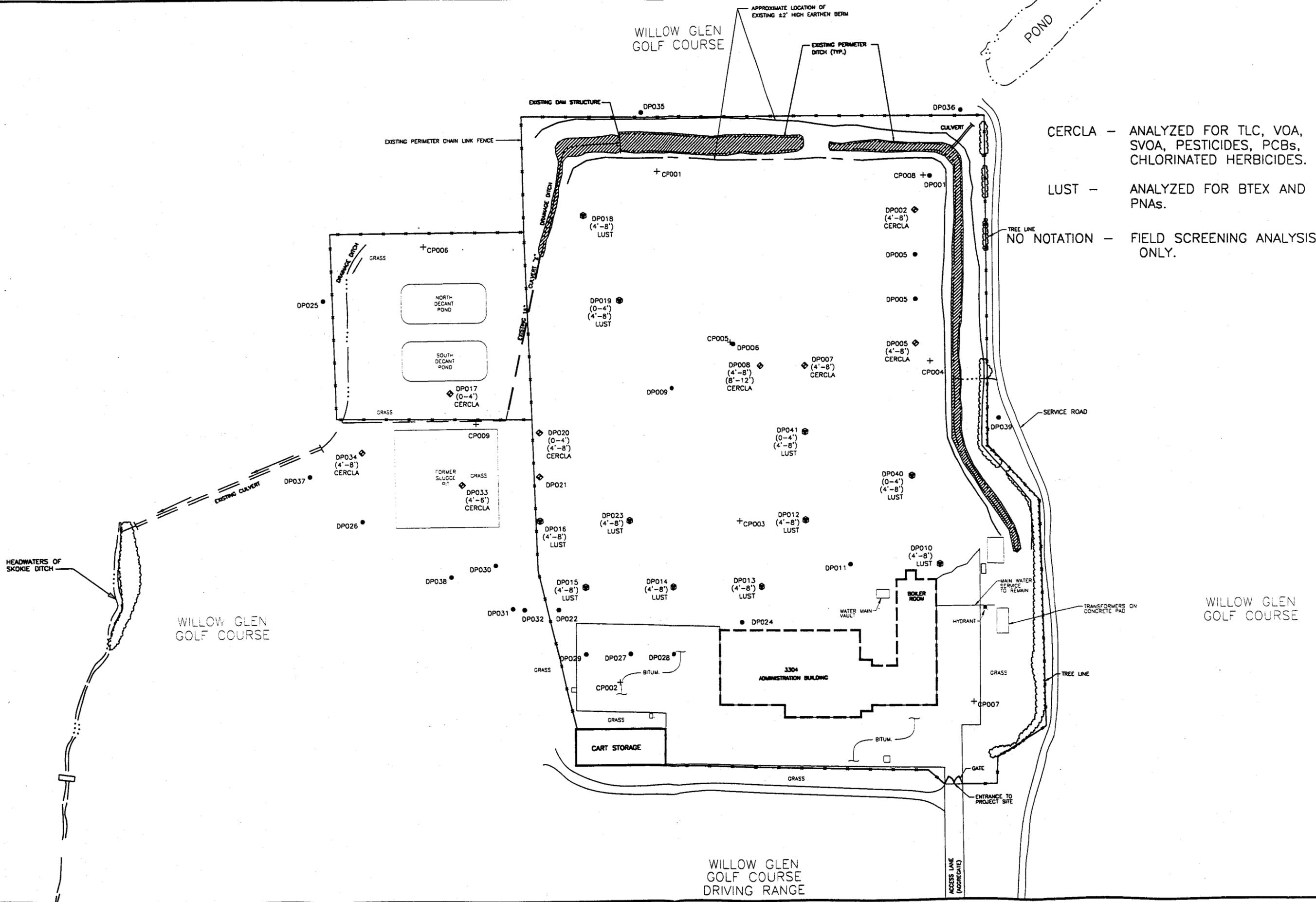


<b>FIGURE 1</b>		<b>JOB NUMBER:</b> 29886		<b>DATE:</b> JULY 1998							
<b>SITE MAP</b>		<b>SUBSURFACE REMEDIAL INVESTIGATION</b>									
<b>US DEPARTMENT OF THE NAVY</b>		<b>NAVAL TRAINING CENTER GREAT LAKES, ILLINOIS</b>									
<b>ENVIRONMENTAL REMEDIATION OF THE PREPOTING TRAINING UNIT (PTTU)</b>		<table border="1"> <tr><td>DESIGNED</td><td>EW LOTT</td></tr> <tr><td>DRAWN</td><td>EW LOTT</td></tr> <tr><td>CHECKED</td><td>ME, AP, NEWELL</td></tr> </table>				DESIGNED	EW LOTT	DRAWN	EW LOTT	CHECKED	ME, AP, NEWELL
DESIGNED	EW LOTT										
DRAWN	EW LOTT										
CHECKED	ME, AP, NEWELL										
<b>BELING CONSULTANTS</b>		<p>Professional Engineer          State No. 0036          John A. Beling, P.E., Chicago, IL          Dwight A. Newell, P.E., Hammond, IN          Scale: 1" = 100 FEET</p>									
<b>REV.</b>	<b>DATE</b>	<b>REMARKS</b>									

DEPT. 18 CADB 7/20/98 2:17 PM FIGURE-1.dwg



DEPT 18 CADD 7/20/98 2:22 PM FIGURE 3.DWG



CERCLA - ANALYZED FOR TLC, VOA, SVOA, PESTICIDES, PCBs, CHLORINATED HERBICIDES.

LUST - ANALYZED FOR BTEX AND PNAs.

NO NOTATION - FIELD SCREENING ANALYSIS ONLY.

**FIGURE 3**  
JOB NUMBER:  
28886  
DATE:  
JULY 1998

DIRECT PUSH  
SOIL SAMPLE LOCATIONS  
SUBSURFACE  
REMEDIAL INVESTIGATION

US DEPARTMENT OF THE NAVY  
NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS  
ENVIRONMENTAL REMEDIATION OF THE  
FRETIGHTING TRAINING UNIT (FTU)

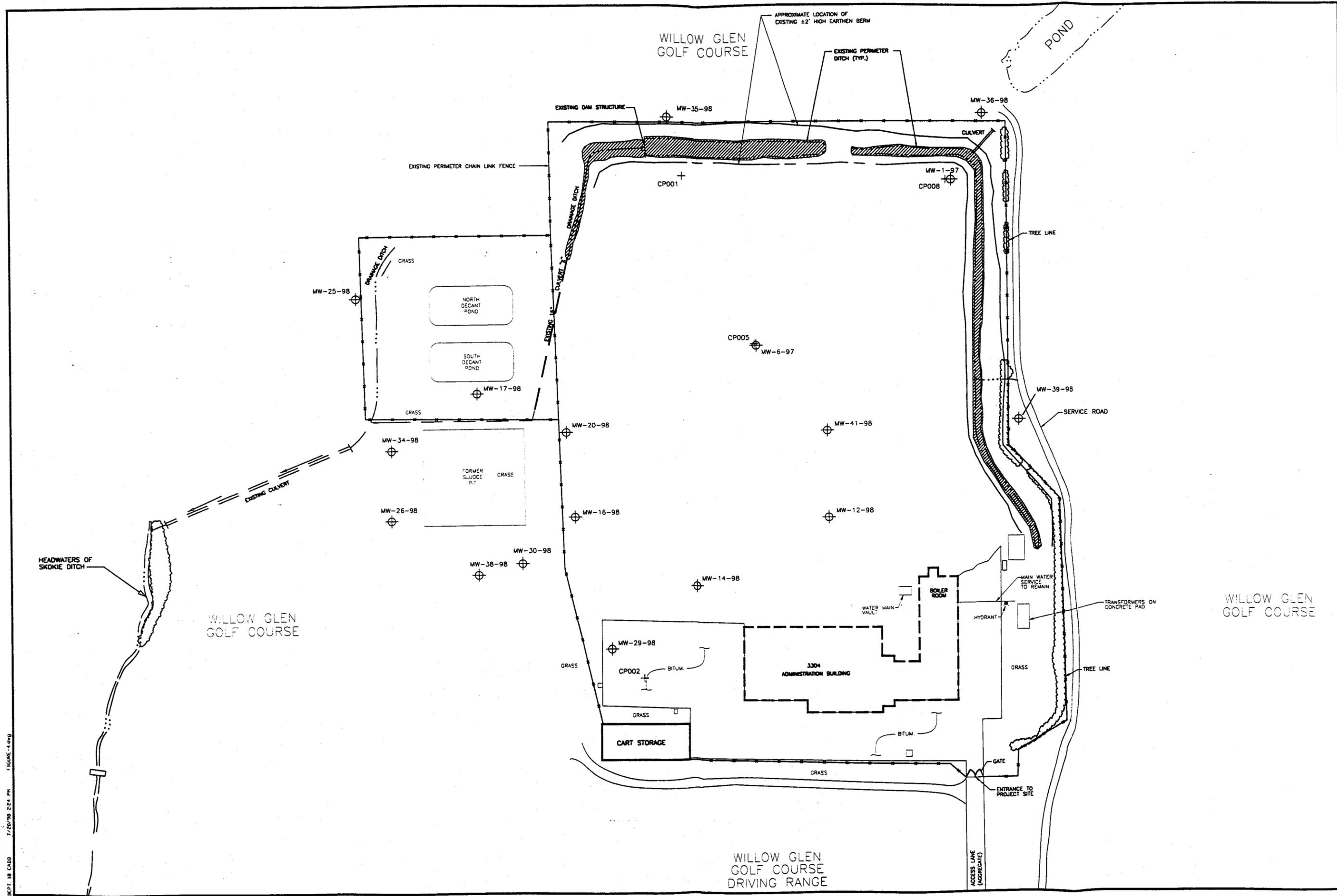
Professional Engineer  
BRUCE BOB  
Illinois, U.S. Code, E.C. Chicago, U.S. Patent, E.C.  
Davenport, U.S. Patent, W. Hammond, W. Hammond, Ill.  
Scale: 1" = 2000 FEET

**BELING CONSULTANTS**

DESIGNED: E.M. LOTT  
DRAWN: E.M. LOTT  
CHECKED: M.E. ARNHEIM

REV.	DATE	REMARKS

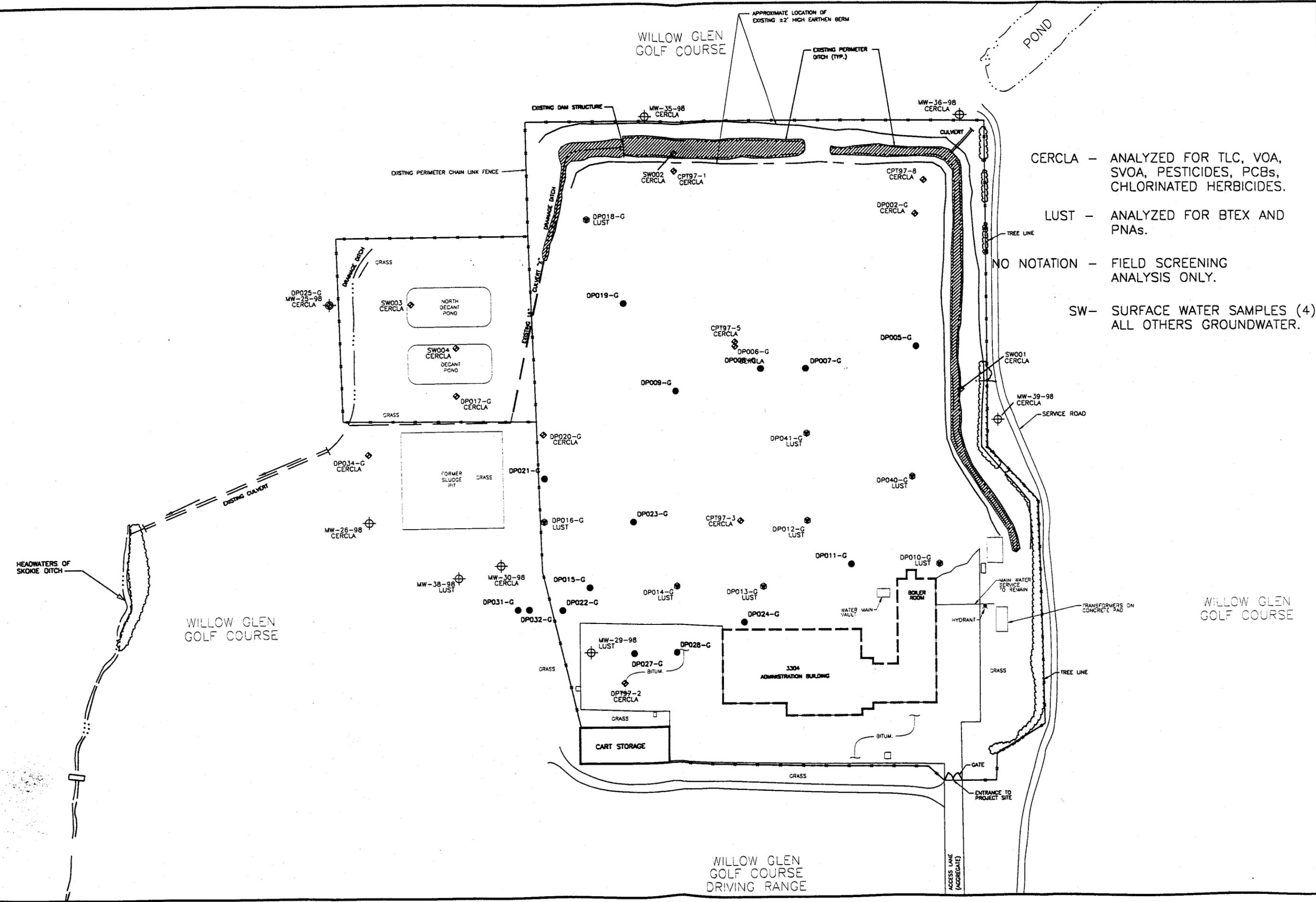
REPT. IS CABD 7/20/98 2:24 PM FIGURE-4.dwg



<b>FIGURE 4</b>		<b>JOB NUMBER:</b> 29886	
<b>MONITORING WELL LOCATIONS</b>		<b>DATE:</b> JULY 1998	
<b>US DEPARTMENT OF THE NAVY</b>		<b>REMEDIAL INVESTIGATION</b>	
<b>NAVAL TRAINING CENTER</b>		<b>SUBSURFACE</b>	
<b>GREAT LAKES, ILLINOIS</b>		<b>EMPIRICAL REMEDIATION OF THE</b>	
		<b>FRESHWATER TRAINING UNIT (FTU)</b>	
<b>BELING CONSULTANTS</b>		Professional Engineering SINCE 806 Illinois, L.S. Juhl, L.S. Chicago, L.S. Park, L.S. Springfield, L.S. St. Louis, L.S. St. Petersburg, L.S. Tallahassee, L.S. Tampa, L.S. Washington, D.C.	
DESIGNED DPA/WW		Scale: 1" = 100 FEET	
CHECKED ME/AP/NEWELL		N	
<b>REV.</b>	<b>DATE</b>	<b>REMARKS</b>	



REV. 18. CAD 7/20/98 2:29 PM FIGURE 6.dwg



CERCLA - ANALYZED FOR TLC, VOA, SVOA, PESTICIDES, PCBs, CHLORINATED HERBICIDES.

LUST - ANALYZED FOR BTEX AND PNAs.

NO NOTATION - FIELD SCREENING ANALYSIS ONLY.

SW- SURFACE WATER SAMPLES (4) ALL OTHERS GROUNDWATER.

**FIGURE 6**  
JOB NUMBER  
29886  
DATE  
JULY 1998

WATER SAMPLING LOCATIONS  
SUBSURFACE  
REMEDIAL INVESTIGATION

US DEPARTMENT OF THE NAVY  
NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS  
ENVIRONMENTAL REMEDIATION OF THE  
FREETONING TRAINING UNIT (FTTU)

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Professional Engineering  
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Davenport, IA • St. Louis, MO • Hammond, IN • Columbia, SC

Scale: 1" = 100 FEET

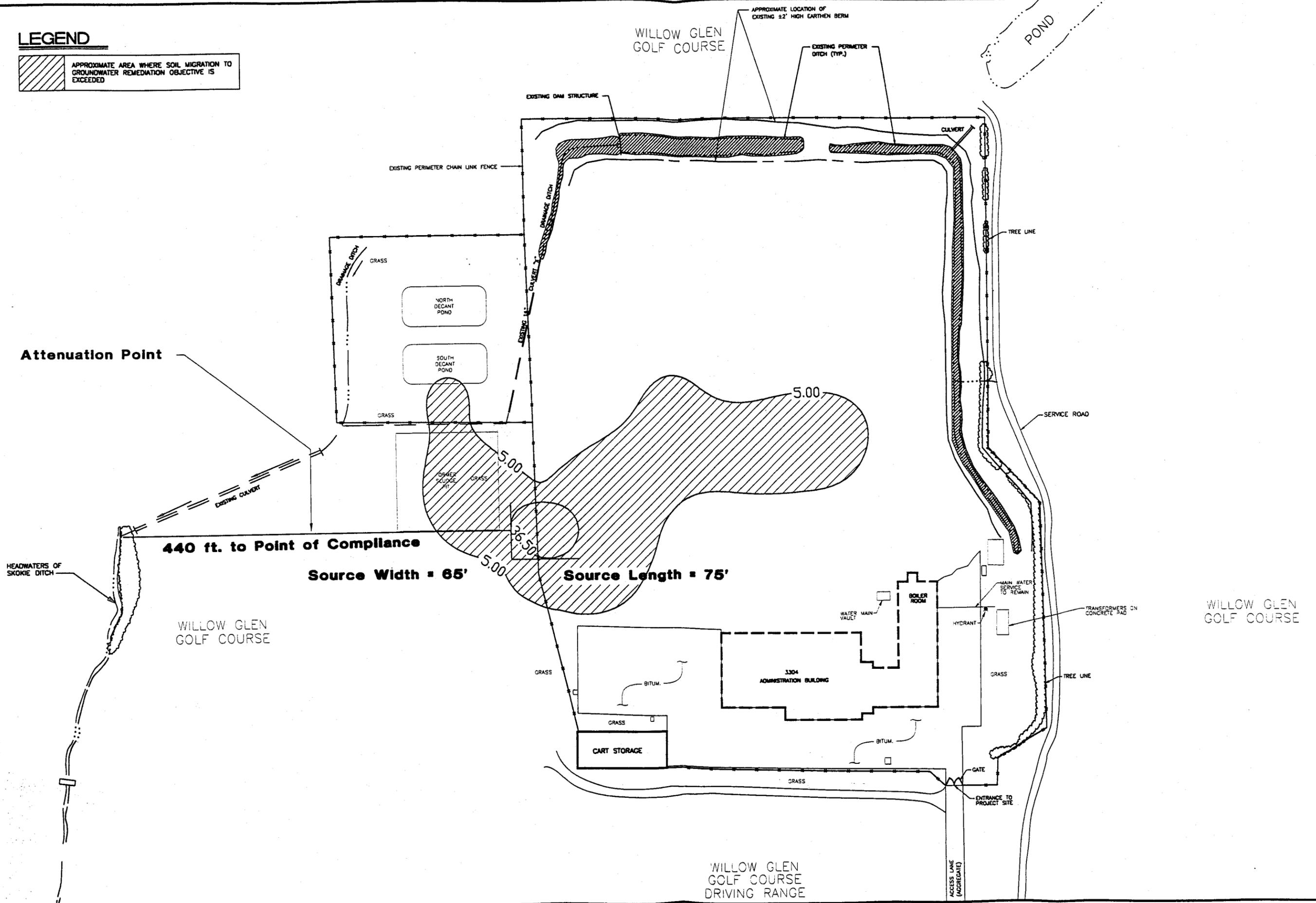
DESIGNED: DR/DMW  
CHECKED: ME/AN/NEWELL

ENV. LOTT  
ENV. LOTT  
CHECKED: ME/AN/NEWELL

REV.	DATE	REMARKS

**LEGEND**

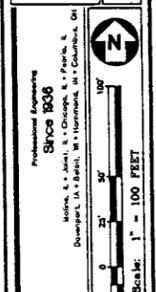
 APPROXIMATE AREA WHERE SOIL MIGRATION TO GROUNDWATER REMEDIATION OBJECTIVE IS EXCEEDED



**FIGURE 7**  
JOB NUMBER  
29886  
DATE  
JULY 1998

BENZENE IN GROUNDWATER  
SUBSURFACE  
REMEDIATION INVESTIGATION

US DEPARTMENT OF THE NAVY  
NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS  
ENVIRONMENTAL REMEDIATION OF THE  
PREFIGHTING TRAINING UNIT (FTTU)

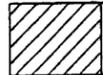


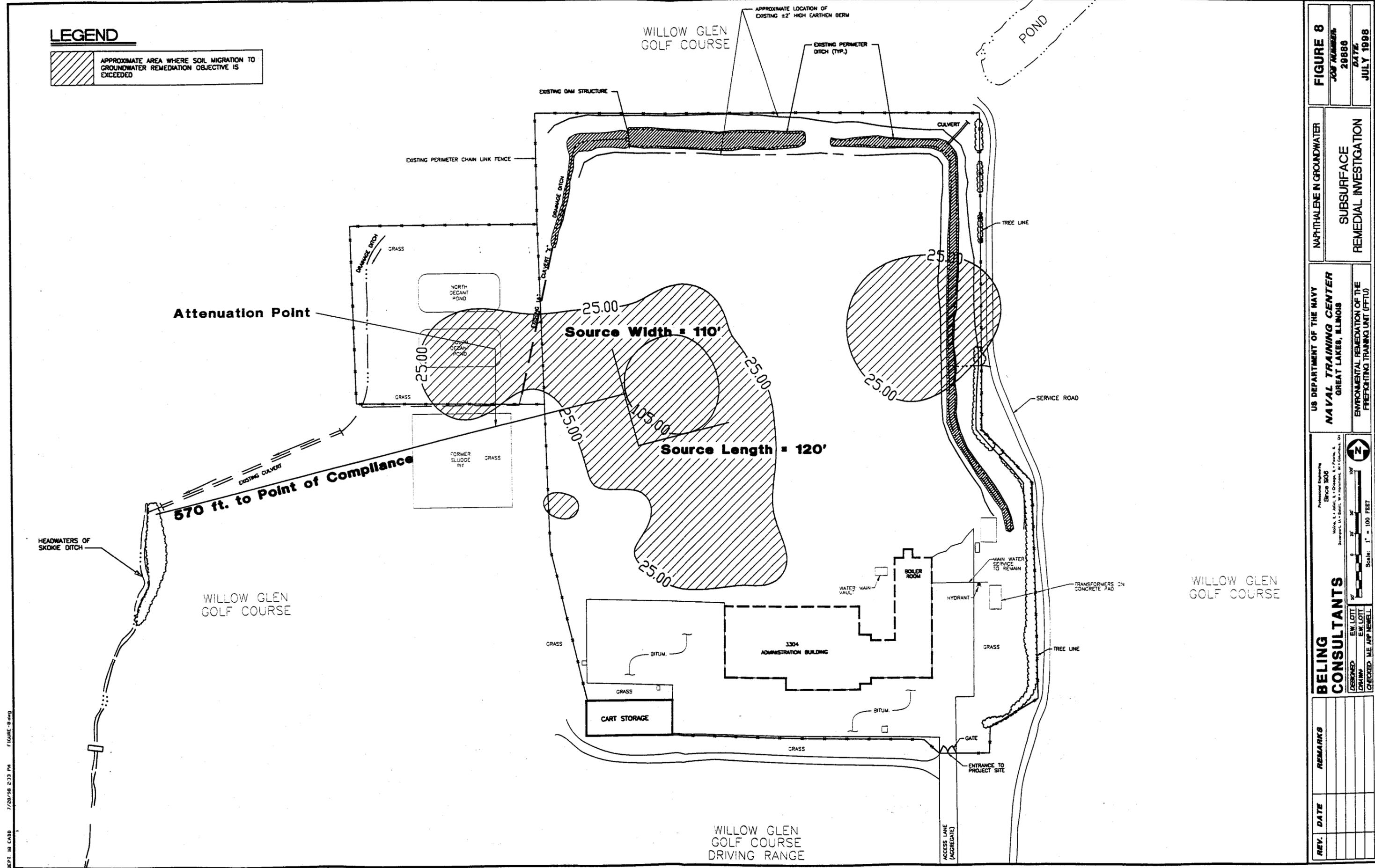
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Davenport, IA • St. Louis, MO • Hammond, IN • Columbus, OH

REV.	DATE	REMARKS

DEPT. 18 CAUD 7/20/98 2:31 PM FIGURE-7.dwg

**LEGEND**

 APPROXIMATE AREA WHERE SOIL MIGRATION TO GROUNDWATER REMEDIATION OBJECTIVE IS EXCEEDED



DEPT. 18 CADD 7/20/98 2:33 PM FIGURE-8.dwg

**FIGURE 8**  
JOB NUMBER: 28886  
DATE: JULY 1998

NAPHTHALENE IN GROUNDWATER  
SUBSURFACE  
REMEDIAL INVESTIGATION

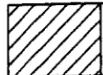
US DEPARTMENT OF THE NAVY  
NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS  
ENVIRONMENTAL REMEDIATION OF THE  
FREIGHTING TRAINING UNIT (FTTU)

Professional Engineer  
SINCE 1906  
MILWAUKEE, WISCONSIN  
Scale: 1" = 100 FEET

**BELING CONSULTANTS**  
DESIGNED: E.W. LOTT  
DRAWN: E.W. LOTT  
CHECKED: M.E. APPEL

REV.	DATE	REMARKS

**LEGEND**

 APPROXIMATE AREA WHERE SOIL MIGRATION TO GROUNDWATER REMEDIATION OBJECTIVE IS EXCEEDED

WILLOW GLEN GOLF COURSE

APPROXIMATE LOCATION OF EXISTING 2' HIGH EARTHEN BERM

EXISTING PERIMETER DITCH (TYP.)

POND

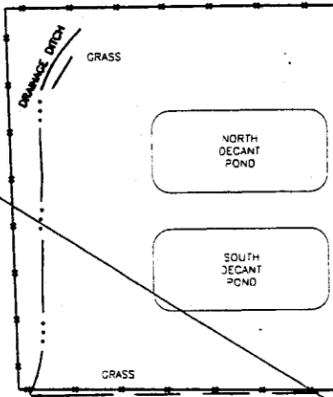
EXISTING DAM STRUCTURE

EXISTING PERIMETER CHAIN LINK FENCE

CUVERT

TREE LINE

Attenuation Point



FORMER SLUDGE PIT

Source Length = 30'

Source Width = 20'

2.435mg/kg

650 ft. to Point of Compliance

HEADWATERS OF SKOKIE DITCH

WILLOW GLEN GOLF COURSE

WILLOW GLEN GOLF COURSE

SERVICE ROAD

BOILER ROOM

TRANSFORMERS ON CONCRETE PAD

3304 ADMINISTRATION BUILDING

CART STORAGE

WILLOW GLEN GOLF COURSE DRIVING RANGE

HYDRANT

WATER MAIN VAULT

MAIN WATER SERVICE TO REMAIN

GRASS

TREE LINE

GRASS

GATE

ENTRANCE TO PROJECT SITE

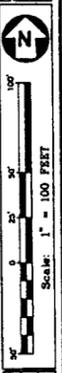
ACCESS LAKE (AGGREGATE)

**FIGURE 9**  
JOB NUMBER: 28886  
DATE: JULY 1998

BENZENE IN SOIL MIGRATING TO GROUNDWATER  
SUBSURFACE REMEDIAL INVESTIGATION

US DEPARTMENT OF THE NAVY  
NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS  
ENVIRONMENTAL REMEDIATION OF THE FREIGHTING TRAINING UNIT (FTTU)

Professional Engineering  
SINCE 1936  
Illinois, I. J. Juhl, A. J. Chicago, R. J. Paris, K. Deverett, M. J. Blain, W. J. Hammond, M. J. Columbus, O. I.



**BELING CONSULTANTS**  
DESIGNED: E.W. LOTT  
DRAWN: E.W. LOTT  
CHECKED: M.E. NEWELL

REV.	DATE	REMARKS

**LEGEND**

 APPROXIMATE AREA WHERE SOIL MIGRATION TO GROUNDWATER REMEDIATION OBJECTIVE IS EXCEEDED

WILLOW GLEN GOLF COURSE

APPROXIMATE LOCATION OF EXISTING ±2' HIGH EARTHEN BERM

EXISTING PERIMETER DITCH (TYP.)

POND

EXISTING PERIMETER CHAIN LINK FENCE

EXISTING DAM STRUCTURE

CULVERT

TREE LINE

GRASS

NORTH DECANT POND

SOUTH DECANT POND

Attenuation Point

SERVICE ROAD

GRASS

560 ft to Point of Compliance

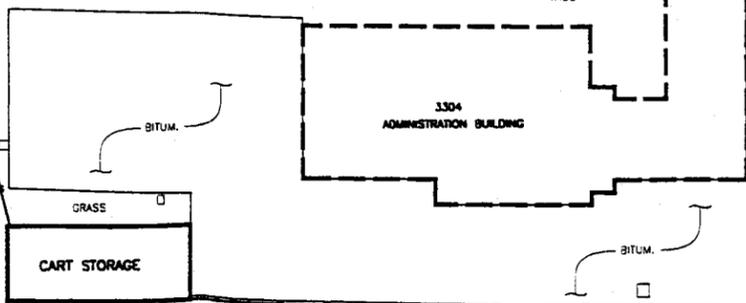
source length = 30 ft

source width = 30 ft

HEADWATERS OF SKOKIE DITCH

WILLOW GLEN GOLF COURSE

WILLOW GLEN GOLF COURSE



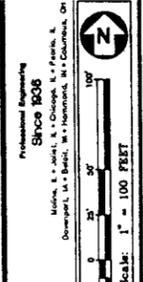
CART STORAGE

WILLOW GLEN GOLF COURSE DRIVING RANGE

**FIGURE 10**  
JOB NUMBER: 29886  
DATE: JULY 1998

ETHYLBENZENE IN SOIL MIGRATING TO GROUNDWATER  
SUBSURFACE REMEDIAL INVESTIGATION

US DEPARTMENT OF THE NAVY  
NAVAL TRAINING CENTER  
GREAT LAKES, ILLINOIS  
ENVIRONMENTAL REMEDIATION OF THE PREFIGHTING TRAINING UNIT (PFTU)



**BEILING CONSULTANTS**  
DESIGNED: E.W. LOTT  
DRAWN: E.W. LOTT  
CHECKED: M.E. APPENWELL

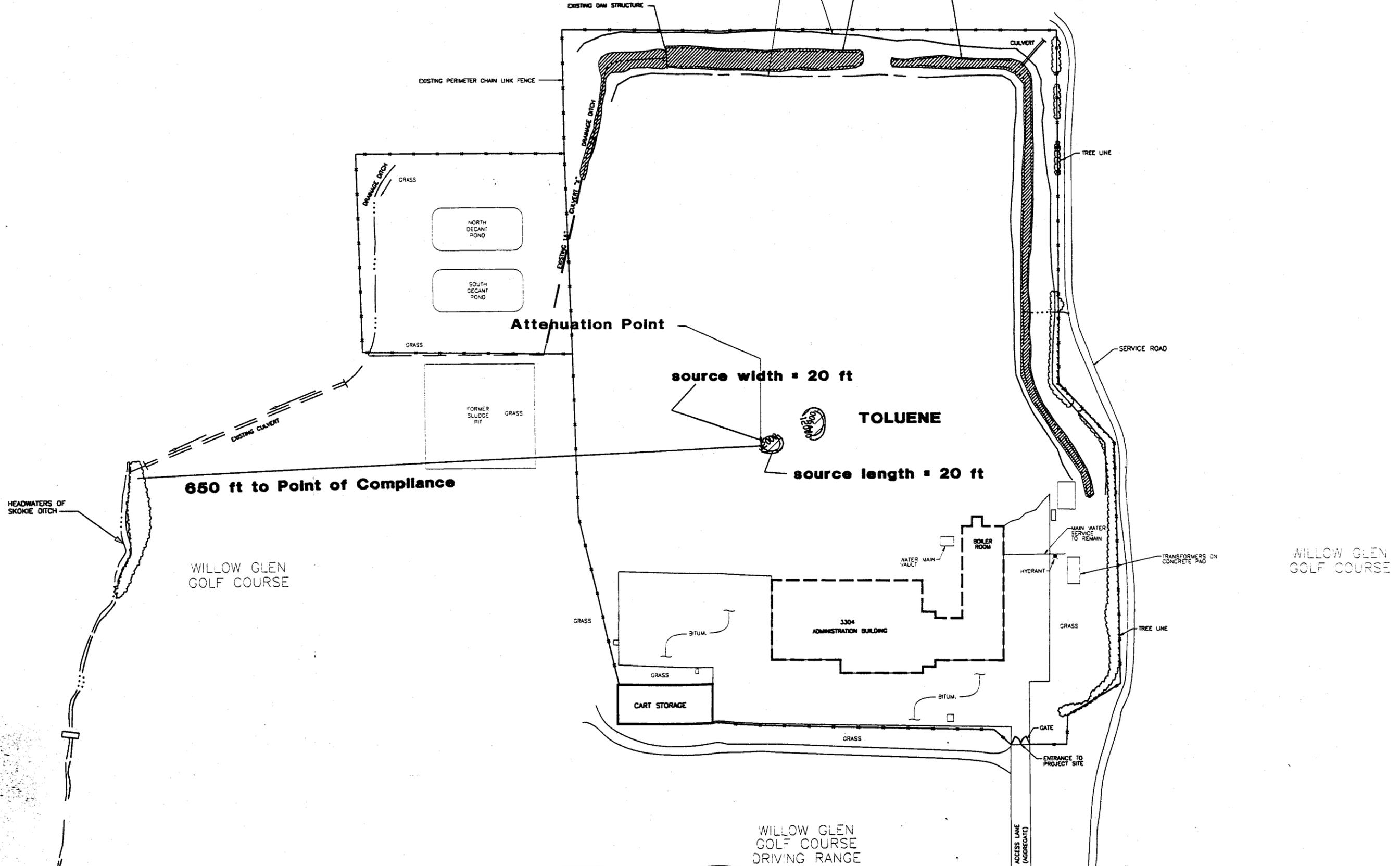
REV.	DATE	REMARKS

**LEGEND**

APPROXIMATE AREA WHERE SOIL MIGRATION TO GROUNDWATER REMEDIATION OBJECTIVE IS EXCEEDED

WILLOW GLEN GOLF COURSE  
 APPROXIMATE LOCATION OF EXISTING 22' HIGH EARTHEN BERM  
 EXISTING PERIMETER DITCH (TYP.)

POND



**FIGURE 11**  
 JOB NUMBER  
 29886  
 DATE  
 JULY 1998

TOLUENE N SOIL MIGRATING TO GROUNDWATER  
 SUBSURFACE  
 REMEDIAL INVESTIGATION

US DEPARTMENT OF THE NAVY  
 NAVAL TRAINING CENTER  
 GREAT LAKES, ILLINOIS  
 ENVIRONMENTAL REMEDIATION OF THE  
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 DRAWN: E.W. LOTT  
 CHECKED: M.E. APPELWELL

Scale: 1" = 100 FEET

**BELING CONSULTANTS**

REV.	DATE	REMARKS

DEPT. 18 CADDD 7/20/98 2:41 PM FIGURE-11.dwg



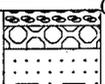


LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP001-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1742 N-1738	Date: Start <b>10/14/97</b> Finish <b>10/14/97</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~4' ▽ Depth After Drilling	Auger Depth <b>12'</b> Rig: <b>Geoprobe, Direct Push</b> Rotary Depth <b>N/A</b> Geologist: <b>Fred Lawrence #29886</b> Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>	 Illinois Environmental Protection Agency
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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1	HG	2.2		0	100	SP-SM	asphalt, old and broken gravel and sand silty sand, firm, moist to wet				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
2	HG	4.0				SP	sand poorly graded, some thin silty clay layers				Install piezometer DP001-97 to 12' with a 10' prepacked screen
3	HG	2.5		10	90	CH	sandy clay, hard and damp				NO PETROLEUM ODOR THROUGHOUT BORING
						CL-ML	silty clay, gray glacial till, Diamicton	2.2	3.0		Total Depth=12 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP002-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1725 N-1700	Date: Start <u>10/15/97</u> Finish <u>10/15/97</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>14'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~4'</u>	Rotary Depth <u>N/A</u>	Geologist: <u>Fred Lawrence #29886</u>	
▽ Depth After Drilling <u>n/a</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer	PID	Remarks
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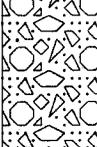
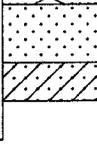
1	AG	2.0		0	100	SP	asphalt, old and broken gravel and sand gravel and sand (? fill), thin silty clay layers				@ 3' to 8' strong petroleum odor @ 4' Saturated
2	AG	3.5				SP					@ 8' to 14' mild petroleum odor A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
3	2G	1.6			90						
4	2G	1.4									
5	2G	1.2				CL-ML	silty clay, some sand,				Total Depth=14 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP003-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1725 N-1650	Date: Start <u>10/14/97</u> Finish <u>10/14/97</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>18'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling ~4'	Rotary Depth <u>N/A</u>	Geologist: <u>Fred Lawrence #29886</u>	
▽ Depth After Drilling N/A	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
---------------	---------------	-----------------	------------------	--------------	-------------------------	---------------------	------------------------------------	------------------------------	---------------------	-----	---

1	HG	3.0		0	100	GP	gravel with sand, some clay, firm to soft, moist to sat.				No petroleum odor throughout boring.
2	HG	3.4				GP					@ 4' Saturated
3	2G	1.2			90	GP	gravel with sand, sat., soft				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
4	2G	1.2				GP					
5	2G	1.2				GP					
6	2G	2.0				SP	sand, firm, wet		1.0		
7	2G	2.0				CH	sandy clay, with silt, very stiff, damp		2.7		Total Depth=18 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP005-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1725 N-1550	Date: Start <u>10/16/97</u> Finish <u>10/16/97</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~4'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Fred Lawrence #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer Qu	PID	Remarks
---------------	---------------	-----------------	------------------	--------------	------------------------	---------------------	------------------------------------	------------------------------	----------------------	-----	---------

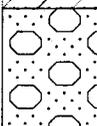
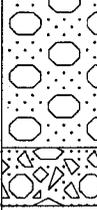
1	AG	3.2		0	100	GP	gravel with sand, (fill?), firm, damp to wet				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR THROUGHOUT BORING  Total Depth=12 ft
2	AG	3.5				GP	crushed rock, sand and gravel, saturated				
3	AG	3.5		10	90	CL-ML	silty clay, Diamicton, very stiff, moist		3.6		

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP006-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1520 N-1550</b>	Date: Start <b>10/16/97</b> Finish <b>10/16/97</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <b>13'</b>	Rig: <b>Geoprobe, Direct Push</b>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <b>-8'</b>	Rotary Depth <b>N/A</b>	Geologist: <b>Fred Lawrence #29886</b>	
▽ Depth After Drilling <b>N/A</b>	Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Arbutary Benchmark Surface Elevation: 100  Remarks
---------------	---------------	-----------------	------------------	--------------	------------------------	---------------------	------------------------------------	------------------------------	----------------------------------	-----	--

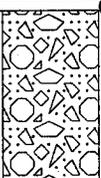
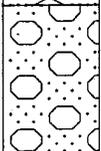
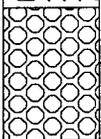
1	HG	3.6		0	100	CL-ML	silty clay, very stiff, damp to moist	4.5	1.5		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
2	HG	4.0				SP	sand with gravel, firm and wet to saturated				Install piezometer DP006-97 to 13' with a 10' prepacked screen
3	HG	3.0		10	90	GP	gravel with sand, saturated				NO PETROLEUM ODOR THROUGHOUT BORING
											Total Depth=13 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP007-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1600 N-1525	Date: Start <u>10/16/97</u> Finish <u>10/16/97</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~5'</u>	Rotary Depth <u>N/A</u>	Geologist: <u>Fred Lawrence #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer $Q_u$	PID	Remarks
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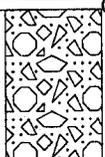
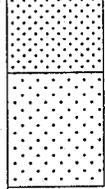
1	AG	3.0			100	GP	gravel with sand, stiff, damp				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  @ 4' to 12' mild petroleum odor  Total Depth=13 ft
2	AG	4.0				SP	sand with gravel, firm, saturated				
3	AG	?			90	GP	gravel, some sand, crushed rock				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP008-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1550 N-1525	Date: Start <u>10/17/97</u> Finish <u>10/17/97</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~8'</u>	Rotary Depth <u>N/A</u>	Geologist: <u>Fred Lawrence #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Remarks
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1	AG	3.2		0	100	GP	gravel with sand, stiff, moist, some silt and clay				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
2	AG	3.0				SW	sand, well graded, saturated				Strong petroleum odor throughout boring
3	AG	?		-10	90	SP	sand, saturated,				Product sheen observed
											Total Depth=12 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP009-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1450 N-1500</b>	Date: Start <b>10/17/97</b> Finish <b>10/17/97</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling <b>~8'</b> ▽ Depth After Drilling <b>N/A</b>	Auger Depth <b>14'</b> Rig: <b>Geoprobe, Direct Push</b> Rotary Depth <b>N/A</b> Geologist: <b>Fred Lawrence #29886</b> Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b> NOTE: Boring backfilled unless otherwise noted.	 Illinois Environmental Protection Agency
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Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Remarks
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1	4G	3.8		0	100	GP	gravel with sand, stiff, damp, some silt and clay				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
2	4G	4.0									No petroleum odor throughout boring
3	4G	?		10	90	SP	sand, soft, saturated, crushed rock @ 8'				@ 8' Crushed rock
4	2G	?				CL-ML	silty clay, sandy, Diamicton, very stiff, damp				Total Depth=14 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP010-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1750 N-1300	Date: Start <u>1/26/98</u> Finish <u>1/26/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>-g'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: <u>Arbitrary Benchmark</u> Surface Elevation: <u>100</u>  Remarks
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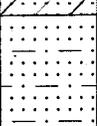
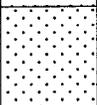
1	4G	3.4			100	GP-GS	gravelly clay, fill				In area of trenching activities  A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Fine sand @ 8-8.5', Saturated  NO PETROLEUM ODOR  Total Depth=12 ft
						CL-ML	silty clay, mixed w/gravel	2.0	.5		
2	4G	3.4				SM	silty sand, to sand with gravel, poorly graded	<.5			
						SP	sand, poorly graded,				
3	4G	3.4			90	CL-ML	silty clay, glacial till, hi-plast., diamicton	2.5			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP011-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1650 N-1300</b>	Date: Start <b>1/26/98</b> Finish <b>1/26/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <b>12'</b>	Rig: <b>Geoprobe, Direct Push</b>	 Illinois Environmental Protection Agency
▼ Depth While Drilling ~7'	Rotary Depth <b>N/A</b>	Geologist: <b>Rick Elgin #29886</b>	
▽ Depth After Drilling N/A	Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100	Remarks
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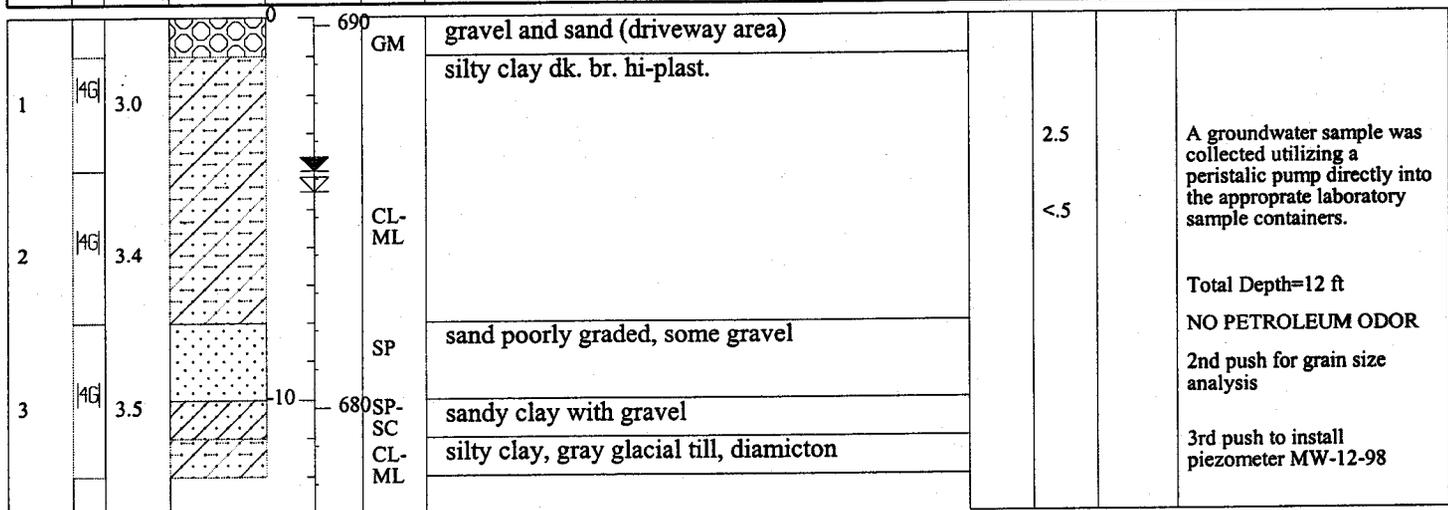
1	AG	3.0		0	100	CL-ML	gravel and sand (driveway area)					A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  Total Depth=12 ft
						CL-ML	silty clay, dk. br. hi-plast.	1.5				
2	AG	3.4				SM	silty sand with clay, poorly graded	1.5				
						SP	sand, poorly graded, some thin clay layers	<.5				
3	AG	3.5		-10	90	CL-ML	silty clay, gray glacial till, diamicton	<.5	2.0			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP012-98/MW-12-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1600 N-1350	Date: Start <u>1/26/98</u> Finish <u>1/26/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~4'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>4.5'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Elevation Datum: <u>Arbitrary Benchmark</u> Surface Elevation: <u>100</u>  Remarks
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Created from setup file: c:\logplt97\logfiles\iepa1.lcf  
This is for the IEPA LUST Program Boring Logs

PLOT AT 5 FEET = 1 INCH

top base x y elev  
SETUP: 0.00 -13.00 0 0 100

EDIT-TEXT: datum\_type  
Arbitrary Benchmark

EDIT-TEXT: Surf\_Elev  
100

EDIT-TEXT: LUST\_Num  
0971255004

EDIT-TEXT: Bor\_Num  
DP013-98

EDIT-TEXT: Start\_Date  
1/27/98

EDIT-TEXT: Fin\_Date  
1/27/98

EDIT-TEXT: Location  
1550 N-1275

EDIT-TEXT: Site\_Name  
Great Lakes Navy Training Center

EDIT-TEXT: Address1  
Fire Fighting Training Unit

EDIT-TEXT: Address2  
Great Lakes, IL 60088-2600

EDIT-TEXT: WL\_Drill  
5

EDIT-TEXT: WL\_After  
N/A

EDIT-TEXT: Auger\_Depth  
2'

EDIT-TEXT: Rotary Depth  
N/A

EDIT-TEXT: Rig  
Geoprobe, Direct Push

EDIT-TEXT: Geologist  
Rick Elgin #29886

EDIT-TEXT: Driller  
Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS

WITH: Lithology  
<top> <bottom> <keyword>^  
0 -1 gravel^  
-1 -4 sandy clay^  
4 -10 sand^

0 -12 silty clay^  
END-DATA:

TH: Lith\_Descr  
:top> <bottom> <keyword>  
:<description>^

-1 gravel and sand mixed w/clay^  
-4 sandy clay with gravel^  
-4 -10 sand and gravel, some silt and clay^  
-10 -12 silty clay gray glacial till, diamicton^

END-DATA:

FILLBAR: Device  
:top> <bottom>

-4  
-8  
-8 -12

END-DATA:

TEXT-COLUMN: Sample\_Num  
:depth> <text>^

-2 1^  
-6 2^  
-10 3^

END-DATA:

TEXT-COLUMN: Samp\_recov  
:depth> <text>^

-2 2.8^  
-6 3.1^  
-10 4.0^

END-DATA:

TEXT-COLUMN: USCS  
:depth> <text>^

-5 GM^  
-2 SP-SC^  
-8 SP^  
-11.25 CL-ML^

END-DATA:

TEXT-COLUMN: Moist\_%

:depth> <text>^

WAITING ON GEOTECH RESULTS  
END-DATA:

TEXT-COLUMN: Hand\_Pen  
:depth> <text>^

-2 <.5^  
-11 4.0^

END-DATA:

TEXT-COLUMN: PID

:<depth> <text>^

END-DATA:

TEXT-COLUMN: Remarks

:<depth> <text>^

-4 SLIGHT PETROLEUM ODOR^

-7 PETROLEUM ODOR^

12 Total Depth=12 ft^

13 A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.^

END-DATA:

SYMBOL-COLUMN: water\_lev

:<depth> <symbol #> <symbol size>

Water level while drilling

Water level after drilling

-5 140 .25

END-DATA:

SYMBOL-COLUMN: TEST1

:<depth> <symbol #> <symbol size>

2 260 .1

5 260 .1

-10 260 .1

END-DATA:

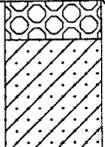
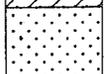
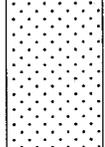
END-LOG:

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP013-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1550 N-1275</b>	Date: Start <b>1/27/98</b> Finish <b>1/27/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <b>12'</b>	Rig: <b>Geoprobe, Direct Push</b>	 Illinois Environmental Protection Agency
▼ Depth While Drilling ~5	Rotary Depth <b>N/A</b>	Geologist: <b>Rick Elgin #29886</b>	
▽ Depth After Drilling N/A	Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>E</sub> Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
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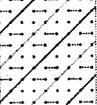
1	AG	2.8		0	100	GM	gravel and sand mixed w/clay				SLIGHT PETROLEUM ODOR  PETROLEUM ODOR A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Total Depth=12 ft
						SP-SC	sandy clay with gravel		<.5		
2	AG	3.1				SP	sand and gravel, some silt and clay				
3	AG	4.0		10	90	CL-ML	silty clay gray glacial till, diamicton		4.0		

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP012-98/MW-12-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1600 N-1350	Date: Start <u>1/26/98</u> Finish <u>1/26/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~4'</u>	Rotary Depth <u>N/A</u>	Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>4.5'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 690.21	Remarks
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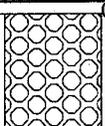
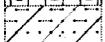
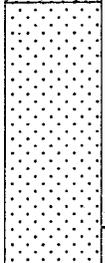
1	AG	3.0			690	GM	gravel and sand (driveway area)					
2	AG	3.4				CL-ML	silty clay dk. br. hi-plast.		2.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Total Depth=12 ft NO PETROLEUM ODOR 2nd push for grain size analysis  3rd push to install piezometer MW-12-98
3	AG	3.5				SP	sand poorly graded, some gravel		<5			
					680	SP-SC	sandy clay with gravel					
						CL-ML	silty clay, gray glacial till, diamicton					

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP014-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1450 N-1273	Date: Start <u>1/27/98</u> Finish <u>1/27/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~5' ▽ Depth After Drilling 3.54'	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	 Illinois Environmental Protection Agency
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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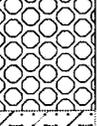
1	AG	2.9				GM	gravel and sand mixed w/silt and clay		<.5		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  SLIGHT PETROLEUM ODOR STRONG PETROLEUM ODOR  PETROLEUM SHEEN 2nd push to set piezometer @ 12' with 9' screen, MW-14-98  Total Depth=12 ft
						CL-ML	silty clay, hi-plast.				
2	AG	3.2				SP	sand and gravel, some silt and clay		.5		
					680	CL-ML	silty clay, gray glacial till, diamicton		<.5		
3	AG	4.0		10					2.5-3.0		

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP015-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1350 N-1275	Date: Start <u>1/27/98</u> Finish <u>1/27/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>14'</u> Rig: Geoprobe, Direct Push	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer Qu	PID	Remarks
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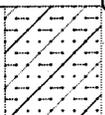
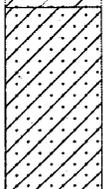
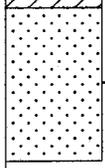
1	AG	2.9			100	GM	gravel and sand mixed w/silt and clay	2.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  PETROLEUM ODOR  PETROLEUM ODOR PETROLEUM SHEEN ON WATER  PETROLEUM ODOR  Total Depth=14 ft
						CL-ML	silty clay, very sandy	.5			
2	AG	3.3				SP	sand and gravel, some silt and clay	<.5			
3	AG	3.6			90	CL-ML	silty clay, gray glacial till, diamicton	3.0			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP016-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1310 N-1353	Date: Start <u>1/27/98</u> Finish <u>1/27/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~6' ▽ Depth After Drilling 4.34'	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u> NOTE: Boring backfilled unless otherwise noted.	 Illinois Environmental Protection Agency
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Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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1	AG	2.4				CL-ML	silty clay with some gravel		3.5		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  A piezometer set @ 12' with an 8' screen, MW-16-98  Total Depth=12 ft
2	AG	2.7			680	SP-SC	sandy clay and silty gravel		<.5		
3	AG	4.0		10		SP	sand and gravel some silt and clay		<.5		

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP017-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1200 N-1495	Date: Start <u>1/28/98</u> Finish <u>1/28/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling -g'	Rotary Depth <u>N/A</u>	Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling N/A	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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1	AG	3.6		0	100	CL-CM	silty clay fill, (dike)		1.5		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  SLIGHT PETROLEUM ODOR  Total Depth=12 ft
2	AG	3.5				CL-CM SP-SC	silty clay, hi-plast. sandy clay with gravel		.5		
						SP	sand and silty gravel		.5		
3	AG	?		-10	90	CL-ML	silty clay, gray to br. glacial till, diamicton		4.0		

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP018-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1350 N-1695	Date: Start <u>1/28/98</u> Finish <u>1/28/98</u>

NOTE: Stratification lines are approximate-in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling -6' ▽ Depth After Drilling N/A	Auger Depth <u>16'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u> NOTE: Boring backfilled unless otherwise noted.	 Illinois Environmental Protection Agency
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Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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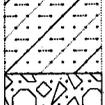
1	AG	3.4			100	CL-ML	gravel with silty clay silty clay with some gravel	2.0			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  No sample recovered from 12-16' due to obstruction  Total Depth=16 ft
2	AG	2.8				MH	sandy gravelly silt with some clay	.5			
3	AG	4.0			90	CL-ML	silty clay, glacial till sand, gravelly with silt	2.0			
4	AG	?				SP CL-ML	silty clay, br. glacial till, diamicton				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP019-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1390 N-1600	Date: Start <u>1/28/98</u> Finish <u>1/28/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>-5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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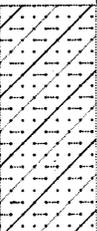
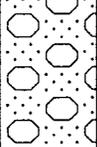
1	AG	3.0		0	100	GM-SP	gravel and silty sand	2.0			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
						CL-ML	silty clay with some gravel				
2	AG	3.4		▼	90	GM-SC	gravel with sand with silty clay	<.5			NO PETROLEUM ODOR
							sand with silt, poorly graded				
3	AG	4.0		-10	90	SP		.5			Total Depth=12 ft
						CL-ML	silty clay gray to br. glacial till, diamicton				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP020-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1300 N-1450	Date: Start <u>1/28/98</u> Finish <u>1/28/98</u>

NOTE: Stratification lines are approximat~~in~~-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: Geoprobe, Direct Push	 Illinois Environmental Protection Agency
▼ Depth While Drilling ~8'	Rotary Depth <u>N/A</u> Geologist: Rick Elgin #29886	
▽ Depth After Drilling 4.93'	Driller/Co. Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 688.03  Remarks
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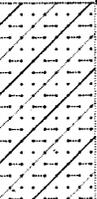
1	4G	1.9				CL-ML	silty clay mixed with gravel	2.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  Total Depth=12 ft
2	4G	2.2				-7 GM	gravel with sand with silty clay	.5			
						-12 SP	sand with gravel with silt and some clay	<.5			
3	4G	3.0			680			<.5			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP021-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1300 N-1400	Date: Start <u>1/28/98</u> Finish <u>1/28/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~6'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100	Remarks
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1	HG	3.0		0	100	CL-ML	silty clay mixed with gravel, intermitten with silty sand	.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  <b>PETROLEUM ODOR AND SHEEN</b>  Total Depth=8 ft
2	HG	2.9				GM-CL-ML	gravel with sand with silty clay	<.5			
								<.5			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP022-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1320 N-1250	Date: Start <u>1/28/98</u> Finish <u>1/28/98</u>

NOTE: Stratification lines are approximatēn-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~6' ▽ Depth After Drilling NVA	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u> NOTE: Boring backfilled unless otherwise noted.	 Illinois Environmental Protection Agency
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Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Qu Hand Penetrometer	PID	Elevation Datum:Arbitrary Benchmark Surface Elevation:100  Remarks
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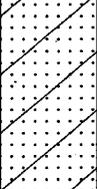
1	4G	3.3		0	100	CL-ML	silty clay mixed with gravel, intermitten with silty sand		1.5-2.0		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  Total Depth=8 ft
2	4G	?				GM-CL-ML	gravel with sand with silty clay				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP023-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1400 N-1350</b>	Date: Start <b>1/29/98</b> Finish <b>1/29/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling <b>-5'</b> ▽ Depth After Drilling <b>N/A</b>	Auger Depth <b>8'</b> Rig: <b>Geoprobe, Direct Push</b> Rotary Depth <b>N/A</b> Geologist: <b>Rick Elgin #29886</b> Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>	 Illinois Environmental Protection Agency
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer Qu	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
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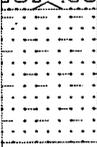
1	4G	3.2		0	100	CL-ML	silty clay mixed with gravel				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  <b>PETROLEUM ODOR AND SHEEN ON WATER</b>  Total Depth=8 ft
2	4G	3.1				SP-SC	sandy silty clay with gravel				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP024-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1528 N-1235	Date: Start <u>1/29/98</u> Finish <u>1/29/98</u>

NOTE: Stratification lines are approximat~~on~~-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~5' ▽ Depth After Drilling N/A	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u> NOTE: Boring backfilled unless otherwise noted.	 Illinois Environmental Protection Agency
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Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Elevation Datum:Arbitrary Benchmark Surface Elevation:100  Remarks
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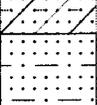
1	HG	2.9		0 - 2.9	100	GM-CL-ML	gravel with sandy clay intermitten with silty clay				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  Total Depth=8 ft
2	HG	3.2		2.9 - 3.2		SP-SM	sandy silt with gravel				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP025-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1061 N-1605</b>	Date: Start <b>1/29/98</b> Finish <b>1/29/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <b>16'</b>	Rig: <b>Geoprobe, Direct Push</b>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <b>-13</b>	Rotary Depth <b>N/A</b>	Geologist: <b>Rick Elgin #29886</b>	
▽ Depth After Drilling <b>7.23'</b>	Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer Qu	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 690.45	Remarks
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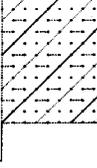
1	4G	3.1		0	690	SW-SM	silty clay, rootlets, hi-plast.		< 5		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Fill was dry and with no cohesiveness  NO PETROLEUM ODOR Piezometer set @ 15' with a 10' screen, MW-25-98  Total Depth=16 ft
2	4G	1.7				N/A	fill and debris, brick, glass, ashes, plastic sheeting		< 5		
3	4G	0.0		-10	680	SP-SC	sand with clay, black, some rocks				
4	4G	2.0				CL-ML	silty clay, gray to brown glacial till, diamicton		4.0		

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP026-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1100 N-1340	Date: Start <u>1/29/98</u> Finish <u>1/29/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: Geoprobe, Direct Push	 Illinois Environmental Protection Agency
▼ Depth While Drilling Dry	Rotary Depth <u>N/A</u> Geologist: Rick Elgin #29886	
▽ Depth After Drilling -18'	Driller/Co. Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Remarks
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1	HG	2.3		0	680	CL-ML	silty clay, with sand and gravel	2.5			
2	HG	4.0				CL-ML	silty clay, gray to brown glacial till, diamicton	3.5-4.0			*** DRY HOLE *** Set piezometer MW-26-98
3	HG	4.0		10				>4.5			NO PETROLEUM ODOR Total Depth=12 ft

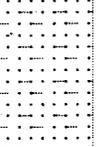
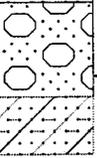


LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP028-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1450 N-1200	Date: Start <u>1/30/98</u> Finish <u>1/30/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
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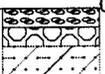
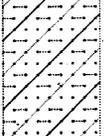
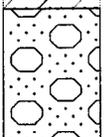
1	AG	2.5		0	100	CL-ML	asphalt, old silty clay with gravel	.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  Total Depth=12 ft
						ML	sandy silt with layers of silty clay				
2	AG	3.8		10	90	SP-ML	sand with gravel and silt				
						CL-ML	silty clay, gray to brown glacial till, diamicton				
3	AG	4.0		10	90						

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP029-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1351 N-1201</b>	Date: Start <b>1/30/98</b> Finish <b>1/30/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <b>12'</b>	Rig: <b>Geoprobe, Direct Push</b>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <b>~7'</b>	Rotary Depth <b>N/A</b>	Geologist: <b>Rick Elgin #29886</b>	
▽ Depth After Drilling <b>2.76'</b>	Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>		
NOTE: Boring backfilled unless otherwise noted.			

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Remarks
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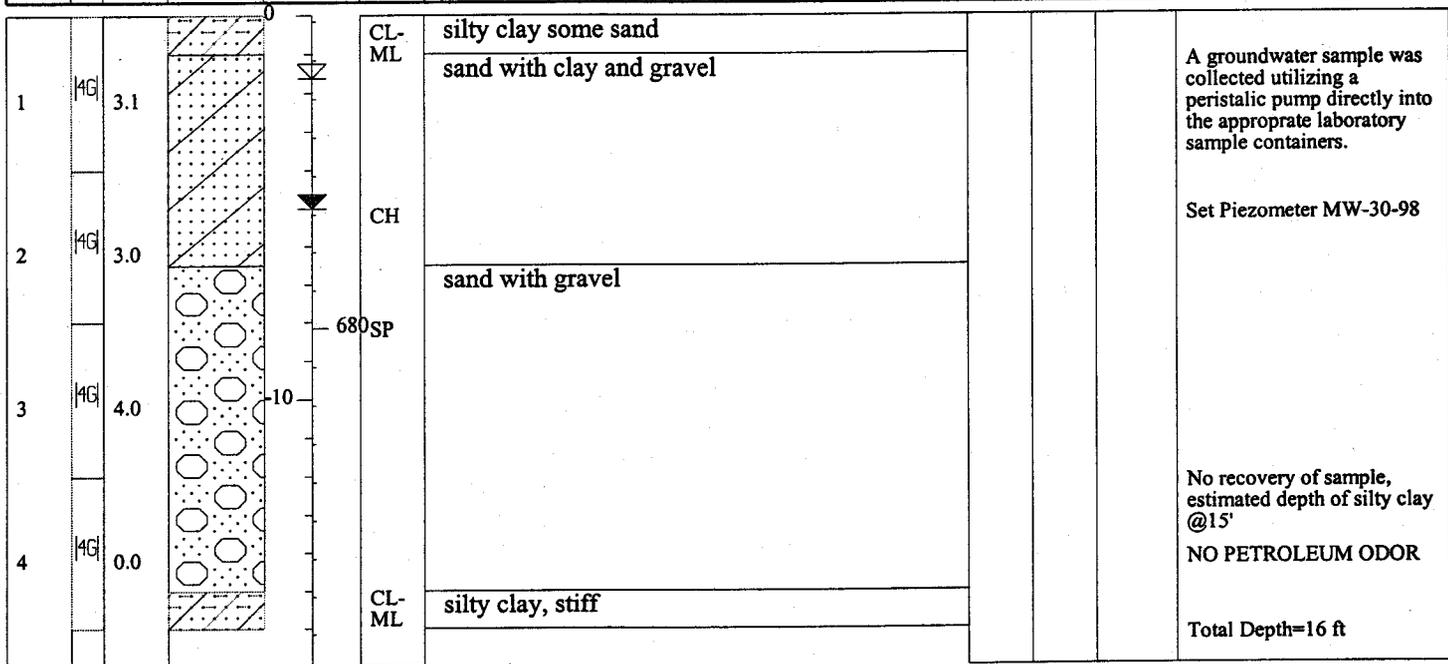
1	HG	3.4				CL-ML	asphalt, old gravel with silt and clay silty clay, gray to brown glacial till, diamicton				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  2nd boring for grain size analysis (1-5' & 7-11')  Piezometer set to 12' with a 9' screen, MW-29-98  NO PETROLEUM ODOR  Total Depth=12 ft
2	HG	3.3				ML	sand with gravel and silt		1.5-2.0		
3	HG	4.0		10	680SP	CL-ML	silty clay, with gravel, diamicton				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP030-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1251 N-1299	Date: Start <u>1/30/98</u> Finish <u>1/30/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>16'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>-5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>1.62'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 688.16	Remarks
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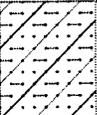


LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP031-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1269 N-1251	Date: Start <u>2/2/98</u> Finish <u>2/2/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~6' ▽ Depth After Drilling N/A	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	 Illinois Environmental Protection Agency
NOTE: Boring backfilled unless otherwise noted.		

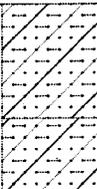
Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Elevation Datum:Arbitrary Benchmark Surface Elevation:100  Remarks
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1	4G	2.4		0	100	CL-ML	Dk. br. silty clay with gravel				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  NO PETROLEUM ODOR  Total Depth=8 ft
						ML	sandy silt small amount of gravel		2.5		
2	4G	3.4				SP	gravel with sand with silty clay				
						SP	sand with clay some gravel				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP032-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1282 N-1250</b>	Date: Start <b>2/2/98</b> Finish <b>2/2/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>		Auger Depth <u>8'</u>	Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>-5'</u>	Rotary Depth <u>N/A</u>	Geologist: <u>Rick Elgin #29886</u>		
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>			
NOTE: Boring backfilled unless otherwise noted.				

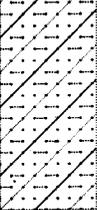
Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Qu Hand Penetrometer	PID	Remarks
1	4G	3.2		0-3.2	100	CL-ML	Dk. br. silty sandy clay with gravel	2.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  <b>NO PETROLEUM ODOR</b>  Total Depth=8 ft
						CL-ML	silty clay with sand and small amount of gravel	2.0			
2	4G	2.9		3.2-2.9		GP	gravel with sand with silt	.5			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP033-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1213 N-1391	Date: Start <u>2/3/98</u> Finish <u>2/3/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>-5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>N/A</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
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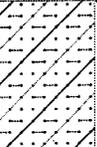
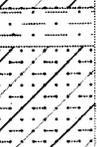
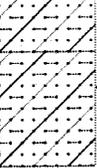
1	4G	3.2			100	CL-ML	Dk. br. to gray silty clay with gravel				
2	4G	2.9				ML	sandy silt with sand and gravel				NO PETROLEUM ODOR  Total Depth=8 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP034-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1101 N-1429	Date: Start <u>2/3/98</u> Finish <u>2/3/98</u>

NOTE: Stratification lines are approximately in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: Geoprobe, Direct Push	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~6'</u>	Rotary Depth <u>N/A</u> Geologist: Rick Elgin #29886	
▽ Depth After Drilling <u>0.65'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer Qu	PID	Remarks
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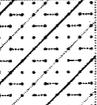
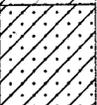
1	AG	3.1				CL-ML	Dk br. to gray silty clay some gravel	1.0-1.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  PETROLEUM ODOR Piezometer installed @ 11' with a 9' screen, MW-34-98  Total Depth=12 ft
2	AG	3.4			680	ML	Very dk. br. silt	<.5			
						CL-ML	silty clay with sand and gravel				
3	AG	?			-10	CL-ML	silty clay gray to br. glacial till, diamicton	3.0			
								>4.5			

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP035-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1417 N-1810	Date: Start <u>2/4/98</u> Finish <u>2/4/98</u>

NOTE: Stratification lines are approximat~~in~~-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>-5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>1.32'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer	PID	Remarks
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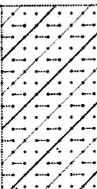
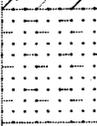
1	4G	1.2		1.2	690	CL-ML	Dk br. to gray silty clay some gravel hi-plast.				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Piezometer installed @ 11' with a 9' screen, MW-35-98  NO PETROLEUM ODOR Total Depth=8 ft
2	4G	3.8		3.8		CH	sandy clay intermitten with thin clay layers				
						CL-ML	silty clay, gray to br. glacial till, diamicton				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP036-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1776 N-1814	Date: Start <b>2/3/98</b> Finish <b>2/3/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~6' ▽ Depth After Drilling 2.44'	Auger Depth <u>8'</u> Rig: Geoprobe, Direct Push Rotary Depth <u>N/A</u> Geologist: Rick Elgin #29886 Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u> NOTE: Boring backfilled unless otherwise noted.	 Illinois Environmental Protection Agency
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Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>E</sub> Hand Penetrometer	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 696.13	Remarks
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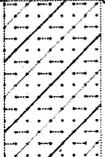
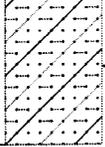
1	HG	3.3		3.3		CL-ML	Dk br. to gray silty sandy clay some gravel, hi-plast.		1.5			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.
2	HG	3.5		3.5	690 ML	ML	sandy silt with gravel					Set piezometer MW-36-98  NO PETROLEUM ODOR Total Depth=8 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP037-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1041 N- 1401	Date: Start <b>2/4/98</b> Finish <b>2/4/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling N/A	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling N/A	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
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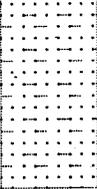
1	HQ	3.3		0	100	CL-ML	Dk br. to gray silty clay some gravel, hi-plast.		>4.5		A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Temporary piezometer installed to collect the water sample
2	HQ	?				CL-ML	silty clay with gravel glacial till, diamicton		1.5-2.0		No soil sample to field lab from 10-12'
3	HQ	?		-10	90				>4.5		NO PETROLEUM ODOR Total Depth=12 ft

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP038-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1201 N-1286	Date: Start <u>2/4/98</u> Finish <u>2/4/98</u>

NOTE: Stratification lines are approximat~~in~~-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>8'</u> Rig: <u>Geoprobe, Direct Push</u>	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~5'</u>	Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u>	
▽ Depth After Drilling <u>0.8'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Hand Penetrometer	PID	Remarks
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1	4G	?				CL-ML	Dk br. silty clay intermitten with sandy silt (fill?)	1.0			A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Piezometer installed @ 9' with a 5' screen, MW-38-98  NO PETROLEUM ODOR Total Depth=8 ft
2	4G	?			680	ML	sandy silt with gravel	<5			

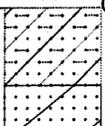
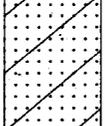
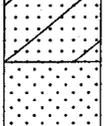


LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP039-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1816 N-1464	Date: Start <u>2/4/98</u> Finish <u>2/4/98</u>

NOTE: Stratification lines are approximat~~in~~-situ transition between soil types may be gradual.

<b>Groundwater Data</b>	Auger Depth <u>12'</u> Rig: Geoprobe, Direct Push	 Illinois Environmental Protection Agency
▼ Depth While Drilling <u>~9'</u>	Rotary Depth <u>N/A</u> Geologist: Rick Elgin #29886	
▽ Depth After Drilling <u>2.24'</u>	Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation(feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q Hand Penetrometer	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 693.24	Remarks
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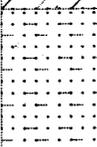
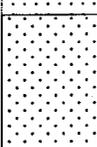
1	HG	3.2		0	690	CL-ML	Dk br. silty clay hi-plast.					A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Piezometer installed @ 12' with a 9' screen, MW-39-98          NO PETROLEUM ODOR Total Depth=12 ft
2	HG	4.0				CH	sandy gravelly clay	<.5				
3	HG	3.3				WP	sand, well graded	>4.5				
				-10		ML	sandy silt with gravel					

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP040-98</b>	Page 1 of 1
Site Name: Great Lakes Navy Training Center Address: Fire Fighting Training Unit Great Lakes, IL 60088-2600	Boring Location: E-1720 N-1400	Date: Start <u>2/5/98</u> Finish <u>2/5/98</u>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling ~5' ▽ Depth After Drilling N/A	Auger Depth <u>12'</u> Rig: <u>Geoprobe, Direct Push</u> Rotary Depth <u>N/A</u> Geologist: <u>Rick Elgin #29886</u> Driller/Co. <u>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</u>	 Illinois Environmental Protection Agency
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Arbitrary Benchmark Surface Elevation: 100  Remarks
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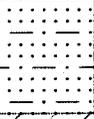
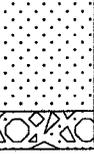
1	4G	3.3			100	GP	gravel, fill, temporary drive silty clay, with gravel				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  @ 6' petroleum odor and product  @ 8' No petro odor or product  Total Depth=12 ft
2	4G	3.0				CL-ML	sandy silt with gravel				
						SP-SM	sand, with silty gravel				
3	4G	3.2			90	SP					
						CL-ML	silty clay, diamicton				

LUST Incident No: <b>0971255004</b>	Boring Number: <b>DP041-98</b>	Page 1 of 1
Site Name: <b>Great Lakes Navy Training Center</b> Address: <b>Fire Fighting Training Unit</b> <b>Great Lakes, IL 60088-2600</b>	Boring Location: <b>E-1600 N-1450</b>	Date: Start <b>2/5/98</b> Finish <b>2/5/98</b>

NOTE: Stratification lines are approximate in-situ transition between soil types may be gradual.

<b>Groundwater Data</b> ▼ Depth While Drilling <b>~8'</b> ▽ Depth After Drilling <b>4.08'</b>	Auger Depth <b>12'</b> Rig: <b>Geoprobe, Direct Push</b> Rotary Depth <b>N/A</b> Geologist: <b>Rick Elgin #29886</b> Driller/Co. <b>Bill Lang/Soilprobe, Inc. for BELING CONSULTANTS</b>	 Illinois Environmental Protection Agency
NOTE: Boring backfilled unless otherwise noted.		

Sample Number	Sample Device	Sample Recovery	Lithology Symbol	Depth (feet)	Elevation (feet-datum)*	USCS Classification	Detailed Soil and Rock Description	Natural Moisture Content (%)	Q <sub>u</sub> Hand Penetrometer	PID	Elevation Datum: Disk Elev. 702.44 Surface Elevation: 690.19	Remarks
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1	HG	2.0		0	690	SP-SM	silty sand and gravel, soft and damp				A groundwater sample was collected utilizing a peristaltic pump directly into the appropriate laboratory sample containers.  Piezometer installed @ 12' with a 9' screen, MW-41-98          NO PETROLEUM ODOR Total Depth=12 ft
						CL-ML	silty clay, soft and damp				
2	HG	4.0				GP-GM	gravelly sandy silt, soft and wet				
3	HG	3.2		-10	680SP		sand, to sand and gravel, saturated				



Incident No.: \_\_\_\_\_  
 Site Name: Fire Fighting Training Unit  
 Drilling Contractor: Soilprobe, Inc  
 Driller: Andrew  
 Drilling Method: Direct Push

Well No.: MW- 1 -98  
 Date Drilled Start: 10-14-97  
 Date Completed: 10-14-97  
 Geologist: Fred Lawrence/Rick Elgin  
 Drilling Fluids (type): None

Annular Space Details

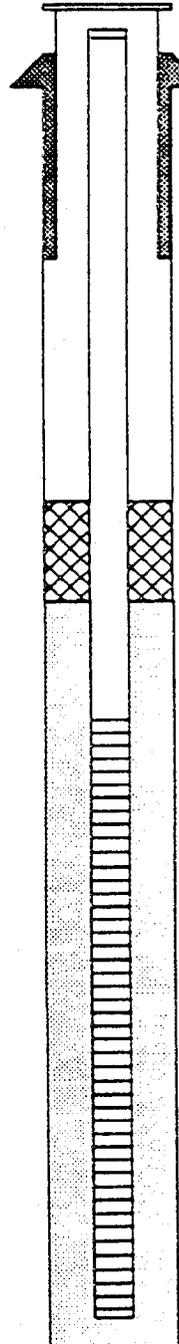
Type of Surface Seal: Concrete  
 Type of Annular Sealant: Bentonite  
 Type of Bentonite Seal (Granular, Pellet): \_\_\_\_\_  
Granular-Hydrated  
 Type of Sand Pack: Silica

Elevations - .01 ft.

691.71 Top of Protective Casing  
691.53 Top of Riser Pipe  
691.71 Ground Surface  
690.53 Top of Annular Sealant  
0 Casing Stickup

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		



690.53 Top of Seal  
.5 Total Seal Interval  
690.03 Top of Sand  
689.53 Top of Screen

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>2'</u>
Screen length	<u>10' Prepacked w/ SAND</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>N/A</u>
Depth to water	<u>2.49'</u>
Elevation of water	<u>689.04</u>
Free Product thickness	<u>N/A</u>
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

10 Total Screen Interval

679.53 Bottom of Screen  
679.53 Bottom of Borehole

Completed by: R.J. E.

the Agency is authorized to require this information under 415 ILCS 5/4 and 21. Disclosure of this information is required. The Agency is authorized to require this information under 415 ILCS 5/4 and 21. Disclosure of this information is required. The Agency is authorized to require this information under 415 ILCS 5/4 and 21. Disclosure of this information is required.





Incident No.: \_\_\_\_\_  
 Site Name: Fire Fighting Training Unit  
 Drilling Contractor: Soilprobe, Inc  
 Driller: Andrew  
 Drilling Method: Direct Push

Well No.: MW-12-98  
 Date Drilled Start: 1-27-98  
 Date Completed: 1-27-98  
 Geologist: Fred Lawrence/Rick Elgin  
 Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete  
 Type of Annular Sealant: Bentonite  
 Type of Bentonite Seal (Granular, Pellet): \_\_\_\_\_  
Granular-Hydrated  
 Type of Sand Pack: Silica

Elevations - .01 ft.

693.87 Top of Protective Casing  
693.68 Top of Riser Pipe  
690.21 Ground Surface  
690.21 Top of Annular Sealant  
3.64 Casing Stickup

Well Construction Materials

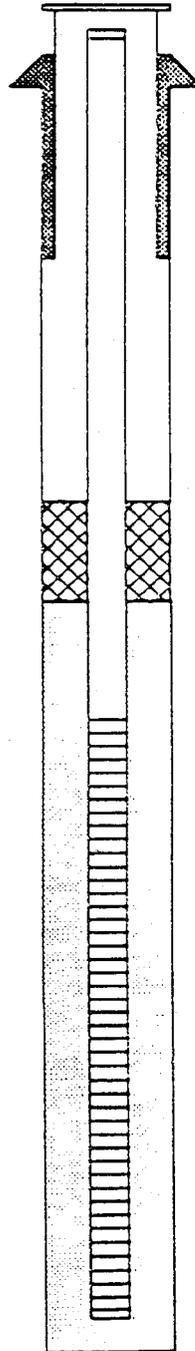
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

690.21 Top of Seal  
1 Total Seal Interval  
689.21 Top of Sand

688.21 Top of Screen

10 Total Screen Interval

678.21 Bottom of Screen  
678.21 Bottom of Borehole



Measurements

to .01 ft (where applicable)

Riser pipe length	<u>411 ~ 5.5'</u>
Screen length	<u>10'</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>5'</u>
Depth to water	<u>4.53'</u>
Elevation of water	<u>689.15</u>
Free Product thickness	<u>N/A</u>
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

Completed by: R.J.E.

Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, a fine up to \$50,000.00 per year, and/or imprisonment for up to 5 years. This has been approved by the Illinois Environmental Protection Agency.



Incident No.: \_\_\_\_\_  
 Site Name: Fire Fighting Training Unit  
 Drilling Contractor: Soilprobe, Inc  
 Driller: Andrew  
 Drilling Method: Direct Push

Well No.: MW-14-98  
 Date Drilled Start: 1-27-98  
 Date Completed: 1-27-98  
 Geologist: Fred Lawrence/Rick Elgin  
 Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete  
 Type of Annular Sealant: Bentonite  
 Type of Bentonite Seal (Granular, Pellet): \_\_\_\_\_  
Granular-Hydrated  
 Type of Sand Pack: Silica

Elevations - .01 ft.

692.27 Top of Protective Casing  
691.32 Top of Riser Pipe  
688.98 Ground Surface  
687.98 Top of Annular Sealant  
3.24 Casing Stickup

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

687.89 Top of Seal  
1 Total Seal Interval  
686.98 Top of Sand

685.98 Top of Screen

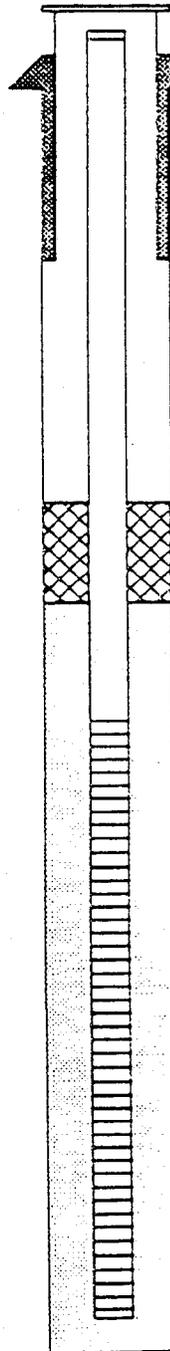
Measurements

to .01 ft (where applicable)

Riser pipe length	<u>~ 7'</u>
Screen length	<u>9'</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>5'</u>
Depth to water	<u>3.54</u>
Elevation of water	<u>687.78</u>
Free Product thickness	N/A
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

9 Total Screen Interval

676.98 Bottom of Screen  
676.98 Bottom of Borehole



Completed by: R.J. ELGIN

Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, a fine up to \$50,000.00  
 implementation to year is has applic by form agent



Incident No.: \_\_\_\_\_

Well No.: MW-16-98

Site Name: Fire Fighting Training Unit

Date Drilled Start: 1-27-98

Drilling Contractor: Soilprobe, Inc

Date Completed: 1-27-98

Driller: Andrew

Geologist: Fred Lawrence/Rick Elgin

Drilling Method: Direct Push

Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

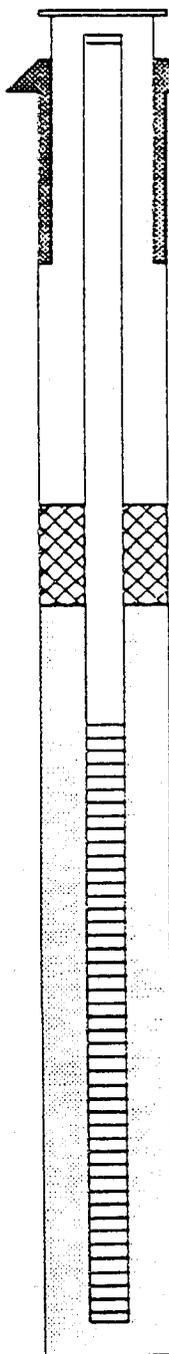
Type of Annular Sealant: Bentonite

Type of Bentonite Seal (Granular, Pellet):  
Granular-Hydrated

Type of Sand Pack: Silica

Elevations - .01 ft.

- 691.15 Top of Protective Casing
- 690.26 Top of Riser Pipe
- 687.93 Ground Surface
- 685.43 Top of Annular Sealant
- 3.22 Casing Stickup



- 685.93 Top of Seal
- 1 Total Seal Interval
- 684.93 Top of Sand

683.93 Top of Screen

8 Total Screen Interval

- 675.93 Bottom of Screen
- 675.93 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>27'</u>
Screen length	<u>8'</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>5'</u>
Depth to water	<u>4.34'</u>
Elevation of water	<u>685.92</u>
Free Product thickness	<u>N/A</u>
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

Completed by: R. J. E

Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, a fine up to \$50,000.00 and imprisonment to one year.







Incident No.: \_\_\_\_\_

Well No.: MW-25-98

Site Name: Fire Fighting Training Unit

Date Drilled Start: 1-29-98

Drilling Contractor: Soilprobe, Inc

Date Completed: 1-29-98

Driller: Andrew

Geologist: Fred Lawrence/Rick Elgin

Drilling Method: Direct Push

Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

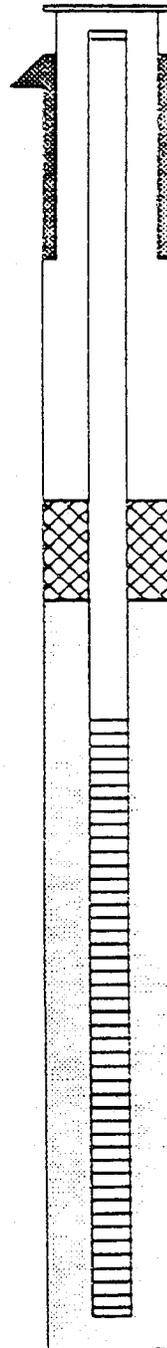
Type of Annular Sealant: Bentonite

Type of Bentonite Seal (Granular, Pellet): \_\_\_\_\_  
Granular-Hydrated

Type of Sand Pack: Silica

Elevations - .01 ft.

- 690.45 Top of Protective Casing
- 690.22 Top of Riser Pipe
- 690.45 Ground Surface
- 688.45 Top of Annular Sealant
- 0 Casing Stickup



- 688.45 Top of Seal
- 3 Total Seal Interval
- 685.45 Top of Sand

684.45 Top of Screen

10 Total Screen Interval

674.45 Bottom of Screen  
674.45 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>6'</u>
Screen length	<u>10'</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>0.75</u>
Depth to water	<u>7.23'</u>
Elevation of water	<u>682.99</u>
Free Product thickness	N/A
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

Completed by: RJE

Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, a fine up to \$50,000.00 and/or imprisonment for up to 1 year.







Incident No.: \_\_\_\_\_

Well No.: MW-30-98

Site Name: Fire Fighting Training Unit

Date Drilled Start: 1-30-98

Drilling Contractor: Soilprobe, Inc

Date Completed: 1-30-98

Driller: Andrew

Geologist: Fred Lawrence/Rick Elgin

Drilling Method: Direct Push

Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

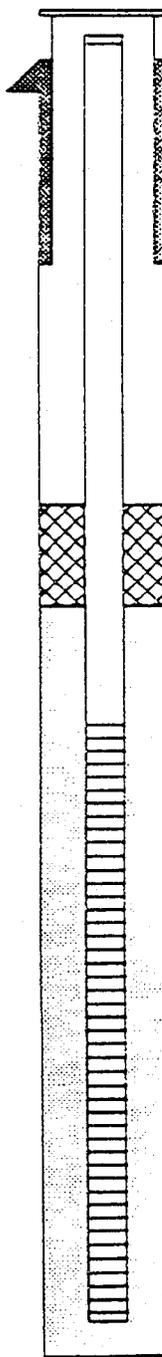
Type of Annular Sealant: Bentonite

Type of Bentonite Seal (Granular, Pellet):  
Granular-Hydrated

Type of Sand Pack: Silica

Elevations - .01 ft.

- 688.16 Top of Protective Casing
- 687.89 Top of Riser Pipe
- 688.16 Ground Surface
- 686.16 Top of Annular Sealant
- 0 Casing Stickup



- 686.16 Top of Seal
- 43 Total Seal Interval
- 683.16 Top of Sand
- 682.16 Top of Screen

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>6'</u>
Screen length	<u>10'</u>
Screen slot size	<u>0.01"</u>
Protective casing length	<u>75'</u>
Depth to water	<u>1.62'</u>
Elevation of water	<u>686.27</u>
Free Product thickness	<u>N/A</u>
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

10' Total Screen Interval

- 672.16 Bottom of Screen
- 672.16 Bottom of Borehole

Completed by: R. J. E.

the agency is authorized to assess a civil penalty up to \$25,000 for each day the failure continues, and fine up to \$50,000.00. This information is required. Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, and fine up to \$50,000.00. This information is required. Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, and fine up to \$50,000.00. This information is required.



Incident No.: \_\_\_\_\_  
 Site Name: Fire Fighting Training Unit  
 Drilling Contractor: Soilprobe, Inc  
 Driller: Andrew  
 Drilling Method: Direct Push

Well No.: MW-34-98  
 Date Drilled Start: 2-3-98  
 Date Completed: 2-3-98  
 Geologist: Fred Lawrence/Rick Elgin  
 Drilling Fluids (type): None

Annular Space Details

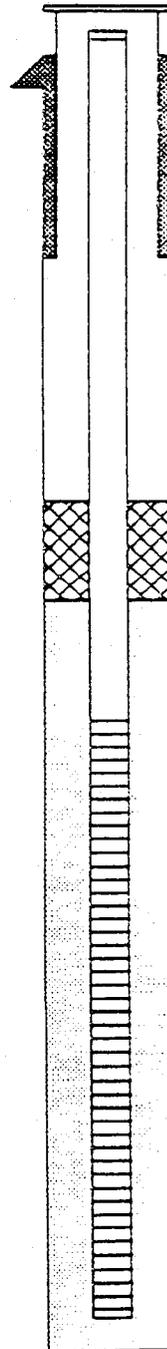
Type of Surface Seal: Concrete  
 Type of Annular Sealant: Bentonite  
 Type of Bentonite Seal (Granular, Pellet): \_\_\_\_\_  
Granular-Hydrated  
 Type of Sand Pack: Silica

Elevations - .01 ft.

684.60 Top of Protective Casing  
684.35 Top of Riser Pipe  
684.60 Ground Surface  
683.60 Top of Annular Sealant  
0 Casing Stickup

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		



683.60 Top of Seal  
.5 Total Seal Interval  
683.10 Top of Sand

682.60 Top of Screen

9 Total Screen Interval

673.60 Bottom of Screen  
673.60 Bottom of Borehole

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>2'</u>
Screen length	<u>9'</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>.75</u>
Depth to water	<u>0.65'</u>
Elevation of water	<u>683.70</u>
Free Product thickness	<u>N/A</u>
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

Completed by: R.J.E.

Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues. A fine up to \$50,000.00 may be assessed for each day the failure continues. For more information, contact the Illinois Environmental Protection Agency, 1501 East Lake Street, Chicago, Illinois 60610.







Incident No.: \_\_\_\_\_

Well No.: MW-39-98

Site Name: Fire Fighting Training Unit

Date Drilled Start: 2-4-98

Drilling Contractor: Soilprobe, Inc

Date Completed: 2-4-98

Driller: Andrew

Geologist: Fred Lawrence/Rick Elgin

Drilling Method: Direct Push

Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

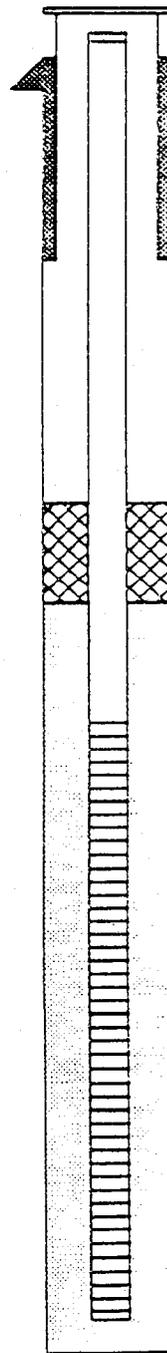
Type of Annular Sealant: Bentonite

Type of Bentonite Seal (Granular, Pellet):  
Granular-Hydrated

Type of Sand Pack: Silica

Elevations - .01 ft.

- 693.24 Top of Protective Casing
- 693.07 Top of Riser Pipe
- 693.24 Ground Surface
- 692.24 Top of Annular Sealant
- 0 Casing Stickup



- 692.24 Top of Seal
- 1.5 Total Seal Interval
- 690.74 Top of Sand

690.24 Top of Screen

9 Total Screen Interval

- 686.24 Bottom of Screen
- 681.24 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>3'</u>
Screen length	<u>9'</u>
Screen slot size	<u>0.01"</u>
Protective casing length	<u>.75'</u>
Depth to water	<u>2.24'</u>
Elevation of water	<u>690.83</u>
Free Product thickness	<u>N/A</u>
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

Completed by: R.J.E.

Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues a fine up to \$50,000.00





Incident No.: \_\_\_\_\_  
 Site Name: Fire Fighting Training Unit  
 Drilling Contractor: Soilprobe, Inc  
 Driller: Andrew  
 Drilling Method: Direct Push

Well No.: MW-41-98  
 Date Drilled Start: 2-5-98  
 Date Completed: 2-5-98  
 Geologist: Fred Lawrence/Rick Elgin  
 Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete  
 Type of Annular Sealant: Bentonite  
 Type of Bentonite Seal (Granular, Pellet): \_\_\_\_\_  
Granular-Hydrated  
 Type of Sand Pack: Silica

Elevations - .01 ft.

693.58 Top of Protective Casing  
693.24 Top of Riser Pipe  
690.19 Ground Surface  
689.19 Top of Annular Sealant  
3.39 Casing Stickup

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

689.19 Top of Seal  
1.6 Total Seal Interval  
687.59 Top of Sand

687.19 Top of Screen

Measurements

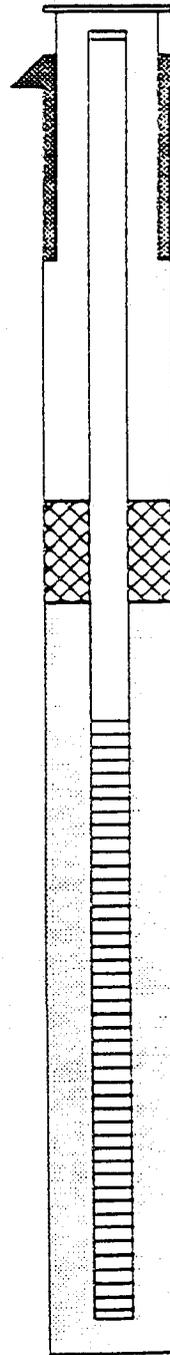
to .01 ft (where applicable)

Riser pipe length	<u>6.5'</u>
Screen length	<u>9'</u>
Screen slot size	<u>0.01"</u>
Protective casing length	<u>5'</u>
Depth to water	<u>4.08'</u>
Elevation of water	<u>689.16</u>
Free Product thickness	N/A
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>1" PVC</u>

9 Total Screen Interval

678.19 Bottom of Screen  
678.19 Bottom of Borehole

Completed by: R.J.E.



Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, a fine up to \$50,000.00  
 implementation to year has app by Form age Cent



Incident No.: \_\_\_\_\_

Well No.: CPZ-001

Site Name: Fire Fighting Training Unit

Date Drilled Start: \_\_\_\_\_

Drilling Contractor: Soilprobe, Inc

Date Completed: \_\_\_\_\_

Driller: Andrew

Geologist: Fred Lawrence/Rick Elgin

Drilling Method: Direct Push

Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

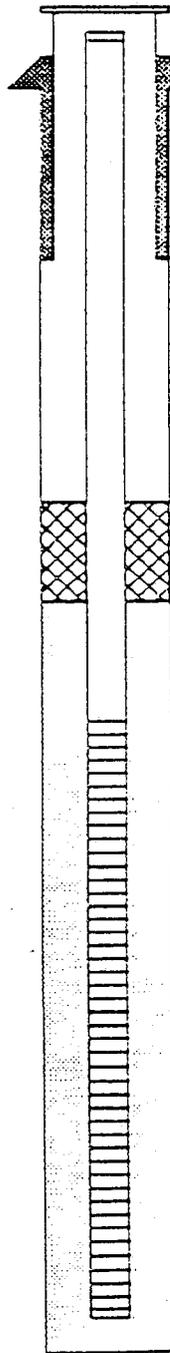
Type of Annular Sealant: Bentonite

Type of Bentonite Seal (Granular, Pellet):  
Granular-Hydrated

Type of Sand Pack: Silica

Elevations - .01 ft.

- 689.26 Top of Protective Casing
- 689.21 Top of Riser Pipe
- 689.26 Ground Surface
- 688.26 Top of Annular Sealant
- 0 Casing Stickup



- 688.26 Top of Seal
- 32 Total Seal Interval
- 656.26 Top of Sand

654.26 Top of Screen

5 Total Screen Interval

- 649.26 Bottom of Screen
- 649.26 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint		X	
Riser pipe above w.t.		X	
Riser pipe below w.t.		X	
Screen		X	
Coupling joint screen to riser		X	
Protective casing	X		

Measurements

to .01 ft (where applicable)

Riser pipe length	<u>35'</u>
Screen length	<u>5'</u>
Screen slot size	<u>0.01</u>
Protective casing length	<u>.75'</u>
Depth to water	<u>23.81'</u>
Elevation of water	<u>665.40</u>
Free Product thickness	N/A
Gallons removed (develop)	
Gallons removed (purge)	
Other	<u>.75" PVC</u>

Completed by: R.S.E

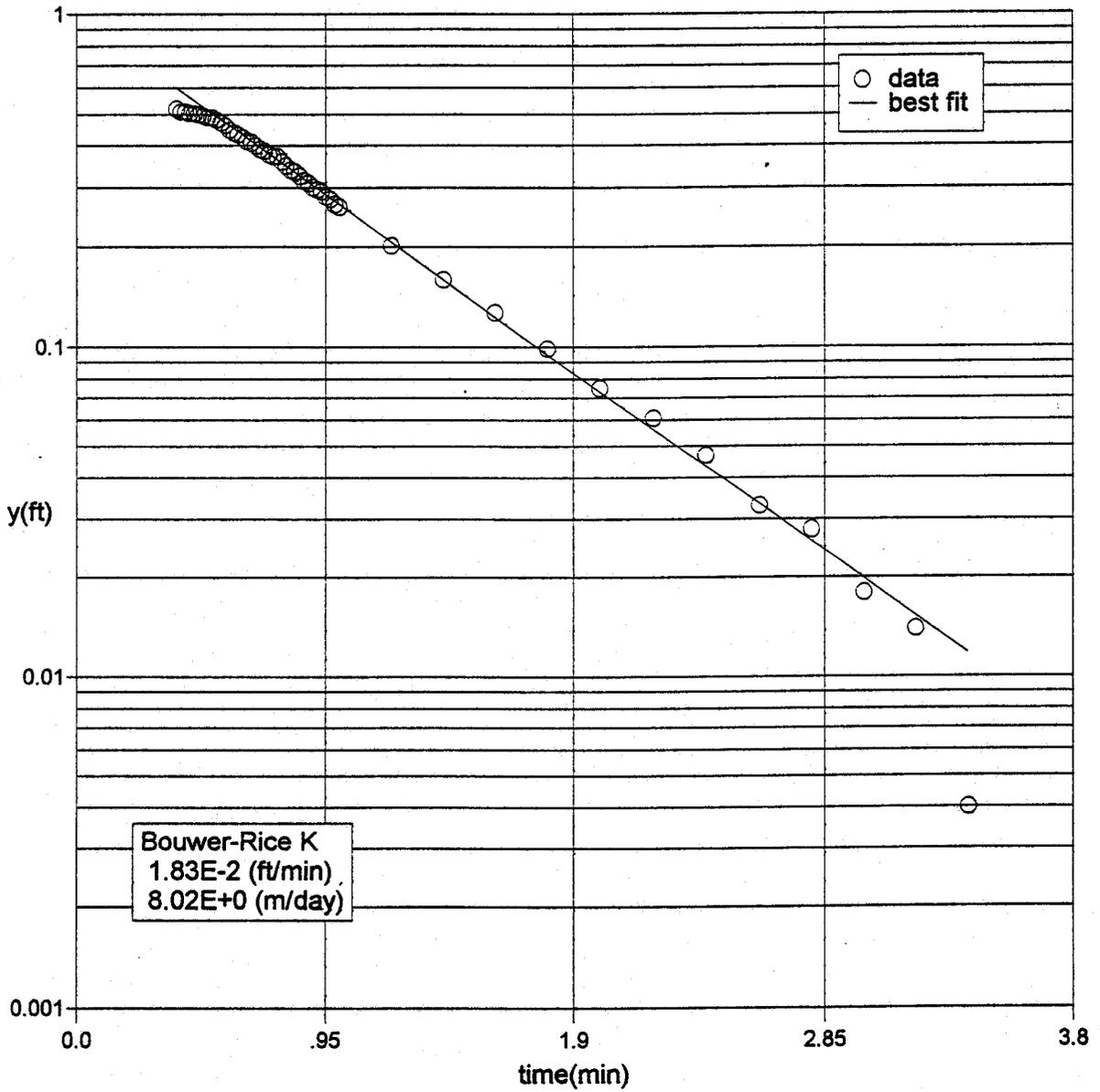
Failure to do so may result in a civil penalty up to \$25,000.00 for each day the failure continues, a fine up to \$50,000.00 and imprisonment up to 30 days for each day the failure continues.







Slug Test - MW-30-98 on 2/19/98



Slug Test Results

Title: Slug in (feet/min)  
Client: Great Lakes NTC-FFTU  
Job Number: 29886  
Well Number: MW-30-98

Hydraulic Conductivity

-----  
Bower-Rice: 1.83E-2 (ft/min), 8.02E+0 (m/day)

Well Geometry (ft)

H: 12.0  
Le: 10.0  
Lw: 11.0  
rc: .042  
rw: .083

drainable filter pack porosity: 15.0  
effective radius: 2.80E-1 (ft)

Bower Rice Coefficients

Le/rw: 120.482  
A: 4.602  
B: 0.802  
C: 4.661  
ln(Re/rw): 3.573

Least Squares Fit

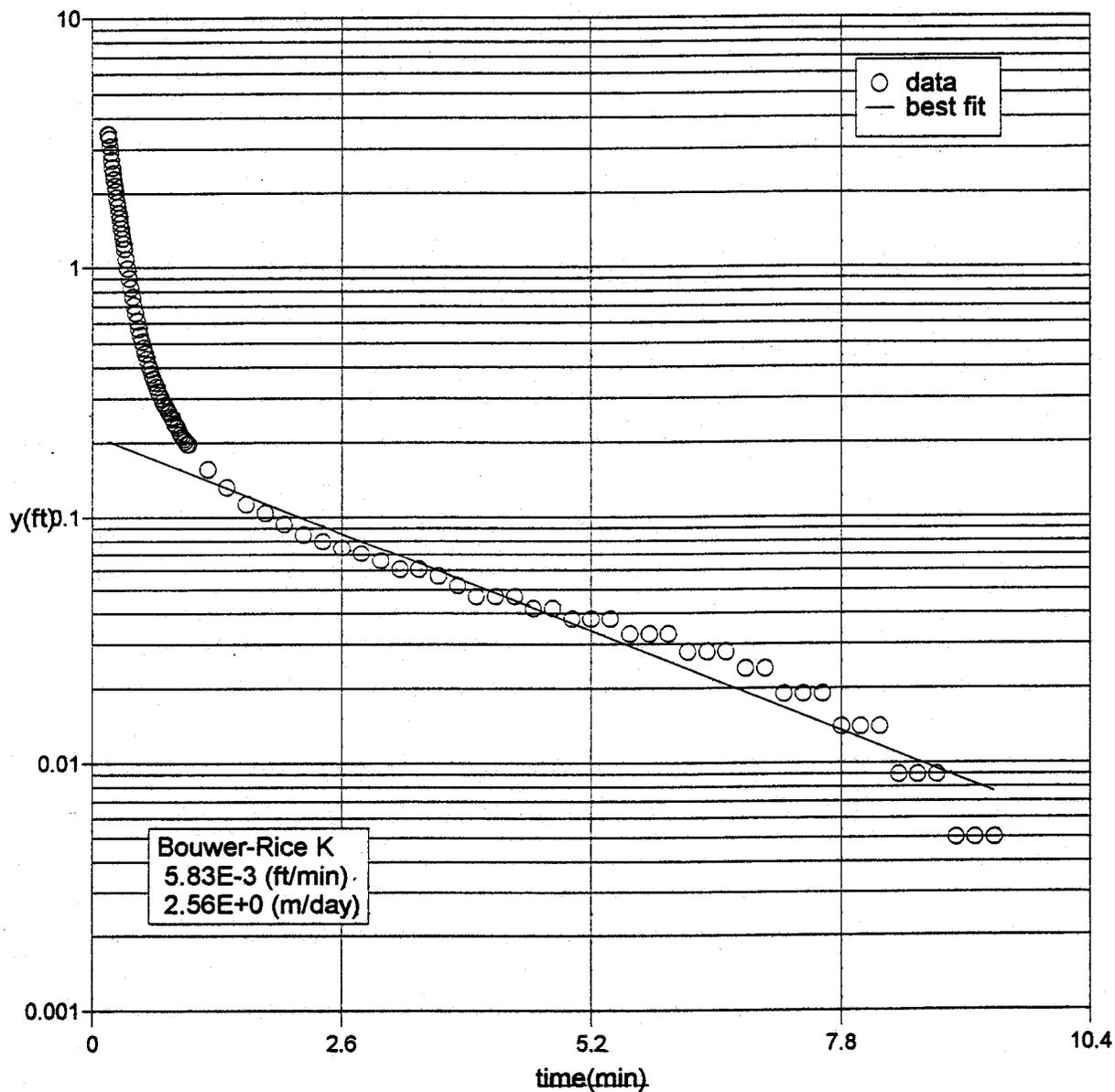
slope: -1.30E+0  
intercept: -1.51E-2

Recovery Data and Fit

time(min)	y(ft)	weight	fit(ft)
0.3833	0.518	0.0	0.598
0.4	0.508	0.0	0.586
0.4166	0.508	0.0	0.573
0.4333	0.503	0.0	0.561
0.45	0.503	0.0	0.549
0.4666	0.499	0.0	0.537
0.4833	0.494	0.0	0.525
0.5	0.489	0.0	0.514
0.5166	0.489	0.0	0.503
0.5333	0.480	0.0	0.492
0.55	0.471	0.0	0.482
0.5666	0.461	0.0	0.471
0.5833	0.447	0.0	0.461
0.6	0.438	0.0	0.451
0.6166	0.433	0.0	0.442
0.6333	0.423	0.0	0.432
0.65	0.414	0.0	0.423

0.6666	0.409	0.0	0.414
0.6833	0.400	0.0	0.405
0.7	0.390	0.0	0.396
0.7166	0.386	1.0	0.388
0.7333	0.376	1.0	0.380
0.75	0.372	1.0	0.371
0.7666	0.372	1.0	0.364
0.7833	0.358	1.0	0.356
0.8	0.348	1.0	0.348
0.8166	0.339	1.0	0.341
0.8333	0.334	1.0	0.333
0.85	0.325	1.0	0.326
0.8666	0.315	1.0	0.319
0.8833	0.310	1.0	0.312
0.9	0.301	1.0	0.306
0.9166	0.296	1.0	0.299
0.9333	0.292	1.0	0.293
0.95	0.282	1.0	0.286
0.9666	0.277	1.0	0.280
0.9833	0.268	1.0	0.274
1.0	0.263	1.0	0.268
1.2	0.202	1.0	0.207
1.4	0.160	1.0	0.160
1.6	0.127	1.0	0.123
1.8	0.099	1.0	0.095
2.0	0.075	1.0	0.073
2.2	0.061	1.0	0.056
2.4	0.047	1.0	0.043
2.6	0.033	1.0	0.034
2.8	0.028	1.0	0.026
3.0	0.018	1.0	0.020
3.2	0.014	1.0	0.015
3.4	0.004	0.0	0.012

# Slug Test MW-41-98 on 2/29/98



## Slug Test Results

Title: Slug in feet/min  
Client: Great Lakes NTC-FFTU  
Job Number: 29886  
Well Number: MW-41-98

### Hydraulic Conductivity

-----

Bouwer-Rice: 5.83E-3 (ft/min), 2.56E+0 (m/day)

### Well Geometry (ft)

H: 10.0  
Le: 7.75  
Lw: 7.75  
rc: .042  
rw: .083

drainable filter pack porosity: 15.0  
effective radius: 2.80E-1 (ft)

### Bouwer Rice Coefficients

Le/rw: 93.373  
A: 3.962  
B: 0.667  
C: 3.992  
ln(Re/rw): 3.242

### Least Squares Fit

slope: -3.55E-1  
intercept: -1.54E+0

### Recovery Data and Fit

time(min)	y(ft)	weight	fit(ft)
0.1583	3.471	0.0	0.203
0.1666	3.448	0.0	0.203
0.175	3.311	0.0	0.202
0.1833	3.103	0.0	0.201
0.1916	2.919	0.0	0.201
0.2	2.726	0.0	0.200
0.2083	2.547	0.0	0.200
0.2166	2.414	0.0	0.199
0.225	2.287	0.0	0.198
0.2333	2.155	0.0	0.198
0.2416	2.051	0.0	0.197
0.25	1.929	0.0	0.197
0.2583	1.848	0.0	0.196
0.2666	1.768	0.0	0.195
0.275	1.669	0.0	0.195
0.2833	1.598	0.0	0.194
0.2916	1.523	0.0	0.194

0.3	1.448	0.0	0.193
0.3083	1.377	0.0	0.193
0.3166	1.315	0.0	0.192
0.325	1.249	0.0	0.191
0.3333	1.193	0.0	0.191
0.35	1.084	0.0	0.190
0.3666	0.990	0.0	0.189
0.3833	0.905	0.0	0.188
0.4	0.830	0.0	0.186
0.4166	0.764	0.0	0.185
0.4333	0.707	0.0	0.184
0.45	0.660	0.0	0.183
0.4666	0.613	0.0	0.182
0.4833	0.575	0.0	0.181
0.5	0.542	0.0	0.180
0.5166	0.509	0.0	0.179
0.5333	0.481	0.0	0.178
0.55	0.457	0.0	0.177
0.5666	0.434	0.0	0.176
0.5833	0.410	0.0	0.175
0.6	0.396	0.0	0.174
0.6166	0.377	0.0	0.173
0.6333	0.363	0.0	0.172
0.65	0.349	0.0	0.171
0.6666	0.335	0.0	0.170
0.6833	0.321	0.0	0.169
0.7	0.311	0.0	0.168
0.7166	0.302	0.0	0.167
0.7333	0.292	0.0	0.166
0.75	0.283	0.0	0.165
0.7666	0.278	0.0	0.164
0.7833	0.269	0.0	0.163
0.8	0.264	0.0	0.162
0.8166	0.255	0.0	0.161
0.8333	0.250	0.0	0.160
0.85	0.240	0.0	0.159
0.8666	0.236	0.0	0.158
0.8833	0.231	0.0	0.157
0.9	0.222	0.0	0.156
0.9166	0.217	0.0	0.155
0.9333	0.212	0.0	0.154
0.95	0.207	0.0	0.153
0.9666	0.203	0.0	0.153
0.9833	0.198	0.0	0.152
1.0	0.198	0.0	0.151
1.2	0.156	1.0	0.140
1.4	0.132	1.0	0.131
1.6	0.113	1.0	0.122
1.8	0.104	1.0	0.114
2.0	0.094	1.0	0.106
2.2	0.085	1.0	0.098
2.4	0.080	1.0	0.092
2.6	0.075	1.0	0.085

2.8	0.071	1.0	0.080
3.0	0.066	1.0	0.074
3.2	0.061	1.0	0.069
3.4	0.061	1.0	0.064
3.6	0.057	1.0	0.060
3.8	0.052	1.0	0.056
4.0	0.047	1.0	0.052
4.2	0.047	1.0	0.048
4.4	0.047	1.0	0.045
4.6	0.042	1.0	0.042
4.8	0.042	1.0	0.039
5.0	0.038	1.0	0.036
5.2	0.038	1.0	0.034
5.4	0.038	1.0	0.032
5.6	0.033	1.0	0.029
5.8	0.033	1.0	0.027
6.0	0.033	1.0	0.026
6.2	0.028	1.0	0.024
6.4	0.028	1.0	0.022
6.6	0.028	1.0	0.021
6.8	0.024	1.0	0.019
7.0	0.024	1.0	0.018
7.2	0.019	1.0	0.017
7.4	0.019	1.0	0.016
7.6	0.019	1.0	0.015
7.8	0.014	1.0	0.014
8.0	0.014	1.0	0.013
8.2	0.014	1.0	0.012
8.4	0.009	1.0	0.011
8.6	0.009	1.0	0.010
8.8	0.009	1.0	0.009
9.0	0.005	1.0	0.009
9.2	0.005	1.0	0.008
9.4	0.005	1.0	0.008

TELEPHONE  
309-673-2131

TESTS \* INVESTIGATIONS  
ANALYSIS \* DESIGN \* EVALUATIONS  
CONSULTATION \* REPORTS \* INSPECTIONS  
ARBITRATION \* EXPERT WITNESS TESTIMONY  
\*\*\*\*\*  
SOILS \* PORTLAND CEMENT CONCRETE  
BITUMINOUS CONCRETE \* STEEL  
ASPHALT \* AGGREGATES \* EMULSIONS  
POZOLANIC MATERIALS \* LIME



**WHITNEY & ASSOCIATES**  
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2406 West Nebraska Avenue  
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TELEFAX  
309-673-3050

GEOTECHNICAL ENGINEERING  
CONSTRUCTION QUALITY CONTROL  
SUBSURFACE EXPLORATIONS  
ENVIRONMENTAL INVESTIGATIONS  
\*\*\*\*\*  
MONITORING WELL INSTALLATIONS  
BUILT-UP ROOF INVESTIGATIONS  
WELDER CERTIFICATIONS  
INSURANCE INVESTIGATIONS

CLIENT:

W&A FILE NO. 9336001

DATE: 04-06-98

Mr. Fred Lawrence  
Beling Consultants, Inc.  
1001 16th Street  
Moline, Illinois 61265

PROJECT:

Great Lakes NTC  
Beling Job #29886

### GEOTECHNICAL SOIL TEST RESULTS

SAMPLE DESIGNATION	:	DP012	DP029	DP029
SAMPLE DEPTH - FEET		4.0 - 8.0	1.0 - 5.0	7.0 - 11.0
SAMPLE CLASSIFICATION	:	SILTY SAND SM; Fine- To Medium- Grained	SILTY CLAY WITH SAND - CL-ML (Clay Loam)	Poorly Graded SAND With Silt SP-SM; Fine- To Medium-Grained
NATURAL MOISTURE CONTENT - %	:	12.3	23.6	13.6
MOIST BULK DENSITY - PCF	:	119.2	117.6	132.7
DRY BULK DENSITY - PCF	:	106.1	95.1	116.8
TOTAL ORGANIC CARBON - %	:	0.80	1.21	0.30
POROSITY *- PERCENT	:	0.3661	0.4310	0.3014

\*Assumed Specific Gravity 2.68

**HYDROMETER ANALYSIS TEST RESULTS**

SIEVE DESIGNATION	PERCENTAGE FINER - %		
	DP012 4.0' - 8.0'	DP029 1.0' - 5.0'	DP029 7.0' - 11.0'
1"	100	100	100
3/4"	100	100	100
3/8"	97	100	100
#4	91	100	98
#10	80	100	91
#20	66	99	76
#40	52	98	53
#60	34	96	27
#140	18	82	11
#200	15.9	76.8	9.6
<b>MAXIMUM DIAMETER - M.M.</b>			
.0400	12	63	7
.0260	10	56	6
.0150	8	45	5
.0100	7	40	5
.0074	6	36	4
.0050	5	29	3
.0036	4	26	3
.0010	3	20	2
SAND-%	84	23	90
SILT -%	11	48	7
CLAY-%	5	29	3

SOIL CLASSIFICATION

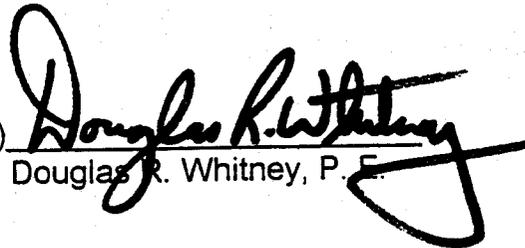
SAMPLE NUMBER	SAMPLE DEPTH - FEET	SOIL CLASSIFICATION
DP012	4.0 - 8.0	SILTY SAND - SM; Fine- To Medium-Grained, Some Coarse-Grained Sand And Small Amount of Fine-Grained Gravel
DP029	1.0 - 5.0	SILTY CLAY With Sand - CL-ML (Clay Loam)
DP029	7.0 - 11.0	Poorly Graded SAND With Silt - SP-SM; Fine- To Medium-Grained, Small Amount of Coarse-Grained Sand, Trace of Fine-Grained Gravel

Should you have any questions or comments whatsoever in regard to these test results, or if any additional information is desired, please do not hesitate to contact me personally at your convenience.

Respectfully submitted,

WHITNEY & ASSOCIATES

(By)

  
Douglas R. Whitney, P. E.

DRW:rma

TELEPHONE  
309 673-2131

TESTS  
DESIGN  
REPORTS  
ANALYSIS  
INSPECTION  
CONSULTATION  
INVESTIGATIONS



**WHITNEY & ASSOCIATES**  
INCORPORATED

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STEEL - BITUMINOUS CONCRETE  
CONSTRUCTION MATERIALS  
AGGREGATES - ASPHALT - POZ-O-PAC

SOILS AND GRAVEL SURVEYS  
MATERIALS QUALITY CONTROL  
SOIL MECHANICS AND  
FOUNDATION ENGINEERING  
DRILLING - CORING - TESTING

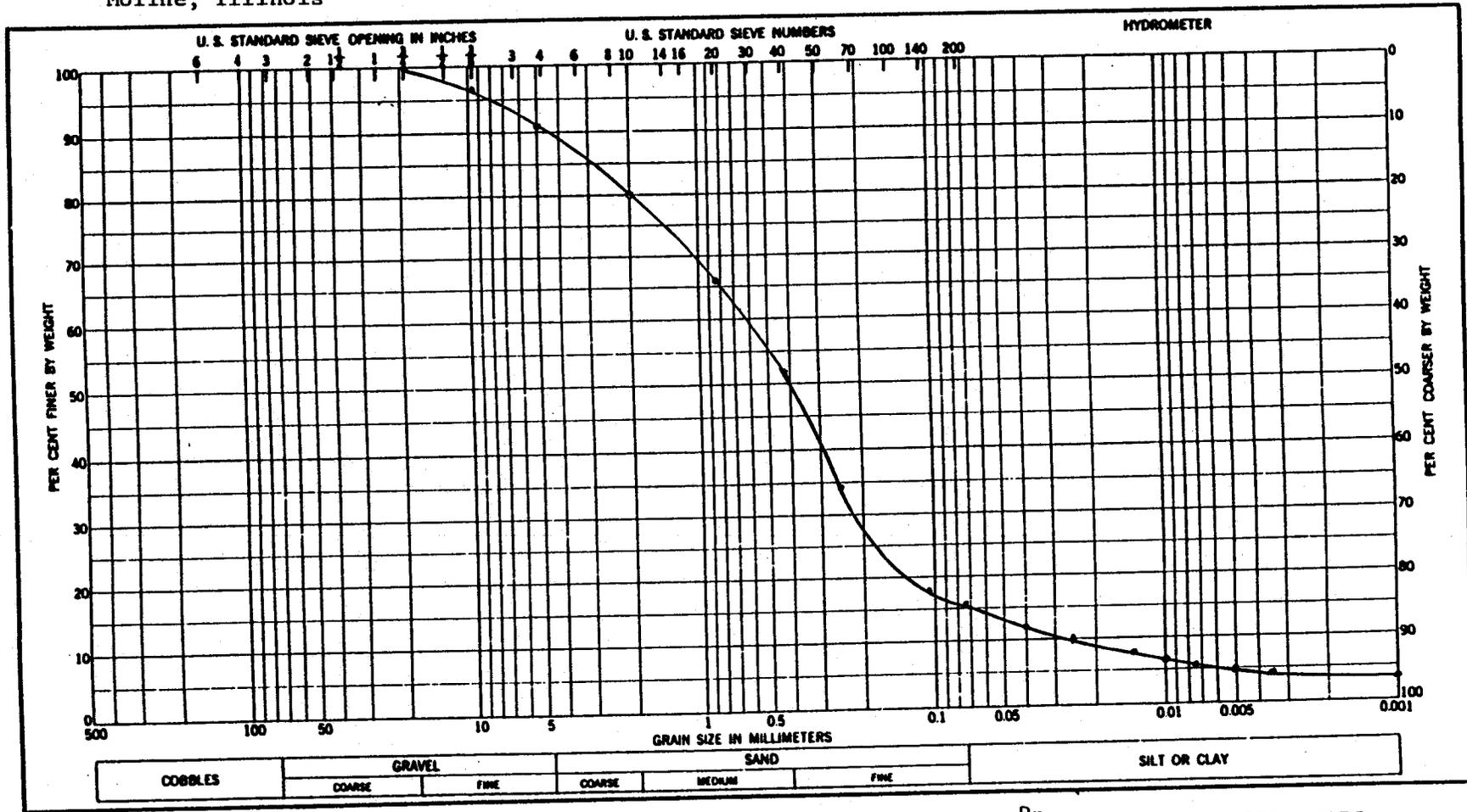
PROJECT: Great Lakes NTC  
Beling Job #29886

W. & A. FILE NO. 9338

CLIENT: Beling Consultants, Inc.  
Moline, Illinois

DATE 4-06-98  
SAMPLE NO. DP012  
SAMPLE DEPTH: 4.0'-8.0'

### REPORT OF SOIL/AGGREGATE ANALYSIS





TELEPHONE  
309 673-2131

TESTS  
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INVESTIGATIONS



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SOILS AND GRAVEL SURVEYS  
MATERIALS QUALITY CONTROL  
SOIL MECHANICS AND  
FOUNDATION ENGINEERING  
DRILLING - CORING - TESTING

PROJECT: Great Lakes NTC  
Beling Job #29886

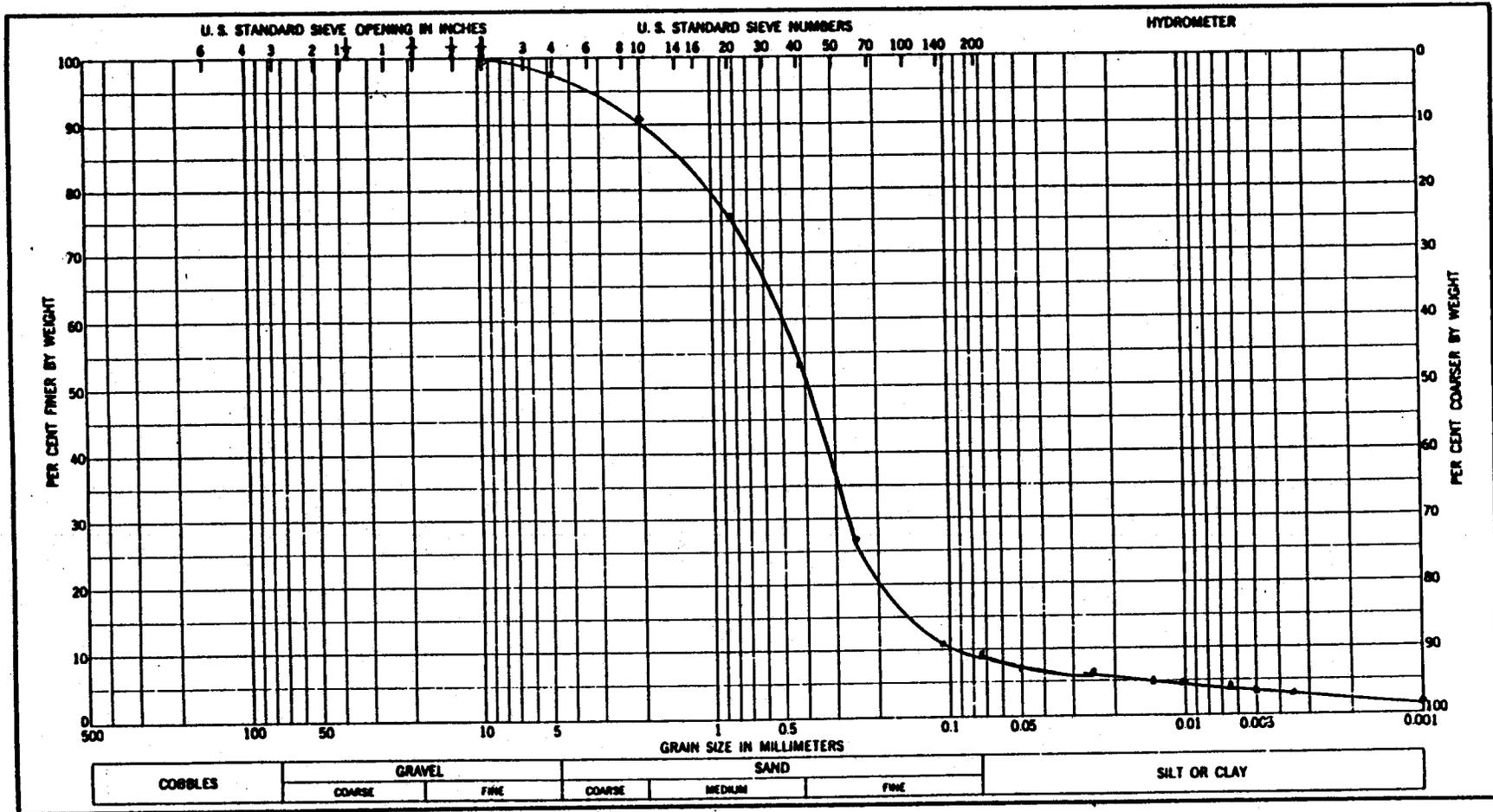
W. & A. FILE NO. 9338

CLIENT: Beling Consultants, Inc.  
Moline, Illinois

DATE 4-06-98  
SAMPLE NO. DP029

SAMPLE DEPTH: 7.0'-11.0'

### REPORT OF SOIL/AGGREGATE ANALYSIS



**TELEPHONE**

309-673-2131

TESTS \* INVESTIGATIONS  
ANALYSIS \* DESIGN \* EVALUATIONS  
CONSULTATION \* REPORTS \* INSPECTIONS  
ARBITRATION \* EXPERT WITNESS TESTIMONY

SOILS \* PORTLAND CEMENT CONCRETE  
BITUMINOUS CONCRETE \* STEEL  
ASPHALT \* AGGREGATES \* EMULSIONS  
POZOLANIC MATERIALS \* LIME

**CLIENT:**

Mr. Fred Lawrence  
Beling Consultants, Inc.  
1001 16th Street  
Moline, Illinois 61265



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**TELEFAX**

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GEO TECHNICAL ENGINEERING  
CONSTRUCTION QUALITY CONTROL  
SUBSURFACE EXPLORATIONS  
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MONITORING WELL INSTALLATIONS  
BUILT-UP ROOF INVESTIGATIONS  
WELDER CERTIFICATIONS  
INSURANCE INVESTIGATIONS

**W&A FILE NO. 8843001**

**DATE: 07-09-97**

**PROJECT:**

U. S. Navy GLNTC - FFTU  
North Chicago, Illinois  
Beling Job #29649

**HYDROMETER ANALYSIS TEST RESULTS**

<u>SIEVE DESIGNATION</u>	<u>PERCENTAGE FINER-%</u>	
	<u>SS-001-1</u>	<u>SS-001-2</u>
#10	100	100
#20	94	100
#40	88	98
#60	86	98
#140	84	97
#200	83.6	95.8
<u>MAXIMUM DIAMETER-M.M.</u>		
.0400	81	71
.0260	77	57
.0150	69	41
.0100	65	33
.0074	57	27
.0050	48	21
.0036	44	18
.0010	30	12
SAND-%	16	4
SILT -%	36	75
CLAY-%	48	21

<u>SIEVE DESIGNATION</u>	<u>PERCENTAGE FINER-%</u>	
	<u>SS-001-3</u>	<u>CP-005-1</u>
#10	100	100
#20	98	99
#40	96	92
#60	92	55
#140	82	17
#200	72.6	13.6
<u>MAXIMUM DIAMETER-M.M.</u>		
.0400	49	12
.0260	37	10
.0150	27	9
.0100	23	8
.0074	19	6
.0050	16	5
.0036	14	5
.0010	10	4
SAND-%	27	86
SILT -%	57	9
CLAY-%	16	5

**SOIL CLASSIFICATION**

<u>SAMPLE NUMBER</u>	<u>SOIL CLASSIFICATION</u>
SS-001-1	LEAN CLAY WITH SAND - CL (CLAY)
SS-001-2	SILTY CLAY - CL-ML (SILTY CLAY LOAM)
SS-001-3	SILT WITH SAND - ML (SILT LOAM)
CP-005-1	SILTY, FINE-GRAINED SAND; Small Amount Medium-Grained Sand - SM



ATTERBERG LIMITS TEST RESULTS

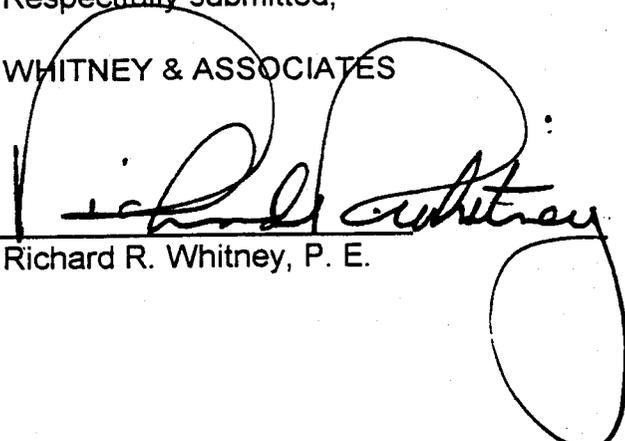
	<u>SS-001-1</u>	<u>SS-001-2</u>	<u>SS-001-3</u>	<u>CP-005-1</u>
LIQUID LIMIT-%	33.3	21.1	16.4	None
PLASTIC LIMIT-%	16.4	16.8	15.2	None
PLASTICITY INDEX-%	16.9	4.3	1.2	Non-Plastic
NATURAL MOISTURE CONTENT-%	18.0	18.4	12.6	19.9

Should you have any questions or comments whatsoever in regard to these test results, or if any additional information is desired, please do not hesitate to contact me personally at your convenience.

Respectfully submitted,

WHITNEY & ASSOCIATES

(By)

  
Richard R. Whitney, P. E.

RRW:rma

TELEPHONE  
309 673-2131

TESTS  
DESIGN  
REPORTS  
ANALYSIS  
INSPECTION  
CONSULTATION  
INVESTIGATIONS



# WHITNEY & ASSOCIATES INCORPORATED

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SPECIALISTS IN  
SOILS - PORTLAND CEMENT CONCRETE  
STEEL - BITUMINOUS CONCRETE  
CONSTRUCTION MATERIALS  
AGGREGATES - ASPHALT - POZ-O-PAC

SOILS AND GRAVEL SURVEYS  
MATERIALS QUALITY CONTROL  
SOIL MECHANICS AND  
FOUNDATION ENGINEERING  
DRILLING - CORING - TESTING

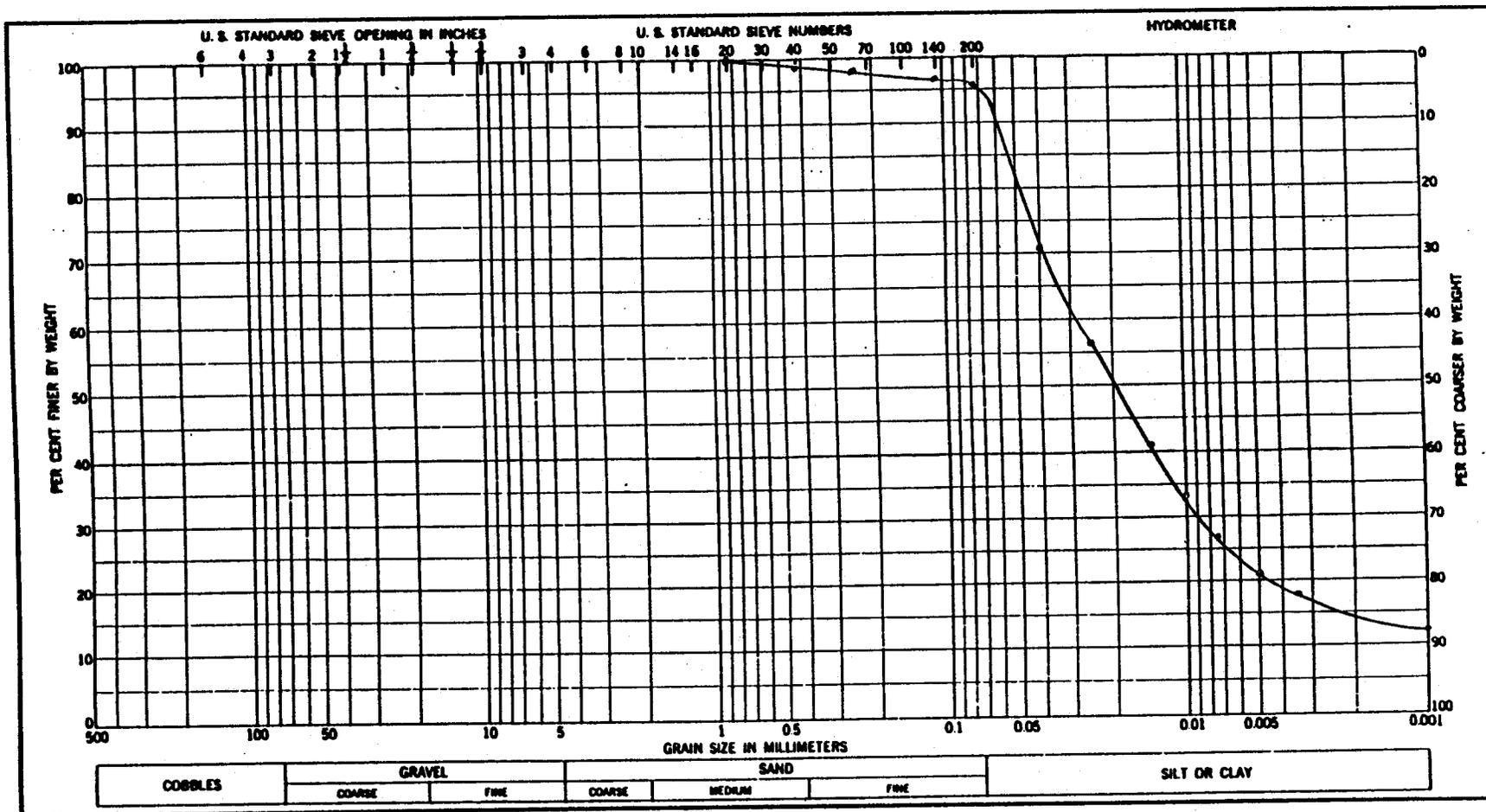
PROJECT: U. S. Navy - GLNTC - FFTU  
North Chicago, Illinois  
CLIENT: Beling Consultants, Inc.  
Moline, Illinois

W. & A. FILE NO. 8843

DATE 7-09-97

SS-001-2

## REPORT OF SOIL/AGGREGATE ANALYSIS



WHITNEY & ASSOCIATES  
PEORIA, ILLINOIS

SOIL/AGGREGATE CLASSIFICATION SILTY CLAY - CL-ML (SILTY CLAY LOAM) UNIFORMITY COEFFICIENT,  $\frac{D_{60}}{D_{10}} =$  \_\_\_\_\_ EFFECTIVE GRAIN SIZE,  $D_{10} =$  \_\_\_\_\_

TELEPHONE  
309 673-2131

TESTS  
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## WHITNEY & ASSOCIATES

INCORPORATED

2406 West Nebraska Avenue  
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SOILS - PORTLAND CEMENT CONCRETE  
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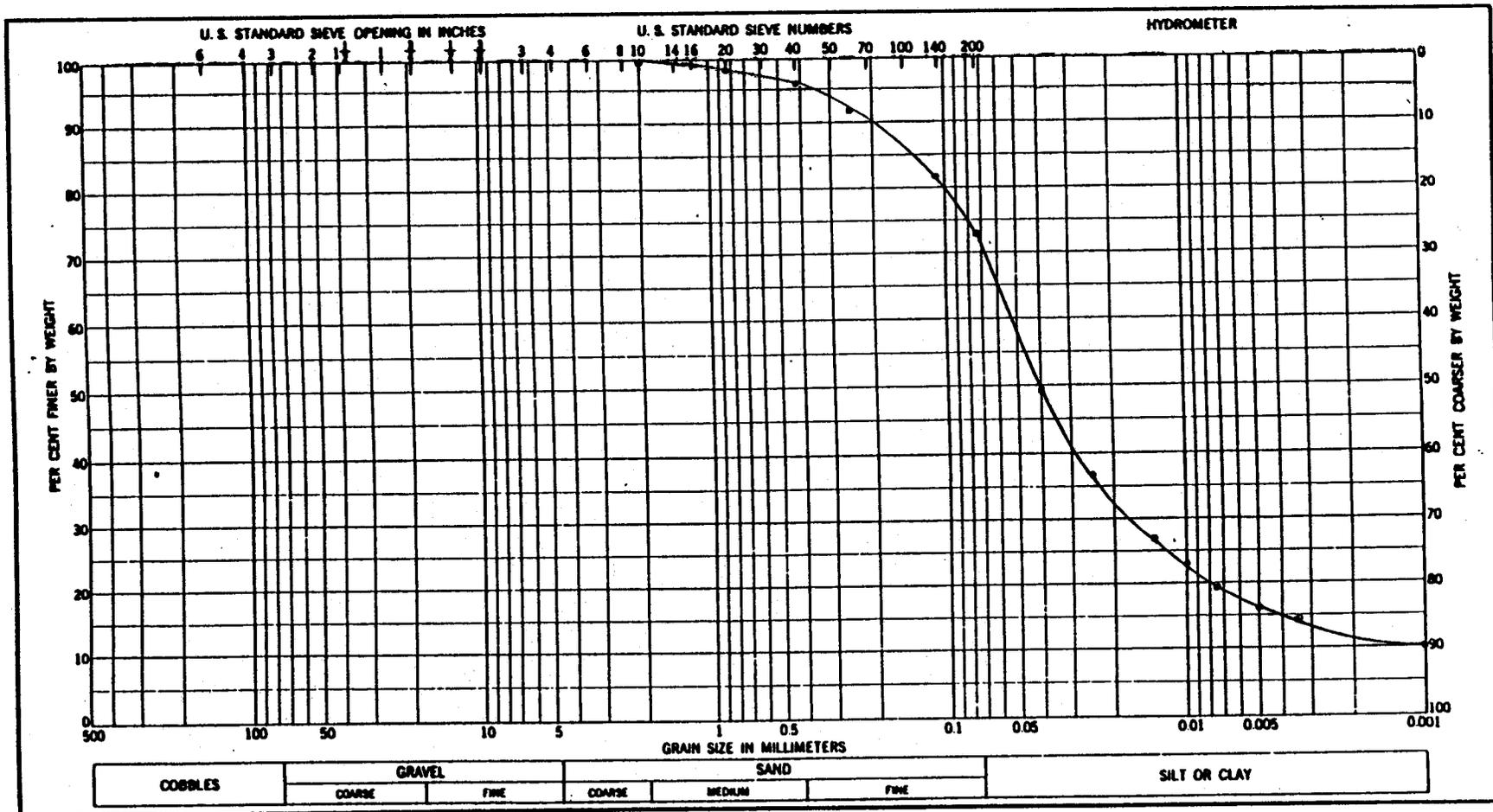
SOILS AND GRAVEL SURVEYS  
MATERIALS QUALITY CONTROL  
SOIL MECHANICS AND  
FOUNDATION ENGINEERING  
DRILLING - CORING - TESTING

PROJECT: U. S. Navy GLNTC - FFTU  
North Chicago, Illinois

CLIENT: Beling Consultants, Inc.  
Moline, Illinois

W. & A. FILE NO. 8843  
DATE 7-09-97  
SS-001-3

### REPORT OF SOIL/AGGREGATE ANALYSIS





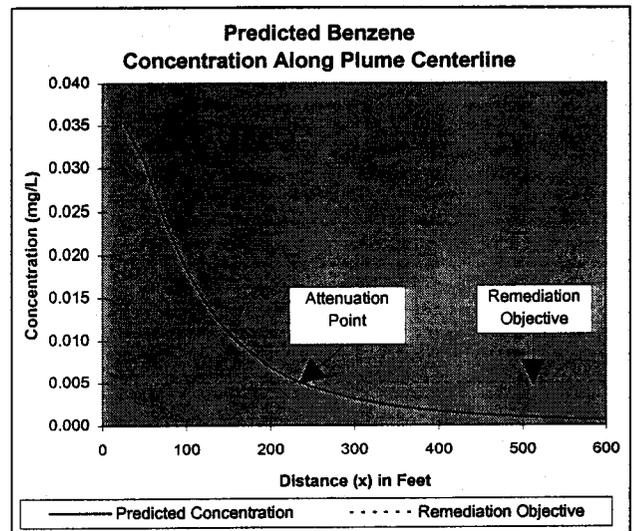
**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

**STEADY STATE ATTENUATION MODEL RESULTS**  
**Benzene in Groundwater**

$$C(x) = C_{source} \cdot \exp\left[\left(\frac{X}{2\alpha_x}\right) \cdot \left(1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}}\right)\right] \cdot \operatorname{erf}\left[\frac{S_w}{4 \cdot \sqrt{\alpha_y} \cdot X}\right] \cdot \operatorname{erf}\left[\frac{S_d}{2 \cdot \sqrt{\alpha_z} \cdot X}\right]$$

(Domenico, 1985; ASTM, 1995)

	<b>Remediation Objective (mg/L)</b>	<b>0.005</b>
<b>K</b>	<b>Hydraulic Conductivity (cm/d)</b>	<b>800</b>
<b>i</b>	<b>Gradient</b>	<b>0.01</b>
$\theta_T$	<b>porosity</b>	<b>0.33</b>
<b>S<sub>w</sub></b>	<b>Source Width (cm)**</b>	<b>1981</b>
<b>S<sub>d</sub></b>	<b>Source Depth (cm)</b>	<b>244</b>
$\lambda$	<b>Degradation Constant (1/d)</b>	<b>0.0009</b>
$U = \frac{K \cdot i}{\theta_T}$ <b>Specific Discharge (cm/d)</b> <b>24.242</b>		
<b>C<sub>source</sub></b>	<b>Source Concentration (mg/L)</b>	<b>0.0365</b>
<b>X</b>	<b>Distance Along Centerline</b>	<b>Table Below</b>
$\alpha_x = 0.10 \cdot X$	<b>Longitudinal Dispersivity (cm)</b>	<b>Table Below</b>
$\alpha_y = \frac{\alpha_x}{10}$	<b>Transverse Dispersivity (cm)</b>	<b>Table Below</b>
$\alpha_z = \frac{\alpha_x}{20}$	<b>Vertical Dispersivity (cm)</b>	<b>Table Below</b>



Downgradient Locations	Distance Along Centerline X (ft)	Distance Along Centerline X (cm)	Longitudinal Dispersivity $\alpha_x$ (cm)	Transverse Dispersivity $\alpha_y$ (cm)	Vertical Dispersivity $\alpha_z$ (cm)	Predicted Concentration $C(x)$ (mg/L)
25 feet from source	25	762	76.2	7.62	3.81	0.035
50 feet from source	50	1524	152.4	15.24	7.62	0.031
75 feet from source	75	2286	228.6	22.86	11.43	0.024
100 feet from source	100	3048	304.8	30.48	15.24	0.018
120 feet from source	120	3658	365.76	36.576	18.288	0.015
140 feet from source	140	4267	426.72	42.672	21.336	0.012
160 feet from source	160	4877	487.68	48.768	24.384	0.010
200 feet from source	200	6096	609.6	60.96	30.48	0.007
225 feet from source	225	6858	685.8	68.58	34.29	0.005
250 feet from source	250	7620	762	76.2	38.1	0.004
300 feet from source	300	9144	914.4	91.44	45.72	0.003
350 feet from source	350	10668	1066.8	106.68	53.34	0.002
400 feet from source	400	12192	1219.2	121.92	60.96	0.002
500 feet from source	500	15240	1524	152.4	76.2	0.001
550 feet from source	550	16764	1676.4	167.64	83.82	0.001
600 feet from source	600	18288	1828.8	182.88	91.44	0.001

\*\*S<sub>w</sub> based on contour of 0.5 \* maximum concentration.

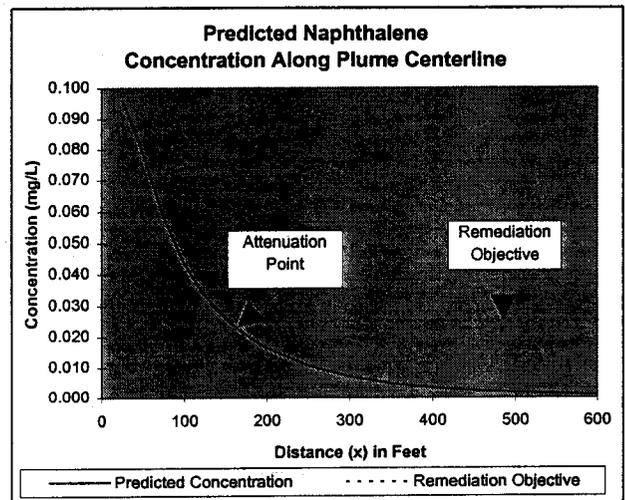
**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

**STEADY STATE ATTENUATION MODEL RESULTS**  
**Naphthalene in Groundwater**

$$C(x) = C_{source} \cdot \exp\left[\left(\frac{X}{2\alpha_x}\right) \cdot \left(1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}}\right)\right] \cdot \operatorname{erf}\left[\frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot X}}\right] \cdot \operatorname{erf}\left[\frac{S_d}{2 \cdot \sqrt{\alpha_z \cdot X}}\right]$$

(Domenico, 1985; ASTM, 1995)

K	Remediation Objective (mg/L)	0.025
i	Hydraulic Conductivity (cm/d)	800
$\theta_T$	Gradient	0.01
$S_w$	porosity	0.33
$S_d$	Source Width (cm)**	3353
$\lambda$	Source Depth (cm)	244
	Degradation Constant (1/d)	0.0027
	$U = \frac{K \cdot i}{\theta_T}$ Specific Discharge (cm/d)	24.242
$C_{source}$	Source Concentration (mg/L)	0.105
X	Distance Along Centerline	Table Below
	$\alpha_x = 0.10 \cdot X$ Longitudinal Dispersivity (cm)	Table Below
	$\alpha_y = \frac{\alpha_x}{10}$ Transverse Dispersivity (cm)	Table Below
	$\alpha_z = \frac{\alpha_x}{20}$ Vertical Dispersivity (cm)	Table Below



Downgradient Locations	Distance Along Centerline X (ft)	Distance Along Centerline X (cm)	Longitudinal Dispersivity $\alpha_x$ (cm)	Transverse Dispersivity $\alpha_y$ (cm)	Vertical Dispersivity $\alpha_z$ (cm)	Predicted Concentration $C(x)$ (mg/L)
25 feet from source	25	762	76.2	7.62	3.81	0.096
50 feet from source	50	1524	152.4	15.24	7.62	0.079
75 feet from source	75	2286	228.6	22.86	11.43	0.058
100 feet from source	100	3048	304.8	30.48	15.24	0.044
120 feet from source	120	3658	365.76	36.576	18.288	0.035
140 feet from source	140	4267	426.72	42.672	21.336	0.029
Remediation Obj. Not Exceeded						
180 feet from source	180	5486	548.64	54.864	27.432	0.020
200 feet from source	200	6096	609.6	60.96	30.48	0.016
250 feet from source	250	7620	762	76.2	38.1	0.011
300 feet from source	300	9144	914.4	91.44	45.72	0.007
350 feet from source	350	10668	1066.8	106.68	53.34	0.005
400 feet from source	400	12192	1219.2	121.92	60.96	0.003
450 feet from source	450	13716	1371.6	137.16	68.58	0.002
500 feet from source	500	15240	1524	152.4	76.2	0.002
600 feet from source	600	18288	1828.8	182.88	91.44	0.001

Point of Compliance

\*\* $S_w$  based on contour of 0.5 \* maximum concentration.

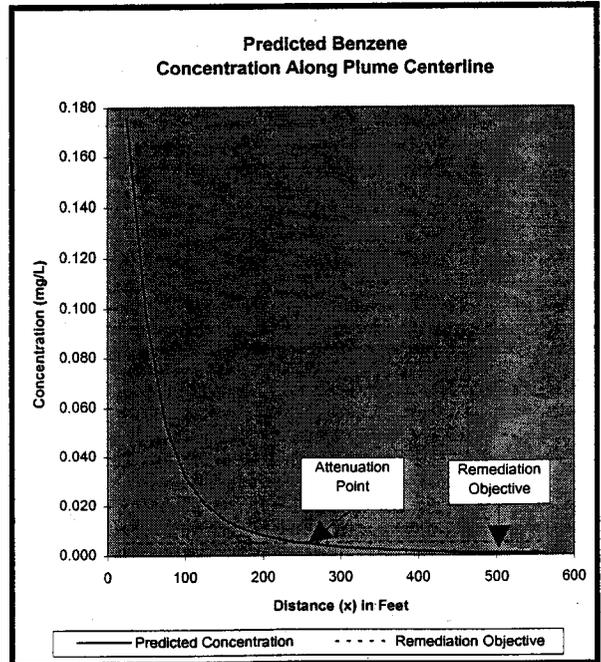
**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

**SOIL LEACHING TO GROUNDWATER MODEL**  
**for Benzene with TACO Defaults**

	Class I Groundwater Remediation Objective (mg/L)	0.005	*for Benzene
CS <sub>source</sub>	Soil Source Concentration (mg/kg)**	2.435	
θ <sub>ws</sub>	Volumetric Water Content in Vadose Zone Soils (cm <sup>3</sup> water/cm <sup>3</sup> soil)	0.15	*Surface Soil (top 1 meter) = 0.15, Subsurface Soil (below 1 meter) = 0.30
θ <sub>as</sub>	Volumetric Air Content in Vadose Zone Soils (cm <sup>3</sup> air/cm <sup>3</sup> soil)	0.28	*Surface Soil (top 1 meter) = 0.28, Subsurface Soil (below 1 meter) = 0.13
I	Infiltration Rate (cm/yr)	30	
ρ <sub>s</sub>	Soil Bulk Density (g/cm <sup>3</sup> )	1.5	
U <sub>gw</sub>	Groundwater Darcy Velocity (cm/yr)	2920	$U_{gw} = K \cdot i$
f <sub>oc</sub>	Organic Carbon Content of Soil (g/g)	0.006	*Surface Soil = 0.006, Subsurface Soil = 0.002, or Site-Specific
K <sub>oc</sub>	Organic Carbon Partition Coefficient (L/kg)	58.9	*for Benzene
k <sub>s</sub>	Soil Water Sorption Coefficient	0.353	$k_s = K_{oc} \cdot f_{oc}$
δ <sub>gw</sub>	Groundwater Mixing Zone Thickness (cm)	200	
H'	Henry's Law Constant (cm <sup>3</sup> water/cm <sup>3</sup> air)	0.228	*for Benzene
W	Width of Source Area Parallel to Direction of Groundwater Movement (cm)**	914	Field Measurement
LF <sub>sw</sub>	Leaching Factor (mg/Lwater)/(mg/kgsoil)	0.085	$LF_{sw} = \frac{\rho_s \cdot \frac{cm^3 \cdot kg}{L \cdot g}}{\left[ \theta_{ws} + (k_s \cdot \rho_s) + (H' \cdot \theta_{as}) \right] \cdot \left[ 1 + \frac{(U_{gw} \cdot \delta_{gw})}{(I \cdot W)} \right]}$
K	Hydraulic Conductivity (cm/d)	800	} Field Measurement
i	Gradient	0.01	
θ <sub>r</sub>	porosity	0.33	
S <sub>w</sub>	Source Width (cm)**	609.6	
S <sub>d</sub>	Source Depth (cm)	244	
λ	Degradation Constant (1/d)	0.0009	*for Benzene
U	Specific Discharge (cm/d)	24.24	$U = \frac{K \cdot i}{\theta_r}$
C <sub>source</sub>	Calculated Groundwater Source Concentration (mg/L)	0.206	$C_{source} = CS_{source} \cdot LF_{sw}$
RO <sub>soil</sub>	Calculated Soil Remediation Objective (mg/kg)	0.059	$RO_{soil} = \frac{GW_{source}}{LF_{sw}}$ (to meet Tier 1 objective)

$C(x) = C_{source} \cdot \exp \left[ \left( \frac{X}{2\alpha_x} \right) \cdot \left( 1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}} \right) \right] \cdot \operatorname{erf} \left[ \frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot X}} \right] \cdot \operatorname{erf} \left[ \frac{S_d}{2 \cdot \sqrt{\alpha_z \cdot X}} \right]$  (Domenico, 1985; ASTM, 1995)

Distance Along Centerline X (ft)	Distance Along Centerline X (cm)	Longitudinal Dispersivity α <sub>x</sub> = 0.10 • X (cm)	Transverse Dispersivity α <sub>y</sub> = $\frac{\alpha_x}{3}$ (cm)	Vertical Dispersivity α <sub>z</sub> = $\frac{\alpha_x}{20}$ (cm)	Concentration C(x) (mg/L)
25	762	76.2	25.4	3.81	0.176
50	1524	152.4	50.8	7.62	0.097
75	2286	228.6	76.2	11.43	0.053
100	3048	304.8	101.6	15.24	0.032
125	3810	381	127	19.05	0.021
150	4572	457.2	152.4	22.86	0.014
175	5334	533.4	177.8	26.67	0.010
200	6096	609.6	203.2	30.48	0.008
225	6858	685.8	228.6	34.29	0.006
250	7620	762	254	38.1	0.004
275	8382	838.2	279.4	41.91	0.004
300	9144	914.4	304.8	45.72	0.003
325	9906	990.6	330.2	49.53	0.003
350	10668	1066.8	355.6	53.34	0.002
375	11430	1143	381	57.15	0.002
400	12192	1219.2	406.4	60.96	0.002
425	12954	1295.4	431.8	64.77	0.001
435	13258.8	1325.88	441.96	66.294	0.001
475	14478	1447.8	482.6	72.39	0.001
500	15240	1524	508	76.2	0.001
525	16002	1600.2	533.4	80.01	0.001



\*From 35 IAC Part 742, Appendix C

\*\*S<sub>w</sub>, CS<sub>source</sub> and W based on contour of 0.5 \* maximum concentration.

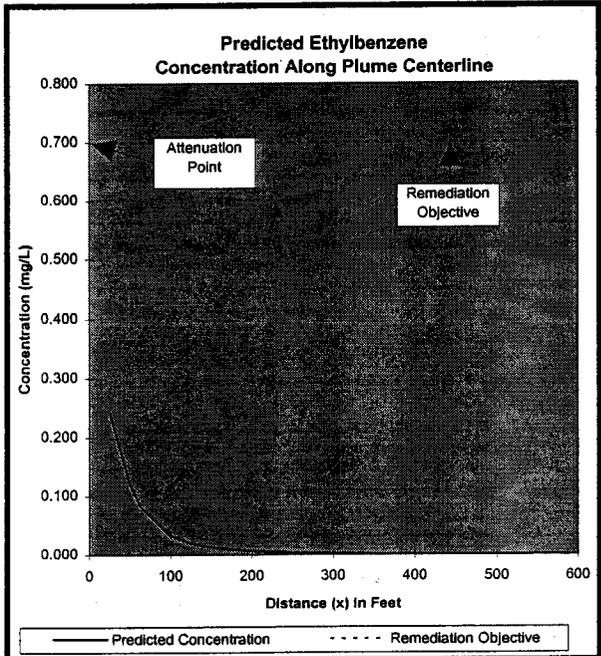
**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

**SOIL LEACHING TO GROUNDWATER MODEL**  
**for Ethylbenzene with TACO Defaults**

<b>CS<sub>source</sub></b>	Class I Groundwater Remediation Objective (mg/L)	0.7	*for Ethylbenzene
	Soil Source Concentration (mg/kg)**	20.75	
<b>θ<sub>ws</sub></b>	Volumetric Water Content in Vadose Zone		
	Soils (cm <sup>3</sup> water/cm <sup>3</sup> soil)	0.15	*Surface Soil (top 1 meter) = 0.15, Subsurface Soil (below 1 meter) = 0.30
<b>θ<sub>ss</sub></b>	Volumetric Air Content in Vadose Zone		
	Soils (cm <sup>3</sup> air/cm <sup>3</sup> soil)	0.28	*Surface Soil (top 1 meter) = 0.28, Subsurface Soil (below 1 meter) = 0.13
<b>I</b>	Infiltration Rate (cm/yr)	30	
<b>ρ<sub>s</sub></b>	Soil Bulk Density (g/cm <sup>3</sup> )	1.5	
<b>U<sub>gw</sub></b>	Groundwater Darcy Velocity (cm/yr)	2920	$U_{gw} = K \cdot i$
<b>f<sub>oc</sub></b>	Organic Carbon Content of Soil (g/g)	0.006	*Surface Soil = 0.006, Subsurface Soil = 0.002, or Site-Specific
<b>K<sub>oc</sub></b>	Organic Carbon Partition Coefficient (L/kg)	363	*for Ethylbenzene
<b>k<sub>s</sub></b>	Soil Water Sorption Coefficient	2.178	$k_s = K_{oc} \cdot f_{oc}$
<b>δ<sub>gw</sub></b>	Groundwater Mixing Zone Thickness (cm)	200	
<b>H'</b>	Henry's Law Constant (cm <sup>3</sup> water/cm <sup>3</sup> air)	0.323	*for Ethylbenzene
<b>W</b>	Width of Source Area Parallel to Direction of Groundwater Movement (cm)**	914	Field Measurement
<b>LF<sub>sw</sub></b>	Leaching Factor (mg/Lwater)/(mg/kgsoil)	0.014	$LF_{sw} = \frac{\rho_s \cdot \frac{cm^3 \cdot kg}{L \cdot g}}{\left[ \theta_{ws} + (k_s \cdot \rho_s) + (H' \cdot \theta_{ss}) \right] \cdot \left[ 1 + \frac{(U_{gw} \cdot \delta_{gw})}{(I \cdot W)} \right]}$
<b>K</b>	Hydraulic Conductivity (cm/d)	800	} Field Measurement
<b>i</b>	Gradient	0.01	
<b>θ<sub>T</sub></b>	porosity	0.33	
<b>S<sub>w</sub></b>	Source Width (cm)**	914	
<b>S<sub>d</sub></b>	Source Depth (cm)	152	
<b>λ</b>	Degradation Constant (1/d)	0.003	*for Ethylbenzene
<b>U</b>	Specific Discharge (cm/d)	24.24	$U = \frac{K \cdot i}{\theta_T}$
<b>C<sub>source</sub></b>	Calculated Groundwater Source Concentration (mg/L)	0.285	$C_{source} = CS_{source} \cdot LF_{sw}$
<b>RO<sub>soil</sub></b>	Calculated Soil Remediation Objective (mg/kg)	50.973	$RO_{soil} = \frac{GW_{source}}{LF_{sw}}$ (to meet Tier 1 objective)

$C(x) = C_{source} \cdot \exp \left[ \left( \frac{X}{2\alpha_x} \right) \cdot \left( 1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}} \right) \right] \cdot \operatorname{erf} \left[ \frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot X}} \right] \cdot \operatorname{erf} \left[ \frac{S_d}{2 \cdot \sqrt{\alpha_z \cdot X}} \right]$  (Domenico, 1985; ASTM, 1995)

Distance Along Centerline X (ft)	Distance Along Centerline X (cm)	Longitudinal Dispersivity $\alpha_x = 0.10 \cdot X$ (cm)	Transverse Dispersivity $\alpha_y = \frac{\alpha_x}{3}$ (cm)	Vertical Dispersivity $\alpha_z = \frac{\alpha_x}{20}$ (cm)	Concentration C(x) (mg/L)
25	Attenuation Point	76.2	25.4	3.81	0.243
50		152.4	50.8	7.62	0.122
63.3	1929.384	192.9384	64.3128	9.64692	0.083
100	3048	304.8	101.6	15.24	0.033
125	3810	381	127	19.05	0.020
150	4572	457.2	152.4	22.86	0.013
175	5334	533.4	177.8	26.67	0.009
200	6096	609.6	203.2	30.48	0.006
225	6858	685.8	228.6	34.29	0.005
250	7620	762	254	38.1	0.003
275	8382	838.2	279.4	41.91	0.003
300	9144	914.4	304.8	45.72	0.002
325	9906	990.6	330.2	49.53	0.002
350	10668	1066.8	355.6	53.34	0.001
375	11430	1143	381	57.15	0.001
400	12192	1219.2	406.4	60.96	0.001
425	12954	1295.4	431.8	64.77	0.001
450	13716	1371.6	457.2	68.58	0.001
475	14478	1447.8	482.6	72.39	0.000
500		1524	508	76.2	0.000
525	Point of Compliance	1600.2	533.4	80.01	0.000



\*From 35 IAC Part 742, Appendix C

\*\*S<sub>w</sub>, CS<sub>source</sub> and W based on contour of 0.5 \* maximum concentration.

**Remedial Investigation Activities**  
**U.S. Navy, Great Lakes Training Base, FFTU Site**  
**Great Lakes, Illinois**

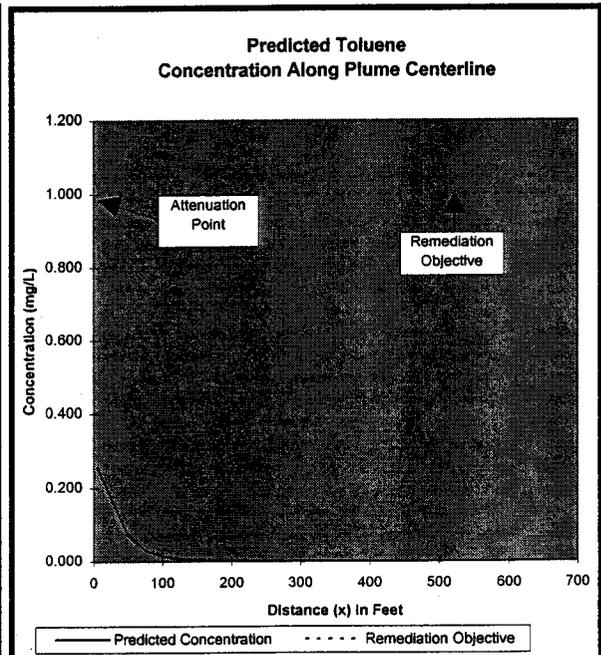
**SOIL LEACHING TO GROUNDWATER MODEL**  
**for Toluene with TACO Defaults**

	Class I Groundwater Remediation Objective (mg/L)	1.00	*for Toluene
CS <sub>source</sub>	Soil Source Concentration (mg/kg)**	14.9	
θ <sub>ws</sub>	Volumetric Water Content in Vadose Zone Soils (cm <sup>3</sup> water/cm <sup>3</sup> soil)	0.15	*Surface Soil (top 1 meter) = 0.15, Subsurface Soil (below 1 meter) = 0.30
θ <sub>as</sub>	Volumetric Air Content in Vadose Zone Soils (cm <sup>3</sup> air/cm <sup>3</sup> soil)	0.28	*Surface Soil (top 1 meter) = 0.28, Subsurface Soil (below 1 meter) = 0.13
I	Infiltration Rate (cm/yr)	30	
ρ <sub>s</sub>	Soil Bulk Density (g/cm <sup>3</sup> )	1.5	
U <sub>gw</sub>	Groundwater Darcy Velocity (cm/yr)	2920	$U_{gw} = K \cdot i$
f <sub>oc</sub>	Organic Carbon Content of Soil (g/g)	0.006	*Surface Soil = 0.006, Subsurface Soil = 0.002, or Site-Specific
K <sub>oc</sub>	Organic Carbon Partition Coefficient (L/kg)	182	*for Toluene
k <sub>s</sub>	Soil Water Sorption Coefficient	1.092	$k_s = K_{oc} \cdot f_{oc}$
δ <sub>gw</sub>	Groundwater Mixing Zone Thickness (cm)	200	
H'	Henry's Law Constant (cm <sup>3</sup> water/cm <sup>3</sup> air)	0.272	*for Toluene
W	Width of Source Area Parallel to Direction of Groundwater Movement (cm)**	610	Field Measurement
LF <sub>sw</sub>	Leaching Factor (mg/Lwater)/(mg/kgsoil)	0.019	$LF_{sw} = \frac{\rho_s \cdot \frac{cm^3 \cdot kg}{L \cdot g}}{\left[ \theta_{ws} + (k_s \cdot \rho_s) + (H' \cdot \theta_{as}) \right] \cdot \left[ 1 + \frac{(U_{gw} \cdot \delta_{gw})}{(I \cdot W)} \right]}$
K	Hydraulic Conductivity (cm/d)	800	} Field Measurement
i	Gradient	0.01	
θ <sub>r</sub>	porosity	0.33	
S <sub>w</sub>	Source Width (cm)**	609.6	
S <sub>d</sub>	Source Depth (cm)	244	
λ	Degradation Constant (1/d)	0.011	*for Toluene
U	Specific Discharge (cm/d)	24.24	$U = \frac{K \cdot i}{\theta_r}$
C <sub>source</sub>	Calculated Groundwater Source Concentration (mg/L)	0.276	$C_{source} = CS_{source} \cdot LF_{sw}$
RO <sub>soil</sub>	Calculated Soil Remediation Objective (mg/kg)	53.945	$RO_{soil} = \frac{GW_{source}}{LF_{sw}}$ (to meet Tier 1 objective)

$C(x) =$

$C_{source} \cdot \exp\left[\left(\frac{X}{2\alpha_x}\right) \cdot \left(1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}}\right)\right] \cdot \operatorname{erf}\left[\frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot X}}\right] \cdot \operatorname{erf}\left[\frac{S_d}{2 \cdot \sqrt{\alpha_z \cdot X}}\right]$  (Domenico, 1985; ASTM, 1995)

Distance Along Centerline X (ft)	Distance Along Centerline X (cm)	Longitudinal Dispersion α <sub>x</sub> = 0.10 • X (cm)	Transverse Dispersion α <sub>y</sub> = $\frac{\alpha_x}{3}$ (cm)	Vertical Dispersion α <sub>z</sub> = $\frac{\alpha_x}{20}$ (cm)	Concentration C(x) (mg/L)
5	Attenuation Point	15.24	5.08	0.762	0.258
50		152.4	50.8	7.62	0.072
75		228.6	76.2	11.43	0.030
100		304.8	101.6	15.24	0.014
125		381	127	19.05	0.007
150		457.2	152.4	22.86	0.004
175		533.4	177.8	26.67	0.002
200		609.6	203.2	30.48	0.001
225		685.8	228.6	34.29	0.001
240		7315.2	243.84	36.576	0.001
275		838.2	279.4	41.91	0.000
300		914.4	304.8	45.72	0.000
325		990.6	330.2	49.53	0.000
350		1066.8	355.6	53.34	0.000
375		1143	381	57.15	0.000
400		1219.2	406.4	60.96	0.000
425		1295.4	431.8	64.77	0.000
435		1325.8	441.96	66.294	0.000
475		1447.8	482.6	72.39	0.000
500	Point of Compliance	1524	508	78.2	0.000
525		1600.2	533.4	80.01	0.000



\*From 35 IAC Part 742, Appendix C

\*\*S<sub>w</sub>, CS<sub>source</sub> and W based on contour of 0.5 \* maximum concentration.

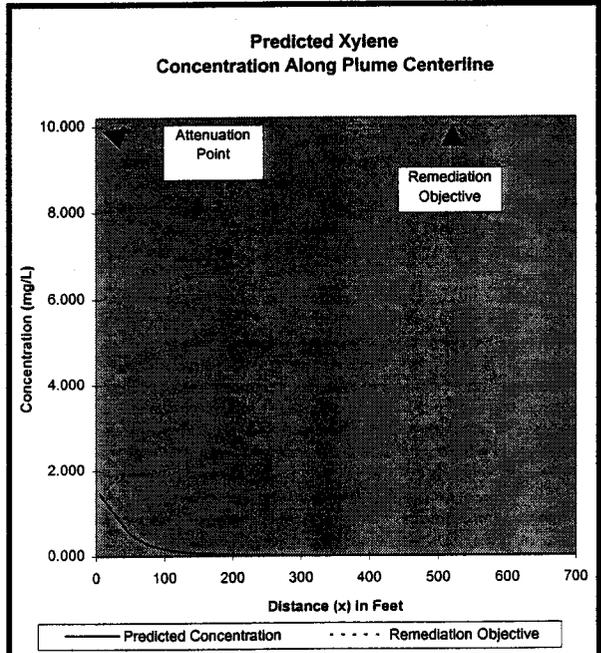
**Remedial Investigation Activities  
U.S. Navy, Great Lakes Training Base, FFTU Site  
Great Lakes, Illinois**

**SOIL LEACHING TO GROUNDWATER MODEL  
for Xylene with TACO Defaults**

<b>CS<sub>source</sub></b>	Class I Groundwater Remediation Objective (mg/L)	10.00	*for Xylene
	Soil Source Concentration (mg/kg)**	150	
<b>θ<sub>ws</sub></b>	Volumetric Water Content in Vadose Zone		
	Soils (cm <sup>3</sup> water/cm <sup>3</sup> soil)	0.15	*Surface Soil (top 1 meter) = 0.15, Subsurface Soil (below 1 meter) = 0.30
<b>θ<sub>as</sub></b>	Volumetric Air Content in Vadose Zone		
	Soils (cm <sup>3</sup> air/cm <sup>3</sup> soil)	0.28	*Surface Soil (top 1 meter) = 0.28, Subsurface Soil (below 1 meter) = 0.13
<b>I</b>	Infiltration Rate (cm/yr)	30	
<b>ρ<sub>s</sub></b>	Soil Bulk Density (g/cm <sup>3</sup> )	1.5	
<b>U<sub>gw</sub></b>	Groundwater Darcy Velocity (cm/yr)	2920	$U_{gw} = K \cdot i$
<b>f<sub>oc</sub></b>	Organic Carbon Content of Soil (g/g)	0.008	*Surface Soil = 0.008, Subsurface Soil = 0.002, or Site-Specific
<b>K<sub>oc</sub></b>	Organic Carbon Partition Coefficient (L/kg)	260	*for Xylene
<b>k<sub>s</sub></b>	Soil Water Sorption Coefficient	1.560	$k_s = K_{oc} \cdot f_{oc}$
<b>δ<sub>gw</sub></b>	Groundwater Mixing Zone Thickness (cm)	200	
<b>H'</b>	Henry's Law Constant (cm <sup>3</sup> water/cm <sup>3</sup> air)	0.25	*for Xylene
<b>W</b>	Width of Source Area Parallel to Direction of Groundwater Movement (cm)**	457	Field Measurement
<b>LF<sub>sw</sub></b>	Leaching Factor (mg/Lwater)/(mg/kgsoil)	0.010	$LF_{sw} = \frac{\rho_s \cdot \frac{cm^3 \cdot kg}{L \cdot g}}{\left[ \theta_{ws} + (k_s \cdot \rho_s) + (H' \cdot \theta_{as}) \right] \cdot \left[ 1 + \frac{(U_{gw} \cdot \delta_{gw})}{(I \cdot W)} \right]}$
<b>K</b>	Hydraulic Conductivity (cm/d)	800	} Field Measurement
<b>i</b>	Gradient	0.01	
<b>θ<sub>r</sub></b>	porosity	0.33	
<b>S<sub>w</sub></b>	Source Width (cm)**	457.2	
<b>S<sub>d</sub></b>	Source Depth (cm)	244	
<b>λ</b>	Degradation Constant (1/d)	0.0019	*for Xylene
<b>U</b>	Specific Discharge (cm/d)	24.24	$U = \frac{K \cdot i}{\theta_r}$
<b>C<sub>source</sub></b>	Calculated Groundwater Source Concentration (mg/L)	1.471	$C_{source} = CS_{source} \cdot LF_{sw}$
<b>RO<sub>soil</sub></b>	Calculated Soil Remediation Objective (mg/kg)	1019.725	$RO_{soil} = \frac{GW_{source}}{LF_{sw}}$ (to meet Tier 1 objective)

$C(x) = C_{source} \cdot \exp \left[ \left( \frac{X}{2\alpha_x} \right) \cdot \left( 1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}} \right) \right] \cdot \operatorname{erf} \left[ \frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot X}} \right] \cdot \operatorname{erf} \left[ \frac{S_d}{2 \cdot \sqrt{\alpha_z \cdot X}} \right]$  (Domenico, 1985; ASTM, 1995)

Distance Along Centerline X (ft)	Distance Along Centerline X (cm)	Longitudinal Dispersivity $\alpha_x = 0.10 \cdot X$ (cm)	Transverse Dispersivity $\alpha_y = \frac{\alpha_x}{3}$ (cm)	Vertical Dispersivity $\alpha_z = \frac{\alpha_x}{20}$ (cm)	Concentration C(x) (mg/L)
5	Attenuation Point	15.24	5.08	0.762	1.454
50		152.4	50.8	7.62	0.511
75		228.6	76.2	11.43	0.285
100		304.8	101.6	15.24	0.153
125		381	127	19.05	0.097
150		457.2	152.4	22.86	0.065
175		533.4	177.8	26.67	0.046
200		609.6	203.2	30.48	0.033
225		685.8	228.6	34.29	0.025
240		7315.2	243.84	36.576	0.021
275		838.2	279.4	41.91	0.015
300		914.4	304.8	45.72	0.012
325		990.6	330.2	49.53	0.010
350		1066.8	355.6	53.34	0.008
375		1143	381	57.15	0.007
400		1219.2	406.4	60.96	0.006
425		1295.4	431.8	64.77	0.005
435		13258.8	441.96	66.294	0.004
475		1447.8	482.6	72.39	0.003
500	Point of Compliance	1524	508	76.2	0.003
525		1600.2	533.4	80.01	0.003



\*From 35 IAC Part 742, Appendix C

\*\*S<sub>w</sub>, CS<sub>source</sub> and W based on contour of 0.5 \* maximum concentration.

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