

**REVISED ADDITIONAL ASSESSMENT AND
CORRECTIVE ACTION PLAN**

FOR

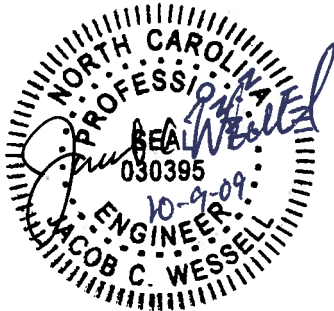
TC-341 PIPELINE

**MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

**NCDENR INCIDENT NO.: 32505
RISK CLASSIFICATION: INTERMEDIATE
LAND USE CLASSIFICATION: INDUSTRIAL/COMMERCIAL**

October 9, 2009

**CONTRACT NO.: N62470-05-D-6200
DELIVERY ORDER NO.: 0036
CATLIN PROJECT NO.: 206-111**



PREPARED BY:

**CATLIN ENGINEERS AND SCIENTISTS
P. O. BOX 10279
WILMINGTON, NORTH CAROLINA 28404-0279
(910) 452-5861**

NORTH CAROLINA CORPORATE ENGINEERING LICENSE NO. C-0585

TITLE PAGE

SITE IDENTIFICATION

Date of Report: October 9, 2009
Facility ID: N/A UST Incident Number (if known): 32505
Site Risk: Intermediate Site Rank: _____ Land Use Category: Industrial/Commercial
Site Name: TC-341 Pipeline
Site Location: Marine Corps Base, Camp Lejeune
City/Town: Jacksonville County: Onslow
Geographical Data Point: Approximate Release Point Location Method: GPS
Longitude: 77° 77' 06.55" W Latitude: 34° 44' 20.10" N

INFORMATION ABOUT CONTACTS ASSOCIATED WITH LEAKING UST SYSTEM

UST Owner: Commanding Officer Attn: Director I&E/EMD/EQB
Address: PSC Box 2004, MCB, Camp Lejeune, NC Phone: 910-451-5068
UST Operator: Same as above
Address: Same as above Phone: Same as above
Property Owner: Same as above
Address: Same as above Phone: Same as above
Property Occupant: None
Address: None Phone: Same as above
Consultant: CATLIN Engineers and Scientists
Address: 220 Old Dairy Road Phone: (910) 452-5861
Wilmington, North Carolina 28405
Analytical Lab.: SGS Environmental Services, Inc. State Cert. No.: _____
Address: 5500 Business Drive Phone: (910) 350-1903
Wilmington, North Carolina 28405

INFORMATION ABOUT RELEASE

Date Discovered: Unknown Estimated Quantity of Release: Unknown
Cause of Release: Unknown
Source of Release (Dispenser/Piping/UST): Suspected release from underground transfer pipeline associated with former Camp Geiger Fuel Farm.
Sizes and contents of UST system(s) from which the release occurred: 6-inch diameter fuel transfer line (TC-341 Pipeline). Contents reported to be Number 6 Fuel Oil and kerosene.

I, Jacob C. Wessell, P.E. a Professional Engineer Licensed Geologist (circle one) for CATLIN Engineers and Scientists, do certify that the information contained in this report is correct and accurate to the best of my knowledge.



(Please Affix Seal and Signature)

CATLIN Engineers and Scientists is licensed to practice geology/engineering (circle one or both) in North Carolina. Our company's certification number is C-0585.

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**REVISED ADDITIONAL ASSESSMENT
AND CORRECTIVE ACTION PLAN**

FOR

TC-341 PIPELINE

**MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

October 9, 2009

EXECUTIVE SUMMARY

This Revised Additional Assessment and Corrective Action Plan (CAP) report was prepared for the TC-341 Pipeline project site, formerly known as Site G-480, located at Camp Geiger which is part of the Marine Corps Base (MCB), Camp Lejeune military complex. The project site is located north of Building G-480, a classroom facility for Advanced Infantry Training Battalion (AITB), located within Camp Geiger between "E" and "F" Streets. Free-phase product has been historically identified in monitoring well IR35-MW67A dating back to 1998 and during groundwater gauging and sampling activities conducted in the area. CATLIN Engineers and Scientists (CATLIN) prepared a Comprehensive Site Assessment (CSA) dated August 19, 2008 that showed the site surficial aquifer impacted with dissolved and free-phase petroleum constituents.

As part of this investigation, two additional groundwater monitoring wells (one Type II and one intermediate Type III) were installed in June 2009 as requested by North Carolina Department of Environment and Natural Resources (NCDENR) personnel in an effort to further refine delineation of the free-phase product plume and the dissolved contaminant plume. A review of data compiled during this investigation indicates that the dissolved contaminant plume has been delineated horizontally and vertically to a depth of less than 30 feet BLS.

Due to the presence of free-phase product at the subject site, an Intermediate Risk Classification has been assumed for the site. The primary CAP goal is to contain and recover free-phase product at the site.

Recommendations are to install two groundwater and free-phase product recovery trenches parallel to F Street, one along the east side and one along the west side. Based on the depth to groundwater and subgrade stormwater features, each recovery trench will be excavated to a depth of approximately nine feet below grade or greater in order to create a hydraulic gradient sufficient to recover free-phase product and protect stormwater drainage features in the vicinity from petrochemical impact. Groundwater and free-phase product will be pumped from recovery sumps installed within the recovery trenches and the recovered fluid delivered to an on-site treatment system.

A Pump-and-Treat (P&T) remediation system is recommended for treatment of contaminated groundwater and free-phase product recovered from the trenches. The P&T system will consist of an oil/water separator, product storage tank, surge tank, tower

air stripper, sump tank, bag filters, carbon absorption drums, and associated piping and pumps. The treated water is to be discharged to a nearby storm drainage system with an approved National Pollutant Discharge Elimination System (NPDES) General Permit for groundwater remediation systems.

In order to enhance the recovery of free-phase product, a series of subsurface surfactant injection/flushing events, performed on a quarterly frequency, is recommended during operation of the P&T system. The application of a surfactant solution within strategically placed injection wells should enhance the mobilization of residual free-phase product that has become trapped in the soil pore spaces by breaking the bonds of interfacial tension and adsorption in the capillary fringe or “smear zone” soils. The P&T system will include the addition of a holding tank between the extraction pumps and the oil/water separator that should enhance separation of the surfactant/free-phase product emulsion from the groundwater prior to sending recovered fluids through the system. In addition, to prevent potential surfactant foaming issues within the air stripper, a de-foaming solution would be injected between the oil/water separator and the air stripper

The overall corrective action strategy is to perform the remediation activities in a staged approach, beginning with three months of continuous operation of the P&T system. The next stage would incorporate the surfactant injection/flushing technology in conjunction with P&T technology. The initial surfactant injection/flushing event would be followed by three months of continuous operation of the P&T system. CATLIN will then evaluate the free-phase product removal efficiency of each stage to determine the need for additional surfactant injection/flushing events.

Once free-phase product has been removed to less than 0.01 feet at the site monitoring wells, recommendations are to obtain groundwater samples from the formerly free-phase product impacted wells to assess post free-phase product surficial groundwater quality. An evaluation of the site surficial groundwater quality, at that time, will determine if site conditions warrant further remediation.

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**MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

October 9, 2009

1.0 INTRODUCTION

1.1 AUTHORIZATION

CATLIN was authorized to prepare this Revised Additional Assessment and Corrective Action Plan (CAP) by the Naval Facilities Engineering Command Mid-Atlantic (NAVFAC Mid-Atlantic) and Marine Corps Base (MCB), Camp Lejeune in accordance with Order for Supplies and Services Contract No. N62470-05-D-6200, Delivery Order Number 0036 dated April 9, 2007.

This CAP was authorized based on the findings and recommendations of a CSA by CATLIN, dated August 19, 2008 and in response to a Notice of Regulatory Requirements (NORR) dated September 25, 2008 issued by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management (DWM), Underground Storage Tank (UST) Section. A copy of the NORR is included in Appendix A.

1.2 PURPOSE OF CORRECTIVE ACTION PLAN

This CAP evaluates various remedial approaches to address the presence of free-phase product accumulation at the TC-341 Pipeline project site aboard MCB, Camp Lejeune, North Carolina. This CAP provides conceptual plans for corrective actions in general accordance with Title 15A North Carolina Administrative Code (NCAC) Subchapter 2L Section .0106, and the document entitled "Guidelines for Assessment and Corrective Action for UST Releases" as released by the NCDENR DWM, UST Section, effective July 15, 2008 (2008 Guidelines).

2.0 SITE HISTORY AND CHARACTERIZATION

The site information discussed within is based on a site reconnaissance and site specific data presented within the Comprehensive Site Assessment (CSA). Site TC-341 Pipeline is located to the immediate north of Building G-480 within Camp Geiger between "E" and "F" Streets. Site TC-341 Pipeline is situated within the project limits of Operable Unit 10 (OU10) also known as Installation Restoration

Site 35 (IR35), the site of the former Camp Geiger Fuel Farm (CGFF). Camp Geiger is located at the northwest corner of MCB, Camp Lejeune, North Carolina. Please refer to Figure 1 and Figure 4 for general location and site plan, respectively. Pertinent data is summarized in the following sections.

2.1 SOURCE INFORMATION

The source of petroleum impact at the project site is believed to be a 6-inch diameter pipeline that was previously used to transfer No. 6 fuel oil and kerosene from the CGFF to UST TC-341 at the former Marine Corps Mess Hall Heating Plant located west of the project site.

The CGFF originally consisted of five 10,000 to 15,000-gallon above ground storage tanks (ASTs) used to store No. 6 fuel oil. The ASTs were later converted to store unleaded gasoline, diesel fuel, No. 6 fuel oil, and kerosene and the 6-inch diameter pipeline was replaced with a 3-inch diameter pipeline. The date of conversion is unknown. The CGFF additionally contained infrastructure such as pumping stations, loading/unloading pads, and underground distribution lines necessary to receive and deliver petroleum products. USTs TC-341 and G-480-1 were formerly included in the storage and distribution network associated with CGFF. The CGFF fuel farm has been abandoned and demolished. Pipeline and storage tank information is presented on Table 1.

Based on a review of historical as-built and demolition details pertaining to the CGFF detailed in email correspondences with MCB, Camp Lejeune and NCDENR personnel in September 2008, underground transfer piping, associated USTs, the underground portion of the CGFF, and associated piping accounted for 10.04% of the total volume of the system. A "UST System", as defined in the 2008 Guidelines, is "any one or combination of tanks, including underground pipes connected thereto, that is used to contain an accumulation of regulated substances, and the volume of which (including the volume of underground pipes connected thereto) is 10 percent or more beneath the surface of the ground". Therefore, the regulatory framework for the TC-341 Pipeline project site may be based on the Risk Based Corrective Actions.

2.2 OWNERS AND OPERATORS

The TC-341 Pipeline site is owned and operated by the Commanding Officer of MCB, Camp Lejeune. Building G-480 is currently used as an Explosive Ordnance and Disposal Armory and Office Supply. Previous uses of Building G-480 are not known. According to Baker Environmental, Inc. (1994), construction of Camp Geiger was completed in 1945. Refer to Table 2 for site owner/operator information.

2.3 RELEASE DESCRIPTION

Free-phase product has been historically identified in monitoring well IR35-MW67A dating back to 1998 and during groundwater gauging and sampling activities conducted in the area. Monitoring well IR35-MW67A is located adjacent to the TC-341 pipeline which is assumed to be the source of the free-phase product. As part of a 2003 "Hot Spot" Characterization conducted by Baker Environmental, Inc. (Baker), a synthetic distillation analysis was conducted on a sample of free-product collected from IR35-MW67A. Results of the analysis indicated that the carbon number range of C8 to C17 corresponded to that of kerosene.

Additional releases in the area as provided in the 2004 CH2M HILL Engineering Evaluation/Cost Assessment for LNAPL Removal at OU10 IR35 are summarized on Table 3 and include the following:

- Gasoline leak from underground fuel line between AST and dispenser at CGFF.
- Release of "several thousand gallons" from an underground distribution line at CGFF between 1957 and 1958.
- Unauthorized discharge from a tanker truck resulting in unknown volume of diesel or jet fuel along an unnamed drainage channel north of CGFF.
- Potential impact noted during closure of UST G-480 located immediately north of Building G-480.
- Additional undocumented fuel and chlorinated solvent releases are suspected in the area of the CGFF.

2.4 SITE CHARACTERISTICS

The following information was obtained from reconnaissance of the site and surrounding area in addition to review of previous documents.

2.4.1 Land Use

As previously discussed, TC-341 Pipeline is located adjacent to Building G-480. Building G-480 is located within Camp Geiger between "E" and "F" Streets. Camp Geiger, a satellite facility to MCB, Camp Lejeune, is home to the School of Infantry. The building is situated within the project limits of OU10 IR35, the site of the former CGFF. The area located to the immediate east and northeast of the subject site is composed of the United States Highway 17 Bypass (US 17 Bypass), North Carolina Department of Transportation (NCDOT) right-of-way, and undeveloped lowland. The site vicinity is presented on Figure 1.

2.4.2 Site Topography

The project site is generally flat at an elevation of approximately 15 feet above mean sea level (MSL) and covered by asphalt parking and grass. The topography slopes downward in the wooded area to the immediate east of Building G-480 towards manmade drainage ditches. A substantial elevation rise, of approximately 17 feet exists further to the east of the site in the fill areas associated with the US 17 Bypass.

2.4.3 Surface Water

According to the Camp Lejeune, USGS Topographic Quadrangle, the nearest named surface water body is Brinson Creek approximately 600 feet northeast of the subject site. Based on a review of the NCDENR Division of Water Quality (DWQ) Surface Water Classification, Brinson Creek is designated as tidal salt water (SC) with a supplemental classification as a Nutrient Sensitive Water (NSW). A manmade drainage ditch is located east of Building G-480. During site reconnaissance the ditch was observed with standing water. The drainage ditch flows to the northeast through a 48-inch diameter drainage pipe under the US Highway 17 Bypass and discharges into wetlands located to the northeast of the US Highway 17 Bypass. There is also drainage piping running north of the site that eventually discharges into the catch basin at the corner of Third and F Streets. Discharge from this basin flows through piping to the catch basin in the middle of the US Highway 17 Bypass. The surface water bodies are shown on Figures 1, 2, and 4.

2.4.4 Water Supply

As Illustrated on Figure 1 and listed on Table 4, no potable water supply wells are located within 1,500 feet of the subject site. The nearest water supply well, TC-600, is located approximately 2,150 feet southwest of the release. This well is no longer in use and has reportedly been properly abandoned. The nearest active potable well is well TC-1253 located approximately 4,800 feet south southwest of the site.

Public water is provided to buildings within 1,500 feet of the subject site by water mains which carry treated potable water. Potable water is supplied to the site and surrounding areas by the MCB water supply system. Typically, groundwater obtained from the Castle Hayne aquifer is the raw water source for the treatment facilities.

Active NCDENR Test Wells, ON-354 and ON-355, are located approximately 1,600 feet west-southwest of the subject site. These wells are not used to obtain potable water.

2.5 ADJACENT PROPERTY OWNERS AND OCCUPANTS

As previously discussed, the project site is located within the boundaries of Camp Geiger aboard MCB, Camp Lejeune. The property located to the north, south, and west of the subject site has historically and continues to be occupied and owned by MCB, Camp Lejeune. US Highway 17 Bypass is located east of the release area. The US Highway 17 Bypass right-of-way is controlled and maintained by the NCDOT. Land located east of the bypass is predominantly thickly wooded wetland associated with the floodplain of Brinson Creek.

2.6 POTENTIAL RECEPTORS AT RISK

CATLIN conducted a receptor survey as part of the CSA and identified a manmade drainage ditch located east of the suspected release area as well as a subsurface stormwater system located north and east of the source area. During site reconnaissance the ditch was observed with standing water. The stormwater piping and the drainage ditch flows to the northeast through a 48-inch diameter drainage pipe and a 24-inch diameter drainage pipe under the US Highway 17 Bypass discharging into wetlands located to the northeast of the Bypass. Brinson Creek is located across US Highway 17 Bypass approximately 600 feet to the east northeast. Potential receptors are further detailed in Section 4.0.

2.7 PREVIOUS REPORTS

With the exception of the CSA and CAP completed by CATLIN, no additional reports have been completed specifically addressing the CGFF Pipeline. However, numerous investigations associated with the former CGFF, IR35/OU10, and Building TC-341 have been completed in the vicinity. These reports are on file at the NCDENR Wilmington Regional Office and MCB, Camp Lejeune.

2.8 INITIAL ABATEMENT AND CORRECTIVE ACTIONS

Free-phase product gauging and recovery has been conducted at the project site on a bi-weekly basis by OSAGE. When measurable thicknesses of free-phase product are identified, a peristaltic pump is used to recover product. Approximately 150 gallons of free-phase product have been recovered (as of July 2009) since recovery efforts were initiated in February 2008. Additionally, sorbent booms have been placed in a catch basin located immediately adjacent to monitoring well USTG480-MW24 and at the stormwater outflow drainage ditch located across US Highway

17 Bypass and are monitored and replace or repaired as necessary. Table 8 contains free-phase product recovery information.

3.0 COMPREHENSIVE SITE ASSESSMENT

The following information was obtained from data presented in the CSA dated August 19, 2008. As recommended in the CSA, additional field activities were completed by CATLIN as part of this investigation and are also presented herein.

3.1 SCOPE OF WORK

The CSA investigation was conducted in multiple phases starting with a monitoring well inventory in which CATLIN personnel conducted field reconnaissance to locate existing monitoring wells in the vicinity of the project site. Data pertaining to monitoring well identification, location, diameter, condition, etc. was recorded in the field then compared to data in the Camp Lejeune Geographical Information System (GIS) to allow for preparation of an updated site map. Subsequent to the monitoring well inventory, four existing monitoring wells were gauged to determine depth to groundwater and free-phase product thickness, where present. Free-phase product was identified during the preliminary groundwater gauging activities in monitoring well IR35-MW67A. A receptor survey was conducted in order to obtain information necessary for the NCDENR to assign a land-use classification and to classify risk level of the release. Information generated during the monitoring well inventory, gauging event, and receptor survey was utilized to assist with the proper placement of additional monitoring wells.

Five Type II monitoring wells were installed encircling existing monitoring well IR35-MW67A during the initial phase of drilling conducted by CATLIN personnel in May 2007. Based on the results of the gauging conducted on the initial groundwater monitoring wells, twelve additional Type II monitoring wells and one Type III monitoring well were installed at the project site and within the US Highway Bypass Right-of-Way by CATLIN personnel. As recommended in the CSA, four additional groundwater monitoring wells were installed, gauged, and sampled as part of this CAP to the north and east of the estimated dissolved contaminant plume in order to delineate the horizontal extent of contamination. Two additional groundwater monitoring wells (one Type II and one intermediate Type III) were installed in June 2009 as requested by NCDENR personnel in an effort to further refine the free-phase product plume as well as provide vertical delineation of the dissolved contaminant plume. Surface water samples were additionally collected during the additional assessment activities. Locations of groundwater monitoring wells and surface water sample locations are presented on Figure 4.

One soil sample for laboratory analysis was collected during installation of each monitoring well installed during the initial phases of drilling of the

CSA investigation. No soil samples were submitted for laboratory analysis from monitoring wells installed within the US Highway 17 Bypass median or from wells installed as part of this CAP (wells USTG480-MW16 through USTG480-MW25). All work was conducted in accordance with the CATLIN Standard Methods of Investigation included in Appendix B.

3.2 REGIONAL GEOLOGY

The project site lies within the southeastern portion of the Outer Coastal Plain physiographic province of North Carolina. In Onslow County, the pre-Mesozoic crystalline basement rock, onto which the Coastal Plain was deposited, lies approximately 1,500 feet below mean sea level (MSL). The dominant structural features within the surrounding area of the subject site are the Cape Fear arch, a seaward (southeasterly) plunging anticline and the Albemarle Embayment. The axis of the Cape Fear arch is located roughly 100 miles southwest of the subject site.

As detailed in the Wellhead Management Program report (Geophex, 1991), geologic units identified beneath the nearby MCB, Camp Lejeune include the Cretaceous Peedee Formation that is composed of sands, clayey sands, and clay. The Peedee Formation does not outcrop anywhere on base and has only been identified from drill-hole data. The Upper Eocene Castle Hayne Formation lies unconformably on the Peedee Formation. The Castle Hayne Formation consists of widespread limestone units that are intermixed with substantial beds of calcareous sands and silty sands. Overlying the Castle Hayne Formation is moldic limestone of the upper Oligocene River Bend Formation. The uppermost limestone unit in much of the nearby area is the lower Miocene Belgrade Formation. The Belgrade rests unconformably on the River Bend or directly on the Castle Hayne Formation where the River Bend is absent. Undifferentiated surficial sediments throughout most of the surrounding area typically overlie the Belgrade.

3.3 REGIONAL HYDROGEOLOGY

Aquifers underlying MCB, Camp Lejeune includes the surficial, Castle Hayne, Beaufort, and Peedee. These aquifers are typically separated by confining units of less permeable materials consisting of beds or groups of clay and silt containing varying amounts of sand (Winner and Coble, 1989). Recharge to Coastal Plain aquifers occurs predominantly through direct surface recharge by rainfall in interstream areas (Cardinell, et al, 1993). The Castle Hayne aquifer is the primary source of potable water aboard MCB, Camp Lejeune.

3.4 SITE GEOLOGY

Representative soil samples were collected from each boring advanced during this investigation to facilitate the installation of groundwater

monitoring wells. Soil samples were classified in accordance with the Unified Soils Classification System (USCS) and a boring log of each boring was produced. Boring logs are included in Appendix C.

Two geologic cross sections were generated based on the information obtained from monitoring well installation during this investigation. Figure 5 illustrates the plan view of the cross section layouts, and Figures 5A and 5B depict cross sections A-A' and B-B', respectively.

As depicted on the cross sections and within the boring logs, the site is underlain by interbedded sand, silty sand, and clayey sand to a depth of approximately 20 feet. The surficial material is underlain by limestone with varying degrees of weathering.

3.5 SITE HYDROGEOLOGY

Classification

The groundwater aquifer is classified as GA groundwater according to NCAC Title 2L Subchapter 15A, Section .0201 Groundwater Classification.

Depth to Groundwater and Groundwater Elevation

A groundwater gauging event was conducted on May 20, 2008 by CATLIN personnel. Groundwater elevations in the Type II monitoring wells across the site ranged from 4.26 (USTG480-MW16) to 10.24 (USTTC341-MW17) feet MSL. Depth to water measurements ranged from 7.80 ft. BLS (USTG480-MW11) to 4.99 ft. BLS (USTTC341-MW17). Monitoring well gauging data is included in Table 5. Figure 7 illustrates the water table elevation contours as of May 20, 2008.

Direction of Flow

As depicted on Figure 7 the generalized groundwater flow trend in the shallow aquifer is towards the east to northeast across the subject site. Hydraulic head differences between shallow and deep monitoring wells indicated the potential for both "upward" and "downward" movement of groundwater flow within the surficial aquifer.

Aquifer Characteristics

Based on the in-situ hydraulic conductivity tests performed on Type II monitoring well USTG480-MW09 on June 6, 2008, CATLIN estimated the hydraulic parameters for the surficial aquifer. The following summarizes these estimations:

Hydraulic Conductivity (K) = 1.06 feet/day
Effective Porosity = 0.437

Hydraulic Gradient = 0.011 feet/feet
Groundwater Flow Velocity = 0.0268 feet/day

3.6 SOIL SAMPLING RESULTS

During the installation of wells USTG480-MW01 through USTG480-MW17, soil samples were submitted to SGS Environmental Services, Inc. (SGS) of Wilmington, North Carolina for laboratory analysis for volatile organics + IPE + MTBE per EPA Method 8260 with 5030 preparation and base/neutrals/extractables per EPA Method 8270. Boring logs summarizing field data from the monitoring well boring advancement conducted during this investigation are included in Appendix C.

Due to the presence of free-phase product, the site Risk Classification has been assumed to be Intermediate. Therefore, the lowest MSCC for each of the identified petroleum constituents has been used to establish regulatory compliance. The estimated areal extent of all soil results in excess of applicable NCDENR MSCCs is presented on Figure 6. Laboratory analytical reports for the selected soil samples are included in Appendix E and are summarized as follows:

EPA METHOD 8260

The following compounds were identified at concentrations above the lowest NCDENR MSCCs: Benzene, n-Butylbenzene, sec-Butylbenzene, 2-Butanone, Chloromethane, Ethylbenzene, Isopropylbenzene, Methylene Chloride, Naphthalene, n-Propylbenzene, 1,2,3-Trichlorobbenzene, 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, and Total Xylenes. All other EPA Method 8260 compounds detected were below the established NCDENR STGW MSCCs and/or reported as below the method detection level (BMDL). The soil samples identified with concentrations greater than the lowest MSCCs were primarily located across the north to northeastern portion of the project site. Laboratory results are summarized on Table 6. The estimated extent of EPA Method 8260 constituents above the lowest MSCCs in addition to summarized laboratory data are presented on Figure 6 included in Appendix D.

EPA METHOD 8270

The following compounds, Dibenzofuran, 2-Methylnaphthalene, and Naphthalene were detected in soil samples at concentrations that exceeded the lowest NCDENR MSCCs. All other EPA Method 8270 compounds detected were below the established NCDENR MSCCs and/or reported as BMDL. The soil samples identified with concentrations greater than the lowest MSCCs were consistent with those identified with EPA Method 8260 constituents above the lowest MSCCs. Laboratory results are summarized on Table 6A. The estimated extent of EPA Method 8270 constituents above the lowest MSCC in addition to

summarized laboratory data are presented on Figure 6A included in Appendix D.

MADEP EPH/VPH

As indicated in Tables 6B and 6C and illustrated on Figure 6B included in Appendix D, concentrations of Massachusetts Department of Environmental Protection (MADEP) Extractable Petroleum Hydrocarbons/Volatile Petroleum Hydrocarbons (EPH/VPH) constituents were identified in ten of the 15 soils samples above the current lowest NCDENR MSCCs for the C9-C22 Aromatics. Five of the samples were additionally identified with concentrations of the C9-C18 Aliphatics in excess of the lowest MSCCs. It should be noted that, although soil sample USTG480-MW08 (3-5) was not confirmed to contain detectable levels of C9-C22 Aromatics, the Method Detection Limit (MDL) of 110 mg/kg is above the lowest MSCC (STGW) of 34 mg/kg. Only the soil sample collected from USTG480-MW06 from a depth of four to six feet BLS contained concentrations of C5-C8 Aliphatics (75 mg/kg) above the lowest MSCC of 72 mg/kg. No C19-C36 Aliphatics were identified above the lowest MSCCs. Soil samples with MADEP EPH/VPH concentrations identified above the lowest MSCCs were consistent with those identified with EPA Method 8260 and 8270 constituents above the lowest MSCCs.

3.7 GROUNDWATER SAMPLING RESULTS

Groundwater samples were collected from newly installed and existing groundwater monitoring wells on July 16, 2007, May 8, 2008, November 18, 2008, and June 15, 2009. Groundwater samples were collected from 23 monitoring wells that did not contain measurable free-phase product at the time of gauging. After collection, the groundwater samples were placed in laboratory glassware, labeled, placed immediately on ice in a cooler, and transported under proper Chain-of-Custody protocol to SGS Environmental Services Inc. (SGS) of Wilmington, North Carolina and analyzed per EPA Methods 602 and 625 plus Tentatively Identified Compounds (TICs). All additional monitoring wells, except USTG480-MW24 and USTG480-MW25, were also analyzed per MADEP EPH/VPH. It should be noted that free-phase product was identified during subsequent gauging events in four of the groundwater monitoring wells (USTG480-MW01, USTG480-MW04, USTG480-MW10, and USTG480-MW13) from which samples were obtained. Analytical reports for the groundwater samples analyzed are included in Appendix E and are summarized as follows:

EPA METHOD 602

Concentrations of Benzene were detected in groundwater samples collected from ten Type II monitoring wells and one Type III well above the 2L GWQS of 1 µg/L at concentrations ranging from 2.28 µg/L (USTG480-MW14) to 173

µg/L (USTG480-MW10). Total Xylenes concentrations of 702 µg/L were identified in the groundwater sample collected from USTG480-MW10. The current 2L GWQS for total Xylenes is 530 µg/L. All other EPA 602 compounds were below the 2L GWQS and/or reported as BMDL. Laboratory results are summarized on Table 7 and illustrated on Figure 8.

EPA METHOD 625 Plus TICs

As indicated in Table 7A and illustrated on Figure 8A, EPA Method 625 constituents were detected in ten groundwater samples at concentrations above current 2L GWQS. Naphthalene was reported in nine groundwater samples at concentrations above the current 2L GWQS of 21 µg/L ranging from 259 µg/L (USTG480-MW23) to 1,280 µg/L (USTG480-MW10). Bis(2-ethylhexyl) phthalate was identified in groundwater samples collected from two Type II monitoring wells, USTG480-MW18 and USTTC341-MW14, above the 2L GWQS of 2.5 µg/L at estimated concentrations 2.85 µg/L and 31.0 µg/L, respectively. Phenanthrene was identified at concentrations above the 2L GWQS of 210 µg/L in groundwater samples collected from USTG480-MW05, USTG480-MW10, and USTTC341-MW14 at concentrations of 262 µg/L, 408 µg/L, and 328 µg/L, respectively. All other EPA Method 625 target compounds were below the applicable 2L GWQS or reported as BMDL.

MADEP EPH/VPH

Groundwater samples collected from ten of the 21 monitoring wells contained one or more MADEP EPH and/or VPH constituents above current 2L GWQS. The C9-C18 Aliphatics (2L GWQS = 4,200 µg/L) were identified in eight samples at concentrations above the 2L GWQS ranging from 5,180 µg/L (USTG480-MW17) to 142,320 µg/L (USTG480-MW04). The C19-C36 Aliphatics (2L GWQS = 42,000 µg/L) were not identified at concentrations in excess of the 2L GWQS in any of the submitted groundwater samples. The C9-C22 Aromatics (2L GWQS = 210 µg/L) were identified in ten samples at concentrations above the 2L GWQS ranging from 444 µg/L (USTG480-MW18) to 85,820 µg/L (USTG480-MW04). The C5-C8 Aliphatics were identified at concentrations above the 2L GWQS of 420 µg/L in samples USTG480-MW05 (466 µg/L) and USTG480-MW13 (727 µg/L). All other MADEP Aliphatic and Aromatic hydrocarbon fractions were below the 2L GWQS or reported as BMDL. Analytical results are summarized on Table 7B and compared to the 2L GWQS on Table 7C and on Figure 8B.

EPA METHOD 601

A groundwater sample collected from monitoring well IR35-MW14S on November 18, 2008 was analyzed per EPA Method 601. The well had been identified within the estimated extent of groundwater impacted with

chlorinated solvents during previous investigations. As presented in the laboratory results summarized on Table 7D, cis-1,2-Dichloroethene (359 µg/L), Trichloroethene (37.5 µg/L), and Vinyl Chloride (2.06 µg/L) were identified at concentrations above the current 2L GWQS of 70 µg/L, 2.8 µg/L, and 0.015 µg/L, respectively.

3.8 SURFACE WATER SAMPLING RESULTS

Two surface water samples were collected during the November 2008 sampling event; one sample (USTG480-SW01) was collected from the standing water in the drainage ditch located in the wooded area approximately 50 feet east of Building G480 and the second sample (USTG480-SW02) was collected from standing water at the drainage pipe outfall located east of US Highway 17 Bypass. Both surface water samples were analyzed per EPA Method 602 + IPE, MTBE, and Xylenes, EPA Method 625 + TICs, and MADEP VPH/EPH.

In response to the identification of free-phase product observed in a stormwater catch basin located adjacent to monitoring well USTG480-MW24 (details described below in Section 3.9), two surface water samples were again collected on June 15, 2009. One sample (TC-341 Basin) was collected from standing water within the catch basin located adjacent to USTG480-MW24 and the second sample (TC-341 Outfall) was collected from standing water at the drainage pipe outfall near previous surface water sample location USTG480-SW02. Both of these surface water samples were analyzed per EPA Method 602 + IPE, MTBE, and Xylenes and EPA Method 625 + TICs. Laboratory results are summarized and compared to applicable Standards and criteria on Tables 9, 9A, 9B, and 9C for EPA Method 602, EPA Method 625, MADEP EPH/VPH, and MADEP EPH/VPH compared to applicable standards and criteria, respectively. There were no contaminants detected in the surface water samples that were in exceedance of established 15A NCAC 2B Standards or National Criteria per EPA (Surface Water Standards).

3.9 FREE-PHASE PRODUCT CONTAMINATION

According to previous documents, in April 1990, free-phase product was discovered by Camp Geiger personnel along two unnamed drainage ditches located northeast of the TC-341 Pipeline site. The source of the release was unknown but suspected to have been an unauthorized discharge from a tanker truck. The exact location of the drainage ditches is unknown but suspected to have been within the northeast portions of the excavation limits shown on Figure 4.

Free-phase product was noted in groundwater monitoring well IR35-MW67A in 1998 and has been encountered consistently up to the present. As previously discussed, a groundwater monitoring well network was

expanded around well IR35-67A, primarily to the northeast, during this investigation. Biweekly gauging has been conducted on select monitoring wells by OSAGE from February 2008 to the present. Measurable free-phase product has been detected in 10 of the newly installed monitoring wells at thicknesses ranging from 0.02 feet to 2.87 feet. As of July 2009, approximately 150 gallons of free-phase product (measured liquid) have been recovered by OSAGE. Overall free-phase product recovery information from February 2008 through July 2009 (including averages and cumulative totals) is summarized on Table 8 and historical free-phase product gauging data are included in Appendix F. The estimated areal extent of free-phase product from a July 21, 2009 gauging and recovery event is displayed on Figure 9.

During a site visit conducted by CATLIN personnel on June 6, 2009, free-phase product was identified in a stormwater catch basin located approximately six feet southwest of monitoring well USTG480-MW24. MCB Environmental Management Division (EMD) personnel were immediately contacted and notified of the discovery, prompting the installation of free-phase product sorbent booms within the catch basin as well as within the drainage ditch located northeast of the subject site across US Highway 17 Bypass.

3.10 SUMMARY OF CORRECTIVE ACTIONS TO DATE

According to a *Contractor's Closeout Report* dated May 1997, OHM Remediation Services Corporation (currently Shaw Environmental Services) excavated approximately 15,700 tons of petroleum impacted soil from an area extending from approximately IR35-MW67A to 400 feet northeast. Excavation activities were conducted between September 1995 and May 1996. The approximate limits of the excavation are presented on Figure 4. According to the 1997 document, excavation continued both laterally and vertically until the remedial action objectives were achieved or the water table was encountered. Field screening and confirmatory sampling were conducted throughout the excavation activities to confirm that remedial action objectives were obtained.

Aggressive fluid vapor recovery (AFVR) was conducted on groundwater monitoring well IR35-MW67A by Shaw beginning in May 2003. Details of the AFVR events were unavailable at the time of this report. However, in the CH2MHILL report Engineering Evaluation/Cost Assessment LNAPL Removal - Operable Unit 10 (Site 35) dated September 2004, CH2MHILL noted that as July 21, 2004, 30 events had been completed by Shaw resulting in the recovery of 355 gallons of "petroleum product".

Subsequent to completion of the CSA by CATLIN, OSAGE commenced biweekly groundwater gauging and free-phase product recovery where applicable. Free-phase product recovery is accomplished using a peristaltic pump and disposable plastic tubing. Gauging and recovery

efforts have been conducted at the subject site from February 2008 to the present. As of July 2009, approximately 150 gallons of free-phase product (measured liquid) have been recovered by OSAGE. Summary sheets detailing each gauging and recovery event are included in Appendix F. A summary of average and cumulative free-phase product gauging and recovery efforts is included on Table 8.

During the previously discussed biweekly gauging and free-phase recovery events, OSAGE personnel observe all accessible drainage features at the site in addition to the drainage ditch located across US Highway 17 bypass and note the presence or absence of free-phase product on the water surface. As part of the activities, the sorbent booms are visually inspected for accumulation of free-phase product and physical condition.

No additional known corrective actions have been completed at the site.

4.0 RECEPTOR INFORMATION

As defined by the NCDENR in Section .0102 of NCAC T15A:02L, potential receptors include any human, plant, animal, or structure with the potential to be adversely affected by the release or migration of contaminants. Guidance documents issued by the regulatory agency indicate that structures may include items such as utility lines, basements, and elevator shafts. Although not specifically included in the rule definition (NCAC T15A:02L .0102), regulatory officials also consider potential receptors to include environmental resources such as water supply wells, surface waters, drinking water supplies, and "regions of groundwater that have been identified for planned resource development".

Performance of the potential receptors survey involved not only an evaluation of the presence of potential receptors but also an evaluation of transport mechanisms by which the contaminants are transported from the source to the receptor. Furthermore, with respect to human receptors, the survey also involved a cursory evaluation of exposure pathways including ingestion, inhalation, and adsorption. As petroleum fuel seeps through the subsurface, adsorption onto soil particles and volatilization into pore spaces occurs. The remaining petroleum fuel moves vertically downward (in the absence of preferred lateral routes of migration) until it reaches the capillary fringe (in the absence of a permeable barrier above the capillary fringe). Petroleum fuel, now in the liquid phase, spreads throughout the capillary fringe and dissolves into the groundwater.

Exposure to contaminated soils is contingent upon site disturbance through construction or remediation activities. Potential receptors can be exposed to petroleum hydrocarbons found in the soil through inhalation of volatilized compounds and dermal contact with contaminated soil.

4.1 WATER SUPPLY WELLS

As illustrated on Figure 1 and listed on Table 4, no potable water supply wells are located within 1,500 feet of the subject site. The nearest water supply well, TC-600, is located approximately 2,150 feet southwest of the release. This well is no longer in use and has reportedly been properly abandoned. The nearest active potable well is well TC-1253 located approximately 4,800 feet south southwest of the site.

4.2 PUBLIC WATER SUPPLIES

Public water is provided to buildings within 1,500 feet of the subject site by water mains which carry treated potable water. Potable water is supplied to the site and surrounding areas by the MCB water supply system. Typically, groundwater obtained from the Castle Hayne aquifer is the raw water source for the treatment facilities.

4.3 SURFACE WATER

According to the Camp Lejeune, USGS Topographic Quadrangle, the nearest named surface water body is Brinson Creek approximately 600 feet northeast of the subject site. Based on a review of the NCDENR DWQ Surface Water Classification, Brinson Creek is classified as SC water with the supplemental classification of NSW. A manmade drainage ditch is located east of the suspect release area as well as stormwater piping located north of the source area. During site reconnaissance the ditch was observed with standing water. The drainage ditch appears to flow to the northeast through a 48-inch diameter drainage pipe under the US Highway 17 Bypass and discharges into wetlands located to the northeast of the Bypass. Sorbent booms are currently in place at the discharge and monitored biweekly by OSAGE for potential free-phase product accumulation and physical condition then replaced or repaired when necessary. The surface water bodies are shown on Figures 1, 2, and 4.

4.4 WELLHEAD PROTECTION AREAS

At the MCB Camp Lejeune, wellhead protection areas defined by 42 USC 300h-7(e) have not, as of this time, been designated by the State. However, MCB Camp Lejeune has identified wellhead protection areas on the base. Based on the most recent Wellhead Protection Plan – 2002 Update, the potential source area is not located within a proposed wellhead protection area.

4.5 DEEP AQUIFERS IN THE COASTAL PLAIN PHYSIOGRAPHIC REGION

As identified in the Geologic Map of North Carolina (North Carolina Department of Natural Resources and Community Development, 1985), the subject site lies within the Coastal Plain physiographic province.

The potential source area is located just above an apparent unconfined surficial groundwater aquifer. While there is the potential for recharge by rainfall to the unconfined surficial aquifer at the Base, the surficial aquifer is not used for water supply aboard MCB, Camp Lejeune. Groundwater obtained from the Castle Hayne Aquifer is the raw water source for the MCB, Camp Lejeune potable water treatment facilities.

To determine deep aquifers underlying the subject site, the area was profiled in the "Visual Hydrogeologic Framework" database provided in the NCDENR Division of Water Resources website (VHF website). This is a database of well and soil boring log data from numerous locations across the North Carolina Coastal Plain.

Including the Surficial aquifer there are eleven identified aquifers (seven principal aquifers and four minor aquifers) within the North Carolina Coastal Plain physiographic region. Data from the USGS Test Hole T-15, advanced to the immediate south of the subject site, indicated the following:

Hydrogeologic Units	Approximate Depth (feet)
Surficial Aquifer	0-59
Castle Hayne Confining Unit	59-104
Castle Hayne Aquifer	104-302
Pee Dee Confining Unit	302+

4.6 SUBSURFACE STRUCTURES

As depicted on Figure 3, a stormwater collection and distribution system consisting of numerous catch basins and underground piping is present at the site. Field measurements of elevations at the low points of the system (catch basin floors or inverts) revealed an elevation of 5.0 feet above mean sea level (MSL) in the catch basin adjacent to monitoring well USTG480-MW24, 1.7 feet MSL in the catch basin located northeast of the site in the median of US Highway 17 Bypass, and 1.2 feet MSL at the invert of the storm drain outfall across US Highway Bypass. Additional underground utilities and utility conduits are also present at the site and displayed on Figure 3.

With the exception of the previously described features, no subsurface structures were identified at the subject site. Building G-480 is slab-on-grade construction.

5.0 OBJECTIVES OF CORRECTIVE ACTION PLAN

5.1 GENERAL DESCRIPTION

The objective of this CAP is to present a proposed remedial method to address the presence of free-phase product accumulation at the TC-341 Pipeline site.

5.2 GOALS OF CORRECTIVE ACTION PLAN

The goals of this CAP are:

- Removal and recovery of the free-phase product to meet the site rehabilitation goals. Specifically, the goal of remediation is to reduce free-phase product accumulations to less than 0.01 feet, at which point the site will be re-evaluated and may be reclassified as "Low Risk". If reclassified as a "Low Risk" site, GCLs will become the appropriate groundwater cleanup standard and Industrial/Commercial MSCCs will become the appropriate soil cleanup standard.
- Protect surface waters from free-phase product and dissolved-phase contamination associated with the release.
- Provide a schedule for the implementation and operation of the proposed corrective actions.
- Detail a monitoring plan with the capacity to evaluate the effectiveness of the proposed corrective actions at this site and to monitor the removal efficiency of the product recovery efforts.

6.0 EVALUATION OF REMEDIATION ALTERNATIVES

Numerous technologies are available that address the remediation of free-phase product from the subsurface. Specific remedial alternatives that were reviewed include the following: Excavation and Disposal, Product-only Skimmer System, Pump-and-Treat (P&T), Soil Vapor Extraction (SVE), Air Sparging, Aggressive Fluid Vapor Recovery (AFVR), Multi-Phase Extraction (MPE), Enhancement Methods utilizing Steam, Surfactants, or Phased Soil Heating. Some of these technologies have demonstrated an acceptable level of success when implemented in the field, while others appear to have been ineffective. In certain instances, implementation of any available remediation technology by itself will not suffice. Hence, a combination of treatment technologies is at times more

effective. Site specific conditions, nature and extent of contamination together with an analysis of a particular remediation technology's record of success with similar sites will allow the screening of technically feasible alternative technologies. The "best" remedial strategy is the one that can fulfill the established remediation objectives at the least cost.

Based on the site characteristics, CATLIN recommends that a combination of surfactant injection/flushing and total fluids Pump-and-Treat may be the most viable and cost-effective remediation option for this site. Each of these technologies have been performed at a number of remediation projects that involve recovery of residual free-phase product, and the combination of the two technologies has most recently been used two nearby Marine Corps sites. Results from these projects indicate that the combination of surfactant injection/flushing with total fluid recovery and treatment via P&T technology may prove to be an especially cost effective option when compared to other remediation alternatives. The enhancement of the recoverability of free-phase product via surfactant flushing should result in shorter remediation time due to faster and more efficient recovery; thus, operation and maintenance cost savings should be realized.

The use of surfactant-enhanced free-phase product recovery via P&T technology may be accomplished at the subject site through the construction of two trenches in conjunction with recovery sumps. The trenches should be installed immediately east and west of F Street to approximately two feet below the seasonal low depth to groundwater which has historically averaged approximately seven feet BLS. A recovery sump should be installed at the midpoint of each recovery trench and connected to slotted pipes that will be emplaced in the bottom of each trench. The trenches will then be backfilled with coarse gravel to approximately three feet BLS. The recovery system will be designed and constructed in a way to allow recovery of total fluids utilizing submersible pumps within the recovery sumps.

The injection of a non-ionic surfactant solution into several available wells (i.e. new injection wells in addition to several existing monitoring wells) and allowing 12 to 24 hours of contact time, followed by the injection of a moderate volume of chase water to hydraulically "push" the surfactant out into the aquifer, should enhance the recommended P&T recovery technology by effectively providing emulsification and mobilization of the residual free-phase product that is trapped within the soil pore spaces. Performing surfactant injection/flushing in conjunction with P&T should increase the recoverability of free-phase product, thus enhancing the efficiency of the P&T system.

7.0 PROPOSED REMEDIATION

It is recommended that an eight-inch diameter recovery sump well be installed at the midpoint of each recovery trench at the locations proposed on Figure 10. Each trench is recommended to be constructed parallel to F Street, one along the east side and one along the west side, for an approximate distance of 120 feet and 200 feet, respectively. The trench along the east side of F Street will

also be extended perpendicular to F Street from the southern end, parallel with the stormwater ditch, in order to provide hydraulic control in that area and, thus, prevent contamination from reaching sensitive surface waters. An additional recovery sump well will be installed at the point where this trench bends to run parallel to the stormwater ditch. Based on our recent survey of the site stormwater drainage system and the presence of free-phase product confirmed within the system, stormwater drainage piping may be hydraulically connected to the free-phase product plume. The trench parallel to the ditch will act to protect surface water from impact from the free-phase product plume, while the trench depth will provide enough drawdown to lower the groundwater and/or free-phase product to a sufficient level to protect the stormwater system from further impact.

Each recovery trench will be excavated to a depth of approximately nine feet below grade or greater in order to create a hydraulic gradient sufficient to recover free-phase product and protect stormwater drainage features in the vicinity from petrochemical impact. As a primary conduit, a four-inch diameter slotted, polyethylene pipe will be placed at the bottom of the trench. The trench will be backfilled to within three feet of the ground surface with 57 m washed granite stone (or approved equivalent). To prevent sediment infiltration within the backfilled stone, a layer of non-woven geotextile will be placed on top of the washed stone. The remainder of the trench will be backfilled to land surface with screened excavated soil and/or clean borrow material. The disturbed land surface will be seeded with vegetation cover compatible with existing site vegetation.

A P&T remediation system is recommended for treatment of contaminated groundwater and free-phase product recovered from the trenches/sumps. The P&T system will consist of an oil/water separator, product storage tank, surge tank, tower air stripper, sump tank, bag filters, carbon absorption drums, and associated piping and pumps. The treated water is to be discharged to a nearby storm drainage system with an approved NPDES General Permit for groundwater remediation systems. Submersible total-fluids pumps will be installed within each recovery sump to extract groundwater and free-phase product from the trench system. This will lower the water table within the influence of the trench system inducing free-phase product and contaminated groundwater into the trenches to be collected in the recovery sump. The combination of groundwater table drawdown and the induced hydraulic gradient should facilitate the recovery of free-phase product.

In order to enhance the recovery of free-phase product, a series of subsurface surfactant injection/flushing events, performed on a quarterly frequency, is recommended during operation of the P&T system. The application of a surfactant solution should enhance the mobilization of residual free-phase product that has become trapped within the soil pore spaces. The surfactant solution is formulated to break the interfacial tension of the free-phase product that is adsorbed to soil particles in the capillary fringe or "smear zone". Once the residual free-phase product has been mobilized by the surfactant solution, it is expected to flow more readily toward the recovery trenches, especially when a

hydraulic gradient is induced upon the trenches through groundwater table drawdown provided by the recovery pumps. The treatment process for the extracted fluids that contain surfactant is virtually no different than for fluids containing only groundwater and free-phase product. The P&T system would require slight modifications including the addition of a large holding tank between the extraction pumps and the oil/water separator to create quiescent conditions that should enhance separation of the surfactant/free-phase product emulsion from the groundwater prior to sending recovered fluids through the system. In addition, due to the potential for periodic “slugs” of surfactant that may pass through the oil/water separator, possibly causing some foaming issues within the air stripper, a de-foaming solution would be injected with a metering pump and in-line mixer between the oil/water separator and the air stripper. Significant foaming issues are not anticipated due to the distance of the injection points from the trench and the expected dilution rate of the surfactant solution once it is injected into the subsurface.

The installation of a total of ten additional injection wells is recommended for the surfactant injection to provide adequate coverage of the free-phase product plume, although several existing monitoring wells may be utilized for injection purposes as well. In order to increase peripheral distribution of the surfactant solution, as many injection wells as possible should be surged using a surge block during and upon completion of the injection activities. The surfactant solution should then be allowed a 12- to 24-hour contact time before restarting the submersible recovery pumps. In addition, following the surfactant injection and surging, approximately 2,000 to 4,000 gallons of potable chase water should be injected into the available injection wells in order to hydraulically “push” the surfactant solution through the impacted soil and toward the recovery trenches/sumps. The chase water injection may be performed prior to or concurrently with operation of the P&T system.

In an effort to reduce a large portion of the labor and equipment costs associated with each surfactant injection event, the addition of a small holding tank, transfer pump, and a flow-splitter should be considered for the P&T system. These components would allow for both the discharge of treated groundwater and constant injection of a portion (i.e. 10% to 25%) of the treated groundwater into upgradient injection points, which would not only increase the hydraulic gradient toward the recovery trenches, but would also provide the “chase water” to follow the surfactant injection. It is estimated that at least two to three surfactant injection/flushing events may be necessary to mobilize and capture the bulk of the free-phase product present in the subsurface at this site, although CATLIN plans to perform a thorough evaluation of the effectiveness of the initial surfactant injection/flushing event to determine the necessity of additional events.

The overall corrective action strategy is to perform the remediation activities in a staged approach, beginning with three months of continuous operation of the P&T system, providing only groundwater and free-phase product recovery at the trenches/sumps, followed by treatment and discharge of the recovered fluids.

The next stage would incorporate the surfactant injection/flushing technology in conjunction with P&T technology in order to enhance the efficiency and increase the recoverability of free-phase product. The initial surfactant injection/flushing event would be followed by three months of continuous operation of the P&T system providing recovery, treatment, and discharge of the recovered fluids (surfactant, free-phase product, and groundwater) in the same manner as the initial stage of the remediation approach. CATLIN will then evaluate the free-phase product removal efficiency of each stage to determine the need for additional quarterly surfactant injection/flushing events.

Please refer to the Surfactant-Enhanced Recovery Quote by ETEC, LLC, located in Appendix G, for more detailed information on the recommended surfactant product and proposed injection, flushing, and extraction procedures.

8.0 MONITORING PLAN

8.1 GOALS OF MONITORING PLAN

The goals of the monitoring plan are to track the removal efficiency of the initial remedial activities in addition to implementing additional free-phase product removal events if necessary.

8.2 MONITORING ACTIVITIES AND SCHEDULE

The following monitoring activities are proposed upon completion of the excavation and free-phase product removal activities and installation of the recovery system components:

- Gauging of fourteen existing groundwater monitoring wells in addition to the two proposed recovery sumps to be performed every other week for six months following the initial remedial activities. If measurable free-phase product is encountered, conduct removal activities as necessary.
- Sampling of selected monitoring wells for groundwater analysis per EPA Methods 602 and 625 parameters and MADEP EPH/VPH parameters performed on an annual basis unless site conditions dictate more frequent sampling.
- When measurable free-phase product thickness is not identified for four consecutive quarters (one year) increase groundwater sampling frequency to bi-annual then re-evaluate site conditions with respect to NCDENR Risk Classification.

All monitoring and free-phase product gauging results will be included in the MCB, Camp Lejeune UST Management Program and submitted to the NCDENR semi-annually.

9.0 PERMITS

An Underground Injection Control (UIC) Permit to Construct and/or Use a Well(s) for Injection (Type 5I) is required for injection of the surfactant chemical. In addition, a NPDES General Permit (NCG510000) will be required for discharge of the treated effluent from the P&T groundwater remediation system.

10.0 PUBLIC NOTICE

In accordance with NCAC T15A:02L .0114(a), public notification is required by any person submitting a Corrective Action Plan proposing to cleanup groundwater contamination to a standard other than 2L GWQS. The following parties are required to be notified:

- The local health director;
- The chief administrative officer of each political jurisdiction in which the contamination occurs;
- All property owners and occupants residing within or contiguous to the area containing contamination;
- All property owners and occupants residing within or contiguous to the area where the contamination is expected to migrate.

11.0 LIMITATIONS

The field and groundwater data evaluated as part of this report provide isolated data points and may not represent conditions at every location in the project area. Analyses and conclusions of this report, being based on interpolation between data points at the project area, may not be completely representative of all site conditions. Conclusions and recommendations from this report are based on the best available data in an effort to comply with current regulatory requirements.

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- Winner, M.D., Jr., and Coble, R.W., 1989, *Hydrogeologic Framework of the North Carolina Coastal Plain Aquifer System: U.S. Geological Survey Open-File Report 87-690*, 155p.

TABLES

TABLE 1
SITE HISTORY - UST SYSTEM INFORMATION

Incident Name / Number: TC-341 Pipeline / 32505

UST ID Number	Product (gasoline, diesel, jet fuel, etc.)	Capacity (gallons)	Date Installed	Date Permanently Closed (P), or Still in Use* (C) (m/dd/yy)	Was Release Associated With UST System? (Yes / No)
G-480-1	Diesel / #2 Fuel Oil	550	~ 1976	(P) 2/17/1994	Yes
TC-341	Kerosene / #6 Fuel Oil	1,300	~1941	(P) Unknown	Yes
Various**	Kerosene / #6 Fuel Oil	~ 7,900	~ 1941	(P) Unknown	Yes

* Still in use means not permanently closed.

** Numerous USTs and ASTs associated with former Camp Geiger Fuel Farm were source of fuel for TC-341 Pipeline.

TABLE 2
SITE HISTORY - UST OWNER/OPERATOR INFORMATION

Incident Name / Number: TC-341 Pipeline / 32505

Dates of Ownership / Operation	UST ID Number	Name of Owner/ Operator	Address	Telephone Number
~ 1941 - 1994	G-480-1	Commanding Officer Attn: Director I&E/EMD/EQB	PSC Box 20004 Marine Corps Base Camp Lejeune, NC 28542	(910) 451-5068
~ 1941 - Unknown	TC-341	Commanding Officer Attn: Director I&E/EMD/EQB	PSC Box 20004 Marine Corps Base Camp Lejeune, NC 28542	(910) 451-5068
~ 1941 - Unknown	Various*	Commanding Officer Attn: Director I&E/EMD/EQB	PSC Box 20004 Marine Corps Base Camp Lejeune, NC 28542	(910) 451-5068

* Numerous USTs and ASTs associated with former Camp Geiger Fuel Farm were source of fuel for TC-341 Pipeline.

TABLE 3
CONTAMINANT SOURCE INVENTORY

Incident Name / Number: TC-341 Pipeline / 32505

SOURCE	PRODUCT TYPE	INSTALLATION DATE	SIZE	STATUS
UST G480-1	#2 Fuel Oil or Diesel	1976	500 Gallons	Abandoned
UST TC341	Kerosene / #6 Fuel Oil	1941	Unknown	Abandoned In Place
TC-341 Pipeline	Kerosene / #6 Fuel Oil	1941	~ 7,900 Gallons	Abandoned In Place
Camp Geiger Fuel Farm	Gasoline, Diesel, Kerosene, and #6 Heating Oil	1941	5 15,000-Gallon ASTs	Demolished
Gas Station Building 341	Gasoline and Diesel	Unknown	Unknown	Demolished

TABLE 4
WATER SUPPLY WELL INFORMATION

Incident Name / Number: TC-341 Pipeline / 32505

WELL NUMBER	LATITUDE LONGITUDE	TOTAL WELL DEPTH (FT.)	SCREEN INTERVAL	WELL USAGE AND STATUS	APPROXIMATE DISTANCE FROM SITE (FT.)
TC-600	37.7353	70	48 - 70	Water Supply - Abandoned	2,150
	-77.4574				
TC-700	34.7323	76	27.5 - 76 (OPEN HOLE)	Water Supply - Abandoned	3,000
	-77.4577				
TC-1253	34.7266	250	120 - 170	Water Supply - Active	4,800
	-77.4571				

TABLE 5
MONITORING WELL CONSTRUCTION INFORMATION

Incident Name and No.: TC-341 Pipeline / 32505

WELL IDENTIFICATION	DATE INSTALLED (m/dd/yy)	DATE WATER LEVEL MEASURED (m/dd/yy)	WELL CASING DEPTH (ft. BLS)	SCREENED INTERVAL (x to y ft. BLS)	BOTTOM OF WELL (ft. BLS)	TOP OF CASING ELEV.* (ft.)	DEPTH TO WATER From Top of Casing (ft.)	GROUND WATER ELEV.* (ft.)	FREE-PHASE PRODUCT THICKNESS (ft.)	COMMENTS
IR35- MW09S	ND	11/18/08	3.0	3.0 - 12.5	13.0		7.63		NMT	Existing Permanent Type II Stick-up.
IR35- MW14D	ND	5/20/08	24.5 Inner 20.0 Outer	24.5 - 28.0	28.5	16.51	10.21	6.30	NMT	Existing Permanent Type III Stick-up.
IR35- MW14S	ND	11/18/08	3.5	3.5 - 12.0	12.5	16.55	10.45	6.10	NMT	Existing Permanent Type II Stick-up.
IR35- MW67A	ND	9/26/08	5.0	5.0 - 14.5	15.0	14.17	7.95	6.75	0.65	Existing Permanent Type II Flush Mount.
USTG480- MW01	7/03/07	9/26/08	4.0	4.0 - 13.5	14.0	13.70	7.17	6.59	0.07	Permanent Type II Flush Mount.
USTG480- MW02	5/22/07	9/26/08	4.0	4.0 - 13.5	14.0	13.96	8.68	6.49	1.48	Permanent Type II Flush Mount.
USTG480- MW03	5/16/07	4/28/09	5.0	5.0 - 14.5	15.0	13.79	9.62	6.52	2.87	Permanent Type II Flush Mount.
USTG480- MW04	5/16/07	9/26/08	5.0	5.0 - 14.5	15.0	14.28	7.54	7.22	0.59	Permanent Type II Flush Mount.
USTG480- MW05	5/16/07	9/26/08	3.0	3.0 - 12.5	13.0	14.23	6.72	7.51	NMT	Permanent Type II Flush Mount.
USTG480- MW06	5/16/07	9/26/08	5.0	5.0 - 14.5	15.0	13.24	7.45	6.18	0.48	Permanent Type II Flush Mount.
USTG480- MW07	7/05/07	9/26/08	3.0	3.0 - 12.5	13.0	10.98	6.25	5.82	1.33	Permanent Type II Flush Mount.
USTG480- MW08	7/05/07	9/26/08	3.0	3.0 - 12.5	13.0	12.84	8.24	5.75	1.40	Permanent Type II Flush Mount.
USTG480- MW09	7/03/07	9/26/08	3.0	3.0 - 12.5	13.0	14.68	7.20	7.55	0.08	Permanent Type II Flush Mount.

* Reference Point for Elevation Measurements (Survey Grade GPS - Mean Sea Level)

** If free-phase product present, groundwater elevation calculated by: [Top of Casing Elevation - Depth to Water] + [Free-Phase Product Thickness x 0.82]

ft. BLS = Feet Below Land Surface

NMT = No Measurable Thickness

ND = No Data

TABLE 5
MONITORING WELL CONSTRUCTION INFORMATION

Incident Name and No.: TC-341 Pipeline / 32505

WELL IDENTIFICATION	DATE INSTALLED (m/dd/yy)	DATE WATER LEVEL MEASURED (m/dd/yy)	WELL CASING DEPTH (ft. BLS)	SCREENED INTERVAL (x to y ft. BLS)	BOTTOM OF WELL (ft. BLS)	TOP OF CASING ELEV.* (ft.)	DEPTH TO WATER From Top of Casing (ft.)	GROUND WATER ELEV.* (ft.)	FREE-PHASE PRODUCT THICKNESS (ft.)	COMMENTS
USTG480- MW10	7/05/07	9/26/08	3.0	3.0 - 12.5	13.0	14.44	7.14	7.30	NMT	Permanent Type II Flush Mount.
USTG480- MW11	7/10/07	9/26/08	3.0	3.0 - 13.0	13.0	14.31	6.61	7.70	NMT	Permanent Type II Flush Mount.
USTG480- MW12	7/11/07	9/26/08	3.0	3.0 - 13.0	13.0	13.51	6.80	6.71	NMT	Permanent Type II Flush Mount.
USTG480- MW13	7/11/07	9/26/08	3.0	3.0 - 13.0	13.0	12.94	7.70	5.72	0.59	Permanent Type II Flush Mount.
USTG480- MW14	7/11/07	9/26/08	3.0	3.0 - 13.0	13.0	14.76	7.45	7.31	NMT	Permanent Type II Flush Mount.
USTG480- MW15	7/12/07	9/26/08	51.0 Inner 43.0 Outer	51.0 - 56.0	56.0	13.80	6.92	6.88	NMT	Permanent Type III Flush Mount.
USTG480- MW16	5/07/08	5/20/08	5.0	5.0 - 15.0	15.0	10.16	5.90	4.26	NMT	Permanent Type II Flush Mount.
USTG480- MW17	5/07/08	5/20/08	5.0	5.0 - 15.0	15.0	10.08	5.16	4.92	NMT	Permanent Type II Flush Mount.
USTG480- MW18	5/07/08	5/20/08	5.0	5.0 - 15.0	15.0	12.65	6.81	5.84	NMT	Permanent Type II Flush Mount.
USTG480- MW19	11/06/08	11/18/08	4.7	4.7 - 14.7	15.0	14.89	6.64	8.25	NMT	Permanent Type II Flush Mount.
USTG480- MW20	11/06/08	11/18/08	4.7	4.7 - 14.7	15.0	14.99	7.33	8.01	0.43	Permanent Type II Flush Mount.
USTG480- MW21	11/05/08	11/18/08	0.7	0.7 - 5.7	6.0	7.79	3.73	4.06	NMT	Permanent Type II Stick-up.
USTG480- MW22	11/06/08	11/18/08	1.2	1.2 - 6.2	6.5	10.85	6.55	4.30	NMT	Permanent Type II Stick-up.

* Reference Point for Elevation Measurements (Survey Grade GPS - Mean Sea Level)

** If free-phase product present, groundwater elevation calculated by: [Top of Casing Elevation - Depth to Water] + [Free-Phase Product Thickness x 0.82]

ft. BLS = Feet Below Land Surface

NMT = No Measurable Thickness

ND = No Data

TABLE 5
MONITORING WELL CONSTRUCTION INFORMATION

Incident Name and No.: TC-341 Pipeline / 32505

WELL IDENTIFICATION	DATE INSTALLED (m/dd/yy)	DATE WATER LEVEL MEASURED (m/dd/yy)	WELL CASING DEPTH (ft. BLS)	SCREENED INTERVAL (x to y ft. BLS)	BOTTOM OF WELL (ft. BLS)	TOP OF CASING ELEV.* (ft.)	DEPTH TO WATER From Top of Casing (ft.)	GROUND WATER ELEV.* (ft.)	FREE-PHASE PRODUCT THICKNESS (ft.)	COMMENTS
USTG480- MW23	11/17/08	11/18/08	4.7	4.7 - 14.7	15.0	14.83	6.06	8.77	NMT	Permanent Type II Flush Mount.
USTG480- MW24	6/03/09	6/30/09	3.0	3.0 - 13.0	13.0	12.61	6.30	6.31	NMT	Permanent Type II Flush Mount.
USTG480- MW25	6/04/09	6/30/09	27.0 Inner 24.0 Outer	27.0 - 32.0	32.0	14.09	6.75	7.34	NMT	Permanent "Intermediate" Type III Flush Mount.
USTTC341- MW07	ND	11/18/08	3.0	3.0 - 12.5	13.0	19.32	7.77	11.55	NMT	Existing Permanent Type II Flush Mount.
USTTC341- MW14	ND	5/20/08	3.0	3.0 - 12.5	13.0	15.36	5.65	9.71	NMT	Existing Permanent Type II Flush Mount.
USTTC341- MW15	ND	5/20/08	25.0 Inner 22.0 Outer	25.0 - 29.5	30.0	15.33	5.77	9.56	NMT	Existing Permanent Type III Flush Mount.
USTTC341- MW17	ND	5/20/08	3.0	3.0 - 12.5	13.0	15.23	4.99	10.24	NMT	Existing Permanent Type II Flush Mount.

* Reference Point for Elevation Measurements (Survey Grade GPS - Mean Sea Level)

** If free-phase product present, groundwater elevation calculated by: [Top of Casing Elevation - Depth to Water] + [Free-Phase Product Thickness x 0.82]

ft. BLS = Feet Below Land Surface

NMT = No Measurable Thickness

ND = No Data

TABLE 6
SUMMARY OF SOIL LABORATORY RESULTS
EPA METHOD 8260

Incident Name / Number: TC-341 Pipeline / 32505

Sample ID	Contaminant of Concern →		Acetone	Benzene	Bromomethane	2-Butanone	n-Butylbenzene	sec-Butylbenzene	Chloromethane	Ethylbenzene	Isopropylbenzene	4-Isopropyltoluene	Methylene chloride	Naphthalene	n-Propylbenzene	Toluene	1,2,3-Trichlorobenzene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Total Xylenes	All Other EPA Method 8260 Analytes
	Date Collected	Sample Depth (ft. BLS)																			
Residential MSCC (mg/kg) Industrial/Commercial MSCC (mg/kg) STGW MSCC (mg/kg)			1,564 40,880 2.8	18 164 0.0056	NE NE NE	NE NE NE	626 16,350 4.3	626 16,350 3.3	49 440 0.02	1,560 40,000 4.6	1,564 40,880 1.7	NE NE NE	85 763 0.02	313 8,176 0.58	626 16,350 1.7	3,200 82,000 7.3	NE NE NE	782 20,440 7.5	782 20,440 7.3	3,129 81,760 5	Varies Varies Varies
USTG480-MW01(0-2)	7/3/2007	0-2	0.141	BMDL	BMDL	0.00508 J	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW02 (3-5)	5/22/2007	3-5	BMDL	BMDL*	BMDL	BMDL	0.761	0.309	0.0907 J	0.293	0.253	0.28	BMDL*	1.19	0.516	BMDL	BMDL	1.89	0.781	0.2138 J	BMDL
USTG480-MW02 (3-5) DUP	5/22/2007	3-5	BMDL	BMDL*	BMDL	BMDL	1.33	0.480	0.0751 J	0.318	0.339	0.425	BMDL*	1.92	0.737	BMDL	BMDL	3.03	1.19	0.2293 J	BMDL
USTG480-MW03 (4-6)	5/16/2007	4-6	BMDL	BMDL*	BMDL	BMDL	5.67	2.61	0.385 J	4.07	2.49	2.03	BMDL*	12.5	4.44	BMDL	BMDL	12.6	2.42	2.89	BMDL
USTG480-MW04 (4-6)	5/16/2007	4-6	0.562 J	BMDL*	BMDL	BMDL	0.646	0.268	0.225	0.237	0.344	0.493	BMDL*	1.11	0.412	BMDL	BMDL	0.160 J	BMDL	BMDL	BMDL
USTG480-MW05 (4-6)	5/16/2007	4-6	1.48 J	BMDL*	BMDL	BMDL	7.43	4.12	0.502 J	3.11	3.78	2.59	BMDL*	13.9	7.52	BMDL	BMDL	7.92	1.77	0.817 J	BMDL
USTG480-MW06 (4-6)	5/16/2007	4-6	BMDL	BMDL*	BMDL	BMDL	6.51	2.64	0.620 J	4.98	2.73	3.12	BMDL*	18.6	4.54	BMDL	BMDL	21.4	7.34	8.86	BMDL
USTG480-MW07(0-2)	7/5/2007	0-2	0.0163 J	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW08 (3-5)	7/5/2007	3-5	0.0330 J	0.00305 J	BMDL	0.00567 J	BMDL	BMDL	BMDL	0.0204	0.0029 J	0.0317	BMDL	BMDL	0.00691	BMDL	BMDL	BMDL	0.00289 J	0.0113 J	BMDL
USTG480-MW09 (4-6)	7/3/2007	4-6	BMDL	BMDL*	BMDL	BMDL	6.61	2.75	BMDL*	5.30	2.77	2.21	BMDL*	17.9	5.87	BMDL	BMDL	22.1	7.37	4.529 J	BMDL
USTG480-MW10 (3-5)	7/5/2007	3-5	BMDL	0.0248 J	BMDL	BMDL	2.36	1.07	BMDL	2.09	0.996	1.25	BMDL*	4.65	2.21	BMDL	BMDL	0.542	3.33	0.8465	BMDL
USTG480-MW11 (3-5)	7/10/2007	3-5	0.166 J	BMDL	BMDL	BMDL	0.295	0.188	BMDL	0.0184 J	0.0516 J	0.0459 J	0.282 J	0.606	0.13	0.0126 J	0.0275 J	BMDL	BMDL	BMDL	BMDL
USTG480-MW12 (3-5)	7/11/2007	3-5	0.0161 J	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13 (3-5)	7/11/2007	3-5	0.167 J	0.00935 J	0.0366 J	BMDL	0.529	0.199	BMDL	0.276	0.152	0.412	0.207 J	0.630	0.314	BMDL	BMDL	1.22	0.354	0.1962 J	BMDL
USTG480-MW14 (3-5)	7/11/2007	3-5	0.0141 J	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW15 (2-4)	7/10/2007	2-4	0.0240 J	BMDL	BMDL	0.00331 J	BMDL	BMDL	BMDL	0.00265 J	BMDL	0.00514	BMDL	0.00385 J	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW20 (1-3)	11/6/2008	1-3	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	0.00084 J	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	0.001 J	< 0.00245 J	BMDL

All results in milligrams per kilogram (mg/kg).
Bold results indicate concentrations above lowest established MSCC.
BMDL or < = Below Method Detection Limit
BMDL* = Below Method Detection Limit, Method Detection Limit above lowest MSCC

J = Estimated concentration, below calibration range and above method detection limit.
ft. BLS = Feet Below Land Surface
MSCC = Maximum Soil Contaminant Concentration
STGW = Soil to Groundwater

NE = None Established

TABLE 6A
SUMMARY OF SOIL LABORATORY RESULTS
EPA METHOD 8270

Incident Name / Number: TC-341 Pipeline / 32505

Sample ID	Contaminant of Concern		Acenaphthene	Anthracene	Dibenzofuran	Fluorene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	All Other EPA Method 8270 Analytes
	Date Collected	Sample Depth (ft. BLS)									
Residential MSCC (mg/kg)			940	4,600	62	620	63	313	469	469	Varies
Industrial/Commercial MSCC (mg/kg)			24,000	122,000	1,635	16,400	1,635	8,176	12,264	12,264	Varies
STGW MSCC (mg/kg)			8.2	1,000	4.7	44	1.7	0.58	60	290	Varies
USTG480-MW01 (0-2)	7/3/2007	0-2	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW02 (3-5)	5/22/2007	3-5	BMDL	BMDL	0.222 J	0.179 J	4.68	1.37	0.300 J	0.0880 J	BMDL
USTG480-MW03 (4-6)	5/16/2007	4-6	BMDL	1.44 J	3.69 J	3.69 J	56.3	12	9.71	BMDL	BMDL
USTG480-MW04 (4-6)	5/16/2007	4-6	1.90 J	9.03	4.14 J	4.42 J	56.1	8.56	8.76	BMDL	BMDL
USTG480-MW05 (4-6)	5/16/2007	4-6	5.38 J	4.43 J	9.38	10.4	116	24.8	22.7	BMDL	BMDL
USTG480-MW06 (4-6)	5/16/2007	4-6	2.63 J	2.02 J	5.39 J	5.73 J	75.0	19.8	11.3	BMDL	BMDL
USTG480-MW07 (0-2)	7/5/2007	0-2	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW08 (3-5)	7/5/2007	3-5	0.060 J	BMDL	BMDL	0.088 J	BMDL	BMDL	0.120 J	BMDL	BMDL
USTG480-MW09 (4-6)	7/3/2007	4-6	2.84 J	1.45 J	5.48 J	5.88 J	75.2	13.9	11.9	BMDL	BMDL
USTG480-MW10 (3-5)	7/5/2007	3-5	1.72 J	1.08 J	3.64	4.01	50.9	8.33	6.47	BMDL	BMDL
USTG480-MW11 (3-5)	7/10/2007	3-5	0.135 J	0.124 J	0.280 J	0.328 J	1.83	0.200 J	0.781	BMDL	BMDL
USTG480-MW12 (3-5)	7/11/2007	3-5	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13 (3-5)	7/11/2007	3-5	BMDL	0.162 J	0.351	0.439	3.63	0.547	0.862	BMDL	BMDL
USTG480-MW14 (3-5)	7/11/2007	3-5	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW15 (2-4)	7/10/2007	2-4	BMDL	BMDL	BMDL	0.053 J	0.194 J	BMDL	0.113 J	BMDL	BMDL
USTG480-MW20 (1-3)	11/6/2008	1-3	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL

All results in milligrams per kilogram (mg/kg).

Bold results indicate concentrations above lowest established MSCC.

BMDL = Below Method Detection Limit

NE = None Established

J = Estimated concentration, below calibration range and above method detection limit

ft. BLS = Feet Below Land Surface

MSCC = Maximum Soil Contaminant Concentration

STGW = Soil to Groundwater

TABLE 6B
SUMMARY OF SOIL LABORATORY RESULTS
MADEP EPH/VPH

Incident Name / Number: TC-341 Pipeline / 32505

Sample ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
	Date Collected	Sample Depth (ft. BLS)						
USTG480-MW01 (0-2)	7/3/2007	0-2	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW02 (3-5)	5/22/2007	3-5	1,100	110	100	BMDL	53	28
USTG480-MW03 (4-6)	5/16/2007	4-6	3,000	BMDL	1,400	14	91	71
USTG480-MW04 (4-6)	5/16/2007	4-6	3,400	BMDL	1,500	BMDL	70	46
USTG480-MW05 (4-6)	5/16/2007	4-6	4,400	270	2,000	41	130	120
USTG480-MW06 (4-6)	5/16/2007	4-6	7,300	480	3,100	75	190	240
USTG480-MW07 (0-2)	7/5/2007	0-2	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW08 (3-5)	7/5/2007	3-5	360	22	100	BMDL	BMDL	BMDL
USTG480-MW09 (4-6)	7/3/2007	4-6	3,200	BMDL	1,900	58.2	232	301
USTG480-MW10 (3-5)	7/5/2007	3-5	3,600	BMDL	1,100	38.6	215	232
USTG480-MW11 (3-5)	7/10/2007	3-5	120	23	57	BMDL	34.0	34.2
USTG480-MW12 (3-5)	7/11/2007	3-5	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13 (3-5)	7/11/2007	3-5	200	52.0	200	BMDL	50.8	48.4
USTG480-MW14 (3-5)	7/11/2007	3-5	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW15 (2-4)	7/10/2007	2-4	52.0	18.0	BMDL	BMDL	BMDL	BMDL
USTG480-MW20 (1-3)	11/6/2008	1-3	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL

All results in milligrams per kilogram (mg/kg).

ft. BLS = Feet Below Land Surface

BMDL = Below Method Detection Limit

TABLE 6C
SUMMARY OF SOIL LABORATORY RESULTS
MADEP EPH/VPH AS COMPARED TO NCDENR MSCCs

Incident Name / Number: TC-341 Pipeline / 32505

Sample ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics	C5-C8 Aliphatics
	Date Collected	Sample Depth (ft. BLS)				
Residential MSCC (mg/kg)			9,386	93,860	469	939
Industrial/Commercial MSCC (mg/kg)			245,280	#	12,264	24,528
STGW MSCC (mg/kg)			3,300	##	34	72
USTG480-MW01 (0-2)	7/3/2007	0-2	BMDL	BMDL	BMDL	BMDL
USTG480-MW02 (3-5)	5/22/2007	3-5	1,153	110	128	BMDL
USTG480-MW03 (4-6)	5/16/2007	4-6	3,091	BMDL	1,471	14
USTG480-MW04 (4-6)	5/16/2007	4-6	3,470	BMDL	1,546	BMDL
USTG480-MW05 (4-6)	5/16/2007	4-6	4,530	270	2,120	41
USTG480-MW06 (4-6)	5/16/2007	4-6	7,490	480	3,340	75
USTG480-MW07 (0-2)	7/5/2007	0-2	BMDL	BMDL	BMDL	BMDL
USTG480-MW08 (3-5)	7/5/2007	3-5	<370*	22	<110*	BMDL
USTG480-MW09 (4-6)	7/3/2007	4-6	3,432	BMDL	2,201	58.2
USTG480-MW10 (3-5)	7/5/2007	3-5	3,815	BMDL	1,332	38.6
USTG480-MW11 (3-5)	7/10/2007	3-5	154	23	91.2	BMDL
USTG480-MW12 (3-5)	7/11/2007	3-5	BMDL	BMDL	BMDL	BMDL
USTG480-MW13 (3-5)	7/11/2007	3-5	250.8	52.0	248.4	BMDL
USTG480-MW14 (3-5)	7/11/2007	3-5	BMDL	BMDL	BMDL	BMDL
USTG480-MW15 (2-4)	7/10/2007	2-4	<62.0*	18.0	BMDL	BMDL
USTG480-MW20 (1-3)	11/6/2008	1-3	BMDL	BMDL	BMDL	BMDL

All results in milligrams per kilogram (mg/kg).

Bold results indicate concentrations above lowest established MSCC.

ft. BLS = Feet Below Land Surface

BMDL or < = Below Method Detection Limit

= Health based level (>100%)

= Considered Immobile

STGW = Soil to Groundwater

MSCC = Maximum Soil Contaminant Concentration

* = The value represents the sum of the reported practical quantitation limit of one fraction and the detected concentration of the other fraction.

TABLE 7
SUMMARY OF GROUNDWATER LABORATORY RESULTS
EPA METHOD 602

Incident Name / Number: TC-341 Pipeline / 32505

Well ID	Contaminant of Concern →		Benzene	Diisopropyl ether (DIPE)	Ethylbenzene	Toluene	Total Xylenes	All Other EPA Method 602 Analytes
	Sample ID	Date Collected						
	GCL (µg/L)		5,000	70,000	84,500	257,500	87,500	Varies
	2L GWQS (µg/L)		1	70	550	1,000	530	Varies
USTG480-MW01	USTG480-MW01	7/16/2007	4.78 J	BMDL	175	BMDL	<191.67	BMDL
USTG480-MW01	USTG480-MW01 DUP	7/16/2007	5.31 J	BMDL	176	BMDL	<190.67	BMDL
USTG480-MW04	USTG480-MW04	7/16/2007	57.4	BMDL	278	14.6	401	BMDL
USTG480-MW05	USTG480-MW05	7/16/2007	13.9	BMDL	283	BMDL	<81.94	BMDL
USTG480-MW10	USTG480-MW10	7/16/2007	173	BMDL	431	94.7	702	BMDL
USTG480-MW11	USTG480-MW11	7/16/2007	4.16 J	BMDL	113	BMDL	<5.82 J	BMDL
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13	USTG480-MW13	7/16/2007	94.8	BMDL	325	BMDL	<194.7	BMDL
USTG480-MW14	USTG480-MW14	7/16/2007	2.28	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	0.212 J	BMDL	BMDL
USTG480-MW17	USTG480-MW17	5/8/2008	61.5	BMDL	179	9.84	260.6	BMDL
USTG480-MW18	USTG480-MW18	5/8/2008	BMDL	BMDL	2.21	0.850 J	<1.517 J	BMDL
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW23	USTG480-MW23	11/18/2008	9.8	BMDL	59.6	BMDL	41.86	BMDL
USTG480-MW23	USTG480-MW23 DUP	11/18/2008	9.56	BMDL	64.9	BMDL	50.1	BMDL
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTTC341-MW14	USTTC341-MW14	7/16/2007	9.7	BMDL	39.2	BMDL	52.052 J	BMDL
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S DUP	11/18/2008	0.761 J	0.283 J	BMDL	BMDL	BMDL	BMDL
USTG480-MW24	TC-341 MW-24	6/30/2009	0.759 J	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW25	TC-341 MW-25	6/30/2009	3.71	29.1	2.61	BMDL	<4.105	BMDL

All results in micrograms per liter (ug/L).

Bold results indicate concentrations above 2L GWQS or GCL.

BMDL and < = Below Method Detection Limit

NE = None Established

J = Estimated concentration, below calibration range and above method detection limit

GCL = Gross Contaminant Level

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

TABLE 7A
SUMMARY OF GROUNDWATER LABORATORY RESULTS
EPA METHOD 625

Incident Name / Number: TC-341 Pipeline / 32505

Well ID	Contaminant of Concern →		Acenaphthene	Acenaphthylene	Anthracene	Bis(2-ethylhexyl)phthalate	Di-n-octylphthalate	Fluorene	Naphthalene	Phenanthrene	All Other EPA Method 625 Analytes
	Sample ID	Date Collected									
GCL (µg/L)			2,120	1,965	2,100	2,500	NE	950	15,500	410	Varies
2L GWQS (µg/L)			80	210	2,100	2.5	140	280	21	210	Varies
USTG480-MW01	USTG480-MW01	7/16/2007	9.50 J	BMDL	BMDL	BMDL	BMDL	18.0 J	376	27.0 J	BMDL
USTG480-MW04	USTG480-MW04	7/16/2007	46.0 J	29.0 J	21.0 J	BMDL	18.0 J	91.0 J	691	187	BMDL
USTG480-MW05	USTG480-MW05	7/16/2007	59.0 J	BMDL	38.0 J	BMDL	BMDL	119	962	262	BMDL
USTG480-MW10	USTG480-MW10	7/16/2007	BMDL	BMDL	68.0 J	BMDL	BMDL	190 J	1,280	408	BMDL
USTG480-MW11	USTG480-MW11	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	8.50 J	328	9.50 J	BMDL
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13	USTG480-MW13	7/16/2007	35.0 J	BMDL	19.0 J	BMDL	BMDL	67.0 J	693	156	BMDL
USTG480-MW14	USTG480-MW14	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW17	USTG480-MW17	5/8/2008	20.8 J	BMDL	BMDL	BMDL	BMDL	26.6 J	373	46.4 J	BMDL
USTG480-MW18	USTG480-MW18	5/8/2008	2.39 J	BMDL	BMDL	2.85 J	BMDL	2.33 J	9.44	1.71 J	BMDL
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW23	USTG480-MW23	11/18/2008	7.81 J	BMDL	BMDL	BMDL	BMDL	16.1 J	259	24.0 J	BMDL

TABLE 7A
SUMMARY OF GROUNDWATER LABORATORY RESULTS
EPA METHOD 625

Incident Name / Number: TC-341 Pipeline / 32505

Well ID	Contaminant of Concern →		Acenaphthene	Acenaphthylene	Anthracene	Bis(2-ethylhexyl)phthalate	Di-n-octylphthalate	Fluorene	Naphthalene	Phenanthrene	All Other EPA Method 625 Analytes
	Sample ID	Date Collected									
GCL (µg/L)			2,120	1,965	2,100	2,500	NE	950	15,500	410	Varies
2L GWQS (µg/L)			80	210	2,100	2.5	140	280	21	210	Varies
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTTC341-MW14	USTTC341-MW14	7/16/2007	63.0 J	BMDL	34.0 J	31.0 J	BMDL	133	645	328	BMDL
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	1.50 J	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW24	TC-341 MW-24	6/30/2009	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	8.65	BMDL	BMDL
USTG480-MW25	TC-341 MW-25	6/30/2009	1.55 J	BMDL	BMDL	BMDL	BMDL	1.91 J	10.9	3.66 J	BMDL

All results in micrograms per liter (ug/L).

Bold results indicate concentrations above 2L GWQS or GCL.

BMDL = Below Method Detection Limit

NE = None Established

J = Estimated concentration, below calibration range and above method detection limit

GCL = Gross Contaminant Level

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

TABLE 7B
SUMMARY OF GROUNDWATER LABORATORY RESULTS
MADEP EPH/VPH

Incident Name / Number: TC-341 Pipeline / 32505

Well ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
	Sample ID	Date Collected						
USTG480-MW01	USTG480-MW01	7/16/2007	4,300	200	78,000	170	1,300	1,100
USTG480-MW04	USTG480-MW04	7/16/2007	140,000	9,200	83,000	398	2,320	2,820
USTG480-MW05	USTG480-MW05	7/16/2007	49,000	3,400	31,000	466	1,950	2,520
USTG480-MW10	USTG480-MW10	7/16/2007	97,000	13,000	51,000	360	1,340	989
USTG480-MW11	USTG480-MW11	7/16/2007	210	BMDL	1,400	BMDL	477	285
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13	USTG480-MW13	7/16/2007	38,000	BMDL	25,000	727	2,210	4,290
USTG480-MW14	USTG480-MW14	7/16/2007	BMDL	BMDL	BMDL	138	BMDL	BMDL
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW17	USTG480-MW17	5/8/2008	3,210	289	6,580	297	1,970	1,700
USTG480-MW18	USTG480-MW18	5/8/2008	112	BMDL	330	BMDL	115	114
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	342	BMDL	BMDL	BMDL	BMDL
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW23	USTG480-MW23	11/18/2008	12,300	837	5550	BMDL	446	885
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTTC341-MW14	USTTC341-MW14	7/16/2007	140,000	6,800	4,000	418	1,820	3,150
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL

All results in micrograms per liter (µg/L).

BMDL = Below Method Detection Limit

TABLE 7C
SUMMARY OF GROUNDWATER LABORATORY RESULTS
MADEP EPH/VP AS COMPARED TO NCDENR 2L GWQS

Incident Name / Number: TC-341 Pipeline / 32505

Well ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics	C5-C8 Aliphatics
	Sample ID	Date Collected				
2L GWQS (µg/L)			4,200	42,000	210	420
USTG480-MW01	USTG480-MW01	7/16/2007	5,600	200	79,100	170
USTG480-MW04	USTG480-MW04	7/16/2007	142,320	9,200	85,820	398
USTG480-MW05	USTG480-MW05	7/16/2007	50,950	3,400	33,520	466
USTG480-MW10	USTG480-MW10	7/16/2007	98,340	13,000	51,989	360
USTG480-MW11	USTG480-MW11	7/16/2007	687	BMDL	1,685	BMDL
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL
USTG480-MW13	USTG480-MW13	7/16/2007	40,210	BMDL	29,290	727
USTG480-MW14	USTG480-MW14	7/16/2007	BMDL	BMDL	BMDL	138
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	BMDL
USTG480-MW17	USTG480-MW17	5/8/2008	5,180	289	8,280	297
USTG480-MW18	USTG480-MW18	5/8/2008	227	BMDL	444	BMDL
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	342	BMDL	BMDL
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL
USTG480-MW23	USTG480-MW23	11/18/2008	12,746	837	6,435	BMDL
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL
USTTC341-MW14	USTTC341-MW14	7/16/2007	141,820	6,800	7,150	418
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL

All results in micrograms per liter (µg/L).

Bold results indicate concentrations above 2L GWQS.

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

BMDL = Below Method Detection Limit

TABLE 7D
SUMMARY OF GROUNDWATER LABORATORY RESULTS
EPA METHOD 601

Incident Name / Number: TC-341 Pipeline / 32505

Well ID	Contaminant of Concern →		1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride	All Other EPA Method 601 Analytes
	Sample ID	Date Collected						
GCL (µg/L)			7,000	70,000	100,000	2,800	15	VARIES
2L GWQS (µg/L)			7	70	100	2.8	0.015	VARIES
IR35-MW14S	IR35-MW14S	11/18/2008	0.410 J	359	26.4	37.5	2.06	BMDL

All results in micrograms per liter (µg/L).

BMDL = Below Method Detection Limit

Bold results indicate concentrations above 2L GWQS.

J = Estimated concentration, below calibration range and above method detection limit

GCL = Gross Contaminant Level

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

TABLE 8
FREE-PHASE PRODUCT RECOVERY INFORMATION
FEBRUARY 2008 THROUGH JULY 2009

Incident Name / Number: TC-341 Pipeline / 32505

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	AVERAGE PRODUCT THICKNESS BEFORE RECOVERY (inches)	AVERAGE AMOUNT OF PRODUCT RECOVERED (gallons)	TOTAL AMOUNT OF PRODUCT RECOVERED (gallons)	AVERAGE DEPTH TO WATER (feet)*
USTG480-MW01	KEROSENE / #6 FUEL OIL	2	0.09	0.041	1.48	7.04
USTG480-MW02	KEROSENE / #6 FUEL OIL	2	0.92	0.601	21.64	8.10
USTG480-MW03	KEROSENE / #6 FUEL OIL	2	1.54	0.968	34.85	8.36
USTG480-MW04	KEROSENE / #6 FUEL OIL	2	0.47	0.247	8.91	7.30
USTG480-MW05	KEROSENE / #6 FUEL OIL	2	NMT	0.002	0.06	6.51
USTG480-MW06	KEROSENE / #6 FUEL OIL	2	0.18	0.089	3.19	7.19
USTG480-MW07	KEROSENE / #6 FUEL OIL	2	1.33	1.024	36.86	6.22
USTG480-MW08	KEROSENE / #6 FUEL OIL	2	0.89	0.683	24.58	7.84
USTG480-MW09	KEROSENE / #6 FUEL OIL	2	0.05	0.029	1.03	7.09
USTG480-MW10	KEROSENE / #6 FUEL OIL	2	NMT	0.000	0.00	7.09
USTG480-MW11	KEROSENE / #6 FUEL OIL	2	NMT	0.000	0.00	6.67
USTG480-MW12	KEROSENE / #6 FUEL OIL	2	NMT	0.000	0.00	6.84
USTG480-MW13	KEROSENE / #6 FUEL OIL	2	0.47	0.259	9.31	7.53
USTG480-MW14	KEROSENE / #6 FUEL OIL	2	NMT	0.000	0.00	7.46
USTG480-MW15	KEROSENE / #6 FUEL OIL	2	NMT	0.000	0.01	6.84
IR35-67A	KEROSENE / #6 FUEL OIL	2	0.84	0.217	7.80	7.84
CUMULATIVE TOTAL	--	--	--	--	149.73	--

* = Depth to Water as measured. Not adjusted for free-phase product thickness

NMT = No Measurable Thickness

TABLE 9
SUMMARY OF SURFACE WATER LABORATORY RESULTS
EPA METHOD 602

Incident Name / Number: TC-341 Pipeline / 32505

Contaminant of Concern →		Benzene	Diisopropyl ether (DIPE)	Ethylbenzene	Total Xylenes	All Other EPA Method 602 Analytes
Sample ID	Date Collected					
Most Stringent Standard, Criteria, or Toxic Consideration Adopted per 15A NCAC 2B or are National Criteria per EPA		51 (HH)	13,000 (FAL)	97 (FAL)	370 (SAL)	Varies
USTG480-SW01	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-SW02	11/18/2008	1.56	0.827 J	BMDL	BMDL	BMDL
TC-341 Outfall	6/15/2009	1.84	1.17	BMDL	BMDL	BMDL
TC-341 Basin	6/15/2009	1.26	BMDL	0.208 J	<1.615 J	BMDL

All results and Standards in micrograms per liter (µg/L).

BMDL and < = Below Method Detection Limit

NE = None Established

J = Estimated concentration, below calibration range and above method detection limit

(HH) = Human Health Standard 15A NCAC 2B or National Criteria per EPA

(FAL) = Freshwater Aquatic Life Standard 15A NCAC 2B or National Criteria per EPA

(SAL) = Saltwater Aquatic Life Standard 15A NCAC 2B or National Criteria per EPA

TABLE 9A
SUMMARY OF SURFACE WATER LABORATORY RESULTS
EPA METHOD 625

Incident Name / Number: TC-341 Pipeline / 32505

Contaminant of Concern →		Acenaphthene	Bis(2-ethylhexyl)phthalate	Fluorene	Naphthalene	Phenanthrene	All Other EPA Method 625 Analytes
Sample ID	Date Collected						
Most Stringent Standard, Criteria, or Toxic Consideration Adopted per 15A NCAC 2B or are National Criteria per EPA		20 (SAL)	2.2 (HH)	46 (FAL)	52 (SAL)	NE	Varies
USTG480-SW01	11/18/2008	0.765 J	BMDL	BMDL	1.17 J	BMDL	BMDL
USTG480-SW02	11/18/2008	BMDL	BMDL	1.24 J	BMDL	1.14 J	BMDL
TC-341 Outfall	6/15/2009	BMDL	BMDL	0.842 J	1.00 J	1.11 J	BMDL
TC-341 Basin	6/15/2009	1.14 J	0.519 J	2.08 J	34.7	1.25 J	BMDL

All results and Standards in micrograms per liter (µg/L).

BMDL = Below Method Detection Limit

NE = None Established

J = Estimated concentration, below calibration range and above method detection limit

HH = Human Health Standard 15A NCAC 2B or National Criteria per EPA

FAL = Freshwater Aquatic Life Standard 15A NCAC 2B or National Criteria per EPA

SAL = Saltwater Aquatic Life Standard 15A NCAC 2B or National Criteria per EPA

TABLE 9B
SUMMARY OF SURFACE WATER LABORATORY RESULTS
MADEP EPH/VPH

Incident Name / Number: TC-341 Pipeline / 32505

Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
Sample ID	Date Collected						
USTG480-SW01	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-SW02	11/18/2008	BMDL	BMDL	123	BMDL	BMDL	BMDL

All results in micrograms per liter (µg/L).

BMDL = Below Method Detection Limit

TABLE 9C

**SUMMARY OF SURFACE WATER LABORATORY RESULTS
MADEP EPH/VPH AS COMPARED TO SURFACE WATER STANDARDS / CRITERIA**

Incident Name / Number: TC-341 Pipeline / 32505

Contaminant of Concern →		C5-C8 Aliphatics	C9-C18 Aliphatics	C18-C32 Aliphatics	C9-C32 Aromatics
Sample ID	Date Collected				
Most Stringent Standard, Criteria, or Toxic Consideration Adopted per 15A NCAC 2B or are National Criteria per EPA		120 (HH)	S	S	400 (HH)
USTG480-SW01	11/18/2008	BMDL	BMDL	BMDL	170*
USTG480-SW02	11/18/2008	BMDL	BMDL	BMDL	BMDL

All results and Standards in micrograms per liter (µg/L).

BMDL and < = Below Method Detection Limit

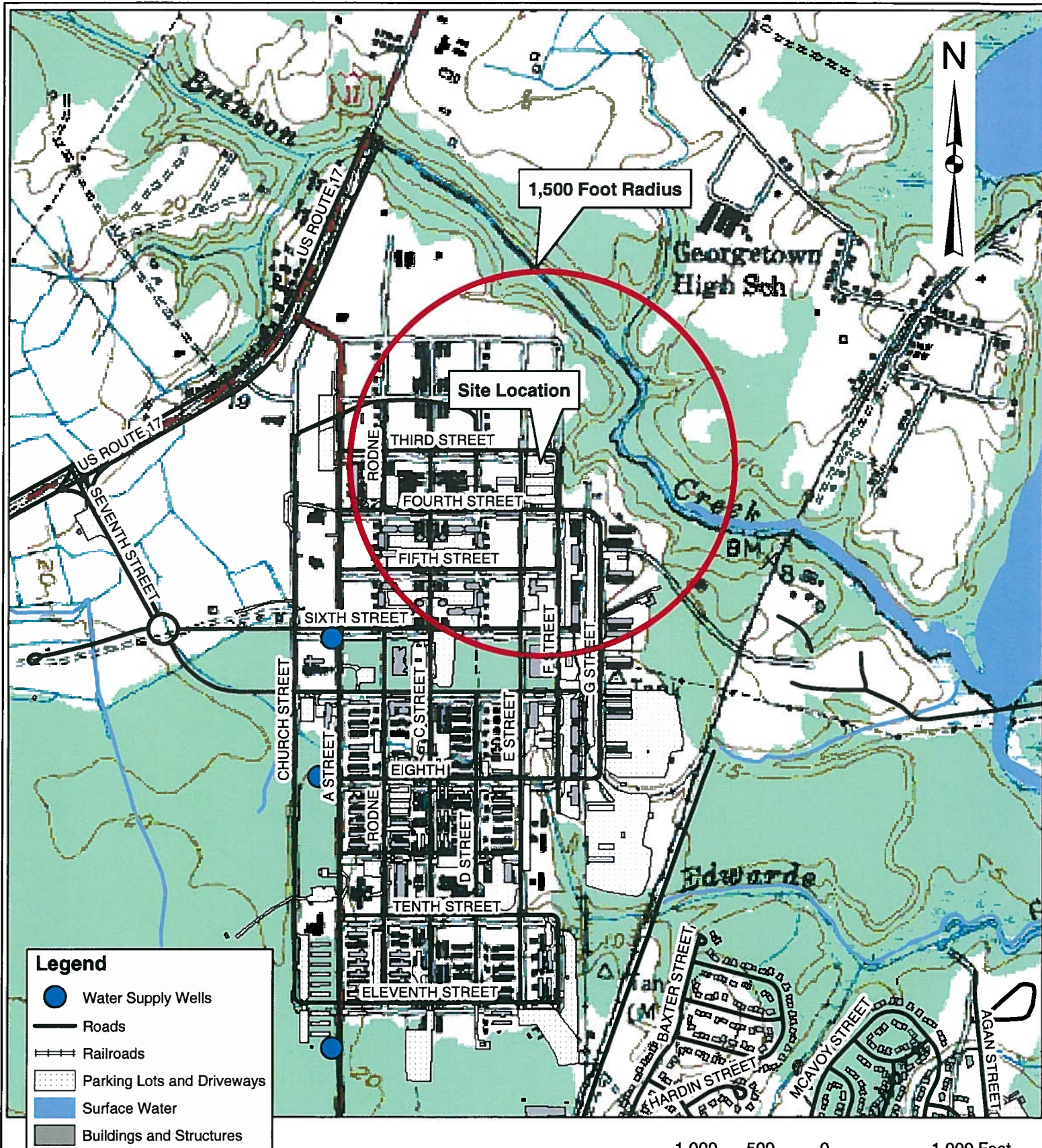
NE = None Established

* = The value represents the sum of the reported practical quantitation limit of one fraction and the detected concentration of the other fraction.

(HH) = Human Health Standard 15A NCAC 2B or National Criteria per EPA

S = Toxicity exceeds solubility, no visible sheen or free product in water or on sediment or shoreline.

FIGURES



Data Sources: GIS Data Layers provided by MCB Camp Lejeune GIS Office.
USGS Topographical Quad = Jacksonville South, NC 1952 (Photoinspected 1971).



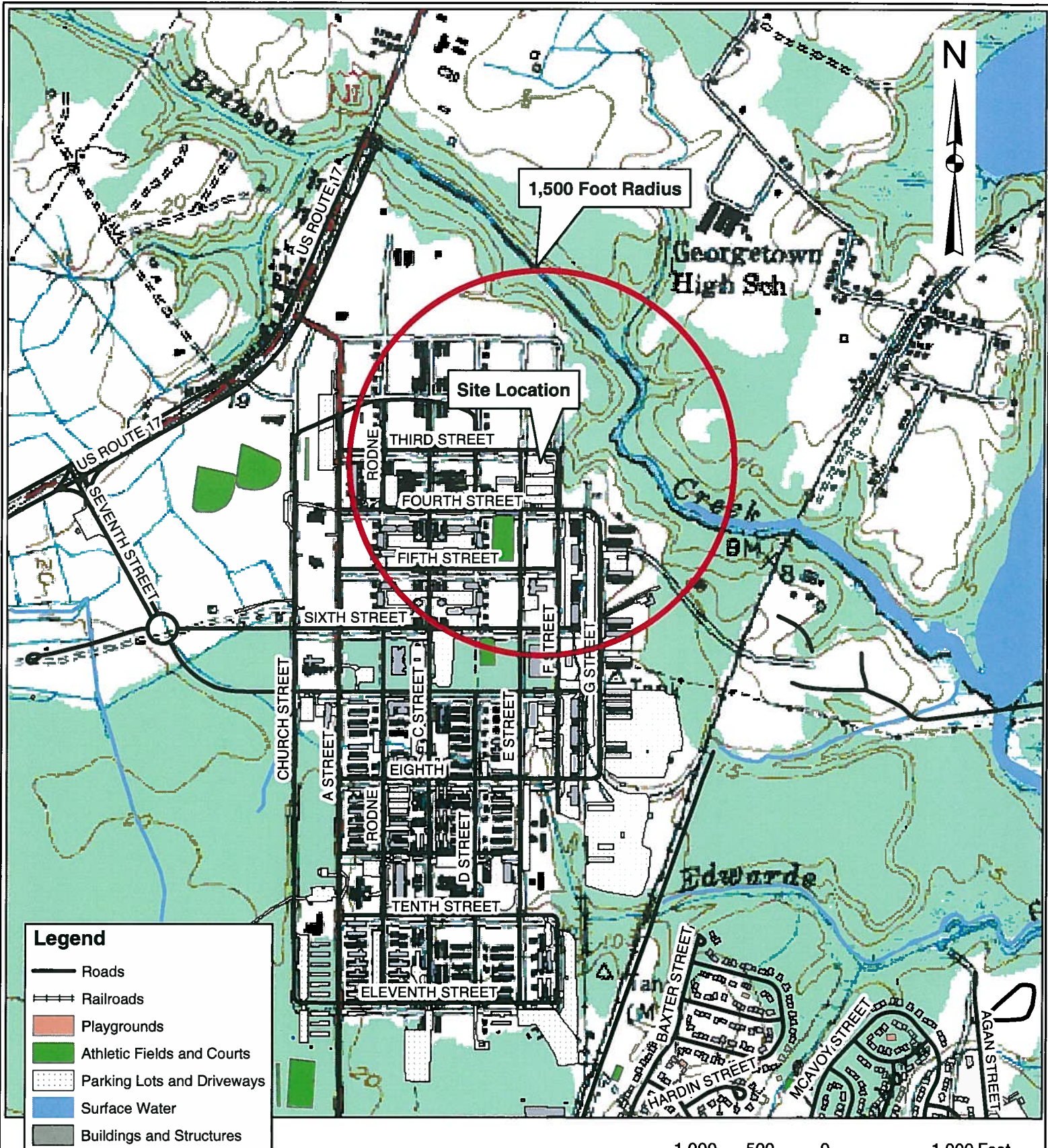
PROJECT
REVISED ADDITIONAL
ASSESSMENT AND CAP
SITE TC-341 PIPELINE
MARINE CORPS BASE
CAMP LEJEUNE, NC

TITLE
**SITE VICINITY AND
WATER SUPPLY WELLS**

FIGURE

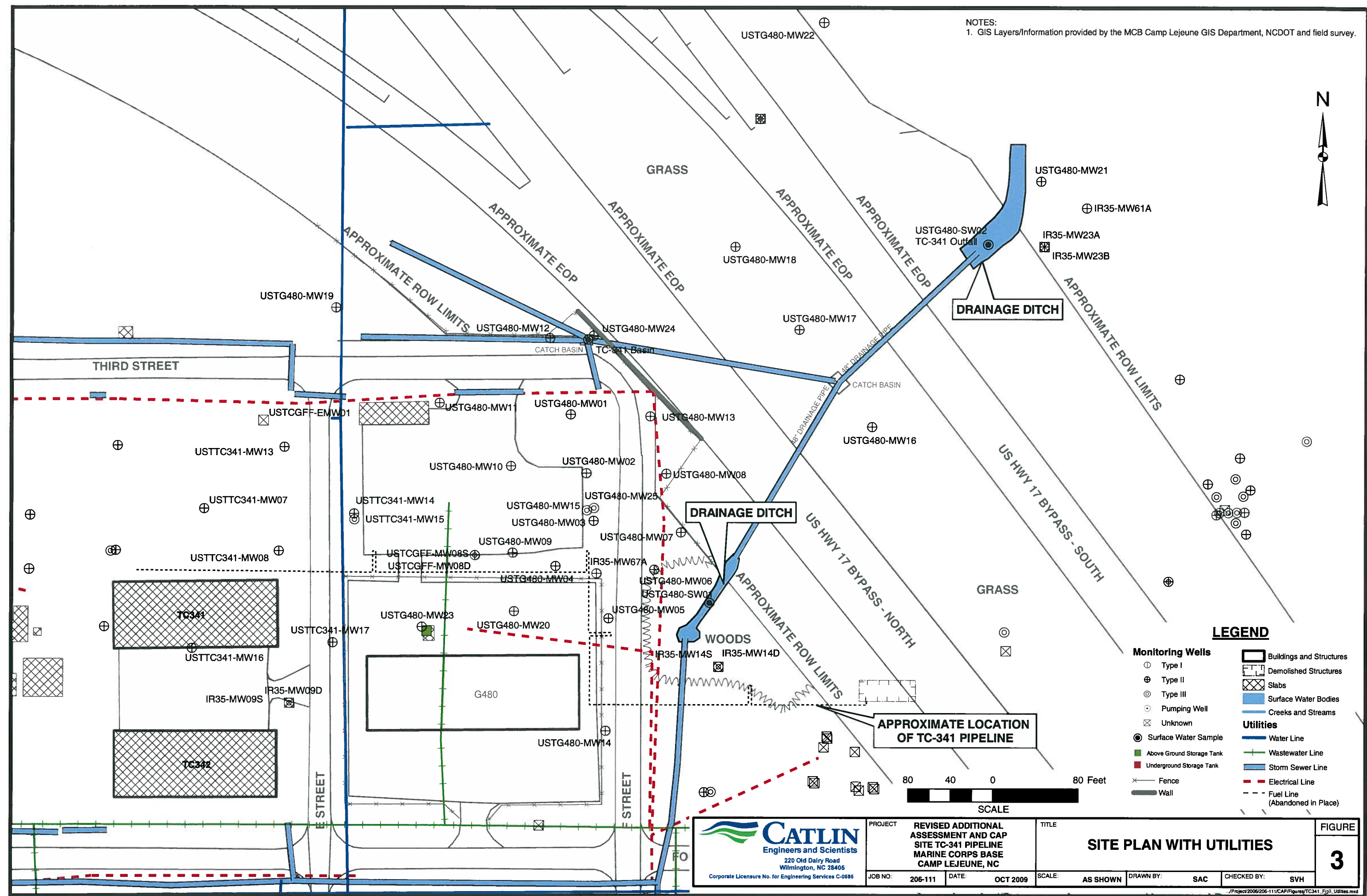
1

JOB NO. 206-111	DATE OCT 2009	SCALE AS SHOWN	DRAWN BY SAC	CHECKED BY SVH
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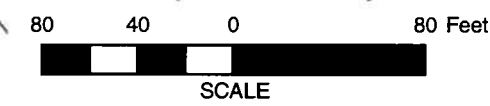
Data Sources: GIS Data Layers provided by MCB Camp Lejeune GIS Office.
USGS Topographical Quad = Jacksonville South, NC 1952 (Photoinspected 1971).

NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.



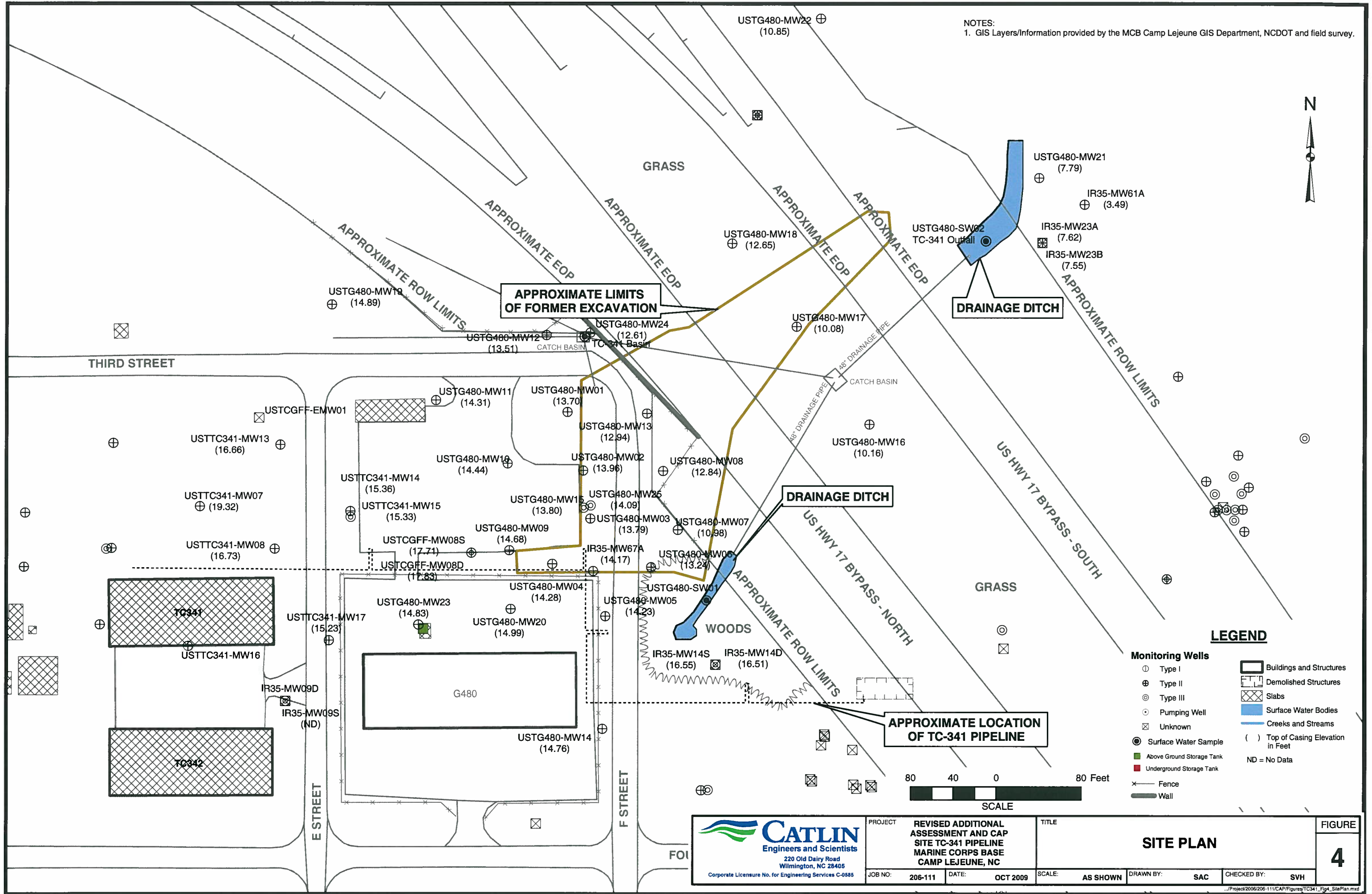
LEGEND

Monitoring Wells	Buildings and Structures
○ Type I	Demolished Structures
⊕ Type II	Slabs
⊙ Type III	Surface Water Bodies
⊙ Pumping Well	Creeks and Streams
⊗ Unknown	
⊙ Surface Water Sample	
■ Above Ground Storage Tank	Utilities
■ Underground Storage Tank	Water Line
— Fence	Wastewater Line
— Wall	Storm Sewer Line
	Electrical Line
	Fuel Line (Abandoned in Place)



 CATLIN Engineers and Scientists 220 Old Dairy Road Wilmington, NC 28405 Corporate License No. for Engineering Services C-0696	PROJECT REVISED ADDITIONAL ASSESSMENT AND CAP SITE TC-341 PIPELINE MARINE CORPS BASE CAMP LEJEUNE, NC	TITLE SITE PLAN WITH UTILITIES		FIGURE 3
	JOB NO: 206-111	DATE: OCT 2009	SCALE: AS SHOWN	DRAWN BY: SAC
			CHECKED BY: SVH	

.J:\Project\2006\206-111\CAP\Figures\TC341_Fig3_Uilities.mxd

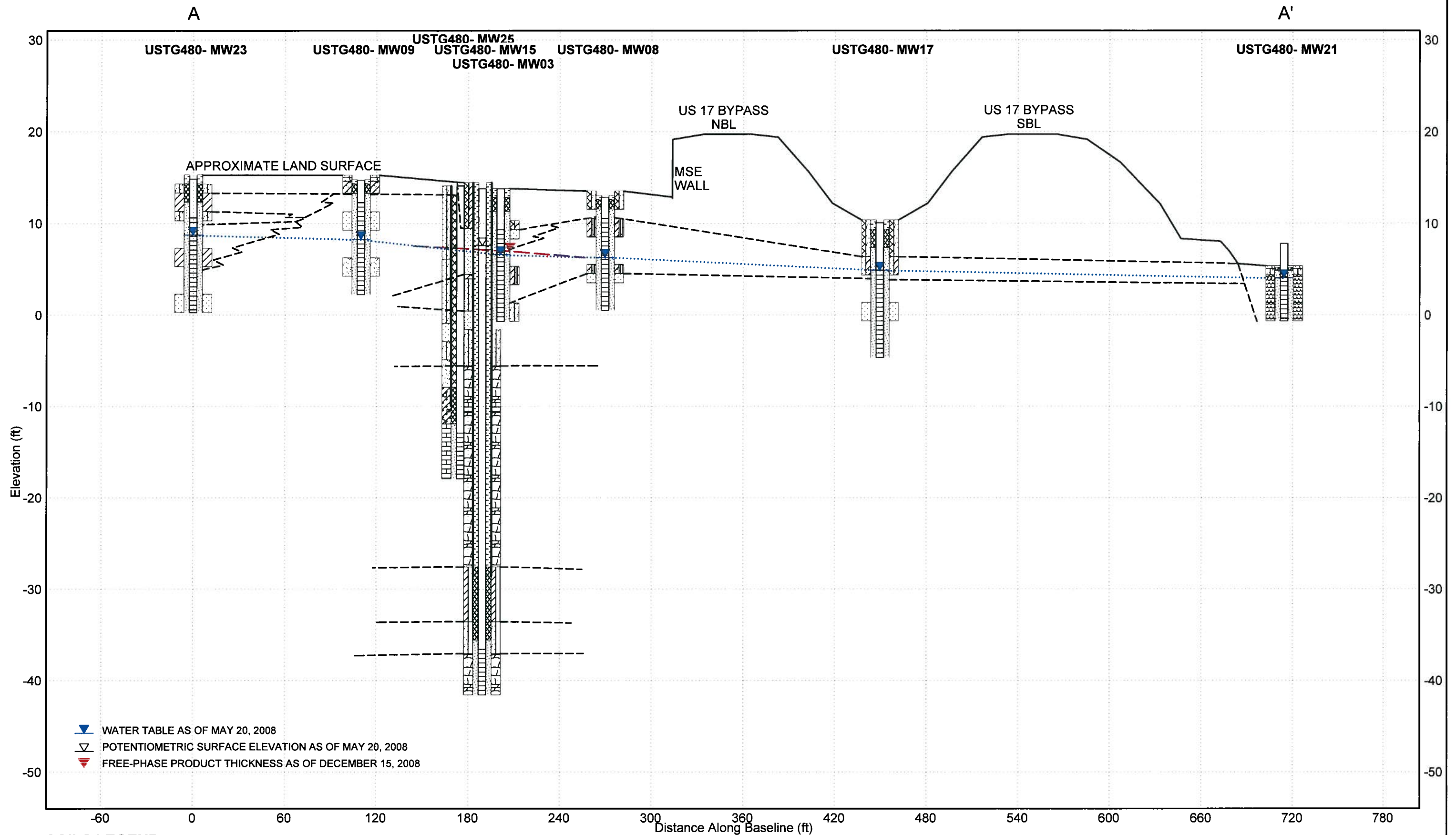


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PROJECT: REVISED ADDITIONAL ASSESSMENT AND CAP SITE TC-341 PIPELINE MARINE CORPS BASE CAMP LEJEUNE, NC
JOB NO: 206-111
DATE: OCT 2009

TITLE: SITE PLAN
SCALE: AS SHOWN
DRAWN BY: SAC
CHECKED BY: SVH

FIGURE 4



SOILS LEGEND

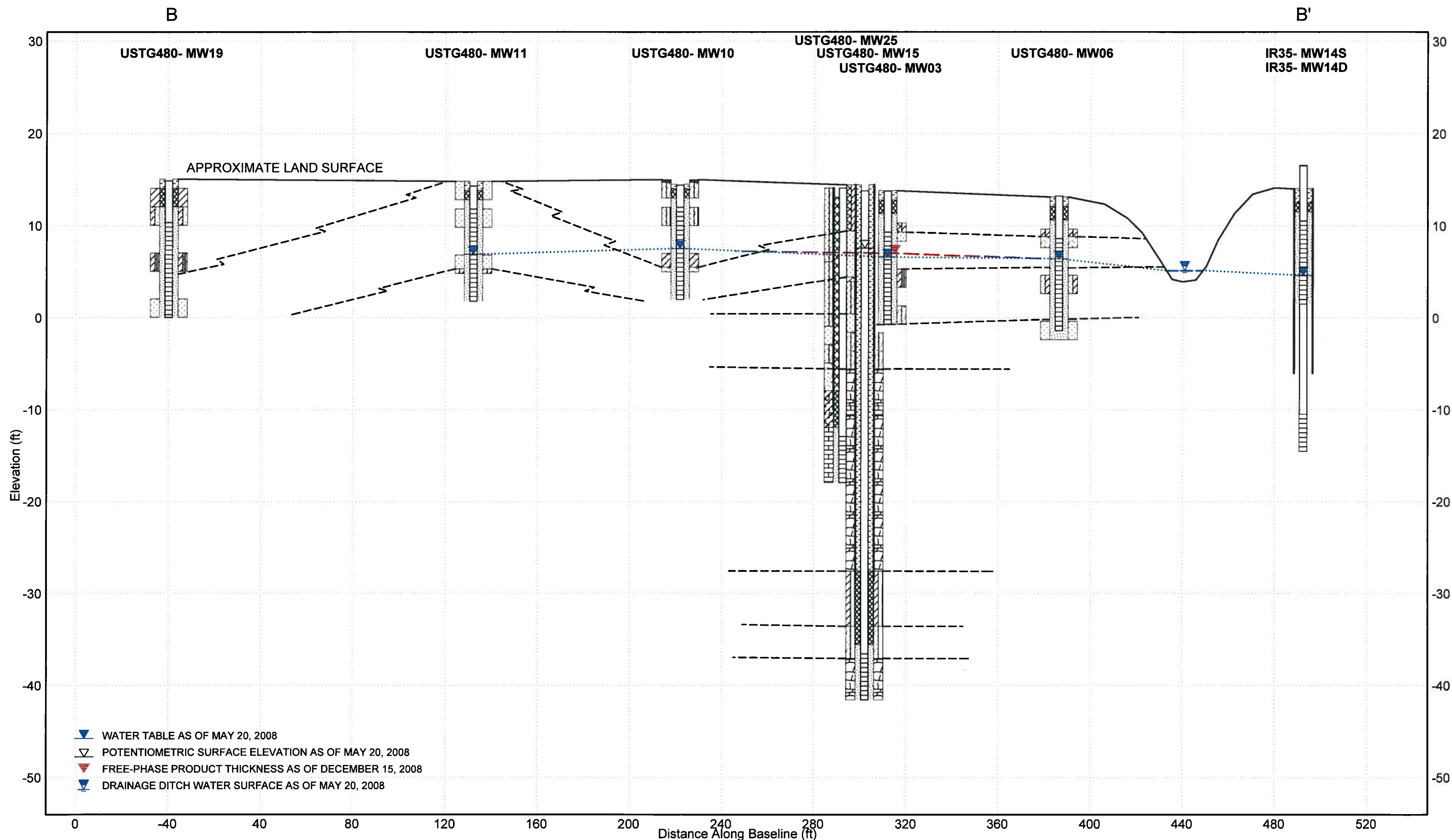
	CLAYEY SAND FILL		(SP) Poorly-graded Sand		(SC-SM) Clayey/Silty Sand		(SM) Silty Sand
	SILTY SAND FILL		Topsoil		(GW) Well-graded Gravel		(SC) Clayey Sand
	(SW) Well-graded Sand		(SP-SM) Poorly-graded Sand with Silt		Weathered Limestone		Limestone

WELL BACKFILL

	Portland Cement
	Bentonite Pellets
	#2 Medium Sand



PROJECT	REVISED ADDITIONAL ASSESSMENT AND CAP SITE TC-341 PIPELINE MARINE CORPS BASE CAMP LEJEUNE, NC			TITLE	CROSS SECTION A - A'			FIGURE	5A
JOB NO.	206-111	DATE	OCT 2009	SCALE	VERT. 1"=10' HORZ. 1"=60'	DRAWN BY	SVH	CHECKED BY	SVH



SOILS LEGEND

	CLAYEY SAND FILL		(SP) Poorly-graded Sand		(SC-SM) Clayey/Silty Sand		(SM) Silty Sand
	(SC-CL) Clayey Sand to Sandy Clay (SP-SM)		(SW) Well-graded Sand		Poorly-graded Sand with Clay		Asphalt
	Poorly-graded Sand with Silt		(SC) Clayey Sand		Interbedded Sand and Clay		Weathered Limestone

WELL BACKFILL

	Portland Cement
	Bentonite Pellets
	#2 Medium Sand

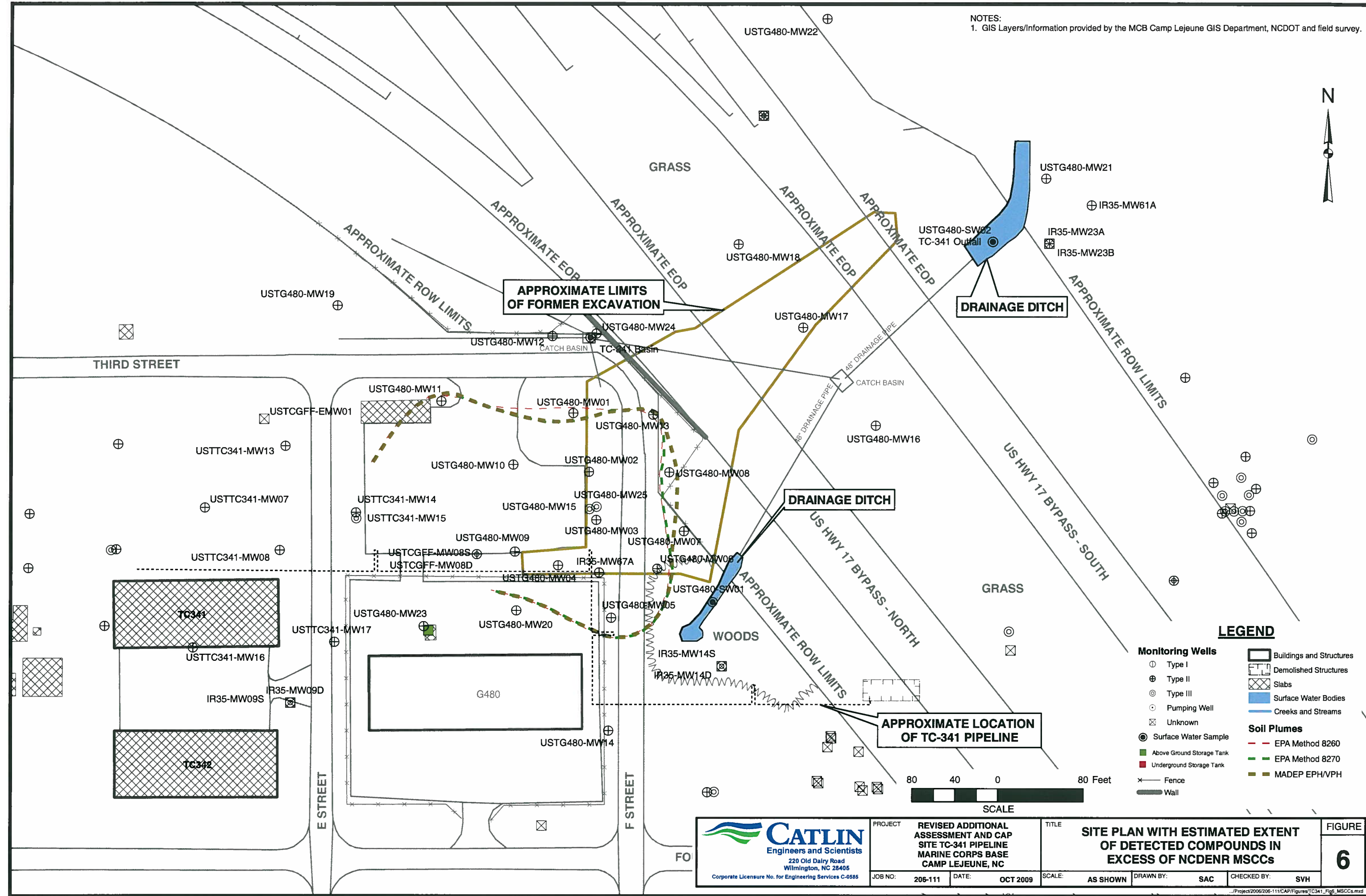


PROJECT	REVISED ADDITIONAL ASSESSMENT AND CAP SITE TC-341 PIPELINE MARINE CORPS BASE CAMP LEJEUNE, NC		
JOB NO.	206-111	DATE	OCT 2009

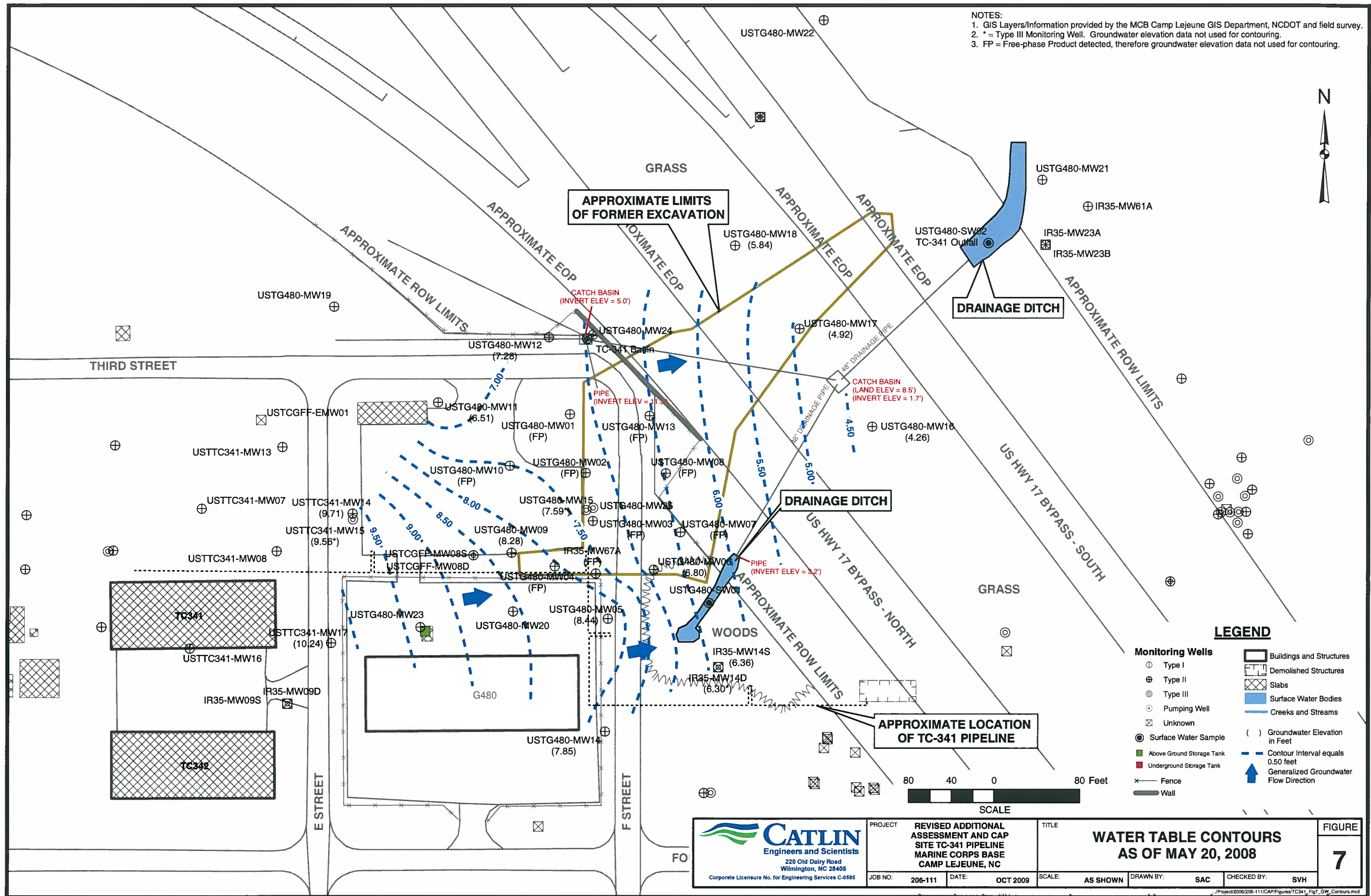
TITLE	CROSS SECTION B - B'		
SCALE	VERT. 1"=10'	DRAWN BY	SVH
	HORZ. 1"=60'	CHECKED BY	SVH

FIGURE
5B

NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.



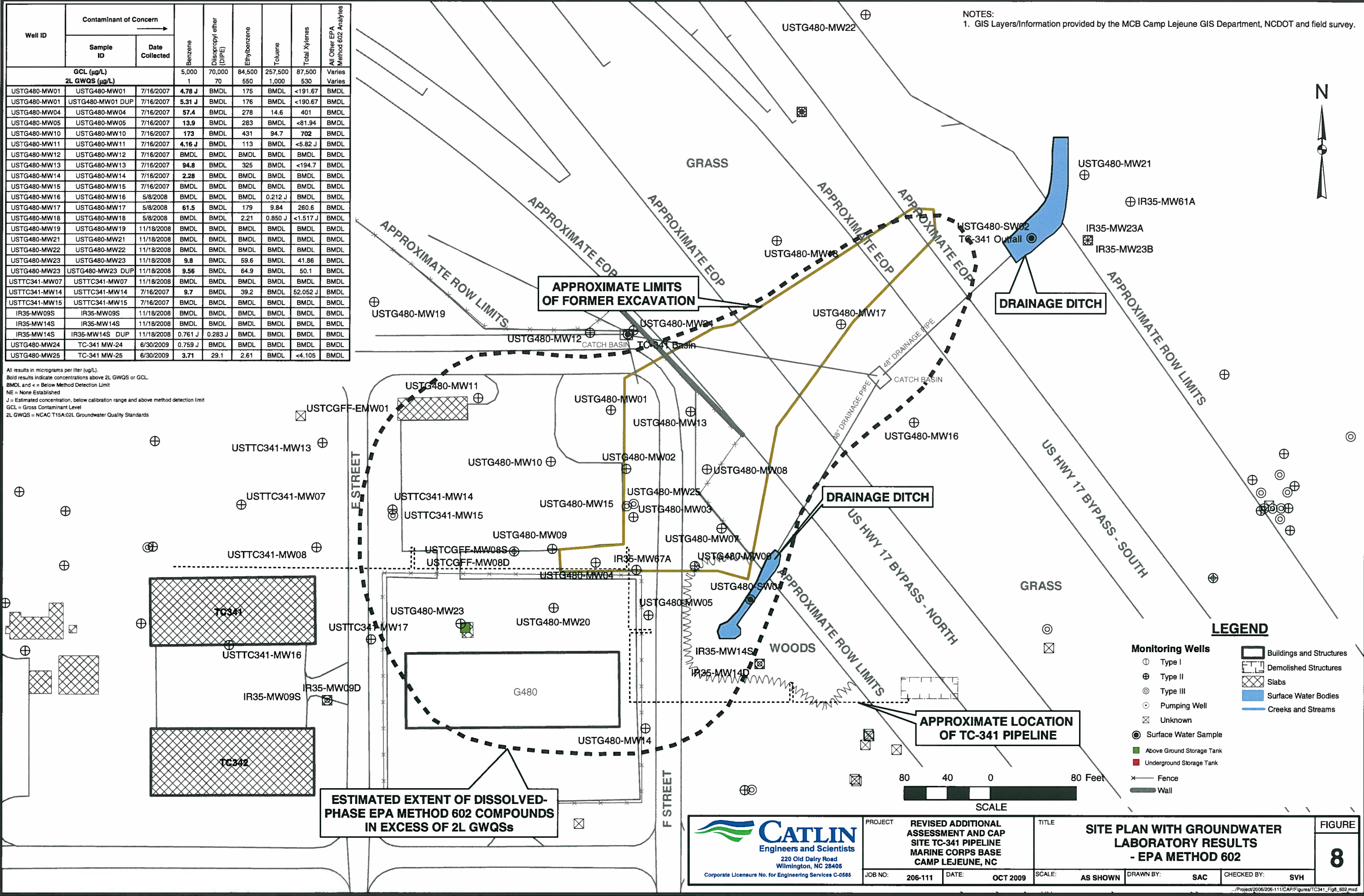
NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.
2. * = Type III Monitoring Well. Groundwater elevation data not used for contouring.
3. FP = Free-phase Product detected, therefore groundwater elevation data not used for contouring.



Well ID	Contaminant of Concern		Benzene	Disinfection byproduct (DBP)	Ethylbenzene	Toluene	Total Xylenes	All Other EPA Method 602 Analytes
	Sample ID	Date Collected						
	GCL (µg/L)		5,000	70,000	84,500	257,500	87,500	Varies
	2L GWQS (µg/L)		1	70	550	1,000	530	Varies
USTG480-MW01	USTG480-MW01	7/16/2007	4.78 J	BMDL	175	BMDL	<191.67	BMDL
USTG480-MW01	USTG480-MW01 DUP	7/16/2007	5.31 J	BMDL	176	BMDL	<190.67	BMDL
USTG480-MW04	USTG480-MW04	7/16/2007	57.4	BMDL	278	14.6	401	BMDL
USTG480-MW05	USTG480-MW05	7/16/2007	13.9	BMDL	283	BMDL	<81.94	BMDL
USTG480-MW10	USTG480-MW10	7/16/2007	173	BMDL	431	94.7	702	BMDL
USTG480-MW11	USTG480-MW11	7/16/2007	4.16 J	BMDL	113	BMDL	<5.82 J	BMDL
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW13	USTG480-MW13	7/16/2007	94.8	BMDL	325	BMDL	<194.7	BMDL
USTG480-MW14	USTG480-MW14	7/16/2007	2.28	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	0.212 J	BMDL	BMDL
USTG480-MW17	USTG480-MW17	5/8/2008	61.5	BMDL	179	9.84	260.6	BMDL
USTG480-MW18	USTG480-MW18	5/8/2008	BMDL	BMDL	2.21	0.850 J	<1.517 J	BMDL
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW23	USTG480-MW23	11/18/2008	9.8	BMDL	59.6	BMDL	41.86	BMDL
USTG480-MW23	USTG480-MW23 DUP	11/18/2008	9.56	BMDL	64.9	BMDL	50.1	BMDL
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
USTTC341-MW14	USTTC341-MW14	7/16/2007	9.7	BMDL	39.2	BMDL	52.052 J	BMDL
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S DUP	11/18/2008	0.761 J	0.283 J	BMDL	BMDL	BMDL	BMDL
USTG480-MW24	TC-341 MW-24	6/30/2009	0.759 J	BMDL	BMDL	BMDL	BMDL	BMDL
USTG480-MW25	TC-341 MW-25	6/30/2009	3.71	29.1	2.61	BMDL	<4.105	BMDL

All results in micrograms per liter (µg/L).
 Bold results indicate concentrations above 2L GWQS or GCL.
 BMDL and < = Below Method Detection Limit
 NE = None Established
 J = Estimated concentration, below calibration range and above method detection limit
 GCL = Gross Contaminant Level
 2L GWQS = NCAC T15A-02L Groundwater Quality Standards

NOTES:
 1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.



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JOB NO: 206-111 DATE: OCT 2009

TITLE
SITE PLAN WITH GROUNDWATER LABORATORY RESULTS - EPA METHOD 602

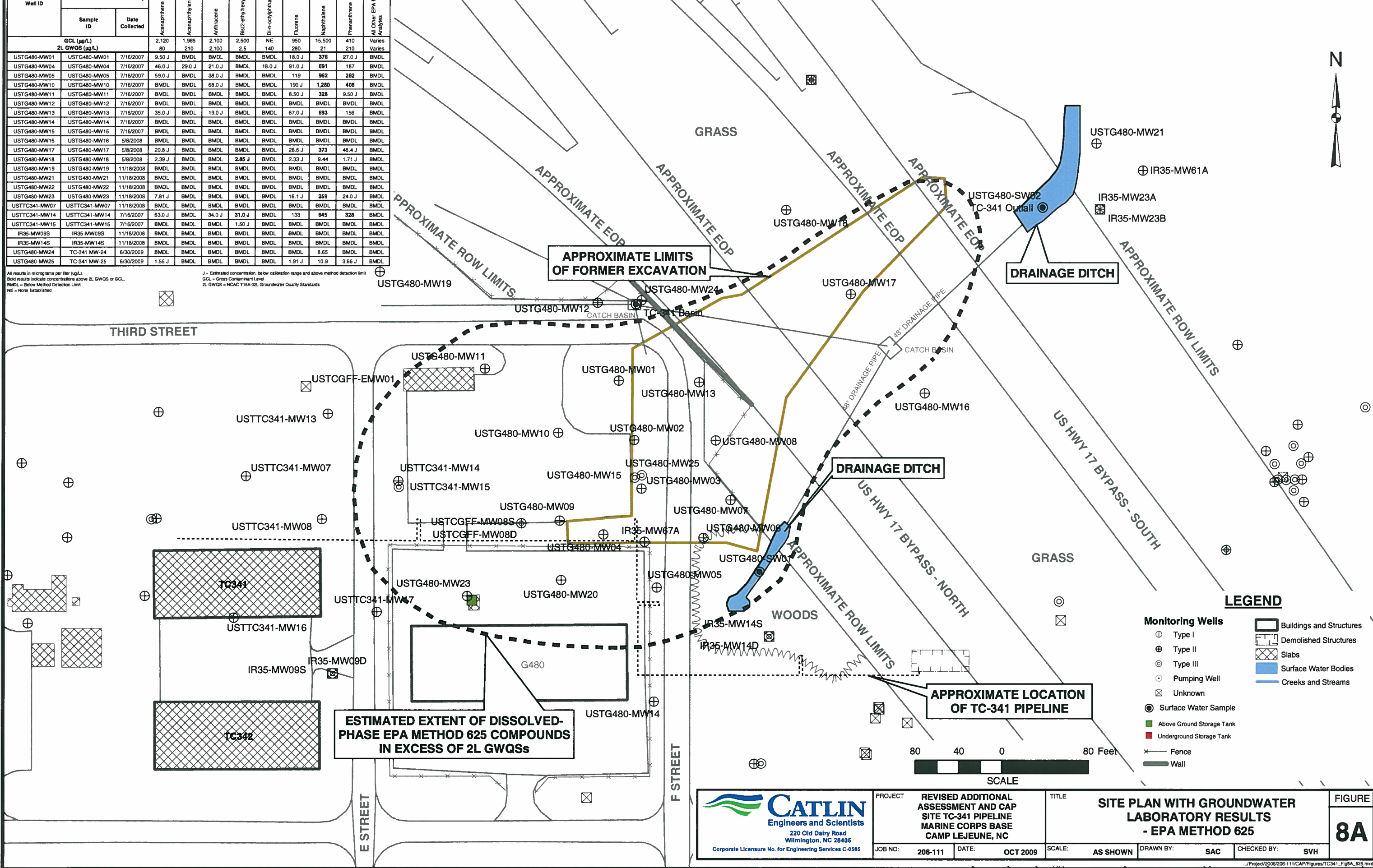
SCALE: AS SHOWN DRAWN BY: SAC CHECKED BY: SVH

FIGURE
8

Well ID	Contaminant of Concern		Date Collected	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Fluorene	Naphthalene	Phenanthrene	All Other EPA Method 625 Analytes
	Sample ID	Date Collected											
GCL (µg/L)				2,120	1,965	2,100	2,500	NE	950	15,500	410	Varies	
2L GWQS (µg/L)				80	210	2,100	2.5	140	280	21	210	Varies	
USTG480-MW01	USTG480-MW01	7/16/2007	9.50 J	BMDL	BMDL	BMDL	BMDL	18.0 J	378	27.0 J	BMDL		
USTG480-MW04	USTG480-MW04	7/16/2007	46.0 J	29.0 J	21.0 J	BMDL	18.0 J	91.0 J	691	187	BMDL		
USTG480-MW05	USTG480-MW05	7/16/2007	59.0 J	BMDL	38.0 J	BMDL	BMDL	119	962	262	BMDL		
USTG480-MW10	USTG480-MW10	7/16/2007	BMDL	BMDL	68.0 J	BMDL	BMDL	190 J	1,280	408	BMDL		
USTG480-MW11	USTG480-MW11	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	8.50 J	328	9.50 J	BMDL		
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW13	USTG480-MW13	7/16/2007	35.0 J	BMDL	19.0 J	BMDL	BMDL	67.0 J	693	156	BMDL		
USTG480-MW14	USTG480-MW14	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW17	USTG480-MW17	5/8/2008	20.8 J	BMDL	BMDL	BMDL	BMDL	26.6 J	373	46.4 J	BMDL		
USTG480-MW18	USTG480-MW18	5/8/2008	2.39 J	BMDL	BMDL	2.85 J	BMDL	2.33 J	9.44	1.71 J	BMDL		
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW23	USTG480-MW23	11/18/2008	7.81 J	BMDL	BMDL	BMDL	BMDL	16.1 J	259	24.0 J	BMDL		
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTTC341-MW14	USTTC341-MW14	7/16/2007	63.0 J	BMDL	34.0 J	31.0 J	133	645	328	BMDL	BMDL		
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	1.50 J	BMDL	BMDL	BMDL	BMDL	BMDL		
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL		
USTG480-MW24	TC-341 MW-24	6/30/2009	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	8.65	BMDL	BMDL		
USTG480-MW25	TC-341 MW-25	6/30/2009	1.55 J	BMDL	BMDL	BMDL	BMDL	1.91 J	10.9	3.66 J	BMDL		

All results in micrograms per liter (µg/L).
 Bold results indicate concentrations above 2L GWQS or GCL.
 BMDL = Below Method Detection Limit
 NE = None Established
 J = Estimated concentration, below calibration range and above method detection limit
 GCL = Gross Contaminant Level
 2L GWQS = NCAC 115A.02, Groundwater Quality Standards

NOTES:
 1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.



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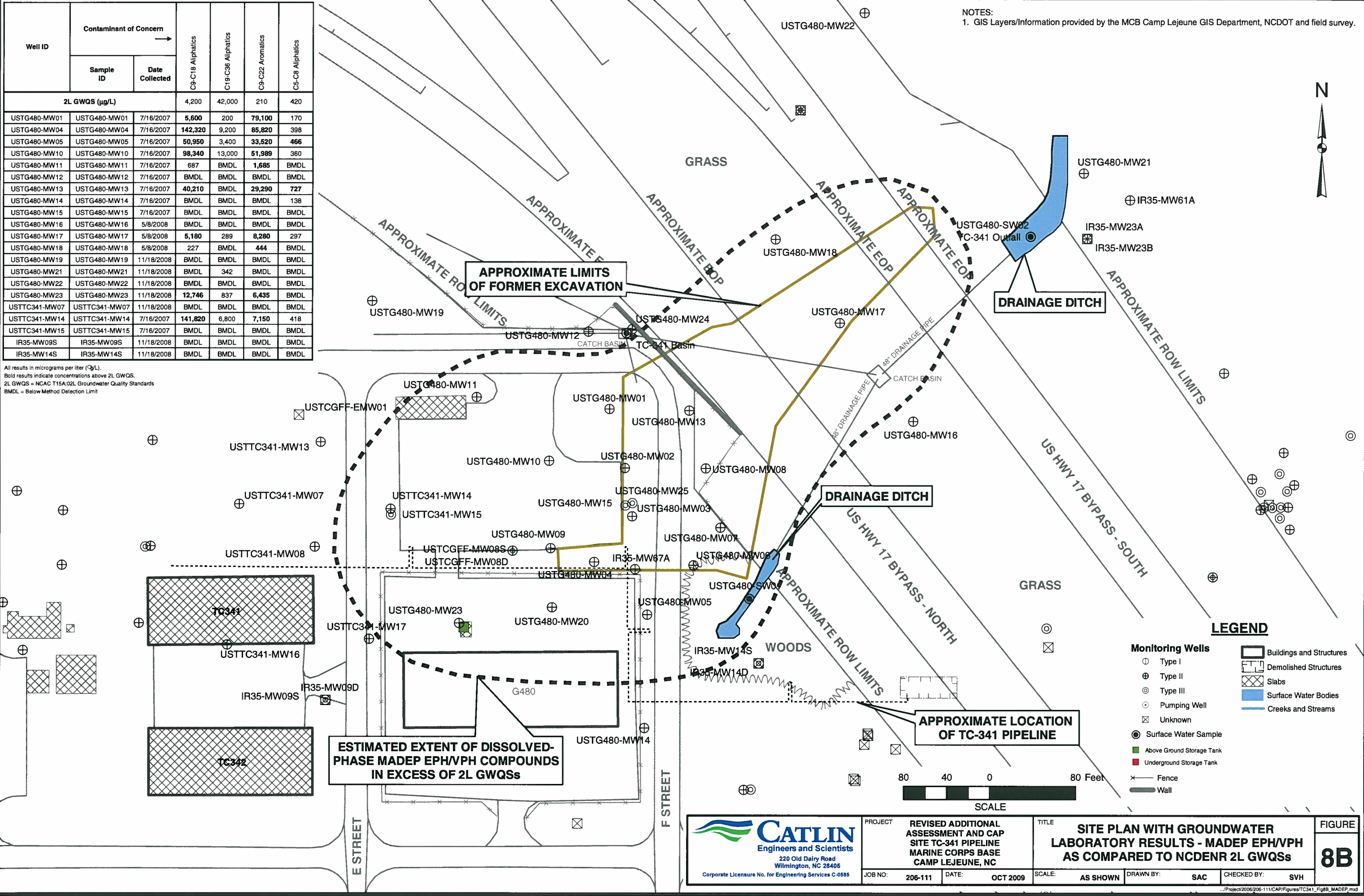
PROJECT	REVISED ADDITIONAL ASSESSMENT AND CAP SITE TC-341 PIPELINE MARINE CORPS BASE CAMP LEJEUNE, NC		TITLE	SITE PLAN WITH GROUNDWATER LABORATORY RESULTS - EPA METHOD 625		FIGURE	8A
JOB NO:	206-111	DATE:	OCT 2009	SCALE:	AS SHOWN	DRAWN BY:	SAC
						CHECKED BY:	SVH

.../Project/2006/206-111/CAP/Figures/TC341_Fig8A_625.mxd

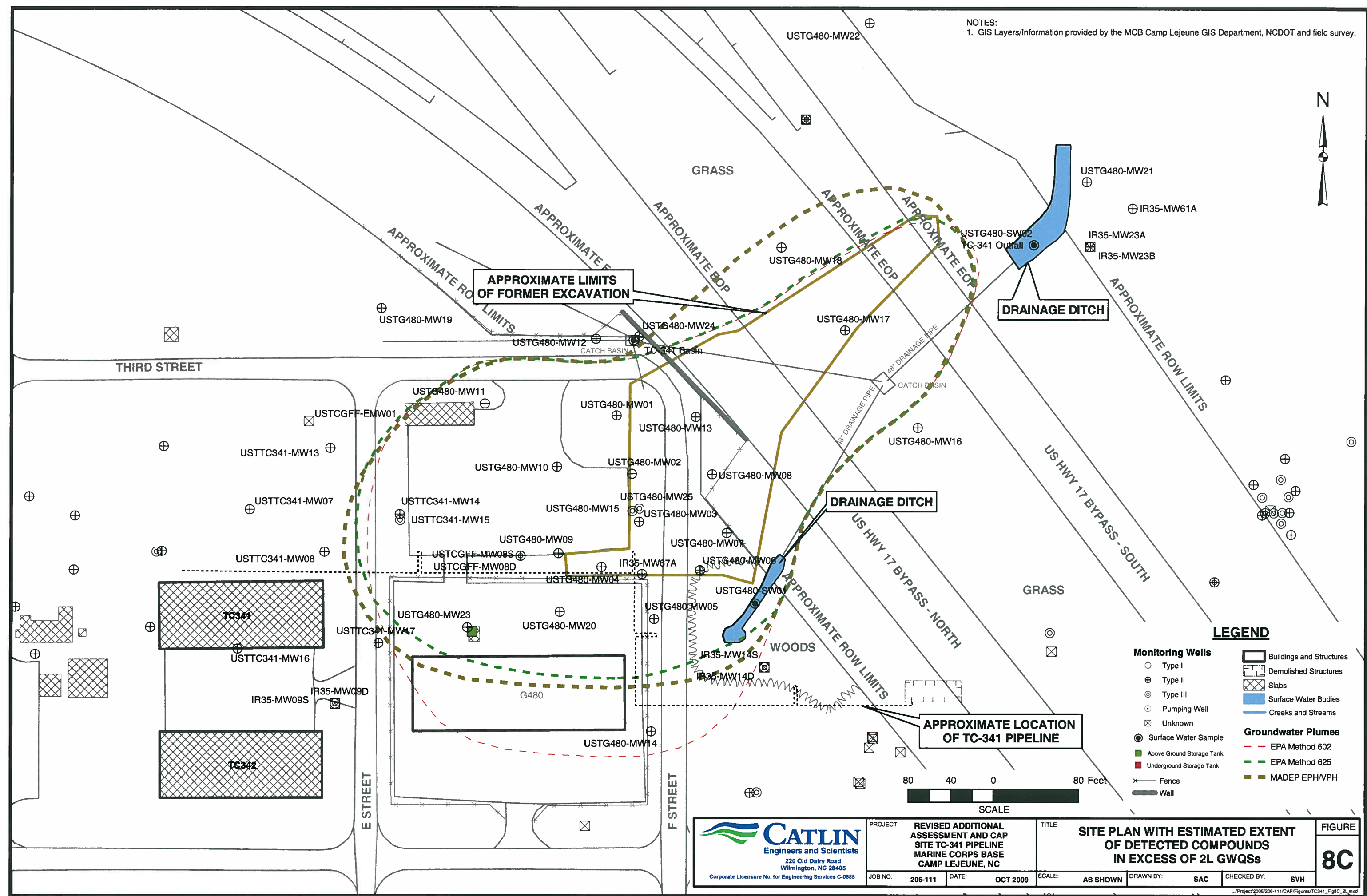
Well ID	Contaminant of Concern		C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics	C5-C8 Aliphatics
	Sample ID	Date Collected				
2L GWQS (µg/L)			4,200	42,000	210	420
USTG480-MW01	USTG480-MW01	7/16/2007	5,600	200	79,100	170
USTG480-MW04	USTG480-MW04	7/16/2007	142,320	9,200	85,820	398
USTG480-MW05	USTG480-MW05	7/16/2007	50,950	3,400	33,520	466
USTG480-MW10	USTG480-MW10	7/16/2007	98,340	13,000	51,989	360
USTG480-MW11	USTG480-MW11	7/16/2007	687	BMDL	1,685	BMDL
USTG480-MW12	USTG480-MW12	7/16/2007	BMDL	BMDL	BMDL	BMDL
USTG480-MW13	USTG480-MW13	7/16/2007	40,210	BMDL	29,290	727
USTG480-MW14	USTG480-MW14	7/16/2007	BMDL	BMDL	BMDL	138
USTG480-MW15	USTG480-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL
USTG480-MW16	USTG480-MW16	5/8/2008	BMDL	BMDL	BMDL	BMDL
USTG480-MW17	USTG480-MW17	5/8/2008	5,180	289	8,280	297
USTG480-MW18	USTG480-MW18	5/8/2008	227	BMDL	444	BMDL
USTG480-MW19	USTG480-MW19	11/18/2008	BMDL	BMDL	BMDL	BMDL
USTG480-MW21	USTG480-MW21	11/18/2008	BMDL	342	BMDL	BMDL
USTG480-MW22	USTG480-MW22	11/18/2008	BMDL	BMDL	BMDL	BMDL
USTG480-MW23	USTG480-MW23	11/18/2008	12,746	837	6,435	BMDL
USTTC341-MW07	USTTC341-MW07	11/18/2008	BMDL	BMDL	BMDL	BMDL
USTTC341-MW14	USTTC341-MW14	7/16/2007	141,820	6,800	7,150	418
USTTC341-MW15	USTTC341-MW15	7/16/2007	BMDL	BMDL	BMDL	BMDL
IR35-MW09S	IR35-MW09S	11/18/2008	BMDL	BMDL	BMDL	BMDL
IR35-MW14S	IR35-MW14S	11/18/2008	BMDL	BMDL	BMDL	BMDL

All results in micrograms per liter (µg/L).
Bold results indicate concentrations above 2L GWQS.
2L GWQS = NCAC T15A-02L Groundwater Quality Standards
BMDL = Below Method Detection Limit

NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.



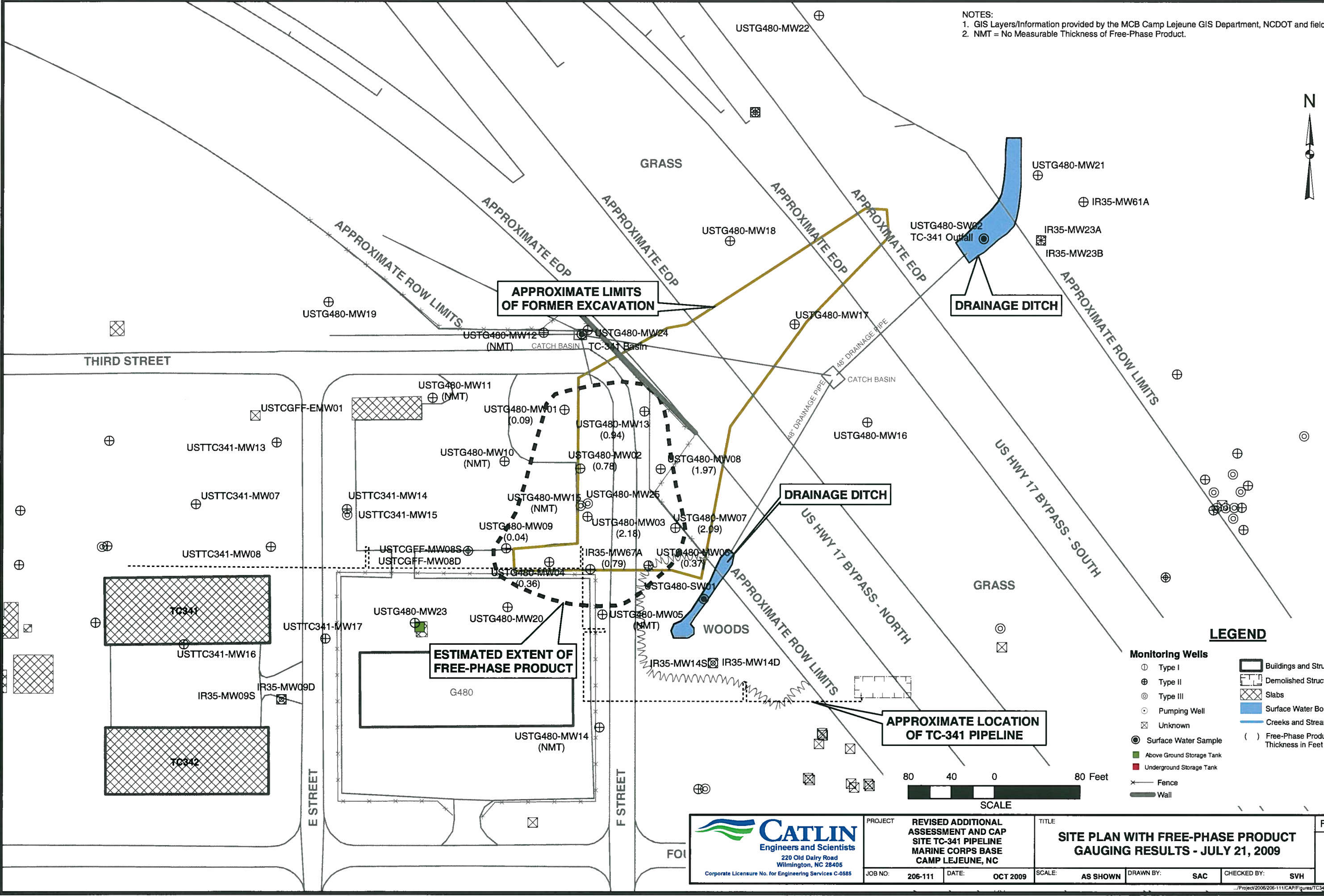
NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.



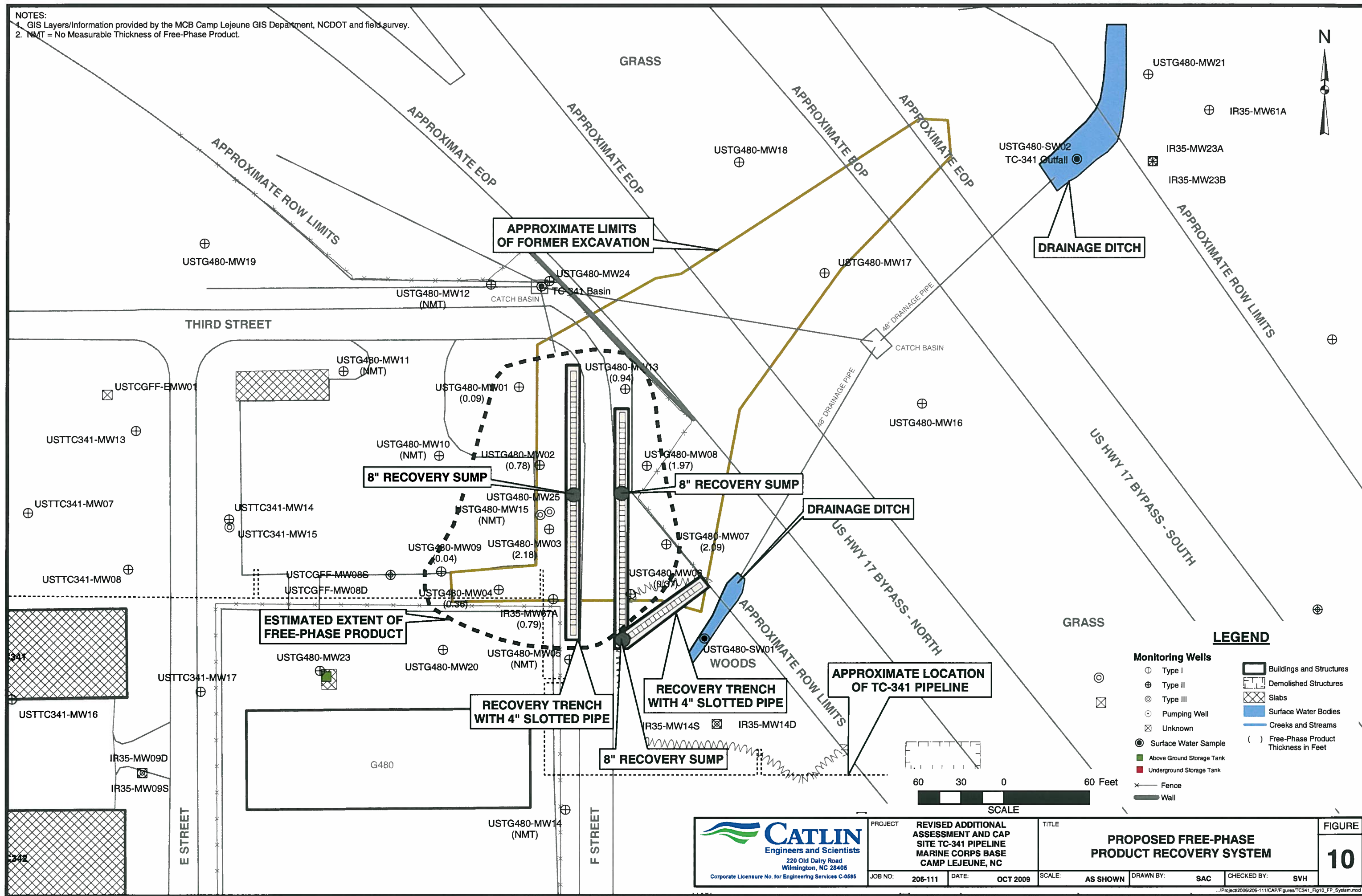
LEGEND

- | | |
|---------------------------|---------------------------|
| Monitoring Wells | Buildings and Structures |
| Type I | Demolished Structures |
| Type II | Slabs |
| Type III | Surface Water Bodies |
| Pumping Well | Creeks and Streams |
| Unknown | |
| Surface Water Sample | Groundwater Plumes |
| Above Ground Storage Tank | EPA Method 602 |
| Underground Storage Tank | EPA Method 625 |
| Fence | MADEP EPH/VPH |
| Wall | |

 CATLIN Engineers and Scientists 220 Old Dairy Road Wilmington, NC 28405 Corporate License No. for Engineering Services C-0585	PROJECT REVISED ADDITIONAL ASSESSMENT AND CAP SITE TC-341 PIPELINE MARINE CORPS BASE CAMP LEJEUNE, NC	TITLE SITE PLAN WITH ESTIMATED EXTENT OF DETECTED COMPOUNDS IN EXCESS OF 2L GWQSS	FIGURE 8C
	JOB NO: 206-111 DATE: OCT 2009	SCALE: AS SHOWN DRAWN BY: SAC CHECKED BY: SVH	



NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.
2. NMT = No Measurable Thickness of Free-Phase Product.



APPENDIX A
NCDENR NORR

**State of North Carolina
Department of Environment
and Natural Resources
Wilmington Regional Office
Division of Waste Management
UST Section**

**Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director**



September 25, 2008

Commanding Officer
Attn: I&E/EMD/EQB (J. Arnold, Bldg. 12)
PSC Box 20004
MCB Camp Lejeune, NC 28542-0004

Subject: Review of Report Entitled "Leaking
 Underground Storage Tank
 Comprehensive Site Assessment
 Report For Site G480"
 TC-341 Pipeline Incident
 Camp Lejeune, Onslow County
 Incident No. 32505

Dear Dr. Arnold:

Thank you for submitting the subject "Comprehensive Site Assessment" (CSA) report to the UST Section on September 4, 2008, and additional information on September 24, 2008. This report was understood to address contamination from the UST formerly located at Building G480, but instead has focused on an apparent former pipeline release north of Building G480. The Division will consider the pipeline release a commercial-nonregulated UST system release due to the calculations received from the Base on September 24, 2008.

No investigation was performed to further assess conditions at the former UST location of UST G480. Due to the fact that the release from the former UST at G480 has not been properly addressed to-date, another letter will be sent to Camp Lejeune regarding UST incident number 23444 that was discovered in January 1994. The TC-341 pipeline release has been assigned incident number 32505.

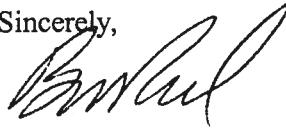
There is a major discrepancy between the 1994 Law report and the subject report concerning the location of MW-14. One report has the well located east of F Street, and one report has the well located west of F Street. Please let us know which one is correct.

Also, looking at the Law report, there was a geophysical anomaly discovered along F Street just north of the reported location of a former gasoline station at Bldg. 341. If the Base is concerned about the possibility of tanks still in the ground and possible contamination around the former gasoline station, subsurface investigation and reporting is recommended in these areas.

Assessment of the pipeline incident is incomplete. Please complete the assessment, and it can be presented in the Corrective Action Plan as proposed. However, the document should be titled so that the reader can determine that additional assessment information is contained within the document. Please see the document entitled *UST Section Guidelines for Assessment and Corrective Action for UST Releases* for assessment and cleanup criteria. This document may be found at the following Internet address, http://www.wastenotnc.org/ust/docs/aca_body.pdf. The Corrective Action Plan is due by November 25, 2008.

If you have any questions concerning this letter, please contact me at (910) 796-7400.

Sincerely,



Bruce Reed
Hydrogeologist II

cc: WiRO-UST

s:\bruce\arnoldtc341pipeline.sep

APPENDIX B

CATLIN STANDARD METHODS OF INVESTIGATION

CATLIN STANDARD METHODS OF INVESTIGATION

1.0 DATA COLLECTION

1.1 BACKGROUND DATA

Background data and history information relevant to the site investigation is generated through numerous sources. These sources may include, but are not limited to, the following:

- Conversations with the client and regulatory officials involved with the incident.
- Review of pertinent regulatory correspondence.
- Review of previous and existing reports and other technical data.
- Review of available historical records.

1.2 SURVEYS AND POTENTIAL RECEPTOR DATA

Physical survey and potential receptor data are collected in accordance with the intended level of investigation. In general, the purpose is to collect sufficient information for site assessment and corrective action planning.

Individual receptors are identified and evaluated in the context of their potential for contaminant impact. Potential receptors of contamination can include surface water bodies, groundwater supply wells, wellhead protection areas, and subsurface building structures.

1.2.1 Horizontal Survey

Horizontal survey data are generated using either accepted general field surveying techniques, or existing survey maps; or by using a combination of existing data and field generated information. The survey area generally extends to a point at least 50 feet beyond suspected plume boundaries. A receptor scale survey of a larger area surrounding a site will be made if appropriate and necessary.

1.2.2 Vertical Survey

A vertical survey is conducted at the site typically within an accuracy of 0.01 foot. The datum plane is generally assumed unless otherwise noted. Assumed temporary benchmarks (TBM) are selected near ground level. The vertical survey includes such points as top of all well casings, selected ground shots, important utility inverts, utility fluid levels, important surface water levels, and other items determined to be significant.

1.3 DRILLING AND MONITORING WELL/PIEZOMETER INSTALLATION

Necessary permits are applied for and obtained in accordance with federal, state, and local requirements prior to drilling or well construction activities. Additionally, the well locations are scanned for underground utilities prior to conducting intrusive subsurface activities. Wells are installed under applicable licensing requirements, and are designed and constructed in accordance with accepted standards and practices. Any wells purposely installed at off-site locations are permitted through appropriate right-of-entry agreements with all necessary property owners and/or their agents.

1.3.1 Drilling Methods and Subsurface Data Collection

Drilling is accomplished utilizing one or more of the following methods:

Auger Drilling

Auger drilling is the preferred, most often used method of subsurface investigation and is accomplished using a vehicle or trailer mounted drill rig. Continuous flight auger types used vary upon the site and situation; ranging from the 4-inch outside diameter solid stem to the 12-inch outside diameter hollow stem. Auger type is selected based upon appropriateness and/or site-specific requirements.

Hand Augering

Hand augering is utilized when economically and scientifically feasible, or when no other method is suitable. Hand augers typically produce three-inch diameter holes and are generally limited to depths of less than 15 feet.

Direct Push

Direct push methods of subsurface investigation are used generally for soil screening purposes or collection of groundwater samples where permanent wells are not viable.

Other Methods

Other drilling methods, such as mud and air rotary, rock coring, cable tool, and large bucket augering are used when site conditions or project requirements dictate.

Regardless of the drilling method used, the drill rig(s) and all drilling tools are thoroughly cleaned between boreholes to prevent cross introduction of contaminants. Split spoon samples are collected and field-described at intervals of five feet or less, and cuttings are continuously monitored for organic vapors. Drill cuttings are containerized for off-site disposal or are spread on the ground surface in proximity to the well or boring in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) requirements. A geologist or engineer, trained in using visual/manual techniques, is always present during drilling and is

responsible for subsurface contaminant and geologic data collection. Soils are classified in general agreement with the Unified Soils Classification System (USCS).

1.3.2 Hydropunch Installation

Hydropunch penetrometers (Hydropunches) are used to delineate the spatial extent of dissolved and free phase plumes. Soil borings are advanced to the appropriate depth and then the Hydropunch is advanced through the soil boring into undisturbed material. Groundwater samples are collected by pulling back on the body of the Hydropunch and allowing the groundwater to enter the screened portion of the sample chamber. Samples are retrieved using a decontaminated Teflon bailer or peristaltic pump.

1.3.3 Well Installation

Wells are typically constructed of threaded PVC casing and screen. No glues or cements are used in joining PVC components. Well diameter, slot sizes, and protective covers vary depending upon site-specific conditions or situation-specific requirements.

1.3.4 Well Development

Wells are developed by over-pumping or surging using appropriate pumps, blocks, or bailers. Through development, unwanted fine materials are removed from the natural formation surrounding the well. Well development will be performed no sooner than 24-hours after grouting is completed for the Type III wells. Water generated during development is containerized and properly disposed or is discharged onto the ground in proximity of the well in accordance with NCDENR requirements.

1.4 HYDROGEOLOGIC DATA COLLECTION

Data used to help characterize hydrogeologic conditions at a site are obtained through various procedures including, but not necessarily limited to, those described below:

1.4.1 Regional Geology

Information pertaining to the regional geologic framework is compiled from existing publications, maps, and scientific papers.

1.4.2 Site Geology

Shallow site geology is generally determined from field descriptions and borehole samples. Interpretations with regard to hydrogeologically important contacts, zones, fractures, faults, cleavage, and facies changes are made when possible.

1.4.3 Groundwater Occurrence and Characteristics

Groundwater data is obtained utilizing a number of methods and procedures, not limited to the general list below:

Well Water Levels

After well development, wells are allowed to stabilize for a minimum of 24 hours prior to measuring. Water level and free product thickness (where applicable) measurements are performed using an electronic interface probe or steel tape with water/product finding pastes.

The specific gravity of any accumulated product is determined and used to calculate true hydraulic grade from measured water levels. This information is combined with vertical survey data to determine relative potentiometric surface elevations for all wells.

Aquifer Testing

Various aquifer tests may be used to make determinations of hydraulic conductivity. Slug or pumping tests are often used to characterize site hydrogeologic conditions and to develop remedial action alternatives utilizing appropriate pumping technologies.

Other Methods

Other methods may be deemed appropriate for determining various groundwater characteristics. These other methods may include nested well configurations and/or clustered piezometer installations; sieve or pipette analysis; fracture trace analysis; computer modeling; and geophysical logging.

1.5 PETROLEUM HYDROCARBON DATA COLLECTION

1.5.1 Collection Methods

Petroleum hydrocarbon data is obtained through various methods including, but not limited to, the following:

Field Analysis

- Direct thickness measurement of phase separated components using tapes and/or probes.
- Manual vapor analysis using a photoionization detector (PID) or flame ionization detector (FID).
- Detectable odor and visual observation.

Laboratory Analysis

- Laboratory analysis of phase-separated products.

- Laboratory vapor, soil, and groundwater analysis using appropriate EPA Methods.

1.5.2 Field Sampling

Field sampling procedures are performed in accordance with recommended protocol, accepted industry standards, and under appropriate chain-of-custody procedures. Generally, sampling procedures are as follows:

Product Samples

Product samples are obtained using clean equipment and containers. Each is shipped to the analytical laboratory in protective containers.

Vapor Samples

PID/FID readings are measured from soil sample headspace using containerized samples that have been brought to ambient temperature.

Carbon tubes are utilized in conjunction with a laboratory-calibrated vacuum pump to obtain vapor samples. The carbon tubes are sealed and refrigerated for shipment to the analytical laboratory (This method is known as the Carbon Adsorption Method).

Soil Samples

Soil samples are immediately packed into clean containers, and refrigerated for shipment to the analytical laboratory.

Groundwater Samples

Groundwater samples are collected in accordance with the following procedures:

- Creeks/Lakes/Etc.

Grab samples are obtained.

- Domestic Wells

Wells are pumped for a time sufficient to completely purge the well and any pressure or holding tanks prior to sampling.

- Monitoring Wells

Water level measurements are made and well volumes calculated for each well.

Three well volumes are removed from each well using a thoroughly cleaned Teflon bailer or appropriate purging pump. If it is not possible to

remove three volumes, due to very low yields, a minimum of one volume is removed prior to obtaining a sample.

Where analysis for metals is required, wells are typically sampled utilizing low flow techniques, which reduce turbidity and the potential for matrix interference.

Samples are collected and containerized in a manner that minimizes agitation and contact with the air.

Sampling records are field prepared.

Samples are labeled and proper Chain-of-Custody documents are maintained.

Samples are promptly protectively packed, refrigerated, and shipped to the analytical laboratory for analysis.

2.0 DATA EVALUATION

Data obtained as a result of the site investigation is compiled and evaluated and a report is prepared for client review and distribution to the appropriate agencies. Generally, specific data are evaluated as follows:

- Background data are evaluated in context with the suspected or confirmed problem.
- Survey data are utilized to develop site maps and to evaluate contaminant receptors.
- Well construction records are compiled and presented as part of the report. As-built information is used in combination with other data to evaluate subsurface conditions and monitoring well screen settings as they relate to the investigation.
- Subsurface drilling logs are used to develop geologic cross-sections, fence diagrams, isopaths, structure contours, or other constructions. Regional geologic data are used to obtain an overall framework.
- Hydrogeologic data are used to develop contour maps, flow nets and other constructions. The data is also used to calculate various hydrogeologic parameters that describe aquifer characteristics.
- Hydrocarbon data are utilized to develop various plume geometry and isoconcentration maps.
- All data are compiled and utilized for making specific recommendations with regard to remedial action alternatives.

APPENDIX C

BORING LOGS, MONITORING WELL CONSTRUCTION DETAILS, AND NORTH CAROLINA WELL CONSTRUCTION RECORDS

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

WELL LOG

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SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: TC-341 Pipeline		LOGGED BY: BAKER	WELL ID: USTCGFF-MW14A
		DRILLER: BAKER	
NORTHING: 3846795.4	EASTING: 275571.0	CREW: BAKER	
SYSTEM: UTM NAD83 (m)		BORING LOCATION:	T.O.C. ELEV.: 17.78
DRILL MACHINE:		METHOD:	0 HOUR DTW:
START DATE:		FINISH DATE: 8/20/91	24 HOUR DTW:
			TOTAL DEPTH: 12.5
			WELL DEPTH: 12.5

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in							
									0.0 LAND SURFACE	15.3	2.5 0.0
											2" Sch. 40 PVC 1.5 2.5 3.5
											2" Slot 010 Sch. 40 PVC 12.0 12.5
									Boring Terminated at Elevation 2.8 ft		12.5

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

WELL LOG

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SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW02	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846850.6	EASTING: 275533.1	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION:	T.O.C. ELEV.: 15.07	
DRILL MACHINE: Diedrich D-50	METHOD: HSA	0 HOUR DTW: 7.6	TOTAL DEPTH: 15.0
START DATE: 5/22/07	FINISH DATE: 5/22/07	24 HOUR DTW:	WELL DEPTH: 14.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
6in	6in	6in	6in								
									0.0 LAND SURFACE	15.1	0.0
3.0											1.5
	3	7	7	9	1635	UST G480-MW02 (3-5)*	SM		Lt. brownish gray, SILTY, f. SAND. Trace clay in top of sample. Slight HCO.	12.1	2.5
									5.0	10.1	
8.0											
	2	5	5	5	>3982		SC/SM		Gray to lt. brown, SILTY/CLAYEY, f. SAND. Poorly sorted. Strong HCO w/sheen on spoon.	7.1	
									10.0	5.1	
13.0											
	1	1	0	1	1276		SP		Gray to orange brown, f. SAND w/trace silt. Slight HCO.	2.1	13.5
									15.0	0.1	14.0
									Boring Terminated at Elevation 0.1 ft * Duplicate Taken		15.0

CATLIN BORING LOG - 206-111 SITE G480 GEL TEST GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

WELL LOG

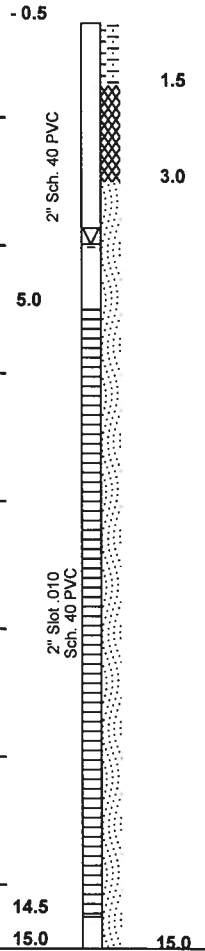
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SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW03	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846837.0	EASTING: 275535.2	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION:	T.O.C. ELEV.: 14.90	
DRILL MACHINE: Diedrich D-50	METHOD: HSA	0 HOUR DTW: 7.50*	TOTAL DEPTH: 15.0
START DATE: 5/16/07	FINISH DATE: 5/16/07	24 HOUR DTW:	WELL DEPTH: 15.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
6in	6in	6in	6in									
									0.0	LAND SURFACE	15.4	0.0
4.0									4.0		11.4	
	2	5	8	9	>3395	UST G480-MW03 (4-6)	SC		5.0	Brown to drk. brown, CLAYEY, f. SAND. Strong HCO.	10.4	5.0
							SP		6.0	Lt. brown, f. SAND w/trace med. grains. Strong HCO.	9.4	
9.0									9.0		6.4	
	2	5	9	9	>3395		SC/SM		11.0	Orange brown, SILTY, f. SAND w/interbedded clayey sand. Strong HCO.	4.4	
13.0									13.0		2.4	
	0	1	1	1	115.6		SM		15.0	Dark greenish gray, SILTY, f. SAND. Strong HCO.	0.4	14.5
												15.0
										Boring Terminated at Elevation 0.4 ft * = 0.70ft. Product		



CATLIN BORING LOG 206-111 SITE G480 G.P.J. TEST GDT 7/24/07

Portland Cement
 Bentonite Pellets
 #2 Medium Sand

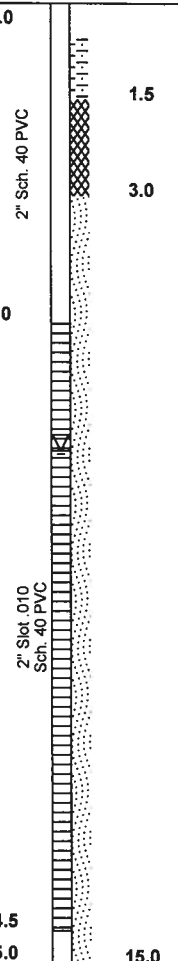
WELL LOG

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SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW04	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846824.0	EASTING: 275524.4	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION:	T.O.C. ELEV.: 15.39	
DRILL MACHINE: Diedrich D-50	METHOD: HSA	0 HOUR DTW: 7.0	TOTAL DEPTH: 15.0
START DATE: 5/16/07	FINISH DATE: 5/16/07	24 HOUR DTW:	WELL DEPTH: 15.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U	S	C	L	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
6in	6in	6in	6in												
												0.0	LAND SURFACE	15.4	0.0
4.0	1	1	3	4	>3395	UST G480-MW04 (4-6)	SC/					4.0	Brown, interbedded CLAYEY, f. SAND and SILTY, f. SAND. Thin layers of high plasticity clay. Strong HCO.	11.4	5.0
												6.0		9.4	
9.0	2	4	5	6	>3395		SW					9.0	Lt. brown, cse. to f. SAND w/some silt. Poorly sorted. Strong HCO.	6.4	
												11.0		4.4	
13.0	2	2	2	2	>3395		SP					13.0	Lt. brown to orange brown, f. SAND w/trace silt. Well sorted. Strong HCO.	2.4	
												15.0		0.4	14.5
													Boring Terminated at Elevation 0.4 ft		15.0



CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

Portland Cement
 Bentonite Pellets
 #2 Medium Sand

WELL LOG

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SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480		LOGGED BY: Tom Stetler	WELL ID: USTG480-MW05
		DRILLER: Bobbie D. Fowler	
NORTHING: 3846809.1	EASTING: 275539.5	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)		BORING LOCATION:	T.O.C. ELEV.: 15.34
DRILL MACHINE: Diedrich D-50	METHOD: HSA	0 HOUR DTW: 6.7	TOTAL DEPTH: 16.0
START DATE: 5/16/07	FINISH DATE: 5/16/07	24 HOUR DTW:	WELL DEPTH: 13.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION		ELEVATION	WELL DETAIL
	6in	6in	6in	6in					DEPTH			
									0.0	LAND SURFACE	15.3	0.0
												0.0
												1.0
												2.0
												3.0
4.0									4.0		11.3	
	3	3	5	5	>3395	UST G480 -MW05 (4-6)	SM		6.0	Dark brownish gray, SILTY, f. SAND. Strong HCO.	9.3	
									9.0		6.3	
9.0	2	2	2	4	1438		SC/ SM		11.0	Lt. brownish gray, SILTY/CLAYEY, f. SAND. Poorly sorted. Strong HCO.	4.3	
									14.0		1.3	
14.0	2	4	5	2	2170		CL		14.5	Dark brown, SANDY CLAY. Med. to low plasticity.	0.8	
							SP		16.0	Lt. orange brown, f. SAND. Strong HCO.	-0.7	
										Boring Terminated at Elevation -0.7 ft		16.0

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

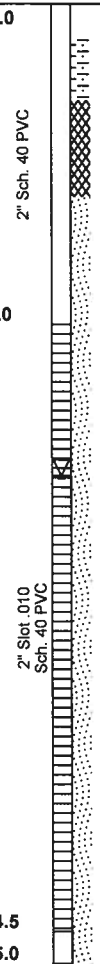
WELL LOG

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SHEET 1 OF 1

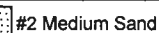
PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW06	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846823.1	EASTING: 275552.6	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION:	T.O.C. ELEV.: 14.35	
DRILL MACHINE: Diedrich D-50	METHOD: HSA	0 HOUR DTW: 7.4	TOTAL DEPTH: 16.0
START DATE: 5/16/07	FINISH DATE: 5/22/07	24 HOUR DTW:	WELL DEPTH: 15.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in							
									0.0 LAND SURFACE	14.4	0.0
4.0											
	1	6	8	9	>3395	UST G480-MW06 (4-6)	SC/CL		Brown, SANDY CLAY to CLAYEY, f. SAND. Strong HCO.	9.6	5.0
							SW		Lt. gray, f. SAND w/trace silt and med. cse. sand. Poorly sorted. Strong HCO.	8.4	
9.0											
	1	1	4	8	2040		SP/SC		Interbedded gray, f. SAND and CLAYEY, f. SAND. Strong HCO.	3.4	
14.0											
	1	1	1	1	1761		SP		Lt. brown, f. SAND w/trace silt. Strong HCO.	0.4	14.5
											15.0
									16.0 Boring Terminated at Elevation -1.7 ft	-1.7	16.0

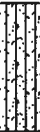
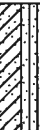


CATLIN BORING LOG 206-111 SITE G480.GPL TEST GDT 7/24/07

Portland Cement
 Bentonite Pellets
 #2 Medium Sand



SHEET 1 OF 1

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in							
0.0									0.0 LAND SURFACE	14.6	0.0
	9	8	8	7	6.8		SM		Brown, SILTY, v.f. SAND w/trace root frags near surface. No HCO.		-0.7
									2.0	12.6	1.0
3.0									3.0	11.6	2.0
	3	3	5	6	1213	USTG480 -MW08 (3-5)	SC/ SM		Grayish brown, SILTY/CLAYEY, v.f. SAND. Slight HCO.		3.0
									5.0	9.6	
8.0									8.0	6.6	
	1	2	5	6	>3848		SC/ SM		Brown to gray, SILTY/CLAYEY, v.f. SAND. Strong HCO.		2" Slot .010 Sch. 40 PVC
							SP		Brown, f. to v.f. SAND w/trace silt. Strong HCO.		
									10.0	4.6	
											12.5
											13.0
									Boring Terminated at Elevation 1.6 ft		13.0

 Portland Cement  Bentonite Pellets  #2 Medium Sand

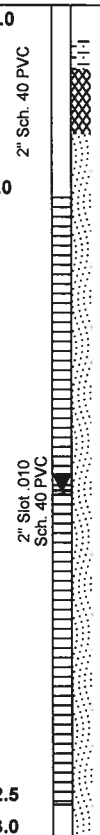
WELL LOG

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SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	DRILLER: Bobbie D. Fowler	WELL ID: USTG480-MW09
NORTHING: 3846827.9	EASTING: 275512.1	CREW: Anthony Chance	T.O.C. ELEV.:
SYSTEM: UTM NAD83 (m)	BORING LOCATION:	0 HOUR DTW: 7.6	TOTAL DEPTH: 13.0
DRILL MACHINE: Diedrich D-50	METHOD: HSA	24 HOUR DTW: 7.6	WELL DEPTH: 13.0
START DATE: 7/3/07	FINISH DATE: 7/3/07		

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U	S	C	S	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	WELL DETAIL
6in	6in	6in	6in											
0.0												0.0	LAND SURFACE	0.0
												0.3	Topsoil	0.0
												0.7	Deteriorated ASPHALT "rubble".	1.0
8	12	10	8	1217			SC					2.0	Brown, CLAYEY, f. to v.f. SAND. Mod. HCO.	2.0
														3.0
4.0												4.0		
5	6	8	11	>3923	USTG480-MW09 (4-6)		SP					6.0	Lt. brown, well sorted f. to v.f. SAND. Strong HCO.	
												9.0		
2	2	3	3	>3923			SW					11.0	Grayish brown, moderately sorted f. to med. SAND w/trace clay. Strong HCO.	
														12.5
														13.0
													Boring Terminated at Depth 13.0 ft	13.0



CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

Portland Cement
 Bentonite Pellets
 #2 Medium Sand

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

SHEET 1 OF 1

 Portland Cement  Bentonite Pellets  #2 Medium Sand

WELL LOG

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SHEET 1 OF 3

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW15	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846840.0	EASTING: 275533.3	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: Next to MW03	T.O.C. ELEV.: 14.91	
DRILL MACHINE: Diedrich D-50	METHOD: HSA/MR	0 HOUR DTW: NM	TOTAL DEPTH: 56.0
START DATE: 7/10/07	FINISH DATE: 7/12/07	24 HOUR DTW: 7.5	WELL DEPTH: 56.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U	S	C	L	O	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in										
0.0												0.0 LAND SURFACE	15.6	0.0
3.0	3	8	9	8	12.3									
5.0	5	6	7	6	87.0	USTG480-MW15 (2-4)	SC					Brown, SILTY to CLAYEY f. to v.f. SAND. Moist. Slight HCO.		
10.0	2	3	4	6	579.1							5.0	10.6	
15.0	5	5	4	3	688.0		SP					Lt. grayish brown, med. to v.f. SAND. Tr. silt. Wet with product between 6 and 8' BLS. Saturated at 10' BLS. Strong HCO.		
20.0	2	3	2	1	2020.0							10.0	5.6	
25.0	4	7	5	6	925.0		SC					10.5 Same as above, but high clay component.	5.1	
30.0	3	5	5	6	921.0		SP/SM					Orange-brown grading downward to lt. brown, SILTY v.f. SAND. Only tr. silt. Pronounced change in color from above. Wet. Strong HCO.		
35.0												14.0	1.6	
40.0	2	2	1	2	378.1		SP					Lt. grayish brown, v.f. SAND. Saturated. Strong HCO.		
45.0												16.0	-0.4	
50.0	0	0	3	7	15.0		SM					Gray, SILTY, calcareous f. to v.f. SAND. Wet. Strong HCO.		
55.0	6	8	9	15	13.8							20.0	-4.4	

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

WELL LOG

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206-111
Wilmington, NC

SHEET 2 OF 3

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW15	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846840.0	EASTING: 275533.3	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: Next to MW03	T.O.C. ELEV.: 14.91	
DRILL MACHINE: Diedrich D-50	METHOD: HSA/MR	0 HOUR DTW: NM	TOTAL DEPTH: 56.0
START DATE: 7/10/07	FINISH DATE: 7/12/07	24 HOUR DTW: 7.5	WELL DEPTH: 56.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
20.0	6in	6in	6in	6in								
	18	16	16	21	18.7							
22.0							GW/SW			Gray, poorly consolidated calcareous SAND and GRAVELS. V. poorly sorted. Saturated. Slight HCO.		
	18	19	20	30	14.4							
24.0	50/6"				8.4				24.0		-8.4	
										No return. Assumed LIMESTONE cap rock at 24.5' BLS.		
									25.0		-9.4	
26.0												
	29	19	22	23	10.6							
28.0												
	19	18	15	23	27.4							
30.0												
	26	20	15	23	29.7							
32.0												
	16	38	21	18	21.9		GW/SW			Gray, poorly consolidated, calcareous, cse. to f. SAND and GRAVEL-sized limestone fragments. Tr. to few clay. Saturated. No HCO below 28' BLS.		
34.0												
	11	14	20	17	24.2							
36.0												
	14	17	16	17	24.2							
38.0												
	13	15	16	13	26.8							
40.0												
	15	17	12	14	15.8							

CATLIN BORING LOG 206-111 SITE G480 GPL TEST GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

WELL LOG

CATLIN
ENGINEERS and SCIENTISTS
206-111
Wilmington, NC

SHEET 3 OF 3

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW15	
	DRILLER: Bobbie D. Fowler		
NORTHING: 3846840.0	EASTING: 275533.3	CREW: Anthony Chance	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: Next to MW03	T.O.C. ELEV.: 14.91	
DRILL MACHINE: Diedrich D-50	METHOD: HSA/MR	0 HOUR DTW: NM	TOTAL DEPTH: 56.0
START DATE: 7/10/07	FINISH DATE: 7/12/07	24 HOUR DTW: 7.5	WELL DEPTH: 56.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in								
42.0									42.0		-26.4	42.0
	6	7	8	12	1.9							43.0
44.0							CL/ML			Greenish-gray, SILTY CLAY to CLAYEY SILT. Moist. Low plasticity. No HCO. Tr. white shell fragments.		
	3	4	6	6	2.5							
46.0												
	3	4	5	6	2.7							
48.0									48.0		-32.4	
	3	5	5	7	2.4		SM/ML			Same as above, but higher component of v.f. SAND. Greenish-gray, low plasticity SANDY SILT to SILTY SAND. Moist to wet. No HCO.		50.0
50.0												
	3	7	16	32	0.0				51.5		-35.9	51.0
52.0												
	16	29	17	30	0.0		GW/SW			Gray, v. poorly sorted, CLAYEY to SILTY calcareous SAND and GRAVELS. Poorly indurated LIMESTONE. 54-56' BLS interval from drill cuttings.		
54.0												2" Slot .010 Sch. 40 PVC
					NM				56.0		-40.4	56.0
										Boring Terminated at Elevation -40.4 ft		56.0

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

WELL LOG

CATLIN

ENGINEERS and SCIENTISTS

206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480		LOGGED BY: LAW	WELL ID: USTTC341-MW14
		DRILLER: LAW	
NORTHING: 3846839.0	EASTING: 275466.9	CREW: LAW	
SYSTEM: UTM NAD83 (m)		BORING LOCATION:	T.O.C. ELEV.: 16.47
DRILL MACHINE:		METHOD:	0 HOUR DTW:
START DATE: 3/8/94		FINISH DATE: 3/8/94	24 HOUR DTW:
			TOTAL DEPTH: 15.0
			WELL DEPTH: 13.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in							
									0.0 LAND SURFACE	16.5	0.0
									0.5 TOPSOIL	16.0	0.0
							SM		1.0 Dark brown and tan, slightly silty, f. SAND.	15.5	
							CL		Yellowish brown, f. sandy CLAY.		2.0
									4.0	12.5	3.0
							SM		Yellowish brown grading to lt. brown, slightly silty, f. SAND.		
									15.0	1.5	12.5
									Boring Terminated at Elevation 1.5 ft		13.0
											14.0



Portland Cement



#2 Medium Sand

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST GDI 7/24/07

WELL LOG

CATLIN
ENGINEERS and SCIENTISTS
206-111
Wilmington, NC

SHEET 1 OF 2

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480		LOGGED BY: LAW	WELL ID: USTTC341-MW15
		DRILLER: LAW	
NORTHING: 3846837.4	EASTING: 275467.0	CREW: LAW	
SYSTEM: UTM NAD83 (m)		BORING LOCATION:	T.O.C. ELEV.: 16.44
DRILL MACHINE:		METHOD:	0 HOUR DTW: TOTAL DEPTH: 30.0
START DATE: 3/8/94		FINISH DATE: 3/8/94	24 HOUR DTW: WELL DEPTH: 30.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
6in	6in	6in	6in									
									0.0	LAND SURFACE	16.4	0.0
									0.5	TOPSOIL.	15.9	0.0
							SC			Orange brown, clayey, f. SAND.		
									3.5		12.9	
							CL		4.0	Yellowish brown, f. sandy CLAY.	12.4	
							SM			Yellowish brown and tan, slightly silty, f. SAND.		
									8.5		7.9	
							SM			Light gray, slightly silty, f. to cse. SAND.		
									13.5		2.9	
							SM			Reddish brown, slightly silty, f. SAND.		
									18.5		-2.1	
							SM		19.3	Dark gray, slightly silty, f. SAND.	-2.9	
							SM			Lt. gray, slightly silty, f. to cse. SAND w/shell frags.		

2" Sch. 40 PVC

6" Sch. 40 PVC

CATLIN BORING LOG 206-111 SITE G480.GPJ TEST.GDT 7/24/07

 Portland Cement
  Bentonite Pellets
  #2 Medium Sand

 Portland Cement  Bentonite Pellets  #2 Medium Sand

WELL LOG

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ENGINEERS and SCIENTISTS

206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB, Camp Geiger
PROJECT NAME: SITE G480		LOGGED BY: LAW	WELL ID: USTTC341-MW17
		DRILLER: LAW	
NORTHING: 3846802.3	EASTING: 275460.8	CREW: LAW	
SYSTEM: UTM NAD83 (m)		BORING LOCATION:	T.O.C. ELEV.: 16.34
DRILL MACHINE:		METHOD:	0 HOUR DTW:
START DATE: 3/8/94		FINISH DATE: 3/8/94	24 HOUR DTW:
			TOTAL DEPTH: 15.0
			WELL DEPTH: 13.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
6in	6in	6in	6in									
									0.0	LAND SURFACE	16.3	0.0
									0.5	TOPSOIL.	15.8	0.0
							SM			Light brown to dark brown, slightly silty, f. SAND.		2.0
									3.5		12.8	3.0
							SM			Light gray and yellowish brown, slightly silty to silty, f. to med. SAND.		
									8.5		7.8	2" Slot .010 Sch. 40 PVC
							SM			Light tan, slightly silty, f. to cse. SAND.		
									13.5		2.8	12.5
							SM			Light brown, slightly silty, f. SAND.		13.0
									15.0		1.3	14.0
										Boring Terminated at Elevation 1.3 ft		

CATLIN BORING LOG-206-111 SITE G480.GPJ TEST.GDT 7/24/07



Portland Cement



#2 Medium Sand

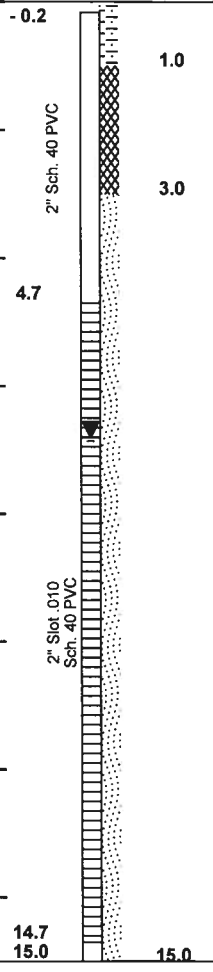
WELL LOG

CATLIN
ENGINEERS and SCIENTISTS
206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB Camp Geiger
PROJECT NAME: TC-341 Pipeline	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW19	
	DRILLER: John E. Wood, III		
NORTHING: 3846898.0	EASTING: 275461.5	CREW: Roger Caulder	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: In grass North of 3rd St.	T.O.C. ELEV.: 14.89	
DRILL MACHINE: Diedrich D-50	METHOD: H.S. Augers	0 HOUR DTW: 7.3	TOTAL DEPTH: 15.0
START DATE: 11/6/08	FINISH DATE: 11/6/08	24 HOUR DTW: 6.6	WELL DEPTH: 15.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in								
									0.0	LAND SURFACE	15.1	0.0
1.0					33.8		CL		1.0		14.1	-0.2
3.0					41.9		SC/CL		3.0	Brown to lt. brown, f. SANDY CLAY. Low plasticity. Moist. No HCO.	12.1	1.0
									5.0	Same as above, but increasing sand content with depth. Moist. No HCO. Tr. orange-brown mottling.	10.1	3.0
8.0					30.5		SC/SM		8.0		7.1	4.7
									10.0	Lt. grayish brown, SILTY to CLAYEY vf. SAND. Wet. No HCO. Soft at top of interval.	5.1	
13.0					38.0		SP		13.0		2.1	
									15.0	Orange-brown, f. SAND. Tr. silt. Saturated. No HCO.	0.1	14.7
										Boring Terminated at Elevation 0.1 ft		15.0



CATLIN BORING LOG 206-111 TC-341 GEL CATLIN GDT 3/10/08

Portland Cement
 Bentonite Pellets
 #2 Medium Sand

WELL LOG

CATLIN
ENGINEERS and SCIENTISTS
206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB Camp Geiger
PROJECT NAME: TC-341 Pipeline	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW20	
	DRILLER: John E. Wood, III		
NORTHING: 3846811.2	EASTING: 275512.5	CREW: Roger Caulder	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: Inside G-480 compound, rear of bldg	T.O.C. ELEV.: 14.99	
DRILL MACHINE: Diedrich D-50	METHOD: H.S. Augers	0 HOUR DTW: 7.4	TOTAL DEPTH: 15.0
START DATE: 11/6/08	FINISH DATE: 11/6/08	24 HOUR DTW:	WELL DEPTH: 15.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
6in	6in	6in	6in									
									0.0	LAND SURFACE	15.3	0.0
									0.2	ASPHALT	15.1	-0.3
1.0									1.0		14.3	
					35.9	*MW20 (1-3)	SM		2.0	Brown, SILTY vf. SAND. Tr. clay. Moist. No HCO.	13.3	1.5
3.0							CL		4.0	Brown to orange-brown, SILTY to vf. SANDY CLAY. Low plasticity. Slight HCO.	11.3	3.0
					228		SM		5.0	Brown, SILTY vf. SAND. Moist. Strong HCO.	10.3	4.7
									8.0		7.3	
8.0					275		SP/SC		10.0	Gray, CLAYEY med. to vf. SAND. Mod. HCO. Mod. grading. Moist with product?	5.3	
									13.0		2.3	
13.0					377		SP		15.0	Gray to orange-brown with depth, vf. SAND. Uniform. Poorly graded. Saturated. Mod. HCO.	0.3	14.7
											15.0	15.0
										Boring Terminated at Elevation 0.3 ft * = Sample prefaced with "USTG480-"		

CATLIN BORING LOG 206-111 TC-341 G.P.I. CATLIN GDT 3/10/08



Portland Cement



Bentonite Pellets



#2 Medium Sand

WELL LOG

CATLIN

ENGINEERS and SCIENTISTS

206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB Camp Geiger
PROJECT NAME: TC-341 Pipeline	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW21	
	DRILLER: John E. Wood, III		
NORTHING: 3846934.0	EASTING: 275662.9	CREW: Roger Caulder	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: In woods East of Hwy 17 Bypass	T.O.C. ELEV.: 7.79	
DRILL MACHINE: Hand Auger	METHOD: Hand Auger	0 HOUR DTW: 3.0	TOTAL DEPTH: 6.0
START DATE: 11/5/08	FINISH DATE: 11/5/08	24 HOUR DTW: 3.7	WELL DEPTH: 6.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in								
0.0					25.1		SM		0.0	LAND SURFACE	5.4	2.4
									0.3	TOPSOIL and organic debris at surface.	5.1	0.0
									1.0	Brown to lt. brown, SILTY f. SAND. Moist.	4.4	0.3
2.0					23.7		CH/PT			Dark brown, SILTY to vf. SANDY CLAY with root fragments. Mod. to high organic content. Strong organic odor. Saturated at approximately 1.5' BLS.	1.4	0.5
4.0					NM		CH/PT		4.0	No return. Assume same as above.	-0.6	
									6.0	Boring Terminated at Elevation -0.6 ft		5.7
												6.0



Portland Cement



Bentonite Pellets



#2 Medium Sand

CATLIN BORING LOG 206-111 TC-341 GEL CATLIN GDT 3/10/09

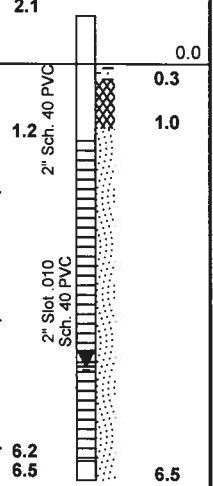
WELL LOG

CATLIN
ENGINEERS and SCIENTISTS
206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB Camp Geiger
PROJECT NAME: TC-341 Pipeline	LOGGED BY: Tom Stetler	WELL ID: USTG480-MW22	
	DRILLER: John E. Wood, III		
NORTHING: 3846979.2	EASTING: 275600.6	CREW: Roger Caulder	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: In woods East of Hwy 17 Bypass	T.O.C. ELEV.: 10.85	
DRILL MACHINE: Hand Auger	METHOD: Hand Auger	0 HOUR DTW: 4.7	TOTAL DEPTH: 7.5
START DATE: 11/3/08	FINISH DATE: 11/6/08	24 HOUR DTW: 4.5	WELL DEPTH: 6.5

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION	WELL DETAIL
	6in	6in	6in	6in								
0.0					26.1				0.0	LAND SURFACE	8.8	2.1
									1.0	TOPSOIL and organic debris at surface.	7.8	0.0
2.0					40.9		SM			Lt. brown, SILTY vf. SAND. Moist. No odor. Tr. root fragments. Decreasing silt content and tr. med. sand with depth.		0.3
4.0					38.6		SC		4.0	Lt. brown, SILTY to CLAYEY cse. to vf. SAND. Well graded. Wet. No odor.	4.8	1.0
6.0					32.8		SP/SM		5.0	Lt. brown, f. to vf. SAND. Tr. silt. Saturated at 5' BLS. No odor. Refusal on hard layering at base of interval (white quartzite gravels in last bucket).	3.8	
									7.5		1.3	6.2
										Boring Terminated at Elevation 1.3 ft		6.5



Portland Cement
 Bentonite Pellets
 #2 Medium Sand

WELL LOG

CATLIN

ENGINEERS and SCIENTISTS

206-111
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 206-111	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB Camp Geiger
PROJECT NAME: TC-341 Pipeline		LOGGED BY: Tom Stetler	WELL ID: USTG480-MW23
		DRILLER: Bobbie D. Fowler	
NORTHING: 3846806.7	EASTING: 275486.2	CREW: John Wood	
SYSTEM: UTM NAD83 (m)		BORING LOCATION: Corner of excavated area.	T.O.C. ELEV.: 14.83
DRILL MACHINE: Diedrich D-50	METHOD: H.S. Augers	0 HOUR DTW: 6.0	TOTAL DEPTH: 15.0
START DATE: 11/17/08	FINISH DATE: 11/17/08	24 HOUR DTW: 6.1	WELL DEPTH: 15.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION		ELEVATION	WELL DETAIL
	6in	6in	6in	6in					DEPTH			
									0.0	LAND SURFACE	15.3	0.0
1.0					537.1		SM		1.0		14.3	-0.5
									2.0	Brown to gray, SILTY vf. SAND. Moist. No HCO.	13.3	1.0
3.0					1972		CL		4.0	Brown to orange-brown, SILTY CLAY. Mod to low plasticity. Moist. Soft. Mottled. No HCO.	11.3	3.0
							SM		5.0	Gray, SILTY vf. SAND. Tr. clay. Wet at base of interval. Mod. HCO.	10.3	4.7
8.0					1503		CL		8.0		7.3	
									10.0	Orange-brown to gray, mottled, low plasticity, SILTY CLAY. Moist. Strong HCO at top of interval.	5.3	
13.0					236.3		SP		13.0		2.3	
									15.0	Gray, f to vf. SAND. Tr. silt. Saturated. Slight HCO.	0.3	14.7
										Boring Terminated at Elevation 0.3 ft		15.0

Portland Cement
 Bentonite Pellets
 #2 Medium Sand

CATLIN BORING LOG 206-111 TC-341 GPL CATLIN.GDT 3/10/09

SHEET 1 OF 1

 Bentonite Pellets #2 Medium Sand

WELL LOG



208-018
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 208-018	STATE: N.C.	COUNTY: Onslow	LOCATION: MCB Camp Geiger
PROJECT NAME: TC-341 Pipeline			LOGGED BY: Justin Heter
			DRILLER: Bobbie D. Fowler
NORTHING: 3846840.7	EASTING: 275535.3	CREW: Tom Stetler	WELL ID: USTG480-MW25
SYSTEM: UTM NAD83 (m)	BORING LOCATION: Near MW-15		T.O.C. ELEV.: 14.09
DRILL MACHINE: Diedrich D-50	METHOD: H.S. Augers w/ M.R.	0 HOUR DTW: 4.0	TOTAL DEPTH: 32.0
START DATE: 6/3/09	FINISH DATE: 6/4/09	24 HOUR DTW:	WELL DEPTH: 32.0

DEPTH	BLOW COUNT				OVA (ppm)	LAB.	M O I S	L O G	SOIL AND ROCK DESCRIPTION		ELEVATION	WELL DETAIL
	6in	6in	6in	6in					DEPTH			
0.0									0.0	LAND SURFACE	14.1	0.0
8.0								M	(SP/SM) - Brown SILTY to fine SAND. Moist. Slight fuel odor.		6.1	
15.0								W	(SP/SM) - Brown SILTY to fine SAND. Wet. Moderate fuel odor.		-0.9	
17.0	1	1	1	1	11.1			Sat.	(SP) - Brown fine SAND. Uniform. Loose. Saturated. Strong fuel odor.		-2.9	
19.0	1	3	5	6	2.5			W	(SM) - Gray fine calcareous SAND to SILTY SAND. Wet. No odor.		-4.9	
21.0	2	4	8	19	3.5			Sat.	(SW) - Gray fine calcareous SAND with some SILT. Moderate amounts of shells and coarse sand grains. Saturated. No odor.		-7.9	
23.0	6	4	13	20	10.3			Sat.	(SWG) - Gray calcareous SAND w/ large GRAVELS. Well-graded. Saturated. Slight Fuel odor.		-11.9	
26.0								Sat.	(GW/SW) - Gray coarse to fine SAND w/ gravel-sized LIMESTONE fragments. Very dense. Well-graded. Saturated.		-17.9	
									Boring Terminated at Elev. -17.9 ft			

Bentonite Grout
 Bentonite Pellets
 #2 Medium Sand

CATLIN BORING LOG 208-053 TC-341 GEL CATLIN GDT 9/2/09



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources - Division of Water Quality

WELL CONTRACTOR CERTIFICATION #: 2869

1. WELL CONTRACTOR:

Bobbie D. Fowler

Well Contractor (Individual) Name

CATLIN Engineers and Scientists

Well Contractor Company Name

STREET ADDRESS 220 Old Dairy Road

Wilmington North Carolina 28405

City or Town State Zip Code

(910) - 452-5861

Area code - Phone number

2. WELL INFORMATION

SITE WELL ID #(if applicable): USTG480- MW24

STATE WELL PERMIT #(if applicable): N/A

DWQ or OTHER PERMIT # (if applicable): N/A

WELL USE (Check Applicable Box): Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use):

DATE DRILLED: 06/03/2009

TIME COMPLETED: 11:00 AM ☒ PM ☐

3. WELL LOCATION:

CITY: MCB Camp Geiger COUNTY: Onslow

2nd & F Street, 28540

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING

Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other: _____

NORTHING: 3,846,866.9

EASTING: 275,551.3

UTM NAD83 (m)

May be in degrees,
minutes, seconds, or
in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topo. map

(Location of well must be shown on a USGS topo map and
attached to this form if not using a GPS.)

4. FACILITY - is the name of the business where the well is located.

FACILITY ID #(if applicable) N/A

NAME OF FACILITY: Pipeline near Building G-480

STREET ADDRESS: 2nd & F Street

MCB Camp Geiger NC 28540

City or Town State Zip Code

CONTACT PERSON: Thomas H. Burton

STREET ADDRESS: Attn: I&E/ EMD/ EQB/ PSC Box 20004

Camp Lejeune NC 28542-0004

City or Town State Zip Code

(910)- 451-9017

Area code - Phone number

5. WELL DETAILS:

a. TOTAL DEPTH: 13

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 7.5 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 0 FT. Above Land Surface*

* Top of casing terminated at/or below land surface requires
a variance in accordance with 15A NCAC 2C.0118

e. YIELD (gpm): N/A METHOD OF TEST: N/A

f. DISINFECTION: Type N/A Amount: N/A

g. WATER ZONES (depth):

From _____ To _____ From _____ To _____

From _____ To _____ From _____ To _____

From _____ To _____ From _____ To _____

6. CASING:

Depth Diameter Thickness/ Weight Material
From 0 To 3 ft. 2" Sch. 40 PVC

From _____ To _____ ft. " " "

From _____ To _____ ft. " " "

7. GROUT:

Depth Material Method
From _____ To _____ Ft. _____

From 1 To 2 Ft. _____

From _____ To _____ Ft. _____

8. SCREEN:

Depth Diameter Slot Size Material
From 3 To 13 Ft. 2 in. Slot .010 in. PVC

From _____ To _____ Ft. in. in. _____

From _____ To _____ Ft. in. in. _____

9. SAND/GRAVEL PACK:

Depth Size Material
From 2 To 13 Ft. #2 Medium Torpedo Sand

From _____ To _____ Ft. _____

From _____ To _____ Ft. _____

10. DRILLING LOG

From To Formation Description

SEE
ATTACHED

11. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH
15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS
RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Bobbie D. Fowler
SIGNATURE OF CERTIFIED WELL CONTRACTOR

6-5-09
DATE

Bobbie D. Fowler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days, Attn: Information Management,
1617 Mail Service Center - Raleigh, NC 27699167, Phone No. (919) 733-7015 ext 568.

Modified from
Form GW-1b
Rev. 7/05



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources - Division of Water Quality

WELL CONTRACTOR CERTIFICATION #: 2869

1. WELL CONTRACTOR:

Bobbie D. Fowler

Well Contractor (Individual) Name

CATLIN Engineers and Scientists

Well Contractor Company Name

STREET ADDRESS 220 Old Dairy Road

Wilmington North Carolina 28405

City or Town State Zip Code

(910) - 452-5861

Area code - Phone number

2. WELL INFORMATION

SITE WELL ID #(if applicable): USTG480- MW25

STATE WELL PERMIT #(if applicable): N/A

DWQ or OTHER PERMIT # (if applicable): N/A

WELL USE (Check Applicable Box): Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use):

DATE DRILLED: 06/04/2009

TIME COMPLETED: 13:00 AM ☐ PM ☒

3. WELL LOCATION:

CITY: MCB Camp Geiger COUNTY: Onslow

2nd & F Street, 28540

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING

Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other:

NORTHING: 3,846,840.0

EASTING: 275,533.3

UTM NAD83 (m)

May be in degrees, minutes, seconds, or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topo. map

(Location of well must be shown on a USGS topo map and attached to this form if not using a GPS.)

4. FACILITY - is the name of the business where the well is located.

FACILITY ID #(if applicable) N/A

NAME OF FACILITY: Pipeline near Building G-480

STREET ADDRESS: 2nd & F Street

MCB Camp Geiger NC 28540

City or Town State Zip Code

CONTACT PERSON: Thomas H. Burton

STREET ADDRESS: Attn: I&E/ EMD/ EQB/ PSC Box 20004

Camp Lejeune NC 28542-0004

City or Town State Zip Code

(910)- 451-9017

Area code - Phone number

5. WELL DETAILS:

a. TOTAL DEPTH: 32

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 4.0 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 0 FT. Above Land Surface*

* Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

e. YIELD (gpm): N/A METHOD OF TEST: N/A

f. DISINFECTION: Type N/A Amount: N/A

g. WATER ZONES (depth):

From To From To

From To From To

From To From To

6. CASING:

Depth	Diameter	Thickness/Weight	Material
From 0 To 27 ft.	2"	Sch. 40	PVC
From 0 To 24 ft.	6"	Sch. 40	PVC
From To ft.	"		

7. GROUT:

Depth	Material	Method
From To Ft.		
From 22 To 26 Ft.	Bent. Pellets	Surface Pour
From To Ft.		

8. SCREEN:

Depth	Diameter	Slot Size	Material
From 27 To 32 Ft.	2 in.	Slot .010in.	PVC
From To Ft.	in.	in.	
From To Ft.	in.	in.	

9. SAND/GRAVEL PACK:

Depth	Size	Material
From 26 To 32 Ft.	#2 Medium	Torpedo Sand
From To Ft.		
From To Ft.		

10. DRILLING LOG

From To Formation Description

SEE ATTACHED

11. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

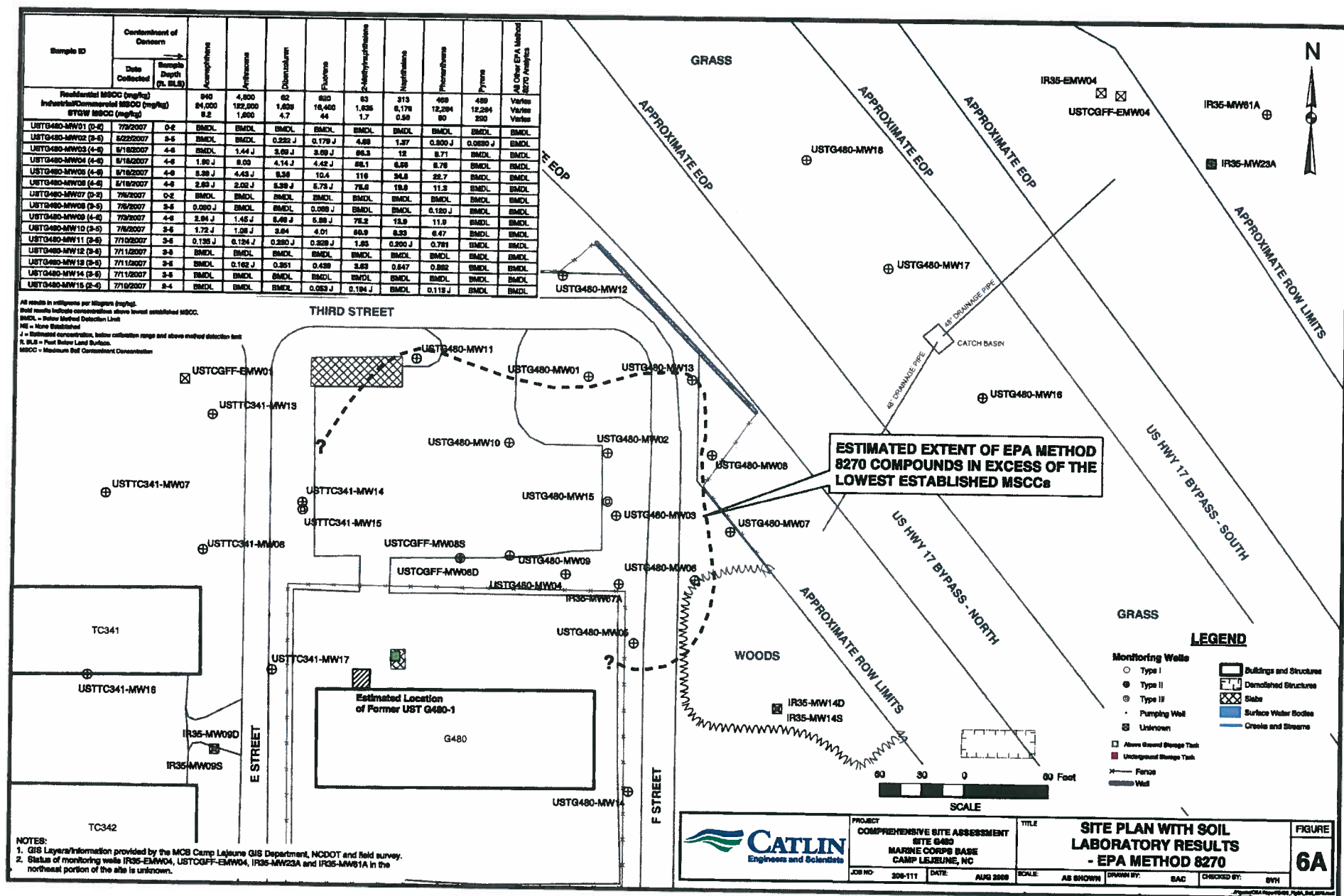
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

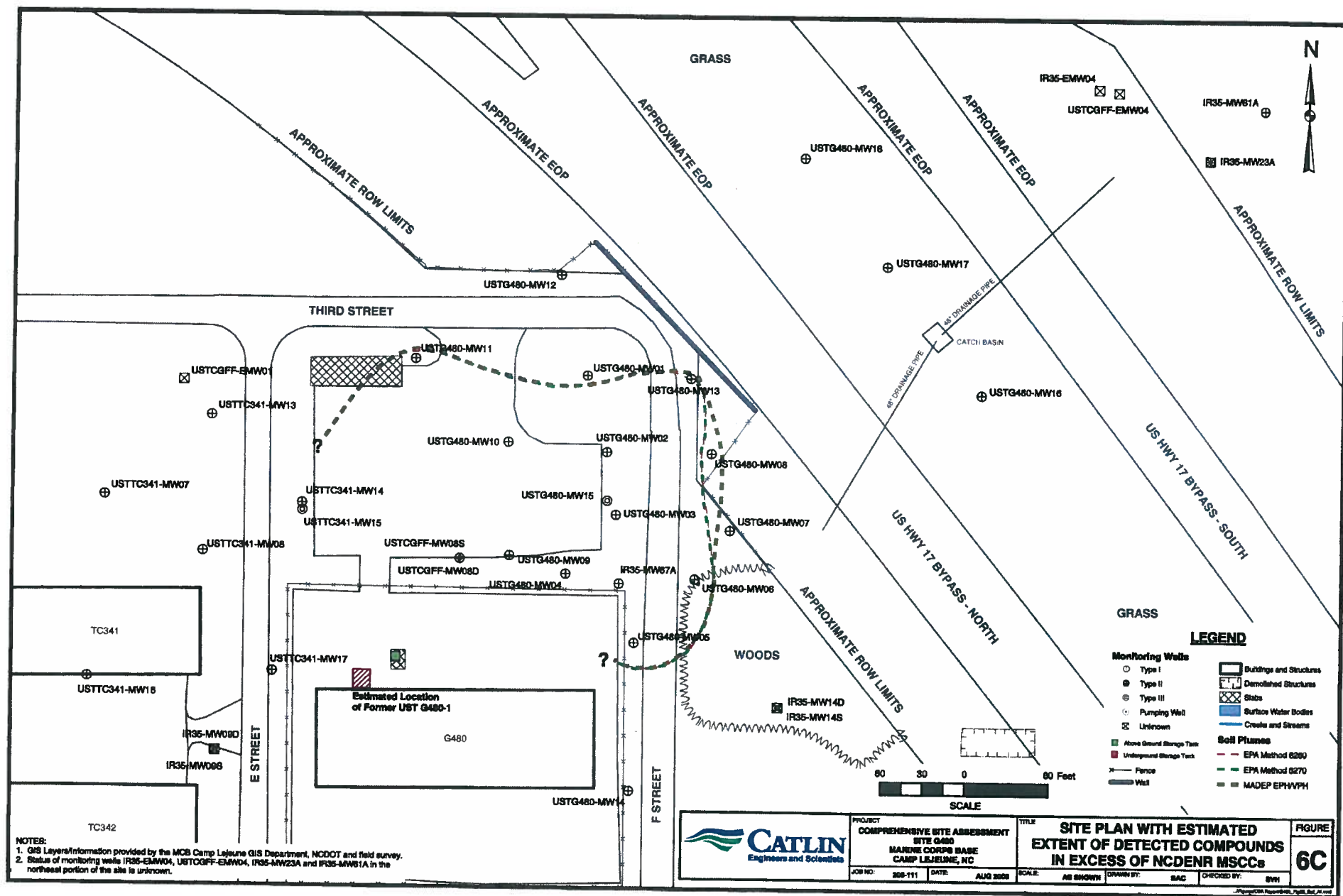
Bobbie D. Fowler

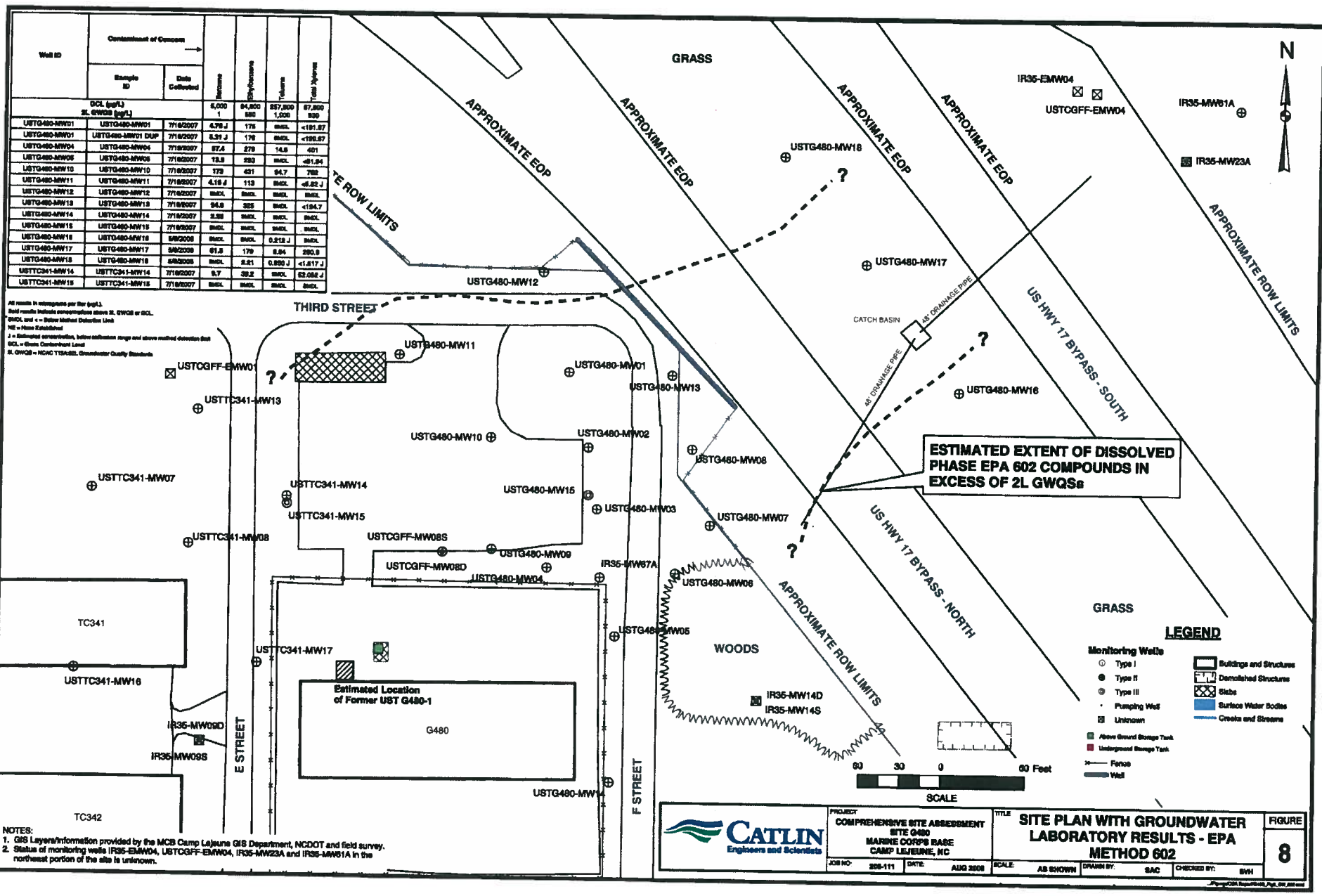
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

APPENDIX D

SELECTED FIGURES FROM PREVIOUS REPORTS







NOTES:
1. GIS Layers/Information provided by the MCB Camp Lejeune GIS Department, NCDOT and field survey.
2. Status of monitoring wells IR35-EMW04, USTCGFF-EMW04, IR35-MW23A and IR35-MW51A in the northeast portion of the site is unknown.

CATLIN
Engineers and Scientists

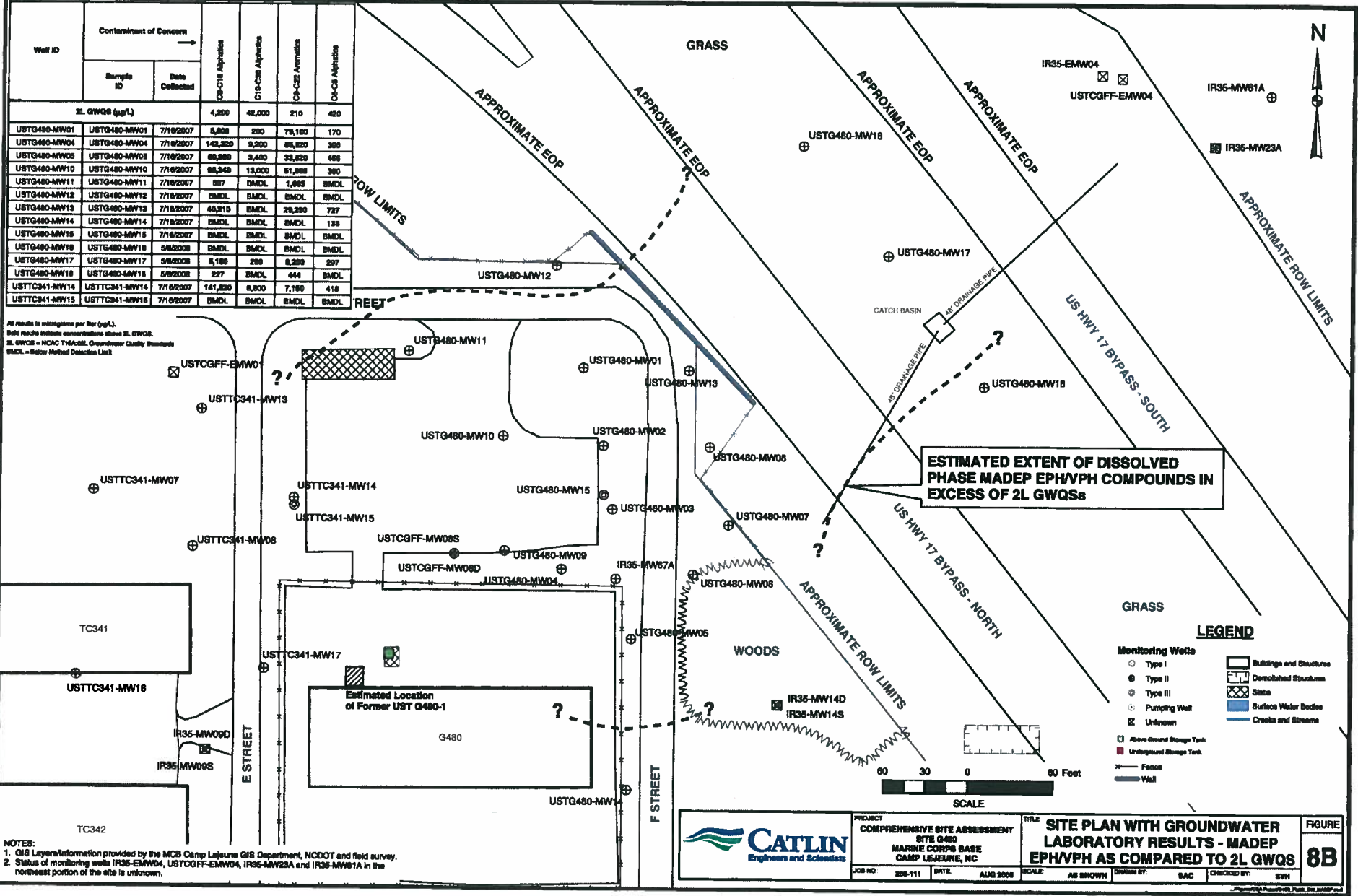
PROJECT
COMPREHENSIVE SITE ASSESSMENT
SITE G480
MARINE CORPS BASE
CAMP LEJEUNE, NC

TITLE
SITE PLAN WITH GROUNDWATER
LABORATORY RESULTS - EPA
METHOD 602

FIGURE
8

JOB NO. 208-111 **DATE** AUG 2008 **SCALE** AS SHOWN **DRAWN BY** SAC **CHECKED BY** BWH

**ESTIMATED EXTENT OF DISSOLVED
PHASE EPA 602 COMPOUNDS IN
EXCESS OF 2L GWQS**



APPENDIX E

**LABORATORY REPORTS AND
CHAIN-OF-CUSTODY DOCUMENTATION**

SGS North America, Inc.



Steve Hudson
Richard Catlin & Associates
P.O. Box 10279
Wilmington, NC 28404-0279

Report Number: G128-2386

Client Project: TC-341 (208-018)

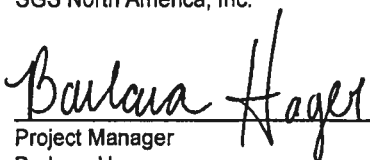
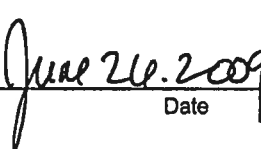
Dear Steve Hudson,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. Any samples submitted to our laboratory will be retained for a maximum of thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or services performed during this project, please call Barbara Hager at (910) 350-1903. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS Environmental Services for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America, Inc.

 
Project Manager Date
Barbara Hager

SGS North America, Inc.
List of Reporting Abbreviations
And Data Qualifiers

B = Compound also detected in batch blank

BQL = Below Quantification Limit (RL or MDL)

DF = Dilution Factor

Dup = Duplicate

D = Detected, but RPD is > 40% between results in dual column method.

E = Estimated concentration, exceeds calibration range.

J = Estimated concentration, below calibration range and above MDL

LCS(D) = Laboratory Control Spike (Duplicate)

MDL = Method Detection Limit

MS(D) = Matrix Spike (Duplicate)

PQL = Practical Quantitation Limit

RL/CL = Reporting Limit / Control Limit

RPD = Relative Percent Difference

UJ = Target analytes with recoveries that are $10\% < \%R < LCL$; # of MEs are allowable and compounds are not detected in the sample.

mg/kg = milligram per kilogram, ppm, parts per million

ug/kg = micrograms per kilogram, ppb, parts per billion

mg/L = milligram per liter, ppm, parts per million

ug/L = micrograms per liter, ppb, parts per billion

% Rec = Percent Recovery

% solids = Percent Solids

Special Notes:

- 1) Metals and mercury samples are digested with a hot block; see the standard operating procedure document for details.
- 2) Uncertainty for all reported data is less than or equal to 30 percent.

SGS North America, Inc.

Results for Volatiles

by GC 602

Client Sample ID: TC 341 Outfall

Analyzed By: DVO

Client Project ID: TC-341 (208-018)

Date Collected: 6/15/2009 10:45

Lab Sample ID: G128-2386-1A

Date Received: 6/15/2009

Lab Project ID: G128-2386

Matrix: Water

Analyte	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flags
Benzene	1.84	1.00	0.177	1	6/23/2009	
Diisopropyl ether (DIPE)	1.17	1.00	0.253	1	6/23/2009	
Ethylbenzene	BQL	1.00	0.19	1	6/23/2009	
Methyl-tert butyl ether (MTBE)	BQL	2.00	0.306	1	6/23/2009	
Toluene	BQL	1.00	0.313	1	6/23/2009	
m/p-Xylene	BQL	2.00	0.481	1	6/23/2009	
o-Xylene	BQL	2.00	0.405	1	6/23/2009	

Surrogate Spike Recoveries

	Spike Added	Spike Result	Percent Recovery
Trifluorotoluene	40	39.8	99.4

Comments:

All values corrected for dilution.

BQL = Below quantitation limit.

SGS North America, Inc.

Results for Volatiles

by GC 602

Client Sample ID: TC 341 Basin
 Client Project ID: TC-341 (208-018)
 Lab Sample ID: G128-2386-2A
 Lab Project ID: G128-2386

Analyzed By: DVO
 Date Collected: 6/15/2009 11:07
 Date Received: 6/15/2009
 Matrix: Water

Analyte	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flags
Benzene	1.26	1.00	0.177	1	6/23/2009	
Diisopropyl ether (DIPE)	BQL	1.00	0.253	1	6/23/2009	
Ethylbenzene	0.208	1.00	0.19	1	6/23/2009	J
Methyl-tert butyl ether (MTBE)	BQL	2.00	0.306	1	6/23/2009	
Toluene	BQL	1.00	0.313	1	6/23/2009	
m/p-Xylene	1.21	2.00	0.481	1	6/23/2009	J
o-Xylene	BQL	2.00	0.405	1	6/23/2009	

Surrogate Spike Recoveries

	Spike Added	Spike Result	Percent Recovery
Trifluorotoluene	40	40.9	102

Comments:

All values corrected for dilution.
 BQL = Below quantitation limit.

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC 341 Outfall
Client Project ID: TC-341 (208-018)
Lab Sample ID: G128-2386-1E
Lab Project ID: G128-2386

Analyzed By: DCS
Date Collected: 6/15/2009 10:45
Date Received: 6/15/2009
Date Extracted: 6/16/2009
Matrix: Water

Initial/Final Amt: 950 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Acenaphthene	BQL	5.26	0.784	1	6/23/2009	
Acenaphthylene	BQL	5.26	0.784	1	6/23/2009	
Anthracene	BQL	5.26	0.921	1	6/23/2009	
Benzo[a]anthracene	BQL	5.26	0.716	1	6/23/2009	
Benzo[a]pyrene	BQL	5.26	0.668	1	6/23/2009	
Benzo[b]fluoranthene	BQL	5.26	0.753	1	6/23/2009	
Benzo[g,h,i]perylene	BQL	5.26	0.647	1	6/23/2009	
Benzo[k]fluoranthene	BQL	5.26	0.579	1	6/23/2009	
Bis(2-chloroethoxy)methane	BQL	5.26	1.08	1	6/23/2009	
Bis(2-chloroethyl)ether	BQL	5.26	1.09	1	6/23/2009	
Bis(2-chloroisopropyl)ether	BQL	5.26	1.03	1	6/23/2009	
Bis(2-ethylhexyl)phthalate	BQL	5.26	0.432	1	6/23/2009	
4-bromophenyl phenyl ether	BQL	5.26	0.821	1	6/23/2009	
Butylbenzylphthalate	BQL	5.26	0.468	1	6/23/2009	
2-Chloronaphthalene	BQL	5.26	0.911	1	6/23/2009	
2-Chlorophenol	BQL	5.26	1.23	1	6/23/2009	
4-Chloro-3-methylphenol	BQL	5.26	0.837	1	6/23/2009	
4-Chlorophenyl phenyl ether	BQL	5.26	3.43	1	6/23/2009	
Chrysene	BQL	5.26	0.584	1	6/23/2009	
Dibenzo[a,h]anthracene	BQL	5.26	0.463	1	6/23/2009	
Di-n-Butylphthalate	BQL	5.26	0.868	1	6/23/2009	
3,3'-Dichlorobenzidine	BQL	10.5	1.28	1	6/23/2009	
2,4-Dichlorophenol	BQL	5.26	1.18	1	6/23/2009	
Diethylphthalate	BQL	5.26	0.779	1	6/23/2009	
Dimethylphthalate	BQL	5.26	0.584	1	6/23/2009	
2,4-Dimethylphenol	BQL	5.26	1.71	1	6/23/2009	
Di-n-octylphthalate	BQL	5.26	0.611	1	6/23/2009	
4,6-Dinitro-2-methylphenol	BQL	26.3	0.579	1	6/23/2009	
2,4-Dinitrophenol	BQL	26.3	0.674	1	6/23/2009	
2,4-Dinitrotoluene	BQL	5.26	0.563	1	6/23/2009	
2,6-Dinitrotoluene	BQL	5.26	0.684	1	6/23/2009	
Diphenylamine *	BQL	5.26	0.600	1	6/23/2009	
Fluoranthene	BQL	5.26	0.742	1	6/23/2009	
Fluorene	0.842	5.26	0.763	1	6/23/2009	J
Hexachlorobenzene	BQL	5.26	0.532	1	6/23/2009	
Hexachlorobutadiene	BQL	5.26	0.800	1	6/23/2009	
Hexachlorocyclopentadiene	BQL	10.5	10.5	1	6/23/2009	
Hexachloroethane	BQL	5.26	0.784	1	6/23/2009	
Indeno(1,2,3-c,d)pyrene	BQL	5.26	2.41	1	6/23/2009	
Isophorone	BQL	5.26	0.932	1	6/23/2009	
Naphthalene	1.00	5.26	0.958	1	6/23/2009	J
Nitrobenzene	BQL	5.26	1.11	1	6/23/2009	
2-Nitrophenol	BQL	5.26	1.29	1	6/23/2009	
4-Nitrophenol	BQL	26.3	1.14	1	6/23/2009	
N-Nitrosodi-n-propylamine	BQL	5.26	1.58	1	6/23/2009	
Pentachlorophenol	BQL	26.3	1.49	1	6/23/2009	
Phenanthrene	1.11	5.26	0.468	1	6/23/2009	J

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC 341 Outfall
Client Project ID: TC-341 (208-018)
Lab Sample ID: G128-2386-1E
Lab Project ID: G128-2386

Analyzed By: DCS
Date Collected: 6/15/2009 10:45
Date Received: 6/15/2009
Date Extracted: 6/16/2009
Matrix: Water

Initial/Final Amt: 950 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Phenol	BQL	5.26	1.12	1	6/23/2009	
Pyrene	BQL	5.26	2.17	1	6/23/2009	
1,2,4-Trichlorobenzene	BQL	5.26	0.758	1	6/23/2009	
2,4,6-Trichlorophenol	BQL	5.26	0.974	1	6/23/2009	
		Spike Added	Spike Result	Percent Recovered		
2-Fluorobiphenyl		10	8.1	81		
2-Fluorophenol		10	6.9	69		
Nitrobenzene-d5		10	7.8	78		
Phenol-d6		10	7	70		
2,4,6-Tribromophenol		10	9.9	99		
4-Terphenyl-d14		10	10.1	101		

Comments:

Flags:

BQL = Below Quantitation Limits.
J = Detected below the quantitation limit.

Reviewed By: CS

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC 341 Basin
 Client Project ID: TC-341 (208-018)
 Lab Sample ID: G128-2386-2E
 Lab Project ID: G128-2386

Analyzed By: DCS
 Date Collected: 6/15/2009 11:07
 Date Received: 6/15/2009
 Date Extracted: 6/16/2009
 Matrix: Water

Initial/Final Amt: 963 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Acenaphthene	1.14	5.19	0.774	1	6/23/2009	J
Acenaphthylene	BQL	5.19	0.774	1	6/23/2009	
Anthracene	BQL	5.19	0.909	1	6/23/2009	
Benzo[a]anthracene	BQL	5.19	0.706	1	6/23/2009	
Benzo[a]pyrene	BQL	5.19	0.659	1	6/23/2009	
Benzo[b]fluoranthene	BQL	5.19	0.742	1	6/23/2009	
Benzo[g,h,i]perylene	BQL	5.19	0.639	1	6/23/2009	
Benzo[k]fluoranthene	BQL	5.19	0.571	1	6/23/2009	
Bis(2-chloroethoxy)methane	BQL	5.19	1.07	1	6/23/2009	
Bis(2-chloroethyl)ether	BQL	5.19	1.08	1	6/23/2009	
Bis(2-chloroisopropyl)ether	BQL	5.19	1.01	1	6/23/2009	
Bis(2-ethylhexyl)phthalate	0.519	5.19	0.426	1	6/23/2009	J
4-bromophenyl phenyl ether	BQL	5.19	0.810	1	6/23/2009	
Butylbenzylphthalate	BQL	5.19	0.462	1	6/23/2009	
2-Chloronaphthalene	BQL	5.19	0.898	1	6/23/2009	
2-Chlorophenol	BQL	5.19	1.21	1	6/23/2009	
4-Chloro-3-methylphenol	BQL	5.19	0.826	1	6/23/2009	
4-Chlorophenyl phenyl ether	BQL	5.19	3.38	1	6/23/2009	
Chrysene	BQL	5.19	0.576	1	6/23/2009	
Dibenzo[a,h]anthracene	BQL	5.19	0.457	1	6/23/2009	
Di-n-Butylphthalate	BQL	5.19	0.857	1	6/23/2009	
3,3'-Dichlorobenzidine	BQL	10.4	1.27	1	6/23/2009	
2,4-Dichlorophenol	BQL	5.19	1.16	1	6/23/2009	
Diethylphthalate	BQL	5.19	0.768	1	6/23/2009	
Dimethylphthalate	BQL	5.19	0.576	1	6/23/2009	
2,4-Dimethylphenol	BQL	5.19	1.68	1	6/23/2009	
Di-n-octylphthalate	BQL	5.19	0.602	1	6/23/2009	
4,6-Dinitro-2-methylphenol	BQL	26.0	0.571	1	6/23/2009	
2,4-Dinitrophenol	BQL	26.0	0.665	1	6/23/2009	
2,4-Dinitrotoluene	BQL	5.19	0.556	1	6/23/2009	
2,6-Dinitrotoluene	BQL	5.19	0.675	1	6/23/2009	
Diphenylamine *	BQL	5.19	0.592	1	6/23/2009	
Fluoranthene	BQL	5.19	0.732	1	6/23/2009	
Fluorene	2.08	5.19	0.753	1	6/23/2009	J
Hexachlorobenzene	BQL	5.19	0.524	1	6/23/2009	
Hexachlorobutadiene	BQL	5.19	0.789	1	6/23/2009	
Hexachlorocyclopentadiene	BQL	10.4	10.4	1	6/23/2009	
Hexachloroethane	BQL	5.19	0.774	1	6/23/2009	
Indeno(1,2,3-c,d)pyrene	BQL	5.19	2.37	1	6/23/2009	
Isophorone	BQL	5.19	0.919	1	6/23/2009	
Naphthalene	34.7	5.19	0.945	1	6/23/2009	
Nitrobenzene	BQL	5.19	1.09	1	6/23/2009	
2-Nitrophenol	BQL	5.19	1.28	1	6/23/2009	
4-Nitrophenol	BQL	26.0	1.12	1	6/23/2009	
N-Nitrosodi-n-propylamine	BQL	5.19	1.56	1	6/23/2009	
Pentachlorophenol	BQL	26.0	1.47	1	6/23/2009	
Phenanthrene	1.25	5.19	0.462	1	6/23/2009	J

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC 341 Basin
Client Project ID: TC-341 (208-018)
Lab Sample ID: G128-2386-2E
Lab Project ID: G128-2386

Analyzed By: DCS
Date Collected: 6/15/2009 11:07
Date Received: 6/15/2009
Date Extracted: 6/16/2009
Matrix: Water

Initial/Final Amt: 963 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Phenol	BQL	5.19	1.10	1	6/23/2009	
Pyrene	BQL	5.19	2.14	1	6/23/2009	
1,2,4-Trichlorobenzene	BQL	5.19	0.748	1	6/23/2009	
2,4,6-Trichlorophenol	BQL	5.19	0.961	1	6/23/2009	
		Spike Added	Spike Result	Percent Recovered		
2-Fluorobiphenyl		10	8.7	87		
2-Fluorophenol		10	8.2	82		
Nitrobenzene-d5		10	8.4	84		
Phenol-d6		10	7.9	79		
2,4,6-Tribromophenol		10	10.6	106		
4-Terphenyl-d14		10	10.8	108		

Comments:

Flags:

BQL = Below Quantitation Limits.
J = Detected below the quantitation limit.

Reviewed By: CSO

CHAIN OF CUSTODY RECORD
SGS Environmental Services Inc.

Locations Nationwide

- Alaska
- Ohio
- New Jersey
- West Virginia
- Hawaii
- Maryland
- North Carolina

www.us.sgs.com

091333

[illegible]



Steve Hudson
Richard Catlin & Associates
P.O. Box 10279
Wilmington, NC 28404-0279

Report Number: G128-2402

Client Project: TC-341

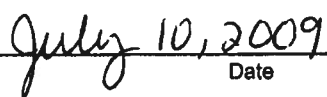
Dear Steve Hudson,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. Any samples submitted to our laboratory will be retained for a maximum of thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or services performed during this project, please call Barbara Hager at (910) 350-1903. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America, Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America, Inc.

 
Project Manager Date
Barbara Hager

SGS North America, Inc.
List of Reporting Abbreviations
And Data Qualifiers

B = Compound also detected in batch blank

BQL = Below Quantification Limit (RL or MDL)

DF = Dilution Factor

Dup = Duplicate

D = Detected, but RPD is > 40% between results in dual column method.

E = Estimated concentration, exceeds calibration range.

J = Estimated concentration, below calibration range and above MDL

LCS(D) = Laboratory Control Spike (Duplicate)

MDL = Method Detection Limit

MS(D) = Matrix Spike (Duplicate)

PQL = Practical Quantitation Limit

RL/CL = Reporting Limit / Control Limit

RPD = Relative Percent Difference

UJ = Target analytes with recoveries that are $10\% < \%R < LCL$; # of MEs are allowable and compounds are not detected in the sample.

mg/kg = milligram per kilogram, ppm, parts per million

ug/kg = micrograms per kilogram, ppb, parts per billion

mg/L = milligram per liter, ppm, parts per million

ug/L = micrograms per liter, ppb, parts per billion

% Rec = Percent Recovery

% solids = Percent Solids

Special Notes:

- 1) Metals and mercury samples are digested with a hot block; see the standard operating procedure document for details.
- 2) Uncertainty for all reported data is less than or equal to 30 percent.

SGS North America, Inc.

Results for Volatiles
by GC 602

Client Sample ID: TC-341 MW-24
Client Project ID: TC-341
Lab Sample ID: G128-2402-1B
Lab Project ID: G128-2402

Analyzed By: DVO
Date Collected: 6/30/2009 12:21
Date Received: 6/30/2009
Matrix: Water

Analyte	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flags
Benzene	0.759	1.00	0.177	1	7/8/2009	J
Diisopropyl ether (DIPE)	BQL	1.00	0.253	1	7/8/2009	
Ethylbenzene	BQL	1.00	0.19	1	7/8/2009	
Methyl-tert butyl ether (MTBE)	BQL	2.00	0.306	1	7/8/2009	
Toluene	BQL	1.00	0.313	1	7/8/2009	
m/p-Xylene	BQL	2.00	0.481	1	7/8/2009	
o-Xylene	BQL	2.00	0.405	1	7/8/2009	

Surrogate Spike Recoveries	Spike Added	Spike Result	Percent Recovery
Trifluorotoluene	40	39.4	98.6

Comments:

All values corrected for dilution.
BQL = Below quantitation limit.

Results for Volatiles

by GC 602

Client Sample ID: TC-341 MW-25

Analyzed By: DVO

Client Project ID: TC-341

Date Collected: 6/30/2009 13:20

Lab Sample ID: G128-2402-2B

Date Received: 6/30/2009

Lab Project ID: G128-2402

Matrix: Water

Analyte	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flags
Benzene	3.71	1.00	0.177	1	7/8/2009	
Diisopropyl ether (DIPE)	29.1	1.00	0.253	1	7/8/2009	
Ethylbenzene	2.61	1.00	0.19	1	7/8/2009	
Methyl-tert butyl ether (MTBE)	BQL	2.00	0.306	1	7/8/2009	
Toluene	BQL	1.00	0.313	1	7/8/2009	
m/p-Xylene	3.70	2.00	0.481	1	7/8/2009	
o-Xylene	BQL	2.00	0.405	1	7/8/2009	

Surrogate Spike Recoveries

	Spike Added	Spike Result	Percent Recovery
Trifluorotoluene	40	38.9	97.3

Comments:

All values corrected for dilution.

BQL = Below quantitation limit.

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC-341 MW-24
Client Project ID: TC-341
Lab Sample ID: G128-2402-3B
Lab Project ID: G128-2402

Analyzed By: DCS
Date Collected: 6/30/2009 12:20
Date Received: 6/30/2009
Date Extracted: 7/2/2009
Matrix: Water

Initial/Final Amt: 965 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Acenaphthene	BQL	5.18	0.772	1	7/8/2009	
Acenaphthylene	BQL	5.18	0.772	1	7/8/2009	
Anthracene	BQL	5.18	0.907	1	7/8/2009	
Benzo[a]anthracene	BQL	5.18	0.705	1	7/8/2009	
Benzo[a]pyrene	BQL	5.18	0.658	1	7/8/2009	
Benzo[b]fluoranthene	BQL	5.18	0.741	1	7/8/2009	
Benzo[g,h,i]perylene	BQL	5.18	0.637	1	7/8/2009	
Benzo[k]fluoranthene	BQL	5.18	0.570	1	7/8/2009	
Bis(2-chloroethoxy)methane	BQL	5.18	1.07	1	7/8/2009	
Bis(2-chloroethyl)ether	BQL	5.18	1.08	1	7/8/2009	
Bis(2-chloroisopropyl)ether	BQL	5.18	1.01	1	7/8/2009	
Bis(2-ethylhexyl)phthalate	BQL	5.18	0.425	1	7/8/2009	
4-bromophenyl phenyl ether	BQL	5.18	0.808	1	7/8/2009	
Butylbenzylphthalate	BQL	5.18	0.461	1	7/8/2009	
2-Chloronaphthalene	BQL	5.18	0.896	1	7/8/2009	
2-Chlorophenol	BQL	5.18	1.21	1	7/8/2009	
4-Chloro-3-methylphenol	BQL	5.18	0.824	1	7/8/2009	
4-Chlorophenyl phenyl ether	BQL	5.18	3.37	1	7/8/2009	
Chrysene	BQL	5.18	0.575	1	7/8/2009	
Dibenzo[a,h]anthracene	BQL	5.18	0.456	1	7/8/2009	
Di-n-Butylphthalate	BQL	5.18	0.855	1	7/8/2009	
3,3'-Dichlorobenzidine	BQL	10.4	1.26	1	7/8/2009	
2,4-Dichlorophenol	BQL	5.18	1.16	1	7/8/2009	
Diethylphthalate	BQL	5.18	0.767	1	7/8/2009	
Dimethylphthalate	BQL	5.18	0.575	1	7/8/2009	
2,4-Dimethylphenol	BQL	5.18	1.68	1	7/8/2009	
Di-n-octylphthalate	BQL	5.18	0.601	1	7/8/2009	
4,6-Dinitro-2-methylphenol	BQL	25.9	0.570	1	7/8/2009	
2,4-Dinitrophenol	BQL	25.9	0.663	1	7/8/2009	
2,4-Dinitrotoluene	BQL	5.18	0.554	1	7/8/2009	
2,6-Dinitrotoluene	BQL	5.18	0.674	1	7/8/2009	
Diphenylamine *	BQL	5.18	0.591	1	7/8/2009	
Fluoranthene	BQL	5.18	0.731	1	7/8/2009	
Fluorene	BQL	5.18	0.751	1	7/8/2009	
Hexachlorobenzene	BQL	5.18	0.523	1	7/8/2009	
Hexachlorobutadiene	BQL	5.18	0.788	1	7/8/2009	
Hexachlorocyclopentadiene	BQL	10.4	10.4	1	7/8/2009	
Hexachloroethane	BQL	5.18	0.772	1	7/8/2009	
Indeno(1,2,3-c,d)pyrene	BQL	5.18	2.37	1	7/8/2009	
Isophorone	BQL	5.18	0.917	1	7/8/2009	
Naphthalene	8.65	5.18	0.943	1	7/8/2009	
Nitrobenzene	BQL	5.18	1.09	1	7/8/2009	
2-Nitrophenol	BQL	5.18	1.27	1	7/8/2009	
4-Nitrophenol	BQL	25.9	1.12	1	7/8/2009	
N-Nitrosodi-n-propylamine	BQL	5.18	1.55	1	7/8/2009	
Pentachlorophenol	BQL	25.9	1.47	1	7/8/2009	
Phenanthrene	BQL	5.18	0.461	1	7/8/2009	

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC-341 MW-24
Client Project ID: TC-341
Lab Sample ID: G128-2402-3B
Lab Project ID: G128-2402

Analyzed By: DCS
Date Collected: 6/30/2009 12:20
Date Received: 6/30/2009
Date Extracted: 7/2/2009
Matrix: Water

Initial/Final Amt: 965 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Phenol	BQL	5.18	1.10	1	7/8/2009	
Pyrene	BQL	5.18	2.14	1	7/8/2009	
1,2,4-Trichlorobenzene	BQL	5.18	0.746	1	7/8/2009	
2,4,6-Trichlorophenol	BQL	5.18	0.959	1	7/8/2009	
		Spike Added	Spike Result	Percent Recovered		
2-Fluorobiphenyl		10	7.2	72		
2-Fluorophenol		10	7.4	74		
Nitrobenzene-d5		10	8	80		
Phenol-d6		10	7.6	76		
2,4,6-Tribromophenol		10	9	90		
4-Terphenyl-d14		10	4.6	46		

Comments:

* N-Nitrosodiphenylamine is reported as the breakdown product Diphenylamine.

Flags:

BQL = Below Quantitation Limits.
J = Detected below the quantitation limit.

Reviewed By: 

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC-341 MW-25
Client Project ID: TC-341
Lab Sample ID: G128-2402-4B
Lab Project ID: G128-2402

Analyzed By: DCS
Date Collected: 6/30/2009 13:20
Date Received: 6/30/2009
Date Extracted: 7/2/2009
Matrix: Water

Initial/Final Amt: 969 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Acenaphthene	1.55	5.16	0.769	1	7/8/2009	J
Acenaphthylene	BQL	5.16	0.769	1	7/8/2009	
Anthracene	BQL	5.16	0.903	1	7/8/2009	
Benzo[a]anthracene	BQL	5.16	0.702	1	7/8/2009	
Benzo[a]pyrene	BQL	5.16	0.655	1	7/8/2009	
Benzo[b]fluoranthene	BQL	5.16	0.738	1	7/8/2009	
Benzo[g,h,i]perylene	BQL	5.16	0.635	1	7/8/2009	
Benzo[k]fluoranthene	BQL	5.16	0.568	1	7/8/2009	
Bis(2-chloroethoxy)methane	BQL	5.16	1.06	1	7/8/2009	
Bis(2-chloroethyl)ether	BQL	5.16	1.07	1	7/8/2009	
Bis(2-chloroisopropyl)ether	BQL	5.16	1.01	1	7/8/2009	
Bis(2-ethylhexyl)phthalate	BQL	5.16	0.423	1	7/8/2009	
4-bromophenyl phenyl ether	BQL	5.16	0.805	1	7/8/2009	
Butylbenzylphthalate	BQL	5.16	0.459	1	7/8/2009	
2-Chloronaphthalene	BQL	5.16	0.893	1	7/8/2009	
2-Chlorophenol	BQL	5.16	1.21	1	7/8/2009	
4-Chloro-3-methylphenol	BQL	5.16	0.820	1	7/8/2009	
4-Chlorophenyl phenyl ether	BQL	5.16	3.36	1	7/8/2009	
Chrysene	BQL	5.16	0.573	1	7/8/2009	
Dibenzo[a,h]anthracene	BQL	5.16	0.454	1	7/8/2009	
Di-n-Butylphthalate	BQL	5.16	0.851	1	7/8/2009	
3,3'-Dichlorobenzidine	BQL	10.3	1.26	1	7/8/2009	
2,4-Dichlorophenol	BQL	5.16	1.16	1	7/8/2009	
Diethylphthalate	BQL	5.16	0.764	1	7/8/2009	
Dimethylphthalate	BQL	5.16	0.573	1	7/8/2009	
2,4-Dimethylphenol	BQL	5.16	1.67	1	7/8/2009	
Di-n-octylphthalate	BQL	5.16	0.599	1	7/8/2009	
4,6-Dinitro-2-methylphenol	BQL	25.8	0.568	1	7/8/2009	
2,4-Dinitrophenol	BQL	25.8	0.660	1	7/8/2009	
2,4-Dinitrotoluene	BQL	5.16	0.552	1	7/8/2009	
2,6-Dinitrotoluene	BQL	5.16	0.671	1	7/8/2009	
Diphenylamine *	BQL	5.16	0.588	1	7/8/2009	
Fluoranthene	BQL	5.16	0.728	1	7/8/2009	
Fluorene	1.91	5.16	0.748	1	7/8/2009	J
Hexachlorobenzene	BQL	5.16	0.521	1	7/8/2009	
Hexachlorobutadiene	BQL	5.16	0.784	1	7/8/2009	
Hexachlorocyclopentadiene	BQL	10.3	10.3	1	7/8/2009	
Hexachloroethane	BQL	5.16	0.769	1	7/8/2009	
Indeno(1,2,3-c,d)pyrene	BQL	5.16	2.36	1	7/8/2009	
Isophorone	BQL	5.16	0.913	1	7/8/2009	
Naphthalene	10.9	5.16	0.939	1	7/8/2009	
Nitrobenzene	BQL	5.16	1.08	1	7/8/2009	
2-Nitrophenol	BQL	5.16	1.27	1	7/8/2009	
4-Nitrophenol	BQL	25.8	1.11	1	7/8/2009	
N-Nitrosodi-n-propylamine	BQL	5.16	1.55	1	7/8/2009	
Pentachlorophenol	BQL	25.8	1.46	1	7/8/2009	
Phenanthrene	3.66	5.16	0.459	1	7/8/2009	J

SGS North America, Inc.

Results for Semivolatiles
by GCMS 625

Client Sample ID: TC-341 MW-25
Client Project ID: TC-341
Lab Sample ID: G128-2402-4B
Lab Project ID: G128-2402

Analyzed By: DCS
Date Collected: 6/30/2009 13:20
Date Received: 6/30/2009
Date Extracted: 7/2/2009
Matrix: Water

Initial/Final Amt: 969 mL / 5.0 mL

Compound	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flag
Phenol	BQL	5.16	1.09	1	7/8/2009	
Pyrene	BQL	5.16	2.13	1	7/8/2009	
1,2,4-Trichlorobenzene	BQL	5.16	0.743	1	7/8/2009	
2,4,6-Trichlorophenol	BQL	5.16	0.955	1	7/8/2009	
		Spike Added	Spike Result	Percent Recovered		
2-Fluorobiphenyl		10	8.5	85		
2-Fluorophenol		10	8.8	88		
Nitrobenzene-d5		10	9.5	95		
Phenol-d6		10	9.3	93		
2,4,6-Tribromophenol		10	9.3	93		
4-Terphenyl-d14		10	11	110		

Comments:

* N-Nitrosodiphenylamine is reported as the breakdown product Diphenylamine.

Flags:

BQL = Below Quantitation Limits.

J = Detected below the quantitation limit.

Reviewed By: 

SGS

CHAIN OF CUSTODY RECORD
SGS North America Inc.

Locations Nationwide
• Alaska
• New York
• New Jersey
• North Carolina
• Ohio

www.us.sgs.com

098405

SGS North America, Inc.

1 CLIENT: Catlin		CONTACT: Steve Hudson		PHONE NO: (910) 452-5861		PROJECT: TC-341		REPORTS TO: Steve Hudson		INVOICE TO: Catlin		QUOTE #: 700 101		P.O. NUMBER: 290630-6											
2 LAB NO.		SAMPLE IDENTIFICATION		DATE		TIME		MATRIX		S R E N I A T I O N C		No		SAMPLE TYPE		Preservatives		Analysis Required		C= COMPT		G= GRAB			
3		TC-341		MW-24		6-30-09		1221		H2O		3		6		✓		✓		✓		✓		✓	
4		TC-341		MW-25		6-30-09		1320		H2O		3		6		✓		✓		✓		✓		✓	
5		TC-341		MW-24		6-30-09		1220		H2O		1		6		✓		✓		✓		✓		✓	
6		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
7		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
8		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
9		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
10		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
11		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
12		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
13		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
14		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
15		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
16		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
17		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
18		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
19		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
20		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
21		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
22		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
23		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
24		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
25		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
26		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
27		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
28		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
29		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
30		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
31		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
32		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
33		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
34		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
35		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
36		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
37		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
38		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
39		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
40		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
41		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
42		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
43		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
44		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
45		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
46		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
47		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
48		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
49		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
50		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
51		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
52		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
53		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
54		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
55		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
56		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
57		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
58		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
59		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
60		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
61		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
62		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
63		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
64		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
65		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
66		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
67		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
68		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
69		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
70		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
71		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
72		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
73		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
74		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
75		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
76		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
77		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
78		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
79		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
80		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
81		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
82		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
83		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
84		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
85		TC-341		MW-24		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
86		TC-341		MW-25		6-30-09		1320		H2O		1		6		✓		✓		✓		✓		✓	
87		TC-341		MW-24		6-30-09		1320		H2O															

APPENDIX F

**HISTORICAL FREE-PHASE PRODUCT GAUGING
AND
RECOVERY INFORMATION**



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 8-Feb-08 Friday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.55	0.15	0.06250	7.70
MW02		2	7.71	0.92	0.50000	8.63
MW03		2	7.32	1.75	1.25000	9.07
MW04		2	7.48	0.34	0.18750	7.82
MW05		2				
MW06		2	7.40	0.13	0.06250	7.53
MW07		2	5.33	1.15	0.75000	6.48
MW08		2	7.30	0.70	0.50000	8.00
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	7.42	0.81	0.50000	8.23
MW14		2				
MW15		2				
IR3567A		2	7.75	0.56	0.25000	8.31
			Total Product Recovered:		4.06250	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 22-Feb-08 Friday
 FACILITY ID: G-480
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.02	0.18	0.03125	7.20
MW02		2	7.42	0.33	0.06250	7.75
MW03		2	7.08	1.03	0.75000	8.11
MW04		2	7.05	0.35	0.25000	7.40
MW05		2				
MW06						7.10
MW07		2	5.08	0.95	0.75000	6.03
MW08						7.09
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	7.17	0.43	0.50000	7.60
MW14		2				
MW15		2				
IR3567A		2	7.10	0.22	0.06250	7.32
			Total Product Recovered:		2.40625	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011
 OSAGE PROJECT #: N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 13-Mar-08 Thursday
 FACILITY ID: G-480
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.92	0.09	0.06250	7.01
MW02		2	7.25	0.10	0.12500	7.35
MW03		2	6.85	1.15	0.50000	8.00
MW04		2	6.83	0.67	0.37500	7.50
MW05		2				
MW06						
MW07		2	4.87	1.03	0.50000	5.90
MW08						
MW09		2	6.90	0.12	0.06250	7.02
MW10		2				
MW11		2				
MW12		2				
MW13		2	7.08	0.24	0.37500	7.32
MW14		2				
MW15		2				
IR3567A		2	7.11	0.89	0.25000	8.00
			Total Product Recovered:		2.25000	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 27-Mar-08 Thursday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.00	0.11	0.03125	7.11
MW02		2	7.31	0.33	0.12500	7.64
MW03		2	6.86	1.51	1.00000	8.37
MW04		2	6.84	0.73	0.37500	7.57
MW05		2				
MW06						
MW07		2	4.94	1.15	1.00000	6.09
MW08		2	6.96	0.33	0.12500	7.29
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	7.12	0.31	0.12500	7.43
MW14		2				
MW15		2				
IR3567A		2	7.19	0.79	0.50000	7.98
			Total Product Recovered:		3.28125	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT #: N40085-06-D-7006 - 0011DATE: 10-Apr-08 ThursdayCLIENT'S NAME: NAVFAC MID LANTFACILITY ID: G-480INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.87	0.11	0.03125	6.98
MW02		2	7.23	0.29	0.18750	7.52
MW03		2	6.85	1.16	0.75000	8.01
MW04		2	6.83	0.57	0.25000	7.40
MW05		2				
MW06						
MW07		2	4.96	0.80	0.50000	5.76
MW08		2	7.29	0.21	0.37500	7.50
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	7.07	0.31	0.18750	7.38
MW14		2				
MW15		2				
IR3567A		2	7.10	0.67	0.00000	7.77
			Total Product Recovered:		2.28125	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 24-Apr-08 Thursday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.55	0.02	0.03125	6.57
MW02		2	6.98	0.05	0.03125	7.03
MW03		2	6.57	1.03	0.75000	7.60
MW04		2	6.49	0.64	0.50000	7.13
MW05		2				
MW06						
MW07		2	4.60	0.90	1.00000	5.50
MW08		2	7.62	0.01	0.03125	7.63
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	6.80	0.28	0.18750	7.08
MW14		2				
MW15		2				
IR3567A		2	6.85	0.90	0.12500	7.75
			Total Product Recovered:		2.65625	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 14-May-08 Wednesday
 FACILITY ID: G-480
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.15	0.13	0.03125	6.28
MW02		2	6.70	0.01	0.03125	6.71
MW03		2	6.40	0.48	0.25000	6.88
MW04		2	6.28	0.67	0.50000	6.95
MW05		2				
MW06						
MW07		2	4.91	0.62	1.00000	5.53
MW08						
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	6.85	0.28	0.25000	7.13
MW14		2				
MW15		2				
IR3567A		2	6.61	0.64	0.25000	7.25
			Total Product Recovered:		2.31250	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT # : N40085-06-D-7006 - 0011DATE: 30-May-08 FridayCLIENT'S NAME: NAVFAC MID LANTFACILITY ID: G-480INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.70	0.07	0.03125	6.77
MW02		2	6.98	0.56	0.18750	7.54
MW03		2	6.49	1.52	0.75000	8.01
MW04		2	6.52	0.63	0.25000	7.15
MW05		2				
MW06						
MW07		2	4.65	1.33	1.00000	5.98
MW08		2	6.60	0.90	0.37500	7.50
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	6.83	0.28	0.06250	7.11
MW14		2				
MW15		2				
IR3567A		2	6.92	0.60	0.12500	7.52
			Total Product Recovered:		2.78125	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 13-Jun-08 Wednesday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.92	0.09	0.01563	7.01
MW02		2	7.03	1.35	0.75000	8.38
MW03		2	6.70	1.80	1.25000	8.50
MW04		2	6.07	0.20	0.37500	6.27
MW05		2				
MW06		2	6.90	0.34	0.06250	7.24
MW07		2	4.80	1.80	1.25000	6.60
MW08		2	6.70	1.60	1.12500	8.30
MW09		2	N/A			6.85
MW10		2				
MW11		2				
MW12		2				
MW13		2	6.99	0.61	0.14063	7.60
MW14		2				
MW15		2				
IR3567A		2	7.11	0.69	0.31250	7.80
			Total Product Recovered:		5.28126	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT #: N40085-06-D-7006 - 0011DATE: 24-Jun-08 WednesdayCLIENT'S NAME: NAVFAC MID LANTFACILITY ID: G-480INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.14	0.03	0.02344	7.17
MW02		2	7.22	1.00	0.75000	8.22
MW03		2	6.88	2.05	1.25000	8.93
MW04		2	6.93	0.65	0.25000	7.58
MW05		2				
MW06		2				
MW07		2	4.94	1.81	1.37500	6.75
MW08		2	6.85	1.75	1.25000	8.60
MW09		2				
MW10		2				
MW11		2				
MW12		2				
MW13		2	7.13	0.67	0.25000	7.80
MW14		2				
MW15		2				
IR3567A		2	7.30	0.70	0.12500	8.00
			Total Product Recovered:		5.27344	Gallons
				Total Fluids:	21	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT # : N40085-06-D-7006 - 0011DATE: 7-Jul-08 MondayCLIENT'S NAME: NAVFAC MID LANTFACILITY ID: G-480INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.31	0.04	0.03125	7.35
MW02		2	7.28	2.02	1.25000	9.30
MW03		2	7.00	2.15	1.25000	9.15
MW04		2	7.12	0.68	0.25000	7.80
MW05		2	N/A			6.92
MW06		2	7.16	0.74	0.25000	7.90
MW07		2	5.05	2.00	1.50000	7.05
MW08		2	6.30	1.85	1.37500	8.15
MW09		2	N/A			7.27
MW10		2	N/A			7.35
MW11		2	N/A			6.85
MW12		2	N/A			7.00
MW13		2	7.25	0.81	0.31250	8.06
MW14		2	N/A			7.75
MW15		2	N/A			7.20
IR3567A		2	7.48	0.67	0.15625	8.15
			Total Product Recovered:		6.37500	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 24-Jul-08 Thursday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.38	0.07	0.01563	7.45
MW02		2	7.55	1.60	1.25000	9.15
MW03		2	7.04	2.31	1.37500	9.35
MW04		2	7.21	0.64	0.25000	7.85
MW05		2	N/A			6.90
MW06		2	7.23	0.47	0.20313	7.70
MW07		2	5.05	2.00	1.50000	7.05
MW08		2	6.98	1.97	1.50000	8.95
MW09		2	7.34	0.20	0.06250	7.54
MW10		2	N/A			7.41
MW11		2	N/A			6.92
MW12		2	N/A			7.03
MW13		2	7.28	0.85	0.37500	8.13
MW14		2	N/A			9.80
MW15		2	N/A			7.25
IR3567A		2	7.53	0.77	0.20313	8.30
			Total Product Recovered:		6.73438	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 7-Aug-08 Thursday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.36	0.09	0.03125	7.45
MW02		2	7.38	1.67	0.87500	9.05
MW03		2	7.02	2.28	1.25000	9.30
MW04		2	7.22	0.53	0.12500	7.75
MW05		2	N/A			6.72
MW06		2	7.25	0.35	0.06250	7.60
MW07		2	5.05	2.15	1.50000	7.20
MW08		2	6.98	1.71	1.12500	8.69
MW09		2	7.35	0.21	0.06250	7.56
MW10		2	N/A			7.45
MW11		2	N/A			7.01
MW12		2	N/A			7.10
MW13		2	7.27	0.78	0.31250	8.05
MW14		2	N/A			7.75
MW15		2	N/A			7.30
IR3567A		2	7.51	0.57	0.12500	8.08
			Total Product Recovered:		5.46875	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT # : N40085-06-D-7006 - 0011DATE: 22-Aug-08 FridayCLIENT'S NAME: NAVFAC MID LANTFACILITY ID: G-480INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.12	0.10	0.02344	7.22
MW02		2	7.24	1.11	0.62500	8.35
MW03		2	6.88	1.70	1.00000	8.58
MW04		2	6.98	0.47	0.25000	7.45
MW05		2	N/A			6.00
MW06		2	7.02	0.26	0.06250	7.28
MW07		2	4.94	1.44	1.00000	6.38
MW08		2	6.91	0.93	0.75000	7.84
MW09		2	7.11	0.14	0.04688	7.25
MW10		2	N/A			7.20
MW11		2	N/A			6.77
MW12		2	N/A			6.90
MW13		2	7.11	0.52	0.31250	7.63
MW14		2	N/A			7.47
MW15		2	N/A			7.03
IR3567A		2	7.30	0.50	0.12500	7.80
			Total Product Recovered:		4.19531	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: G-480 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT #: N40085-06-D-7006 - 0011DATE: 8-Sep-08 FridayCLIENT'S NAME: NAVFAC MID LANTFACILITY ID: G-480INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.88	0.10	0.02343	6.98
MW02		2	7.10	0.76	0.50000	7.86
MW03		2	6.75	1.17	0.78125	7.92
MW04		2	6.80	0.40	0.25000	7.20
MW05		2	N/A			6.50
MW06		2	6.83	0.07	0.04688	6.90
MW07		2	4.81	0.94	0.81250	5.75
MW08		2	6.78	0.47	0.25000	7.25
MW09		2	6.95	0.05	0.03125	7.00
MW10		2	N/A			6.98
MW11		2	N/A			6.52
MW12		2	N/A			6.70
MW13		2	6.95	0.32	0.25000	7.27
MW14		2	N/A			7.21
MW15		2	N/A			6.82
IR3567A		2		7.10	0.12500	7.60
			Total Product Recovered:		3.07031	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **G-480 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 26-Sep-08 Friday

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: G-480

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.10	0.07	0.01563	7.17
MW02		2	7.20	1.48	1.00000	8.68
MW03		2	6.70	1.82	1.12490	8.52
MW04		2	6.95	0.59	0.21875	7.54
MW05		2	N/A			6.72
MW06		2	6.97	0.48	0.25000	7.45
MW07		2	4.92	1.33	1.00000	6.25
MW08		2	6.84	1.40	0.87500	8.24
MW09		2	7.12	0.08	0.03125	7.20
MW10		2	N/A			7.14
MW11		2	N/A			6.61
MW12		2	N/A			6.80
MW13		2	7.11	0.59	0.25000	7.70
MW14		2	N/A			7.45
MW15		2	N/A			6.92
IR3567A		2	7.30	7.10	0.18750	7.95
			Total Product Recovered:		4.95303	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT #: N40085-06-D-7006 - 0011DATE: 4-Oct-08CLIENT'S NAME: NAVFAC MID LANTFACILITY ID: TC-341INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.15	0.13	0.00781	6.28
MW02		2	6.70	0.01	0.01563	6.71
MW03		2	6.40	0.48	0.25000	6.88
MW04		2	6.28	0.67	0.50000	6.95
MW05		2	N/A			5.20
MW06		2	N/A			6.40
MW07		2	4.91	0.62	1.00000	5.53
MW08		2	N/A			6.45
MW09		2	N/A			6.47
MW10		2	N/A			6.48
MW11		2	N/A			5.92
MW12		2	N/A			6.23
MW13		2	6.61	0.24	0.25000	6.85
MW14		2	N/A			6.77
MW15		2	N/A			6.00
IR3567A		2	6.61	0.64	0.25000	7.25
			Total Product Recovered:		2.27344	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **TC-341 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 30-Oct-08

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: TC-341

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.35	0.25	0.06250	7.60
MW02		2	7.43	1.71	1.00000	9.14
MW03		2	7.07	2.29	1.00000	9.36
MW04		2	7.19	0.76	0.31250	7.95
MW05		2	N/A			6.84
MW06		2	7.20	0.57	0.20313	7.77
MW07		2	5.11	1.77	1.00000	6.88
MW08		2	7.11	1.49	1.00000	8.60
MW09		2	7.35	0.17	0.03125	7.52
MW10		2	N/A			7.48
MW11		2	N/A			6.82
MW12		2	N/A			7.09
MW13		2	7.30	0.89	0.31250	8.19
MW14		2	N/A			7.67
MW15		2	N/A			7.11
IR3567A		2	7.55	0.79	0.31250	8.34
Total Product Recovered:					5.23438	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **TC-341 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT #: **N40085-06-D-7006 - 0011**

DATE: 12-Nov-08

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: TC-341

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.08	0.11	0.03125	7.19
MW02		2	7.29	0.91	0.50000	8.20
MW03		2	6.93	1.47	1.25000	8.40
MW04		2	6.88	0.28	0.12500	7.16
MW05		2	N/A			6.63
MW06		2	6.97	0.13	0.12500	7.10
MW07		2	4.91	1.00	2.48438	5.91
MW08		2	6.88	0.87	0.75000	7.75
MW09		2	N/A			7.04
MW10		2	N/A			7.10
MW11		2	N/A			6.75
MW12		2	N/A			6.86
MW13		2	7.13	0.32	0.25000	7.45
MW14		2	N/A			7.58
MW15		2	N/A			6.93
IR3567A		2	7.30	0.48	0.25000	7.78
Total Product Recovered:					5.76563	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **TC-341 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 24-Nov-08

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: TC-341

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.92	0.09	0.06250	7.01
MW02		2	7.16	0.56	0.25000	7.72
MW03		2	6.78	1.20	0.75000	7.98
MW04		2	6.83	0.35	0.12500	7.18
MW05		2	N/A			6.49
MW06		2	N/A			6.88
MW07		2	4.85	0.85	0.75000	5.70
MW08		2	6.82	0.36	0.32813	7.18
MW09		2	N/A			6.98
MW10		2	N/A			7.02
MW11		2	N/A			6.62
MW12		2	N/A			7.64
MW13		2	6.99	0.21	0.25000	7.20
MW14		2	N/A			7.32
MW15		2	N/A			6.76
IR3567A		2	7.11	0.47	0.10938	7.58
			Total Product Recovered:		2.62500	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: **TC-341 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : **N40085-06-D-7006 - 0011**

DATE: 2-Dec-08

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: TC-341

INCIDENT NUMBER AND NAME: **N/A**RECOVERY METHOD: **Peristaltic Pump/tubing**

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.15	0.14	0.09375	7.29
MW02		2	7.38	1.03	0.62500	8.41
MW03		2	6.99	1.72	1.12500	8.71
MW04		2	7.09	0.42	0.18750	7.51
MW05		2	N/A	N/A	0.00000	6.76
MW06		2	7.14	0.27	0.15625	7.41
MW07		2	5.09	1.30	1.00000	6.39
MW08		2	7.01	1.07	0.75000	8.08
MW09		2	7.20	0.21	0.09375	7.41
MW10		2	N/A	N/A	0.00000	7.31
MW11		2	N/A	N/A	0.00000	6.81
MW12		2	N/A	N/A	0.00000	6.94
MW13		2	7.25	0.40	0.12500	7.65
MW14		2	N/A	N/A	0.00000	7.51
MW15		2	N/A	N/A	0.00000	6.93
IR3567A		2	7.44	0.47	0.12500	7.91
			Total Product Recovered:		4.28125	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 15-Dec-08
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.48	0.10	0.06250	6.58
MW02		2	7.10	0.09	0.12500	7.19
MW03		2	6.79	0.43	0.50000	7.22
MW04		2	6.71	0.13	0.09375	6.84
MW05		2	6.38	0.01	0.03125	6.39
MW06		2	N/A	N/A	0.00000	6.78
MW07		2	4.81	0.37	0.12500	5.18
MW08		2	N/A	N/A	0.00000	6.80
MW09		2	N/A	N/A	0.00000	6.88
MW10		2	N/A	N/A	0.00000	6.84
MW11		2	N/A	N/A	0.00000	6.33
MW12		2	N/A	N/A	0.00000	7.55
MW13		2	6.91	0.23	0.21875	7.14
MW14		2	N/A	N/A	0.00000	7.02
MW15		2	N/A	N/A	0.00000	6.55
IR3567A		2	7.01	0.37	0.12500	7.38
Total Product Recovered:					1.28125	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT #: N40085-06-D-7006 - 0011DATE: 2-Jan-09CLIENT'S NAME: NAVFAC MID LANTFACILITY ID: TC-341INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.51	0.10	0.09375	6.61
MW02		2	6.91	0.10	0.12500	7.01
MW03		2	6.58	0.70	0.50000	7.28
MW04		2	6.50	0.34	0.25000	6.84
MW05		2	6.01	0.01	0.03125	6.02
MW06		2	N/A	N/A	0.00000	6.64
MW07		2	4.69	0.61	0.50000	5.30
MW08		2	6.61	0.29	0.25000	6.90
MW09		2	N/A	N/A	0.00000	6.65
MW10		2	N/A	N/A	0.00000	6.68
MW11		2	N/A	N/A	0.00000	6.25
MW12		2	N/A	N/A	0.00000	6.45
MW13		2	6.79	0.13	0.12500	6.92
MW14		2	N/A	N/A	0.00000	7.09
MW15		2	N/A	N/A	0.00000	6.45
IR3567A		2	6.84	0.47	0.15625	7.31
Total Product Recovered:					2.03125	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 21-Jan-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.84	0.08	0.06250	6.92
MW02		2	7.12	1.02	0.50000	8.14
MW03		2	6.78	1.31	0.75000	8.09
MW04		2	6.65	0.64	0.25000	7.29
MW05		2	N/A	N/A	0.00000	6.35
MW06		2	6.80	0.01	0.06250	6.81
MW07		2	4.80	0.82	0.75000	5.62
MW08		2	6.70	0.01	0.50000	6.71
MW09		2	6.82	0.03	0.01563	6.85
MW10		2	N/A	N/A	0.00000	6.98
MW11		2	N/A	N/A	0.00000	6.47
MW12		2	N/A	N/A	0.00000	6.65
MW13		2	6.93	0.01	0.12500	6.94
MW14		2	N/A	N/A	0.00000	6.22
MW15		2	N/A	N/A	0.00000	6.65
IR3567A		2	7.00	0.69	0.28125	7.69
			Total Product Recovered:		3.29688	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT # : N40085-06-D-7006 - 0011DATE: 4-Feb-09CLIENT'S NAME: NAVFAC MID LANTFACILITY ID: TC-341INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.91	0.09	0.06250	7.00
MW02		2	6.93	1.10	1.38280	8.03
MW03		2	6.82	1.63	1.37500	8.45
MW04		2	6.78	0.57	0.20313	7.35
MW05		2	N/A	N/A	0.00000	6.42
MW06		2	6.98	0.22	0.12500	7.20
MW07		2	4.68	1.62	1.00000	6.30
MW08		2	6.80	1.15	0.78125	7.95
MW09		2	6.90	0.03	0.04688	6.93
MW10		2	N/A	N/A	0.00000	7.01
MW11		2	N/A	N/A	0.00000	6.51
MW12		2	N/A	N/A	0.00000	6.71
MW13		2	7.05	0.46	0.21875	7.51
MW14		2	N/A	N/A	0.00000	8.33
MW15		2	N/A	N/A	0.00000	6.76
IR3567A		2	7.15	0.77	0.25000	7.92
			Total Product Recovered:		5.44530	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 17-Feb-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.11	0.01	0.04688	7.12
MW02		2	7.24	1.46	0.85938	8.70
MW03		2	6.91	1.84	1.38280	8.75
MW04		2	6.94	0.01	0.21875	6.95
MW05		2	N/A	N/A	0.00000	6.84
MW06		2	7.10	0.35	0.12500	7.45
MW07		2	5.00	1.58	1.00000	6.58
MW08		2	6.90	1.53	1.00000	8.43
MW09		2	N/A	N/A	0.00000	7.09
MW10		2	N/A	N/A	0.00000	7.19
MW11		2	N/A	N/A	0.00000	6.72
MW12		2	N/A	N/A	0.00000	6.86
MW13		2	7.19	0.48	0.14063	7.67
MW14		2	N/A	N/A	0.00000	7.55
MW15		2	N/A	N/A	0.00000	6.98
IR3567A		2	7.32	0.87	0.32813	8.19
Total Product Recovered:					5.10155	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 5-Mar-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.78	0.10	0.04688	6.88
MW02		2	7.14	0.54	0.37500	7.68
MW03		2	6.80	1.02	0.75000	7.82
MW04		2	6.75	0.40	0.23438	7.15
MW05		2	N/A	N/A	0.00000	6.49
MW06		2	6.90	0.10	0.06250	7.00
MW07		2	4.89	0.85	0.75000	5.74
MW08		2	6.81	0.59	0.39063	7.40
MW09		2	6.88	0.08	0.07813	6.96
MW10		2	N/A	N/A	0.00000	6.94
MW11		2	N/A	N/A	0.00000	6.85
MW12		2	N/A	N/A	0.00000	6.64
MW13		2	7.00	0.29	0.25000	7.29
MW14		2	N/A	N/A	0.00000	7.23
MW15		2	N/A	N/A	0.00000	6.69
IR3567A		2	7.10	0.66	0.21875	7.76
			Total Product Recovered:		3.15625	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 17-Mar-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.96	0.04	0.06250	7.00
MW02		2	7.10	1.39	0.75000	8.49
MW03		2	6.75	1.80	1.00000	8.55
MW04		2	6.76	0.50	0.15625	7.26
MW05		2	N/A	N/A	0.00000	6.55
MW06		2	6.90	0.29	0.09375	7.19
MW07		2	4.85	1.37	1.00000	6.22
MW08		2	7.75	0.29	0.89844	8.04
MW09		2	7.42	0.30	0.12500	7.72
MW10		2	N/A	N/A	0.00000	7.41
MW11		2	N/A	N/A	0.00000	6.69
MW12		2	N/A	N/A	0.00000	6.71
MW13		2	7.05	0.44	0.12500	7.49
MW14		2	N/A	N/A	0.00000	7.34
MW15		2	N/A	N/A	0.00000	6.75
IR3567A		2	7.14	0.71	0.25000	7.85
			Total Product Recovered:		4.46094	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 4-Apr-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.54	0.06	0.04688	6.60
MW02		2	6.85	0.24	0.20313	7.09
MW03		2	6.51	0.64	0.50000	7.15
MW04		2	6.45	0.27	0.21875	6.72
MW05		2	N/A	N/A	0.00000	6.14
MW06		2	6.56	0.01	0.01563	6.57
MW07		2	4.59	0.76	0.75000	5.35
MW08		2	6.53	0.45	0.25000	6.98
MW09		2	6.61	0.01	0.04688	6.62
MW10		2	N/A	N/A	0.00000	6.64
MW11		2	N/A	N/A	0.00000	6.38
MW12		2	N/A	N/A	0.00000	6.42
MW13		2	6.71	0.26	0.21875	6.97
MW14		2	N/A	N/A	0.00000	7.04
MW15		2	N/A	N/A	0.00000	6.42
IR3567A		2	6.73	0.83	0.25000	7.56
			Total Product Recovered:		2.50000	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011LOGGED BY: Theresa EllermanOSAGE PROJECT # : N40085-06-D-7006 - 0011DATE: 28-Apr-09CLIENT'S NAME: NAVFAC MID LANTFACILITY ID: TC-341INCIDENT NUMBER AND NAME: N/ARECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.00	0.01	0.01563	7.01
MW02		2	7.05	1.70	1.07813	8.75
MW03		2	6.75	2.87	1.12500	9.62
MW04		2	N/A	N/A	0.00000	6.76
MW05		2	N/A	N/A	0.00000	6.51
MW06		2	6.92	0.37	0.12500	7.29
MW07		2	4.82	1.85	1.12500	6.67
MW08		2	6.72	1.68	1.05469	8.40
MW09		2	N/A	N/A	0.00000	6.96
MW10		2	N/A	N/A	0.00000	7.05
MW11		2	N/A	N/A	0.00000	6.75
MW12		2	N/A	N/A	0.00000	6.72
MW13		2	7.02	0.53	0.21875	7.55
MW14		2	N/A	N/A	0.00000	7.44
MW15		2	6.75	0.01	0.00781	6.76
IR3567A		2	7.50	0.72	0.37500	8.22
			Total Product Recovered:		5.12500	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 8-May-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.05	0.07	0.04688	7.12
MW02		2	7.64	0.77	1.12500	8.41
MW03		2	6.82	1.82	2.34300	8.64
MW04		2	6.83	0.87	0.31250	7.70
MW05		2	N/A	N/A	0.00000	6.69
MW06		2	7.00	0.33	0.09375	7.33
MW07		2	4.86	1.89	1.50000	6.75
MW08		2	6.78	1.84	1.48000	8.62
MW09		2	7.04	0.04	0.04688	7.08
MW10		2	N/A	N/A	0.00000	7.09
MW11		2	N/A	N/A	0.00000	6.74
MW12		2	N/A	N/A	0.00000	6.74
MW13		2	7.10	0.61	0.28125	7.71
MW14		2	N/A	N/A	0.00000	6.48
MW15		2	N/A	N/A	0.00000	6.89
IR3567A		2	7.20	0.91	0.25000	8.11
Total Product Recovered:					7.47925	Gallons



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 21-May-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.72	0.05	0.01563	6.77
MW02		2	7.00	0.54	0.37500	7.54
MW03		2	6.69	0.84	0.46875	7.53
MW04		2	6.62	0.06	0.25000	6.68
MW05		2	N/A	N/A	0.00000	6.33
MW06		2	6.72	0.04	0.06250	6.76
MW07		2	4.72	0.78	0.87500	5.50
MW08		2	6.68	0.46	0.25000	7.14
MW09		2	6.79	0.11	0.04688	6.90
MW10		2	N/A	N/A	0.00000	6.82
MW11		2	N/A	N/A	0.00000	6.45
MW12		2	N/A	N/A	0.00000	6.52
MW13		2	6.88	0.22	0.25000	7.10
MW14		2	N/A	N/A	0.00000	7.04
MW15		2	N/A	N/A	0.00000	6.59
IR3567A		2	6.97	0.64	0.28175	7.61
Total Product Recovered:					2.87550	Gallons

FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011

LOGGED BY: Theresa Ellerman

OSAGE PROJECT # : N40085-06-D-7006 - 0011

DATE: 3-Jun-09

CLIENT'S NAME: NAVFAC MID LANT

FACILITY ID: TC-341

INCIDENT NUMBER AND NAME: N/A

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	6.98	0.08	0.04688	7.06
MW02		2	7.03	1.59	0.87500	8.62
MW03		2	6.70	2.00	0.87500	8.70
MW04		2	6.75	0.60	0.21875	7.35
MW05		2	N/A	N/A	0.00000	6.50
MW06		2	6.91	0.34	0.12500	7.25
MW07		2	4.71	1.93	1.12500	6.64
MW08		2	6.73	1.50	1.00000	8.23
MW09		2	6.94	0.07	0.06250	7.01
MW10		2	N/A	N/A	0.00000	7.02
MW11		2	N/A	N/A	0.00000	6.72
MW12		2	N/A	N/A	0.00000	6.70
MW13		2	7.01	0.53	0.25000	7.54
MW14		2	N/A	N/A	0.00000	7.40
MW15		2	N/A	N/A	0.00000	6.76
IR3567A		2	6.91	0.58	0.25000	7.49
			Total Product Recovered:		4.82813	Gallons
	* No product or sheen in ditch.					



FREE PRODUCT RECOVERY

OSAGE PROJECT: **TC-341 - CTO 0011**
 OSAGE PROJECT #: **N40085-06-D-7006 - 0011**
 CLIENT'S NAME: **NAVFAC MID LANT**
 INCIDENT NUMBER AND NAME: **N/A**

LOGGED BY: **Theresa Ellerman**
 DATE: **17-Jun-09**
 FACILITY ID: **TC-341**
 RECOVERY METHOD: **Peristaltic Pump/tubing**

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.08	0.01	0.01563	7.09
MW02		2	7.12	1.68	1.07800	8.80
MW03		2	6.81	1.85	1.12500	8.66
MW04		2	6.89	0.56	0.25000	7.45
MW05		2	N/A	N/A	0.00000	6.55
MW06		2	6.96	0.38	0.12500	7.34
MW07		2	4.85	1.83	1.25000	6.68
MW08		2	6.80	1.58	1.12500	8.38
MW09		2	7.05	0.02	0.06250	7.07
MW10		2	N/A	N/A	0.00000	7.14
MW11		2	N/A	N/A	0.00000	6.83
MW12		2	N/A	N/A	0.00000	6.83
MW13		2	7.02	0.68	0.25000	7.70
MW14		2	N/A	N/A	0.00000	7.46
MW15		2	N/A	N/A	0.00000	6.83
IR3567A		2	7.21	0.88	0.34375	8.09
Total Product Recovered:					5.62488	Gallons
	*No Product or sheen in ditch.					



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 7-Jul-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.36	0.06	0.06250	7.42
MW02		2	7.28	2.35	1.15000	9.63
MW03		2	6.99	2.53	1.25000	9.52
MW04		2	7.19	0.54	0.21875	7.73
MW05		2	N/A	N/A	0.00000	6.91
MW06		2	7.21	0.01	0.56250	7.22
MW07		2	5.00	2.41	1.11000	7.41
MW08		2	7.38	1.10	1.50000	8.48
MW09		2	N/A	N/A	0.00000	7.29
MW10		2	N/A	N/A	0.00000	7.40
MW11		2	N/A	N/A	0.00000	7.11
MW12		2	N/A	N/A	0.00000	7.06
MW13		2	7.24	1.10	0.56250	8.34
MW14		2	N/A	N/A	0.00000	8.34
MW15		2	N/A	N/A	0.00000	7.20
IR3567A		2	7.48	0.90	0.25000	8.38
			Total Product Recovered:		6.66625	Gallons
	*No Product or sheen in ditch.					



FREE PRODUCT RECOVERY

OSAGE PROJECT: TC-341 - CTO 0011
 OSAGE PROJECT # : N40085-06-D-7006 - 0011
 CLIENT'S NAME: NAVFAC MID LANT
 INCIDENT NUMBER AND NAME: N/A

LOGGED BY: Theresa Ellerman
 DATE: 21-Jul-09
 FACILITY ID: TC-341
 RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	AMOUNT OF PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2	7.32	0.09	0.04680	7.41
MW02		2	7.50	0.78	1.00000	8.28
MW03		2	7.00	2.18	1.25000	9.18
MW04		2	7.19	0.36	0.12500	7.55
MW05		2	N/A	N/A	0.00000	6.90
MW06		2	7.17	0.37	0.12500	7.54
MW07		2	5.05	2.09	1.33000	7.14
MW08		2	6.97	1.97	1.62000	8.94
MW09		2	7.35	0.04	0.07800	7.39
MW10		2	N/A	N/A	0.00000	7.21
MW11		2	N/A	N/A	0.00000	7.10
MW12		2	N/A	N/A	0.00000	7.09
MW13		2	7.25	0.94	0.50000	8.19
MW14		2	N/A	N/A	0.00000	7.71
MW15		2	N/A	N/A	0.00000	7.25
IR3567A		2	7.50	0.79	0.21870	8.29
			Total Product Recovered:		6.29350	Gallons
	*No Product or sheen in ditch.					



RECOVERY TOTAL 2008-2009

OSAGE PROJECT: **TC-341 - CTO 0011**

LOGGED BY: Theresa Ellerman

OSAGE PROJECT #: **N40085-06-D-7006 - 0011**

DATE:

CLIENT'S NAME: **NAVFAC MID LANT**

FACILITY ID: TC-341

INCIDENT NUMBER AND NAME: **N/A**

RECOVERY METHOD: Peristaltic Pump/tubing

WELL ID	PRODUCT TYPE	CASING DIAMETER (Inches)	DEPTH TO PRODUCT (feet)	PRODUCT THICKNESS BEFORE RECOVERY (feet)	TOTAL PRODUCT RECOVERED (gallons)	DEPTH TO WATER (feet)
MW01		2		0.00	1.48430	
MW02		2		0.00	21.64205	
MW03		2		0.00	34.85070	
MW04		2		0.00	8.90625	
MW05		2			0.06250	
MW06		2		0.00	3.18750	
MW07		2		0.00	36.86188	
MW08		2		0.00	24.58438	
MW09		2		0.00	1.03113	
MW10		2			0.00000	
MW11		2			0.00000	
MW12		2			0.00000	
MW13		2		0.00	9.31251	
MW14		2			0.00000	
MW15		2			0.00781	
IR3567A		2		0.00	7.79733	
Total Product Recovered:					149.7283	Gallons

APPENDIX G

SURFACTANT-ENHANCED RECOVERY QUOTE – ETEC, LLC.

SURFACTANT-ENHANCED RECOVERY QUOTE

Contact:	Mr. Jake Wessell, P.E.	From:	David Laughlin, P.E.
Company:	Catlin Engineers and Scientists	Phone:	503-709-7123
Phone:	919-838-2875	Fax:	505-897-4201
Fax:	919-838-6682	Date:	August 5, 2009
Pages:	3	Proposal:	1009-089

RE: Surfactant-enhanced Free Product Recovery – TC-341 Pipeline, Marine Corps Base, Camp Lejeune, North Carolina

Jake:

This quote includes surfactant costs for subsurface injection events as part of a groundwater pump-and-treat system to enhance recovery of persistent separate-phase hydrocarbon (SPH) fuel from the groundwater, as well as recommendations regarding field application. Based on your information, our understanding of the project includes the following:

- Previous fuel releases (primarily kerosene) from the TC-341 pipeline have impacted subsurface soil and groundwater. A former soil excavation recovered a significant portion of the fuel mass, but persistent free-phase product remains in an area measuring approximately 100 feet x 200 feet. A significant portion of the current free-phase product plume area is beneath a street (F Street).
- The proposed corrective action plan involves installation of two recovery trenches, one trench along the west side of F Street measuring approximately 190 feet in length, and the other trench along the east side of F Street measuring approximately 120 feet in length. These trenches will consist of 4-inch diameter slotted PVC pipe with an 8-inch recovery sump at the north end. These trenches will be installed slightly below the historic groundwater level, and ongoing total fluids extraction from the recovery sumps would encourage mobilization of free-phase product toward the trench sumps for subsequent recovery and treatment. Recent free-phase product thicknesses in various monitoring wells have ranged from 0.01 ft. to 0.43 feet.
- Depth-to-groundwater in the defined free product area typically exists at approximately 6-8 feet below ground surface (bgs). Groundwater flows to the east. Within the free product area, there is a groundwater elevation drop from west to east of as much as 2 feet.
- The soil consists primarily of interbedded sand, silty sand, and clayey sand.
- This proposal provides costs for application of surfactants to enhance mobilization of free product toward the recovery trenches. For application, appropriate volumes of surfactant solution and chase water would be injected into available injection wells within the outer portion of the free-product area on a quarterly basis to enhance the recovery efforts of the pump-and treat system. The injected surfactant would provide more aggressive mobilization of free product toward the recovery trenches. Removal of measurable free product from the soil/groundwater will reduce the site risk classification and hopefully eliminate the need for further site remediation.

We used this information to estimate required surfactant volumes and recommend a suitable injection approach. Details on our proposed approach and recommended products and volumes are provided below.

PROPOSED SURFACTANT PRODUCTS

The proposed surfactant injection approach would utilize our non-ionic surfactant, PetroSolv™. PetroSolv™ is a naturally-formulated, non-toxic, biodegradable, non-ionic surfactant designed for temporary emulsification of hydrophobic constituents (like petroleum compounds). Our PetroSolv™ product has been used successfully on many gasoline-, diesel-, and heating oil-impacted sites around the country.

Laboratory results from various surfactant studies have shown that non-ionic surfactant solutions at concentrations ranging from 0.1 to 10.0% can effectively provide emulsification and mobilization of hydrocarbon constituents. However, in our experience, PetroSolv™ application is also a function of the impacted soil volume being treated. With appropriate injection well infrastructure, we will be able to treat an area of approximately 30 ft. x 100 ft. on the west side of the plume and approximately 30 ft. x 30 ft. on the east side of the plume. Assuming that the injections can obtain effective contact with at least a 5-ft. thick layer of soil, there is approximately 550 cy of product-saturated soil for treatment on the west side, and approximately 200 cy of soil on the east side. Using our general application guideline based on ex situ and in situ field experience, which estimates that 1 gallon of concentrated PetroSolv™ is typically appropriate for application to 2-5 cy of soil volume, then a single injection/extraction event would require 150 to 375 gallons of PetroSolv™. For the initial injection event, we recommend application of 200 gallons of PetroSolv™.

DESCRIPTION AND RECOMMENDATIONS FOR PROPOSED PROCESS

Overall injection event activities include injecting a surfactant solution into available wells (i.e. new injection wells plus possible injection into existing monitoring wells MW01, MW02, MW15, MW03, MW67A, MW06, MW07, and MW13) at periodic intervals during the operation of the groundwater pump and treat system. In general, we would recommend quarterly surfactant injections coupled with the ongoing pump-and-treat system so that maximum hydraulic control could be maintained over the free product zone. If desired, ETEC can work with our local representative, Mid-Atlantic Environmental Equipment, to provide field injection services, or we can simply provide the PetroSolv with injection recommendations for Catlin field personnel. Some brief recommendations regarding mixing/application of the PetroSolv™ surfactant include the following:

1. Because of the significant size of the free product area, we recommend installation of at least 10 new injection wells at the locations shown on the attached figure. Installation of these wells, plus the existing monitoring wells (MW01, MW02, MW15, MW03, MW67A, MW06, MW07, and MW13) would provide an array of injection points that are no more than 15 feet apart, providing optimum coverage of the free product area. The new injection wells would need to be 2-inch diameter PVC wells installed to at least 15 feet bgs, with a screen interval from 5 feet to 15 feet. Each well would need at least 4 feet of bentonite/cement grout seal above the screen/sandpack. The seal is critical for pressure injection of the surfactant solution.
2. The 200 gallons of PetroSolv™ should be mixed with approximately 4,000 to 6,000 gallons of water to make a 3-5% mixed solution. This solution should then be pumped into the available wells under low pressure (10-20 psi) via direct connection to the well casings. Injection of this volume into the available wells will likely take 1-2 days to complete.
3. At 4-hour intervals during the injection, as many injection wells as possible should be surged using a surge block. These 15-30 minute surging events will encourage better contact with surrounding product-saturated smear zone soil, and increase peripheral distribution of the

surfactant solution. After surging the wells multiple times during and after injection, the surfactant solution should be provided with a minimum 12-24 hour contact time.

4. Following the surfactant injection and surging, approximately 2,000 to 4,000 gallons of potable chase water should be injected into the available injection wells. The goal is to utilize the chase water to hydraulically “push” the surfactant solution through the impacted soil and toward the recovery trenches/sumps. Injection of the 2,000 to 4,000 gallons of chase water will likely take 1-2 days to complete. Extracted, treated groundwater from the pump-and-treat system would be ideal for use as chase water. System personnel could simply run a hose from the end of the pump-and-treat system (prior to storm drain discharge) and connect it to the injection wells (see Point #6c below).
5. We understand that a pump-and-treat system will be utilized to recover free product and treat dissolved-phase constituents in groundwater. Advantages of the pump-and treat system include the ability for ongoing groundwater recovery that will create drawdown at the recovery trenches, thus producing a constant gradient to enhance capture of floating product.
6. Recommendations for the pump-and treat system include the following:
 - a. Utilize a holding tank between the total fluids extraction pumps and the oil-water separator. This holding tank (~500 gallons) will create quiescent conditions that will enhance separation of free product from the groundwater. At a 10 gpm flowrate, the 500-gallon holding tank will produce almost 1 hour of hydraulic retention time, which will enhance the efficiency of the subsequent oil-water separation.
 - b. After the holding tank and the oil-water separator, we assume that an air stripper will be utilized. A metering pump and in-line mixer should be installed between the oil-water separator and the air stripper to inject a de-foamer solution so that foam doesn’t build up in the stripper after a surfactant injection. Dilution of the surfactant solution with groundwater will likely render this a non-issue, but the system should be designed to deal with foaming if it occurs. The de-foamer is inexpensive, but will alleviate any foaming issues within the air stripper. A cost estimate for defoamer use is included in the cost table below.
 - c. Because kerosene is a mix of gasoline and diesel-range constituents, activated carbon polishing will likely be necessary prior to discharge. After the activated carbon, Catlin should consider installing a small holding tank, a transfer pump, and a flow-splitter, which would allow for groundwater discharge (to storm drain) and constant injection of a portion of the treated water (i.e. 10-25%) into upgradient injection points to increase the groundwater gradient toward the recovery trenches. Hydraulic control would still be maintained, but free product mobilization and recovery would be enhanced. If Catlin designs their system this way, the surfactant could be mixed in this tank on a quarterly basis and injected into the wellpoints, and the treated groundwater would follow behind as the “chase water” that is described in Point #4 above. This layout would eliminate a large portion of the labor and equipment costs associated with each injection event (as summarized in the table below), thus saving money for your client.

COST

The following table outlines product supply costs and shipping for quarterly surfactant applications. Costs for surfactant injection services by ETEC/MidAtlantic are also included.

Item	Unit Cost	Cost
<i>Quarterly Surfactant and De-Foamer Supply</i>		
PetroSolv™ Surfactant – 200-gallon supply	\$40/gallon	\$8,000.00
D-Foamer – 15-gallon supply	\$20/gallon	\$300.00
Shipping (estimated)	--	\$1,500.00
	SUBTOTAL	\$9,800.00
<i>Surfactant Application Services</i>		
Injection Labor and Expenses – 4 days	\$750/day	\$3,000.00
Injection Equipment Rental – 4 day	\$750/day	\$3,000.00
Equipment Mobilization/Demobilization	--	\$2,500.00
	SUBTOTAL	\$8,500.00

Please note that the surfactant application costs above do not include costs for oversight by Catlin technicians during the injection event. Also note that, depending upon the design of the pump-and-treat system, a portion of the equipment and labor costs associated with each injection event can be eliminated. Catlin would need to provide all water level gauging equipment (i.e. product-water interface probe, etc.) for measurements of SPH thicknesses before, during and after the injection event.

Based on the available data, ETEC estimates that at least 3-4 surfactant injection events will be necessary to mobilize and capture the bulk of the free product present in the subsurface.

We believe that the surfactant injection approach described above will increase capture of residual SPH within the treatment area. Please review this quote and call me at 503-709-7123 with any questions or comments. Thank you for the opportunity.

Respectfully,

ETEC, LLC

David Laughlin, P.E.
Project Manager