



4/2/02-03694

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April 2, 2002

Commander  
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1510 Gilbert Street (Bldg. N-26)  
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Attn: Mr. Kirk Stevens, P.E.  
Navy Technical Representative  
Code EV23

Re: Contract N62470-95-D-6007  
Navy CLEAN, District III  
Contract Task Order (CTO) 0219  
Marine Corps Base, Camp Lejeune  
Site 93 Additional Plume Characterization Letter Report

Dear Mr. Stevens:

Baker Environmental, Inc. (Baker) is pleased to submit this letter report regarding the field effort in support of the Additional Plume Characterization for Site 93, Marine Corps Base (MCB), Camp Lejeune, North Carolina. This letter report contains background information to provide a context for the fieldwork. It also contains a brief discussion of field investigative methods used to delineate the groundwater plume and characterize the hot spot areas.

The additional fieldwork data will be used to support remedial alternative selection and design. This letter report does not cover remedial alternative selection or design. The information gathered during the latest field event will be used to supplement the existing remedial investigation.

### **Background**

In 1993, a 550-gallon underground storage tank (UST) was removed. An investigation of the former UST location was conducted in 1995. Five wells were installed in the immediate vicinity of the former UST. Chlorinated solvents were detected in groundwater samples including tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-DCE). Subsequently, the site was transferred into the Installation Restoration Program (IRP).

The remedial investigation (RI) was initiated in August 1996. The initial phase primarily included the installation and sampling of 12 temporary monitoring wells and soil borings to determine the nature and extent of contamination. The second phase of the RI was conducted in April 1997 and included the installation and sampling of 11 permanent monitoring wells. The findings of the RI can be summarized as follows:

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- Evidence of soil contamination related to site operations is limited. The UST investigation showed that oil and grease were detected in 5 of 7 soil samples from the former UST area, but detections of specific, fuel-related compounds and halogenated solvent compounds were limited to low levels of naphthalene, 1,2,4-trichlorobenzene, and 1,2,4-trimethylbenzene. The RI showed that detections of fuel-related compounds and chlorinated solvent compounds were also limited and generally low. A comparison of the data from both investigations to NC Soil to Groundwater Concentrations and USEPA Region IX preliminary remediation goals (PRGs) showed that only one compound from one sample exceeded a standard. Benzo(a)pyrene was detected above Region IX PRGs of 62 µg/kg at 400J µg/kg in sample IR93-MW02IW-04 (7 to 9 feet below ground surface [bgs]).
- Groundwater contamination was evident and consisted of chlorinated solvents (primarily TCE). This contamination was limited in extent and appeared to be highest in the area south of the former UST. Additionally, this contamination was observed to be shallow, with only trace levels of chlorinated solvents detected in two temporary intermediate wells, and nothing detected in the deep wells.
- The human health risk assessment found both carcinogenic and non-carcinogenic risk to future child and adult residents and future construction workers for exposure to groundwater, primarily attributable to TCE and cis-DCE.

A draft feasibility study (FS) was prepared in November 1997. Subsequently, a proposed remedial action plan (PRAP) and draft Record of Decision (ROD) were prepared in December 1997. The selected remedies for Site 93 were institutional controls with monitored natural attenuation.

Between 1995 and 1996, a geotechnical evaluation was conducted in the area that is labeled "Barracks Area" on Figure 1. This evaluation also included an environmental screening conducted by Baker. This screening included the installation of six soil borings and temporary monitoring wells. Baker also collected groundwater samples from the six temporary wells, plus three existing monitoring wells installed by Law for a UST assessment. Chlorinated solvent contamination was not observed in any soil samples. Trace levels of methylene chloride and PCE were detected in one well (namely TW03B) at 6J µg/L and 17 µg/L, respectively.

Long-Term Monitoring (LTM) was initiated at Site 93 in April 1999. Groundwater samples have been collected semiannually from 3 shallow monitoring wells. Parameters analyzed include volatile organic compounds (VOCs) and natural attenuation parameters (chloride, nitrate, nitrite, sulfate, sulfide, and methane, ethane, and ethene).

A preliminary evaluation of natural attenuation conditions was conducted in 2001. Under appropriate aquifer chemistry conditions chlorinated solvents will degrade (PCE → TCE → cis-DCE [trans-DCE as a minor product] → vinyl chloride [VC] → ethene). The presence of daughter products indicates that natural attenuation is occurring at the site; however, the process appears limited. Generation of VC and ethene appears limited. The evaluation also showed that some naturally occurring carbon is present, especially near Edwards Creek. Fuel-related compounds (a catalyst for natural attenuation) were not detected, but reducing aquifer conditions are still present near MW02 from past biological activity. Other conditions such as dissolved oxygen, nitrate, and ferrous iron levels are favorable for NA, but sulfate and methane levels are not favorable. The preliminary Natural Attenuation Evaluation (NAE) concluded that attenuation of TCE via reductive dechlorination is occurring at Site 93 as evidenced by the presence of

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daughter products and reducing conditions with some natural carbon. However, the aquifer does not appear to be in enough of a reduced state for optimal dechlorination to occur (i.e., the process stops primarily at cis-DCE).

At the November 2001 Partnering Meeting, the team had concluded that the plume at Site 93 required additional delineation. The team also recommended that additional information should be collected to support the idea of potentially using an active remediation system in hot spots. The purpose of this investigation therefore, was threefold:

1. To further delineate groundwater contamination at Site 93;
2. To characterize hot spots; and,
3. Provide additional data to support the selection of an active remedial system.

### **Investigative Methods**

The additional plume characterization field program was conducted between January 7 and 16, 2002. Additional groundwater samples were also collected on February 14, 2002 from borings 93-IS42, 93-IS43, and 93-IS44. Soil and groundwater samples were collected with Geoprobe tools employing an Ingersoll-Rand truck mounted drill rig.

Forty-four boring locations are shown on Figure 1. A maximum of 37 locations were proposed in the January 4, 2002 Work Plan. However, seven additional borings were required to adequately delineate the horizontal and vertical extent of the plume, including three near Edwards Creek (installed on February 14).

A combination truck-mounted drill rig and Geoprobe® rig was used to advance borings so that groundwater grab samples could be obtained. Discreet groundwater samples were collected using a 4-foot long, 1-inch diameter stainless steel Geoprobe® SP-15 groundwater sampler. Table 1 provides a summary of groundwater grab samples collected. Three to four samples were collected from each boring.

Three samples were collected at most locations from 5 to 9 feet bgs, 15 to 19 feet bgs, and 25 to 29 feet bgs. At some locations, a deep sample (35 to 39 feet bgs) was required to further delineate the vertical extent. At some locations, dry intervals were encountered (e.g., boring 93-IS21) or a location was needed to provide horizontal delineation for a particular interval only (e.g., borings 93-IS33 and 93-IS35). In those instances, fewer than three samples were collected.

Groundwater was obtained from the Geoprobe Sampler using a peristaltic pump and virgin silicon and polyethylene tubing at flow rates of typically less than 0.25 L/min. Samples were collected in one 20-mL glass container and given to the mobile laboratory chemist soon after collection. At select sample locations, groundwater samples were split for fixed-base laboratory analysis. Split samples were collected in three 40-mL glass containers, and handled and shipped following Baker standard operating procedures.

Samples were analyzed on-site via headspace analysis using a mobile gas chromatograph (GC). Target analytes included PCE, TCE, cis-DCE, trans-1,2-dichloroethene (trans-DCE), VC, and benzene. Select samples (approximately 10%) were split for analysis via SW846 Method 8260B at a fixed-base laboratory.

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Other on-site analysis included pH, temperature, specific conductance, turbidity, dissolved oxygen, oxidation/reduction potential (ORP), ferrous iron ( $\text{Fe}^{+2}$ ), and alkalinity. Occasionally, turbidity or low yield prevented collection of some or all of the field parameters.

Soil samples collected at borings 93-IS04 and 93-IS13 were also characterized for lithology. Soil samples were collected continuously from the ground surface to a maximum depth of 28 feet below ground surface (bgs), into the shell material of the River Bend Formation. Samples were collected at 2-foot intervals using the Geoprobe Large-Core Sampler. Soil samples were also collected at boring 93-IS01 for analysis of total organic carbon (TOC).

Four permanent shallow monitoring wells were installed at locations shown on Figure 1. Each well was installed to a depth of 15 feet bgs, and constructed of 1-inch diameter, schedule 40, flush joint, threaded PVC casing, and two 5-foot (10-foot total) long pre-packed screens with 0.01-inch slots. The wells were installed using 3-inch diameter Geoprobe rods. The annular space above the screen pack was backfilled with bentonite pellets to about 1-foot bgs. The remaining annular space was backfilled with concrete. Each well was completed with a flush-mount vault box encased in concrete. All wells were developed during this field effort according to standard practices. Attachment A includes well construction records.

All groundwater-grab boring locations were surveyed. Each point was located in the state plane coordinate system and the corresponding elevation measured to feet above mean sea level (MSL). All monitoring wells were also surveyed. The protective well cover was located in the state plane coordinate system and elevation of the ground surface and top of PVC casing were measured to feet above MSL.

### **Stratigraphy and Groundwater**

The stratigraphic sequence under Site 93 is consistent across the site. Figure 2 show three contaminant distributions cross sections (labeled A-A', B-B', and C-C') and one stratigraphic cross section (labeled D-D'). Figure 3 shows cross section D-D', which runs west to east through the site. It should be noted that this section runs through the shallow hot spot from boring 93-IS04 to boring 93-IS13. The surface to a depth of 2 to 3 feet is generally fine-grained material. A heterogeneous sand layer is present below the fine-grained material to a depth of 10 feet at boring 93-IS13A to 20 feet at boring 93-MW03IW. As the cross section shows, this sandy unit varies in grain size laterally and vertically. Occasional silt and clay lenses occur in this sandy unit (e.g., boring 93-IS04A). The layers described above comprise the undifferentiated formation (surficial aquifer). Beginning at a depth of approximately 10 feet at boring 93-IS13A to 20 feet at boring 93-MW03IW are the silts and sands of the Belgrade Formation (the Castle Hayne confining unit). Again, this formation exhibits some heterogeneity. Below the Belgrade Formation, lies the calcareous sands and shell fragments of the River Bend Formation (the upper portion of the Castle Hayne aquifer). The top of the River Bend Formation ranges from a depth of 16 feet bgs at boring 93-IS13A to 34 feet bgs at boring 93-MW03IW. This formation also exhibits some vertical heterogeneity. A fine sand and silt layer was observed in boring 93-MW05IW at a depth of approximately 40 feet. This layer exhibits the same color and composition, and occurs at the same depth, as localized semi-confining layer observed at other sites on Camp Geiger. This layer was not observed towards the Barracks area during the RI. It should be noted contamination has not been observed in monitoring wells installed below this layer at other sites on Camp Geiger.

Shallow hot spot contamination occurs in the sandy unit of the undifferentiated formation. The 5 to 9-foot interval at boring 93-IS13 is in fine to coarse sand with a trace amount of silt (Figure 3). The deeper hot spot contamination occurs in the calcareous fine to coarse sands and shell fragments of the

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River Bend Formation. This is based on formation depths shown on Figure 3 and on boring logs from well 93-MW04IW (Baker 1998).

Figure 4 shows groundwater flow direction in the surficial aquifer, based on January 25, 2002 depth to water measurements. Groundwater flow is to the east between C and D Streets, then bends slightly to the northeast between E Street and Edwards Creek. Groundwater flow is to the north in the vicinity of well 93-MW01. Overall, flow is toward Edwards Creek on a gradient of approximately 0.004 feet/foot. This flow pattern is similar to patterns observed during the RI (Baker 1998) and LTM (Baker 1999).

### **Nature and Extent**

The mobile laboratory results drove the course of the field investigation. The compounds were selected based on historical evidence. The results of the mobile laboratory analysis are presented on Table 2. It is important to demonstrate the reliability and precision of the mobile laboratory so that the data can be applied to plume delineation and hot spot characterization. Reliability is defined here as the ability of an analytical method to provide data that is representative of site conditions (given representative sample collection methods). SW-846 Method 8260B is a method with demonstrated reliability. So, to assess the reliability of the mobile laboratory, samples were split for analysis via SW-846 Method 8260B at a fixed-base laboratory. Precision is defined here as the ability of an analytical method to reproduce the same results for multiple runs of the same sample. Precision was assessed through analysis of duplicate samples.

Table 3 compares sample split data. An examination of Table 3 shows that the split data correlates well. For example, both methods show that sample IR93-IS17-02 exhibits relatively elevated levels of contaminants and at similar concentrations. Conversely, both methods show that samples IR93-IS31-02 and IR93-IS28-02 exhibit low levels of contaminants and again at similar concentrations. It is apparent that the mobile laboratory analytical method is a reliable measure of site conditions.

Table 4 compares duplicate sample data. An examination of Table 4 shows that the duplicate data also correlates well. All of the duplicate data sets show identical or nearly identical results. It is apparent that the mobile laboratory exhibits adequate precision.

PCE, TCE, cis-DCE, trans-DCE, and VC were detected in many of the groundwater samples collected. Contaminant concentrations exceeded North Carolina Groundwater Quality Standards (2L Standards) at several locations. The maximum detection of PCE was 46 µg/L in 93-IS16-02 (15 to 19-foot bgs). The maximum detection of both TCE and cis-DCE was in 93-IS13-01 (5 to 9-foot bgs) at 154 µg/L and 366 µg/L, respectively. The maximum detection of VC was 7 µg/L in sample 93-IS06-01 (5 to 9-foot bgs). There was only one detection of trans-DCE above the 2L Standard of 70 µg/L, also occurring in 93-IS13-01, at 86 µg/L. Thus, trans-DCE is not a contaminant of interest. Benzene was not detected above the detection limit (2 µg/L) in any samples.

Figures 5 through 13 show the horizontal extent of groundwater contamination as defined by detection limits (PCE and VC) or 2L Standards (TCE and cis-DCE) at three depth intervals (5 to 9 feet bgs, 15 to 19 feet bgs, and 25 to 29 feet bgs). It should be noted that the 2L Standard for PCE (0.7 µg/L) and VC (0.015 µg/L) is less than the method detection limit of 1 µg/L for both.

The contaminant plumes are shown in three vertical cross sections (Figure 2). Figure 14 shows contaminant distribution in cross section A-A', which trends parallel to the horizontal groundwater flow direction. Figure 15 shows contaminant distribution in cross section B-B' and Figure 16 shows

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contaminant distribution in cross section C-C'. Both of the later cross sections trend perpendicular to the horizontal groundwater flow direction.

These plume maps and cross sections were generated using Surfer 7.0 and interpolation performed using a Kriging algorithm (with a default variogram). A logarithmic distribution of the organic data was assumed (EPA 1989).

In general, several basic conclusions can be drawn from the data:

1. There appears to be multiple groundwater plumes in the vicinity of Site 93, one related to the former UST area and perhaps two or three attributable to other upgradient sources;
2. Groundwater contamination occurs at generally less than 30 feet bgs;
3. The horizontal and vertical extent of 2L exceedences have been adequately delineated;
4. Contaminant discharge to Edwards Creek appears limited;
5. Some natural attenuation is occurring, and;
6. There appears to be no evidence of dense non-aqueous phase liquid (DNAPL) source areas.

The paragraphs that follow provide the basis for these conclusions and provide further detail.

Geoprobe groundwater grab sample results were used to generate the plume maps for this letter report. The four newly installed and four existing shallow monitoring wells were sampled in late January 2002 as part of LTM. The data from the LTM event will be presented in the next scheduled LTM report for Site 93.

Figures 5, 6, and 7 show PCE in groundwater above detection limits. All three figures clearly show a separate upgradient PCE plume in the vicinity of the Barracks area. PCE was also observed in sample IR93-IS20-02 at 4 µg/L (Figure 6). These detections are hydraulically upgradient of the former UST area, and are therefore not related. The source of these PCE detections is not known. The evidence (collected from this investigation and from the Barracks Area geotechnical evaluation) suggest that there is no continuing source:

- No chlorinated solvent compounds were detected in soil samples from the Barracks Area during the geotechnical evaluation.
- The maximum detection of PCE was 46 µg/L in one sample (IR93-IS16-02); however, most of the detections of PCE were at or near detection limits (ranging from 1 to 4 µg/L).

Additionally, there is no evidence that these detections are on the edge of a significant plume, as the PCE has been delineated horizontally, as shown on the figures.

There is however, some indication that this PCE groundwater plume has encroached on Site 93. The Kriging algorithm connects the PCE detections at boring 93-IS20 to detections in the borings along D Street (Figure 6). The Kriging algorithm also connects the TCE detection at borings 93-IS21 and 93-IS22 to detections in the borings along D Street (Figure 9). This is supported by RI data from temporary

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well 93-TW06, where both PCE and TCE were detected in groundwater (Baker 1998). Temporary well 93-TW06 was located between C and D Streets (Figure 1).

Figure 6 (15 to 19 feet bgs) shows that the highest detections of PCE were generally observed in borings 93-IS04-02 and 93-IS10-02 and also in borings 93-IS12-02 and 93-IS16-02 (light blue shading). PCE concentrations in the 15 to 19 foot bgs interval tend to be higher than the 5 to 9 foot bgs interval. PCE levels tend to remain elevated between 25 to 29 feet bgs (Figure 7), but are near or below detection limits between 35 to 39 feet bgs in borings 93-IS06-04 and 93-IS12-04 (Table 2).

Figures 5, 6, and 7 show that the horizontal extent of PCE has been delineated by the new data set. The PCE concentration diminishes by nearly an order of magnitude at boring 93-IS12 between the 25 to 29-foot interval and the 35 to 39-foot interval. While the PCE concentration remains above the 2L Standard at 39 feet, a semi-confining layer is present in this area of the site at approximately 42-feet bgs. Existing data from the Site 93 RI (well 93-MW02DW) and other sites (e.g., Sites 35 and 89) suggests that the top of the semi-confining layer further limits the vertical extent of contamination.

Figure 8 shows that TCE in the Barracks area is limited in extent and occurs at a low concentration (6  $\mu\text{g/L}$  in IR93-IS24-01). TCE is also present in samples IR93-IS22-02 and IR93-IS04-02 at 15  $\mu\text{g/L}$  and 5  $\mu\text{g/L}$ , respectively (Figure 9). These detections are noteworthy since the locations are downgradient of the Barracks area, and the presence of TCE in these locations could be a result of the degradation of PCE. Figure 9 shows that TCE concentrations are in the 10  $\mu\text{g/L}$  to 50  $\mu\text{g/L}$  range between 15 and 19 feet bgs around borings 93-IS07-02 and 93-IS11-02 (light blue shading). TCE appears to be more widespread at this depth than the 5 and 9 foot bgs interval. Figure 10 shows that the extent of TCE diminishes in concentration and extent with depth at the 25 to 29 foot bgs interval. TCE was not detected above the 2L Standard in the area between 35 and 39 feet bgs (borings 93-IS02-04, 93-IS06-04 and 93-IS12-04 on Table 2). All three figures show that the horizontal extent of TCE has been delineated by the new data set.

Detections of cis-DCE above the 2L Standard are generally limited to the shallow groundwater zone. Figure 11 shows cis-DCE occurs as a single plume in groundwater south and east of Building TC 942. Figure 12 shows the concentration and extent rapidly diminishing with depth. Cis-DCE was not detected above the 2L Standard in any groundwater samples between 25 and 29 feet bgs. It should be noted that cis-DCE is more widespread than depicted on Figures 11 and 12, but concentrations are below the 2L Standard. Both figures show that the horizontal extent of cis-DCE has been delineated to the 2L Standard by the existing data set. These figures also suggest that the vertical extent of 2L Standard exceedences was not observed below the 15 to 19 foot bgs interval.

Detections of VC are relatively low and generally limited to the shallow groundwater zone. Figure 13 shows that VC occurs in four relatively small areas that generally correspond with the highest levels of cis-DCE (Figure 11). The exception is sample 93-IS06-01, which is located in the former UST area. VC was detected at the detection limit in two samples from the 15 to 19 feet bgs interval (borings 93-IS17-02 and 93-IS32-02). Cis-DCE was not detected in samples below this depth.

Evidence of contaminant discharge into Edwards Creek is limited. Groundwater samples were collected from three intervals from three borings that were located near the creek (93-IS42, 93-IS43, and 93-IS44). Only cis-DCE and trans-DCE were detected in one sample (IR93-IS42-01) and at low concentrations (Table 2). Cis-DCE has been detected in Edwards Creek in surface water samples at relatively low levels. For example, cis-DCE was detected in surface water sample IR89-SW07-99D at 9J  $\mu\text{g/L}$  (Baker 2002). It is not clear however, if these detections are attributable to Site 93 or Site 89.

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Figure 14 shows four renderings of cross section A-A', Figure 14a shows PCE, Figure 14b shows TCE, Figure 14c shows cis-DCE, and Figure 14d shows VC. This series of figures show the typical dechlorination sequence along a groundwater flow path (PCE → TCE → cis-DCE). Figure 14a shows that PCE occurs upgradient of the former UST area. TCE appears downgradient of the first appearance of PCE (Figure 14b) and extends farther downgradient than PCE. Cis-DCE appears last along the flow path, and even farther downgradient than TCE (Figure 14c). VC is being generated, but at relatively low levels and is coincident with cis-DCE (Figure 14d). Contamination does not appear above 2L Standards along this section below 19 feet bgs. The one exception is the presence of PCE in sample 93-IS24-03 at 2 µg/L.

Cross Section B-B' (Figure 15) is located at the former UST area and shows that PCE and TCE do not appear along this section above the 2L Standards below 39 feet bgs (Figures 15a and 15b). Furthermore, cis-DCE and VC concentrations above the 2L Standard are limited to a depth of 9 feet bgs (Figure 15c and 15d, respectively).

Cross Section C-C' (Figure 16) is located downgradient of the former UST area and shows that PCE was not detected in the area (Figure 16a). This section also shows that TCE, cis-DCE, and VC are limited in depth and extent (Figures 16b, 16c, 16d). Again, cis-DCE and VC distributions are coincident.

Based on the relatively low contaminant concentrations and their distribution in groundwater, there is no strong evidence to suggest that a continuing source or NAPL is present at the site. The maximum detections of PCE, TCE, and cis-DCE are 46 µg/L, 154 µg/L, and 366 µg/L, respectively. These concentrations are well below concentrations where NAPL is suspect at a site. For example, the aqueous solubility of TCE is 1,100,000 µg/L (Montgomery 1990). As a conservative rule-of-thumb, the presence of NAPL would be suspected if groundwater samples exhibit concentrations at or above 1% of the aqueous solubility, or 11,000 µg/L (EPA 1992). The aqueous solubilities of PCE and cis-DCE are 2,900,000 µg/L and 800,000 µg/L, respectively. It is clear that the maximum detections of chlorinated solvent compounds are several orders of magnitude lower than the rule-of-thumb concentrations. Another indication of the suspected presence of NAPL is increasing dissolved-phase concentrations with depth and dissolved-phase contamination hydraulically upgradient or side-gradient of the known source. As shown on Figures 13 through 15, concentrations generally decrease with depth. While contaminants are present upgradient of the former UST area (Site 93), they can be attributed to other sources and are not NAPL related.

### **Hot Spot Characterization**

Identification of hot spots was based on an examination of the plume maps presented on Figures 5 through 13. For the purposes of this letter report, the areas shaded light blue or green with respect to PCE and TCE contamination are considered as hot spots (i.e., >10 µg/L). With respect to cis-DCE contamination, those areas shaded orange or red are considered as hot spots (i.e., >200 µg/L). VC concentrations above 2 µg/L are also considered as hot spots (shallow groundwater only). The PCE, TCE, cis-DCE, and VC hot spots were composited as shown on Figure 17 (5 to 9 feet bgs) Figure 18 (15 to 19 feet bgs), and Figure 19 (25 to 29 feet bgs).

Based on Figures 17, 18, and 19 there are four apparent hot spot areas. One hot spot is located in the Barracks area, located upgradient of Site 93. The other hot spots are located within Site 93 and include the former UST area.

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The Barracks area hot spot is a hot spot in relative terms only. PCE was detected at 44 µg/L in sample IR93-IS24-01 (Figure 17). The maximum observed total VOC concentration is 50 µg/L in the same sample. This detection appears to be small and localized; detections in nearby borings are limited to PCE and at concentrations near detection limits.

In shallow groundwater, one TCE, cis-DCE, and VC hot spot is located at boring 93-IS13 (Figure 17), with another TCE and VC hot spot at boring 93-IS04. There are two other VC hot spots, one at boring 93-IS06 and the other at boring 93-IS30. In intermediate groundwater (Figure 18), the cis-DCE hot spot at boring 93-IS13 disappears, the hot spot at boring 93-IS04 is PCE and expands towards boring 93-IS10. Additionally, a PCE and TCE hot spot appears in the vicinity of borings 93-IS16 and 93-IS17. In deep groundwater (Figure 19), the PCE and TCE hot spot in the vicinity of borings 93-IS16 and 93-IS17 shrinks substantially.

### **Aquifer and Groundwater Chemistry**

Table 5 provides a summary of aquifer and groundwater chemistry. One groundwater sample (IR93-MW06-02A) was collected from well 93-MW06, located in the hot spot area. Two soil samples (IR93-IS01-05 and IR93-IS01-05) were collected outside the zone of contamination to assess levels of natural organic carbon in the aquifer. Table 6 provides a summary of field analyses, including pH, specific conductance, temperature, ORP, dissolved oxygen, Fe<sup>+2</sup>, and alkalinity. These data summarized on Tables 5 and 6 were collected to provide support for selection and design of remedial alternatives, including active hot spot treatment or passive monitored natural attenuation (MNA).

### **References**

- |                 |  |
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Please do not hesitate to call me if you have any questions or desire further clarification of the investigation results described. We appreciate the opportunity to serve LANTDIV on this project.

Sincerely,

BAKER ENVIRONMENTAL, INC.



Mark K. DeJohn, P.G.  
Project Geologist

MKD/lp  
Attachments

cc: Mr. Channing Blackwell, Code EV23 (LANTDIV)  
Ms. Beth Collier, Code AQ115 (LANTDIV w/o attachments)  
Mr. Rick Raines (Camp Lejeune, Environmental Quality Branch)  
Mr. Thomas Burton (Camp Lejeune, Environmental Quality Branch)  
Ms. Gena Townsend (EPA, Region IV)  
Mr. David Lown (NC DEHR, Superfund Section)  
Ms. Dianne Rossi (NC DEHR, Groundwater Section)  
Mr. Christopher Bozzini (CH2M Hill 2 copies)  
Mr. Scott Bailey (CH2M Hill)  
Mr. Jim Dunn (OHM/IT)

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## Additional Plume Characterization Report

OU No. 16, Site 93

MCB Camp Lejeune

Jacksonville, North Carolina

Contract Task Order Number - 0219  
Contract Number N62470-95-D-6007  
Navy CLEAN II Program

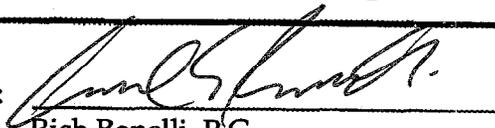
*Prepared by*

Baker Environmental

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Approved by:

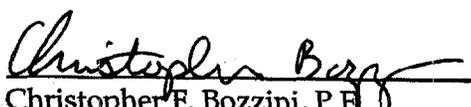
  
Rich Bonelli, P.G.

Activity Manager, Baker Environmental

Date:

4/1/02

Approved by:

  
Christopher F. Bozzini, P.E.

Project Manager, CH2M HILL

Date:

3/29/02

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**TABLES**

TABLE 1

GROUNDWATER SAMPLING SUMMARY  
 SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
 MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	Date Sampled	Time Sampled	Depth Interval (ft)	On-Site Analysis?	Comments
IR93-IS01-01	1/8/02	1050	5 - 9	Yes	
IR93-IS01-02	1/8/02	1112	15 - 19	Yes	
IR93-IS01-03	1/8/02	1138	25 - 29	Yes	
IR93-IS02-01	1/8/02	1355	5 - 9	Yes	
IR93-IS02-02	1/8/02	1406	15 - 19	Yes	
IR93-IS02-03	1/8/02	1430	25 - 29	Yes	
IR93-IS02-04	1/11/02	0810	35 - 39	Yes	
IR93-IS03-01	1/8/02	1512	5 - 9	Yes	
IR93-IS03-02	1/8/02	1550	15 - 19	Yes	
IR93-IS03-03	1/8/02	1608	25 - 29	Yes	
IR93-IS04-01	1/8/02	1632	5 - 9	Yes	
IR93-IS04-02	1/8/02	1644	15 - 19	Yes	
IR93-IS04-03	1/8/02	1700	25 - 29	Yes	
IR93-IS05-01	1/9/02	0745	5 - 9	Yes	
IR93-IS05-02	1/9/02	0805	15 - 19	Yes	
IR93-IS05-03	1/9/02	--	25 - 29	Yes	
IR93-IS06-01	1/9/02	0747	5 - 9	Yes	
IR93-IS06-02	1/9/02	0758	15 - 19	Yes	
IR93-IS06-03	1/9/02	0818	25 - 29	Yes	
IR93-IS06-04	1/11/02	0840	35 - 39	Yes	
IR93-IS07-01	1/9/02	1018	5 - 9	Yes	VOA split
IR93-IS07-02	1/9/02	1058	15 - 19	Yes	
IR93-IS07-03	1/9/02	1115	25 - 29	Yes	
IR93-IS08-01	1/9/02	1030	5 - 9	Yes	
IR93-IS08-02	1/9/02	1050	15 - 19	Yes	
IR93-IS08-03	1/9/02	1110	25 - 29	Yes	
IR93-IS09-01	1/9/02	1250	5 - 9	Yes	
IR93-IS09-02	1/9/02	1310	15 - 19	Yes	
IR93-IS09-02 DUP	1/9/02	1310	15 - 19	Yes	Mobile lab duplicate
IR93-IS09-03	1/9/02	1335	25 - 29	Yes	
IR93-IS10-01	1/9/02	1256	5 - 9	Yes	
IR93-IS10-02	1/9/02	1311	15 - 19	Yes	VOA split
IR93-IS10-03	1/9/02	1330	25 - 29	Yes	
IR93-IS11-01	1/9/02	1420	5 - 9	Yes	
IR93-IS11-02	1/9/02	1432	15 - 19	Yes	
IR93-IS11-03	1/9/02	1452	25 - 29	Yes	
IR93-IS12-01	1/9/02	1430	5 - 9	Yes	VOA split
IR93-IS12-02	1/9/02	1445	15 - 19	Yes	
IR93-IS12-03	1/9/02	1510	25 - 29	Yes	
IR93-IS12-04	1/11/02	0940	35 - 39	Yes	
IR93-IS13-01	1/9/02	1331	5 - 9	Yes	

TABLE 1

**GROUNDWATER SAMPLING SUMMARY  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Sample ID	Date Sampled	Time Sampled	Depth Interval (ft)	On-Site Analysis?	Comments
IR93-IS13-02	1/9/02	1540	15 - 19	Yes	
IR93-IS13-03	1/9/02	1600	25 - 29	Yes	
IR93-IS13-03 DUP	1/9/02	1600	25 - 29	Yes	Mobile lab duplicate
IR93-IS14-01	1/9/02	1540	5 - 9	Yes	
IR93-IS14-02	1/9/02	1600	15 - 19	Yes	
IR93-IS14-03	1/9/02	1618	25 - 29	Yes	
IR93-IS15-01	1/10/02	0730	5 - 9	Yes	
IR93-IS15-02	1/10/02	0810	15 - 19	Yes	
IR93-IS15-03	1/10/02	0830	25 - 29	Yes	
IR93-IS16-01	1/10/02	0900	5 - 9	Yes	
IR93-IS16-01 DUP	1/10/02	0900	5 - 9	Yes	Mobile lab duplicate
IR93-IS16-02	1/10/02	0915	15 - 19	Yes	
IR93-IS16-03	1/10/02	0935	25 - 29	Yes	
IR93-IS17-01	1/10/02	0902	5 - 9	Yes	
IR93-IS17-02	1/10/02	0916	15 - 19	Yes	VOA split
IR93-IS17-03	1/10/02	0933	25 - 29	Yes	
IR93-IS18-01	1/10/02	0955	5 - 9	Yes	
IR93-IS18-02	1/10/02	1006	15 - 19	Yes	
IR93-IS18-03	1/10/02	1020	25 - 29	Yes	
IR93-IS19-01	1/10/02	1000	5 - 9	Yes	
IR93-IS19-02	1/10/02	1015	15 - 19	Yes	
IR93-IS19-03	1/10/02	1038	25 - 29	Yes	
IR93-IS20-01	1/10/02	1214	5 - 9	Yes	
IR93-IS20-02	1/10/02	1231	15 - 19	Yes	VOA split
IR93-IS20-03	1/10/02	1246	25 - 29	Yes	
IR93-IS21-01	1/10/02	--	5 - 9	No	Dry interval - no sample
IR93-IS21-02	1/10/02	1244	15 - 19	Yes	
IR93-IS21-03	1/10/02	1300	25 - 29	Yes	
IR93-IS22-01	1/10/02	1327	5 - 9	Yes	
IR93-IS22-02	1/10/02	1340	15 - 19	Yes	
IR93-IS22-02 DUP	1/10/02	1340	15 - 19	Yes	Mobile lab duplicate
IR93-IS22-03	1/10/02	1358	25 - 29	Yes	
IR93-IS23-01	1/10/02	1322	5 - 9	Yes	VOA split
IR93-IS23-02	1/10/02	1335	15 - 19	Yes	
IR93-IS23-03	1/10/02	1351	25 - 29	Yes	
IR93-IS23-03 DUP	1/10/02	1351	25 - 29	Yes	Mobile lab duplicate
IR93-IS24-01	1/10/02	1445	5 - 9	Yes	
IR93-IS24-02	1/10/02	1504	15 - 19	Yes	
IR93-IS24-03	1/10/02	1523	25 - 29	Yes	
IR93-IS25-01	1/10/02	1445	5 - 9	Yes	
IR93-IS25-02	1/10/02	1500	15 - 19	Yes	

TABLE 1

GROUNDWATER SAMPLING SUMMARY  
 SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
 MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	Date Sampled	Time Sampled	Depth Interval (ft)	On-Site Analysis?	Comments
IR93-IS25-03	1/10/02	1525	25 - 29	Yes	
IR93-IS26-01	1/10/02	1555	5 - 9	Yes	
IR93-IS26-01 DUP	1/10/02	1555	5 - 9	Yes	Mobile lab duplicate
IR93-IS26-02	1/10/02	1608	15 - 19	Yes	
IR93-IS26-03	1/10/02	1622	25 - 29	Yes	
IR93-IS27-01	1/10/02	1600	5 - 9	Yes	
IR93-IS27-02	1/10/02	1619	15 - 19	No	Dry interval - no sample
IR93-IS27-03	1/10/02	1629	25 - 29	Yes	
IR93-IS28-01	1/11/02	0803	5 - 9	Yes	
IR93-IS28-02	1/11/02	0815	15 - 19	Yes	VOA split
IR93-IS28-03	1/11/02	0835	25 - 29	Yes	
IR93-IS28-03 DUP	1/11/02	0835	25 - 29	Yes	Mobile lab duplicate
IR93-IS29-01	1/11/02	0915	5 - 9	Yes	VOA split
IR93-IS29-02	1/11/02	0935	15 - 19	Yes	
IR93-IS29-02 DUP	1/11/02	0935	15 - 19	Yes	Mobile lab duplicate
IR93-IS29-03	1/11/02	1000	25 - 29	Yes	
IR93-IS29-04	1/11/02	1030	35 - 39	Yes	
IR93-IS30-01	1/11/02	1052	5 - 9	Yes	
IR93-IS30-02	1/11/02	1108	15 - 19	Yes	
IR93-IS30-03	1/11/02	1128	25 - 29	Yes	
IR93-IS31-01	1/11/02	1330	5 - 9	Yes	VOA split
IR93-IS31-01 DUP	1/11/02	1330	5 - 9	Yes	Mobile lab duplicate
IR93-IS31-02	1/11/02	1342	15 - 19	Yes	
IR93-IS31-03	1/11/02	1400	25 - 29	Yes	
IR93-IS32-01	1/11/02	1420	5 - 9	Yes	
IR93-IS32-02	1/11/02	1435	15 - 19	Yes	
IR93-IS32-03	1/11/02	1450	25 - 29	Yes	
IR93-IS33-01	1/11/02		5 - 9	No	No sample collected
IR93-IS33-02	1/11/02	1015	15 - 19	Yes	
IR93-IS33-03	1/11/02		25 - 29	No	No sample collected
IR93-IS34-01	1/11/02	1508	5 - 9	Yes	
IR93-IS34-02	1/11/02	1525	15 - 19	Yes	
IR93-IS34-03	1/11/02	1547	25 - 29	Yes	
IR93-IS35-02	1/11/02	1630	15 - 19	Yes	
IR93-IS36-01	1/15/02	1519	5 - 9	Yes	
IR93-IS36-02	1/15/02	1532	15 - 19	Yes	
IR93-IS37-01	1/27/02	0745	5 - 9	Yes	VOA sample at this location only
IR93-IS37-02	1/27/02	0805	15 - 19	Yes	
IR93-IS37-03	1/27/02	0828	25 - 29	Yes	
IR93-IS38-01	1/27/02	0855	5 - 9	Yes	VOA sample at this location only
IR93-IS38-02	1/27/02	0908	15 - 19	Yes	

**TABLE 1**

**GROUNDWATER SAMPLING SUMMARY  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Sample ID	Date Sampled	Time Sampled	Depth Interval (ft)	On-Site Analysis?	Comments
IR93-IS38-03	1/27/02	0926	25 - 29	Yes	
IR93-IS39-01	1/27/02	1447	5 - 9	Yes	VOA sample at this location only
IR93-IS39-02	1/27/02	1504	15 - 19	Yes	
IR93-IS39-03	1/27/02	1524	25 - 29	Yes	
IR93-IS40-01	1/27/02	1545	5 - 9	Yes	VOA sample at this location only
IR93-IS40-02	1/27/02	1556	15 - 19	Yes	
IR93-IS40-03	1/27/02	1618	25 - 29	Yes	
IR93-IS41-01	1/27/02	1640	5 - 9	Yes	VOA sample at this location only
IR93-IS41-02	1/27/02	1653	15 - 19	Yes	
IR93-IS41-03	1/27/02	1715	25 - 29	Yes	
IR93-IS42-01	2/14/02	0824	5 - 9	Yes	VOA sample at this location only
IR93-IS42-02	2/14/02	0835	15 - 19	Yes	
IR93-IS42-03	2/14/02	0900	25 - 29	Yes	
IR93-IS43-01	2/14/02	0924	5 - 9	Yes	VOA sample at this location only
IR93-IS43-02	2/14/02	0934	15 - 19	Yes	
IR93-IS43-03	2/14/02	0958	25 - 29	Yes	
IR93-IS44-01	2/14/02	1015	5 - 9	Yes	VOA sample at this location only
IR93-IS44-02	2/14/02	1028	15 - 19	Yes	
IR93-IS44-03	2/14/02	1055	25 - 29	Yes	
IR93-ER01	1/9/02	1323	--	Yes	From Geoprobe SP-15 Screen
IR93-ER02	1/10/02	1619	--	Yes	From Geoprobe SP-15 Screen

TABLE 2

**MOBILE LABORATORY ANALYTICAL RESULTS  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

SAMPLE ID	PCE	TCE	cis-DCE	trans-DCE	Vinyl Chloride	Benzene
2L Standard	0.7	2.8	70	70	0.015	1
IR93-IS01-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS01-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS01-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS02-01	7	1 U	1 U	1 U	1 U	2 U
IR93-IS02-02	1	1	1 U	1 U	1 U	2 U
IR93-IS02-03	3	5	1 U	1 U	1 U	2 U
IR93-IS02-04	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS03-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS03-02	2	2	1 U	1 U	1 U	2 U
IR93-IS03-03	2	5	1	1 U	1 U	2 U
IR93-IS04-01	10	109	220	4	6	2 U
IR93-IS04-02	22	5	1 U	1 U	1 U	2 U
IR93-IS04-03	1 U	1	1	1 U	1 U	2 U
IR93-IS05-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS05-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS05-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS06-01	1 U	1 U	5	1 U	7	2 U
IR93-IS06-02	13	10	12	3	1 U	2 U
IR93-IS06-03	28	13	2	1 U	1 U	2 U
IR93-IS06-04	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS07-01	3	6	19	6	1 U	2 U
IR93-IS07-02	15	14	39	15	1 U	2 U
IR93-IS07-03	1 U	1 U	2	1 U	1 U	2 U
IR93-IS08-01	1 U	2	137	31	1 U	2 U
IR93-IS08-02	1 U	1 U	7	1 U	1 U	2 U
IR93-IS08-03	4	2	1 U	1 U	1 U	2 U
IR93-IS09-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS09-02	1 U	1 U	1	1 U	1 U	2 U
IR93-IS09-02 DUP	1 U	1 U	1	1 U	1 U	2 U
IR93-IS09-03	1 U	1 U	3	1 U	1 U	2 U
IR93-IS10-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS10-02	28	3	1 U	1 U	1 U	2 U
IR93-IS10-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS11-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS11-02	3	12	53	13	1 U	2 U
IR93-IS11-03	1 U	1 U	3	1 U	1 U	2 U
IR93-IS12-01	13	12	83	29	2	2 U
IR93-IS12-02	20	15	81	9	1 U	2 U
IR93-IS12-03	23	11	38	10	1 U	2 U
IR93-IS12-04	3	2	18	1 U	1 U	2 U
IR93-IS13-01	1 U	154	366	86	6	2 U
IR93-IS13-02	1 U	1 U	7	1 U	1 U	2 U
IR93-IS13-03	1 U	2	6	2	1 U	2 U

TABLE 2

**MOBILE LABORATORY ANALYTICAL RESULTS  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

SAMPLE ID	PCE	TCE	cis-DCE	trans-DCE	Vinyl Chloride	Benzene
2L Standard	0.7	2.8	70	70	0.015	1
IR93-IS13-03 DUP	1 U	2	6	1	1 U	2 U
IR93-IS14-01	1 U	1 U	1	1 U	1 U	2 U
IR93-IS14-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS14-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS15-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS15-02	1 U	2	14	2	1 U	2 U
IR93-IS15-03	1 U	1	4	1 U	1 U	2 U
IR93-IS16-01	1 U	1 U	9	2	1 U	2 U
IR93-IS16-01 DUP	1 U	1 U	9	3	1 U	2 U
IR93-IS16-02	46	24	33	15	1 U	2 U
IR93-IS16-03	6	4	13	1 U	1 U	2 U
IR93-IS17-01	1 U	1	181	39	1	2 U
IR93-IS17-02	21	41	180	52	1	2 U
IR93-IS17-03	1	1	2	1	1 U	2 U
IR93-IS18-01	2	6	11	3	1 U	2 U
IR93-IS18-02	11	7	1	1 U	1 U	2 U
IR93-IS18-03	34	12	1	1 U	1 U	2 U
IR93-IS19-01	2	7	54	6	1 U	2 U
IR93-IS19-02	4	3	1 U	1 U	1 U	2 U
IR93-IS19-03	3	3	1	1 U	1 U	2 U
IR93-IS20-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS20-02	4	1	1 U	1 U	1 U	2 U
IR93-IS20-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS21-02	1 U	3	1 U	1 U	1 U	2 U
IR93-IS21-03	1 U	1 U	1	1 U	1 U	2 U
IR93-IS22-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS22-02	1 U	15	6	3	1 U	2 U
IR93-IS22-02 DUP	1 U	15	6	2	1 U	2 U
IR93-IS22-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS23-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS23-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS23-03	1 U	1 U	1	1 U	1 U	2 U
IR93-IS23-03 DUP	1 U	1 U	1	1 U	1 U	2 U
IR93-IS24-01	44	6	1 U	1 U	1 U	2 U
IR93-IS24-02	4	1 U	1 U	1 U	1 U	2 U
IR93-IS24-03	2	1 U	1 U	1 U	1 U	2 U
IR93-IS25-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS25-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS25-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS26-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS26-01 DUP	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS26-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS26-03	2	1 U	1 U	1 U	1 U	2 U

TABLE 2

**MOBILE LABORATORY ANALYTICAL RESULTS  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

SAMPLE ID	PCE	TCE	cis-DCE	trans-DCE	Vinyl Chloride	Benzene
2L Standard	0.7	2.8	70	70	0.015	1
IR93-IS27-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS27-03	3	2	1 U	1 U	1 U	2 U
IR93-IS28-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS28-02	1 U	1 U	9	1 U	1 U	2 U
IR93-IS28-03	1 U	1 U	9	1 U	1 U	2 U
IR93-IS28-03 DUP	1 U	1 U	8	1 U	1 U	2 U
IR93-IS29-01	1 U	9	86	19	1 U	2 U
IR93-IS29-02	1 U	2	31	2	2	2 U
IR93-IS29-02 DUP	1 U	2	32	2	1 U	2 U
IR93-IS29-03	1 U	1 U	5	1	1 U	2 U
IR93-IS29-04	1 U	1	16	1	1 U	2 U
IR93-IS30-01	1 U	2	130	23	4	2 U
IR93-IS30-02	1 U	1 U	24	1 U	1 U	2 U
IR93-IS30-03	1 U	1 U	4	1 U	1 U	2 U
IR93-IS31-01	1 U	1 U	61	5	1	2 U
IR93-IS31-01 DUP	1 U	1 U	58	5	1 U	2 U
IR93-IS31-02	1 U	1 U	1	1 U	1 U	2 U
IR93-IS31-03	1 U	1 U	2	1 U	1 U	2 U
IR93-IS32-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS32-02	1 U	1 U	61	14	1	2 U
IR93-IS32-03	1 U	1 U	48	1 U	1 U	2 U
IR93-IS33-02	1 U	11	31	12	1 U	2 U
IR93-IS34-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS34-02	1 U	1 U	5	1 U	1 U	2 U
IR93-IS34-03	1 U	1 U	3	1 U	1 U	2 U
IR93-IS35-02	1 U	1 U	2	1 U	1 U	2 U
IR93-IS36-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS36-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS37-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS37-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS37-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS38-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS38-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS38-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS39-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS39-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS39-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS40-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS40-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS40-03	1	1 U	1 U	1 U	1 U	2 U
IR93-IS41-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS41-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS41-03	2	1 U	1 U	1 U	1 U	2 U

TABLE 2

MOBILE LABORATORY ANALYTICAL RESULTS  
 SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
 MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	PCE	TCE	cis-DCE	trans-DCE	Vinyl Chloride	Benzene
2L Standard	0.7	2.8	70	70	0.015	1
IR93-IS42-01	1 U	1 U	13	3	1 U	2 U
IR93-IS42-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS42-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS43-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS43-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS43-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS44-01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS44-02	1 U	1 U	1 U	1 U	1 U	2 U
IR93-IS44-03	1 U	1 U	1 U	1 U	1 U	2 U
IR93-ER01	1 U	1 U	1 U	1 U	1 U	2 U
IR93-ER02	1 U	1 U	1 U	1 U	1 U	2 U

Notes:

Units are expressed in micrograms per liter (ug/L)

2L Standard - North Carolina Groundwater Standards (exceedences are in bold font)

U = Not detected above detection limit

DUP = Duplicate

TABLE 3

**COMPARISON OF FIXED-BASE AND MOBILE LABORATORY ANALYTICAL RESULTS  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Constituent	IR93-IS07-01		IR93-IS10-02		IR93-IS12-01	
	Fixed-Base Lab	Mobile Lab	Fixed-Base Lab	Mobile Lab	Fixed-Base Lab	Mobile Lab
Benzene	0.13 J	2 U	0.11 J	2 U	0.32 J	2 U
Tetrachloroethene	2.4	3	22	28	22	13
Trichloroethene	6	6	2.1	3	18	12
Vinyl Chloride	1 U	10 U	1 U	10 U	4	2
cis-1,2-Dichloroethene	18	19	0.82 J	1 U	130	83
trans-1,2-Dichloroethene	5.4	6	1 U	1 U	38	29
Constituent	IR93-IS17-02		IR93-IS20-02		IR93-IS23-01	
	Fixed-Base Lab	Mobile Lab	Fixed-Base Lab	Mobile Lab	Fixed-Base Lab	Mobile Lab
Benzene	0.17 J	2 U	0.13 J	2 U	0.13 J	2 U
Tetrachloroethene	26	21	1	4	0.42 J	1 U
Trichloroethene	60	41	0.93 J	1	1	1 U
Vinyl chloride	3	1	1 U	10 U	1 U	10 U
cis-1,2-Dichloroethene	190	180	0.67 J	1 U	1 U	1 U
trans-1,2-Dichloroethene	52	52	1 U	1 U	1 U	1 U
Constituent	IR93-IS28-02		IR93-IS29-01		IR93-IS31-02	
	Fixed-Base Lab	Mobile Lab	Fixed-Base Lab	Mobile Lab	Fixed-Base Lab	Mobile Lab
Benzene	0.18 J	2 U	0.90 J	2 U	0.16 J	2 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	14	9	1 U	1 U
Vinyl chloride	1 U	10 U	4.6	2	1 U	10 U
cis-1,2-Dichloroethene	11	9	99	86	1.1	1
trans-1,2-Dichloroethene	1 U	1 U	19	19	1 U	1 U

Notes:

U = Not detected above detection limit

TABLE 4

COMPARISON OF MOBILE LABORATORY DUPLICATES  
 SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
 MCB, CAMP LEJEUNE, NORTH CAROLINA

Constituent	IR93-IS09-02		IR93-IS13-03		IR93-IS16-01		IR93-IS22-02		IR93-IS23-03	
	Sample	Duplicate								
Benzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	2	2	1 U	1 U	15	15	1 U	1 U
Vinyl Chloride	10 U	10 U								
cis-1,2-Dichloroethene	1	1	6	6	9	9	6	6	1	1
trans-1,2-Dichloroethene	1 U	1 U	2	1	2	3	3	2	1 U	1 U
Constituent	IR93-IS26-01		IR93-IS28-03		IR93-IS29-02		IR93-IS31-01			
	Sample	Duplicate	Sample	Duplicate	Sample	Duplicate	Sample	Duplicate		
Benzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U		
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U		
Trichloroethene	1 U	1 U	1 U	1 U	2	2	1 U	1 U		
Vinyl Chloride	10 U	10 U								
cis-1,2-Dichloroethene	1 U	1 U	9	8	31	32	61	58		
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	2	2	5	5		

Notes:

U = Not detected above detection limit

**TABLE 5**

**SUMMARY OF AQUIFER AND GROUNDWATER CHEMISTRY  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Constituent	IR93-MW06-02A	IR93-IS01-05	IR93-IS01-10
Aluminum	5,900 E*	NA	NA
Antimony	3 U	NA	NA
Arsenic	3.5 U	NA	NA
Barium	56 E	NA	NA
Beryllium	0.89 B	NA	NA
Cadmium	0.50 U	NA	NA
Calcium	58,000	NA	NA
Chromium	9.3 B	NA	NA
Cobalt	1 U	NA	NA
Copper	1 U	NA	NA
Iron	16,000	NA	NA
Lead	5 B	NA	NA
Magnesium	5,300	NA	NA
Manganese	140	NA	NA
Mercury	0.10 U	NA	NA
Nickel	2.4 B	NA	NA
Potassium	3,500	NA	NA
Selenium	3.5 U	NA	NA
Silver	0.70 U	NA	NA
Sodium	58,000	NA	NA
Thallium	4.5 U	NA	NA
Vanadium	9.5 B	NA	NA
Zinc	20 B	NA	NA
Chloride	36,000	NA	NA
Nitrate-N	50 U	NA	NA
Nitrite-N	50 U	NA	NA
Sulfate as SO <sub>4</sub>	170,000	NA	NA
Total Organic Carbon	NA	2,600	1,800

Notes:

Units - IR93-MW06-02A is aqueous (ug/L)

IR93-IS01-05 is solid (mg/kg)

IR93-IS01-10 is solid (mg/kg)

B - detected below instrument detection limit  
but above method detection limit

E - Exceeded upper calibration range,  
sample dilution required

U - Not detected above method detection limit

NA - Not analyzed

TABLE 6

SUMMARY OF FIELD ANALYSES  
 SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
 MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	Depth Interval (ft)	pH (SU)	Temp. (°C)	Cond <sup>(1)</sup> (uS)	Redox (mV)	D.O. (ppm)	Fe <sup>+2</sup> (mg/L)	Alk. <sup>(2)</sup> (mg/L)	Comments
IR93-IS01-01	5 - 9	4.64	14.2	165	177.1	2.0	NA <sup>(3)</sup>	NA	
IR93-IS01-02	15 - 19	5.10	16.3	221	131	2.0	NA	NA	
IR93-IS01-03	25 - 29	6.91	16.6	539	-133	1.0	NA	NA	
IR93-IS02-01	5 - 9	6.41	12.1	605	-48.9	3.0	NA	NA	NA - Sample too turbid
IR93-IS02-02	15 - 19	5.64	18.3	104	9.5	2.0	15.96	1.6	
IR93-IS02-03	25 - 29	6.91	17.2	507	-152.4	<1	15.78	1.8	
IR93-IS02A-04	35 - 39	6.80	18	515	-106	NA	NA	NA	NA - Not analyzed this depth
IR93-IS03-01	5 - 9	6.53	13.7	225	-38.7	NA	NA	NA	NA - Sample too turbid
IR93-IS03-02	15 - 19	5.79	15	144	-50.2	2.0	12.18	NA	NA - Sample too turbid
IR93-IS03-03	25 - 29	6.91	15.8	438	-133	1.0	9.96	1.8	
IR93-IS04-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS04-02	15 - 19	6.19	14.5	186	25.3	NA	NA	NA	NA - Sample too turbid
IR93-IS04-03	25 - 29	6.95	16.7	499	-92	NA	NA	NA	NA - Sample too turbid
IR93-IS05-01	5 - 9	4.26	10.4	319.7	140.7	NA	4.95	120	
IR93-IS05-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS05-03	25 - 29	7.06	13.2	548	9.19	1.0	2.80	212	
IR93-IS06-01	5 - 9	6.51	10	716	-34.3	1.0	5.40	1.8	
IR93-IS06-02	15 - 19	6.02	12.4	326	-13	1.0	12.96	8.4	
IR93-IS06-03	25 - 29	7.16	12.1	484	-148	1.0	6.78	NA	
IR93-IS06A-04	35 - 39	6.65	17	521	-144	NA	NA	NA	NA - Not analyzed this depth
IR93-IS07-01	5 - 9	6.11	12.3	933	-42.4	1.0	15.00	2	
IR93-IS07-02	15 - 19	6.71	16.1	455	-97.1	0.4	5.40	10	
IR93-IS07-03	25 - 29	7.20	16.9	458	-154	0.1	11.34	10	
IR93-IS08-01	5 - 9	5.95	14.1	1302	-27.2	0.1	48.30	74	
IR93-IS08-02	15 - 19	6.95	16.5	501	-102.3	1.0	10.98	86	
IR93-IS08-03	25 - 29	7.02	16	473.1	-101	1.0	12.72	102	
IR93-IS09-01	5 - 9	6.78	17.2	610	-118	0.2	13.86	172	
IR93-IS09-02	15 - 19	6.89	18.7	511	-72.7	2.0	4.98	156	
IR93-IS09-03	25 - 29	7.09	19.3	493.4	-143	1.5	11.04	40	
IR93-IS10-01	5 - 9	6.40	NA	NA	-56.9	NA	NA	NA	NA - Insufficient volume
IR93-IS10-02	15 - 19	6.44	19.2	386	-63.6	0.4	6.84	8	
IR93-IS10-03	25 - 29	6.91	17.8	466	-88	0.4	14.64	0.8	
IR93-IS11-01	5 - 9	5.72	17.4	283	-32.5	1.0	11.70	6	
IR93-IS11-02	15 - 19	6.78	18.6	501	-100.3	1.0	5.22	1	
IR93-IS11-03	25 - 29	6.96	19.9	524	-138	0.3	9.66	36	
IR93-IS12-01	5 - 9	5.70	16.8	350.1	17.6	1.0	10.98	24	
IR93-IS12-02	15 - 19	6.76	18.3	504	-142	0.2	8.16	34	
IR93-IS12-03	25 - 29	6.94	19.8	485.7	-150	1.0	10.44	NA	
IR93-IS12A-04	35 - 39	7.02	19	491	-130	NA	NA	NA	NA - Not analyzed this depth
IR93-IS13-01	5 - 9	6.57	15.6	507	-78.2	0.2	9.18	10	
IR93-IS13-02	15 - 19	6.93	18.8	444	-131	0.6	10.68	20	
IR93-IS13-03	25 - 29	7.04	19.8	474	-157	0.3	6.66	2	
IR93-IS14-01	5 - 9	6.51	16.3	386.4	-84	2.0	10.20	48	
IR93-IS14-02	15 - 19	6.92	18.2	439.7	-107	0.7	14.28	30	
IR93-IS14-03	25 - 29	7.04	18.7	450	-138	1.0	10.56	46	
IR93-IS15-01	5 - 9	6.22	13	506	-66.5	NA	NA	NA	NA - Not analyzed this location
IR93-IS15-02	15 - 19	6.48	16.8	515	-102	NA	NA	NA	NA - Not analyzed this location
IR93-IS15-03	25 - 29	6.96	18.8	527	-150.2	NA	NA	NA	NA - Not analyzed this location

TABLE 6

**SUMMARY OF FIELD ANALYSES  
SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Sample ID	Depth Interval (ft)	pH (SU)	Temp. (°C)	Cond <sup>(1)</sup> (uS)	Redox (mV)	D.O. (ppm)	Fe <sup>+2</sup> (mg/L)	Alk. <sup>(2)</sup> (mg/L)	Comments
IR93-IS16-01	5 - 9	6.25	13.9	546	-49	NA	NA	NA	NA - Not analyzed this location
IR93-IS16-02	15 - 19	6.32	16.9	485.8	-72.6	NA	NA	NA	NA - Not analyzed this location
IR93-IS16-03	25 - 29	6.90	18.1	483.1	-135	NA	NA	NA	NA - Not analyzed this location
IR93-IS17-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - tubing clogged
IR93-IS17-02	15 - 19	6.54	16.9	584	-84.6	NA	NA	NA	NA - Not analyzed this location
IR93-IS17-03	25 - 29	6.83	17.3	455.6	-125	NA	NA	NA	NA - Not analyzed this location
IR93-IS18-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS18-02	15 - 19	6.03	18.8	173.5	-72.9	NA	NA	NA	NA - Not analyzed this location
IR93-IS18-03	25 - 29	6.81	18.9	491.5	-111.6	NA	NA	NA	NA - Not analyzed this location
IR93-IS19-01	5 - 9	6.04	17.9	1831	-56.9	NA	NA	NA	NA - Not analyzed this location
IR93-IS19-02	15 - 19	6.15	19.9	309.5	-95.3	NA	NA	NA	NA - Not analyzed this location
IR93-IS19-03	25 - 29	7.03	20.2	463.8	-156.8	NA	NA	NA	NA - Not analyzed this location
IR93-IS20-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS20-02	15 - 19	6.43	19	373	-80.9	3.0	7.56	6	
IR93-IS20-03	25 - 29	6.62	19.8	487	-80	0.4	17.22	2	
IR93-IS21-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - No samples collected
IR93-IS21-02	15 - 19	6.04	19	370.3	-65.5	0.3	17.16	51	
IR93-IS21-03	25 - 29	6.51	20	425.3	8.74	0.4	10.38	27	
IR93-IS22-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS22-02	15 - 19	5.57	21	213.2	-55	0.2	17.70	38	
IR93-IS22-03	25 - 29	6.63	20.3	454.2	-93	1.0	10.08	52	
IR93-IS23-01	5 - 9	5.89	17	225	-49.9	3.0	14.58	34	
IR93-IS23-02	15 - 19	4.94	20.1	112	-21.2	2.0	10.56	1	
IR93-IS23-03	25 - 29	6.48	20	477	-74	NA	6.78	17	
IR93-IS24-01	5 - 9	5.42	19	140	36	NA	NA	NA	NA - Not analyzed this location
IR93-IS24-02	15 - 19	5.06	20	91	27.9	NA	NA	NA	NA - Not analyzed this location
IR93-IS24-03	25 - 29	6.30	22	255	-71	NA	NA	NA	NA - Not analyzed this location
IR93-IS25-01	5 - 9	5.96	18.5	347.3	-38.2	NA	NA	NA	NA - Not analyzed this location
IR93-IS25-02	15 - 19	5.49	19.9	267.9	4.2	NA	NA	NA	NA - Not analyzed this location
IR93-IS25-03	25 - 29	6.13	20.9	335.1	-75	NA	NA	NA	NA - Not analyzed this location
IR93-IS26-01	5 - 9	6.31	18.8	431.2	-32.3	NA	NA	NA	NA - Not analyzed this location
IR93-IS26-02	15 - 19	5.38	19.3	205.3	37.5	NA	NA	NA	NA - Not analyzed this location
IR93-IS26-03	25 - 29	6.26	19.5	396.5	-50	NA	NA	NA	NA - Not analyzed this location
IR93-IS27-01	5 - 9	5.2	17	163	76.9	NA	NA	NA	NA - Not analyzed this location
IR93-IS27-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS27-03	25 - 29	6.30	20	420	-50	NA	NA	NA	NA - Not analyzed this location
IR93-IS28-01	5 - 9	4.99	15.6	186.3	6.4	0.5	9.78	6	
IR93-IS28-02	15 - 19	6.8	18.1	590	-121.2	0.4	9.84	50	
IR93-IS28-03	25 - 29	6.87	19.5	578	-125.6	0.4	13.20	1	
IR93-IS29-01	5 - 9	6.35	15.6	513	-106.5	0.3	11.34	NA	
IR93-IS29-02	15 - 19	6.77	18.2	496.1	-90.3	0.3	15.84	20	
IR93-IS29-03	25 - 29	6.88	18.6	480.6	-125.6	1.0	8.40	76	
IR93-IS29-04	35 - 39	7.02	19.9	453.1	-165.3	NA	NA	NA	NA - Not analyzed this depth
IR93-IS30-01	5 - 9	6.60	16.1	503	-85.4	0.2	10.44	14	
IR93-IS30-02	15 - 19	7.01	18.4	445	-117.3	0.5	9.00	26	
IR93-IS30-03	25 - 29	7.08	19.3	443.6	-151.3	1.0	4.02	38	
IR93-IS31-01	5 - 9	6.63	17.6	487	-95.2	0.3	5.94	24	
IR93-IS31-02	15 - 19	6.88	19.3	463.2	-123.3	0.3	9.66	8	

TABLE 6

SUMMARY OF FIELD ANALYSES  
 SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO-0219  
 MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	Depth Interval (ft)	pH (SU)	Temp. (°C)	Cond <sup>(1)</sup> (uS)	Redox (mV)	D.O. (ppm)	Fe <sup>+2</sup> (mg/L)	Alk. <sup>(2)</sup> (mg/L)	Comments
IR93-IS31-03	25 - 29	7.09	19.5	463.4	-157.4	0.2	8.94	18	
IR93-IS32-01	5 - 9	6.29	16.9	468.4	-48.1	0.4	16.80	12	
IR93-IS32-02	15 - 19	6.77	19.3	547	-108.3	0.4	12.18	12	
IR93-IS32-03	25 - 29	7.04	21.2	519	-122.3	0.0	8.28	10	
IR93-IS33-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - Not analyzed this location
IR93-IS33-02	15 - 19	6.75	20.9	500	-137	NA	NA	NA	NA - Not analyzed this location
IR93-IS33-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	NA - Not analyzed this location
IR93-IS34-01	5 - 9	6.37	17.8	358.5	-97.4	0.05	13.56	38	
IR93-IS34-02	15 - 19	6.90	18.5	574	-115.3	0.1	8.82	46	
IR93-IS34-03	25 - 29	7.12	19.3	563	-157.6	0.2	7.44	54	
IR93-IS35-02	15 - 19	6.88	18.3	658	-128.2	NA	NA	NA	NA - Not analyzed this location
IR93-IS36-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	NA - Insufficient volume
IR93-IS36-02	15 - 19	5.6	19	168	18.4	NA	NA	NA	NA - Not analyzed this location
IR93-IS37-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS37-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS37-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS38-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS38-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS38-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS39-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS39-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS39-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS40-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS40-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS40-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS41-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS41-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS41-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS42-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS42-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS42-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS43-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS43-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS43-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS44-01	5 - 9	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS44-02	15 - 19	NA	NA	NA	NA	NA	NA	NA	VOA sample only
IR93-IS44-03	25 - 29	NA	NA	NA	NA	NA	NA	NA	VOA sample only

- Notes: <sup>(1)</sup> Specific Conductance  
<sup>(2)</sup> Alkalinity  
<sup>(3)</sup> NA = Not Analyzed

**ATTACHMENT A**

## TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 93 Additional Plume Characterization  
 PROJ. NO.: CTO-0219 BORING NO.: 93-MW06  
 COORDINATES: EAST: 2464907.495 NORTH: 360288.4411  
 ELEVATION: SURFACE: 13.63 TOP OF PVC CASING: 13.47

Rig: Ingersol-Rand					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Split Spoon	Casing	Augers	Core Barrel					
Size (ID)	--	3-in	--	--	13-Jan-02	0.0 - 15.0	Sunny, breezy, 40s	--
Length	--	4-ft	--	--				
Type	--	stainless	--	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Installed Geoprobe Prepacked Screens by driving 3-in ID Geoprobe Casing

SAMPLE TYPE					WELL INFORMATION			
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Direct Push P = Piston N = No Sample					Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
					Sch 40 PVC Casing	1-in	0	5.0
					SCH 40, 10 Slot PVC Screen	1-in	5.0	15.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1								1.0
2								
3								
4								
5	D-N					No cuttings generated or samples collected		5.0
6								
7								
8								
9								
10								

Match to Sheet 2

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW06 SHEET 1 OF 2

**TEST BORING AND WELL CONSTRUCTION RECORD**

PROJECT: Site 93 Additional Plume Characterization

CTO NO.: CTO-0219

BORING NO.:

93-MW06

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	D-N					Continued from Sheet 1		
12						No cuttings generated or samples collected		
13								
14								
15						15.0		
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW06 SHEET 2 OF 2



## TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 93 Additional Plume Characterization  
 PROJ. NO.: CTO-0219 BORING NO.: 93-MW07  
 COORDINATES: EAST: 2464277.282 NORTH: 360494.5882  
 ELEVATION: SURFACE: 16.20 TOP OF PVC CASING: 15.95

Rig: <u>Ingersol-Rand</u>					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Split Spoon	Casing	Augers	Core Barrel					
Size (ID)	--	3-in	--	--	16-Jan-02	0.0 - 15.0	Sunny, breezy, 40s	--
Length	--	4-ft	--	--				
Type	--	stainless	--	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

**Remarks:** Installed Geoprobe Prepacked Screens by driving 3-in ID Geoprobe Casing

SAMPLE TYPE	WELL INFORMATION			
S = Split Spoon    A = Auger T = Shelby Tube    W = Wash R = Air Rotary    C = Core D = Direct Push    P = Piston N = No Sample	Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
	Sch 40 PVC Casing	1-in	0	10.0
	SCH 40, 10 Slot PVC Screen	1-in	10.0	15.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1								1.0
2								
3								
4								
5	D-N					No cuttings generated or samples collected		5.0
6								
7								
8								
9								
10								

Match to Sheet 2

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW07 SHEET 1 OF 2

**TEST BORING AND WELL CONSTRUCTION RECORD**

**Baker Environmental**

PROJECT: Site 93 Additional Plume Characterization  
 CTO NO.: CTO-0219 BORING NO.: 93-MW07

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	D-N					Continued from Sheet 1		15.0
12						No cuttings generated or samples collected		
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW07 SHEET 2 OF 2



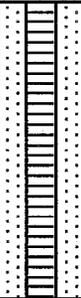
**TEST BORING AND WELL CONSTRUCTION RECORD**

**Baker Environmental**

PROJECT: Site 93 Additional Plume Characterization

CTO NO.: CTO-0219

BORING NO.: 93-MW08

SAMPLE TYPE					DEFINITIONS			
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample					SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background			
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	D-N					Continued from Sheet 1		
12						No cuttings generated or samples collected		
13								
14								
15						15.0		
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW08 SHEET 2 OF 2



## TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 93 Additional Plume Characterization  
 PROJ. NO.: CTO-0219 BORING NO.: 93-MW09  
 COORDINATES: EAST: 2464991.441 NORTH: 360467.0519  
 ELEVATION: SURFACE: 12.97 TOP OF PVC CASING: 12.72

Rig: Ingersol-Rand					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Split Spoon	Casing	Augers	Core Barrel					
Size (ID)	--	3-in	--	--	13-Jan-02	0.0 - 15.0	Sunny, breezy, 40s	--
Length	--	4-ft	--	--				
Type	--	stainless	--	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

**Remarks:** Installed Geoprobe Prepacked Screens by driving 3-in ID Geoprobe Casing

SAMPLE TYPE	WELL INFORMATION			
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Direct Push P = Piston N = No Sample	Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
	Sch 40 PVC Casing	1-in	0	5.0
	SCH 40, 10 Slot PVC Screen	1-in	5.0	15.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1							x x x x	1.0
2							x x x x	
3							x x x x	
4							x x x x	
5	D-N					No cuttings generated or samples collected	x x x x	5.0
6							x x x x	
7							x x x x	
8							x x x x	
9							x x x x	
10							x x x x	

Match to Sheet 2

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW09 SHEET 1 OF 2

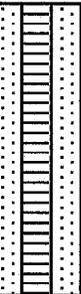
**TEST BORING AND WELL CONSTRUCTION RECORD**

**Baker Environmental**

PROJECT: Site 93 Additional Plume Characterization

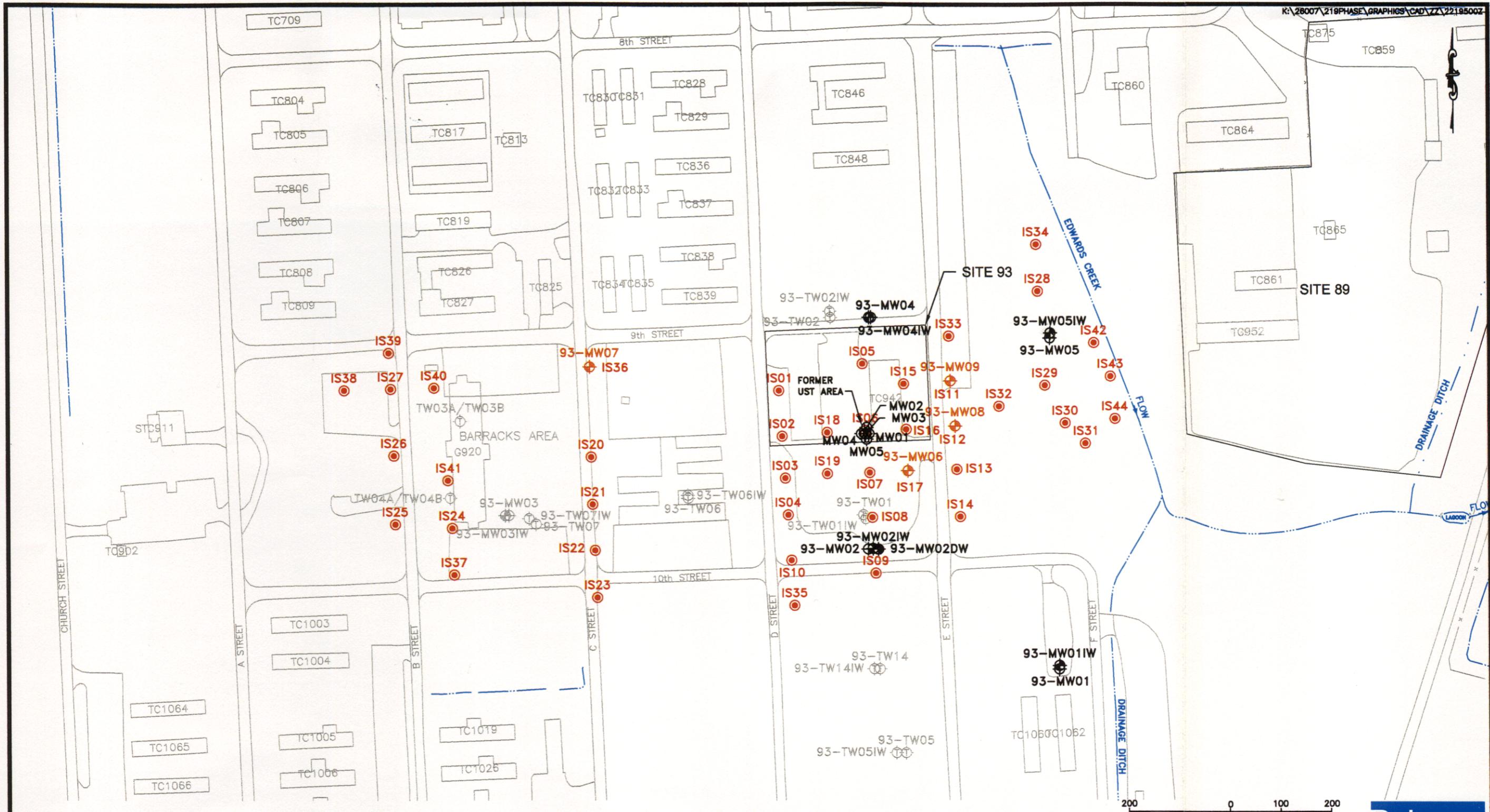
CTO NO.: CTO-0219

BORING NO.: 93-MW09

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	D-N					Continued from Sheet 1		
12						No cuttings generated or samples collected		
13								
14								
15						15.0		
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff  
 DRILLER: Arnold Chapel

BAKER REP.: Mark DeJohn  
 BORING NO.: 93-MW09 SHEET 2 OF 2



NOTE: GRAYED TEMPORARY AND MONITORING WELL LOCATIONS HAVE BEEN ABANDONED.

SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

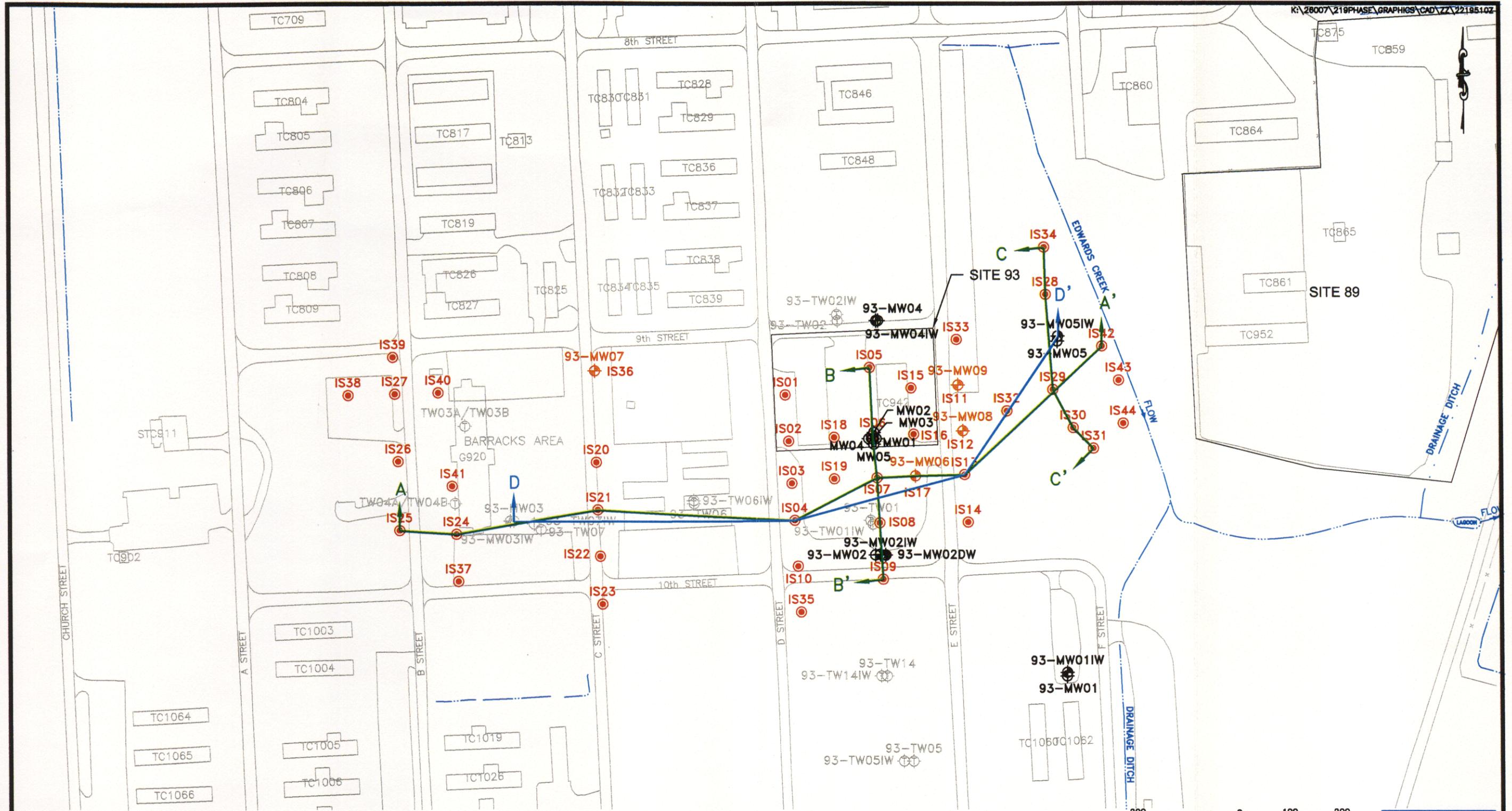
1 inch = 200 ft.



**LEGEND**

- |           |   |         |   |
|-----------|---|---------|---|
| 93-MW01   | - SHALLOW GROUNDWATER MONITORING WELL LOCATION (1997 RI)      | 93-MW06 | - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION) |
| 93-MW01IW | - INTERMEDIATE GROUNDWATER MONITORING WELL LOCATION (1997 RI) | 93-IS01 | - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)                              |
| 93-MW02DW | - DEEP GROUNDWATER MONITORING WELL LOCATION (1997 RI)         | MW01    | - SHALLOW GROUNDWATER MONITORING WELL (1995 SITE CHECK)                                 |
| 93-TW06   | - TEMPORARY GROUNDWATER MONITORING WELL LOCATION (1997 RI)    |         |   |

**FIGURE 1**  
CURRENT CONDITIONS AND CURRENT AND PAST SAMPLING LOCATIONS  
OPERABLE UNIT NO. 16 - SITE 93  
ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219  
MARINE CORPS BASE, CAMP LEJEUNE  
NORTH CAROLINA



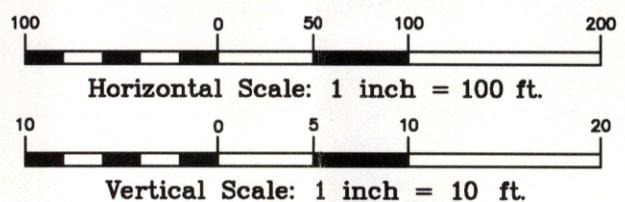
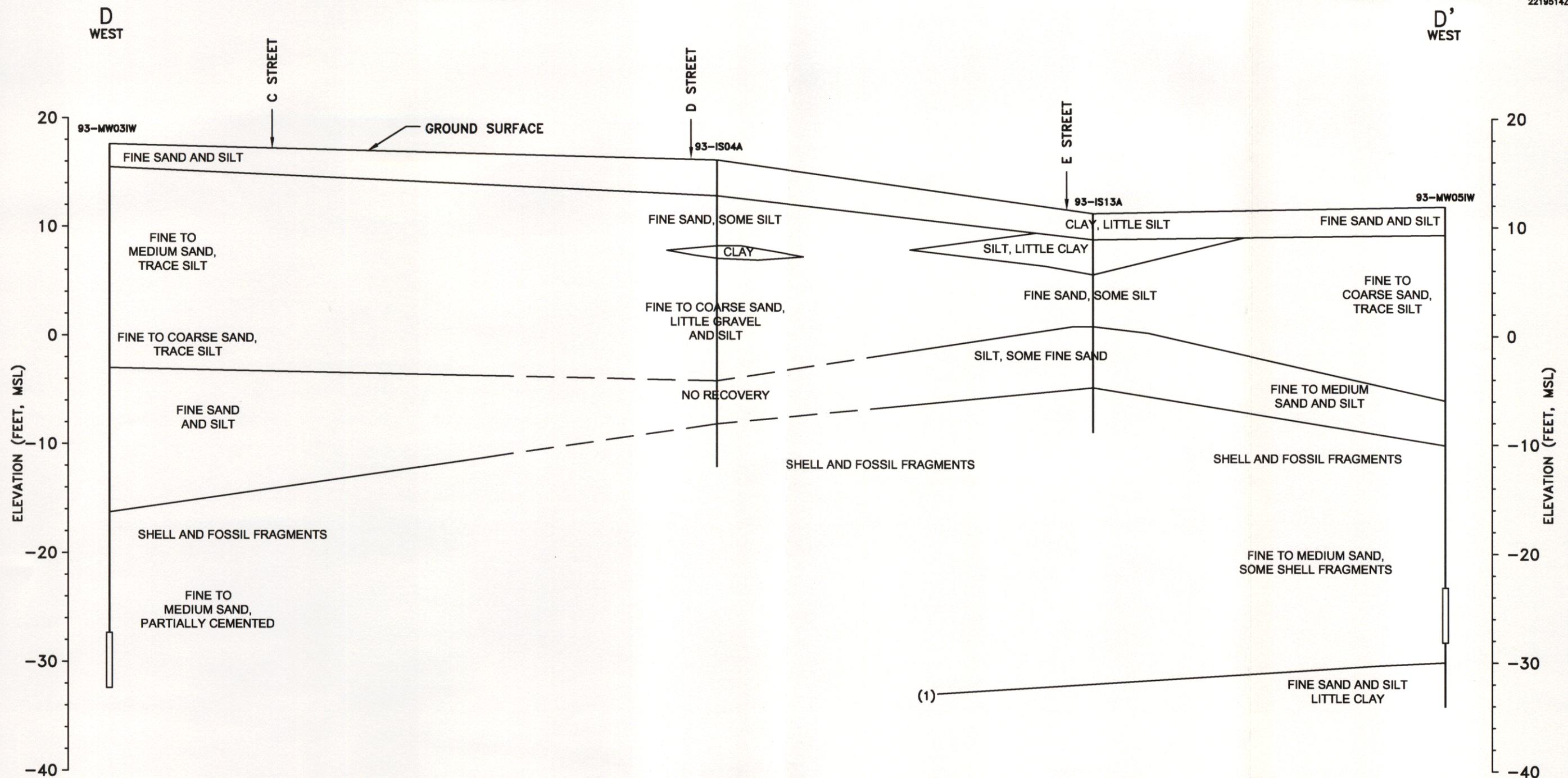
NOTE: GRAYED TEMPORARY AND MONITORING WELL LOCATIONS HAVE BEEN ABANDONED.

SOURCE: MCB, CAMP LEJEUNE MARCH 2000.



LEGEND	
93-MW01	- SHALLOW GROUNDWATER MONITORING WELL LOCATION (1997 RI)
93-MW01IW	- INTERMEDIATE GROUNDWATER MONITORING WELL LOCATION (1997 RI)
93-MW02DW	- DEEP GROUNDWATER MONITORING WELL LOCATION (1997 RI)
93-TW06	- TEMPORARY GROUNDWATER MONITORING WELL LOCATION (1997 RI)
93-MW07	- SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
IS01	- BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
MW01	- SHALLOW GROUNDWATER MONITORING WELL (1995 SITE CHECK)
(Green line with arrows)	- CONTAMINANT PLUME CROSS SECTION
(Blue line with arrows)	- GEOLOGIC CROSS SECTION

**FIGURE 2**  
**CROSS SECTION LOCATION MAP**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**

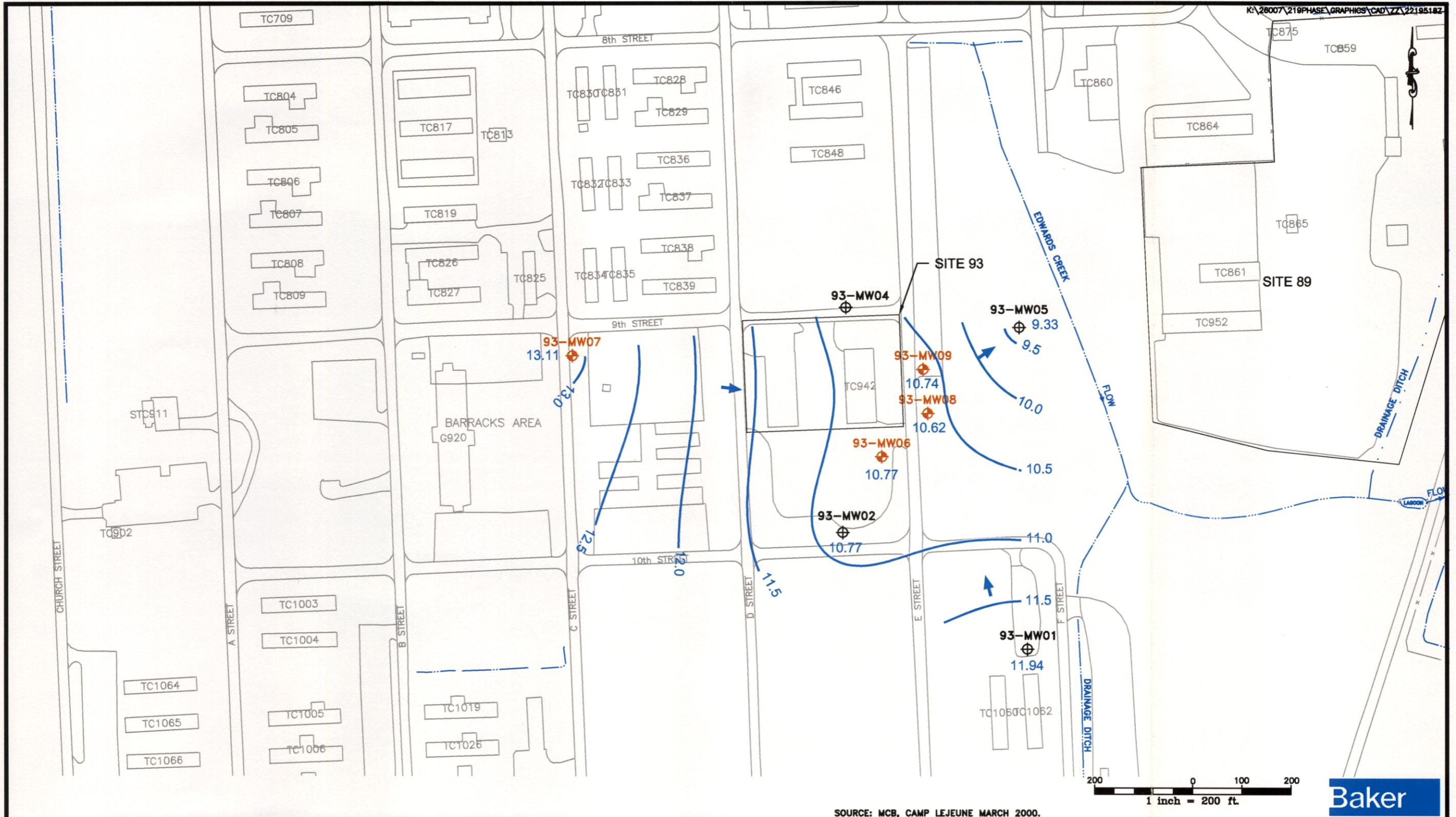


THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

**FIGURE 3**  
**CROSS SECTION D-D'**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**

MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA

NOTE: (1) INFORMATION FROM NEARBY WELL 93-MW021W SUGGESTS CONTACT AT THIS ELEVATION.



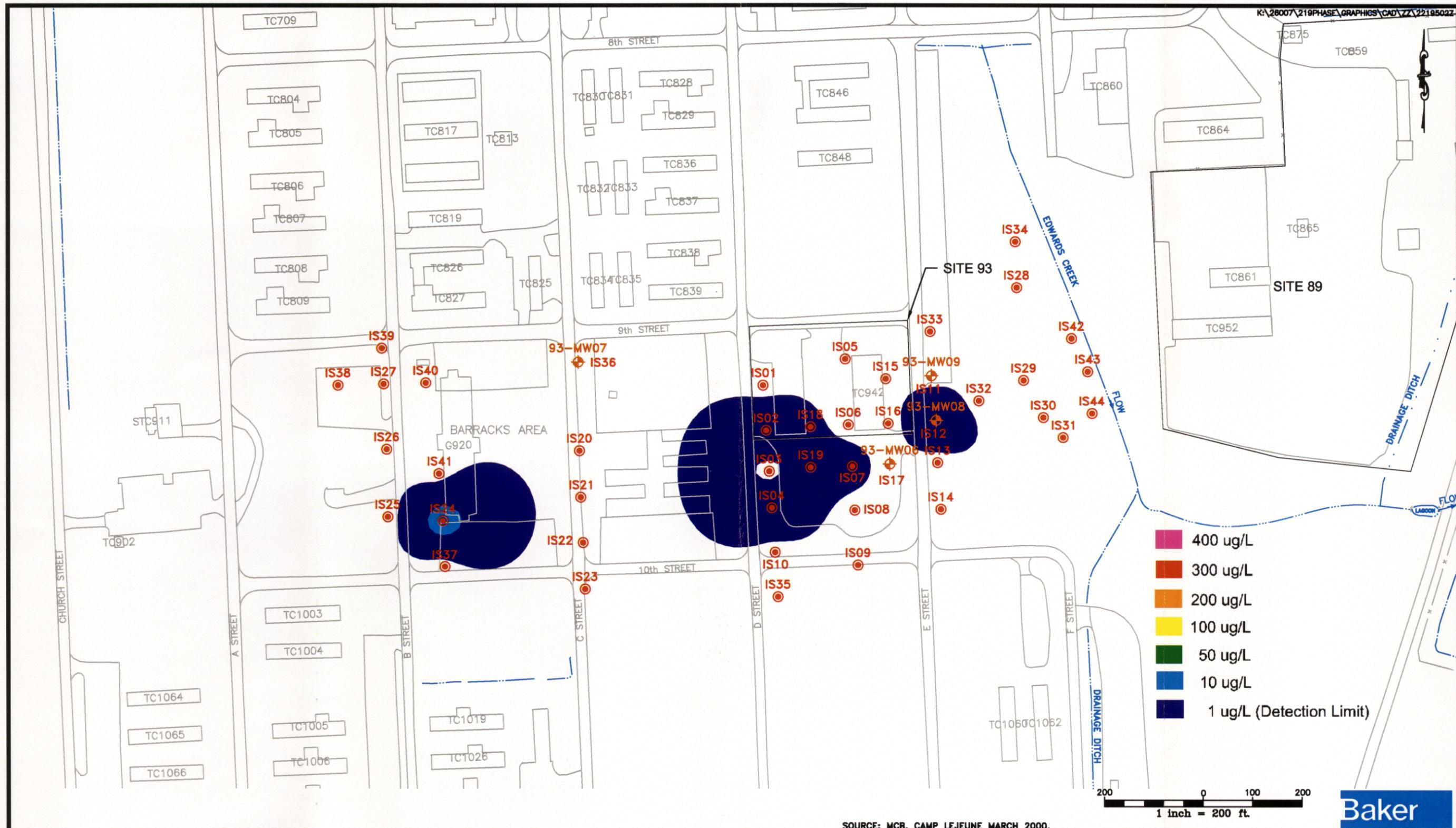
SOURCE: MCB, CAMP LEJEUNE MARCH 2000.



**LEGEND**

<p>93-MW01 ⊕ - SHALLOW GROUNDWATER MONITORING WELL (1997 RI)</p> <p>93-MW07 ⊕ - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)</p> <p>— 11.0 — - ISOELEVATION CONTOUR LINE</p>	<p>➔ - GROUNDWATER FLOW DIRECTION</p>
---	---------------------------------------

**FIGURE 4**  
**GROUNDWATER CONTOUR MAP**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

**LEGEND**

93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

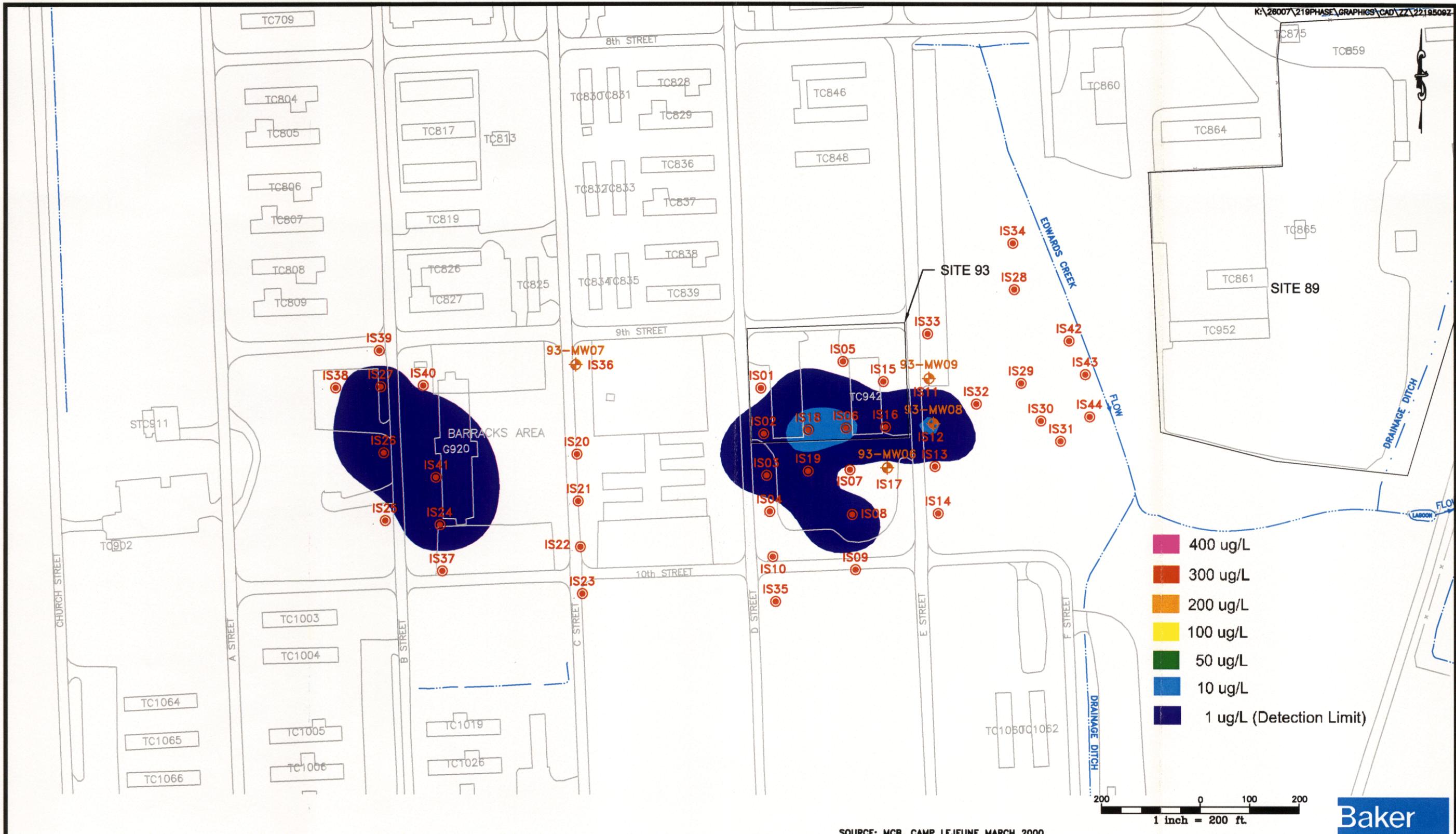
**FIGURE 5**  
 EXTENT OF PCE IN GROUNDWATER (ABOVE DETECTION LIMIT) 5 TO 9 FEET BGS OPERABLE UNIT NO. 16 - SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219 MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

LEGEND	
	93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
	IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 6**  
 EXTENT OF PCE IN GROUNDWATER (ABOVE DETECTION LIMIT) 15 TO 19 FEET BGS OPERABLE UNIT NO. 16 - SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219 MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

LEGEND	
	93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
	IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 7**  
 EXTENT OF PCE IN GROUNDWATER  
 (ABOVE DETECTION LIMIT) 25 TO 29 FEET BGS  
 OPERABLE UNIT NO. 16 - SITE 93  
 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

- 400 ug/L
- 300 ug/L
- 200 ug/L
- 100 ug/L
- 50 ug/L
- 10 ug/L
- 2.8 ug/L (2L Standard)

200 0 100 200  
1 inch = 200 ft.

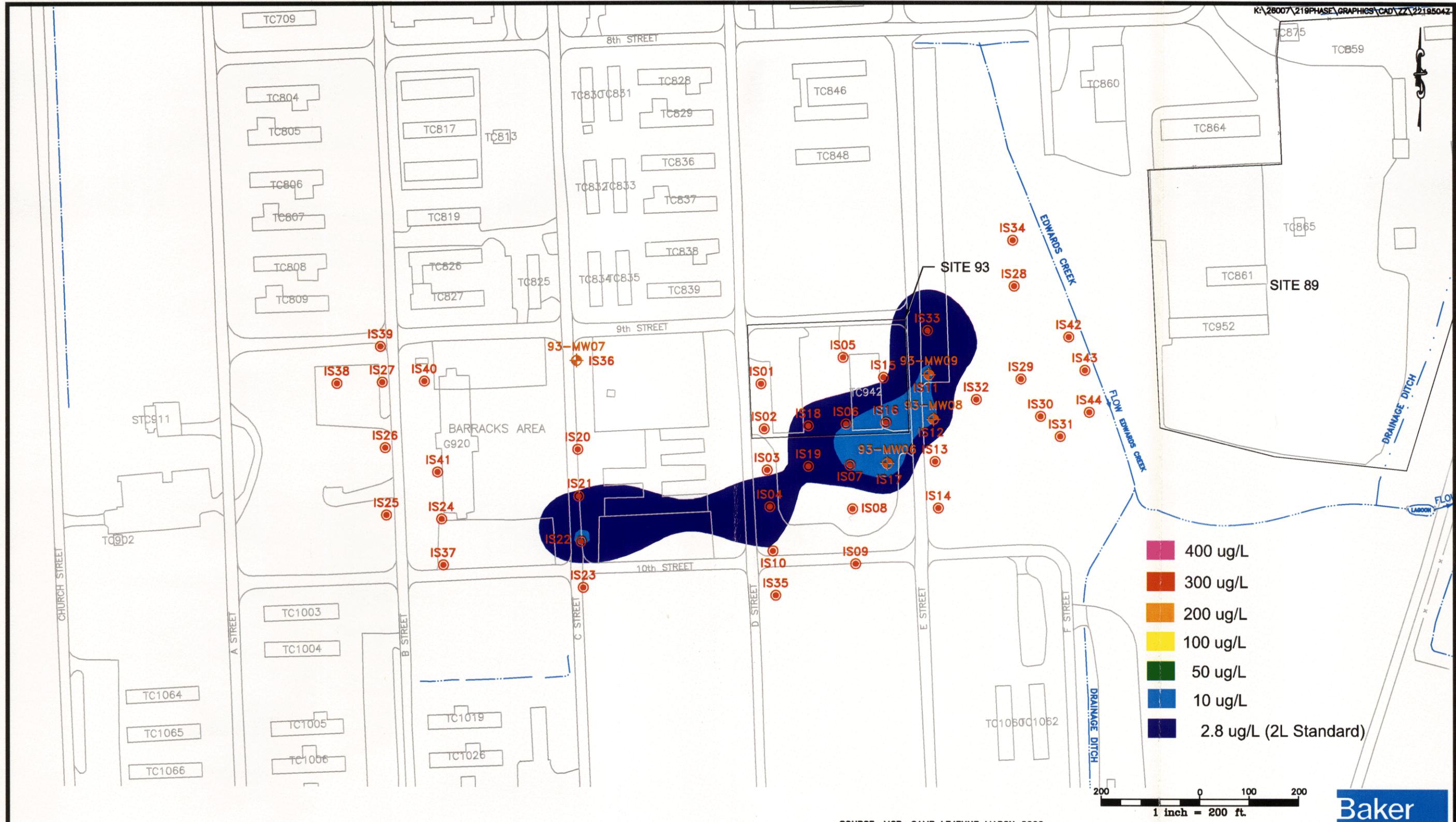


**LEGEND**

◆ 93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

● IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 8**  
 EXTENT OF TCE IN GROUNDWATER  
 (ABOVE 2L STANDARD) 5 TO 9 FEET BGS  
 OPERABLE UNIT NO. 16 - SITE 93  
 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



**LEGEND**

93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

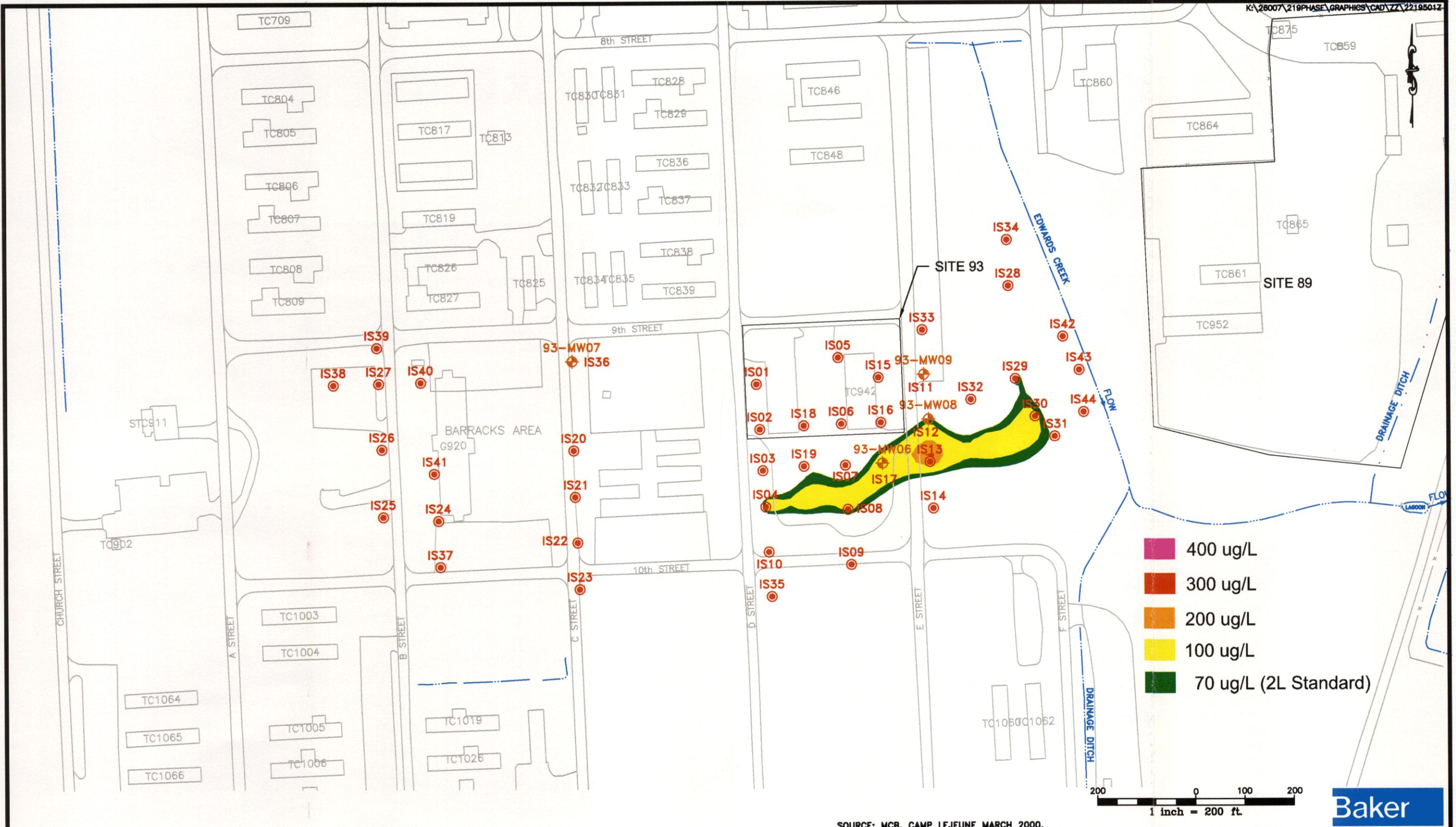
**FIGURE 9**  
 EXTENT OF TCE IN GROUNDWATER (ABOVE 2L STANDARD) 15 TO 19 FEET BGS OPERABLE UNIT NO. 16 - SITE 93  
 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

LEGEND	
93-MW07	- SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
IS01	- BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 10**  
 EXTENT OF TCE IN GROUNDWATER  
 (ABOVE 2L STANDARD) 25 TO 29 FEET BGS  
 OPERABLE UNIT NO. 16 - SITE 93  
 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

**LEGEND**

93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 11**  
 EXTENT OF cis-1,2-DCE IN GROUNDWATER (ABOVE 2L STANDARD) 5 TO 9 FEET BGS OPERABLE UNIT NO. 16 - SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219 MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

- 400 ug/L
- 300 ug/L
- 200 ug/L
- 100 ug/L
- 70 ug/L (2L Standard)

**LEGEND**

93-MW07  - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

IS01  - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 12**  
 EXTENT OF cis-1,2-DCE IN GROUNDWATER (ABOVE 2L STANDARD) 15 TO 19 FEET BGS OPERABLE UNIT NO. 16 - SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219 MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA





SOURCE: MCB, CAMP LEJEUNE MARCH 2000.



**LEGEND**

93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 13**  
 EXTENT OF VINYL CHLORIDE IN GROUNDWATER (ABOVE DETECTION LIMIT) 5 TO 9 FEET BGS OPERABLE UNIT NO. 16 - SITE 93 ADDITIONAL PLUME CHARACTERIZATION, CTO - 0219 MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA

WEST

EAST

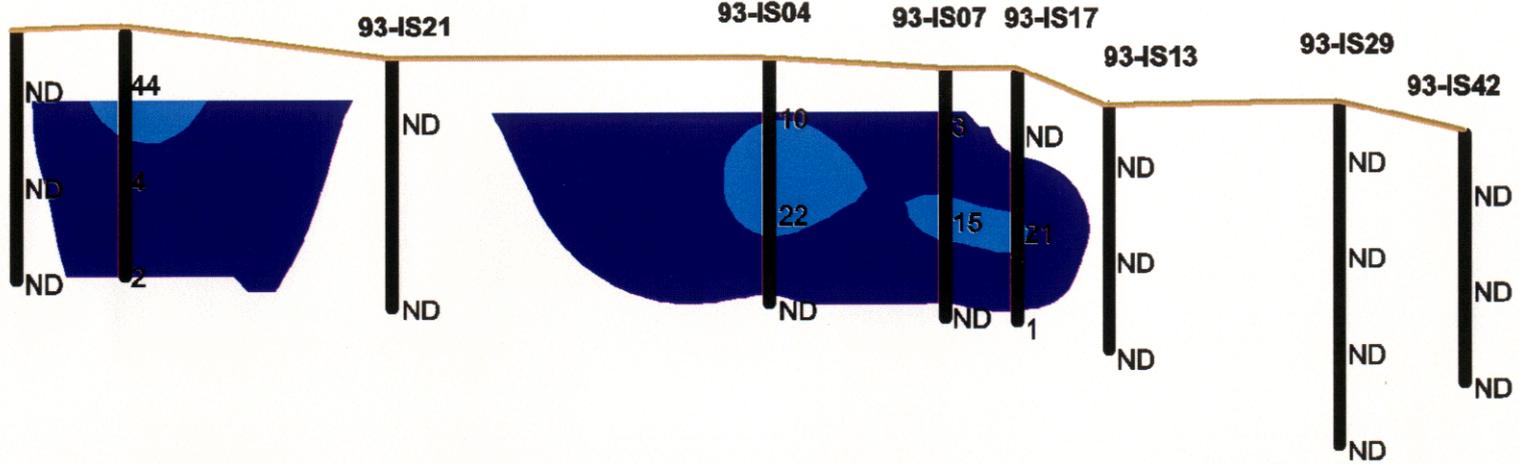
A

Former UST Area

A'

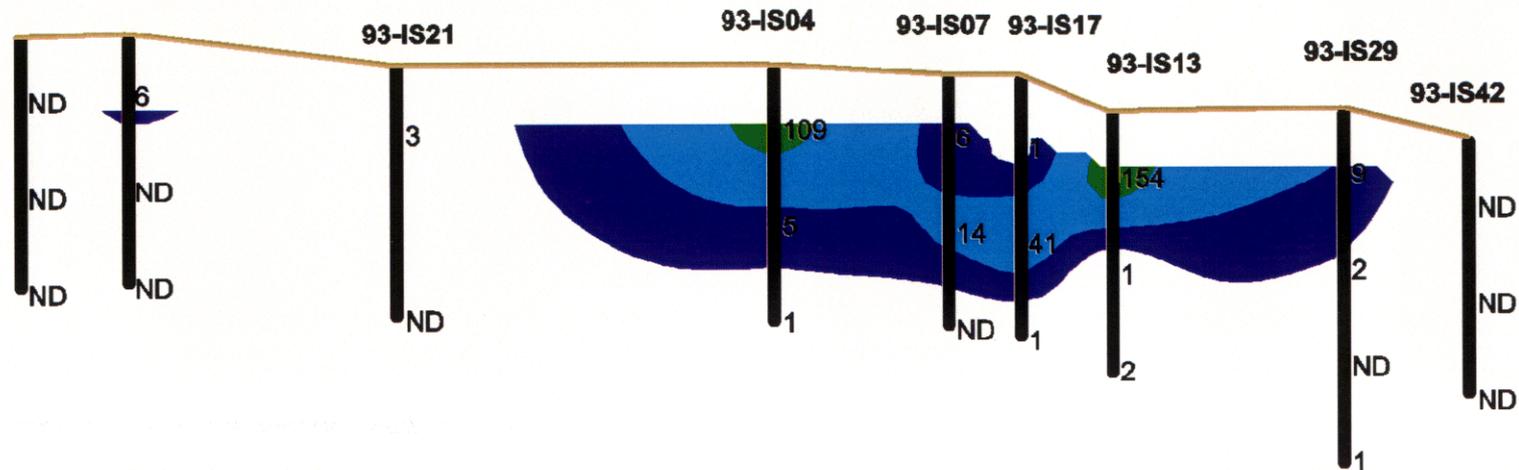
93-IS25 93-IS24

14a-PCE



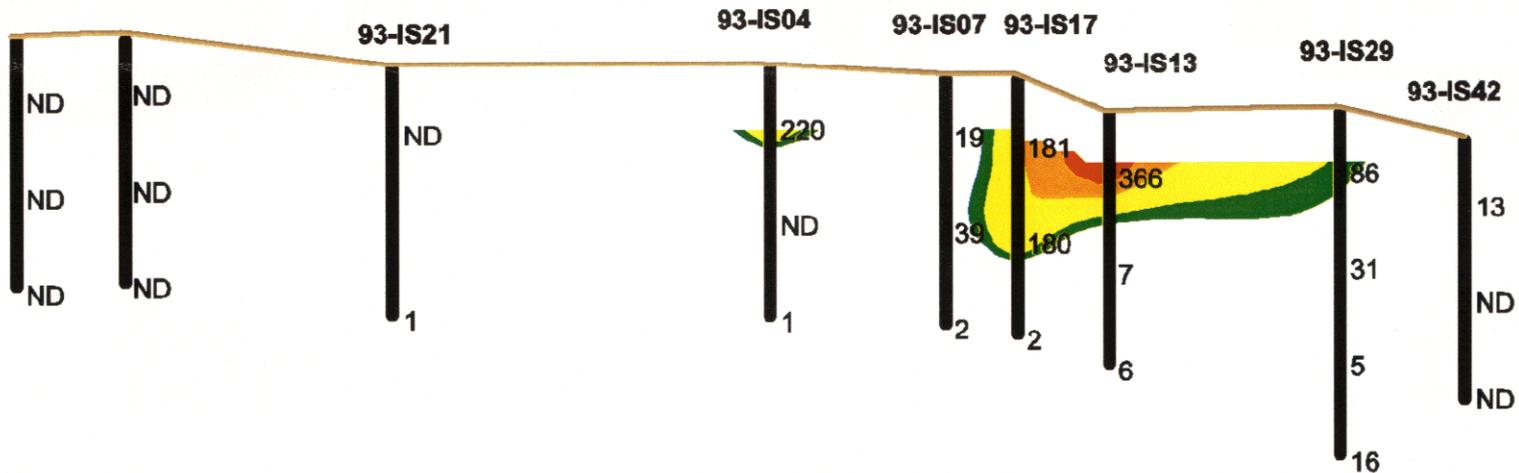
93-IS25 93-IS24

14b-TCE



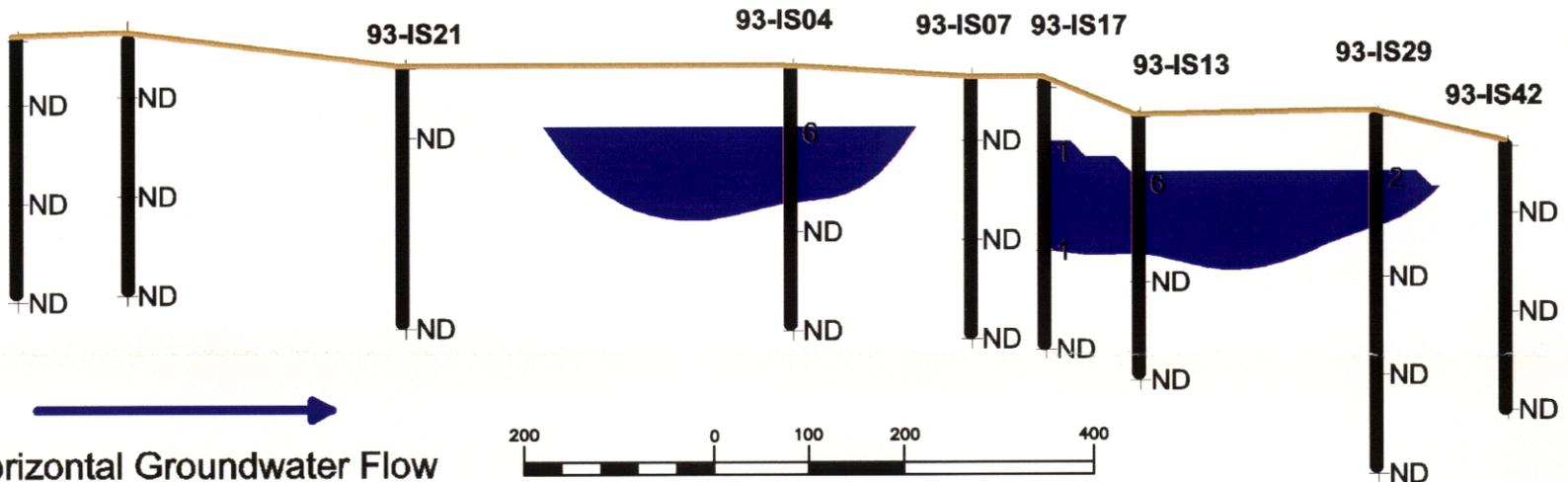
93-IS25 93-IS24

14c-cis-DCE

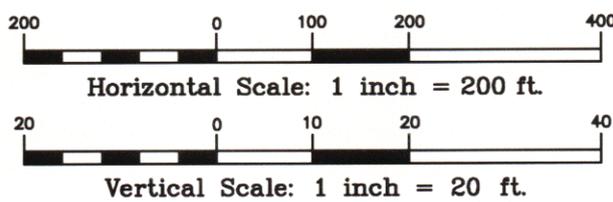


93-IS25 93-IS24

14d-VC



Horizontal Groundwater Flow



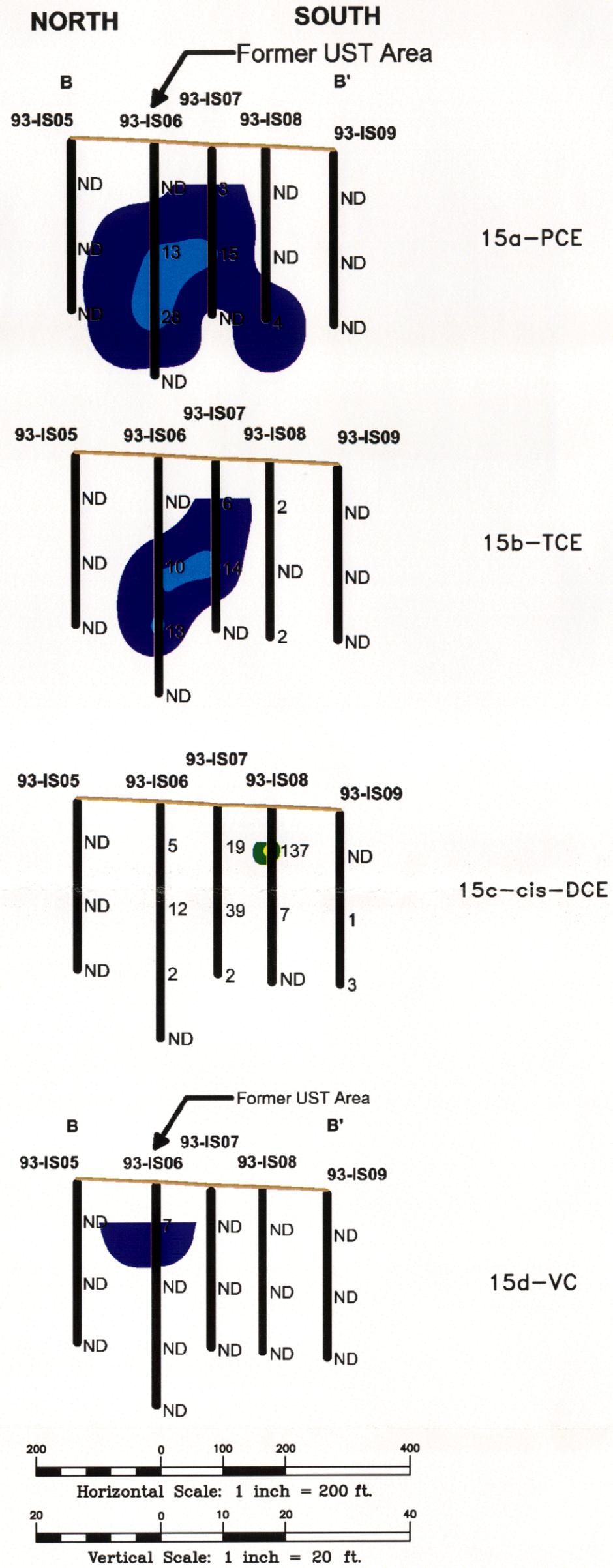
Baker Baker Environmental, Inc.

2219511Z

LEGEND

- 400 ug/L
- 300 ug/L
- 200 ug/L
- 100 ug/L
- 70 ug/L (cis-1,2-DCE) 50 ug/L (PCE & TCE)
- 10 ug/L
- 2.8 ug/L (TCE) 1 ug/L (PCE & VC)

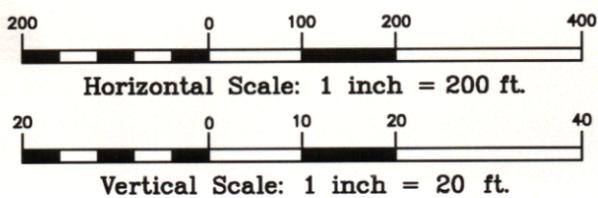
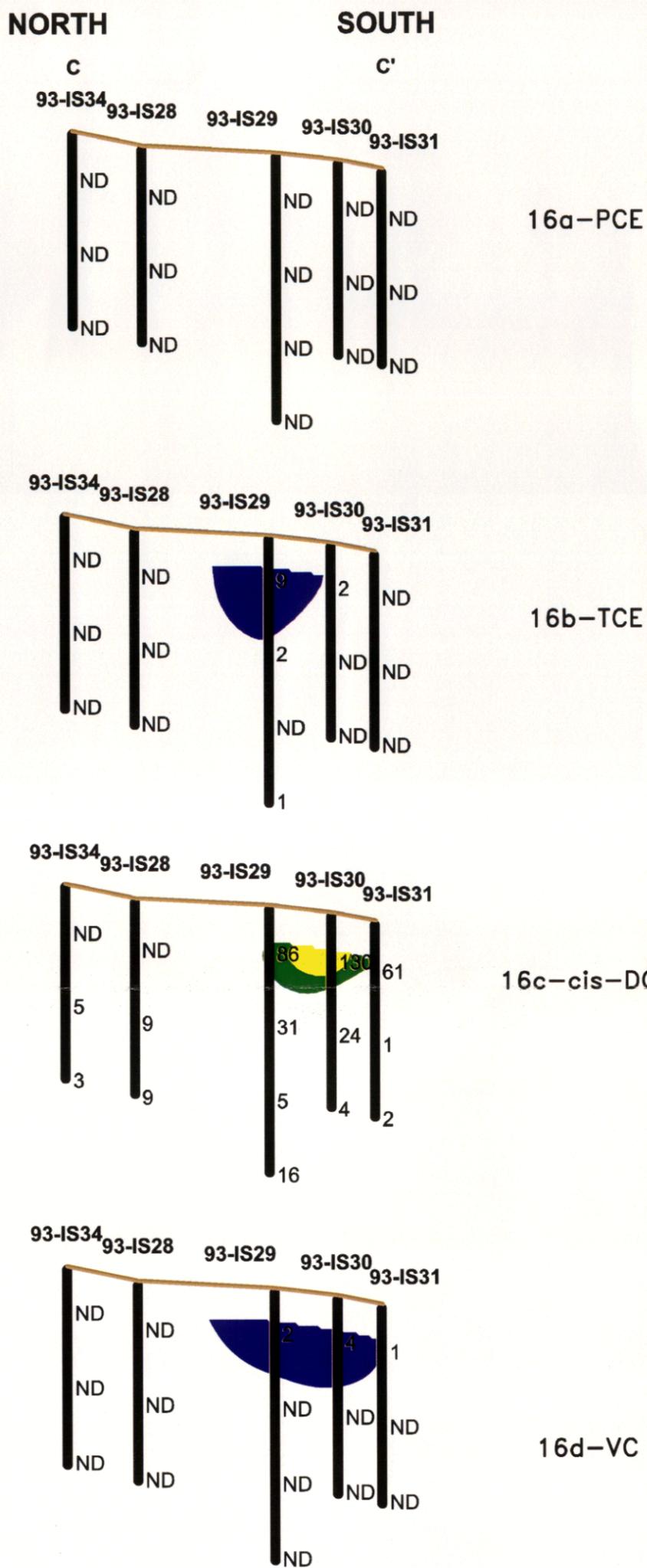
FIGURE 14  
 CROSS SECTION A-A'  
 OPERABLE UNIT NO. 16 - SITE 93  
 ADDITIONAL PLUME CHARACTERIZATION  
 CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



**LEGEND**

- 400 ug/L
- 300 ug/L
- 200 ug/L
- 100 ug/L
- 70 ug/L (cis-1,2-DCE) 50 ug/L (PCE & TCE)
- 10 ug/L
- 2.8 ug/L (TCE) 1 ug/L (PCE & VC)

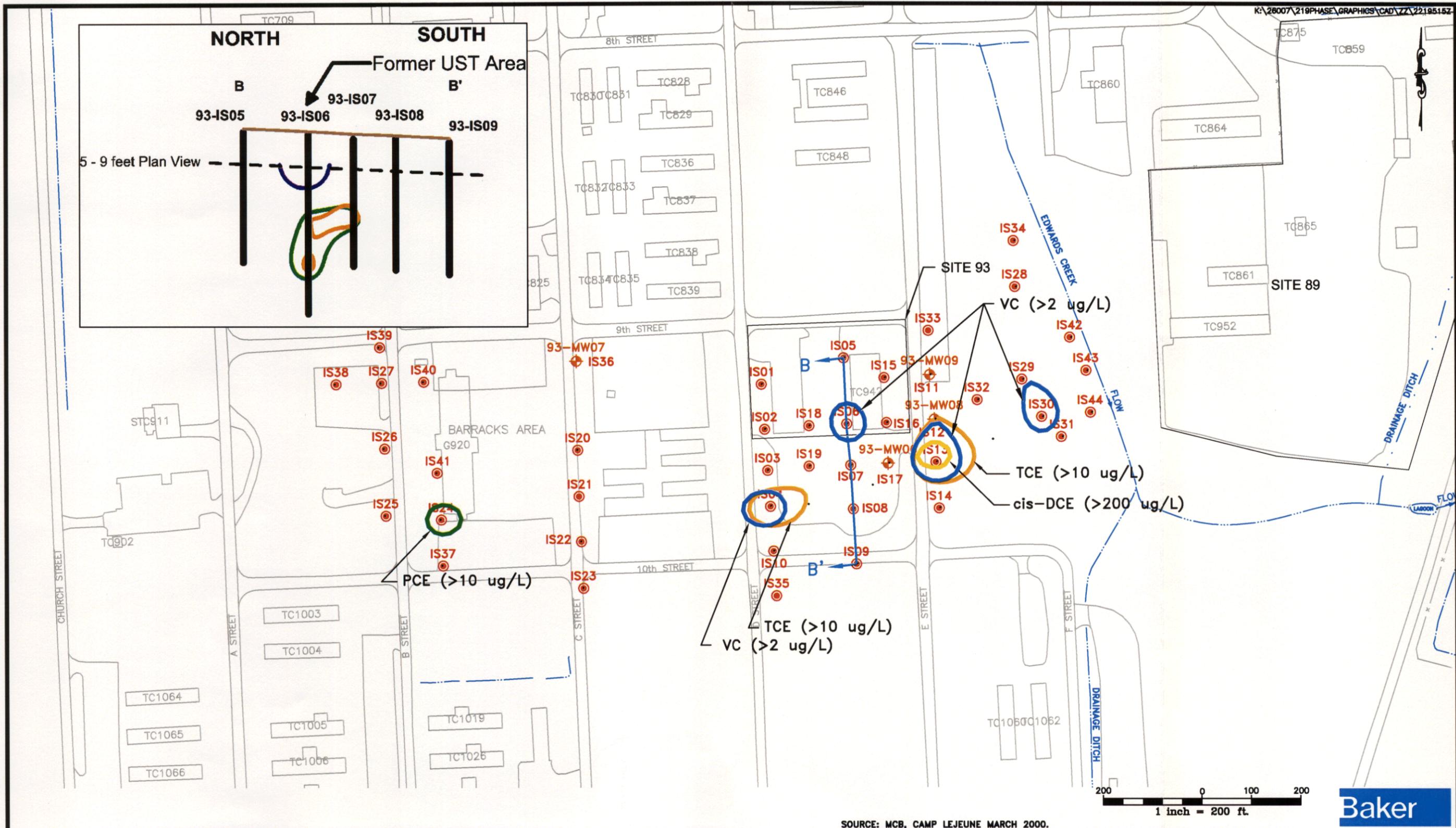
**FIGURE 15**  
**CROSS SECTION B-B'**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**



**LEGEND**

- 400 ug/L
- 300 ug/L
- 200 ug/L
- 100 ug/L
- 70 ug/L (cis-1,2-DCE) 50 ug/L (PCE & TCE)
- 10 ug/L
- 2.8 ug/L (TCE) 1 ug/L (PCE & VC)

**FIGURE 16**  
**CROSS SECTION C-C'**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**

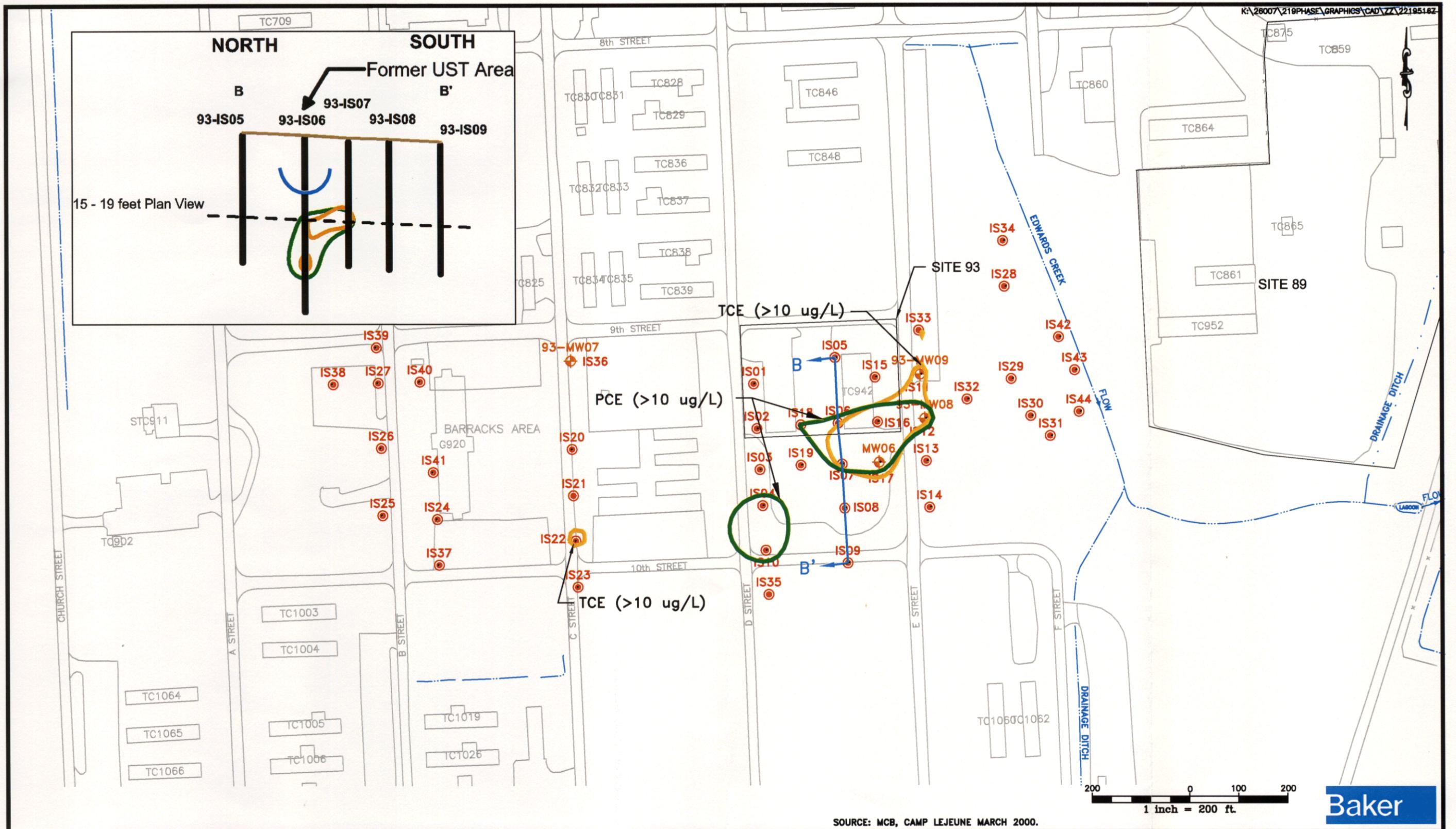


SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

**LEGEND**

- 93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
- IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 17**  
**HOT SPOT LOCATIONS 5 TO 9 FEET BGS**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**

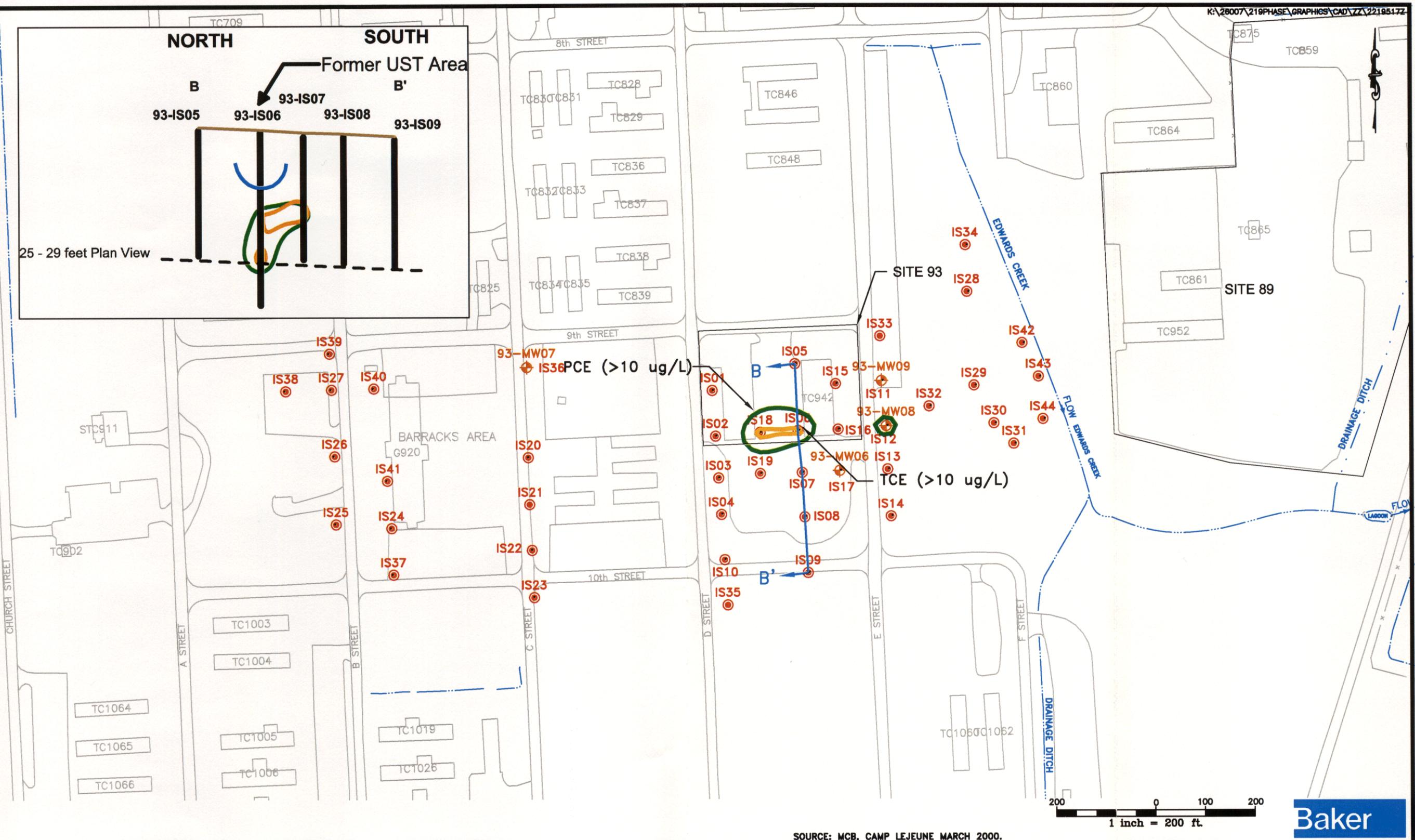
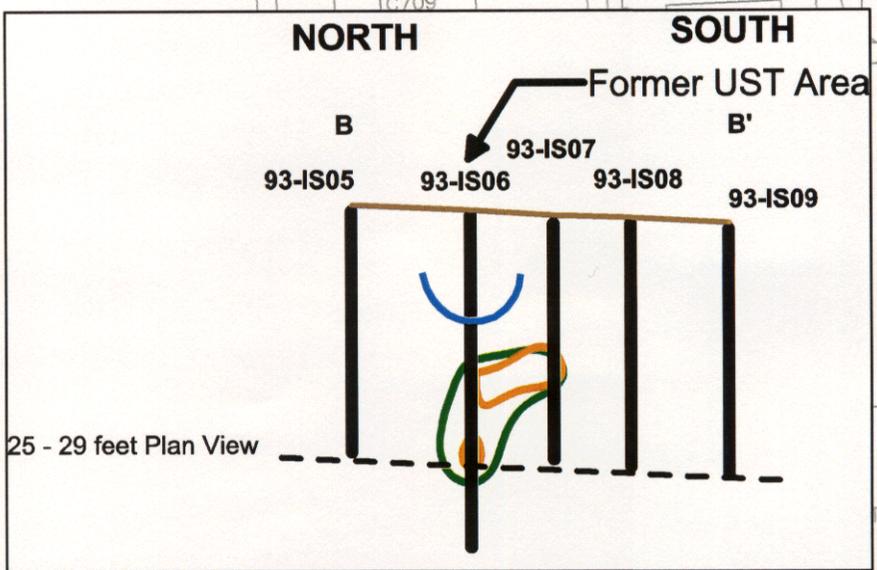


SOURCE: MCB, CAMP LEJEUNE MARCH 2000.

**LEGEND**

- 93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
- IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 18**  
**HOT SPOT LOCATIONS 15 TO 19 FEET BGS**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
**CTO - 0219**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**



SOURCE: MCB, CAMP LEJEUNE MARCH 2000.



**LEGEND**

- 93-MW07 - SHALLOW GROUNDWATER MONITORING WELL LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)
- IS01 - BORING LOCATION (2002 ADDITIONAL PLUME CHARACTERIZATION)

**FIGURE 19**  
**HOT SPOT LOCATIONS 25 TO 29 FEET BGS**  
**OPERABLE UNIT NO. 16 - SITE 93**  
**ADDITIONAL PLUME CHARACTERIZATION**  
 CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA