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TECHNICAL BULLETIN REGARDING FREE PHASE PRODUCT ASSESSMENT SITE 6 NCBC GULFPORT MS

12/3/1993

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TECHNICAL BULLETIN

FREE-PHASE PRODUCT ASSESSMENT
SITE 6 FORMER FIRE-FIGHTING TRAINING AREA
NCBC, GULFPORT, MISSISSIPPI

SUBJECT

Completion of Hydropunch II® Sampling to delineate free-phase product plume

SUMMARY

Approximately 3 feet of floating free-phase product was discovered in monitoring well GPT-6-1 on 31 October 1991. This discovery initiated the Free-Phase Product Assessment. The free-phase product in well GPT-6-1 is apparently a result of the former south fire-fighting training pit which is located approximately 30 feet east of monitoring well GPT-6-1.

Forty-one Hydropunch II® drive points were used to assess the horizontal and vertical extent of the free-phase product. During the field effort, a second plume was discovered. This plume is assumed to be the result of the former north fire-fighting training pit. The two plumes have coalesced and have migrated to the west of the former pits. The south free phase plume has a maximum observed thickness of 2.5 feet, and the north plume has a maximum observed thickness of 1.0 foot.

Two borings, M-18D and M-15D, were extended to collect groundwater samples from the basal part of the sand at the top of the clay layer between 25 and 29 feet below land surface (bls). Sample collections consisted of one free-phase product sample, two groundwater samples at the confining clay layer, and a soil sample at 8 feet bls and a soil sample at 15 feet bls. The two soil samples are being analyzed for grain size, total organic carbon, and cation exchange capacity. A groundwater sample was collected from M-18D between 21 and 25 feet bls and from K-15D between 25 and 29 feet bls.

The formation above the clay layer is a dark brown, fine to medium sand with little silt.

Rising head slug tests were performed on existing monitoring wells GPT-6-2 and GPT-6-3. Analyses of these tests indicate hydraulic conductivity values range between $1.1\text{-}1.3 \times 10^{-3}$ centimeters/second (cm/sec).

ATTACHMENTS

Attachment 1: Chronology of Events at Site 6
Attachment 2: Plume Map at Site 6
Attachment 3: Diagram of Hydropunch II®
Attachment 4: Slug test results
Attachment 5: Proposed Location of Pilot-Scale Pumping Test Well

The data and interpretation contained in this technical bulletin are derived from preliminary field data and are subject to revision as additional data become available.

DISCUSSION

The following discussion presents the methods and results of the field activities conducted from 14 November to 20 November 1993. These field activities included Hydropunch II® drilling, free-phase product measurement, sampling of groundwater for potential dense non-aqueous phase liquids (DNAPLs), soil sampling, and slug testing of monitoring wells. A chronology of the events at Site 6 is provided in Attachment 1.

Hydropunch II® Drilling/Plume Delineation

The primary objective of this field effort was to assess the horizontal and vertical extent of the free-phase product plume at Site 6, former fire-fighting training area. Observations of the free-product were made by installing sacrificial drive points and monitoring points intersecting the groundwater table. From these well screens, visual observations of the product were made by withdrawing the fluids with clear bailers. The results of these observations were recorded in the field book and on a gridded site map (Attachment 2).

Prior to installation of the Hydropunch II® monitoring points, the location was post-holed to 3.0 feet bls. Post holing was performed at all locations because of the presence of buried utilities on the site. The Hydropunch II® tool (Attachment 3, left side) was then attached to the B-50 drill rig via standard AW drill rods and pushed or hammered 2 to 3 feet below the groundwater table. When the tool was withdrawn, the drive point remained in the soil with the well screen attached. This configuration (hydrocarbon mode) of the Hydropunch II® allowed direct sampling and measurement of the floating product. When the points are no longer needed, they will be grouted in place.

The delineation of the free-phase product at the site started with installation of well points near monitoring well GPT-6-1; the well is contaminated with nearly 3 feet of floating free-phase product. The investigation proceeded to the west, south, and east until groundwater that was free of floating product was observed. The map of the site (Attachment 2) shows observations from the monitoring points and the locations of buildings and the former pits. As shown, points Q-16 and Q-14 delineate the south pit free-product to the east. Points O-11, L-11, and I-12 delineate to the south, and F-14, I-16, and J-17 delineate floating free-product to the west. The vertical extent of the floating free-phase product is defined by the points with floating product in them. The thickness of the southern plume's light non-aqueous phase liquid (LNAPL) ranges from 2.5 feet in L-14 to a trace in I-14, M-12, M-16, and O-16. The product in L-14 was described as a dark brown, oily, and viscous fluid with a strong diesel fuel odor.

The product in I-14, M-12, M-16, and O-16 was described as a light brown, oily, and viscous fluid with a hydrocarbon odor.

While delineating the northern edge of the floating free-product in the area of the south pit, a second plume was discovered. This second plume is apparently the result of the second fire-fighting training pit, which is to the north, merging with the floating free-product from the fire-fighting training pit on the south side of the site. This north plume was first discovered when point M-19 was installed. This well point had 1 foot of free-product floating in it. The product was described as a dark brown, oily, and viscous fluid with a strong odor of diesel fuel. M-19 is located in the north pit area, 30 feet south of Building 383. From M-19, delineation and characterization points were installed to the northwest and northeast. The horizontal extent of the floating free-product on the north side of the plume is delineated by points I-20, J-23, M-25, O-25, P-24, S-21, Q-19, and O-17. The vertical extent (thickness) of the floating free-product ranges from 1.0 foot in monitoring point M-19 to less than 0.02 foot in monitoring points J-21, L-23, Q-21, and O-19.

Monitoring well GPT-6-3 did not have any free-product, but flame ionization detector (FID) readings of the well were as high as 500 parts per million (ppm), and a strong diesel odor was present when opened. Monitoring well GPT-6-2 did not have free product, and well head readings with the FID indicated no detectable organic vapors above background.

Groundwater and Soil Sampling

Free-phase product samples were collected for free-phase effluent (fingerprint) analysis, Dioxin 8290 analyses, library search of volatiles, and non-hydrocarbon solvents. The samples were sent to CH2M Hill for these analyses.

Two deep borings were completed to the underlying clay layer. The Hydropunch I® tool was set in the groundwater sampling mode (Attachment 3, right side), which allows discrete sampling at a selected interval. The location of the borings were M-18D and K-15D. The soils encountered were a orange-brown, silty clay to 4 feet, overlying a fine to medium grained, brown sand with vary little of silt, a typical observation for this site. An underlying clay layer was encountered at depths of 25 to 29 feet bls. The boring at M-18 was completed to 21 feet bls, and the Hydropunch® was pushed to 25 feet bls. At that point, the tool was pulled back to allow groundwater to flow in. After 0.5 hour, the tool was removed with 1.2 L of groundwater. The boring at K-15 was completed to 25 feet bls, and the tool was pushed to 29 feet bls. The groundwater samples from M-18 and K-15 will be analyzed by CH2M Hill Laboratories for volatile organics using EPA Method 8260.

Two soil samples were collected from the deep boring M-18D. These samples were sent to GATS, Inc. in Oak Ridge, Tennessee, for grain size analysis (sieve and hydrometer), total organic carbon (TOC), and cation exchange capacity (CEC) analyses. The grain size results will be used to design the screen slot size and the filter pack of the recovery well that will be installed in December.

Results of the sieve and hydrometer tests on the two soil samples were similar. The results are as follows:

- 2% fine gravel,
- 2% coarse sand,
- 21% medium sand,
- 60% fine sand,
- 10% coarse silt, and
- 5% fine silt and clay.

The screening and sampling within deep borings at M-18D and K-15D indicate that groundwater contamination extends to the clay layer at both locations. The clay layer is situated at approximately 25 feet bls, and the results of the DNAPL samples may have implications on the extraction well system and on how the effluent will be handled and disposed.

Slug Testing

Rising head slug tests were performed on existing wells GPT-6-2 and GPT-6-3 (GPT-6-1 was not tested due to the presence of free-product). The results of these tests (Attachment 4) is a hydraulic conductivity on the order of 10^{-3} cm/sec. Attachment 4 contains two slug test sheets per well. The first sheet has data gathered for the durations of the test; the second sheet per well represents the portion of the slug test used to interpret the hydraulic conductivity. Conductivities of this magnitude are indicative of fine to medium sands with silts, as were observed in borings M-18D and K-15D and confirmed by grain size analyses.

The proposed location of a pilot-scale pumping test well is shown on Attachment 5 along with proposed shallow and deep monitoring/observation wells. Prior to the execution of the pump test, slug tests will be performed in selected wells.

Comparison of Hydropunch® Monitoring Points and Monitoring Wells

The results from Hydropunch® monitoring points are comparable to permanent monitoring wells as shown in experimentation between point L-14 and monitoring well GPT-6-1. Observations between the point and the monitoring well resulted in 2.5 feet thickness of free-phase product in both. Bail-

down tests in L-14 and GPT-6-1 resulted in a recovery of product that was similar both with respect to time and thickness. These results lend confidence to the delineation of the product thickness at the two locations. A final round of measurements will be made in the monitoring points prior to abandonment in December.

IMPLICATIONS OF RESULTS

The most important implication of this field effort is the discovery of a north plume resulting from the north fire-fighting training pit. The north plume extends below Building 383. Also, the water surface at several locations in the nearby ditches had a sheen that appeared to be coming from the sides of the ditch. The sheen may be the result of dissolved-phase and free-phase product migrating to the ditches in the groundwater. However, organic-related sheens are commonly a result of algal growth in this area.

The two deep borings indicate that groundwater contamination apparently extends down to the underlying clay layer, as FID readings of drilling cuttings were as high as 1,000 ppm above background.

The soils encountered were fine to medium sand with varying amounts of silt. Rising head slug tests resulted in hydraulic conductivities in the 10^{-3} cm/sec range, typical for fine to medium sand.

Finally, the Hydropunch® push-probe technology proved to be effective at this site for a number of reasons. The shallow groundwater table, the ease of pushing the tool into unconsolidated sediments, and the real-time results from Hydropunch® points compared to installing monitoring wells saved time and money and resulted in a lower volume of investigation derived waste. The results from the Hydropunch® points are comparable to permanent monitoring wells as shown in experimentation between point L-14 and monitoring well GPT-6-1. Observations from the point and the monitoring well both resulted in 2.5 feet of production. Bail down tests in L-14 and GPT-6-1 resulted in recovery of product that was similar with respect to time and thickness.

ATTACHMENT 1

Chronology of Events at Site 6

14 November 1993, Sunday

- Arrive at NCBC Gulfport, Mississippi.
- Superimpose grid on Site 6.

15 November 1993, Monday

- Installed three well points: J-14, K-14, and I-14.
- Heavy rain stops drilling.

16 November 1993, Tuesday

- Installed 17 well points: K-15, L-13, I-12, M-12, M-14, Q-14, O-16, O-13, M-16, 0-11, I-15, I-18, J-19, M-18, 0-17, Q-16, and L-14.
- Made observations and measured floating product thicknesses in 20-inch completed points.

17 November 1993, Wednesday

- Installed 14 well points: M-19, L-21, J-21, I-20, L-23, I-23, M-25, K-25, M-26, L-11, F-14, O-19, Q-19, and J-23.
- Made observations and measured floating product thicknesses in 34-inch completed points.

18 November 1993, Thursday

- Installed four well points: Q-21, O-21, P-24, and O-25.
- Made observations and measured floating product thicknesses in 38-inch completed points.
- Drilled deep borings M-18D and K-15D to collect soil samples and DNAPL groundwater samples for organic analysis.
- Collected free-phase product from M-19.

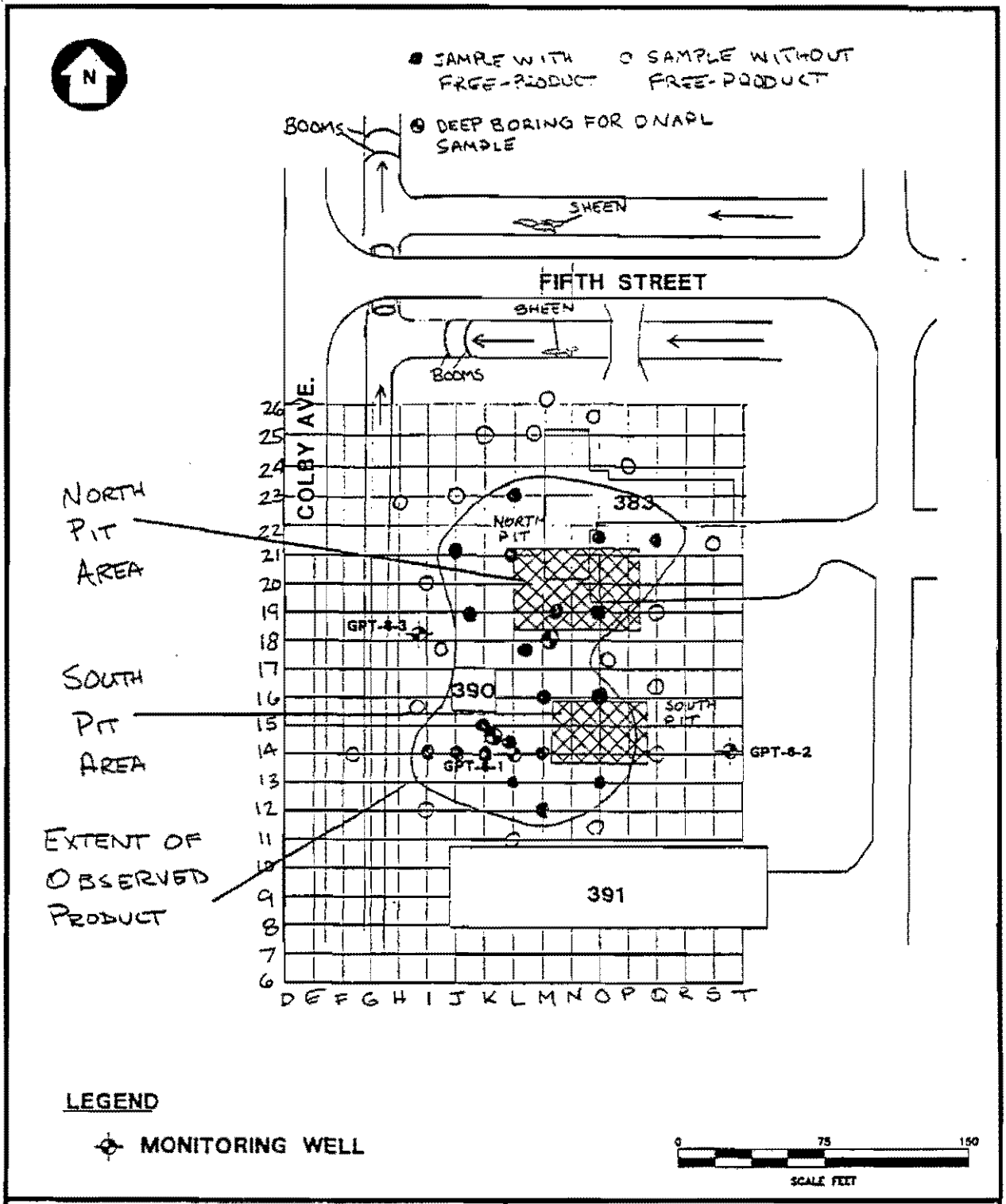
19 November 1993, Friday

- Observe water levels in all points designated as delineation points.
- Perform aquifer slug tests on monitoring well GPT-6-2.

20 November 1993, Saturday

- Perform aquifer slug tests on GPT-6-3.
- Ship equipment back to ABB Navy Department, Tallahassee, Florida.

ATTACHMENT 2: PLUME MAP

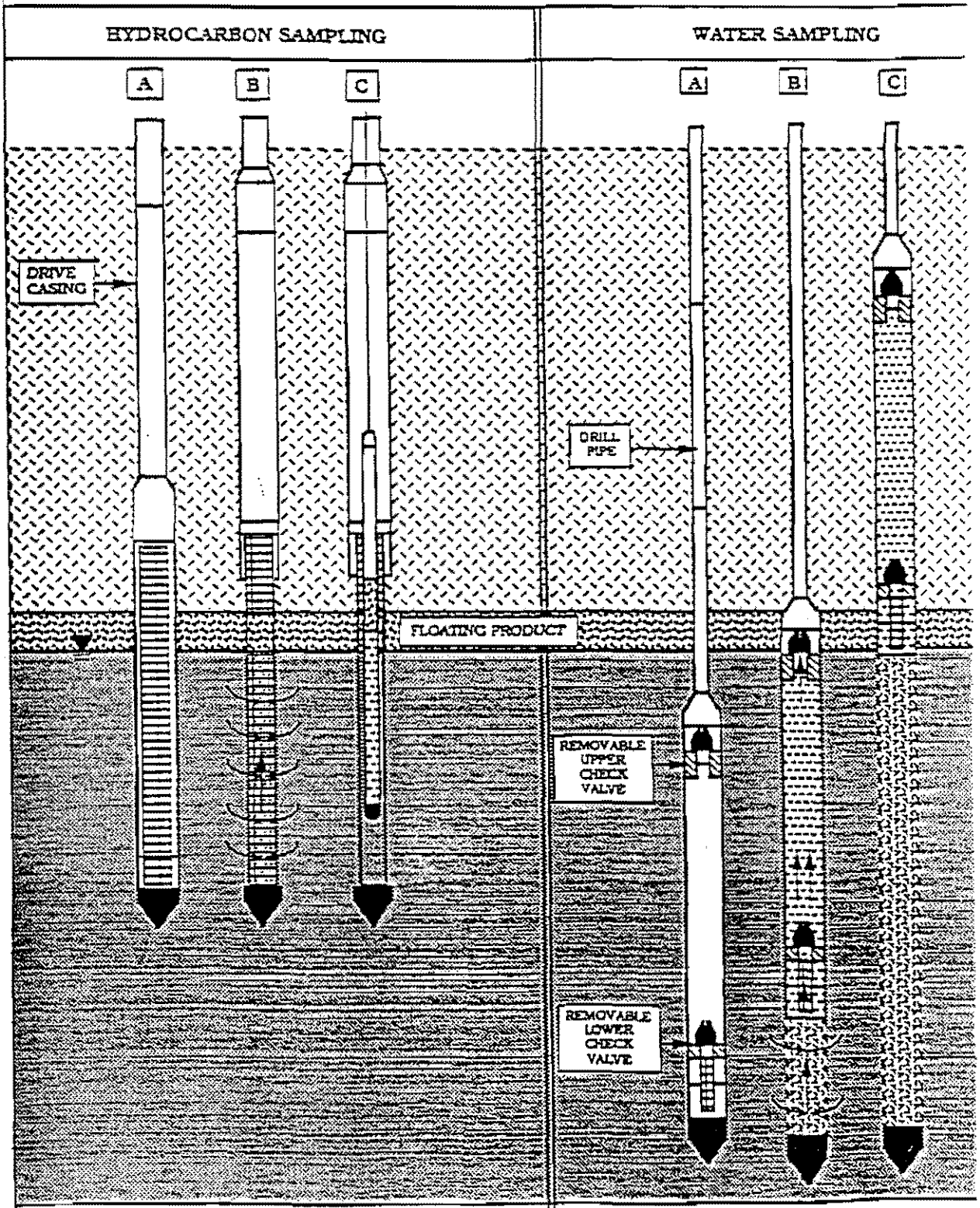


F-PPA/IAD WORK PLAN

NCBC GULFPORT
GULFPORT, MISSISSIPPI

ATTACHMENT 3: DIAGRAM OF HYDROPUNCH II®

HYDROPUNCH II



LEGEND: HYDROCARBON SAMPLING

A. HydroPunch II closed while being driven into position.

B. Tool opened and 5 foot screen telescopes into position for collection of hydrocarbon or water sample at the very top of the aquifer.

C. Hydrocarbon sample being collected using bailer lowered through drive casing.

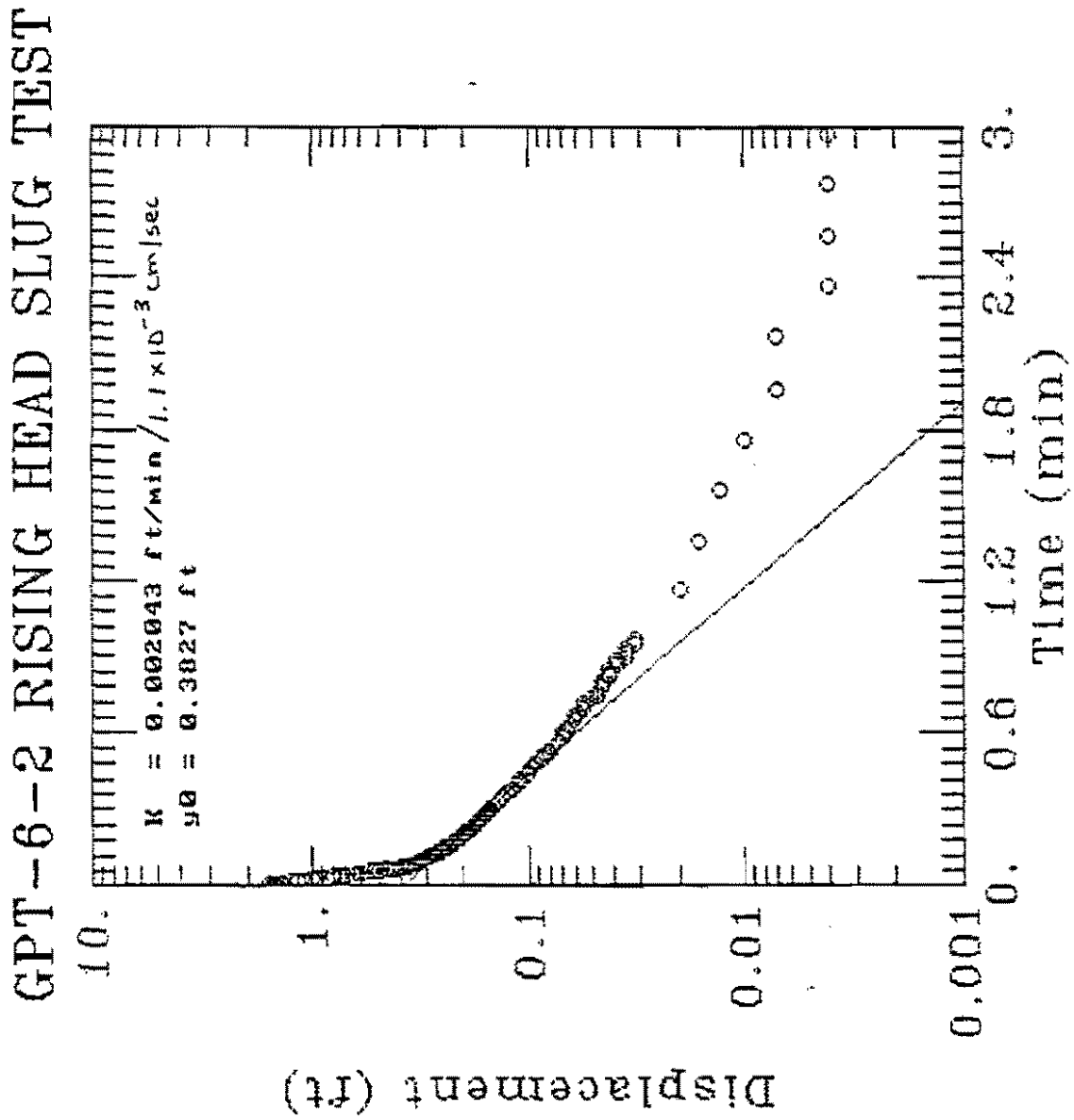
LEGEND: WATER SAMPLING

A. HydroPunch II closed while being driven into position.

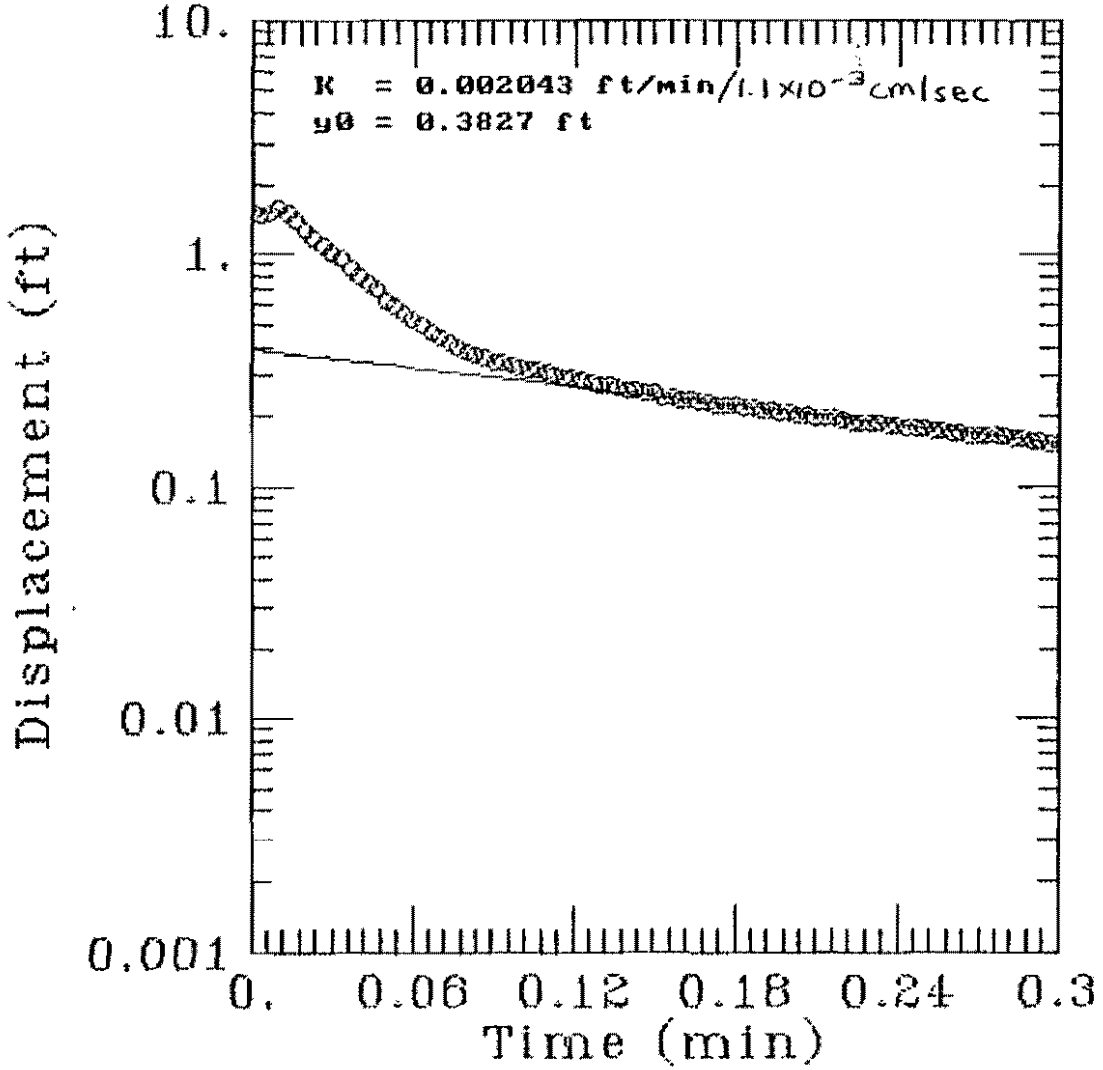
B. Cone separated and tool open to collect sample.

C. Check valves closed as sample is retrieved within body

Attachment 4A: Slug Test Results

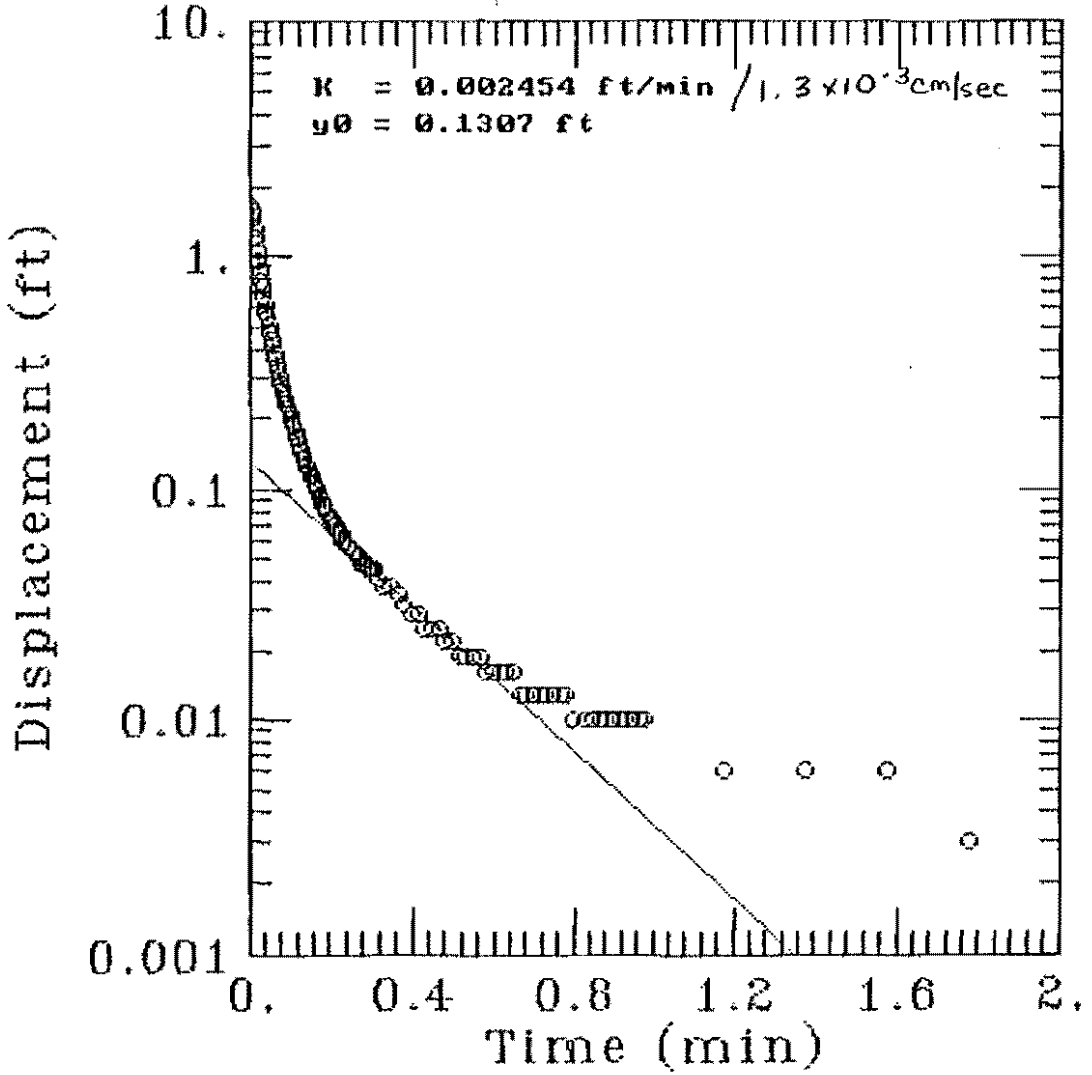


GPT-6-2 RISING HEAD SLUG TEST



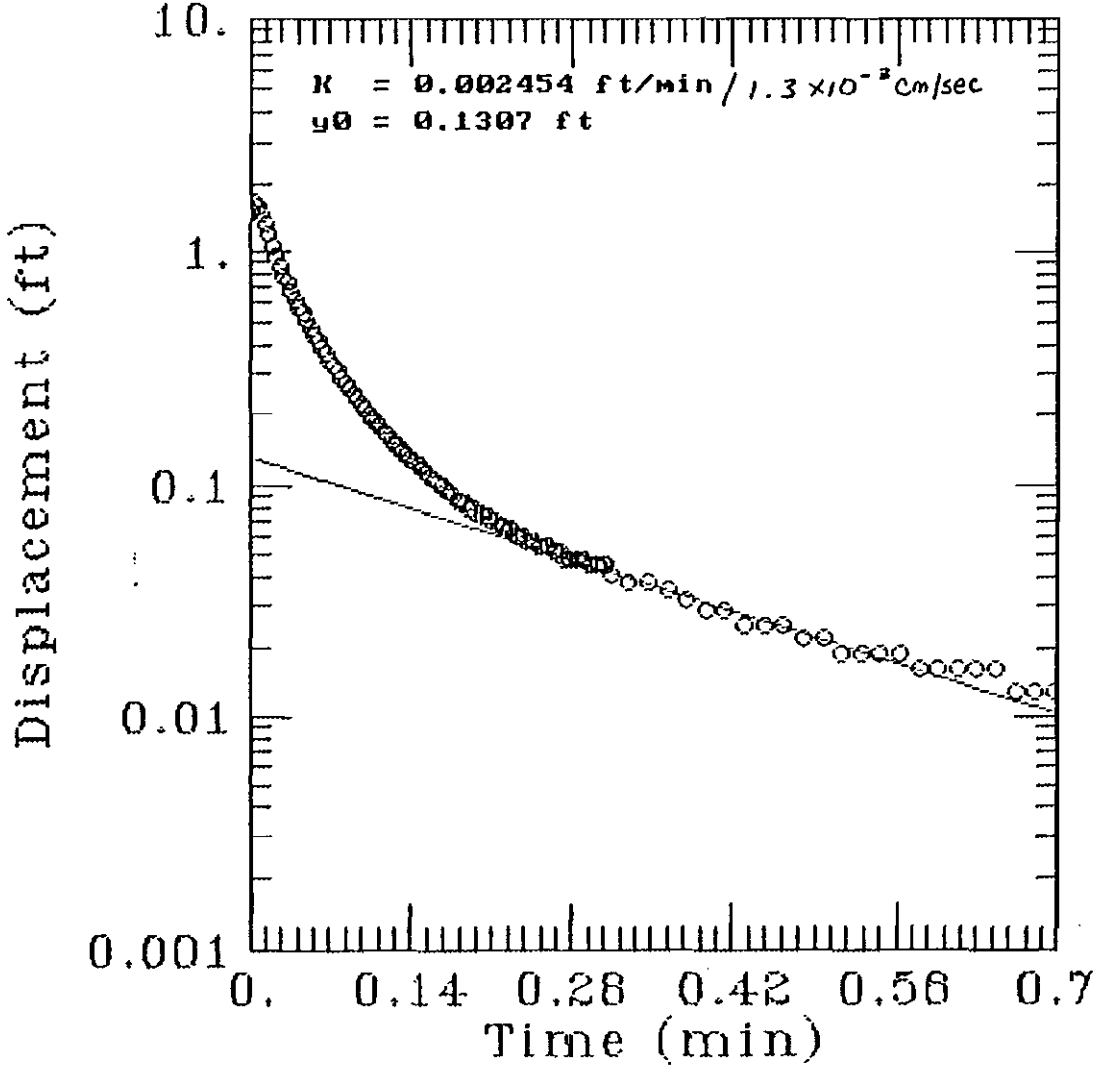
Attachment 4B: Slug Test Results

GPT-6-3 RISING HEAD SLUG TEST



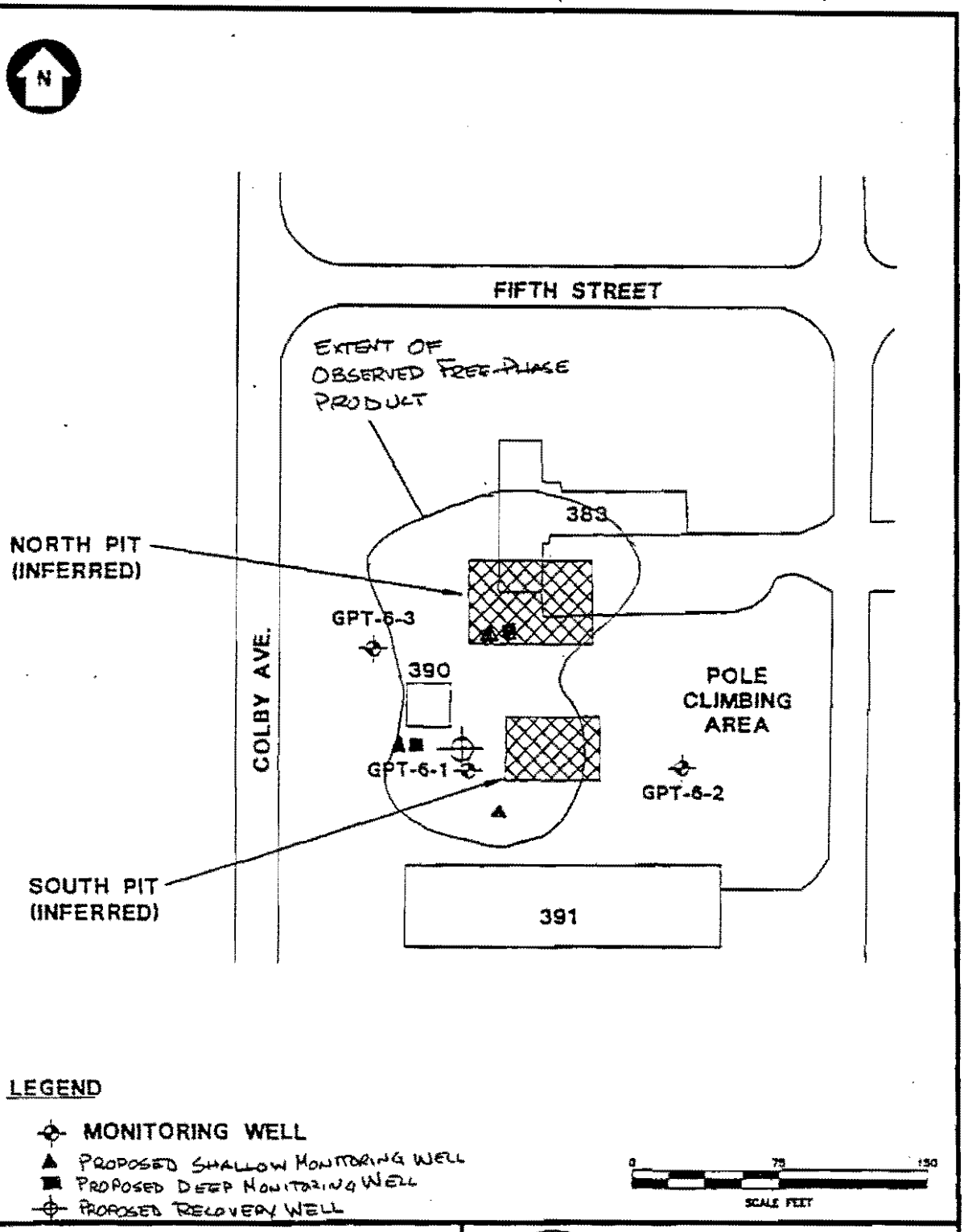
Attachment 4c: Slug Test Results

GPT-6-3 RISING HEAD SLUG TEST



ATTACHMENT 4D: Slug Test Results

ATTACHMENT 5: PROPOSED MONITORING WELL AN RECOVERY WELL LOCATION:



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