TECHNICAL MEMORANDUM

To: Mark Taylor/David Porter, SOUTHDIV
Brian Donaldson/Kay Wischkaemper, EPA Region IV
Jim Morrison, TDEC
Tonya Barker/Rob Williamson, NSA Mid-South
Jack Carmichael, USGS

From: John Stedman, EnSafe Inc.

Date: April 12, 1999

Re: NSA Mid-South AOC A — Aquifer Characterization Tests

INTRODUCTION

This technical memorandum describes a phased approach for conducting aquifer characterization tests for Naval Support Activity (NSA) Mid-South Northside fluvial groundwater (AOC A). Information from these tests will be used to:

- Further refine aquifer parameters
- Provide empirical data for evaluating remedial options and, if required, the design of remedial systems
- Provide data for groundwater modeling

APPROACH

Aquifer characteristic testing will be performed following procedures outlined in the *Comprehensive RFI Work Plan, NAS Memphis — Millington, Tennessee, Revision 0*, October 6, 1994. The general approach will be phased as follows:

Phase I — Specific-Capacity Test

Specific-capacity testing will be used to determine the maximum pumping rate of well 007G37LF which will be used as the pumping well during a constant-rate aquifer test. Monitoring well 007G37LF is a 4-inch diameter well that is screened throughout the entire thickness of the fluvial deposits. An electric submersible pump will be used to maintain a consistent flow rate which will be measured using inline flow meters. During the test, water-level measurements will be

measured and recorded from monitoring wells 007G36LF, 007G38LF, 007G41LF, and 007G42LF using a remote data logger/transducer. Likewise, a hand-held electronic water level indicator will be used to measure water levels in monitoring wells 007G39LF and 007G46LF. A site map showing the location of these wells is attached.

Initially, extracted groundwater will be pumped into a portable 2,000-gallon capacity storage tank that will be near the pumping well (007G37LF). Historical sample results from this well will be used to obtain approval by the City of Millington publicly owned treatment works (POTW) to discharge this water to the base's sanitary-sewer system. These results and an estimated volume of water that will be extracted during subsequent phases of aquifer characterization testing (based on the specific capacity test results) will be used to pre-arrange the discharge of water that will be collected during these later phases (step-drawdown and constant-rate aquifer tests).

A 5-horsepower gasoline engine-driven centrifugal pump and flexible hoses/PVC piping will be used to transfer collected groundwater from the portable storage tank into a tanker truck which will be staged at the nearest accessible road which is approximately 1,500 feet northwest of the pumping well. Assuming that an agreement can be pre-arranged with the POTW, once the tanker truck is full it will transport the collected groundwater to the nearest sanitary-sewer manway approved by base personnel for discharge of this water. This water disposal procedure will be repeated until all water collected during aquifer characterization tests has been discharged. The actual volume of water discharged will be documented in the field notebook.

Phase II — Observation Wells Installation

A minimum of three new observation wells will be required in the area of the proposed pumping well (007G37LF). One well will be installed to the base of the fluvial deposits and screened throughout the thickness of the fluvial aquifer. Measurements taken from this well during the constant-rate aquifer test will be used to measure drawdown in the fluvial aquifer proximal to the pumping well (this will eliminate pumping well inefficiency in determining true aquifer drawdown). To measure the influence of pumping groundwater from the fluvial deposits on the upper and lower confining units (loess and Cockfield Formation), one new well will also be

installed into each confining unit in the area of the pumping well.

Based on the results of the specific-capacity test, up to two additional fluvial deposits wells may be necessary to measure drawdown between the pumping well and the nearest existing well (007G36LF), if it is too far away. However, existing wells will be used if possible.

Phase III — Ambient Monitoring

After the new wells have been installed and developed, ambient monitoring will be conducted to determine antecedent conditions (rising and falling water level trends) in the aquifer. This data is required to detrend resulting aquifer-tests data, if necessary. The behavior of the aquifer under ambient conditions will be monitored for a least three days before the constant-rate aquifer test. A Hermit 2000 data logger will be programmed to record water-level measurements on equal time intervals from the three new observations wells near the proposed pumping well (007G37LF). In addition to these wells, three monitoring wells (one screened in the loess — U-102LS, one screened in the fluvial deposits — U-102LF, and one screened in the Cockfield Formation — U-102C) near Building N-1694, currently equipped with data loggers to record water-level measurements, will also be used for ambient monitoring. Furthermore, monitoring wells V-81(Runway9) and 0BGG01LF, which will be used as a background well during the constant-rate aquifer test, will be equipped with a remote data logger/transducer such as a Troll to measure antecedent conditions.

Phase IV — Step-Drawdown Testing

Step drawdown testing will be conducted on the pumping well to determine specific capacity and efficiency of the well and the maximum optimum pumping rate for the constant rate aquifer test. This test will involve pumping at increasingly greater discharge rates (steps) while monitoring drawdown in the pumping well. Each pumping "step" will be conducted for a minimum of one hour duration. By comparing each discharge rate with corresponding drawdown, the optimum pumping rate for the tested well can be estimated.

All equipment used in the step-drawdown test will be used during the constant rate aquifer test.

Therefore, this test will be used as a "trial run" for the constant-rate test. An electric submersible pump will be used in the proposed pumping well (007G37LF) to extract the groundwater. Two inline flow meters connected to the discharge line will be used to measure the pumping rate. If necessary, a valve will be used to regulate the pumping rate. Water collection, transfer, and disposal procedures will be the same as discussed in Phase I. During the test, water-level measurements will be collected as follows:

- A Hermit 2000 data logger with attached transducers will be used to measure water levels in the three new observation wells in the area of the proposed pumping well (one screened in the loess, one screened in the fluvial deposits, and one screened in the Cockfield Formation), as well as the pumping well (007G37LF). These will be monitored on a logarithmic scale, with a maximum ending monitoring interval of one minute.

- Remote data loggers/transducers will be used to measure and record water levels in the monitoring wells 007G36LF, 007G38LF, 007G41LF, 007G42LF, V-81(Runway9), background well (0BGG01LF), and any additional observation wells installed as determined by the results of the specific-capacity test. These will also be monitored on a logarithmic time scale, with an ending interval of one minute.

- Hand-held electronic water-level indicators will be used to measure water levels in monitoring wells 007G39LF and 007G46LF.

- Water level measurements recorded by existing data loggers at wells U-102LS, U-102LF, and U-102C, will also be collected during this phase.

Phase V — Constant-Rate Aquifer Test

A constant-rate aquifer test will be performed by pumping at the maximum constant rate determined from analyzing the step-drawdown data. Well 007G37LF will be pumped at a constant rate for a minimum of 24 hours. After this time, a determination based on the trend of drawdown will be made by the site hydrogeologist whether to cease pumping or continue. The pumping

period will be long enough to ensure that the aquifer has been sufficiently stressed and drawdown has stabilized in the pumping and observation wells. During the test, water-level measurements will be collected as outlined in Phase IV. Water collection, transfer, and disposal procedures will be the same as discussed in Phase I.

Phase VI — Recovery Monitoring

Water-level measurements will continue to be collected after pumping has stopped. Monitoring will continue until water levels rise back to static conditions or for a maximum of 24 hours after pump shutdown. This data will be used to confirm the results of the constant-rate test.

Data Evaluation

Data from the pumping and recovery phases of the test will be reviewed and reduced as appropriate, given ambient conditions observed during the test phases. Reduced data will be modeled using appropriate analytical techniques with the computer program Aquifer Test Solver (AQTESOLV) published by Geraghty and Miller Modeling Group (1989). Final analyzed results will include data tables, individual well analyses including model graphs, and distance-drawdown analysis. A report presenting the methodology and results of each testing phase as described above will be prepared and submitted to the BCT.

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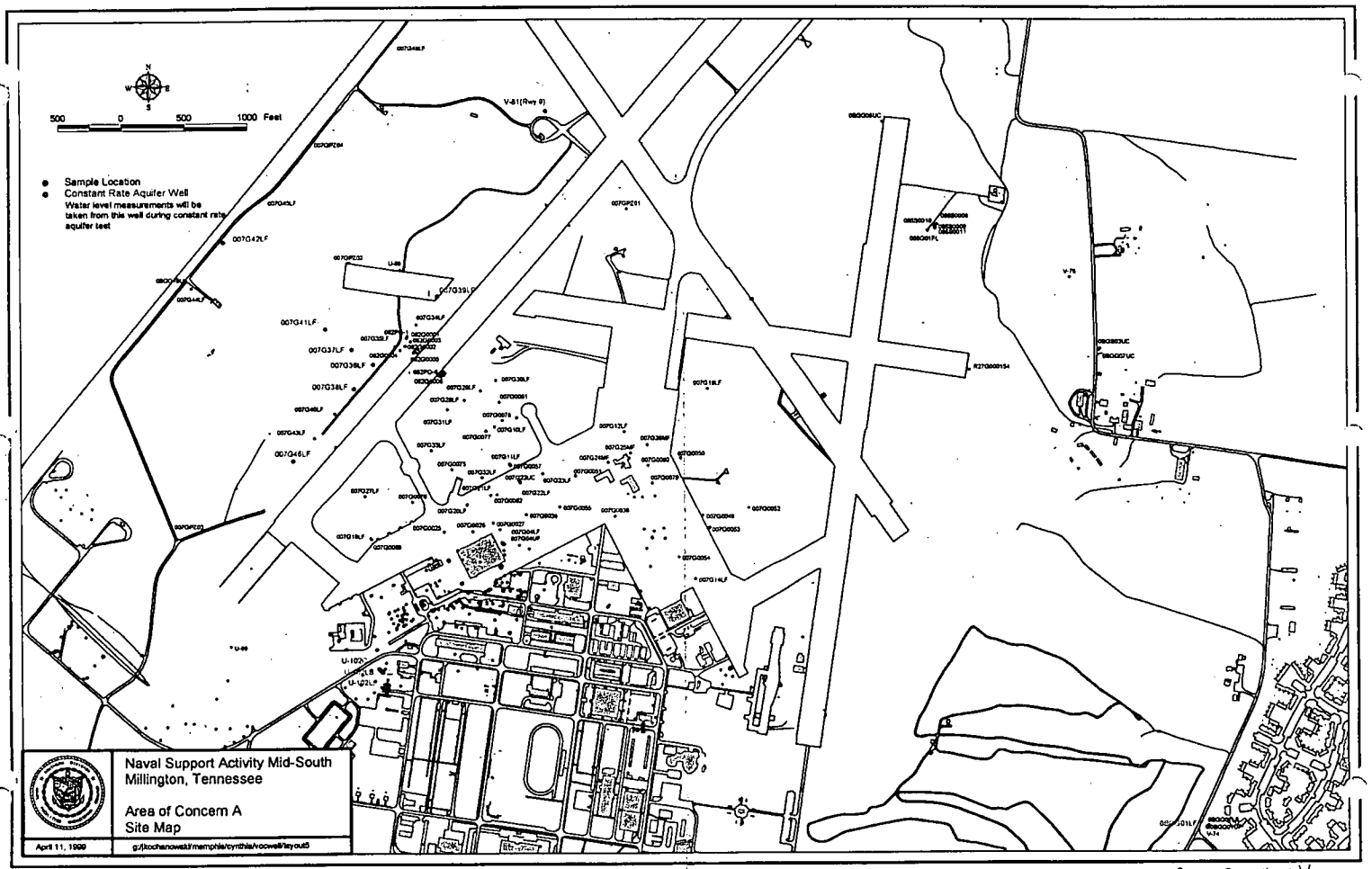
Attachment 1

Site Map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W
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S
500 0 500 1000 Feet
Sample Location
Constant Rate Aquifer Well
Water level measurements will be taken from this well during constant rate aquifer test
Naval Support Activity Mid-South
Millington, Tennessee
Area of Concern A
Site Map
April 11, 1999
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