N00129.AR.000832
NSB NEW LONDON
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Draft
Year 2
Annual Groundwater Monitoring Report
for
Defense Reutilization and Marketing Office (DRMO)

Naval Submarine Base - New London
Groton, Connecticut

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0267

October 2000

TETRA TECH NUS, INC.

100016/P

DRAFT
YEAR 2
ANNUAL GROUNDWATER MONITORING REPORT
FOR
DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO)

NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch Code 18
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113-2090

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CONTRACT NUMBER N62472-90-D-1298
CONTRACT TASK ORDER 0267

OCTOBER 2000

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1.0 INTRODUCTION

This second annual groundwater monitoring report for the Defense Reutilization and Marketing Office (DRMO) at the Naval Submarine Base New London (NSB-NLON) in Groton, Connecticut, was prepared for the U.S. Department of the Navy (Navy) by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN), Contract Number N62472-90-D-1298, Contract Task Order (CTO) 0267. All field activities were performed in accordance with the approved work plan for the DRMO (B&R Environmental, 1998).

[Note: Brown & Root Environmental, Inc. (B&R Environmental), formerly Halliburton NUS, Inc. (HNUS), was purchased on January 1, 1998, and became Tetra Tech NUS, Inc. (TtNUS)].

1.1 PURPOSE

The purpose of this groundwater monitoring report is to present the results of the second year of analytical data collected from monitoring wells located in the vicinity of the DRMO. The sampling was performed from July 1999 through April 2000. Trend evaluation of the first and second years of monitoring data are also included in this report.

Due to elevated levels of lead, Polychlorinated Biphenyls (PCBs), and Polycyclic Aromatic Hydrocarbons (PAHs) in the soil at the DRMO, a time-critical removal action was performed by OHM Remediation Services Corporation during the course of the Phase II Remedial Investigation (B&R Environmental, March 1997). After removal of contaminated soil from the northern half of the site, an asphalt/GCL cap was installed to reduce precipitation infiltration and leaching of contaminants to the groundwater. This groundwater monitoring is part of the post-closure associated with the DRMO cap.

The groundwater monitoring is designed to determine the effectiveness of the existing cap at the DRMO in preventing further migration of constituents to the groundwater and ultimately to the Thames River; the effectiveness of the remediation taken to eliminate health risks; whether the criteria used for evaluating the data have been met; and whether the groundwater plume interferes with any existing use of the groundwater. The ultimate goal of the monitoring program is to attain surface water protection requirements for those contaminants migrating from the site.

1.2 SCOPE AND OBJECTIVES

The objective of the groundwater monitoring is to provide long-term monitoring to evaluate the effectiveness of the cap and to confirm that contamination is not migrating through the soil, into the groundwater, and ultimately discharging to the Thames River.

To meet this objective, groundwater monitoring was conducted at ten monitoring wells. Seven existing Phase I and Phase II monitoring wells were installed during remedial investigations and three newly installed monitoring wells were installed under the monitoring program. Chemical analyses was determined based on an evaluation of site history and previous analytical results.

Five existing monitoring wells (i.e., 6MW1S, 6MW2S, 6MW2D, 6MW3S, and 6MW3D) installed as part of the Phase I and Phase II investigations, and two newly installed monitoring wells (6MW10S and 6MW10D) were used to monitor the groundwater prior to discharge into the Thames River. Two existing wells (6MW6S and 6MW6D) and one newly installed monitoring well (6MW9S), immediately upgradient of the site, were used to establish the quality of groundwater flowing through the capped area of the DRMO site. These wells were screened to monitor shallow and deep groundwater in the overburden. The up-gradient wells were used to establish groundwater concentrations upgradient of the DRMO cap. The downgradient wells were used to monitor groundwater leaving the site. This groundwater monitoring was conducted to verify that significant contamination is not leaching to the groundwater from the capped area at concentrations above regulatory criteria and impacting the Thames River.

1.3 REPORT ORGANIZATION

This report consists of five sections. Section 1.0 provides a brief introduction and describes the scope, objectives, and purpose of the report. Section 2.0 provides a site description of NSB-NLON including site characteristics. Additionally a discussion of previous investigation is included in Section 2.0. Section 3.0 provides the methodologies for performing the groundwater sampling. Section 4.0 presents the findings of the groundwater monitoring as well as a statistical analyses of the data. Finally Section 5.0 provides conclusion and recommendations for the year two review.

2.0 BACKGROUND INFORMATION

The following sections describe the area of investigation identified as the DRMO at the NSB-NLON.

2.1 SITE DESCRIPTION

The DRMO is located adjacent to the Thames River in the northwestern section of NSB-NLON. In the past, the southern half of the DRMO was covered with asphalt, most of which was deteriorated, while the northern portion was unpaved and had a gravel surface. The site was remediated in 1995 and an asphalt/GCL cap was constructed over a majority of the central and northern portions of the site (OHM, September 1995). Bituminous concrete pavement was then placed over the entire area of the composite cap. Currently, the DRMO is used as a storage and collection facility for items to be sold at auctions and sales held periodically throughout the year. Figure 2-1 displays the location of NSB-NLON. Figure 2-2 shows the site location within NSB-NLON, and Figure 2-3 shows the general site plan.

The DRMO was used as a major base landfill and burning ground from 1950 to 1969. The materials burned and landfilled included construction materials, combustible scrap, and other non-salvageable waste items. These materials were burned on the Thames River shoreline adjacent to the current location of the DRMO. The residue was pushed to the shoreline and partially covered.

2.2 SITE CHARACTERISTICS

2.2.1 Topography and Surface Features

The DRMO topography is illustrated in Figure 2-3. An exposed, bedrock highpoint, located to the east of the DRMO, slopes steeply to the west towards the site. The ground surface within the DRMO site boundaries gently slopes westward from an elevation of 8 feet mean sea level (msl) along the eastern boundary of the site to 4 feet msl at the Thames River. The land is relatively flat, low lying and prone to flooding by the Thames River.

A cap was installed during a Time-Critical Removal Action (see Section 2.3.4) and this area, as well as the remaining portion of the DRMO, was upgraded via placement of an asphalt layer. Buildings 479, 355 and 491 are located within the paved area.

2.2.2 Surface Water Features

All surface runoff from the site flows to the Thames River which is located along the western edge of the DRMO. Two storm sewer systems located along the southern boundary of the site transfer runoff from the eastern side of the Providence and Worcester Railroad to the Thames River (Atlantic, August 1992).

2.2.3 Soil Characteristics

The SCS Soils Map (SCS, 1983) classifies the soil at the DRMO as Udorthents-Urban land complex. This classification is defined as being excessively drained to moderately drained soil that has been disturbed by cutting and filling.

To the north of the site, the soil is classified as the Hinkley Loam. This soil is found on stream terraces and outwash plains and consists of a dark, gravely sand loam. Native materials at the DRMO were most likely of this type.

Northwest and upslope of the site, along the exposed bedrock highpoint, the soil is classified as Hollis-Charlton-Rock complex. This classification is defined as being stones and boulders intermingled with a dark, fine, sandy loam. Bedrock outcrops are prevalent.

2.2.4 Geology

Geologic conditions at the DRMO consist of a westward-thickening wedge of overburden materials (fill and natural deposits) overlying fractured metamorphic bedrock. The DRMO is underlain by an upper layer of 2 to 20 feet of fill material. The fill consists primarily of sand and gravel but also contains metal and wood. The fill is thickest along the Thames River and becomes thinner to the east of the site. There was no evidence of fill in areas located in southeast corner of site or the 6MW6 well cluster (offsite) (B&R Environmental, March 1997).

In most cases, the fill is underlain by clayey silt, which thickens from 2 feet along the eastern portion of the DRMO to a maximum observed thickness of 46 feet along the Thames River. The silt layer is underlain by sand and gravel, except at 6MW2D where the silt lies directly on bedrock. Upslope of the DRMO at the 6MW5 and 6MW6 well clusters, the clayey silt is missing and 20 feet of sand and gravel rest on bedrock. The coarse-grained natural overburden materials are generally mapped as terrace deposits along the Thames River (USGS, 1960). These terrace deposits are stratified drift of former glacial meltwater streams. At the DRMO, the coarse-grained terrace deposits are overlain by the clayey silt, which are finer-grained river bottom sediments (B&R Environmental, March 1997).

Bedrock in the northern portion of the DRMO has been mapped as the Granite Gneiss. Bedrock in the southern portion of the DRMO has been mapped as the Mamacoke Formation (USGS, 1967). These mapped formations were detected during drilling: the Granite Gneiss was encountered at 6MW5D and the Mamacoke Formation was encountered at 6MW6D. The Westerly Granite has been mapped along the eastern portion of the site, but it was not detected during drilling (Phase I RI). A bedrock high exists to the east of the DRMO and is an extension of the large bedrock high that borders the north part of NSB-NLON. The bedrock at the DRMO slopes westward toward the Thames River. The slope of the bedrock surface across the DRMO is approximately 25 percent (B&R Environmental, March 1997).

2.2.5 Hydrogeology

Groundwater is present within the overburden and bedrock underlying the DRMO. The water table is generally encountered within the fill materials at the site (between 2.5 and 10.5 feet below ground surface), with the underlying clayey silt and terrace deposits under saturated conditions. Based on the expected relative permeability of these three units (the coarse-grained fill and terrace deposits are expected to be significantly more permeable than the intervening clayey silt layer), the three deposits are considered to be separate hydrostratigraphic units. The clayey silt may function as an aquitard relative to the overlying and underlying coarser grained units.

Groundwater flow is generally from east to west, following topographic and bedrock surface slope to the Thames River. The Thames River is tidally influenced with a mean tidal range at NSB-NLON of 2.2 feet, which creates reversals in groundwater flow directions and causes water levels to fluctuate. Based on a tidal study conducted as part of an Action Memorandum for Building 31 at the Lower Base, monitoring well water levels at a distance of approximately 100 feet from the Thames River were noted to fluctuate by 1.19 feet. Due to the proximity of the site to the river, and the demonstrated influence of tides on groundwater levels near the river at the Lower Base, it is expected that tidal fluctuations of the river locally affect groundwater levels, at least in the western portion of the DRMO.

During low tide, the hydraulic gradient of the groundwater table at NSB-NLON is towards the Thames River and will result in the highest discharge rate of groundwater to the river. During high tide, the hydraulic gradient of the groundwater is reversed and flow occurs from the river to the site, temporarily halting the discharge of groundwater from the base to the river (B&R Environmental, March 1997).

Since the underlying clayey silt layer likely acts to minimize groundwater impacts from the DRMO to the deep river bottom and alluvial deposits, the groundwater flux from the DRMO to the river was calculated from the fill only. The average hydraulic conductivity of the fill materials was calculated by taking the geometric mean of DRMO-specific hydraulic conductivities (both Phase I RI and Phase II RI) for two wells completed within the fill materials. Hydraulic conductivities from Phase I RI well 6MW2S (70 ft/day) and

from Phase II RI well 6MW7S (1.9 ft/day), were used for this calculation. The average hydraulic conductivity calculated for the fill material is 11.5 feet/day. Using Darcy's equation, the associated hydraulic discharge rate was calculated to be 1,666 cubic feet/day The actual discharge rate is likely to be substantially lower than this calculated rate, as tidal effects were not considered. During periods of high tide, groundwater discharge to the river is expected to be halted as gradients reverse and the river recharges the groundwater.

The groundwater is classified as GB. This classification applies to groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills, or leaks of chemicals or land use impacts.

2.3 PREVIOUS INVESTIGATIONS

2.3.1 Phase I Remedial Investigation

The Phase I RI at this site included test borings and monitoring well installation, as well as, soil, surface water, and groundwater sampling. Twelve shallow subsurface (less than 2 feet deep) soil samples plus one field duplicate and 12 subsurface (greater than 2 feet deep) soil samples plus one field duplicate were collected from seven test borings and five monitoring well borings. Four surface soil samples (two composite and two grab samples) plus one field duplicate were collected and analyzed. Six groundwater samples plus one field duplicate were collected from five shallow wells and one deep well. Additionally, one surface water sample was collected from the Thames River at the north end of this site (B&R Environmental, March 1997). The soil samples were analyzed for Target Compound List (TCL) Volatile Organic Compounds (VOCs). Semivolatile Organic Compounds (SVOCs), pesticides and Polychlorinated Biphenyls (PCBs); Target Analyte List (TAL) metals; and Toxicity Characteristics Leaching Procedure (TCLP) metals. The groundwater and surface water samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs; TAL metals; and radiological analyses.

Concentrations of VOCs in the soil were generally low. However, the following VOCs were found in 6TB4 (6-8 feet): vinyl chloride detected at 1,300 µg/kg, trichloroethene detected at 20,000 µg/kg, and tetrachloroethene detected at 210 µg/kg. SVOCs were present in most soil samples collected in the former landfill area. They were predominately comprised of PAHs, many of which were detected at elevated levels (maximum of 931,000 µg/kg). A PCB, Aroclor 1260, was detected at almost all soil sample locations with concentrations ranging from 52 µg/kg to 12,000 µg/kg. Pesticides were detected in one soil sample at elevated concentrations. The total pesticide concentration was 57,800 µg/kg, consisting of 4,4' DDT, 4,4' DDD, and 4,4' DDE.

Out of the 24 soil samples analyzed for TCLP metals, 21 contained one or more metals exceeding "To Be Considered" values (TBCs). TBC values were exceeded for barium, cadmium, chromium, lead, mercury and silver. TCLP values for lead ranged from 6.2 to 52 milligrams per liter (mg/L) at three locations (Atlantic, August 1992), which exceeded the hazardous waste characteristic value of 5 mg/L.

Trichloroethene and 1,2-dichloroethene were present in three downgradient wells (6MW2S, 6MW3S, and 6MW4S). No SVOCs (including polcyclic aromatic hydrocarbons {PAHs}), pesticides, petroleum hydrocarbons, or PCBs were detected in any wells at the DRMO site. Low levels of phthalates and benzoic acid were detected in the upgradient well 6MW5D. The inorganic groundwater analysis results indicated that selenium exceeded the primary drinking water standards at wells 6MW2S, 6MW3S, and 6MW4S (Atlantic, August 1992).

No VOCs, SVOCs, pesticides, or PCBs were detected in the upgradient surface water sample. Comparison of the inorganic results for this sample with the downgradient water sample (Goss Cove) did not suggest any detectable impact on the Thames River form NSB-NLON based on this limited data set (Atlantic, August 1992).

2.3.2 Draft Focused Feasibility Study Field Investigation

A field investigation in support of the draft Focused Feasibility Study (FFS) was performed at the DRMO site in October 1993 to better define the extent of soil contamination. Split-spoon samples were collected from 17 borings. One or more samples were collected from each boring based on visual evidence of contamination, field-measured organic vapor readings, and field-measured lead contamination (using X-Ray Fluorescence). Twelve surface (less than 2 feet deep) soil samples and twelve subsurface (greater than 2 feet deep) soil samples were collected. One surface and two subsurface field duplicates were also collected. The samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs; TAL metals; dioxins; and TCLP VOCs SVOCs, pesticides, and metals. One of the borings was completed as a monitoring well (B&R Environmental, March 1997).

The highest concentrations of VOCs were present in soil samples 6TB17, 6TB19, and 6TB16 where values ranged from 9,600 to 4,840 µg/kg for total VOCs. The TBC value was exceeded for trichloroethene at two locations where values were reported at 3,900 and 40 µg/kg. The TBC value for 1,2-dichloroethane was exceeded at 6TB20 (79 µg/kg) and toluene at 6TB19 (2,900 µg/kg). SVOCs, predominately PAHs with concentrations ranging from non-detected to 931,000 µg/kg, were detected in soil across the site. PCBs (Aroclor 1254, Aroclor 1260, and Aroclor 1242) were detected at nearly all boring locations at low to high concentrations, ranging from 76 to 34,700 µg/kg. Pesticides (4,4' DDE, 4,4' DDD, 4,4' DDT) were detected at many locations across the site, primarily at low concentrations; however, several locations were found to have elevated levels. Inorganic compound levels were above

background at all locations. Of primary concern at the site, were the levels of lead, which ranged from 5.7 to 12,400 µg/kg.

Two soil samples were collected and analyzed for full TCLP parameters. There were no SVOCs, or pesticides values above the Connecticut Department of Environmental Protection (CTDEP) TBC values. Cadmium and 1,2-dichloroethane were detected in one sample above TCLP TBC values at concentrations of 0.028 and 10 micrograms per liter (µg/L), respectively. Both samples contained lead above the TCLP TBC value at concentrations of 904 and 525 µg/L (Atlantic, March 1995).

2.3.3 Phase II Remedial Investigation

Five new groundwater monitoring wells (two shallow and three deep) were installed and sampled during the Phase II RI. Additionally, four previously installed shallow wells were sampled. Two rounds of groundwater sampling were completed and ten samples (including one field duplicate sample) were collected during each sampling round. Three subsurface soil samples were collected during the installation of three of the new wells. The soil samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs and TAL metals. The groundwater samples were analyzed for TCL VOCs, SVOCs, and TAL metals (B&R Environmental, March 1997).

Relatively high concentrations of multiple organic and inorganic compounds were detected in the soil matrix at the DRMO. Organic chemicals detected at high concentrations include various halogenated aliphatic compounds, PAHs, phthalate esters, Aroclor-1254, and Aroclor-1260. The maximum observed concentration of the water insoluble organic compounds in groundwater was bis(2-ethylhexyl)phthalate at 20 µg/L (B&R Environmental, March 1997).

In spite of the fact that relatively high concentrations of some VOCs were detected in the subsurface soil, it does not appear that substantial impact on the groundwater has occurred to date. For example, although halogenated organic compounds such as 1,2-dichloroethene and trichloroethene were detected in soil samples at concentrations up to 16,000 µg/kg and 7,100 µg/kg, respectively, no evidence of substantial impact on groundwater quality has been noted. The maximum concentration of a halogenated organic compound in groundwater samples was 8 µg/L (1,2-dichloroethene and trichloroethene) (B&R Environmental, March 1997).

In addition to the various organic chemicals detected in soil at the DRMO, concentrations of lead still remained in soil after the Time-Critical Removal Action was conducted. Maximum concentrations of lead in surface and subsurface soil were 4,980 mg/kg and 2,140 mg/kg, respectively. In spite of the lead concentrations in soil, only limited evidence of lead migration to the water table is evidenced by the groundwater analytical results. Although lead was detected as high as 52.7 µg/L in one unfiltered

sample, lead concentrations in filtered groundwater samples ranged no higher than 2.4 µg/L. Furthermore, the cap will effectively minimize precipitation infiltration to the groundwater (B&R Environmental, March 1997).

2.3.4 Time-Critical Removal Action

A Time-Critical Removal Action was performed at the DRMO by OHM Remediation Services Corporation during the course of the Phase II RI. Construction aspects of the removal action were completed in January 1995. The removal action focused on the removal of soil contaminated with lead, PAHs, and PCBs from the northern half of the DRMO. The excavation extended to a maximum depth of approximately 3 feet below the ground surface or to the water table. Approximately 4,700 tons of soils were excavated and transported to a RCRA landfill located in Grand View, Idaho. Additionally, a steel-walled spent-acid-storage tank was excavated, cut into manageable pieces, and disposed of offsite with the contaminated soil.

After the completion of removal activities, the excavated area was backfilled with clean borrow material from an offsite location. A cap consisting of a woven geotextile liner, a geosynthetic clay liner, and a nonwoven geotextile liner was installed. Approximately 12 inches of crushed stone and 3 inches of asphalt were placed over the clay/geotextile cover. The remaining (paved) portion of the DRMO was also upgraded via placement of an asphalt layer.

2.3.5 Year One Monitoring Program

The year 1 groundwater monitoring report summarized the initial 4 rounds of groundwater analytical data collected from 10 monitoring wells installed at the DRMO to monitor groundwater quality beneath the asphalt cap installed as part of the post closure activities at the DRMO. The analytical results were compared to site-specific Surface Water Protection Criteria (SWPCs), as well as Federal Ambient Water Quality Criteria (AWQCs) and Connecticut Water Quality Standards (WQSs) as secondary monitoring criteria.

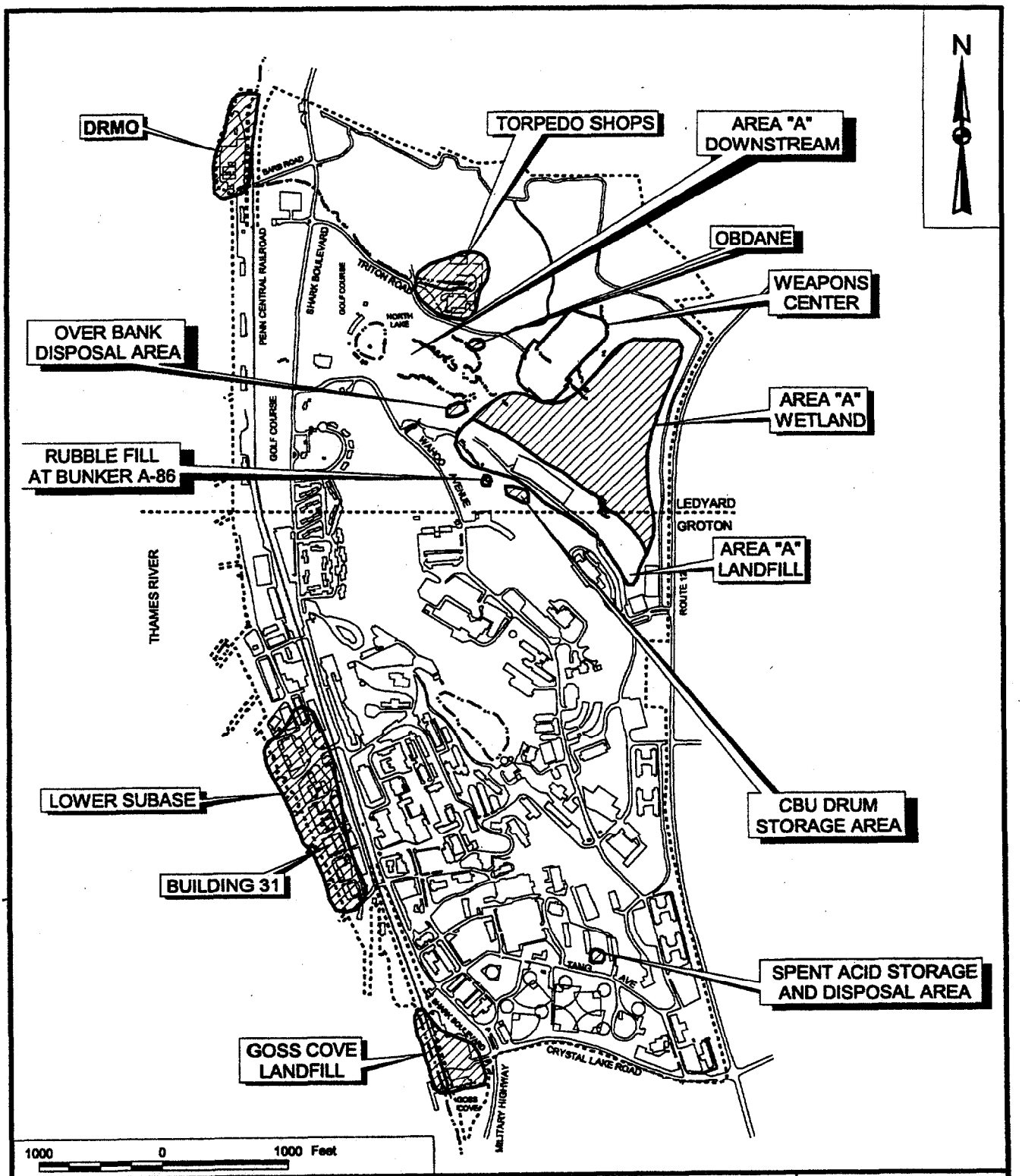
The results obtained for the initial four rounds of groundwater monitoring for volatile organic compounds, semivolatile organic compounds, and inorganic compounds indicated no exceedances of any State of Connecticut Surface Water Protection Criteria (SWPCs). Bis(2-ethylhexyl)phthalate (BEHP) exceeded the secondary monitoring criteria in several samples, however, the results were similar to positive detections noted in samples collected from upgradient monitoring wells. Several polycyclic aromatic hydrocarbons (PAHs) detected in some samples were also noted to exceed secondary monitoring criteria. Arsenic, copper, silver, and zinc were detected in some samples in excess of the secondary monitoring criteria.

A statistical comparisons indicated that upgradient and downgradient concentrations of both organic and inorganic COCs were found to be similar except for arsenic. The average arsenic concentrations for each round were plotted as a function of time and compared to the Connecticut SWPCs. The average concentrations for arsenic showed a decreasing trend.

The analytical results at the end of the initial four rounds of groundwater monitoring sampling indicate no exceedances of the SWPCs, although several contaminants were detected in excess of the secondary monitoring criteria. Because of the various exceedances of secondary monitoring criteria, it was recommended that groundwater monitoring be continued through year two to further evaluate these chemical concentrations.

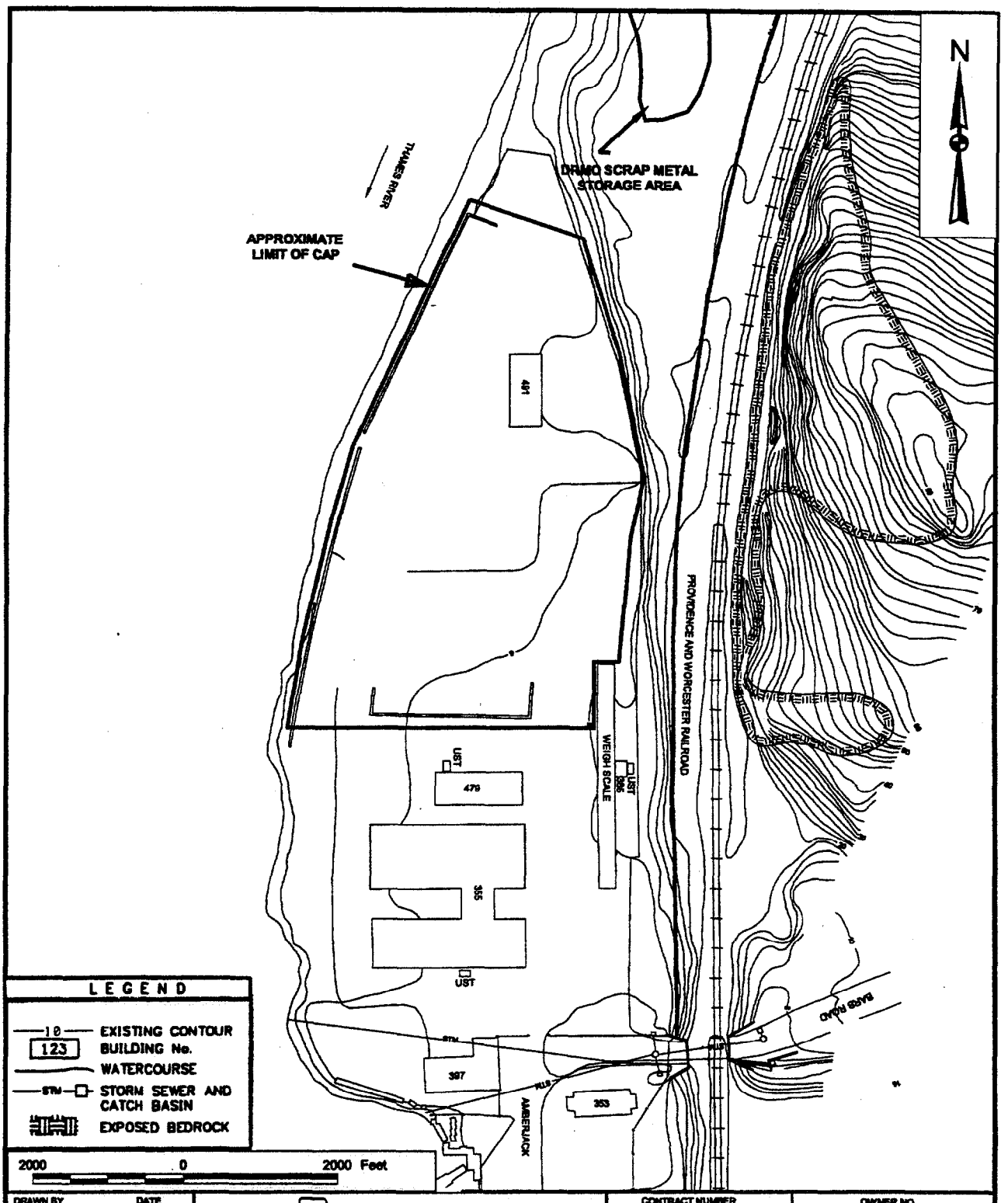
DRAWN BY J. BELLONE — DATE 2/16/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 5082	OWNER NO. —
CHECKED BY — DATE —	LOCATION MAP NSB-NLON GROTON, CONNECTICUT	APPROVED BY CAR	DATE 5/17/01
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE ~~1~~ 2-1	REV 0

P:\GIS\50820370.APR\LOCATION MAP MGS 5-16-01



DRAWN BY J. BELLONE — DATE 10/3/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7363	OWNER NO. —
CHECKED BY MLM — DATE 10/20/99	SITE MAP NSB NLON GROTON, CONNECTICUT	APPROVED BY Mark K Mengel — DATE 10/20/99	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-2	REV 0

P:\GIS\NLON\7363ANNUAL.APR 10/3/99 JCB SITE MAP LAYOUT



DRAWN BY J. BELLONE — DATE 10/1/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7363	OWNER NO.
CHECKED BY MLM — DATE 10/20/99	DRMO SITE PLAN NSB - NLON GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel — DATE 10/20/99	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-3	REV 0

P:\GIS\NLON\7363\ANNUAL.APR 10/1/99 JCB DRMO SITE PLAN LAYOUT

3.0 FIELD ACTIVITIES

This section provides a discussion of the sampling procedures used to conduct the groundwater monitoring, as well as a discussion and presentation of the physical data collected during the sampling.

3.1 SAMPLING LOCATIONS AND ANALYTICAL METHODS

Ten monitoring wells as described in the Groundwater Monitoring Plan for the DRMO (B&R Environmental, 1998) were sampled during the groundwater monitoring program. During the second year of monitoring, wells were sampled during the months of July 1999 (Rd. 5), October 1999 (Rd. 6), January 2000 (Rd. 7), and April 2000 (Rd. 8). Monitoring well locations are shown on Figure 3-1. Monitoring well construction details are shown on Table 3-1.

Each of the monitoring well samples were analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics. Monitoring focused on the organic and inorganic Contaminants of Potential Concern (COPCs), as identified in the Groundwater Monitoring work plan (B&R Environmental, 1998):

- 1,1,2,2-Tetrachloroethane
- 1,2-Dichloroethane
- 1,2-Dichloroethene (total)
- Trichloroethene
- Vinyl Chloride
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzoic Acid
- Bis(2-ethylhexyl)phthalate
- Fluoranthene
- Fluorene
- Naphthalene
- Phenantrene
- Pyrene
- Heptachlor Epoxide
- Aroclors 1254 & 1260
- Hexachlorobiphenyl
- 4,4'-DDD
- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Lead
- Silver
- Zinc

The contaminants were previously detected in soil either at concentrations that could result in exceedances of site specific Surface Water Protection Criteria (SWPCs) or at concentrations that exceed Connecticut's Pollutant Mobility Criteria for GB groundwater.

3.2 SAMPLE COLLECTION PROCEDURES

Ten monitoring wells were sampled during each of the four sampling rounds using low-flow purging and sampling techniques, in accordance with the Tetra Tech NUS SOP SA-1.1 (Groundwater Sample

Acquisition) and the USEPA region I Low- Flow Purging and Sampling Procedure (GW-001). Low-flow purging and sampling was implemented because this method provides the least disturbance to the surrounding formation (less turbulence while purging and sampling and hence lower turbidity), allowing for a more representative sample to be obtained.

Prior to purging, during and before obtaining groundwater samples, water levels were measured using an electronic water-level indicator (M-Scope) capable of 0.01-foot accuracy. Water levels were monitored and recorded every 5 minutes during the purging. Each of the monitoring wells were purged prior to sampling using dedicated bladder pumps and dedicated teflon or teflon-lined polyethylene tubing with bottled nitrogen gas as the air source. Each pump was installed so that the pump intake was placed at the midpoint of the low tide saturated well screen and if possible, no less than 2 feet above the bottom of the well so as to not disturb any sediment located near the bottom of the well.

During the purging, water quality parameters (pH, specific conductivity, temperature, dissolved oxygen, salinity, and Eh) were measured every 5 minutes using a QED FC4000 Water Analyzer equipped with a flow-through cell. Water quality parameters were measured until all of the parameters had stabilized and the minimum purge volume was removed (stabilized purge volume plus the extraction tubing volume). Turbidity was also measured using a Lamotte 2020 Turbidimeter. Water quality parameters obtained at the time of sample collection for each of the sampling rounds are shown on sample logs sheets in Appendix A.

Stabilization of the above parameters is defined as follows:

- pH $\pm$ standard units
- Turbidity $\pm$ 10 percent for the value greater than 1 NTU
- Specific conductance $\pm$ 3 percent
- Temperature $\pm$ 3 percent
- Eh $\pm$ 10 millivolts
- Dissolved oxygen $\pm$ 10 percent

Calibration and standards checks were conducted on the flow-through cell in accordance with the manufacturers' requirements. The cell was cleaned at each well prior to purging and during purging, as necessary (e.g., when fluctuating turbidity readings were observed and confirmed by collection of a turbidity sample before the cell for comparison). A "T" connector with a valve was inserted into the pump's discharge tubing prior to the cell for collection of a turbidity sample. If the cell required cleaning during purging activities, pumping continued and the cell was disconnected for cleaning. When

completed, the cell was reconnected and monitoring activities continued. The cell was cleaned by thoroughly rinsing with deionized water.

Precautions were taken to prevent air entrapment and/or air leaks in the purging system so that potential problems with stabilizing dissolved oxygen were minimized. Precautions included: 1) taking care to fill the entire cell with water while minimizing air entrapment, prior to initiating purging and 2) maintaining a full cell of water by pinching the discharge line shut and elevating the discharge at the end of the tubing from the pump, above the cell. After purging was complete, the flow-through cell was disconnected and samples were collected directly from the pump discharge.

Purge water was containerized, labeled, and turned over to NSB-NLON for disposal.

All sample containers were filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. Samples analyzed for volatile constituents were collected first and immediately sealed in a pre-preserved container so that no head space existed. For filtered inorganic samples, an in-line 0.45 micron filter was used. The filter was pre-rinsed with approximately 400 ml of deionized water and attached to the discharge end of the pump tubing.

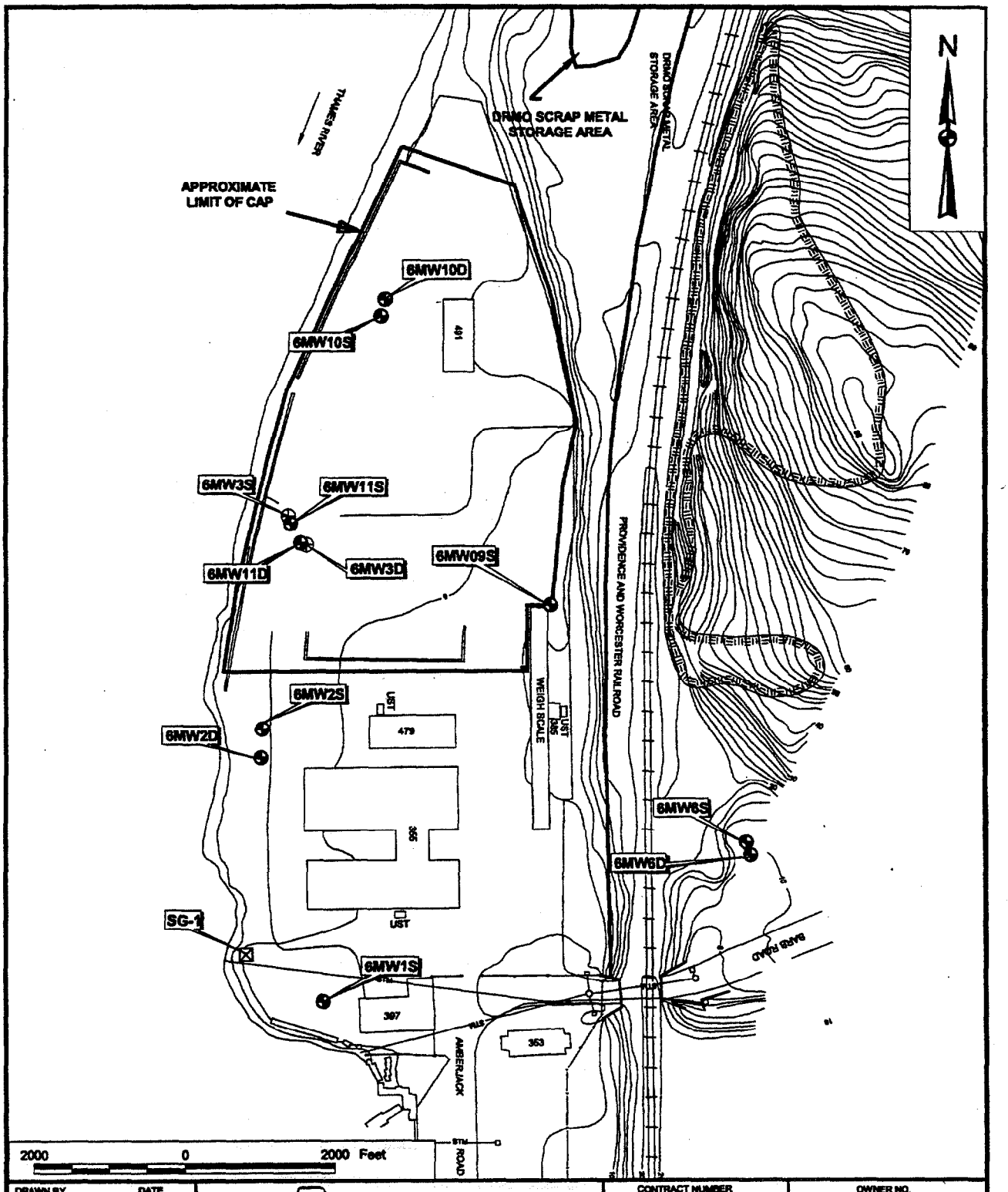
TABLE 3-1

MONITORING WELL CONSTRUCTION DETAILS
NSB-NLON, GROTON, CONNECTICUT

Well I.D.	Material of Construction	Top of Riser Elevation (ft)	Top/Bottom of Screen (ft BGS)	Screened Formation[a]	Total Depth (ft BGS)	Depth to Bedrock (ft BGS)
6MW1S	PVC	8.63	4.0-14.0	Shallow OB	14.0	NA
6MW2S	PVC	7.30	3.0-13.0	Shallow OB	13.0	NA
6MW2D	PVC	7.85	77.0-87.0	Deep OB	88.5	88.5
6MW6S	PVC	12.16	6.0-16.0	Shallow OB	16.0	NA
6MW6D	PVC	12.50	28.0	Bedrock	42.0	22.0
6MW9S	PVC	7.52	4.0-12.0	Shallow OB	12.0	NA
6MW10S	PVC	5.19	4.0-14.0	Shallow OB	14.0	NA
6MW10D	PVC	5.01	43.4-53.4	Deep OB	53.4	59.0
6MW11S	PVC	4.92	3.5-13.5	Shallow OB	14.0	NA
6MW11D	PVC	5.31	75.0-85.0	Deep OB	85.0	85.0

a OB = Overburden

Notes:
Reference elevation is top of well casing (1982 Base Traverse System).
BGS means below ground surface.
NA means information is not available.



DRAWN BY J. SELLONE	DATE 10/1/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7363 / OWNER NO.
CHECKED BY MLM	DATE 10/20/99	DRMO MONITORING WELLS NSB - NLON GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel DATE 10/20/99
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 3-1 / REV 0

P:\GIS\NLON\7363ANNUAL.APR 10/1/99 JCB DRMO MONITORING WELLS LAYOUT

4.0 DATA EVALUATION

This section presents a discussion of the analytical data as well as hydrogeological data obtained during groundwater monitoring activities performed at the DRMO from July 1999 through April 2000.

4.1 EXTENT OF CONTAMINATION

As described in the Groundwater Monitoring Plan (B&R Environmental, 1998), the Connecticut Remediation Standard Regulations (RSRs) require that all groundwater plumes be remediated to attain either a.) the Surface Water Protection Criteria (SWPCs) and the Volatilization Criteria, or b.) the background concentration for each substance in the plume (CTDEP, December 1995). Accordingly, the primary monitoring criteria used to evaluate the analytical data included the site-specific SWPCs developed for the DRMO (B&R Environmental, September 1997) as well as the standard SWPCs and Volatilization Criteria promulgated by the CTDEP. In addition, the groundwater analytical results were compared to secondary monitoring criteria consisting of the Federal Ambient Water Quality Criteria (AWQCs) and the Connecticut Water Quality Standards (WQSs) developed for chronic (long-term) exposure of aquatic receptors in saltwater. Finally, the results were compared to the Federal and State human health criteria for consumption of organisms since recreational fishing may occur in the Thames River. Since the Thames River is not a source of drinking water, no human health criteria for the ingestion of water was used.

Four rounds of groundwater samples were collected from each monitoring well as part of the second year evaluation. Four duplicate samples were collected as noted in the analytical summary tables. The data discussion will be limited to only those compounds designated as contaminants of potential concern as stated in Section 3.0.

A summary of analytical results is shown on Table 4-1. The primary screening criteria used for data evaluation was the site-specific Surface Water Protection Criteria (SWPC) using a site-specific dilution factor of 100. No volatile organics compounds were detected in any samples in excess of the primary screening criteria (SWPCs) during any of the sampling rounds. Additionally, VOCs were not detected in excess of any secondary screening criteria.

The results of semivolatile organic compound analyses indicated no SVOCs were detected in any samples in excess of the primary screening criteria (SWPCs) during any of the sampling rounds. Bis(2-ethylhexyl)phthalate (BEHP) was detected in excess of secondary monitoring criteria in seven of 44 samples at concentrations ranging from 19.8 to 180 µg/l. BEHP was detected two times in monitoring well 6MW1S (rounds 6 and 8) and once each in 6MW2S, 6MW6D, 6MW10D, 6MW10S, and 6MW11S

during round 5. No other SVOCs were detected in excess of any of the secondary monitoring criteria. Additionally, no positive results were reported for any pesticides/PCBs.

The results of metals analyses indicated positive results for arsenic, copper, lead, and zinc in some of the total and dissolved metals samples. None of the positive results exceeded the primary screening criteria (SWPCs). Total metals concentrations of arsenic (7 of 44 samples), copper (8 of 44 samples), lead (1 of 44 samples) and zinc (10 of 44 samples) were detected in excess of the secondary monitoring criteria. Arsenic was detected once in monitoring well 6MW2D (round 5) and in well 6MW2S (round 6); twice in well 6MW11D (rounds 5 and 6); and three times in well 6MW10D (rounds 5, 6, and 7) at concentrations ranging from 1.5 µg/l to 7.5 µg/l. Copper was detected once in monitoring well 6MW2D and 6MW10S in round 5; twice in well 6MW2S (rounds 7 and 8), 6MW9S (rounds 5 and 6) and 6MW11S (rounds 5 and 7) at concentrations ranging from 2.8 µg/l to 15.4 µg/l. Lead was detected once in well 6MW2S (round 8) at a concentration of 9.2 µg/l. Zinc was detected once each in well 6MW10S (round 7) and 6MW11S (round 6), in three of four rounds in well 6MW10D (rounds 5, 6, and 8); and all four rounds in well 6MW9S at concentrations ranging from 76.9 µg/l to 173 µg/l. No other positive results exceeded any primary or secondary monitoring criteria.

A comparison of total and dissolved metals results did not show any discernable differences as the results were mostly similar. It should be noted that some of the positive results for metals were detected in the dissolved phase at slightly higher concentrations than in the total phase. This may be attributable to laboratory instrumentation accuracy and precision controls. Figure 4-1 depicts the secondary monitoring criteria exceedances.

4.2 HYDROLOGIC EVALUATION

Static groundwater levels were measured during each of the four quarterly rounds of groundwater sampling. Groundwater levels were measured approximately one hour before the low tide based upon data acquired from the National Oceanic and Atmospheric Administration (NOAA) on July 23, 1999; October 21, 1999; January 18, 2000; and April 7, 2000. Groundwater levels were also measured at high tide during each of the respective quarterly sampling rounds. Potentiometric surface maps were prepared for each round of water level measurements and are depicted on Figures 4-2 through 4-9. The contours were drawn from the groundwater elevations of the shallow overburden monitoring wells (6MW1S, 6MW2S, 6MW3S, 6MW6S, 6MW9S, and 6MW10S).

Groundwater flow directions essentially mimic the ground surface contours. A comparison of these maps illustrate that groundwater flow patterns are similar throughout the year. Potentiometric surface maps prepared during times of low tide conditions were generally similar and indicate a westerly flow direction toward the Thames River. Potentiometric surface maps prepared during times of high tide illustrate

similar flow patterns toward the Thames River. A slight reverse gradient is shown on Figure 4-8, likely because the tide rises faster than the opposing hydraulic gradient can respond. A comparison of groundwater elevations is summarized on Table 4-2.

4.3 STATISTICAL ANALYSIS

A statistical analysis was performed on the results from the groundwater monitoring effort to determine if contaminants associated with past activities at the DRMO are having an impact on groundwater at the site. This groundwater monitoring program employed three upgradient wells (6MW6S, 6MW6D, and 6MW9S) and seven downgradient wells (6MW1S, 6MW2S, 6MW2D, 6MW3S, 6MW3D, 6MW10S, and 6MW10D) sampled over four quarters.

The specific tests performed on data collected at the NSB-NLON DRMO site are identified and described in the next section.

The statistical methods proposed to evaluate the groundwater data are employed in order to:

- Develop summary statistics (found in Appendix B) that describe environmental contaminant concentrations at the DRMO.
- Allow comparisons of upgradient concentrations to those detected in site environmental samples (i.e., samples collected in areas potentially contaminated by waste disposal) at the DRMO.

4.3.1 Comparison of Downgradient Wells to Upgradient Wells

Figure 4-10 is a flow diagram taken from the Groundwater Monitoring Work Plan (B&R Environmental 1998), that presents the approach used to compare the downgradient data to the data collected from the upgradient wells. Downgradient data was compared to upgradient data using either parametric or non-parametric analysis. No correction for seasonal variability was required since all wells at the facility should be effected similarly. The statistical methods described in the following paragraphs were used to determine if parameter concentrations detected in downgradient wells are significantly different from those detected in samples from the upgradient wells.

The Analysis of Variance (ANOVA) technique was the basic approach used to compare data from upgradient and downgradient monitoring well locations. The ANOVA technique is used to test whether there is statistically significant evidence of contamination. There are two types of ANOVA tests: parametric and non-parametric. Parametric ANOVA tests, the method used here, assume that the data are normally or lognormally distributed. If the parametric analysis demonstrated that this assumption was

violated, a non-parametric ANOVA test was conducted using the ranks of the observations rather than the observations themselves (EPA, 1989). In this case, the Wilcoxon Rank-Sum test (non-parametric ANOVA) was used to compare the downgradient wells to the upgradient wells.

4.3.1.1 Limit of Detection

During the chemical analysis of environmental samples, some analytes may be present at concentrations that are below the sample quantitation limit (SQL) for the analytical procedure. The results are generally reported as not detected (rather than zero), and the appropriate limit of detection is given. The amount of data that are below the detection limit play an important role in selecting the statistical method of addressing the detection limit problem. The non-detects found at the DRMO site were replaced with the SQL, divided by two, prior to the statistical analysis. Clearly, if all the observations were non-detectable results, no statistical analysis was warranted. In addition, field duplicate results were averaged and counted as one sample for use in statistical analysis.

4.3.2 Parametric and Nonparametric Analysis of Variance (ANOVA)

ANOVA is widely used in the examination of environmental data sets. A one-way classification ANOVA is used to determine whether or not the difference between average concentrations of a parameter detected in downgradient wells and upgradient wells is statistically significant. Since only two means are compared, an ANOVA test will give the same result as the t-test for independent samples. The data residuals are the values resulting from subtracting each measured value from the arithmetic mean. The assumptions that the residuals are drawn from an underlying normal (or lognormal) distribution must be examined prior to employing a parametric ANOVA.

4.3.2.1 The Shapiro and Wilk "W-test" of Normality (n ≤50)

As stated above, the data must be analyzed to determine whether they were drawn from an underlying normal or lognormal distribution. A number of statistical evaluations may be used to determine which, if either, of the distributions are exhibited by a given data set. As recommended by the EPA, the Shapiro and Wilk "W-test" (for sample sets <50) and the Shapiro-Francia "W-test" (for sample sets >50) will be used to determine whether the data are normally or lognormally distributed (EPA, 1992). If the test is inconclusive, lognormality is assumed.

The Shapiro and Wilk W-test (Gilbert, 1987) is an effective method for determining whether a data set has been drawn from an underlying normal (or lognormal) distribution. By conducting the Shapiro and Wilk W-test on the log-transformed data, the test may be used to determine whether the data have been drawn from an underlying lognormal distribution. The null hypothesis (H_0) that is tested is:

H_O - The population has a normal (or lognormal when the data is log-transformed) distribution.

The alternate hypothesis (H_A) is:

H_A - The population does not have a normal (or lognormal when the data is log-transformed) distribution.

A "W" statistic (W_{calc}) is computed for a data set (or a log transformed data set) and compared to a test statistic (W_{test}). If $W_{calc} \geq W_{test}$, then the null hypothesis is not rejected and the data are assumed to be normally distributed (or lognormally distributed if log transformed data are tested). If $W_{calc} < W_{test}$, then the null hypothesis is rejected, H_A is accepted, the data are not assumed to be normally distributed (or not lognormally distributed if log transformed data are tested).

The following equations present a step-by-step procedure for conducting the W-test on the residuals.

- Step 1. Group all of the data from each of the individual (K) wells.

- Step 2. Calculate the mean for each of the *k* wells $\overline{x_j}$ by the equation:

$$\overline{x_j} = \frac{\sum_{i=1}^{n} x_i}{n}$$

where *n* is the total number of samples in each well.

- Step 3. Calculate the residuals for each ith well and j^{th} sampling round by:

$$R_{ij} = x_{ij} - \overline{x_i}$$

The equation for conducting the W-Test is:

$$W_{calc} = \left[\frac{b}{S_R\sqrt{n-1}}\right]^2$$

where:

$$b = \sum_{i=1}^{k} a_i \left(R_{[n-i+1]} - R_i\right) = \sum_{i=1}^{k} b_i$$

and n is the total number of sampling rounds.

- Step 4. Order the n residuals from smallest to largest:

$$x_1 \leq x_2 \leq x_3 \leq \ldots \leq x_n$$

- Step 5. Compute the standard deviation by:

$$S_R = \sqrt{\sum_{i=1}^{n} \frac{\left(R_{ij} - \overline{R}\right)^2}{(n-1)}}$$

- Step 6. Determine the coefficients $a_1, a_2, a_3, .., a_k$ for the sample size n using Table B-1 in Appendix B, where:

$$k = \frac{n}{2} \quad \text{if } n \text{ is even; and}$$

$$k = \frac{n-1}{2} \quad \text{if } n \text{ is odd}$$

- Step 7. Determine b by the formula:

$$b = \sum_{i=1}^{k} a_i \left(R_{[n-i+1]} - R_i\right) = \sum_{i=1}^{k} b_i$$

- Step 8. Calculate W_{calc} using b from above, where:

$$W_{calc} = \left[\frac{b}{S_R\sqrt{n-1}}\right]^2$$

- Step 9. Determine W_{test} at the 5% significance level from Table B-2.

- Step 10. Reject H_O at the 5% significance level if W_{calc} is less than W_{test}.

To test the null hypothesis for a data set drawn from an underlying lognormal distribution, transform the data to $y_{1j}, y_{2j}, y_{3j}, \ldots, y_{km}$ where $y_{ij} = \ln R_{ij}$. Repeat steps 1 through 10 as described in the preceding paragraphs.

4.3.2.2 Parametric ANOVA

Assume that a site has k wells and that n_i data points (analyte concentrations) are available for the ith well. The following presents a step-by-step procedure for conducting the parametric ANOVA.

- Step 1 Compute the sums and means of each well (i) using the following equations as follows:

$$X_i = \sum_{j=1}^{n_i} X_{ij}, \Sigma \text{ of all } n_i \text{ observations at well } i$$

$$\overline{X} = \frac{X}{N}, \text{ grand mean of all observations}$$

$$\overline{X_i} = \frac{X_i}{n_i}, \text{average of all } n_i \text{ observations at well } i$$

$$X = \sum_{i=1}^{k} \sum_{j=1}^{n_i} X_{ij}, \text{grand total of all } n_i \text{ observations}$$

$$N = \sum_{i=1}^{k} n_i, \text{total number of observations}$$

- Step 2. Compute the sum of squares of differences between the individual well means and the grand mean by the formula:

$$SS_{sample} = \sum_{i=1}^{k} n_i \left(\overline{X_i} - \overline{X}\right)^2 = \sum_{i=1}^{k} \left[\frac{X_i^2}{n_i}\right] - \frac{X^2}{N}$$

This sum of squares has (k-1) degrees of freedom associated with it and is a measure of the variability between wells.

- Step 3. Compute the corrected total sum of squares by the formula:

$$SS_{total} = \sum_{i=1}^{k}\sum_{j=1}^{n_i}\left(X_{ij} - \overline{X}\right)^2 = \sum_{i=1}^{k}\sum_{j=1}^{n_i}\left[\left(X_{ij}\right)^2\right] - \frac{X^2}{N}$$

This sum of squares has (*N-1*) degrees of freedom associated with it and is a measure of variability in the whole data set.

- Step 4. Compute the sum of squares of differences of observations within wells from the well means. This value is the sum of squares due to error and is obtained by simple subtraction:

$$SS_{Error} = SS_{Total} - SS_{Sample}$$

The sum of squares due to error has associated with it (*N-k*) degrees of freedom and is a measure of the variability within wells.

- Step 5. Set up an ANOVA table as shown below. The sums of squares and their degree of freedom were obtained from Steps 2 through 4. The mean square quantities are simply obtained by dividing each sum of squares by its corresponding degrees of freedom.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Locations	$S_{Ssample}$	MS_{Sample}=k-1	SS_{Sample}/(k-1)	F=$MS_{samples}/MS_{Error}$
Error (within Locations)	SS_{Error}	MS_{Error}=N-k	SS_{Error}/(N-k)	
Total	SS_{Total}	N-1		

- Step 6. To test the hypothesis of equal means for all *k* wells, compute $F = MS_{Sample}/MS_{Error}$ (last column in above table). Compare this statistic to the tabulated F statistic with (*k-1*) and (*N-k*) degrees of freedom (Table B-3) at the 5% significance level. If the calculated *F* value exceeds the tabulated value, reject the hypothesis of equal well means. Otherwise, conclude that there is no significant difference between the concentrations of the *k* wells and thus no evidence of contamination.

4.3.2.3 Nonparametric ANOVA

The parametric ANOVA technique is the preferred approach for comparing environmental measurements from downgradient monitoring wells to upgradient well data. However, parametric ANOVA methods make a key assumption; the results are normally (or lognormally) distributed. If this assumption is violated, non-parametric tests (i.e. Kruskal-Wallis or Wilcoxon Rank-Sum tests) may be used to determine if constituent concentrations present in the downgradient areas significantly exceed those present in the upgradient well.

The Kruskal-Wallis (EPA, 1989) test should be employed when comparing three or more data sets. However, it is not amenable to two data set comparisons. In these situations, the Wilcoxon Rank-Sum test (EPA, 1992) (also known as the Mann-Whitney U test) should be employed.

Non-parametric tests are conducted using the ranks of the analytical results rather than the analytical results themselves. Therefore, the data sets are inspected for extremely high values that may be underestimated as a result of the ranking process.

4.3.2.4 The Wilcoxon Rank-Sum Test

The Wilcoxon Rank-Sum test is described in the following paragraphs.

- Step 1. Combine the upgradient and downgradient data and rank the ordered values from 1 to N. Assume there are n downgradient samples and m upgradient samples so that $N = m + n$.

- Step 2. Compute the Wilcoxon statistic W:

$$W = \sum_{i=1}^{n} E_i - \frac{1}{2}n(n+1)$$

  where E_i are the ranks of the downgradient samples large values of the statistic W give evidence of contamination in downgradient wells.

- Step 3. Compute an approximate *Z-score*. To find the critical value of W, a normal approximation to its distribution is used. The expected value and standard deviation of W under the null hypothesis (i.e., no contamination exists) are given by the formulas

$$E(W) = \frac{1}{2}mn; \qquad SD(W) = \sqrt{\frac{1}{12}mn(N+1)}$$

An approximate *Z-score* for the Wilcoxon Rank-Sum test may be calculated by the following equations:

$$Z = \frac{W - E(W) - \frac{1}{2}}{SD(W)}$$

The factor of 1/2 in the numerator serves as a continuity correction since the discrete distribution of the statistic W is being approximated by the continuous normal distribution. If $n,m > 10$ and ties are present, an adjustment to the approximate *Z-score* must be made as follows:

$$Z_{RS} = \frac{W - E(W) - \frac{1}{2}}{SD'(W)}$$

1

where: $$SD'(W) = \left(\frac{mn}{12} \left[N + 1 - \frac{\sum_{j=1}^{g} t_j(t_j^2 - 1)}{N(N-1)} \right] \right)^{\frac{1}{2}}$$

g = the number of tied groups and t_j is the number of tied data in the jth group.

- Step 4. For a one-tailed 0.05 significance level test for H_0 versus H_A (i.e. the measurements from population 1 tend to exceed those from population 2), reject H_0 and accept H_A if $Z_{rs} > Z_{0.95} = 1.96$. For a one-tailed significance level test for H_0 versus H_A (i.e., the measurements from population 2 tend to exceed those from population 1), reject H_0 and accept H_A if $-Z_{rs} < -Z_{0.95} = -1.96$.

4.3.3 Statistical Findings

The following eleven contaminants were considered potential COCs prior to statistical analysis as they were identified as COCs before round 1 and detected in the downgradient wells at least once during the most recent four sampling rounds (rounds 5 through 8):

Volatile Organics

Trichloroethene	Vinyl Chloride

Semivolatile Organics

Bis(2-ethylhexyl)phthalate	Cis-1,2-dichloroethene
Trans-1,2-dichloroethene	Pyrene

Metals

Arsenic	Barium
Copper	Lead (total only)
Zinc	

Nine potential COCs detected in the downgradient wells at least once during rounds 1 through 4 were not detected during rounds 5 through 8 (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene, fluorene, phenanthrene, chromium, and silver). Only one contaminant (trans-1,2-dichloroethane) was detected in the downgradient wells during rounds 5 through 8 which was not detected during rounds 1 through 4.

The total and dissolved metals were compared to established background concentrations at the site as presented in the Groundwater Monitoring Work Plan (B&R Environmental, 1998). Copper and lead were determined to be at levels below background. The remaining metals were found in downgradient wells at levels above background as shown in Table 4-3.

Shapiro-Wilk W tests were performed to determine the underlying distribution of the upgradient and downgradient wells for each COC. Results of Shapiro-Wilk W tests for downgradient wells is shown in Table 4-4. Results of Shapiro-Wilk W tests for upgradient wells is shown in Table 4-5. If upgradient and downgradient results demonstrated the same underlying distribution (as shown on Table 4-6), a parametric ANOVA was performed at a 95% level of confidence to compare data sets. Results of parametric ANOVA are presented in Table 4-7. If the underlying distributions could not be shown to be the same, a non-parametric ANOVA (Wilcoxon Rank-Sum) test was performed at a 95% level of confidence to compare data sets. Results of non-parametric ANOVA (Wilcoxon Rank-Sum) are

presented in Table 4-8. COCs that produced p-levels below 0.05 have downgradient results that are higher than upgradient results at a 95% level of significance. Table 4-9 shows downgradient inorganic results that exceed the upgradient concentration.

The only COC that showed statistically significant differences between the downgradient and upgradient results was total barium as shown on Table 4-9. There are no site specific or CTDEP SWPC for barium. A plot of total barium concentration as a function of time over round 1 through 8 is shown in Figure 4-11. Although the plot shows a slight upward trend of +10 (± 25) mg/L/year, it should be noted that the most recent sample round was the second lowest result of the 8 rounds.

Downgradient total arsenic concentrations were not statistically higher than upgradient concentrations during rounds 5 through 8 as they were in rounds 1 through 4. The average total arsenic concentration from the first round (4.49 µg/L) was greater than the CTDEP SWPC (4 µg/L). Concentrations in all subsequent rounds have been below this criteria. The average concentration of arsenic was then plotted as a function of time over rounds 1 through 8 as shown on Figure 4-12. The least-squared linear regression line shows a downward trend of -1.2 (± 1.8) mg/L/year. Since such a downward trend should eventually asymptotically approach ½ the detection limit, a best-fit exponential line was calculated as shown in Figure 4-13.

Oxidation-reduction potential (ORP) tends to be lower in downgradient wells when compared to upgradient wells. To determine if there is a relationship between elevated metal concentrations and depleted ORP the Pearson's correlation coefficient (r) was calculated for those metals above background concentration. The Pearson's correlation coefficient is a statistical procedure that allows one to assess the strength and direction of the relationship between two phenomena.

This procedure yields a single number that can have an absolute value in the range from 0.0 to 1.0. The closer the absolute value is to 1.0 the stronger the relationship. The closer the absolute value is to 0.0 the weaker the relationship. Following is a common ranking that may be used to determine the strength of association suggested by the absolute value of the correlation coefficient:

0.80-1.00 Strong Association between Variables
0.60-0.79 Strong to Moderate Association
0.40-0.59 Moderate Association
0.30-0.39 Moderate to Weak Association
0.20-0.29 Weak Association
0.00-0.19 Little, if any association

A negative sign (referred to as a negative or inverse correlation) means that an upward change in one variable is accompanied by a downward change in the other variable, or vice versa.

A comparison of metal concentration to ORP shows only barium (both total and dissolved) has more than a weak correlation (i.e., absolute value of the Pearson r greater than 0.29) between concentration and ORP. Pearson r values between concentrations and ORP are shown in Table 4-10. Barium is a simple metal which typically is not sensitive to ORP. Metals such as arsenic which are typically ORP sensitive show little or weak correlation between concentration and ORP. This supports the theory that there is no cause/effect relationship between the elevated metal concentrations and the lower ORP at the downgradient wells. If the lower ORP was causing the elevated barium concentrations it should also be causing elevated arsenic concentrations.

When one uses Pearson's correlation procedure one sometimes ends up with coefficients that indicate a relationship when there really isn't one. This type of accidental association is a spurious correlation. Spurious correlation is normally due to other extraneous variables that are associated with the independent and dependent variables focused on at the time. Other factors that may effect metals concentration include sampling technique, turbidity, temporal variation, etc.

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW1S 7/22/99	ROUND 6 6MW1S 10/24/99	ROUND 7 6MW1S 1/21/00	ROUND 8 6MW1S 4/11/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	0.44 J	0.4 J	1 U	0.5 J
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.17 U	0.15 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.17 U	0.15 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.17 U	0.15 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.17 U	0.15 U
BENZOIC ACID	NA	NA	50 U	20 U	20 U	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	22 U	19.8	2	43
FLUORANTHENE	37,000	370 [4][5]	1.2 U	1 U	1.1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	1.2 U	1 U	1.1 U	1 U
NAPHTHALENE	NA	NA	1 U	1 U	1.1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1 U	1.1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1 U	1.1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.02 U	0.02 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	1.1 U/2.0 J	3.8 U/3.8 U	2.6 UJ	2.3 U
BARIUM	NA	NA	19.0 J/20.0 J	14.9 U/14.9 U	21.5	42.3
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.30 U/0.30 U	0.3 U	0.68 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	1 U	0.8 U
COPPER	480	2.4 [2]	1.4 UJ/1.7 J	1.2 U/1.2 U	1.3 U	1.6 U
LEAD	130	8.1 [2]	1.0 U/1.0 U	1.7 U/1.7 U	1.8 UJ	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U/1.3 U	1.1 U	0.9 U
ZINC	1,230	81 [2]	12.8 U/14.2 U	19.1/9.1 U	4.5 J	14.4

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW2D 7/21/99	ROUND 6 6MW2D 10/23/99	ROUND 7 6MW2D 1/20/00	ROUND 8 6MW2D 4/11/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	0.9 J	1 U
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	1 U	1 U	1 U	1 U
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	0.8 J	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.16 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.16 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.16 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.16 U
BENZOIC ACID	NA	NA	50 U	20 U	20 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	10 U	1.6 J	2 U	3.7
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1 U	1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1 U	1 U	1 U
NAPHTHALENE	NA	NA	1 U	1 U	1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1 U	1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1 U	1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.021 U	0.021 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.21 U	0.21 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.21 U	0.21 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	1.5 J/1.1 U	3.8 U/4.2 J	2.6 UJ	2.3 U
BARIUM	NA	NA	149/166	166/175	174	146
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.30 U/0.30 U	0.33 U	0.2 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	2.4 U	3 U
COPPER	480	2.4 [2]	4.3 J/1.4 U	1.2 U/1.2 U	3.2 U	7 U
LEAD	130	8.1 [2]	1.1 U/1.0 U	1.7 U/1.7 U	1.8 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U/1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	14.0 U/1.7 UJ	5.9 U/7.2 U	27 J	16.7 J

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW2S 7/21/99	ROUND 6 6MW2S 10/23/99	ROUND 7 6MW2S 1/20/00	ROUND 8 6MW2S 4/11/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	0.24 J	0.3 J	1 U	0.4 J
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	0.44 J	0.3 J	1 U	0.4 J
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.18 U	0.15 U	0.16 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.18 U	0.15 U	0.16 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.18 U	0.15 U	0.16 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.18 U	0.15 U	0.16 U
BENZOIC ACID	NA	NA	50 U	21 U	20 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	37	2.1 U	2 U	2 U
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1.2 U	1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1.2 U	1 U	1 U
NAPHTHALENE	NA	NA	1 U	1.2 U	1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1.2 U	1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1.2 U	1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.02 U	0.021 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.21 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.21 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	1.1 U/1.1 U	3.9 J/3.8 U	2.6 UJ	2.3 U
BARIUM	NA	NA	33.0 J/33.6 J	40.6/42.4	28.1	21.8
CADMIUM	60	NA	6.0 UJ/3.0 UJ	0.30 U/0.30 U	0.6 U	0.42 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	1 U	1.1 U
COPPER	480	2.4 [2]	2.2 J/1.4 U	1.2 U/1.2 U	7.5	15.4
LEAD	130	8.1 [2]	1.0 U/1.0 U	1.7 U/1.7 U	6.1 U	9.2
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U/1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	11.0 U/10.2 U	11.2 J/45.9 J	36.9 J	41.6

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW6D 7/19/99	ROUND 6 6MW6D 10/21/99	ROUND 7 6MW6D 1/18/00	ROUND 8 6MW6D 4/10/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	6.6	6	5	5
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	10	11	9	10
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.16 U	0.16 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.16 U	0.16 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.16 U	0.16 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.15 U	0.16 U	0.16 U
BENZOIC ACID	NA	NA	54 U	20 U	21 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	68	2 U	2.1 U	2 U
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1 U	1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1 U	1 U	1 U
NAPHTHALENE	NA	NA	1 U	1 U	1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1 U	1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1 U	1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.02 U	0.021 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.21 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.21 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	1.1 U/1.1 U	3.8 U	2.6 U	2.3 U
BARIUM	NA	NA	45.6/44.2	36.5	39.3	44.8
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.58 U	0.45 U	0.73 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U	1 U	0.8 U
COPPER	480	2.4 [2]	1.4 U/2.0 J	1.2 U	1.3 U	1.3 U
LEAD	130	8.1 [2]	1.2 U/1.0 U	1.7 U	1.8 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	9.8 U/10.4 U	12.2	13.3 J	14.9

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW6S 7/19/99	ROUND 6 6MW6S 10/21/99	ROUND 6 6MW6S (DUP) 10/21/99	ROUND 7 6MW6S 1/18/00	ROUND 8 6MW6S 4/10/00	ROUND 8 6MW6S (DUP) 4/10/00
VOCs (µg/L)								
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	0.59 J	0.5 J	0.5 J	0.5 J	0.3 J	0.3 J
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U	1 U	1 U
SVOCs (µg/L)								
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.15 U	0.15 U	0.16 U	0.16 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.15 U	0.15 U	0.16 U	0.16 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.15 U	0.15 U	0.16 U	0.16 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.15 U	0.15 U	0.16 U	0.16 U
BENZOIC ACID	NA	NA	50 U	20 U	20 U	20 UJ		
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	10 U	2 U	1.1 J	2 U	2 U	2.1 U
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1.1 U	1 U	1 U	1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1.1 U	1 U	1 U	1 U	1 U
NAPHTHALENE	NA	NA	1 U	1.1 U	1 U	1 U	1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1.1 U	1 U	1 U	1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1.1 U	1 U	1 U	1 U	1 U
Pesticides/PCBs (µg/L)								
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)								
ARSENIC	40	0.14 [4][5]	1.1 U/1.1 U	3.8 U	3.8 U	2.6 U	2.3 U	2.3 U
BARIUM	NA	NA	38.7/35.5	58.4	57.8	27.6	23.5	22.8
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.30 U	0.30 U	0.36 U	0.2 U	0.2 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U	2.4 U	1 U	0.8 U	0.8 U
COPPER	480	2.4 [2]	1.6 J/1.9 J	1.2 U	1.2 U	1.3 U	1 U	1.2 U
LEAD	130	8.1 [2]	2.9 U/1.0 U	1.7 U	1.7 U	1.8 U	2.1 UJ	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U	1.3 U	1.1 UJ	0.9 U	0.9 U
ZINC	1,230	81 [2]	2.7 U/3.8 U	11.5	2.6 U	3.8 U	10.5	15.3

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW9S 7/20/99	ROUND 6 6MW9S 10/22/99	ROUND 7 6MW9S 1/19/00	ROUND 7 6MW9S (DUP) 1/19/00	ROUND 8 6MW9S 4/11/00
VOCs (µg/L)							
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1	1 U	1 U
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	0.47 J	0.7 J	1 U	1 U	0.3 J
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U	1 U
SVOCs (µg/L)							
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.16 U	0.16 U	0.16 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.16 U	0.16 U	0.16 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.16 U	0.16 U	0.16 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.17 U	0.16 U	0.16 U	0.16 U
BENZOIC ACID	NA	NA	50 U	20 U	21 UJ	21 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	10 U	2 U	2.1 U	2.1 U	2 U
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1.1 U	1.1 U	1.1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1.1 U	1.1 U	1.1 U	1 U
NAPHTHALENE	NA	NA	1 U	1.1 U	1.1 U	1.1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1.1 U	1.1 U	1.1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1.1 U	1.1 U	1.1 U	1 U
Pesticides/PCBs (µg/L)							
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.02 U	0.02 U	0.021 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.21 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.21 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)							
ARSENIC	40	0.14 [4][5]	1.1 U/1.9 J	3.8 U/3.8 U	2.6 U	2.6 U	2.3 U
BARIUM	NA	NA	18.5/18.6	17.7 J/18.0 J	14.6	14.4	11.4
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.59 U/0.49 U	0.54 U	0.61 U	0.2 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	1 U	1 U	0.8 U
COPPER	480	2.4 [2]	2.8 J/2.9	3.3/3.7	3 U	2.9 U	5.1 U
LEAD	130	8.1 [2]	1.2 U/1.0 U	1.7 U/1.7 U	1.8 U	1.8 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U/1.3 U	1.1 UJ	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	109 J/76.9 J	96.6/123	111	120	123

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW10D 7/19/99	ROUND 6 6MW10D 10/22/99	ROUND 7 6MW10D 1/18/00	ROUND 8 6MW10D 4/10/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	22	16	15	15
TRANS-1,2-DICHLOROETHENE	NA	NA	0.29 J	0.3 J	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	6.1	5	5	5
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.16 U	0.16 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.16 U	0.16 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.16 U	0.16 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.16 U	0.16 U
BENZOIC ACID	NA	NA	250 U	20 U	21 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	180	2.4	2.1 U	2 U
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1 U	1.1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1 U	1.1 U	1 U
NAPHTHALENE	NA	NA	1 U	1 U	1.1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1 U	1.1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1 U	1.1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][5]	0.020 UJ	0.02 U	0.02 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 UJ	0.2 U	0.2 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 UJ	0.2 U	0.2 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 UJ	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	4.3/5.0 J	7.5 J/4.2 J	4.2 J	4.5 U
BARIUM	NA	NA	44.4 J/44.9 J	42.9/43.5	44.8	35.2
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.33 U/0.30 U	0.37 U	0.22 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	1 U	0.8 UJ
COPPER	480	2.4 [2]	1.4 UJ/3.3	1.2 U/1.2 U	1.3 U	1.6 U
LEAD	130	8.1 [2]	1.1 U/1.0 U	1.7 U/1.7 U	1.8 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U/1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	173 J/167 J	99.4/91.7	77.6	130

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW10S 7/19/99	ROUND 6 6MW10S 10/22/99	ROUND 7 6MW10S 1/18/00	ROUND 8 6MW10S 4/10/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	1.9	2	0.9 J	1
TRANS-1,2-DICHLOROETHENE	NA	NA	0.17 J	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	0.26 J	0.2 J	1 U	0.2 J
VINYL CHLORIDE	157,500	525 [4][5]	1 U	1 U	1 U	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZOIC ACID	NA	NA	50 U	20 U	20 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	43	3.7	4.1	2.4
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1 U	1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1 U	1 U	1 U
NAPHTHALENE	NA	NA	1 U	1 U	1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1 U	1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1 U	1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][6]	0.020 U	0.021 U	0.02 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.21 U	0.2 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.21 U	0.2 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	1.1 U/1.6 J	3.8 U/3.8 U	2.6 U	2.3 U
BARIUM	NA	NA	193/187	133/134	127	73.2
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.30 U/0.38 U	1.2 U	0.4 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	1 U	0.8 U
COPPER	480	2.4 [2]	5.8 J/1.4 U	1.9 J/1.2 U	4.9 U	4.6 U
LEAD	130	8.1 [2]	2.7 U/1.0 U	1.7 U/1.7 U	1.8 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U/1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	18.4 U/6.3 U	12.7/4.8 U	91.5	33.6

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW11D 7/20/99	ROUND 6 6MW11D 10/21/99	ROUND 7 6MW11D 1/19/00	ROUND 8 6MW11D 4/12/00
VOCs (µg/L)						
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	3.4	3	1 U	3
TRANS-1,2-DICHLOROETHENE	NA	NA	1 U	1 U	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	1 U	1 U	1 U	1 U
VINYL CHLORIDE	157,500	525 [4][5]	1 U	0.8 J	1 U	1 U
SVOCs (µg/L)						
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.16 U	0.15 U	0.15 U
BENZOIC ACID	NA	NA	50 U	20 U	20 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	13 U	2 U	2 U	1.4 J
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1 U	1 U	1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1 U	1 U	1 U
NAPHTHALENE	NA	NA	1 U	1 U	1 U	1 U
PHENANTHRENE	0.77	NA	0.2 U	1 U	1 U	1 U
PYRENE	1,100,000	11,000 [4][5]	0.2 U	1 U	1 U	1 U
Pesticides/PCBs (µg/L)						
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.02 U	0.02 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.2 U	0.2 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)						
ARSENIC	40	0.14 [4][5]	2.3/2.1 J	3.8 J	2.6 UJ	7.4 U
BARIUM	NA	NA	242/251	269	280	242
CADMIUM	60	NA	3.0 UJ/3.0 UJ	0.30 U	0.3 UJ	0.44 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U	1 U	3.3 U
COPPER	480	2.4 [2]	1.4 UJ/1.4 U	1.2 U	1.9 U	12.3 U
LEAD	130	8.1 [2]	1.3 U/1.0 U	1.7 U	1.8 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	6.4 U/1.7 U	10.4 U	8.7 J	44.8

TABLE 4-1

ROUNDS 5 THROUGH 8 ANALYTICAL RESULTS SUMMARY
ANNUAL GROUNDWATER MONITORING REPORT
DRMO, NSB-NLON, GROTON, CONNECITICUT

Chemical	Primary Monitoring Criterion [1]	Secondary Monitoring Criterion [1]	ROUND 5 6MW11S 7/20/99	ROUND 5 6MW11S (DUP) 7/22/99	ROUND 6 6MW11S 10/21/99	ROUND 7 6MW11S 1/19/00	ROUND 8 6MW11S 4/12/00
VOCs (µg/L)							
1,1,2,2-TETRACHLOROETHANE	1,100	11 [4][5]	1 UJ	1 UJ	1 U	1 U	1 U
1,2-DICHLOROETHANE	29,700	99 [4][5]	1 UJ	1 UJ	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	NA	NA	2.1	1 U	2	1 U	1
TRANS-1,2-DICHLOROETHENE	NA	NA	0.25 J	1 U	0.3 J	1 U	1 U
TRICHLOROETHENE	23,400	81 [4][5]	0.21 J	0.46 J	1 U	1 U	1 U
VINYL CHLORIDE	157,500	525 [4][5]	1.1	1 U	2	1 U	1 J
SVOCs (µg/L)							
BENZO(A)ANTHRACENE	3.0	0.049 [4][5]	0.2 U	0.2 U	0.17 U	0.16 U	0.17 U
BENZO(A)PYRENE	3.0	0.049 [4][5]	0.2 U	0.2 U	0.17 U	0.16 U	0.17 U
BENZO(B)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.2 U	0.17 U	0.16 U	0.17 U
BENZO(K)FLUORANTHENE	3.0	0.049 [4][5]	0.2 U	0.2 U	0.17 U	0.16 U	0.17 U
BENZOIC ACID	NA	NA	50 U	50 U	21 U	20 UJ	
BIS(2-ETHYLHEXYL)PHTHALATE	590	5.9 [4][5]	39	34 U	2.1 U	2 U	2 U
FLUORANTHENE	37,000	370 [4][5]	0.2 U	1.2 U	1.2 U	1.1 U	1.1 U
FLUORENE	1,400,000	14,000 [4][5]	0.2 U	1.2 U	1.2 U	1.1 U	1.1 U
NAPHTHALENE	NA	NA	1 U	1 U	1.2 U	1.1 U	1.1 U
PHENANTHRENE	0.77	NA	0.2 U	0.2 U	1.2 U	1.1 U	1.1 U
PYRENE	1,100,000	11,000 [4][5]	0.21	0.2 U	1.2 U	1.1 U	1.1 U
Pesticides/PCBs (µg/L)							
4,4'-DDD	NA	0.00084 [4][5]	0.020 U	0.020 U	0.021 U	0.02 U	0.02 U
AROCLOR-1254	5.0	0.00017 [4][5]	0.20 U	0.20 U	0.21 U	0.2 U	0.2 U
AROCLOR-1260	5.0	0.00017 [4][5]	0.20 U	0.20 U	0.21 U	0.2 U	0.2 U
HEPTACHLOR EPOXIDE	0.5	0.00011 [4][5]	0.010 U	0.010 U	0.01 U	0.01 U	0.01 U
Inorganics (total/dissolved) (µg/L)							
ARSENIC	40	0.14 [4][5]	1.1 U/1.1 U	1.1 U/1.6 J	3.8 U	2.6 U	2.3 U
BARIUM	NA	NA	143/148	19.4 J/19.7 J	120	89.4	71.4
CADMIUM	60	NA	3.0 UJ/3.0 UJ	6.0 UJ/3.0 UJ	0.30 U	0.64 U	0.2 U
CHROMIUM	1,100	50 [2]	2.4 U/2.4 U	2.4 U/2.4 U	2.4 U	1 U	0.8 U
COPPER	480	2.4 [2]	4.4 J/1.9 J	1.4 UJ/3.1	3.4	5 U	4.2 U
LEAD	130	8.1 [2]	1.0 U/1.0 U	1.0 U/1.0 U	1.7 U	2.7 U	2.1 UJ
SILVER	120	1.9 [2]	2.2 U/2.2 U	2.2 U/2.2 U	1.3 U	1.1 UJ	0.9 U
ZINC	1,230	81 [2]	13.0 U/1.8 U	14.1 U/21.3 U	92.4	77.4	32.6

NOTES:
Bold numbers denote exceedance of secondary monitoring criterion. There are no exceedances of the primary monitoring criteria.
1 Surface Water Protection Criteria for substances in groundwater, using a site-specific dillution factor of 100.
2 Federal Ambient Water Quality Criteria for protection of aquatic life (chronic, saltwater).
3 Connecticut Water Quality Criteria for protection of aquatic life (chronic, saltwater).
4 Federal Ambient Water Quality Criteria for protection of human health from consumption of organisms.
5 Connecticut Water Quality Criteria for protection of human health from consumption of organisms.
J Estimated Value
R Rejected
U Undetected
NA Not Available

TABLE 4-2

GROUNDWATER ELEVATIONS - ROUNDS 5 - 8
DRMO - NSB-NLON
GROTON, CONNECTICUT

WELL	Jul-99	Oct-99	Jan-00	Apr-00
	HIGH TIDE / LOW TIDE	HIGH TIDE / LOW TIDE	HIGH TIDE / LOW TIDE	HIGH TIDE / LOW TIDE
6MW1S	2.64 / 1.44	3.36 / 1.24	4.89 / 1.43	3.08 / 0.36
6MW2S	2.75 / 1.49	3.36 / 1.32	5.01 / 1.47	3.20 / 0.60
6MW2D	7.72 / 2.11	3.48 / 2.69	4.00 / 2.41	3.39 / 2.29
6MW6S	2.90 / 2.84	3.70 / 3.58	3.67 / 3.37	3.61 / 3.51
6MW6D	2.88 / 2.83	3.66 / 3.59	3.55 / 3.39	3.60 / 3.71
6MW9S	3.11 / 2.82	4.16 / 3.72	4.04 / 3.22	3.74 / 3.28
6MW10S	2.79 / 1.78	3.38 / 1.37	4.84 / 1.61	3.19 / 0.84
6MW10D	3.43 / 2.71	3.99 / 2.93	4.56 / 2.84	4.16 / 2.62
6MW11S	2.91 / 2.66	3.53 / 1.47	4.92 / 1.56	3.30 / 0.77
6MW11D	3.11 / 2.44	3.95 / 3.02	4.54 / 2.71	4.42 / 3.14
SG-01	3.12 / 1.44	3.39 / 1.27	4.97 / 1.36	3.16 / 0.47

TABLE 4-3

GROUNDWATER - ROUNDS 5 THROUGH 8
DOWNGRADIENT GW POTENTIAL COC METAL RESULTS
COMPARED TO BACKGROUND CONCENTRATIONS
DRMO, NSB-NLON, GROTON, CONNECTICUT

PARAMETER	AVERAGE	95% UCL	MAXIMUM POSITIVE DETECTION	BACKGROUND CONCENTRATION
Total Metals (mg/L)				
ARSENIC	2.03	2.66	**7.50**	3.60
BARIUM	105	176	**280**	NA
COPPER	2.59	3.88	15.4	25.6
LEAD	1.25	1.41	9.20	17.5
ZINC	39.0	80.0	**173**	31.3
Dissolved Metals (mg/L)				
ARSENIC	2.25	3.97	**5.00**	3.60
BARIUM	99.1	251	**251**	NA
COPPER	1.11	1.66	3.30	25.6
ZINC	28.2	167	**167**	31.3

Bold indicates inorganic potential COC present in groundwater above background levels.

TABLE 4-4

DOWNGRADIENT GW RESULTS - ROUNDS 5 THROUGH 8
DETECTION STATISTICS AND 95% UPPER CONFIDENCE LIMITS
DRMO, NSB-NLON, GROTON, CONNECTICUT

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTIONS	AVERAGE	SHAPIRO-WILK W NORMAL	SHAPIRO-WILK W LOGNORMAL	SHAPIRO-WILK W TEST	DISTRIBUTION	95% UCL NORMAL	95% UCL LOGNORMAL	MAXIMUM POSITIVE DETECTION	95% UCL
Volatile Organics (µg/L)											
1,1-DICHLOROETHANE	10/28	0.4 - 1.3	0.63	0.6615	0.6851	0.924	LOGNORMAL	0.70	0.70	1.30	0.70
ACETONE	5/22	1.9 - 4.7	2.67	0.5545	0.6093	0.911	LOGNORMAL	2.88	2.86	4.70	2.86
CHLOROFORM	3/28	0.2 - 0.39	0.50	0.4802	0.5169	0.924	LOGNORMAL	0.53	0.54	0.39	0.39
CIS-1,2-DICHLOROETHENE	18/28	0.24 - 22	3.37	0.5587	0.8482	0.924	LOGNORMAL	5.25	5.85	22	5.85
METHYLENE CHLORIDE	1/28	0.7	0.99	0.1943	0.1943	0.924	LOGNORMAL	1.01	1.13	0.70	0.70
TRANS-1,2-DICHLOROETHENE	5/28	0.17 - 0.3	0.46	0.5016	0.4997	0.924	LOGNORMAL	0.49	0.51	0.30	0.30
TRICHLOROETHENE	14/28	0.2 - 6.1	1.13	0.4819	0.6576	0.924	LOGNORMAL	1.69	1.45	6.10	1.45
VINYL CHLORIDE	5/28	0.8 - 2	0.60	0.4003	0.4716	0.924	LOGNORMAL	0.70	0.66	2.00	0.66
Semivolatile Organics (µg/L)											
BIS(2-ETHYLHEXYL)PHTHALATE	14/28	1.4 - 180	14.5	0.4306	0.821	0.924	LOGNORMAL	25.7	28.5	180	28.5
DI-N-BUTYL PHTHALATE	1/28	1.2	2.59	0.3783	0.5641	0.924	LOGNORMAL	4.09	3.07	1.20	1.20
PYRENE	1/28	0.155	0.42	0.6644	0.6095	0.924	LOGNORMAL	0.48	0.60	0.16	0.16
Total Metals (µg/L)											
ALUMINUM	6/28	480 - 1,370	247	0.6176	0.8667	0.924	LOGNORMAL	376	564	1,370	564
ARSENIC	7/28	1.5 - 7.5	2.03	0.7779	0.9309	0.924	LOGNORMAL	2.53	2.66	7.50	2.66
BARIUM	27/28	19 - 280	105	0.8844	0.9511	0.924	LOGNORMAL	132	176	280	176
CALCIUM	28/28	52,400 - 342,000	179,000	0.9188	0.9459	0.924	LOGNORMAL	206,000	220,000	342,000	220,000
COBALT	1/28	2.3	1.16	0.892	0.9239	0.924	LOGNORMAL	1.35	1.45	2.30	1.45
COPPER	8/28	1.9 - 15.4	2.59	0.659	0.8866	0.924	LOGNORMAL	3.60	3.88	15.4	3.88
IRON	25/28	228 - 5,390	1,840	0.8466	0.8995	0.924	LOGNORMAL	2,400	6,810	5,390	5,390
LEAD	1/28	9.2	1.25	0.373	0.7242	0.924	LOGNORMAL	1.77	1.41	9.20	1.41
MAGNESIUM	28/28	57,600 - 827,000	449,000	0.8877	0.9107	0.924	LOGNORMAL	528,000	610,000	827,000	610,000
MANGANESE	25/28	40.3 - 2,730	573	0.786	0.7139	0.924	LOGNORMAL	749	25,000	2,730	2,730
MERCURY	1/28	0.32	0.069	0.3932	0.5592	0.924	LOGNORMAL	0.086	0.077	0.32	0.077
NICKEL	4/28	6.5 - 35.1	4.23	0.4581	0.9058	0.924	LOGNORMAL	6.29	5.85	35.1	5.85
POTASSIUM	28/28	23,400 - 349,000	178,000	0.9391	0.9295	0.924	NORMAL	207,000	236,000	349,000	207,000
SODIUM	28/28	489,000 - 7,560,000	3,650,000	0.9263	0.9407	0.924	LOGNORMAL	4,310,000	4,920,000	7,560,000	4,920,000
THALLIUM	1/28	4.8	2.50	0.6669	0.7425	0.924	LOGNORMAL	2.74	2.71	4.80	2.71
VANADIUM	15/28	1.8 - 311	19.9	0.3468	0.9484	0.924	LOGNORMAL	38.8	60.4	311	60.4
ZINC	20/28	4.5 - 173	39.0	0.786	0.9484	0.924	LOGNORMAL	53.2	80.0	173	80.0
Dissolved Metals (µg/L)											
ARSENIC	7/12	1.075 - 5	2.25	0.8619	0.9037	0.859	LOGNORMAL	3.00	3.97	5.00	3.97
BARIUM	11/12	20 - 251	99.1	0.8927	0.9307	0.859	LOGNORMAL	141	304	251	251
CALCIUM	12/12	52,100 - 342,000	195,000	0.9356	0.9078	0.859	NORMAL	239,000	279,000	342,000	239,000
COBALT	1/12	2.2	1.64	0.7131	0.6872	0.859	LOGNORMAL	1.87	1.97	2.20	1.97
COPPER	3/12	1.7 - 3.3	1.11	0.6329	0.6791	0.859	LOGNORMAL	1.58	1.66	3.30	1.66
IRON	10/12	216.3 - 4,610	1,770	0.8972	0.8363	0.859	NORMAL	2,610	153,000	4,610	2,610
MAGNESIUM	12/12	127,000 - 854,000	494,000	0.8916	0.9156	0.859	LOGNORMAL	625,000	757,000	854,000	757,000
MANGANESE	10/12	59.8 - 1,210	486	0.8655	0.6989	0.859	NORMAL	691	9,500,000	1,210	691
NICKEL	3/12	5.9 - 14.4	4.72	0.7273	0.8257	0.859	LOGNORMAL	6.52	8.35	14.4	8.35
POTASSIUM	12/12	60,800 - 314,000	182,000	0.9044	0.9252	0.859	LOGNORMAL	226,000	259,000	314,000	259,000
SODIUM	12/12	1,250,000 - 7,270,000	4,420,000	0.8804	0.9097	0.859	LOGNORMAL	5,550,000	6,600,000	7,270,000	6,600,000
VANADIUM	7/12	4.8 - 19.2	6.43	0.8737	0.8943	0.859	LOGNORMAL	9.66	32.8	19.2	19.2
ZINC	3/12	45.9 - 167	28.2	0.6019	0.8927	0.859	LOGNORMAL	54.8	266	167	167

Bold indicate parameter has been identified as a potential COC.
Data sets which fail the W test for normality and lognormality are assumed to be lognormal

TABLE 4-5

UPGRADIENT GW RESULTS - ROUNDS 5 THROUGH 8
DETECTION STATISTICS AND 95% UPPER CONFIDENCE LIMITS
DRMO, NSB-NLON, GROTON, CONNECTICUT

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTIONS	AVERAGE	SHAPIRO-WILK W NORMAL	SHAPIRO-WILK W LOGNORMAL	SHAPIRO-WILK W TEST	DISTRIBUTION	95% UCL NORMAL	95% UCL LOGNORMAL	MAXIMUM POSITIVE DETECTION	95% UCL
Volatile Organics (µg/L)											
1,1-DICHLOROETHANE	1/12	0.75 - 1	0.52	0.3270	0.3270	0.859	LOGNORMAL	0.56	0.55	0.75	0.55
ACETONE	3/9	1.8 - 4	2.61	0.6933	0.7441	0.829	LOGNORMAL	2.97	3.00	4	3.00
CHLOROFORM	1/12	0.17	0.47	0.3270	0.3270	0.859	LOGNORMAL	0.52	0.58	0.17	0.17
CIS-1,2-DICHLOROETHENE	5/12	0.75 - 6.6	2.24	0.6750	0.6687	0.859	LOGNORMAL	3.56	7.26	6.6	6.60
METHYLENE CHLORIDE	1/12	1	1.00	---	---	0.859	LOGNORMAL	1.00	1.00	1	1.00
TRICHLOROETHENE	11/12	0.3 - 11	3.66	0.6608	0.7360	0.859	LOGNORMAL	6.10	25.8	11	11.0
Semivolatile Organics (µg/L)											
BIS(2-ETHYLHEXYL)PHTHALATE	2/12	1.1 - 68	7.27	0.3751	0.5807	0.859	LOGNORMAL	17.2	16.4	68	16.4
Total Metals (µg/L)											
ALUMINUM	1/13	336	87.0	0.7404	0.9769	0.866	LOGNORMAL	130	166	336	166
BARIUM	13/13	11.4 - 58.4	30.3	0.9320	0.9447	0.866	LOGNORMAL	37.5	42.1	58.1	42.1
CALCIUM	13/13	1,910 - 86,700	28,700	0.7540	0.8827	0.866	LOGNORMAL	45,000	170,000	86,700	86,700
COBALT	2/13	3.8 - 4.3	1.69	0.8811	0.9502	0.866	LOGNORMAL	2.31	3.19	4.3	3.19
COPPER	4/13	1.6 - 3.7	1.53	0.7952	0.8168	0.866	LOGNORMAL	2.10	2.62	3.7	2.62
IRON	4/13	1,620 - 7,150	1,270	0.6442	0.7790	0.866	LOGNORMAL	2,390	251,000	7,150	7,150
MAGNESIUM	13/13	533 - 70,000	20,100	0.6623	0.8409	0.866	LOGNORMAL	34,200	374,000	70,000	70,000
MANGANESE	9/13	109 - 3,600	1,020	0.7240	0.8256	0.866	LOGNORMAL	1,700	138,000,000	3,600	3,600
MERCURY	2/13	0.14 - 0.25	0.08	0.6170	0.7069	0.866	LOGNORMAL	0.11	0.11	0.24	0.11
NICKEL	5/13	4 - 12.2	4.25	0.8871	0.9478	0.866	LOGNORMAL	5.89	9.60	12.2	9.60
POTASSIUM	13/13	701 - 25,100	8,700	0.6760	0.8481	0.866	LOGNORMAL	13,900	37,400	25,100	25,100
SODIUM	12/13	2,620 - 610,000	174,000	0.6930	0.8979	0.866	LOGNORMAL	294,000	6,830,000	610,000	610,000
VANADIUM	1/13	2.4	0.74	0.6750	0.8351	0.866	LOGNORMAL	1.02	1.05	2.4	1.05
ZINC	10/13	6.4 - 123	48.8	0.7313	0.8793	0.866	LOGNORMAL	75.4	484	123	123
Dissolved Metals (µg/L)											
ARSENIC	1/3	1.9	1.00	0.7500	0.7500	0.767	LOGNORMAL	2.31	120	1.9	1.90
BARIUM	3/3	18.6 - 44.2	32.8	0.9669	0.9249	0.767	NORMAL	54.7	220	44.2	44.2
CALCIUM	3/3	3,400 - 85,100	34,100	0.8437	0.9944	0.767	LOGNORMAL	109,000	1.69E+15	85,100	85,100
COBALT	1/3	4.7	2.83	0.7500	0.7500	0.767	LOGNORMAL	5.56	36.3	4.7	4.70
COPPER	3/3	1.9 - 2.9	2.27	0.8242	0.8395	0.767	LOGNORMAL	3.20	4.08	2.9	2.90
IRON	1/3	838	282	0.7500	0.7500	0.767	LOGNORMAL	1,090	4.38E+39	838	838
MAGNESIUM	3/3	1,290 - 69,400	24,600	0.7713	0.9116	0.767	LOGNORMAL	90,000	1.78E+22	69,400	69,400
MANGANESE	2/3	128 - 3,470	1,200	0.7774	0.9880	0.767	LOGNORMAL	4,520	1.15E+73	3,470	3,470
NICKEL	1/3	11.5	6.77	0.7500	0.7500	0.767	LOGNORMAL	13.7	120	11.5	11.5
POTASSIUM	3/3	1,510 - 23,400	9,270	0.7977	0.9169	0.767	LOGNORMAL	29,900	2.15E+12	23,400	23,400
SODIUM	3/3	8,620 - 617,000	223,000	0.7919	0.9795	0.767	LOGNORMAL	800,000	3.05E+24	617,000	617,000
ZINC	1/3	76.9	28.0	0.7829	0.9352	0.767	LOGNORMAL	99.4	2.81E+16	76.9	76.9

Bold indicate parameter has been identified as a potential COC.

Data sets which fail the W test for normality and lognormality are assumed to be lognormal.

TABLE 4-6

GROUNDWATER - ROUNDS 5 THROUGH 8
PARAMETRIC AND NONPARAMETRIC ANOVA TEST RESULTS COMPARING POTENTIAL COC
DOWNGRADIENT RESULTS WITH UPGRADIENT RESULTS
DRMO, NSB-NLON, GROTON, CONNECTICUT

PARAMETER	DOWNGRADIENT DISTRIBUTION	UPGRADIENT DISTRIBUTION	TYPE OF ANOVA	P LEVEL	ANOVA RESULT
Volatile Organics					
CIS-1,2-DICHLOROETHENE	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.2498	PASSES
TRANS-1,2-DICHLOROETHENE	LOGNORMAL	---	NON-PARAMETRIC	0.0609	PASSES
TRICHLOROETHENE	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.1027	PASSES
VINYL CHLORIDE	LOGNORMAL	---	NON-PARAMETRIC	0.0608	PASSES
Semivolatile Organics					
BIS(2-ETHYLHEXYL)PHTHALATE	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.2958	PASSES
PYRENE	LOGNORMAL	---	NON-PARAMETRIC	0.4697	PASSES
Total Metals					
ARSENIC	LOGNORMAL	---	NON-PARAMETRIC	0.1458	PASSES
BARIUM	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.0006	**FAILS**
COPPER	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.0708	PASSES
LEAD	LOGNORMAL	---	NON-PARAMETRIC	0.7475	PASSES
ZINC	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.7548	PASSES
Dissolved Metals					
ARSENIC	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.1818	PASSES
BARIUM	LOGNORMAL	NORMAL	NON-PARAMETRIC	0.1939	PASSES
COPPER	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.0576	PASSES
ZINC	LOGNORMAL	LOGNORMAL	PARAMETRIC	0.9960	PASSES

Downgradient results are in statistically significant exceedance of upgradient results when p level is less than 0.05.

TABLE 4-7

GROUNDWATER - ROUND 5 THROUGH 8
PARAMETRIC ANOVA RESULTS COMPARING POTENTIAL COC
DOWNGRADIENT RESULTS WITH UPGRADIENT RESULTS
DRMO, NSB-NLON, GROTON, CONNECTICUT

Parameter	Degrees of Freedom Effect	Sum of Squares Effect	Degrees of Freedom Error	Sum of Squares Error	F	p-level	ANOVA RESULT
CIS-1,2-DICHLOROETHENE	1	31.04	44	22.83	1.36	0.25	PASSES
TRICHLOROETHENE	1	23.15	44	8.33	2.78	0.10	PASSES
BIS(2-ETHYLHEXYL)PHTHALATE	1	947.23	44	846.17	1.12	0.30	PASSES
BARIUM	1	59,000.52	44	4,314.63	13.67	0.0006	**FAILS**
COPPER	1	21.64	44	6.31	3.43	0.07	PASSES
ZINC	1	216.34	44	2,190.41	0.10	0.75	PASSES
ARSENIC, FILTERED	1	3.74	13	1.88	1.99	0.18	PASSES
COPPER, FILTERED	1	3.22	13	0.74	4.34	0.06	PASSES
ZINC, FILTERED	1	0.07	13	2,510.66	0.00003	0.996	PASSES

Downgradient results are in statistically significant exceedance of upgradient results when p level is less than 0.05.

TABLE 4-8

GROUNDWATER - ROUND 5 THROUGH 8
WILCOXON RANK-SUM RESULTS COMPARING POTENTIAL COC
DOWNGRADIENT RESULTS WITH UPGRADIENT RESULTS
DRMO, NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Downgradient			Upgradient			Z Score	p-level	Adjusted Z Score (1)	Adjusted p-level (2)	ANOVA RESULT
	Total of Ranks	Number of Samples	Avg Rank	Total of Ranks	Number of Samples	Avg Rank					
TRANS-1,2-DICHLOROETHENE	613	28	21.9	468	18	26.0	-1.01284	0.3111	-1.874490738	0.0609	PASSES
VINYL CHLORIDE	703	28	25.1	378	18	21.0	1.012836	0.3111	1.875085	0.0608	PASSES
PYRENE	628.5	28	22.4	452.5	18	25.1	-0.66397	0.5067	-0.723035	0.4697	PASSES
ARSENIC	721.5	28	25.8	359.5	18	20.0	1.429224	0.1530	1.454608	0.1458	PASSES
LEAD	644	28	23.0	437	18	24.3	-0.3151	0.7527	-0.321906	0.7475	PASSES
BARIUM, FILTERED	105	12	8.8	15	3	5.0	1.299038	0.1939	1.299038	0.1939	PASSES

(1) Adjusted for tied rankings.
(2) Downgradient results are in statistically significant exceedance of upgradient results when p level is less than 0.05.

TABLE 4-9

GROUNDWATER - ROUNDS 5 THROUGH 8
COMPARISON OF POTENTIAL COCS ABOVE BACKROUND AND
UPGRADIENT CONCENTRATIONS TO SURFACE WATER PROTECTION CRITERIA
DRMO, NSB-NLON, GROTON, CONNECTICUT

	Average				Cummulative	Site Specific	CTDEP
	Round 5	Round 6	Round 7	Round 8	Average	SWPC	SWPC
Downgradient Metals (ug/L)							
Total Barium	109	111	109	90.3	105	NA	NA

	Maximum				Cummulative	Site Specific	CTDEP
	Round 5	Round 6	Round 7	Round 8	Maximum	SWPC	SWPC
Upgradient Metals (ug/L)							
Total Barium	45.6	58.1	39.3	44.8	58.1	NA	NA

(1) Surface Water Protection Criteria for Substances in Groundwater, using a Site-Specific Dilution Factor of 100 (B&R Environmental, September 1997).

(2) Surface Water Protection Criteria for Substances in Groundwater, using a Site-Specific Dilution Factor of 10 (Connecticut Department of Environmental Protection, December 1995).

Bold indicated value exceeds criteria

TABLE 4-10

GROUNDWATER - ROUNDS 1 THROUGH 8
PEARSON CORRELATION COEFFICIENTS (r) BETWEEN CONCENTRATION AND OXIDATION-REDUCTION POTENTIAL (ORP) FOR SELECTED METALS
DRMO, NSB-NLON, GROTON, CONNECTICUT

	ORP	
Metal	**Total**	**Dissolved**
Arsenic	-0.29	-0.27
Barium	**-0.64**	**-0.43**
Chromium	-0.15	0.12
Silver	0.13	-0.06
Zinc	-0.11	-0.05

Pearson's r is always between -1 and +1, where -1 means a perfect negative, +1 a perfect positive relationship and 0 means the perfect absence of a relationship.

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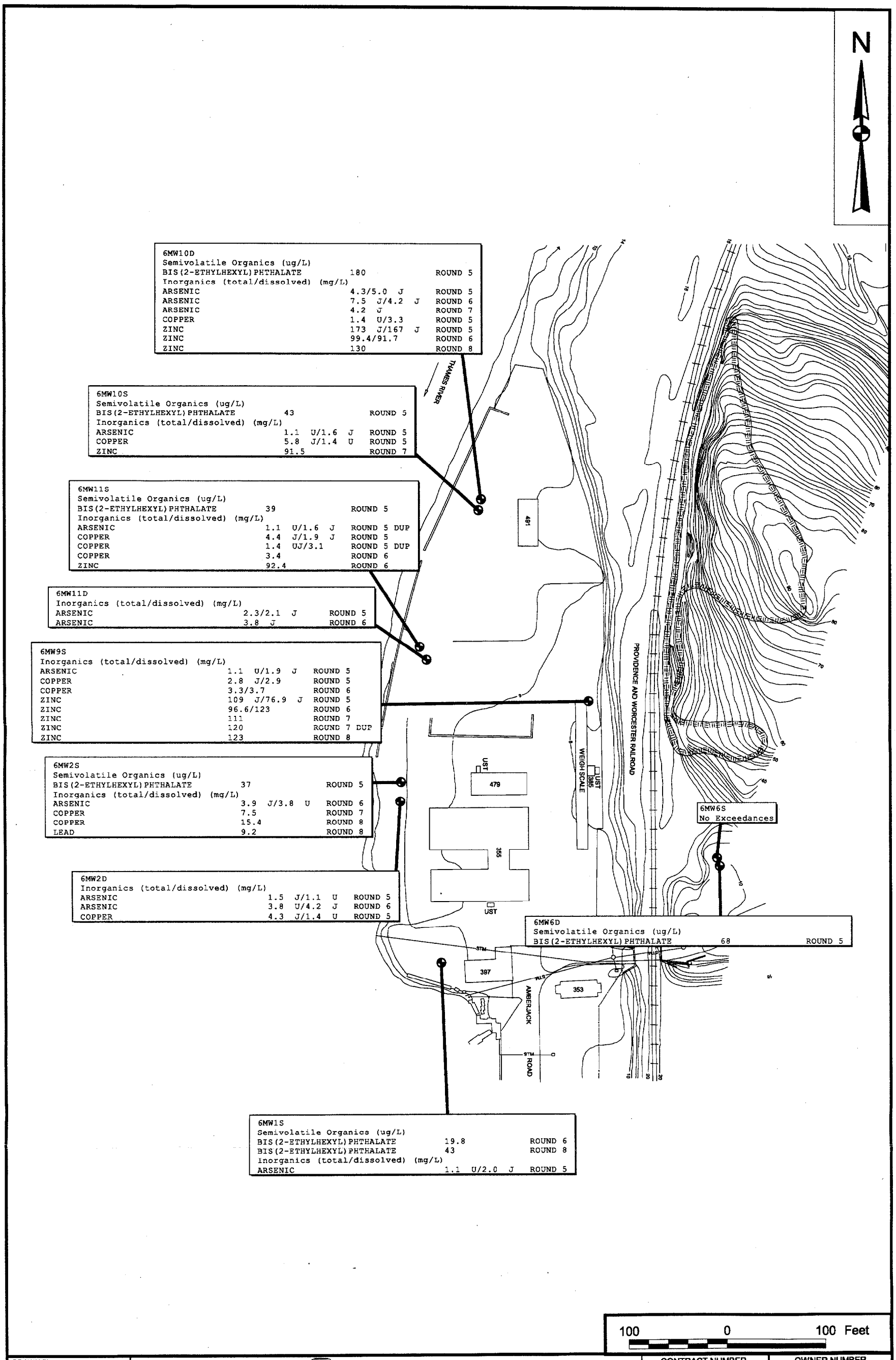

DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NUMBER
J. LAMEY	8/24/00		7363	—
CHECKED BY	DATE	EXCEEDANCES OF SECONDARY MONITORING CRITERIA IN GROUNDWATER ROUNDS 5 THROUGH 8 DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel	DATE 10/17/00
MLM	10/17/00		APPROVED BY —	DATE —
COST/SCHEDULE-AREA			DRAWING NO. FIGURE 4-1	REV 0
SCALE AS NOTED				

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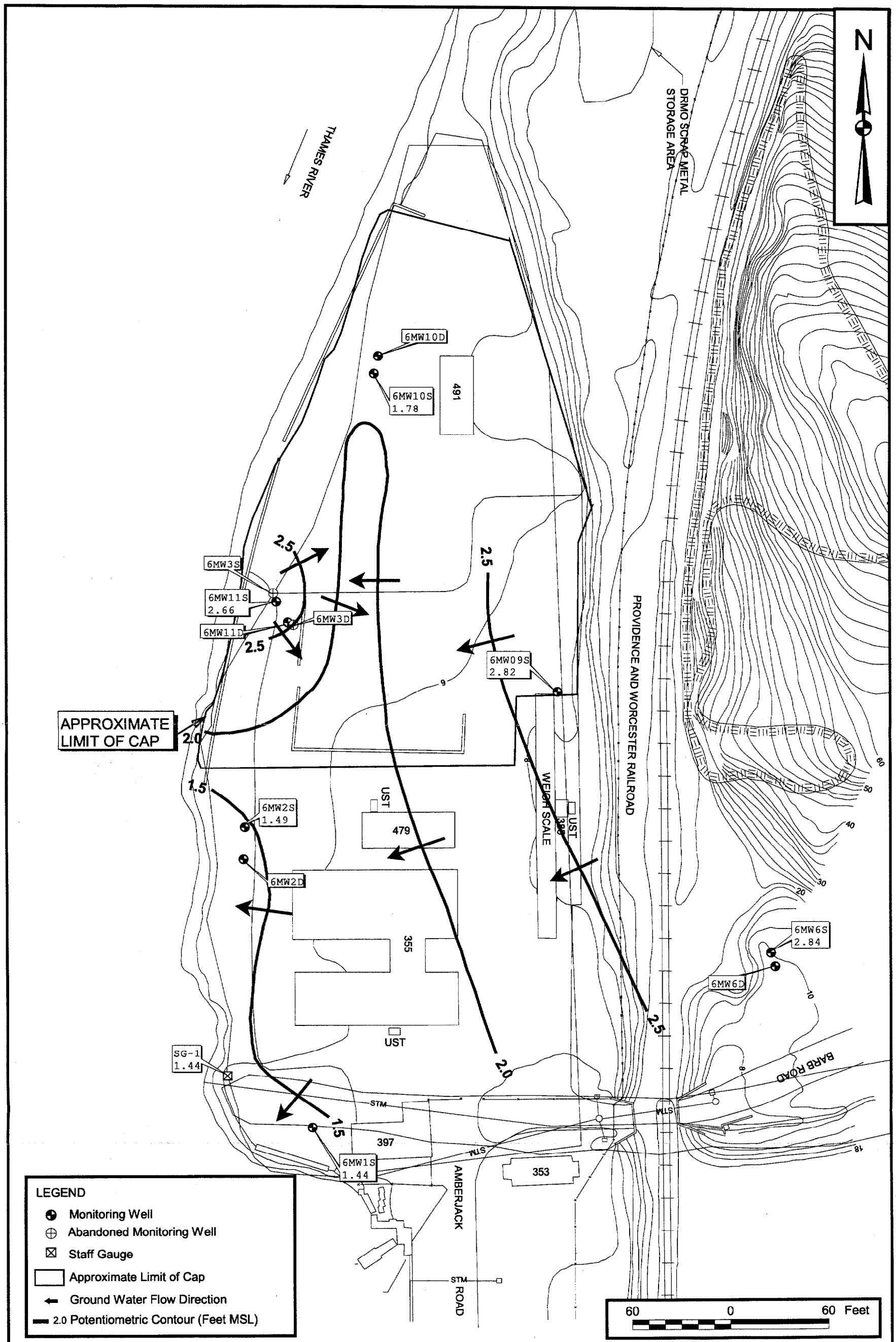

DRAWN BY J. LAMEY DATE 12/6/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER —	OWNER NUMBER —
CHECKED BY C. RICH DATE 10/23/00	LOW TIDE POTENTIOMETRIC SURFACE MAP ROUND 5 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mungel DATE 10/24/00	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 4-2	REV 0

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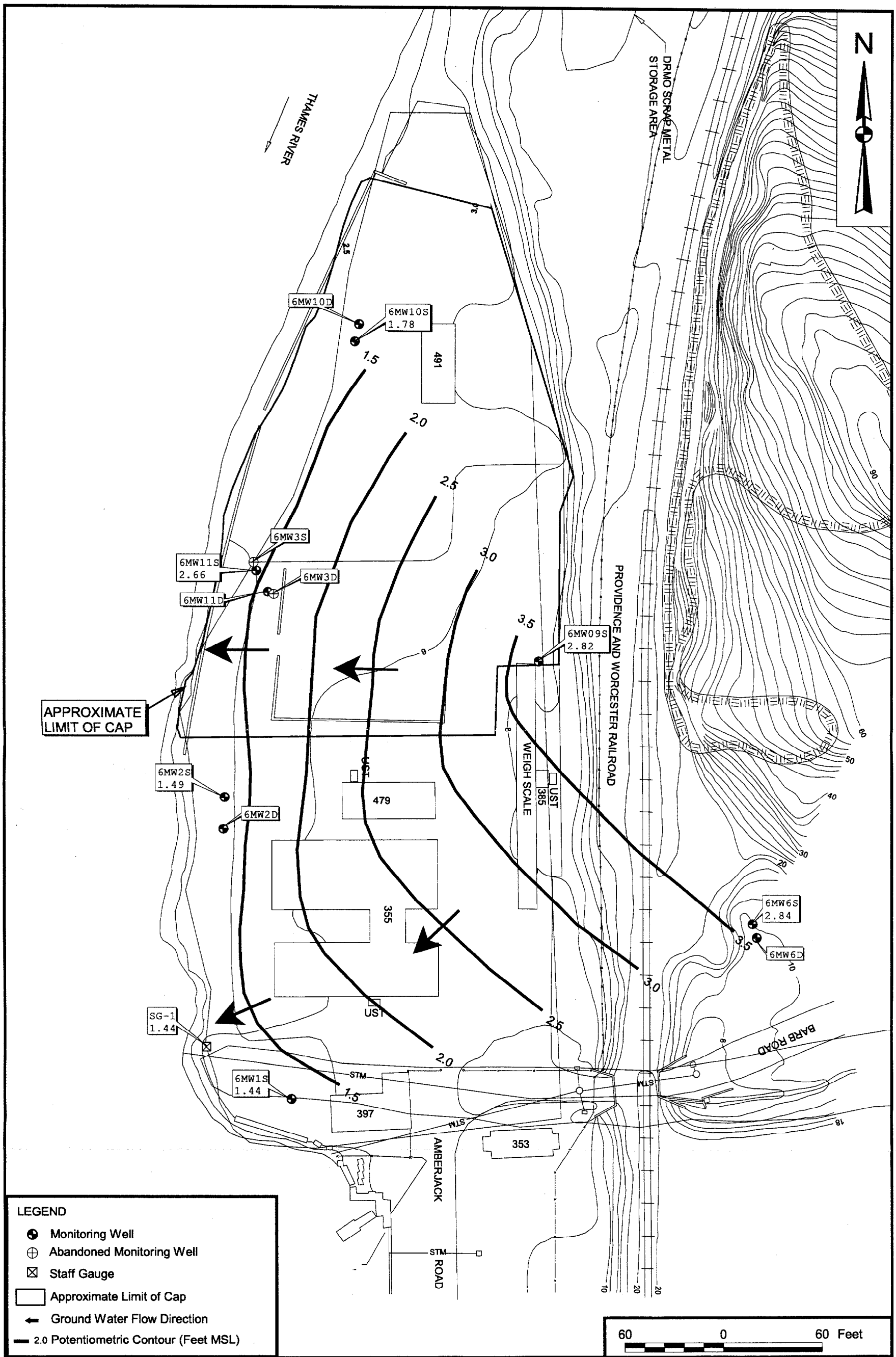

DRAWN BY J. BELLONE — DATE 1/14/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7363	OWNER NUMBER —
CHECKED BY C. RICH — DATE 10/23/00	LOW TIDE POTENTIOMETRIC SURFACE MAP ROUND 6 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mungel — DATE 10/24/00	
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 4-3	REV 0

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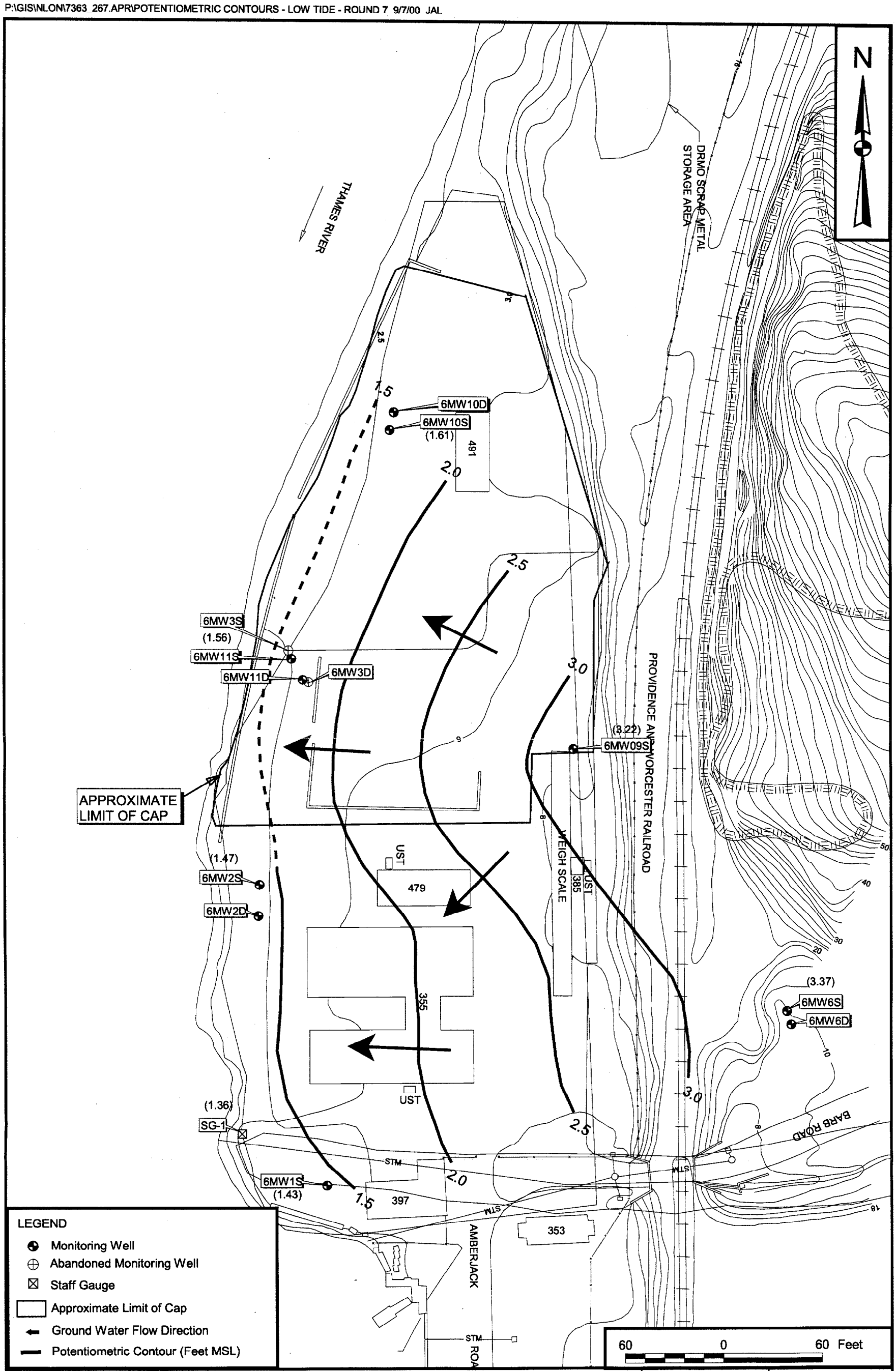

DRAWN BY J. BELLONE DATE 3/30/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER —	OWNER NUMBER —
CHECKED BY C. RICH DATE 10/23/00	LOW TIDE POTENTIOMETRIC SURFACE MAP MONITORING WELL LOCATIONS ROUND 7 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel DATE 10/24/00	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 4-4	REV 0

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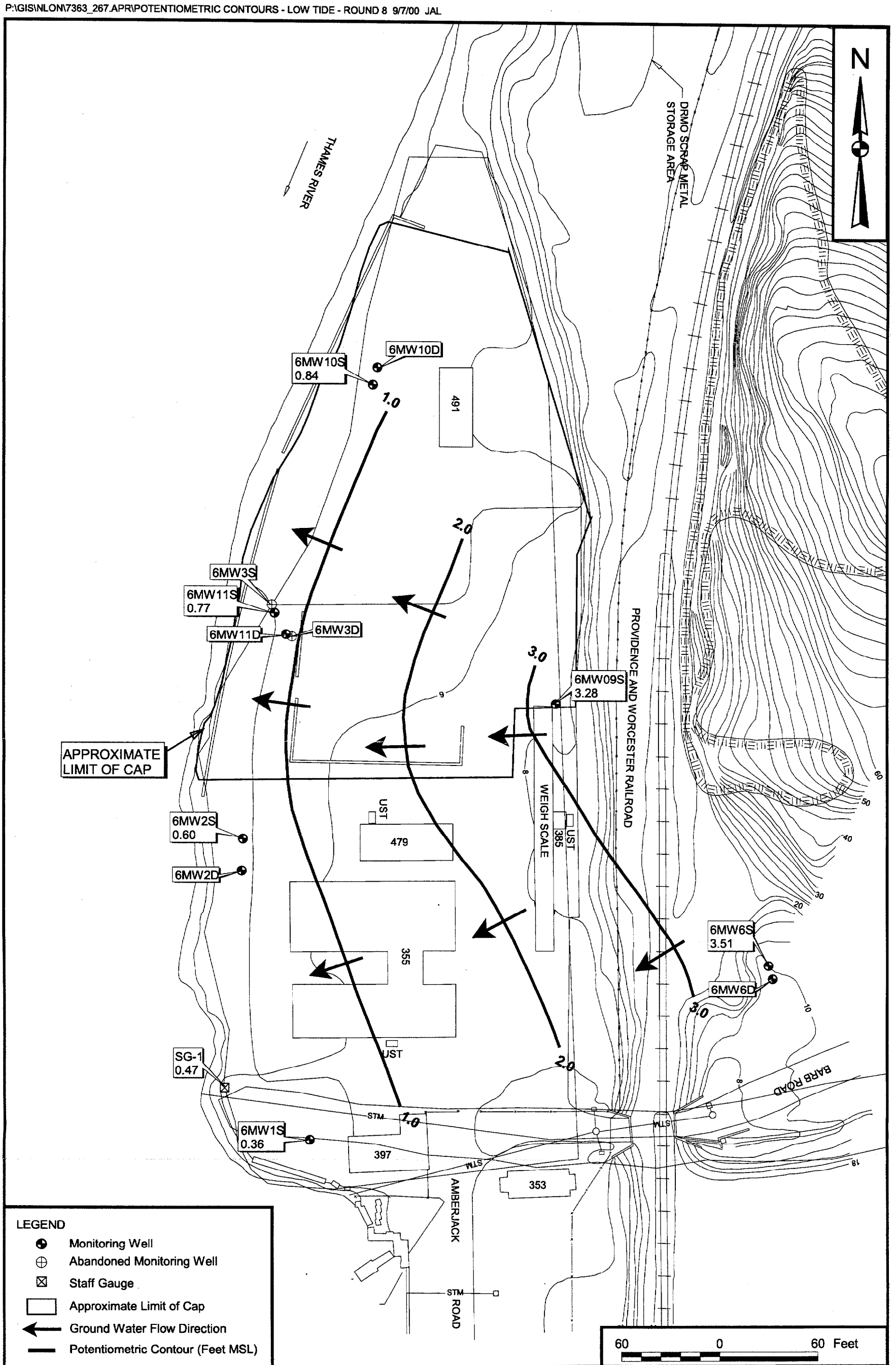

DRAWN BY J. LAMEY	DATE 7/19/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER —	OWNER NUMBER —
CHECKED BY C. RICH	DATE 10/23/00	LOW TIDE POTENTIOMETRIC SURFACE MAP MONITORING WELL LOCATIONS ROUND 8 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel	DATE 10/24/00
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4-5	REV 0

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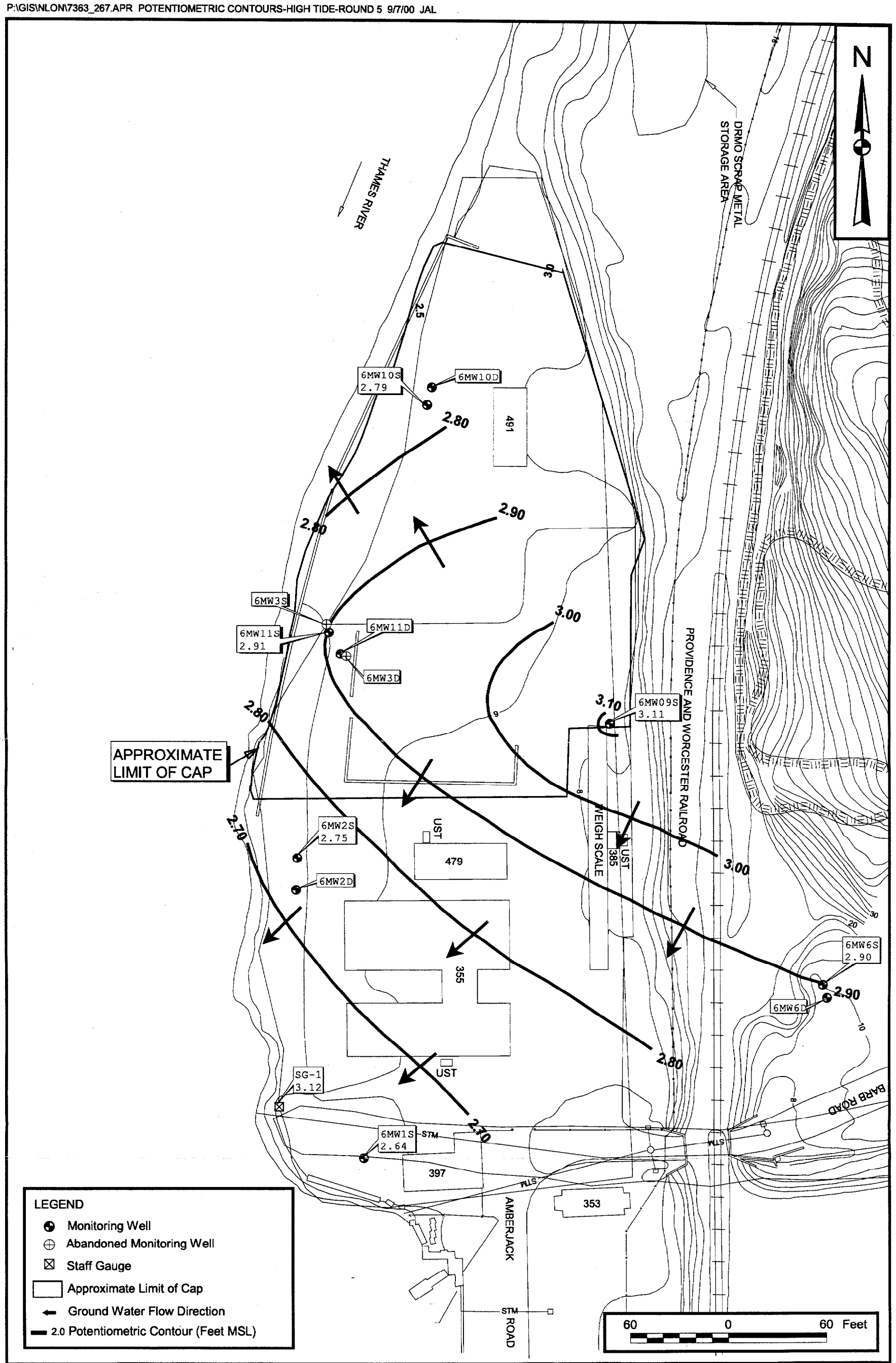

DRAWN BY J. LAMEY — DATE 12/6/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER —	OWNER NUMBER —
CHECKED BY C. RICH — DATE 10/23/00	HIGH TIDE POTENTIOMETRIC SURFACE MAP ROUND 5 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel — DATE 10/24/00	
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 4-6	REV 0

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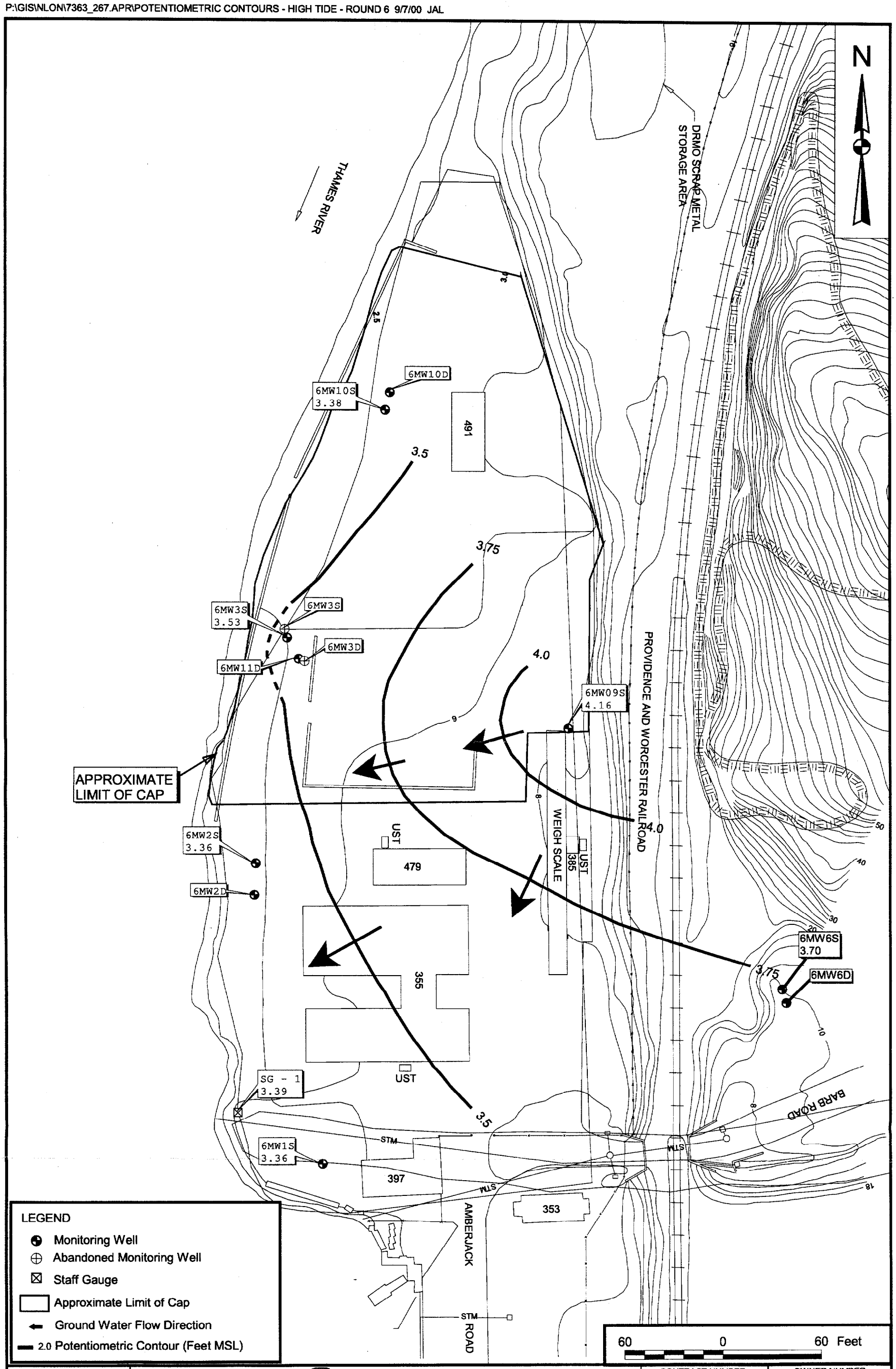

DRAWN BY J. BELLONE — DATE 1/14/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7363	OWNER NUMBER —
CHECKED BY C. RICH — DATE 10/23/00	HIGH TIDE POTENTIOMETRIC SURFACE MAP ROUND 6 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel — DATE 10/24/00	
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 4-7	REV 0

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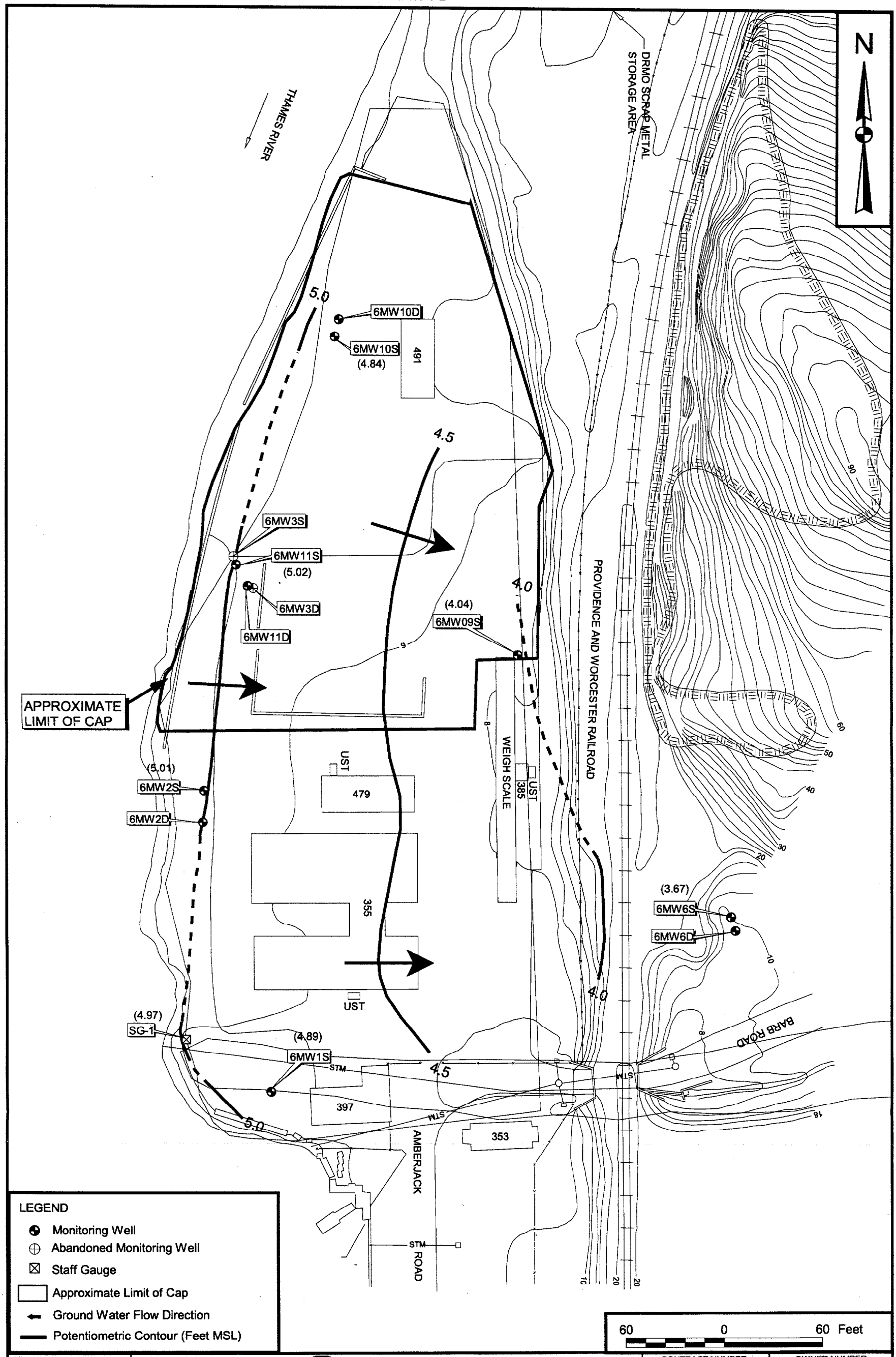

DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NUMBER
J. BELLONE	3/30/00		—	—
CHECKED BY	DATE	HIGH TIDE POTENTIOMETRIC SURFACE MAP MONITORING WELL LOCATIONS ROUND 7 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON CONNECTICUT	APPROVED BY	DATE
C. RICH	10/23/00		Mark L. Mengel	10/24/00
COST/SCHEDULE-AREA			APPROVED BY	DATE
			—	—
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 4-8	0

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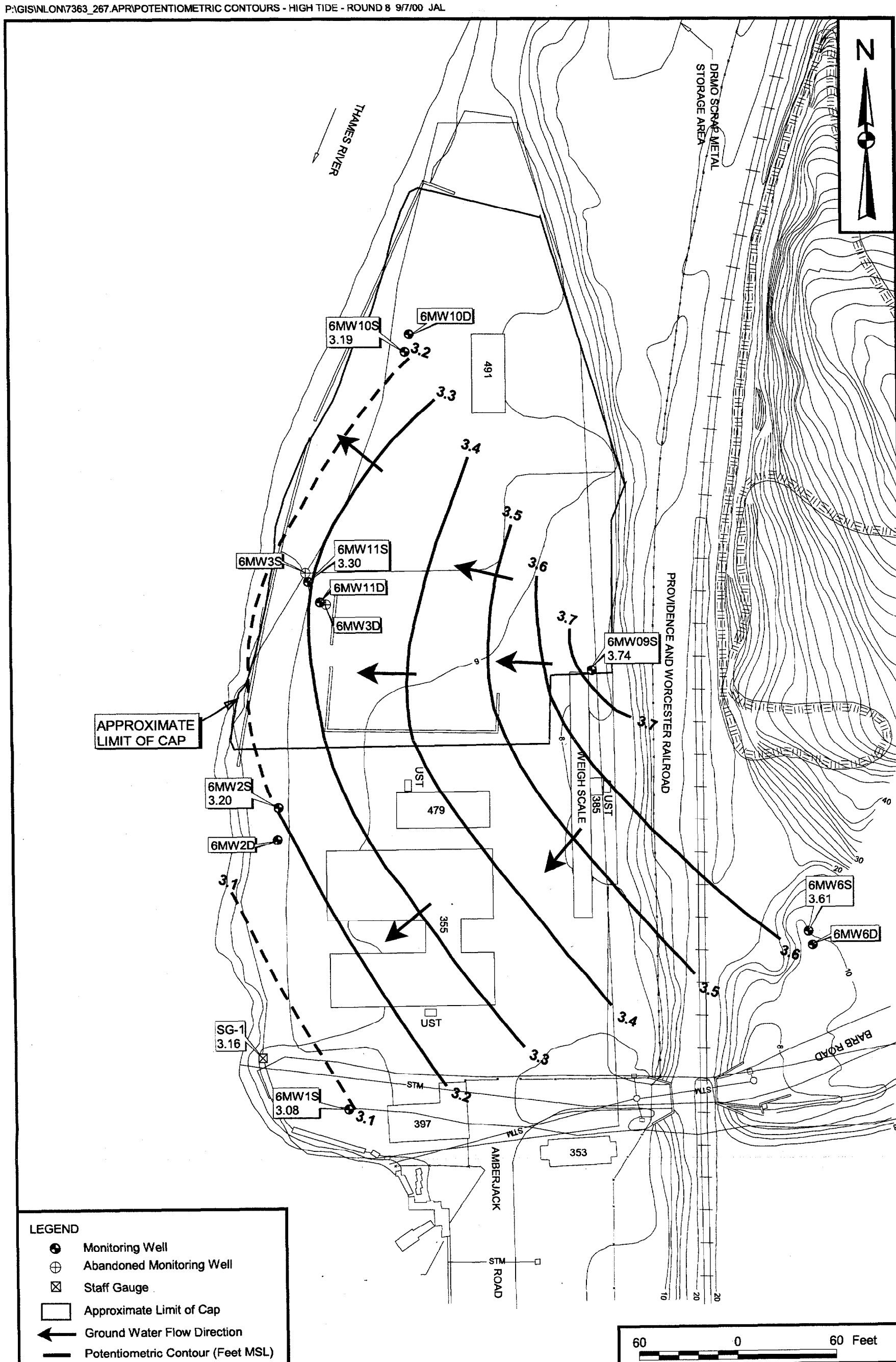
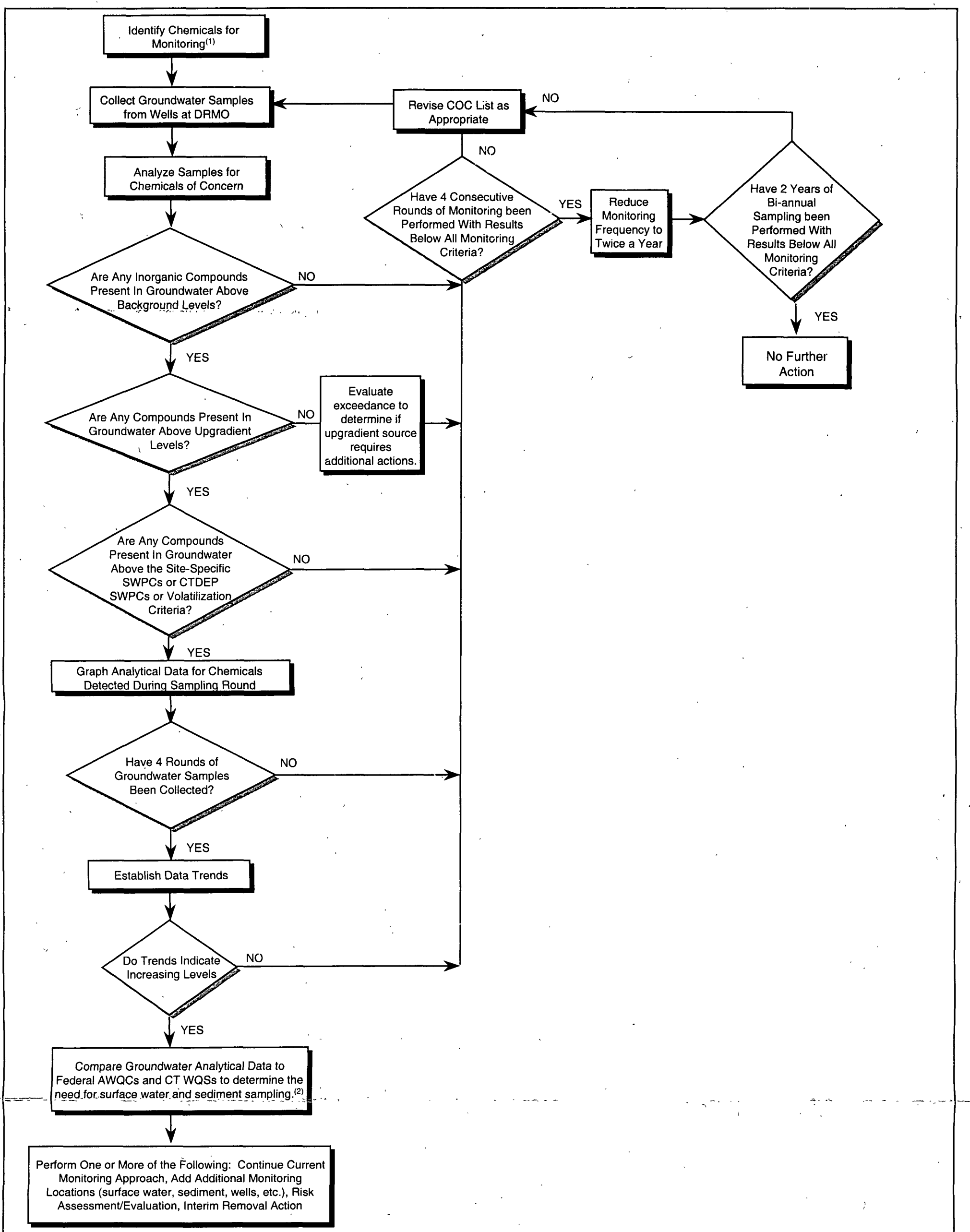


DRAWN BY J. LAMEY	DATE 7/20/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER —	OWNER NUMBER —
CHECKED BY C. RICH	DATE 10/23/00	HIGH TIDE POTENTIOMETRIC SURFACE MAP MONITORING WELL LOCATIONS ROUND 8 GROUNDWATER SAMPLING DRMO NSB-NLON, GROTON, CONNECTICUT	APPROVED BY Mark L. Mengel	DATE 10/24/00
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4-9	REV 1



(1) Initially evaluate soil contaminants which exceed the CTDEP Pollutant Mobility Criteria for GB classified groundwater. Evaluate chemicals in groundwater which exceed the site-specific Surface Water Protection Criteria (SWPCs) and Volatilization Criteria. Also include COCs identified in the Site 6 DRMO Feasibility Study and PCBs.

(2) Surface water samples will be compared to the Federal AWQCs and Connecticut WQSs; sediment samples will be compared to NOAA ERLs/ERMs.

FIGURE 4-10

GROUNDWATER MONITORING PLAN DECISION DIAGRAM
DRMO
NSB-NLON, GROTON, CONNECTICUT

TETRA TECH NUS, INC.

Figure 4 - 11

Average Downgradient Concentration of Barium as a Function of Time

Rounds 1 Through 8

NSB - NLON, Groton, Connecticut

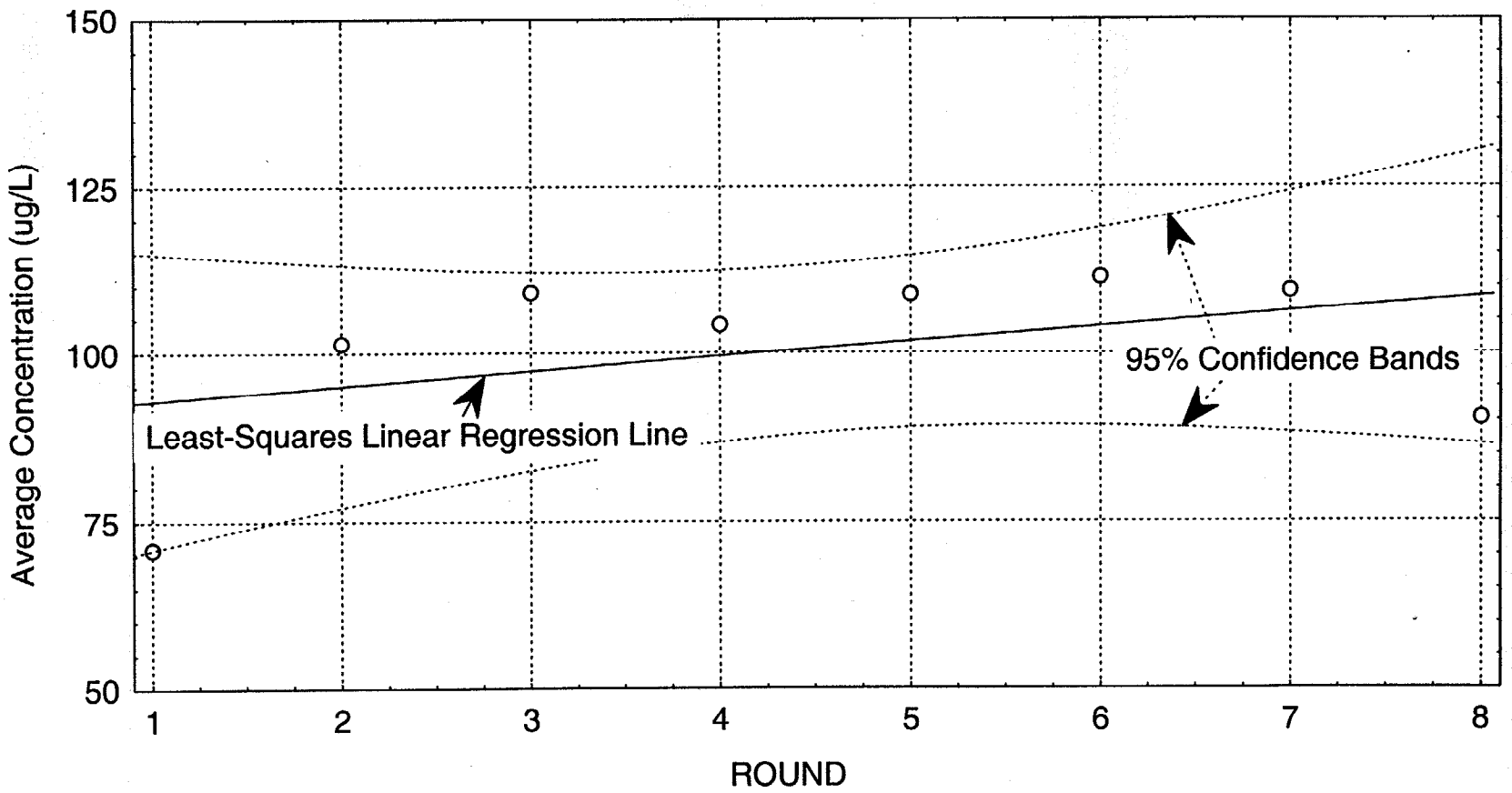


Figure 4 - 12
Average Downgradient Concentration of Arsenic as a Function of Time
Rounds 1 Through 8
NSB - NLON, Groton, Connecticut

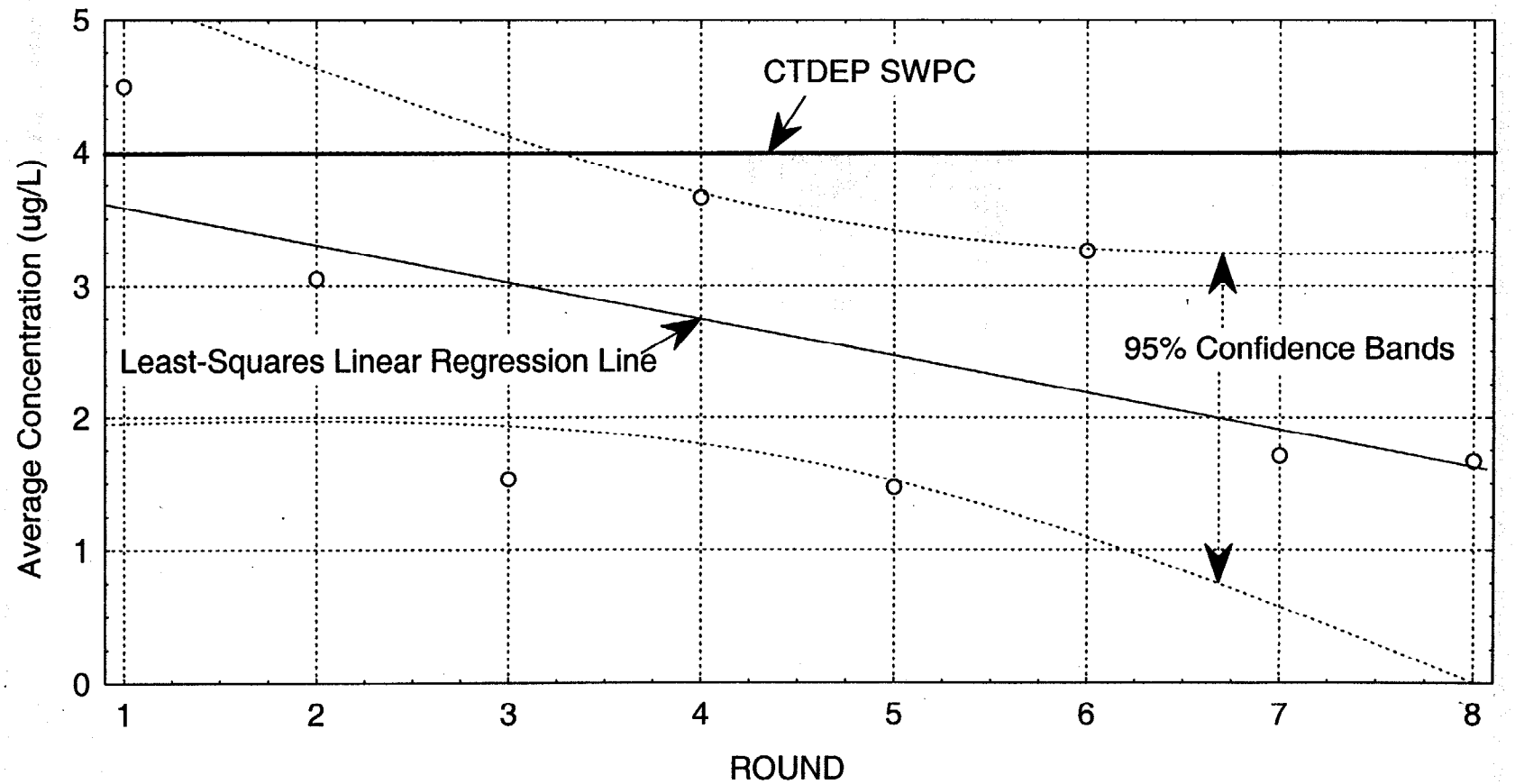
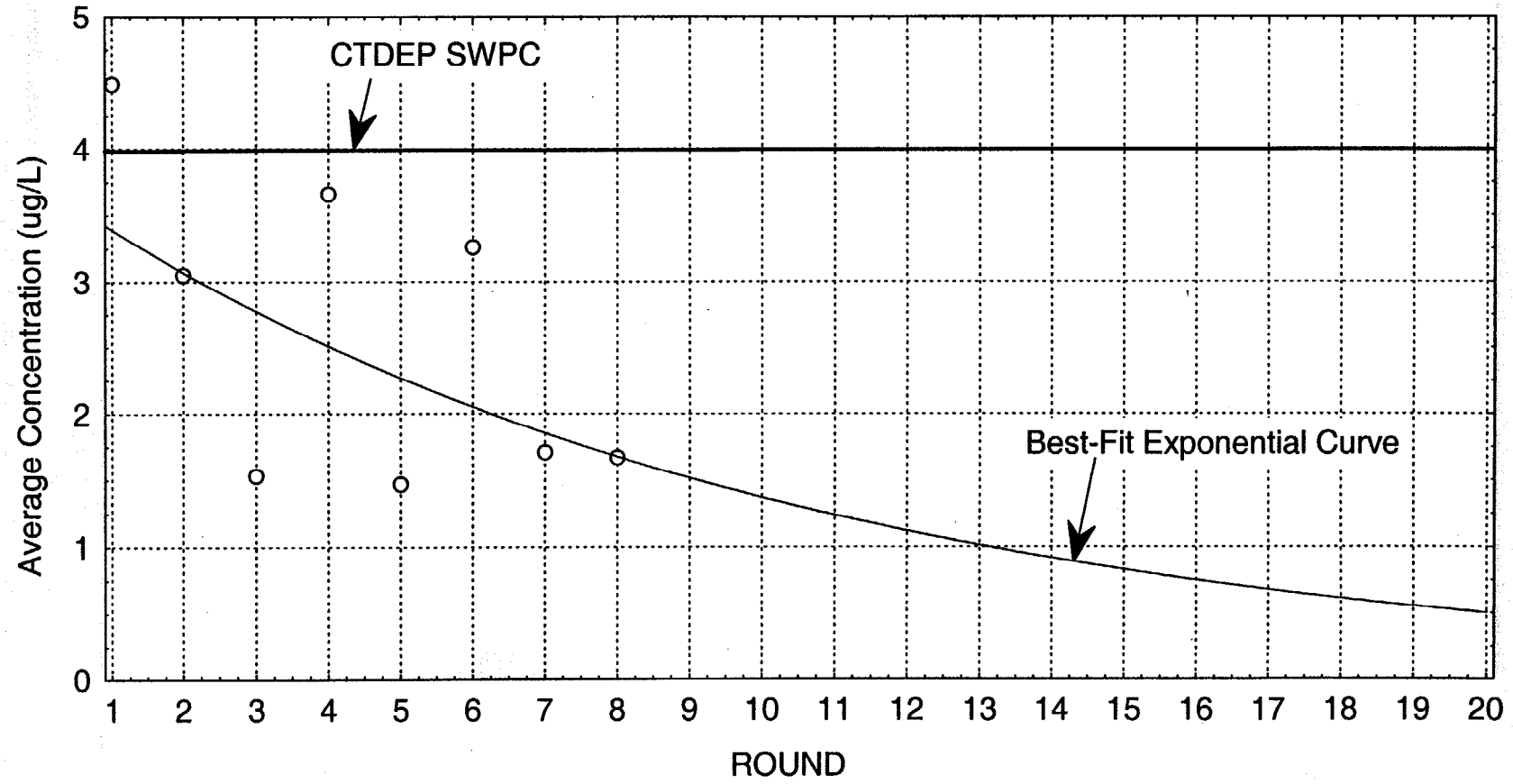


Figure 4 - 13

Average Downgradient Concentration of Arsenic as a Function of Time

Rounds 1 Through 20 - Extrapolated

NSB - NLON, Groton, Connecticut



5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

This groundwater monitoring report summarizes the previous 4 rounds (5 through 8) of quarterly groundwater analytical data collected from 10 monitoring wells installed at the DRMO to monitor groundwater quality beneath the asphalt cap installed as part of the post closure activities at the DRMO. As previously stated, the list of COCs evaluated consists of those contaminants identified in the Groundwater Monitoring Plan as shown on Table 4-1 of this report. To verify that contaminants are not migrating from the site at concentrations above criteria, the analytical results were compared to site-specific Surface Water Protection Criteria (SWPCs). The analytical results were also compared to Federal Ambient Water Quality Criteria (AWQCs) and the Connecticut Water Quality Standards (WQSs) as secondary monitoring criteria. The ultimate goal of the monitoring program is to attain surface water protection requirements for those contaminants.

The results obtained during rounds 5 through 8 of groundwater monitoring for volatile and semivolatile organic compounds indicated no exceedances of any State of Connecticut Surface Water Protection Criteria (SWPCs). Bis(2-ethylhexyl)phthalate (BEHP) exceeded the secondary monitoring criteria in several samples. The concentration ranges (19.8 µg/l to 180 µg/l) noted during the most recent sampling were similar those reported during the first year of monitoring (7 µg/l to 130 µg/l). The low concentrations of BEHP that were detected may be attributable to laboratory artifacts as no clear pattern has been exhibited in any monitoring wells. Phthalate esters have been detected in laboratory QA/QC blanks and samples depending on plastics (gloves, sample tubing) used during sample collection, preparation, and analyses. An examination of the various exceedances of secondary monitoring criteria, do not indicate any increasing or decreasing trends.

Results of the inorganics analyses indicated some positive results for arsenic, copper, lead and zinc in excess of the secondary screening criteria; however, none of the positive results exceeded the respective SWPCs which are the primary screening criteria. No other metals exceeded either primary or secondary screening criteria.

As stated in Section 4.2, contaminant concentrations detected in upgradient monitoring wells (6MW9S, 6MW6S and 6MW6D) were compared to the remaining monitoring wells located downgradient. The statistical comparisons indicated that upgradient and downgradient concentrations of both organic and inorganic COCs were found to be similar except for total barium. The average barium concentrations for each round were plotted as a function of time and compared to the Connecticut SWPCs. As shown on Figure 4-9 the average concentrations for barium show a slight upward trend, although data from the

most recent sampling round showed the second lowest result of the eight rounds. It should also be noted that there is currently no primary or secondary screening criteria established for barium.

Average total arsenic concentrations which exceeded the CTDEP SWPC during the first year, did not exhibit similar concentrations during the last four sampling rounds (rounds 5 – 8) as shown on Figure 4-10.

A review of the inorganic results revealed that in several instances total metal concentrations were less than dissolved metal concentrations. Typically, dissolved metal concentrations are lower as the filtering process removes particulate matter to which the metals bond. For the instances where dissolved metal concentrations exceed total metal concentrations, the concentration variance is primarily attributed to instrumentation fluctuation near the instrument detection limit. Instrumentation signal fluctuation, can result in the reporting of concentrations that marginally exceed the instrument detection limit. Another condition suspected of contributing to the variance between total and dissolved metal concentrations is random laboratory contamination.

In summary, the current groundwater monitoring program compares groundwater data to State SWPCs to determine the effects of any potential release to a surface water body, i.e., the Thames River. Through the second year of monitoring (8 rounds), no exceedances of any of the SWPCs (primary monitoring criteria) were noted. The exceedances highlighted within Table 4-1 are exceedances of secondary monitoring criteria. These exceedances did not exhibit any notable increasing or decreasing spatial trends over the previous two years. Statistically, there was no increase in contaminant concentrations detected in downgradient monitoring wells as compared to upgradient wells, except for barium, which overall exhibited a slight increasing temporal trend.

5.2 RECOMMENDATIONS

The analytical results for the second year of groundwater monitoring sampling indicate no exceedances of the SWPCs, although several contaminants were detected in excess of the secondary monitoring criteria. Because of the various exceedances of secondary monitoring criteria, groundwater monitoring should be continued through year three to further evaluate these chemical concentrations.

The following considerations should be discussed between the Navy, EPA and CTDEP should contaminant concentrations remain similar to those exhibited to date.

- Through 8 rounds of groundwater monitoring no exceedances of primary or secondary monitoring criteria have been noted for volatile organic compounds. Consideration should be given to eliminating VOCs from the analytical suite.

- Only minor exceedances (less than primary monitoring criteria) of the semivolatile organic compound bis(2-ethylhexyl)phthalate were noted. Consideration should be given to reducing the sampling frequency for semivolatile organics from quarterly to biannual.

- Maintain monitoring well integrity (well maintenance, well development) in case of extended monitoring.

- Discuss endpoint for groundwater monitoring if current trends continue.

REFERENCES

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(SCS, 1983): Soil Survey of New London County Connecticut. Soil Conversation Service.

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(USGS, 1967): Bedrock Geologic Map of the Uncasville Quadrangle, New London County, Connecticut. United States Geological Survey.

U.S. EPA 530/SW-89-026. "Guidance Document on the Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities." 1989.

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APPENDIX A

GROUNDWATER SAMPLE LOGSHEETS AND LOW-FLOW PURGE DATA SHEETS

ROUND 5

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW15 - GW-05
Sample Location: 6MW15
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 072199-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7-22-99								
Time: 1155								
Method: Low Flow/Bladder Pump	Clear ✓	6.49	18.59	20.66	0.00	3.53	107.4	11.03

PURGE DATA:

Date: 7-22-99	See Attached Low Flow Purge Data Sheet for Purge Data
Method: Low Flow/Bladder Pump	
Monitor Reading (ppm): —	
Well Casing Diameter & Material Type: 2" PVC	
Total Well Depth (TD): 15.7	
Static Water Level (WL): 7.02	
One Casing Volume (gal/L): 5.4	
Start Purge (hrs): 1110	
End Purge (hrs): 1155	
Total Purge Time (min): 45	
Total Vol. Purged (gal/L): 13.5	

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 x 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	2 x 1 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2 x 1 Qt. Amber Glass	✓
TCL PAH	4° C	2 x 1 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 x 1 L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 x 1 L PE	✓
Hexachlorobiphenyl	4°C	1 x 1 Qt Amber Glass	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.: GWFD-072299 @ 0000 hrs

Signature(s): [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW1S

PROJECT:	NSB-NLON	**DATE:**	7-22-99
PROJECT NUMBER:	7363	**WEATHER:**	P cloudy 75-80°F
SITE:	DRMO	**PERSONNEL:**	T. Evans

Well Screen Depth: 5.7 / 15.7 ft.
Initial Water Level: 7.02 @ 1106 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: 12.0 ft. TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1225 ☐ Not Affected
Total Purge Volume= 13.5 (gal / L) **Total Purge Time=** 45 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1110		~~500~~ (2)		R45 D30 15psi	20.84	6.80	17.29	5.10	0.45	10.17	94.0	clear / cell Full
1115	7.05		300		20.53	6.61	19.48	3.87	0.00	11.62	98.2	
1120	7.10				20.47	6.55	19.36	3.52	0.00	11.54	100.2	
1125	7.10				20.44	6.52	19.21	3.49	0.00	11.45	101.7	
1130	7.11				20.65	6.51	19.05	3.26	0.00	11.35	102.8	
1135	7.12				20.70	6.50	18.97	3.50	0.00	11.29	103.5	
1140	7.13				20.69	6.49	18.83	3.47	0.00	11.21	104.8	
1145	7.14				20.76	6.49	18.75	3.55	0.00	11.15	105.4	
1150	7.15				20.44	6.49	18.68	3.61	0.00	11.11	106.2	
1155	7.17	13.5 total			20.66	6.49	18.59	3.53	0.00	11.03	107.4	
1155												SAMPLE
(13) ~~1207~~ 1310	7.13											End Sample

Water Quality Meter (S/N): 451 6820 (98F0324 AB)
Control Box Type (S/N): QED Well Wizard (16729)
Turbidimeter (S/N): LaMotte 2020 (6896-4[illegible])

Notes: 370mL per cycle

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW25 - GW-05
Sample Location: GMW25
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 072199-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7-21-99								
Time: 1120								
Method: Low Flow/Bladder Pump	CLEAR	7.19	34.03	22.1	5.0	2.48	-146.7	21.29

PURGE DATA:

Date: 7-21-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): NA
Well Casing Diameter & Material
Type: PVC 2"
Total Well Depth (TD): 13.6
Static Water Level (WL): 5.56
One Casing Volume (gal/L): 1.3
Start Purge (hrs): 1011
End Purge (hrs): 1116
Total Purge Time (min): 65
Total Vol. Purged (gal/L): 3.4

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	✓
HEX CHROMIUM	4°C	QT AMBER GLASS	✓

OBSERVATIONS / NOTES:

START SAMPLING 1117
END SAMPLING 1200 WATER LEVEL 5.78'

LT. SULFUR ODOR

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): T. Evans / K. Simpson

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW2S

PROJECT:	NSB-NLON	**DATE:**	7-21-99
PROJECT NUMBER:	7363	**WEATHER:**	WARM 83° SUNNY
SITE:	DRMO	**PERSONNEL:**	K. SIMPSON

Well Screen Depth: 3.6 / 13.6 ft.
Initial Water Level: 5.56 @ 1010 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: 10.0 ft. TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1135 ☐ Not Affected
Total Purge Volume= 13 (~~gal~~ L)
Total Purge Time= 65 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1015	5.68	0	200	30D/50R	21.3	6.38	31.36	5.52	5.0	19.56	-123.0	
1020	5.55	↓	↓	10 PSI	21.2	6.73	32.33	4.77	4.6	20.22	-133.0	
1025 (WL 5.58)	5.48				21.0	6.90	33.08	4.10	4.1	20.75	-139.4	
1030	5.63				21.0	6.98	33.30	3.75	4.7	20.89	-142.8	LET PUMP WENT
1040	5.65				22.0	7.06	33.46	3.49	5.0	20.98	-135.4	TO NEX TO BY
1045	5.65				22.1	7.07	33.37	2.74	5.0	20.92	-137.7	BATTERIES FOR
1105	5.65				22.1	7.17	33.66	2.47	5.0	21.05	-147.5	CONTROL BOX
1110	5.67				22.1	7.18	34.00	2.40	5.0	21.20	-148.3	TIM G. WAS AT
1115	5.69	13,000	↓	↓	22.1	7.19	34.03	2.48	5.0	21.29	-146.7	WELL 20 EQUIPMENT
												WAS IN SIGHT

Water Quality Meter (S/N): 222362R
Control Box Type (S/N): 16626
Turbidimeter (S/N): 0896 4098

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW2D -GW-05
Sample Location: 6MW2D
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 072899-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7-21-99								
Time: 1125								
Method: Low Flow/Bladder Pump	Clear	6.82	31.71	17.44	9.5	0.35	-265.8	19.78

PURGE DATA:

Date: 7-21-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 78.8
Static Water Level (WL): 5.67
One Casing Volume(gal/L): ~~45~~ 45
Start Purge (hrs): 1015
End Purge (hrs): 1121
Total Purge Time (min): 66
Total Vol. Purged (gal/L): 12.9

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 X 40 ml Vial	✓ ✗
TCL SEMIVOLATILES	4° C	2 X 1 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2 X 1 Qt. Amber Glass	✓
TCL PAH	4° C	2 X 1 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 X 1 L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 X 1 L PE	✓
HEXACHLOROBIPHENYL	4°C	2 X 1 QT AMBER GLASS	✓

OBSERVATIONS / NOTES:

* water effervescing on contact w/ HCl pres. in VOCs

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s): [signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW2D

PROJECT:	NSB-NLON	**DATE:**	7-21-99
PROJECT NUMBER:	7363	**WEATHER:**	Sunny 75-80°F
SITE:	DRMO	**PERSONNEL:**	T Evans

Well Screen Depth: 68.8 / 78.8 ft.
Initial Water Level: 5.67 @ 1008 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: ~~80.0~~ 73.0 ft. TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1135 ☐ Not Affected
Total Purge Volume= 12.9 (gal/L) **Total Purge Time=** 66 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1015		500		D6 K45 48psi	20.22	7.18	33.90	1.11	7.9	21.32	-143.3	Clear / Cell Full
1020	5.80	720	144		18.99	6.85	33.61	0.37	7.0	21.19	-152.4	H_2S odor
1025	5.95	780	156		18.15	6.77	32.92	0.26	4.7	20.64	-148.1	gray tint
1030	5.91	940	188		17.94	6.77	32.54	0.24	5.2	20.31	-146.7	
1035	5.97	1150	230		17.80	6.80	32.09	0.35	6.9	19.98	-150.9	
1040	5.93	780	156		17.86	6.80	31.71	0.38	7.0	19.79	-158.0	
1045	6.02	1150	230		17.84	6.81	31.39	0.41	8.0	19.59	-173.4	
1050	5.90	810	162		17.69	6.82	30.72	0.32	8.0	19.17	-186.3	
1055	5.91	810	162		17.56	6.82	31.16	0.21	8.5	19.54	-198.0	
1100	6.04	980	196		17.56	6.82	31.28	0.36	8.0	19.51	-216.6	
1105	6.06	990	198		17.49	6.83	31.96	~~0.23~~	8.3	19.97	-226.4	
1110	6.06	970	194		17.50	6.82	31.56	0.37 0.34	9.3	19.73	-238.8	
1115	6.01	970	194		17.58	6.83	31.55	0.37	9.0	19.70	-250.8	
1118	5.92	670	223		17.56	6.82	31.63	0.32	9.7	19.76	-258.8	
1121	5.98	630	210		17.44	6.82	31.71	0.35	9.5	19.78	-265.8	
1125												Sample
1215	6.04											End Sample

Water Quality Meter (S/N): YSI 6820 (98F0324 AB)
Control Box Type (S/N): QED Well Wizard (16729)
T[illegible]dimeter (S/N): LaMotte 2020 (0301-[illegible]7)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO-6MW68 -GW-05
Sample Location: 6MW68
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7-19-99								
Time: 1440								
Method: Low Flow/Bladder Pump	Clear	5.78	0.309	12.09	0.90	7.36	-41.1	0.15

PURGE DATA:

Date: 7-19-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 18.6
Static Water Level (WL): 9.28
One Casing Volume(gal/L): 5.75
Start Purge (hrs): 1337
End Purge (hrs): 1435
Total Purge Time (min): 58
Total Vol. Purged (gal/L): 11.9

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 x 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	2 x 1 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2 x 1 Qt. Amber Glass	✓
TCL PAH	4° C	2 x 1 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 x 1 L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 x 1 L PE	✓
HEX CHLOROBIPHENYL	4°C	1 x 1 QT AMBER GLASS	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW6S

PROJECT:	NSB-NLON	**DATE:**	7-19-99
PROJECT NUMBER:	7363	**WEATHER:**	Hot (85-90°F) hazy
SITE:	DRMO	**PERSONNEL:**	T. Evans

Well Screen Depth: 8.6 / 18.6 ft.
Initial Water Level: 9.29 @ 1330 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: 14.0 ft. TPVC
Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected
Total Purge Volume= 11.9 (gal (L))
Total Purge Time= 58 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
~~1337~~ ~~0936~~	9.29	830		0.30 RGO 18psi	12.15	6.89	0.313	8.52		0.15	-59.5	Clear
1342		1000	200		12.11	6.64	0.310	8.38		0.15	-54.0	
1345	9.28	1010	202		11.64	6.37	0.311	9.40	3.0	0.15	-52.1	
1350	~~9.10~~	980	196	↓15psi	11.99	6.16	0.310	7.96		0.15	-47.1	
1355	9.28	910	182		11.99	6.10	0.309	8.08	3.0	0.15	-48.3	
1400	9.28	890	178		12.12	5.96	0.311	7.83	2.0	0.15	-47.9	
1405	9.28	910	182		12.08	5.92	0.309	7.42	2.4	0.15	-44.1	
1410	9.28	890	178		12.09	5.95	0.311	7.54	2.2	0.15	-46.5	
1415	9.28	910	182		12.03	5.89	0.308	7.47	2.0	0.15	-47.6	
1420	9.28	890	178		12.00	5.87	0.309	7.47	1.6	0.15	-40.3	
1425	9.28	910	182		12.08	5.81	0.309	7.51	1.2	0.15	-43.0	
1430	9.28	910	182		12.09	5.74	0.309	7.49	1.1	0.15	-39.6	
1435	9.28	900	180		12.09	5.78	0.309	7.36	0.90	0.15	-41.1	
		11.9										
1440	9.28											Sample
1525	9.28											End Sample

Water Quality Meter (S/N): YSI 6820/610DM (98D0778AC) 222362R) Notes:
Control Box Type (S/N): Well Wizard (16729)
Peristaltic Pump (S/N): Cole Parmer 2020 (0896-[illegible]98)

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW6D - GW-05
Sample Location: GMW6D
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7.19.99								
Time: 1430								
Method: Low Flow/Bladder Pump	CLEAR	5.80	3.62	11.3	25	0.23	96.1	1.92

PURGE DATA:

Date: 7.19.99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): NA
Well Casing Diameter & Material
Type: PVC 4"
Total Well Depth (TD): 46.0
Static Water Level (WL): 9.65
One Casing Volume (gal/L): 23.7
Start Purge (hrs): 1334
End Purge (hrs): 1425
Total Purge Time (min): 51
Total Vol. Purged (gal/L): 3.2

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	2 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2 Qt. Amber Glass	✓
TCL PAH	4° C	2 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 L PE	✓
HEX CHLOROBIPHENYL	4° C	2 QT AMBER GLASS	✓

OBSERVATIONS / NOTES:

START SAMPLING @ 1427
END SAMPLING @ 1458

NO ODOR

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): T. Evans / K. Simpson

4" WELL = .653

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW6D

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 7.19.99
WEATHER: SUNNY HOT 87°F
PERSONNEL: R. SIMPSON

Well Screen Depth: 30.5 / 46.0 ft.
Initial Water Level: 9.65 @ 1330 hrs.

Pump Type/Material: Bladder / PVC
Pump Intake Depth: 38.0 ft. TPVC

Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected

Total Purge Volume= 3.2 (gal/L) **Total Purge Time=** 51 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1330	9.65	0	300	10 D/30R	11.73	5.79	3.63	0.61	33	1.93	117.7	
1350	9.66	↓	↓	25 PSI	11.6	5.79	3.641	0.41	30	1.93	111.2	
KS 1355 ~~1352~~	9.67		200	30D/30R	11.4	5.79	3.629	0.48	28	1.92	104.1	
1400	9.68			25 PSI	11.5	5.79	3.628	0.33	25	1.92	105.1	
1405	9.65				11.3	5.78	3.631	0.44	25	1.92	101.6	
1410					11.3	5.79	3.631	0.23	25	1.92	100.2	
1405					11.4	5.79	3.628	0.27	25	1.92	96.1	
1415					11.4	5.79	3.622	0.42	25	1.92	97.2	
1420					11.4	5.79	3.621	0.25	25	1.92	96.8	
1425		12240			11.3	5.80	3.624	0.23	25	1.92	96.1	

Water Quality Meter (S/N): 222137R
Control Box Type (S/N): 16626
Flowmeter (S/N): 0361 4197

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW9S - GW-05
Sample Location: 6MW9S
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7-20-99								
Time: 1332								
Method: Low Flow/Bladder Pump	Clear	5.02	0.080	14.89	0.00	0.72	-97.1	0.04

PURGE DATA:

Date: 7-20-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 11.8
Static Water Level (WL): 4.56
One Casing Volume(gal/L): 4.5
Start Purge (hrs): 1257
End Purge (hrs): 1330
Total Purge Time (min): 33
Total Vol. Purged (gal/L): 8.4

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 x 40 ml Vial	✓ ✓ ✓
TCL SEMIVOLATILES	4° C	2 x 1 Qt. Amber Glass	✓ ✓ ✓
TCL PEST/PCBs	4° C	2 x 1 Qt. Amber Glass	✓ ✓ ✓
TCL PAH	4° C	2 x 1 Qt. Amber Glass	✓ ✓ ✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 x 1 L PE	✓ ✓ ✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 x 1 L PE	✓ ✓ ✓
HEX CHLOROBIPHENYL	4°C	2 x 1 QT AMBER GLASS	✓ ✓ ✓

OBSERVATIONS / NOTES:

Circle if Applicable:
✓ MS/MSD 3x volume
Duplicate ID No.:

Signature(s): [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW9S

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 7-20-99
WEATHER: sunny, clear 80-85°F
PERSONNEL: T Evans

Well Screen Depth: 7.8 / 11.8 ft.
Initial Water Level: 4.56 @ 12:50 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: 10.0 ft. TPVC
Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected
Total Purge Volume= (gal / L)
Total Purge Time= 33 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1257	4.55	820		D 20 R 45 15 psi	14.71	6.56	0.084	5.44	4.6	0.04	-109.5	Clear / Cell Full
1300	4.55	350+720	214	0.0	14.33	5.93	0.083	2.92	2.2	0.04	-107.8	
1305	4.55	1150+400	310	D 6 R 50 ↓10 psi	14.73	5.44	0.081	2.24	1.3	0.04	-104.1	
1310	4.55	1150	230		14.79	5.25	0.081	1.29	0.05	0.04	-99.4	
1315	4.55	950	190		14.84	5.08	0.080	0.84	0.00	0.04	-96.5	
1320	4.55	950	190		14.88	5.05	0.080	0.84	0.00	0.04	-98.2	
1325	4.55	950	190		14.90	4.95	0.080	0.68	0.00	0.04	-93.4	
1330	4.55	950			14.89	5.02	0.080	~~0.81~~ 0.72	0.00	0.04	-97.1	
1332	~~4.26~~											Sample*
1519	4.26											End sample

Water Quality Meter (S/N): YSI 6820 (98D0778 AC)
Control Box Type (S/N): well Wizard (16729)
Turbidimeter (S/N): LaMotte 2020 (0896 0098)

Notes: * Collect MS/MSD
3x Volume

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW105 - GW-05
Sample Location: 6MW105
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7-19-99								
Time: 0943								
Method: Low Flow/Bladder Pump	Clear	7.15	13.28	21.12	2.7	0.19	-157.8	7.67

PURGE DATA:

Date: ~~7-19-99~~ 7-19-99	See Attached Low Flow Purge Data Sheet for Purge Data
Method: Low Flow/Bladder Pump	
Monitor Reading (ppm): —	
Well Casing Diameter & Material Type: 2" PVC	
Total Well Depth (TD): 13.3	
Static Water Level (WL): 3.7	
One Casing Volume (gal/L): 5.9	
Start Purge (hrs): 0905	
End Purge (hrs): 09~~35~~40	
Total Purge Time (min): 35	
Total Vol. Purged (gal/L): 8.5	

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 x 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	2 x 1 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2 x 1 Qt. Amber Glass	✓
TCL PAH	4° C	2 x 1 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 x 1 L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 x 1 L PE	✓
Hexachlorobiphenyl	4°C	2 x 1 Qt Amber glass	✓

OBSERVATIONS / NOTES:

Clear w/ black flecks (fine) in suspension

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s): [signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW10S

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 7-19-99
WEATHER: hot (85-90°F) hazy
PERSONNEL: T. Evans

Well Screen Depth: 3.3 / 13.3 ft.
Initial Water Level: 3.72 @ 0900 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: 9.0 ft. TPVC
Tide Cycle: ☐ High @ ☒ Low @ 0950 ☐ Not Affected
Total Purge Volume= 8.5 (gal/L) **Total Purge Time=** 35 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	* Turbidity NTU	Salinity ppt	Eh mV	Comments
0905		1460	–	D6 R30 8psi	20.72	7.00	12.71	0.55	7.6	7.33	-87.3	Clear/ Black Flecks suspended
0910	3.80	1100	220	R35	20.96	7.08	12.98	0.60	5.4	7.49	-103.7	
0915	3.82	1100	220		20.97	7.12	13.14	0.43	2.9	7.59	-117.9	
0920	3.86	1200	240	R50	21.11	7.14	13.19	0.31	2.6	7.62	-126.6	
0925	3.90	1050	210		21.09	7.15	13.22	0.56	2.0	7.64	-138.5	
0930	3.92	850	170		21.09	7.16	13.29	0.22	2.0	7.67	-145.7	
0935	3.92	980	196		21.06	7.16	13.27	0.20	2.6	7.67	-152.4	
0940	3.92	800	160		21.12	7.15	13.28	0.19	2.7	7.67	-157.8	
			8.5L									
0943	~~3.90~~ (1)											SAMPLE
(1) ~~1044~~	~~3.90~~ (2) 4.04											END SAMPLE

Water Quality Meter (S/N): YSI 6820 w/ 610DM (98F0324AB)
Control Box Type (S/N): Well Wizard (16626) 222362R)
* Turbidimeter (S/N): La Motte 2020 (0361-4[illegible]7)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW10D - GW-05
Sample Location: 6MW10D
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7.19.99								
Time: 0945								
Method: Low Flow/Bladder Pump	CLEAR	6.94	17.90	15.0	2	0.62	-64.8	10.61

PURGE DATA:

Date: 7.19.99	See Attached Low Flow Purge Data Sheet for Purge Data
Method: Low Flow/Bladder Pump	
Monitor Reading (ppm):	
Well Casing Diameter & Material Type: PVC 2"	
Total Well Depth (TD): 54.1	
Static Water Level (WL): 2.51	
One Casing Volume (gal/L): 8.4	
Start Purge (hrs): 0900	
End Purge (hrs): 0940	
Total Purge Time (min): 40	
Total Vol. Purged (gal/L): 1.5	

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements		Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3	40 ml Vial	—
TCL SEMIVOLATILES	4° C	2	Qt. Amber Glass	—
TCL PEST/PCBs	4° C	2	Qt. Amber Glass	—
TCL PAH	4° C	2	Qt. Amber Glass	—
TAL METALS (TOTAL)	HNO_3 / 4° C	1	L PE	—
TAL METALS (DISSOLVED)	HNO_3 / 4° C	FILTERED 1	L PE	—
2 QT AMBER	4° C	HEX CHLOROBI PHENYL		—

OBSERVATIONS / NOTES:

START SAMPLING 0942
END SAMPLING 1015

NO ODOR

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): K. Simpson

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW10D

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 7.19.99
WEATHER: SUNNY HOT 85°F
PERSONNEL: R. SIMPSON

Well Screen Depth: 44.1 / 54.1 ft.
Initial Water Level: 2.51 @ 0850 hrs.

Pump Type/Material: Bladder / PVC
Pump Intake Depth: 49.0 ft. TPVC

Tide Cycle: ☐ High @ ☒ Low @ 0950 ☐ Not Affected

Total Purge Volume= 1.5 (gal/L)
Total Purge Time= 40 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0915	2.54	0	150	30 R/30D	21.0	7.30	18.53	0.99	0	11.01	-100.7	
0920	2.53	↓	↓	20 PSI	16.5	7.03	19.13	0.78	0	11.38	-79.8	
0925	2.53	↓	300	↓	15.5	6.93	18.55	0.49	3	10.95	-68.7	
0930	2.52	↓	↓	↓	15.3	6.94	18.01	0.68	2	10.70	-66.7	
0935	2.52	↓	↓	↓	15.2	6.95	17.91	0.61	2	10.62	-67.4	
0940	2.52	5250	↓	↓	15.0	6.94	17.90	0.62	2	10.61	-64.8	

Water Quality Meter (S/N): 222137 R
Control Box Type (S/N): 16729
Flowmeter (S/N): 0896 4098

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW115 - GW-05
Sample Location: GMW115
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7.20.99								
Time: 1005								
Method: Low Flow/Bladder Pump	CLEAR	7.37	18.55	20.2	0.5	0.33	-193.4	11.03

PURGE DATA:

Date: 7.20.99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): NA
Well Casing Diameter & Material
Type: PVC 2"
Total Well Depth (TD): 13.5
Static Water Level (WL): 2.81
One Casing Volume (gal/L): 1.7
Start Purge (hrs): 0853
End Purge (hrs): 1000
Total Purge Time (min): 67
Total Vol. Purged (gal/L): 4.2

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	✓
HEX CHOROBIPHENYL	4°C	QT AMBER GLASS	✓

OBSERVATIONS / NOTES:

START SAMPLE @ 1002
END SAMPLING @ 1040

NO ODOR

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): K. S. Simpson

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: GMW 11S

PROJECT:	NSB-NLON	DATE:	7.20.99
PROJECT NUMBER:	7363	WEATHER:	SUNNY 75°F
SITE:	DRMO	PERSONNEL:	R. SIMPSON

Well Screen Depth: 3.5 / 13.5 ft.
Initial Water Level: 2.81' @ 0849 hrs.
Pump Type/Material: BLADDER RS ~~2" PO~~ PVC
Pump Intake Depth: 11.0' TOC
Total Purge Volume= 4.2 (gal) ~~(L)~~
Total Purge Time= 60 (min)

Tide Cycle: ☐ High @ ☒ Low @ 1042 ☐ Not Affected

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0900	2.81	0	265	45R/45D	19.7	7.07	17.93	0.94	5.0	10.97	-229.5	
0905	↓	↓	↓	20 PSI	19.8	7.32	18.51	0.83	2.0	11.00	-205.7	
0910				↓	20.0	7.31	18.53	0.71	1.5	11.01	-198.1	
0915					20.3	7.34	18.59	0.63	0.7	11.06	-194.7	
0920					20.1	7.36	18.61	0.73	0.7	11.07	-194.5	
0925					20.1	7.36	18.65	0.80	0.6	11.09	-193.8	
0930					20.1	7.32	18.61	0.57	0.5	11.07	-191.9	
0940					20.2	7.38	18.63	0.49	0.4	11.04	-193.5	
0950					20.2	7.34	18.52	0.30	0.5	10.98	-191.6	
0955					20.2	7.35	18.54	0.29	0.5	11.00	-192.7	
1000	↓	15900	↓	↓	20.2	7.37	18.55	0.33	0.5	11.03	-193.4	

Water Quality Meter (S/N): 222362 R
Control Box Type (S/N): 16729
Turbidimeter (S/N): 0361 4197

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW11D - GW-05
Sample Location: 6MW11D
Sampled By: T. Evans / K. Simpson
C.O.C. No.: 071999-05
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 7/20/99								
Time: 1005								
Method: Low Flow/Bladder Pump	Clear	6.94	35.74	17.96	0.85	0.37	-112.6	22.61

PURGE DATA:

Date: 7-20-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 85.0
Static Water Level (WL): 2.70
One Casing Volume(gal/L): 50.8
Start Purge (hrs): 0852
End Purge (hrs): 1000
Total Purge Time (min): 68
Total Vol. Purged (gal/L): 10.25

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3 x 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	2 x 1 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2 x 1 Qt. Amber Glass	✓
TCL PAH	4° C	2 x 1 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1 x 1 L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	1 x 1 L PE	✓
HEXACHLOROBIPHENYL	4° C	2 x 1 QT AMBER GLASS	✓

OBSERVATIONS / NOTES:

Circle if Applicable:
~~MS/MSD~~ ~~Duplicate ID No.:~~

Signature(s):

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW11D

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 7-20-99
WEATHER: Sunny, 75-80°F
PERSONNEL: T. Evans

Well Screen Depth: 75.0 / 85.0 ft.
Initial Water Level: 2.70 @ 0845 hrs.
Pump Type/Material: Bladder / PVC
Pump Intake Depth: 82.0 ft. TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1042 ☐ Not Affected
Total Purge Volume= 10.25 (gal (L))
Total Purge Time= ~~120~~ 68 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0852	2.75	500	–	D6 R50 45 psi	20.03	7.33	32.69	0.74	1.5	20.47	-87.7	Clear / Cell Full
0855	2.77	480	160		19.41	7.14	32.78	0.49	0.95	20.55	-74.8	
0900	2.79	700	140		18.86	6.94	35.02	0.46	3.4	22.14	-89.9	
0905	2.82	710	142		18.61	6.92	35.99	0.33	11	22.78	-100.8	
0910	2.84	700	140		18.52	6.92	36.05	0.33	12	22.81	-104.0	
0915	2.82	700	140		18.51	6.92	36.00	0.59	7.3	22.81	-106.3	
0920	2.85	700	140		18.23	6.93	36.09	0.44	5.1	22.83	-106.6	
0925	2.87	720	144		18.18	6.93	36.03	0.27	4.0	22.81	-108.6	
0930	2.88	720	144		18.18	6.93	35.98	0.24	2.9	22.78	-109.5	
0935	2.88	720	144		18.12	6.94	35.98	0.21	2.7	22.77	-109.1	
0940	2.93	720	144		18.05	6.93	35.96	0.27	2.8	22.74	-109.1	
0945	2.87	720	144		17.90	6.94	35.89	0.22	1.7	22.71	-109.3	
0950	2.89	720	144		17.90	6.94	35.83	0.34	1.00	22.66	-110.0	
0955	2.91	720	144		17.91	6.94	35.80	0.37	1.4	22.63	-111.7	
1000	2.92	720	144		17.96	6.94	35.74	0.37	0.85	22.61	-112.6	
1005												SAMPLE
1103	2.85											END SAMPLE

Water Quality Meter (S/N): YSI 6820 (98E0324 AB)
Control Box Type (S/N): Well Wizard (16626)
Turbidimeter (S/N): LaMotte 2020 (0896 1048)

Notes:

ROUND 6

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW1S GW-06
Sample Location: 6MW1S
Sampled By: S. Neil
C.O.C. No.: 102399-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10/24/99								
Time: 1615								
Method: Low Flow/Bladder Pump	CLEAR	6.35	7.649	14.2	0.0	1.03	77	4.20

PURGE DATA:

Date: 10/24/99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 15.7
Static Water Level (WL): 7.58
One Casing Volume(gal): 1.3
Start Purge (hrs): 1515
End Purge (hrs): 1610
Total Purge Time (min): 55
Total Vol. Purged (gal): 3.8

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	1
~~HEX CHLOROBPHENYL~~	~~4° C~~	~~Qt. Amber Glass~~	

OBSERVATIONS / NOTES:

End sampling @ 1648.
Final water level = 8.12 ft.

Circle if Applicable:

MS/MSD —
Duplicate ID No.:

Signature(s): Scott Neil

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW15

PROJECT:	NSB-NLON	**DATE:**	10/24/99
PROJECT NUMBER:	7363	**WEATHER:**	Sunny, breezy, mid 50's.
SITE:	DRMO	**PERSONNEL:**	Scott Neil

Well Screen Depth: 5.7 / 15.7 ft.
Initial Water Level: 7.58 @ 1507 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 12.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1626 ☐ Not Affected
Total Purge Volume= 3.8 (gal / L) **Total Purge Time=** 55 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1515	7.58	0	—	40R/40D 20 PSI								Begin Purge
1520	7.72	1315	263		14.6	6.45	9.231	0.80	1.9	5.20	29	
1525	7.73	1315	263		14.5	6.40	8.892	0.84	0.6	4.99	39	
1530	7.79	1315	263		14.4	6.39	8.651	0.81	0.2	4.85	48	
1535	7.82	1315	263		14.3	6.38	8.529	0.79	0.0	4.78	50	
1540	7.89	1315	263 ✓		14.3	6.38	8.323	0.82	0.0	4.65	55	
1545	7.91	1315	263		14.3	6.37	8.148	0.79	0.0	4.55	59	
1550	7.94	1315	263		14.2	6.37	7.996	0.76	0.0	4.46	66	
1555	7.96	1315	263		14.2	6.36	7.894	0.99	0.0	4.40	73	
1600	7.99	1315	263		14.2	6.36	7.787	0.92	0.0	4.33	74	
1605	8.00	1315	263		14.2	6.36	7.713	0.85	0.0	4.29	76	
1610	8.03	1315	263		14.2	6.35	7.649	1.03	0.0	4.20	77	End Purge
	Begin Sampling @ 1615 - Sample ID DRMO - GMW15 - GW - 06											
	End Sampling @ 1648.											

Water Quality Meter (S/N): YSI (
Control Box Type (S/N): QED Well Wizard (17631)
Turbidimeter (S/N): La Motte (1157-1899)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW25 GW-06
Sample Location: 6MW25
Sampled By: K. SIMPSON
C.O.C. No.: 102399-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10.23.99								
Time: 1535								
Method:Low Flow/Bladder Pump	CLEAR	6.91	25.41	18.9	1.0	0.72	-219	15.54

PURGE DATA:

Date: 10.23.99
Method:Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 13.60
Static Water Level (WL): 5.68
One Casing Volume(gal): 1.3
Start Purge (hrs): 1428
End Purge (hrs): 1533
Total Purge Time (min): 65
Total Vol. Purged (gal): 3.7

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	✓
~~HEX CHLOROBP~~HENYL	~~4° C~~	~~Qt. Amber Glass~~	

OBSERVATIONS / NOTES:

KS ~~NO ODOR~~
SULFUR ODOR

END SAMPLE @ 1610
END WL = 6.09'

Circle if Applicable:

MS/MSD —
Duplicate ID No.: —

Signature(s): K. S. Simpson

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW25

PROJECT:	NSB-NLON	**DATE:**	10-23-99
PROJECT NUMBER:	7363	**WEATHER:**	OVERCAST 60°F
SITE:	DRMO	**PERSONNEL:**	K. SIMPSON

Well Screen Depth: 3.6 / 13.6 ft.
Initial Water Level: 5.68 @ 1425 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 10.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1529 ☐ Not Affected
Total Purge Volume= ~~1.5~~ 3.7 (ga) /(L) **Total Purge Time=** 65 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1430	5.73	0	255	30 0/50R	18.5	6.95	24.44	0.32	4.8	14.89	20.3	
1440	5.80	↓	↓	12 PSI	18.6	6.94	24.89	0.39	3.0	15.19	-120	
1445	5.85		200	50R/50D	18.5	6.93	24.94	0.48	2.1	15.23	-136	
1450	5.90			12 PSI	18.5	6.92	25.00	0.45	1.9	15.28	-151	
1455	5.94				18.5	6.93	25.06	0.44	1.8	15.31	-162	
1500	5.96				18.5	6.92	25.14	0.51	1.5	15.36	-172	
1505	5.98				18.6	6.91	25.22	0.56	1.3	15.41	-185	
1510	5.99				18.6	6.91	25.26	0.59	1.2	15.44	-192	
1515	6.02				18.8	6.92	25.31	0.63	1.1	15.48	-201	
1520	6.02				18.8	6.91	25.37	0.66	1.1	15.51	-207	
1525	6.02	↓			18.9	6.91	25.43	0.69	1.1	15.55	-212	
1530	6.04	14,000	↓	↓	18.9	6.91	25.41	0.72	1.0	15.54	-219	

Water Quality Meter (S/N): YSI 220649 R
Control Box Type (S/N): QED 16729
Turbidimeter (S/N): LAMOTTE 0355-4197

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW2D GW-06
Sample Location: 6MW2D
Sampled By: S. NEIL
C.O.C. No.: 102399-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10/23/99								
Time: 1532								
Method: Low Flow/Bladder Pump	GRAY	6.64	38.84	14.0	16.1	0.09	-199	24.74

PURGE DATA:

Date: 10/23/99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): ~~N~~
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 78.8'
Static Water Level (WL): 5.20'
One Casing Volume(gal): 12.0
Start Purge (hrs): 1425
End Purge (hrs): 1527
Total Purge Time (min): 62
Total Vol. Purged (gal): 5.1

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	1
HEX CHLOROBPHENYL	4° C	Qt. Amber Glass	NA

OBSERVATIONS / NOTES:

- End sampling @ 1601.
- Final H_2O level = 5.29 FT.
- Many very small bubbles in discharge line causing VOAs to contain bubbles.

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW2D

PROJECT:	NSB-NLON	**DATE:**	10/23/99
PROJECT NUMBER:	7363	**WEATHER:**	OVERCAST + WINDY LOW 50's.
SITE:	DRMO	**PERSONNEL:**	SCOTT NEIL

Well Screen Depth: 68.8 / 78.8 ft.
Initial Water Level: 5.20 @ 1415 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 73.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1529 ☐ Not Affected
Total Purge Volume= 5.1 (gal/L) **Total Purge Time=** 62 (min)

	Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
	1425	5.20	0	—	300/30R 40 PSI							→	Begin purge
	1430	5.43	2000	400	300/30R 40 PSI	14.4	6.78	38.97	0.42	10.0	24.84	-62	Decrease Flow
	1435	5.45	1480	296	400/40R 40 PSI	14.5	6.75	38.61	0.15	7.5	24.60	-71	
	1440	5.36	1480	296	↓	14.5	6.77	38.59	0.17	6.7	24.58	-94	
4440	1445	5.39	1480	296	↓	14.4	6.79	38.67	0.10	6.0	24.63	-109	WATER IS LIGHT GRAY.
	1450	5.29	1500	300 ✓	400/40R 50 PSI	14.4	6.77	38.79	0.05	5.6	24.72	-134	↓
3000	1455	5.46	1500	300	↓	14.3	6.78	38.94	0.06	5.0	24.81	-145	↓
	1500	5.38	1540	308 ✓	↓	14.2	6.76	38.87	0.04	6.2	24.77	-159	↓
3080	1505	5.39	1540	308	↓	14.2	6.74	38.94	0.02	5.9	24.83	-167	↓
	1510	5.34	1500	300 ✓	↓	14.1	6.70	38.84	0.04	6.3	24.75	-173	↓
	1515	5.40	1500	300	↓	14.1	6.68	38.73	0.03	6.7	24.67	-187	↓
	1518	5.34	(BA) ~~1500~~ 900	300	↓	14.1	6.66	38.75	0.04	12.5	24.69	-189	WATER IS GRAY
	1521	5.31	(DA) ~~1500~~ 900	300	↓	14.0	6.67	38.94	0.06	16.0	24.82	-194	↓
	1524	5.35	927	309 ✓	↓	14.1	6.64	38.83	0.07	16.3	24.74	-197	↓
	1527	5.33	927	309	↓	14.0	6.64	38.84	0.09	16.1	24.74	-199	End Purge.
		Begin sampling at		1532	- Sample ID DRMO - 6MW2D - GW - 06.								
		End sampling @		1601.									

Water Quality Meter (S/N): YSI (99E0152)
Control Box Type (S/N): QED WELL WIZARD (17631)
Turbidimeter (S/N): LaMOTTE 2020 (1157-1899)

Notes: Sulfur odor. Discharge tubing and flow-thru coil contains a multitude of small bubbles.

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW65 GW-06
Sample Location: 6MW65
Sampled By: K. SIMPSON
C.O.C. No.: 10.2099 06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10-21-99								
Time: 0950								
Method: Low Flow/Bladder Pump	CLEAR	5.98	0.474	10.3	0.1	3.98	303	0.23

PURGE DATA:

Date: 10-21-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 18.58
Static Water Level (WL): 8.46
One Casing Volume(gal): 1.7
Start Purge (hrs): 0842
End Purge (hrs): 0947
Total Purge Time (min): 65
Total Vol. Purged (gal): 3.4

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	6
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	4
TCL PEST/PCBs	4° C	Qt. Amber Glass	4
TCL PAH	4° C	Qt. Amber Glass	4
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	2
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	2
~~HEX CHLOROBPHENYL~~	~~4° C~~	~~Qt. Amber Glass~~	
		2 X VOL FOR DUP	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	GWFD-102199

Signature(s): K. Simpson

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW6S

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 10.21.99
WEATHER: SUNNY 48°F
PERSONNEL: K. SIMPSON

Well Screen Depth: 8.6 / 18.6 ft.
Initial Water Level: 8.46 @ 0840 hrs.

Pump Type/Material: Bladder/PVC
Pump Intake Depth: 14.0' TPVC

Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected

Total Purge Volume= 3.4 (gal / L)
Total Purge Time= 65 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0845	8.50	100	200	30D/60R	10.2	6.10	0.424	13.02	4.2	0.21	318	
0855	8.48			15 PSI	10.2	5.99	0.473	12.99	4.4	0.23	292	
0900					10.2	5.98	0.473	12.86	3.2	0.23	310	
0910					10.2	5.99	0.473	12.71	3.7	0.23	308	
0915					10.3	5.98	0.474	11.49	2.1	0.23	311	
0920					10.2	5.99	0.474	9.13	1.5	0.23	299	
0925					10.3	5.99	0.474	9.02	1.0	0.23	307	
0930					10.3	5.98	0.473	7.26	0.3	0.23	309	
0935					10.3	5.98	0.474	6.57	0.3	0.23	305	
0940					10.3	5.99	0.473	4.44	0.3	0.23	307	
0945		13,000			10.3	5.98	0.474	3.98	0.1	0.23	303	

Water Quality Meter (S/N): YSI ~~220964R~~ 220649R
Control Box Type (S/N): 16729 QED
T[illegible]limeter (S/N): 0355-497 LaMotte

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW6D GW-06
Sample Location: 6MW6D
Sampled By: S NEIL
C.O.C. No.: 102099 06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Date: 10/21/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Time: 0934								
Method: Low Flow/Bladder Pump	CLEAR	5.70	4.237	10.3	16	0.25	342	2.26

PURGE DATA:

Date: 10/21/99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: ~~4" PVC~~ 6"
Total Well Depth (TD): 46.0'
Static Water Level (WL): 8.82'
One Casing Volume(gal): 54.7
Start Purge (hrs): 0840
End Purge (hrs): 0930
Total Purge Time (min): 50
Total Vol. Purged (gal): 40

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	1
HEX CHLOROBPHENYL	4° C	Qt. Amber Glass	NA

OBSERVATIONS / NOTES:

6" well. OPEN BOREHOLE
End Sampling @ 1012.

Circle if Applicable:

MS/MSD — Duplicate ID No.:

Signature(s): Scott W. Neil

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW6D

PROJECT: NSB-NLON
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 10/21/99
WEATHER: SUNNY MID-UPPER 40'S.
PERSONNEL: SCOTT NEIL

Well Screen Depth: 30.5 / 46.0 ft.
Initial Water Level: 8.82 @ 0815 hrs.

Pump Type/Material: Bladder/PVC
Pump Intake Depth:

Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected

Total Purge Volume= 4.0 (ga) / L)
Total Purge Time= 50 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0840	8.82	0	—	100/30:2 25PSI								BEGIN PURGING
0845	8.85	1775	355		10.4	5.96	4.235	1.11	23	2.26	327	
0850	8.85	1775	355		10.3	5.86	4.261	0.54	34	2.28	323	
0855	8.80	1460	292	200/30:2 25PSI	10.3	5.77	4.247	0.45	29	2.27	325	
0900	8.81	1460	292		10.3	5.73	4.240	0.24	28	2.26	329	
0905	8.81	1460	292		10.3	5.72	4.237	0.30	20	2.26	331	
0910	8.81	1460	292		10.3	5.71	4.240	0.28	16	2.27	334	
0915	8.81	1460	292		10.3	5.71	4.240	0.23	16	2.26	337	
0920	8.81	1460	292		10.3	5.70	4.241	0.25	16	2.26	339	
0925	8.81	1460	292		10.3	5.70	4.239	0.22	16	2.26	341	
0930	8.82	1460	292		10.3	5.70	4.237	0.25	16	2.26	342	END PURGING.
	Begin sampling @ 0934 - SAMPLE ID DRMO-6MW6D-GW-06.											
	End sampling @ 1012.											

Water Quality Meter (S/N): YSI / 99E0152
Control Box Type (S/N): QED WELL WIZARD / 17631
Turbidimeter (S/N): 1157-1899 LaMotte

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW9S GW-06
Sample Location: GMW9S
Sampled By: S. NEIL
C.O.C. No.: 102299-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10/22/99								
Time: 0846								
Method: Low Flow/Bladder Pump	CLEAR	5.24	0.044	15.3	0.0	2.93	352	0.03

PURGE DATA:

Date: 10/22/99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 16.8'
Static Water Level (WL): 3.34
One Casing Volume(gal): ~~0.507~~ 1.2
Start Purge (hrs): 0807
End Purge (hrs): 0840
Total Purge Time (min): 33
Total Vol. Purged (gal): 3.1

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	1
HEX CHLOROBPHENYL	4° C	Qt. Amber Glass	NA

OBSERVATIONS / NOTES:

End sampling @ 0917.
Final water level = 3.34 ft.

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Scott W. Neil

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW9S

PROJECT:	NSB-NLON	**DATE:**	10/22/99
PROJECT NUMBER:	7363	**WEATHER:**	Mostly sunny, upper 30's.
SITE:	DRMO	**PERSONNEL:**	Scott Neil

Well Screen Depth: 7.8 / 11.8 ft.
Initial Water Level: 3.34 @ 0758 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 10.0' TPVC
Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected
Total Purge Volume= 3.1 (gal / L) **Total Purge Time=** 33 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0807	3.34	0	—	D30/R30 10 PSI							→	Begin Purge.
0812	3.33	1750	350	↓	15.3	5.78	0.071	3.37	3.1	0.03	268	
0817	3.32	1750	350		15.3	5.45	0.066	3.08	1.1	0.03	299	
0822	3.33	1750	350		15.3	5.37	0.065	3.19	0.5	0.03	316	
0827	3.32	1750	350		15.3	5.30	0.065	3.00	0.2	0.03	331	
0832	3.32	1750	350		15.3	5.27	0.065	3.04	0.1	0.03	346	
0837	3.32	1750	350		15.3	5.26	0.065	2.97	0.0	0.03	350	
0840	3.33	1050	350		15.3	5.24	0.064	2.93	0.0	0.03	352	
	Begin sampling @ 0846 - Sample ID DRMO-6MW9S-GW-06.											
	End sampling @ 0917.											

Water Quality Meter (S/N): YSI / 99E0152
Control Box Type (S/N): QED Well Wizard / 17631
Turbidimeter (S/N): LaMotte / 1157-1899

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW105 GW-06
Sample Location: GMW105
Sampled By: K. SIMPSON
C.O.C. No.: 102299-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10-22-99								
Time: 1435								
Method: Low Flow/Bladder Pump	CLEAR	7.11	10.53	18.8	0	0.51	-152	6.17

PURGE DATA:

Date: 10-22-99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): ~~2.94~~ 13.30'
Static Water Level (WL): 2.94
One Casing Volume(gal): 1.7
Start Purge (hrs): 1326
End Purge (hrs): 1430
Total Purge Time (min): 64
Total Vol. Purged (gal): 3.46

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	✓
~~HEX CHLOROBPHENYL~~	~~4° C~~	~~Qt. Amber Glass~~	NA

OBSERVATIONS / NOTES:

END SAMPLING @ 1514
END WL = 3.27

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): K. E. Simpson

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW10S

PROJECT:	NSB-NLON	**DATE:**	10.22.99
PROJECT NUMBER:	7363	**WEATHER:**	OVERCAST 55°F
SITE:	DRMO	**PERSONNEL:**	R. SIMPSON

Well Screen Depth: 3.3 / 13.3 ft.
Initial Water Level: 2.94 @ 1325 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 9.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1454 ☐ Not Affected
Total Purge Volume= 3.46 (ga) / L) **Total Purge Time=** 64 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1330	2.94	0	225	20R/20D	18.6	7.17	10.27	0.48	7.9	5.82	-23	LT. SULFUR ODOR
1340	3.05			10 PSI	18.7	7.15	10.19	0.45	6.1	5.79	-63	TRACE BLACK FINES
1345	3.11			45R/45D	18.6	7.14	10.31	0.40	4.3	5.84	-95	
1350	3.14		205	10 PSI	18.6	7.13	10.36	0.40	2.9	5.88	-99	
1355	3.14			50R/50D	18.6	7.13	10.44	0.39	2.0	5.93	-106	
1400	3.16			10PSI	18.6	7.13	10.50	0.40	1.1	5.97	-111	
1405	3.19				18.7	7.12	10.56	0.39	0.8	6.01	-119	CLEARING
1410	3.20				18.8	7.12	10.63	0.40	0.3	6.04	-128	
1415	3.24				18.8	7.11	10.71	0.40	0.3	6.09	-135	
1420	3.26				18.8	7.12	10.73	0.47	0.3	6.11	-140	
1425	3.28				18.7	7.11	10.78	0.48	0	6.14	-147	
1430	3.28	13,300			18.8	7.11	10.83	0.51	0	6.17	-152	

Water Quality Meter (S/N): YSI 220649R
Control Box Type (S/N): QED 16729
Turbidimeter (S/N): LA MOTTE 0355-4197

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW10D GW-06
Sample Location: 6MW10D
Sampled By: S. NEIL
C.O.C. No.: 102299-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp (SW) Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10/22/99 Time: 1426 Method: Low Flow/Bladder Pump	CLEAR	7.23	21.37	14.63	0.4	0.15	-73	12.87

PURGE DATA:

Date: 10/22/99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 54.10'
Static Water Level (WL): ~~2.43'~~ 1.93'
One Casing Volume(gal): 8.5
Start Purge (hrs): 1325
End Purge (hrs): 1420
Total Purge Time (min): 55
Total Vol. Purged (gal): 5.1

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	1
HEX CHLOROBPHENYL	4° C	Qt. Amber Glass	NA

OBSERVATIONS / NOTES:

End sampling @ 1456.
Final H_2O level = 2.01 ft.

Circle if Applicable:

MS/MSD —
Duplicate ID No.:

Signature(s): Scott [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW10D

PROJECT:	NSB-NLON	**DATE:**	10/22/99
PROJECT NUMBER:	7363	**WEATHER:**	CLOUDY & WINDY, LOW 50'S.
SITE:	DRMO	**PERSONNEL:**	SCOTT NEIL

Well Screen Depth: 44.1 / 54.1 ft.
Initial Water Level: 1.93 @ 1318 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 49.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1454 ☐ Not Affected
Total Purge Volume= 5.1 (gal / L) **Total Purge Time=** 55 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1325	1.93	0	—	30D/30.2	—						→	BEGIN PURGE
1330	1.96	1750	350	30 PSI	14.6	7.21	22.52	0.55	3.2	13.62	218	
1335	1.95	1750	350		14.6	7.21	22.00	0.23	4.0	13.28	90	
1340	1.98	1750	350 ✓		14.5	7.22	21.74	0.23	2.0	13.11	41	
1345	1.99	1750	350		14.5	7.21	21.50	0.16	1.2	12.96	-13	
1350	1.99	1750	350		14.4	7.22	21.44	0.22	0.9	12.89	-35	
1355	1.99	1750	350		14.4	7.21	21.36	0.12	0.8	12.86	-46	
1400	1.99	1825	365 ✓		14.5	7.23	21.35	0.19	0.5	12.86	-55	
1405	2.00	1825	365		14.5	7.23	21.39	0.21	0.5	12.88	-61	
1410	1.99	1825	365		14.5	7.25	21.42	0.16	0.6	12.90	-67	
1415	1.99	1750	350 ✓		14.4	7.23	21.41	0.17	0.3	12.89	-70	
1420	2.00	1750	350		14.3	7.23	21.37	0.15	0.4	12.87	-73	END PURGE.
	BEGIN SAMPLING @ 1426 - SAMPLE ID DRMO-6MW10D-GW-06.											
	END SAMPLING @ 1456.											

Water Quality Meter (S/N): YSI (99E0152)
Control Box Type (S/N): QED WELL WIZARD (17631)
Turbidimeter (S/N): LaMOTTE (1157-1899)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW11S GW-06
Sample Location: 6MW11S
Sampled By: R. SIMPSON
C.O.C. No.: 102099.06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 10·21·99								
Time: 1400								
Method: Low Flow/Bladder Pump	CLEAR	7.39	14.89	19.8	1.0	1.11	-312	8.69

PURGE DATA:

Date: 10·21·99
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2 PVC
Total Well Depth (TD): 13.50
Static Water Level (WL): 3.37
One Casing Volume(gal): 1.7
Start Purge (hrs): 1253
End Purge (hrs): 1357
Total Purge Time (min): 64
Total Vol. Purged (gal): 4.4

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	9
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	6
TCL PEST/PCBs	4° C	Qt. Amber Glass	6
TCL PAH	4° C	Qt. Amber Glass	6
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	3
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	3
~~HEX CHLOROBPHENYL~~	~~4° C~~	~~Qt. Amber Glass~~	
		3X VOL FOR ~~MS/MSD~~ KS	
		MS/MSD	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD YES

Duplicate ID No.:

Signature(s): R. E. Simpson

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW11S

PROJECT:	NSB-NLON	**DATE:**	10.21.99
PROJECT NUMBER:	7363	**WEATHER:**	SUNNY 52°F
SITE:	DRMO	**PERSONNEL:**	R. SIMPSON

Well Screen Depth: 3.5 / 13.5 ft.
Initial Water Level: 3.37 @ 1253 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 11.0 TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1408 ☐ Not Affected
Total Purge Volume= 4.4 (gal / L) **Total Purge Time=** 64 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1300	3.41	0	260	45R/45D	19.7	7.52	15.79	2.33	6.8	9.51	-286	
1310	3.42	↓	↓	20 PSI	19.7	7.41	15.49	3.29	2.6	9.07	-291	
1315	3.44	↓	↓	↓	19.6	7.39	15.37	2.32	2.0	8.99	-296	
1320	3.47	↓	↓	↓	19.8	7.39	15.28	1.03	1.1	8.94	-300	
1325	3.50	↓	↓	↓	19.6	7.40	15.18	1.01	1.0	8.88	-306	
1330	3.52	↓	↓	↓	19.7	7.42	15.17	1.04	0.9	8.87	-308	
1335	3.52	↓	↓	↓	19.6	7.40	15.08	1.02	0.7	8.80	-309	
1340	3.54	↓	↓	↓	19.7	7.40	15.07	1.05	0.6	8.80	-309	
1345	3.58	↓	↓	↓	19.6	7.40	15.06	1.00	0.8	8.80	-311	
1350	3.58	↓	↓	↓	19.7	7.40	14.93	1.08	1.1	8.72	-311	
1355	3.58	↓	14300	↓	19.8	7.39	14.88	1.11	1.0	8.69	-312	
		END	SAMPLING		@	1530						
		END	WATER	LEVEL		=3.20						

Water Quality Meter (S/N): YSI 22649 R
Control Box Type (S/N): QED 16729
Turbidimeter (S/N): LaMOTTE 0355 4197

Notes: LT. SULFUR ODOR

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW11D GW-06
Sample Location: 6MW11D
Sampled By: S. Neil
C.O.C. No.: 102099-06
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Date: 10/21/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Time: 1336								
Method:Low Flow/Bladder Pump	CLEAR	6.97	38.66	15.0	3.9	0.17	-130	24.63

PURGE DATA:

Date: 10/21/99
Method:Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 85.0'
Static Water Level (WL): 2.48'
One Casing Volume(gal):
Start Purge (hrs): 1250
End Purge (hrs): 1335
Total Purge Time (min): 45
Total Vol. Purged (gal): 3.6

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
TAL METALS (DISSOLVED)	HNO_3 / 4° C	L PE	1
HEX CHLOROBPHENYL	4° C	Qt. Amber Glass	NA

OBSERVATIONS / NOTES:

End sampling @ 1412.

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Scott W. Neil

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW11D

PROJECT:	NSB-NLON	**DATE:**	10/21/99
PROJECT NUMBER:	7363	**WEATHER:**	Sunny, windy, low 50's.
SITE:	DRMO	**PERSONNEL:**	Scott Nail

Well Screen Depth: 75.0 / 85.0 ft.
Initial Water Level: 2.48 @ 1244 hrs.
Pump Type/Material: Bladder/PVC
Pump Intake Depth: 82.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1408 ☐ Not Affected
Total Purge Volume= 3.6 (gal / L) **Total Purge Time=** 45 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1250	2.48	0	—	200/40.2 50 PSI							→	Begin purge
1255	2.49	1500	300		16.0	7.02	39.35	0.56	2.0	25.11	31	
1300	2.48	1500	300		15.5	7.01	38.67	0.47	4.9	24.64	-43	
1305	2.48	1500	300		15.4	6.99	38.66	0.33	4.9	24.64	-62	
1310	2.49	1500	300		15.2	6.97	38.63	0.20	4.0	24.63	-85	
1315	2.51	1500	300		15.1	6.96	38.68	0.16	3.6	24.64	-100	
1320	2.52	1500	300		15.1	6.98	38.67	0.14	3.3	24.67	-110	
1325	2.53	1500	300		15.0	6.99	38.68	0.17	3.7	24.66	-118	
1330	2.51	1500	300		15.0	6.97	38.63	0.18	3.7	24.62	-124	
1335	2.51	1500	300	↓	15.0	6.97	38.66	0.17	3.9	24.63	-130	
	Begin sampling @ 1336 - Sample ID DRMO-GMW11D-GW-06.											End purge
	End sampling @ 1412.											

Water Quality Meter (S/N): YSI / 99E0152
Control Box Type (S/N): QED Well Wizard / 17631
Turbidimeter (S/N): La Motte / 1157-1899

Notes:

ROUND 7

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW1S GW-07
Sample Location: 6MW1S
Sampled By: K. SIMPSON
C.O.C. No.: 012100-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-21-00 Time: 1525 Method: Low Flow/Bladder Pump	CLEAR	6.49	10.99	6.1	0	0	100	5.99

PURGE DATA:

Date: 1-21-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): 0
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 15.7
Static Water Level (WL): 6.79
One Casing Volume(gal): 1.5
Start Purge (hrs): 1402
End Purge (hrs): 1522
Total Purge Time (min): 90
Total Vol. Purged (gal): 5.2

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
~~TAL METALS (DISSOLVED)~~ KES	~~HNO_3 / 4° C~~	~~L PE~~	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: GMW15

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-21-00
WEATHER: COLD, WINDY, CLEAR 15°F
PERSONNEL: R. SIMPSON

Well Screen Depth: 5.7 / 15.7 ft.
Initial Water Level: 6.79 @ 1400 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 12.0' TPVC

Tide Cycle: ☐ High @ ☒ Low @ 1610 ☐ Not Affected

Total Purge Volume= 5.2 (gal/L) **Total Purge Time=** 80 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1405	6.98	0	261	40R/40D	6.01	7.00	13.16	0	3.3	7.37	78	
1410	7.11		248	20 PSI	6.3	6.73	20.53	0	1.6	8.48	98	
1420	7.23			45R/40D	5.9	6.59	18.60	0	0.5	7.29	110	
1425	7.30			20 PSI	6.3	6.57	18.95	0	0.5	7.31	113	
1435	7.39				6.3	6.52	11.55	0	0.5	6.43	119	
1445	7.47				6.4	6.51	10.76	0	0.4	6.10	123	
1455	7.62				6.3	6.49	10.31	0	0.4	5.76	125	
1505	7.71				6.0	6.49	11.98	0	0.1	6.08	114	
1510	7.81				6.0	6.49	11.01	0	0	6.12	106	
1515	7.84				6.0	6.49	10.52	0	0	6.17	101	
1520	7.89	19840			6.1	6.49	10.98	0	0	5.99	100	END PURGE
			END	SAMPLING @		1553		WL=	8.19			

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
T[illegible]imeter (S/N): LA MOTTE

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW25 GW-07
Sample Location: 6MW25
Sampled By: S. NEIL
C.O.C. No.: 011900 07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-20-00 Time: 1500 Method: Low Flow/Bladder Pump	CLEAR	7.06	23.98	7.5	3.8	3.24	-132	14.45

PURGE DATA:

Date: 1-20-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 13.60
Static Water Level (WL): 6.90'
One Casing Volume(gal): 1.1
Start Purge (hrs): 1407
End Purge (hrs): 1457
Total Purge Time (min): 50
Total Vol. Purged (gal): 4.9

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
~~TAL METALS (DISSOLVED)~~	~~HNO_3 / 4° C~~	~~L PE~~	~~1~~ (SW)

OBSERVATIONS / NOTES:

FINAL H_2O LEVEL = 7.19 FT.
END SAMPLING @ 1518

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Scott W. Neil

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW25

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-20-00
WEATHER: CLOUDY, WINDY, LOW 20'S.
PERSONNEL: SCOTT NEIL

Well Screen Depth: 3.6 / 13.6 ft.
Initial Water Level: 6.90 @ 1407 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 10.0 TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1520 ☐ Not Affected
Total Purge Volume= 4.9 (gal/L)
Total Purge Time= 50 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1407	6.90	—	—	30R/30D 15 PSI	—						?	BEGIN PURGING
1412	6.96	355	355	↓	7.4	7.20	23.73	4.05	10.3	14.29	-147	SUSPENDED BLK
1417	6.96	↓	↓	↓	7.5	7.14	23.87	3.30	3.6	14.38	-146	FINES.
1422	6.98	↓	↓	↓	7.4	7.10	23.93	3.49	5.6	14.42	-145	
1427	7.02	↓	↓	↓	7.4	7.11	23.92	2.94	5.1	14.44	-143	
1432	7.04	↓	↓	↓	7.5	7.10	23.96	3.21	5.1	14.44	-141	
1437	7.05	↓	↓	↓	7.5	7.09	23.97	3.21	3.9	14.44	-139	
1442	7.06	↓	↓	↓	7.5	7.08	23.99	3.19	3.8	14.46	-137	
1447	7.08	↓	↓	↓	7.5	7.08	23.99	3.45	3.4	14.48	-135	
1452	7.10	↓	↓	↓	7.4	7.08	24.02	3.26	4.2	14.47	-133	
1457	7.11	↓	↓	↓	7.5	7.06	23.98	3.24	3.8	14.45	-132	END PURGING
	BEGIN SAMPLING @ 1500. Sample # DRMO-6MW25-GW-07.											
	END SAMPLING @ 1518.											

Water Quality Meter (S/N): YSI (193933R)
Control Box Type (S/N): QED (15800)
T[illegible]dimeter (S/N): LAMOTTE (0639-1298)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW2D GW-07
Sample Location: 6MW 2D
Sampled By: K. SIMPSON
C.O.C. No.: 011900-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-20-00 Time: 1510 Method: Low Flow/Bladder Pump	CLEAR	6.90	33.75	9.8	8.3	0	-308	21.17

PURGE DATA:

Date: 1-20-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): 0
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 78.8
Static Water Level (WL): 5.61
One Casing Volume(gal): 11.9
Start Purge (hrs): 1411
End Purge (hrs): 1507
Total Purge Time (min): 56
Total Vol. Purged (gal): 4.5

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
~~TAL METALS (DISSOLVED)~~ KES	~~HNO_3 / 4° C~~	~~L PE~~	—

OBSERVATIONS / NOTES:

DISCHARGE LINE FRZ. USED WARM WATER TO THAW; ON TOP 3' OF TUBING OUT OF WELL

Circle If Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): [illegible]

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW2D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-20-00
WEATHER: COLD/WINDY 20°F OVERCAST
PERSONNEL: R. SIMPSON

Well Screen Depth: 68.8 / 78.8 ft.
Initial Water Level: 5.61 @ 1400 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 73.0 TOC

Tide Cycle: ☐ High @ ☒ Low @ 1520 ☐ Not Affected

Total Purge Volume= ~~5.61~~ 4.5 (gal) / L ~~4~~

Total Purge Time= 56 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1415	6.13	0	270	40R/40D	9.6	6.88	33.49	0	16	20.84	-203	
1425	6.15	↓	305	50 PSI	9.6	6.82	32.94	0	12	20.71	-250	
1430	6.20	↓	↓	35R/35D	9.5	6.82	33.41	0	10	20.77	-270	
1440	6.28	↓	↓	50 PSI	9.8	6.87	33.62	0	8.6	21.27	-301	
1445	6.14	↓	↓	↓	9.6	6.88	34.19	0	8.5	21.34	-306	
1450	6.03	↓	↓	↓	9.7	6.88	33.67	0	8.5	21.00	-309	
1455	6.18	↓	↓	↓	9.8	6.90	34.00	0	8.4	21.37	-307	
1500	6.14	↓	↓	↓	9.8	6.90	33.81	0	8.3	21.29	-307	
1505	6.10	1780	↓	↓	9.8	6.90	33.75	0	8.3	21.17	-308	END PURGE

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
Turbidimeter (S/N): LA MOTTE

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW65 GW-07
Sample Location: 6MW65
Sampled By: S. Nail
C.O.C. No.: 011800.07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard 6.10	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-18-00								
Time: 0905								
Method: Low Flow/Bladder Pump	CLEAR	~~9.6~~ SW	0.252	9.6	0.3	7.23	242	0.12

PURGE DATA:

Date: 1-18-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): 0.0
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 18.58
Static Water Level (WL): 9.75
One Casing Volume(gal): 1.4
Start Purge (hrs): 0807
End Purge (hrs): 0902
Total Purge Time (min): 55
Total Vol. Purged (gal): 3.4

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements		Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	3	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	2	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	2	Qt. Amber Glass	✓
TCL PAH	4° C	2	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	1	L PE	✓
~~TAL METALS (DISSOLVED)~~	~~HNO_3 / 4° C~~		~~L PE~~	SW

OBSERVATIONS / NOTES:

Circle if Applicable:
MS/MSD
Duplicate ID No.:

Signature(s): Scott W. Nail

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW65

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-18-00
WEATHER: Breezy, Clear, cold, 3-7°F
PERSONNEL: Scott Neil

Well Screen Depth: 8.6 / 18.6 ft.
Initial Water Level: 9.75 @ 0807 hrs.

Pump Type/Material: BLADDER/ PVC
Pump Intake Depth: 14.0 T PVC

Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected

Total Purge Volume= 3.4 (ga) / L) **Total Purge Time=** 55 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0807	9.75	—	—	45H/45D							→	Begin Purging
0812	9.73	350	233		9.6	6.18	0.253	6.97	6.6	0.12	234	1115
0817	9.71				9.6	6.18	0.253	7.62	4.0	0.12	234	2330
0822	9.71				9.7	6.10	0.253	7.68	3.0	0.12	236	3445
0827	9.71				9.6	6.12	0.252	7.60	1.8	0.12	236	4660
0832	9.71				9.4	6.07	0.254	7.30	1.4	0.12	242	
0837	9.70				9.7	6.13	0.252	7.40	1.2	0.12	239	
0842	9.70				9.7	6.12	0.253	6.90	0.8	0.12	239	
0847	9.70				9.6	6.11	0.252	7.37	0.6	0.12	240	
0852	9.69				9.6	6.12	0.253	6.91	0.5	0.12	241	
0857	9.69				9.6	6.11	0.252	7.18	0.3	0.12	242	
0902	9.69	↓	↓	↓	9.6	6.10	0.252	7.23	0.3	0.12	242	End purging
		Begin sampling @ 0905 - Sample # DRMO-6MW65-GW-07										
		End ~~sampling~~ (SN) sampling @ 0935.										

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
T dimeter (S/N): LaMOTTE (0639-1298)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW6D GW-07
Sample Location: 6MW6D
Sampled By: KES
C.O.C. No.: 011800-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

Date: 1-15-00	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Time: 0915	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Method: Low Flow/Bladder Pump	CLEAR	5.95	3.732	8.9	19	1.33	89	1.97

PURGE DATA:

Date: 1-15-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): 0
Well Casing Diameter & Material Type: 6" ~~PVC~~ KS OPEN BORE HOLE
Total Well Depth (TD): 46.0'
Static Water Level (WL): 9.04
One Casing Volume(gal): 54.3
Start Purge (hrs): 0812
End Purge (hrs): 0912
Total Purge Time (min): 60
Total Vol. Purged (gal): 4.8

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓
~~TAL METALS (DISSOLVED)~~ KS	~~HNO_3 / 4° C~~	~~L PE~~	—

OBSERVATIONS / NOTES:

6" WELL; OPEN BORE HOLE

1.47 GAL/FT

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW6D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-19-00
WEATHER: COLD, CLEAR -3°F
PERSONNEL:

Well Screen Depth: 30.5 / 46.0 ft.
Initial Water Level: 9.04 @ 0905 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth:
Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected
Total Purge Volume= 4.8 (gal/L) **Total Purge Time=** 60 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0815	9.09	0	360	20B/3R 25 PSI	8.2	6.28	3.729	1.01	85	1.99	130.1	
0820	9.06	↓	300	↓	8.8	5.98	3.736	1.10	60	2.00	106	
KS 0830	9.04	↓	↓	↓	8.5	5.97	3.750	9.67	45	2.00	100	
0835	9.04	↓	↓	↓	8.5	5.97	3.763	7.40	45	2.00	97	
0840	9.03	↓	↓	↓	8.6	5.95	3.772	3.31	45	1.99	95	
0845	9.04	↓	↓	↓	9.0	5.96	3.774	2.93	45	1.99	94	
0850	9.04	↓	↓	↓	8.9	5.96	3.752	1.01	45	1.97	94	
0855	9.04	↓	↓	↓	9.1	5.96	3.731	1.80	39	1.99	92	
0900	9.04	↓	↓	↓	9.0	5.96	3.720	1.57	39	1.99	91	
0905	9.04	↓	↓	↓	8.9	5.95	3.731	1.44	23	1.98	90	
0910	9.04	18,000	↓	↓	8.9	5.95	3.732	1.33	19	1.97	89	END PURGE

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
Turbidimeter (S/N): LA MOTTE

Notes: COLD

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW9S GW-07
Sample Location: 6MW9S
Sampled By: K. SIMPSON
C.O.C. No.: 011900
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-19-00								
Time: 0940								
Method: Low Flow/Bladder Pump	CLEAR	5.10	0.049	9.6	0.2	0.63	282	0.02

PURGE DATA:

Date: 1-19-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 11.8
Static Water Level (WL): 3.58
One Casing Volume(gal): 1.4
Start Purge (hrs): 0945 0745
End Purge (hrs): 0935
Total Purge Time (min): 50
Total Vol. Purged (gal): 4.3

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	6
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	4
TCL PEST/PCBs	4° C	Qt. Amber Glass	4
TCL PAH	4° C	Qt. Amber Glass	4
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	2
~~TAL METALS (DISSOLVED)~~ KES	~~HNO_3 / 4° C~~	~~L PE~~	—
		2X VOL COLLECTED FOR DUP	

OBSERVATIONS/NOTES:

COLD 10°F

Circle If Applicable:

MS/MSD —

Duplicate ID No.: GWFD-011900

Signature(s): [signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW9S

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-19-00
WEATHER: 7°F CLEAR
PERSONNEL: R. SIMPSON

Well Screen Depth: 7.8 / 11.8 ft.
Initial Water Level: 3.58 @ 0730 hrs.

Pump Type/Material: BLADDER/ PVC
Pump Intake Depth: 10.0' TPVC

Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected

Total Purge Volume= 4.3 (gal)/(L) **Total Purge Time=** (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0750	3.61	0	325	30R/30D 10 PSI	9.3	5.20	0.056	2.17	8.4	0.02	200	START PURGE
0755	↓	↓	↓	↓	9.4	5.11	0.051	1.92	4.0	0.02	224	
0805					9.7	5.08	0.049	1.20	1.7	0.02	249	
0810	↓				9.5	5.07	0.049	1.64	1.0	0.02	253	
0815	3.64				9.6	5.10	0.049	1.58	0.8	0.02	260	
0820	3.62				9.6	5.07	0.049	1.19	0.5	0.02	270	
0825	↓				9.6	5.10	0.049	0.83	0.4	0.02	273	
0830		↓			9.5	5.10	0.049	0.70	0.2	0.02	278	
0835	↓	16,250	↓	↓	9.6	5.10	0.049	0.63	0.2	0.02	282	END PURGE
		START	SAMPLING		@	0837						
		END	SAMPLING		@	0918						

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
Bladder Pump (S/N): La MOTTE

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW10S GW-07
Sample Location: 6MW10S
Sampled By: S. Neil
C.O.C. No.: 011800-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

Date: 1-18-00	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Time: ~~1350~~ 1315	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Method: Low Flow/Bladder Pump	Clear	7.33	11.18	10.9	0.1	0.47	-264	6.34

PURGE DATA:

Date: 1-18-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): 0.0
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 13.30 SN
Static Water Level (WL): ~~8.50~~ 3.59
One Casing Volume(gal): 1.6
Start Purge (hrs): 1220
End Purge (hrs): 1310
Total Purge Time (min): 50
Total Vol. Purged (gal): 3.6

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	
TCL PEST/PCBs	4° C	Qt. Amber Glass	
TCL PAH	4° C	Qt. Amber Glass	
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	
~~TAL METALS (DISSOLVED)~~	~~HNO_3 / 4° C~~	~~L PE~~	SN

OBSERVATIONS / NOTES:

Suspended solids (Black) in sample.
Sulphur odor.
Final H_2O level = 4.03 Ft.

Check if Applicable:

MS/MSD
Duplicate ID No.:

Signature(s): Scott Neil

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW105

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-18-00
WEATHER: Sunny, clear, windy, cold, 11-16°F
PERSONNEL: SCOTT NEIL

Well Screen Depth: 3.3 / 13.3 ft.
Initial Water Level: 3.59' @ 1220 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 9.0 T PVC

Tide Cycle: ☐ High @ ☒ Low @ ☐ Not Affected

Total Purge Volume= _____ (gal / L)
Total Purge Time= _____ (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1220	3.59	—	—	30R/30D 15PSI							→	BEGIN PURGING
1225	3.70	355	355	40R/40D 15PSI	10.8	7.28	10.44	0.45	2.9	5.92	-70	suspended black particles
1230	3.74	2 (SN)	266		10.8	7.32	10.47	0.41	1.5	6.00	-161	LOT SULFUR ODOR
1235	3.75				10.8	7.35	10.57	0.52	1.9	6.00	-187	
1240	3.77				10.8	7.35	10.76	0.48	0.8	6.11	-208	
1245	3.77				10.8	7.35	10.77	0.58	0.6	6.12	-221	
1250	3.78				10.8	7.35	10.88	0.65	0.4	6.16	-231	
1255	3.79				10.8	7.34	10.96	0.41	0.5	6.22	-239	
1300	3.79				10.8	7.34	11.10	0.43	0.3	6.25	-248	
1305	3.79				10.9	7.33	11.14	0.45	0.3	6.29	-257	
1310	3.81				10.9	7.33	11.18	0.47	0.1	6.34	-264	END PURGING
		Begin sampling @ 1315 - sample ID DRMO - 6MW105 - GW-07.										
		End sampling @ 1350.										

Water Quality Meter (S/N): YSI (193433R)
Control Box Type (S/N): QED
Turbidimeter (S/N): LA MOTTE (0639-1298)

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW10D GW-07
Sample Location: 6MW10D
Sampled By: RES
C.O.C. No.: 011800-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

Date: 1-18-00	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Time: 1315	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Method: Low Flow/Bladder Pump	CLEAR	7.25	18.42	12.4	0.6	3.31	-142	11.22

PURGE DATA:

Date: 1-18-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 54.10
Static Water Level (WL): 2.53
One Casing Volume(gal): 8.4
Start Purge (hrs): 1210
End Purge (hrs): 1310
Total Purge Time (min): 60
Total Vol. Purged (gal): 4.8

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	9
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	6
TCL PEST/PCBs	4° C	Qt. Amber Glass	6
TCL PAH	4° C	Qt. Amber Glass	6
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	3
~~TAL METALS (DISSOLVED)~~ RS	~~HNO_3 / 4° C~~	~~L PE~~	—
		3X VOL COLLECTED	
		FOR MS/MSD	

OBSERVATIONS / NOTES:

FLUSH MT.

Circle if Applicable:

MS/MSD YES

Duplicate ID No.: —

Signature(s): K. S. Simpi

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW 10D

PROJECT:	NSB-NLON, DRMO	**DATE:**	1-18-00
PROJECT NUMBER:	7363	**WEATHER:**	COLD 10°F CLEAR
SITE:	DRMO	**PERSONNEL:**	K. SIMPSON

Well Screen Depth: 44.1 / 54.1 ft.
Initial Water Level: 2.53 @ 1207 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 49.0' TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1338 ☐ Not Affected
Total Purge Volume= 4.8 (gal) **Total Purge Time=** 60 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1220	2.48	0	325	30D/30R 30 PSI	11.9	7.29	19.02	8.31	1.0	11.27	-93	START PURGE
1225	2.49	↓	↓	↓	12.1	7.24	19.08	11.06	1.6	11.28	-119	
1230	2.50				12.2	7.24	18.94	10.61	2.2	11.18	-155	
1240	2.52				12.3	7.25	18.72	11.24	0.9	10.98	-151	
1245	2.53				12.3	7.25	19.05	6.04	1.0	10.94	-145	
1255	2.54				12.4	7.24	18.90	4.51	1.1	11.17	-143	
1300	2.55				12.3	7.24	18.31	3.37	1.0	11.08	-141	
1305	2.57				12.4	7.25	18.59	3.07	0.8	11.31	-139	
1310	2.57	18,000			12.4	7.25	18.42	3.31	0.6	11.22	-142	END PURGE
	START	SAMPLING @			1314							
	END	SAMPLING @			1415							

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
Turbidimeter (S/N): LA MOTTE

Notes: MS/MSD COLLECTED

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW11S GW-07
Sample Location: 6MW11S
Sampled By: KEITH SIMPSON
C.O.C. No.: 011900-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-19-00 Time: 1415 Method: Low Flow/Bladder Pump	CLEAR	7.49	12.31	9.9	1.6	5.77	-326	7.06

PURGE DATA:

Date: 1-19-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 13.50
Static Water Level (WL): 3.24
One Casing Volume(gal): 1.7
Start Purge (hrs): 1320
End Purge (hrs): 1410
Total Purge Time (min): 50
Total Vol. Purged (gal): 3.2

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	3
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	2
TCL PEST/PCBs	4° C	Qt. Amber Glass	2
TCL PAH	4° C	Qt. Amber Glass	2
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	1
~~TAL METALS (DISSOLVED)~~ KES	~~HNO_3 / 4° C~~	~~L PE~~	—

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: GMW 11S

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-19-00
WEATHER: 20°F SUNNY
PERSONNEL: R. SIMPSON

Well Screen Depth: 3.5 / 13.5 ft.
Initial Water Level: 3.24 @ 1255 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 11.0 TPVC
Total Purge Volume= 3.2 (gal/L)
Total Purge Time= 50 (min)

Tide Cycle: ☐ High @ ☒ Low @ 1429 ☐ Not Affected

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1325	3.63	0	240	45R/45D 20 PSI	10.2	7.49	14.77	10.21	14	8.60	-260	START PURGE
1330	3.64	↓	↓	↓	10.2	7.49	13.03	7.63	8.1	7.39	-310	
1335	3.66	↓	↓	↓	10.0	7.49	12.56	7.11	4.5	7.23	-314	
1340	3.65	↓	↓	↓	9.8	7.49	12.33	8.25	3.2	7.05	-314	
1350	3.74	↓	↓	↓	10.0	7.48	12.27	5.65	2.1	7.04	-321	
1355	3.80	↓	↓	↓	9.8	7.49	12.35	3.60	2.0	7.07	-225	
1400	3.80	↓	↓	↓	10.1	7.48	12.34	7.21	2.0	7.08	-319	
1405	3.81	↓	↓	↓	9.9	7.49	12.33	6.47	1.8	7.08	-328	
1410	3.83	12,000	↓	↓	9.9	7.49	12.31	5.77	1.6	7.06	-326	
		START SAMPLING			@	1413						
		END SAMPLING			@							

Water Quality Meter (S/N): YSI
Control Box Type (S/N): QED
Turbidimeter (S/N): LA MOTTE

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW11D GW-07
Sample Location: 6MW11D
Sampled By: S. NEIL
C.O.C. No.: 011900-07
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 1-19-00								
Time: 1433								
Method: Low Flow/Bladder Pump	CLEAR	6.91	34.40	11.8	0.5	5.04	-235	21.61

PURGE DATA:

Date: 1-19-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm): —
Well Casing Diameter & Material
Type: 2 PVC
Total Well Depth (TD): 85.0'
Static Water Level (WL): 3.64'
One Casing Volume(gal): 13.2
Start Purge (hrs): 1330
End Purge (hrs): 1430
Total Purge Time (min): 60
Total Vol. Purged (gal): 7.6

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓
~~TAL METALS (DISSOLVED)~~	~~HNO_3 / 4° C~~	~~L PE~~	~~✓~~ SW

OBSERVATIONS/NOTES:

FINAL H_2O LEVEL = 4.11 FT.

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): Scott W. Neil

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: 6MW11D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 1-19-00
WEATHER: CLEAR, WINDY, COLD, LOW 20'S.
PERSONNEL: SCOTT NEIL

Well Screen Depth: 75.0 / 85.0 ft.
Initial Water Level: 3.94 @ 1330 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 82.0 TPVC

Tide Cycle: ☐ High @ ☒ Low @ 1429 ☐ Not Affected

Total Purge Volume= 7.6 (gal/L) **Total Purge Time=** 60 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1330	3.94	—	—	35A/35D 50PSI	—						→	BEGIN PURGING.
1335	4.03	560	480	↓	10.2	6.99	34.50	2.33	4.0	21.59	-177	
1340	4.03	↓	↓	↓	10.9	6.95	34.48	1.50	2.1	21.57	-181	
1345	4.04	↓	↓	↓	11.0	6.94	34.49	2.32	0.9	21.65	-192	
1350	4.06	↓	↓	↓	11.5	6.94	34.50	2.71	0.8	21.66	-208	
1355	4.06	↓	↓	↓	11.6	6.93	34.51	4.21	0.6	21.66	-221	
1400	4.07	↓	↓	↓	11.4	6.93	34.55	4.28	0.7	21.69	-219	
1405	4.07	↓	↓	↓	11.5	6.93	34.53	4.50	0.6	21.71	-220	
1410	4.09	↓	↓	↓	11.4	6.90	34.59	4.77	0.7	21.74	-224	
1415	4.10	↓	↓	↓	11.6	6.92	34.52	4.68	0.6	21.68	-228	
1420	4.09	↓	↓	↓	11.7	6.92	34.48	4.84	0.6	21.66	-232	
1425	4.10	↓	↓	↓	11.7	6.91	34.42	4.89	0.3	21.63	-232	
1430	4.10	↓	↓	↓	11.8	6.91	34.40	5.04	0.5	21.61	-235	END PURGING
	BEGIN SAMPLING @ 1433; SAMPLE ID # DRMO-6MW11D-GW-07.											
	END SAMPLING @ 1454.											

Water Quality Meter (S/N): YSI (193933R)
Control Box Type (S/N): QED (15800)
Turbidimeter (S/N): LA MOTTE (0639-1298)

Notes: Attempted to begin purging at 1315, however the tubing inside the well casing was frozen. "Unclogged" ice in tubing and began purging @ 1330

ROUND 8

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW15 GW-08
Sample Location: 6MW15
Sampled By: S. NGIL
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Date: 4-11-00	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Time: 1045								
Method: Low Flow/Bladder Pump	Clear	6.21	1.712	10.7	0.0	2.99	139	0.87

PURGE DATA:

Date: 4-11-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 15.68
Static Water Level (WL): 7.82
One Casing Volume(gal): 1.3
Start Purge (hrs): 0923
End Purge (hrs): 1033
Total Purge Time (min): 70
Total Vol. Purged (gal): 4.2

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	(3) 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	(2) Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	(2) Qt. Amber Glass	✓
TCL PAH	4° C	(2) Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	(1) L PE	✓

OBSERVATIONS / NOTES:

Light sheen on sample surface

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Scott Neil

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

Well No.: GMW15

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-11-00
WEATHER: Mostly cloudy, mid 40's / low 40's.
PERSONNEL: S. Neil

Well Screen Depth: 5.7 / 15.7 ft.
Initial Water Level: 7.82 @ 0923 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 12.0' TPVC

Tide Cycle: ☐ High @ ☒ Low @ 1045 ☐ Not Affected

Total Purge Volume= 4.2 (gal / L)
Total Purge Time= 70 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0923	7.82			20 PSI							→	Begin purging.
0928	7.92	340	227	500/40	10.4	6.43	2.046	10.74	7.2	1.37	100	
0933	8.01				10.5	6.31	2.034	12.10	2.4	1.04	109	
0938	8.12				10.5	6.27	1.978	9.44	0.9	1.00	117	
0943	8.15				10.6	6.25	1.916	6.25	0.4	0.98	118	
0948	8.13				10.6	6.24	1.882	4.10	0.0	0.96	123	
0953	8.14				10.6	6.22	1.872	2.55	0.0	0.96	124	
0958	8.17				10.6	6.22	1.849	3.83	0.0	0.95	128	
1003	8.16				10.6	6.21	1.819	3.69	0.2	0.93	129	
1008	8.19				10.6	6.21	1.788	3.21	0.0	0.91	131	
1013	8.19				10.7	6.21	1.768	3.93	0.3	0.90	134	
1018	8.21				10.7	6.19	1.758	3.20	0.0	0.90	135	
1023	8.23				10.7	6.20	1.743	3.03	0.0	0.89	136	
1028	8.23				10.7	6.20	1.725	2.81	0.0	0.88	138	
1033	8.25	15,890			10.7	6.21	1.712	2.99	0.0	0.87	139	End purging.
	Begin	sampling	@	1035.								

Water Quality Meter (S/N): YSI / 97K1095
Control Box Type (S/N): Well Wizard / 16789
T[illegible]imeter (S/N): LaMotte 2020 / 0301-3997

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW25 GW-08
Sample Location: 6MW25
Sampled By: K. SIMPSON
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Date: 4-11-00	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Time: 0950								
Method: Low Flow/Bladder Pump	CLEAR	7.10	11.27	8.7	6.7	0.06	59	6.41

PURGE DATA:

Date: 4-11-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 2" PVC
Total Well Depth (TD): 13.63
Static Water Level (WL): 6.02
One Casing Volume(gal): 1.2
Start Purge (hrs): 0845
End Purge (hrs): 0945
Total Purge Time (min): 60
Total Vol. Purged (gal): 5.6

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	—
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	—
TCL PEST/PCBs	4° C	Qt. Amber Glass	—
TCL PAH	4° C	Qt. Amber Glass	—
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	—

OBSERVATIONS / NOTES:

END SAMPLING 1005 WL = 6.61

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): K. S. Simpson

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW25

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-11-00
WEATHER: SUNNY 45°F
PERSONNEL: R. SIMPSON

Well Screen Depth: 3.6 / 13.6 ft.
Initial Water Level: 6.02 @ 0844 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 10.0 TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1045 ☐ Not Affected
Total Purge Volume= 5.6 (gal/L) **Total Purge Time=** 60 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh ORP mV	Comments
0848	6.08	0	350	30R/30D	8.4	6.81	10.47	0.26	2.1	5.86	194	
0855	6.18			15 PSI	8.7	7.06	10.85	0.07	3.2	6.16	137	
0900	6.20				8.7	7.08	10.89	0.05	5.0	6.18	123	
0905	6.28				8.7	7.09	10.95	0.04	7.8	6.21	107	
0910	6.28				8.7	7.10	10.99	0.04	8.0	6.24	93	
0915	6.28				8.7	7.10	11.03	0.04	8.1	6.27	88	
0920	6.31				8.7	7.10	11.11	0.04	8.0	6.31	77	
0925	6.33				8.8	7.10	11.13	0.05	7.9	6.33	70	
0930	6.37				8.7	7.10	11.18	0.05	7.6	6.35	65	
0935	6.43				8.7	7.10	11.22	0.06	7.2	6.38	61	
0940	6.45				8.7	7.10	11.25	0.06	6.9	6.40	60	
0945	6.48	21,000			8.7	7.10	11.27	0.06	6.7	6.41	59	END PURGE

Water Quality Meter (S/N): YSI 214561R
Control Box Type (S/N): QED 16078
T[illegible]dimeter (S/N): LAMONTTE 1298

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW 2D GW-08
Sample Location: 6MW 2D
Sampled By: R. SIMPSON
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh ORP mV	Salinity ppt
Date: 4-11-00 Time: 1105 Method: Low Flow/Bladder Pump	CLEAR	6.89	34.66	11.3	15	0.10	-281	21.74

PURGE DATA:

Date: 4-11-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 88.84
Static Water Level (WL): 5.58
One Casing Volume(gal):
Start Purge (hrs): 1013
End Purge (hrs): 1103
Total Purge Time (min): 50
Total Vol. Purged (gal): 3.7

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	—
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	—
TCL PEST/PCBs	4° C	Qt. Amber Glass	—
TCL PAH	4° C	Qt. Amber Glass	—
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	—

OBSERVATIONS / NOTES:

SULFUR ODOR EFFERVESCING IN HCL
TRACE BLACK FINES IN WATER
END SAMPLE @ 1123 WL = 5.98

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** 6MW 2D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-11-00
WEATHER: OVERCAST 52°F
PERSONNEL: R. SIMPSON

Well Screen Depth: 68.8 / 78.8 ft.
Initial Water Level: 5.58 @ 1012 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 73.0 PVC
Total Purge Volume= 3.7 (gal/oz)
Total Purge Time= 50 (min)

Tide Cycle: ☐ High @ ☒ Low @ 1045 ☐ Not Affected

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh ORP mV	Comments
1016	5.90	0	280	35R/35D	11.0	6.90	34.80	0.14	21	21.86	-163	
1025	5.90	↓	↓	50 PSI	11.1	6.87	34.52	0.02	24	21.66	-198	
1030	5.91	↓	↓	↓	11.2	6.89	34.44	0.06	26	21.61	-221	
1035	5.93	↓	↓	↓	11.1	6.89	34.40	0.08	22	21.57	-239	
1040	5.95	↓	↓	↓	11.3	6.89	34.39	0.08	19	21.59	-257	
1045	5.97	↓	↓	↓	11.3	6.89	34.60	0.10	17	21.72	-268	
1050	5.98	↓	↓	↓	11.3	6.89	34.65	0.09	15	21.78	-273	
1055	6.00	↓	↓	↓	11.3	6.89	34.68	0.09	15	21.78	-278	
1100	5.98	14,000	↓	↓	11.3	6.89	34.66	0.10	15	21.74	-281	

Water Quality Meter (S/N): YSI 214561R
Control Box Type (S/N): QED 16078
Turbidimeter (S/N): LAMONTTE 1298

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW65 GW-08
Sample Location: GMW65
Sampled By: R. SIMPSON
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh ORP mV	Salinity ppt
Date: 4-10-00 Time: 1345 Method: Low Flow/Bladder Pump	CLEAR	6.13	0.253	10.2	0.3	1.47	158	0.12

PURGE DATA:

Date: 4-10-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 18.58
Static Water Level (WL): 8.44
One Casing Volume(gal): 1.7
Start Purge (hrs): 1243
End Purge (hrs): 1343
Total Purge Time (min): 60
Total Vol. Purged (gal): 3.6

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓

OBSERVATIONS / NOTES:

2X VOC FOR DUP

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	GWFD-041000

Signature(s): R. S. Simpson

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW65

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-10-00
WEATHER: SUNNY 50°F
PERSONNEL: K. SIMPSON

Well Screen Depth: 8.6 / 18.6 ft.
Initial Water Level: 8.44 @ 1240 hrs.
Total Purge Volume= 3.6 (gal/L)

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 14.0 TPVC
Total Purge Time= _____ (min)

Tide Cycle: ☐ High @ ____ ☐ Low @ ____ ☒ Not Affected

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh ORP mV	Comments
1246	8.44	0	225	45D/45R	11.0	7.73	0.309	1.82	1.5	0.15	88	
1250	8.45			25 PSI	10.7	6.65	0.256	1.88	1.3	0.12	116	
1255				45D/45R	10.3	6.42	0.255	2.09	1.1	0.12	122	
1300				10 PSI	10.5	6.23	0.255	1.87	0.9	0.12	131	
1305					10.3	6.18	0.255	1.79	0.6	0.12	137	
1310					10.2	6.15	0.255	2.04	0.5	0.12	143	
1315					10.3	6.15	0.254	1.57	0.5	0.12	145	
1320					10.4	6.14	0.254	1.57	0.4	0.12	148	
1325					10.4	6.14	0.254	1.46	0.3	0.12	149	
1333					10.1	6.14	0.254	1.30	0.4	0.12	157	
1335					10.1	6.14	0.253	1.57	0.3	0.12	157	
1340	8.45	13,500			10.2	6.13	0.253	1.47	0.3	0.12	158	END PURGE
					START		SAMPLE					1342
					END		SAMPLING					1456

Water Quality Meter (S/N): YSI 214561R
Control Box Type (S/N): QED 16078
Turbidimeter (S/N): LAMONTE 1298

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW6D GW-08
Sample Location: 6MW6D
Sampled By: S. NEIL
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 4-10-00								
Time: 1350								
Method: Low Flow/Bladder Pump	Cloudy	5.62	3.820	10.6	31	1.29	94	2.03

PURGE DATA:

Date: 4-10-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 6" ~~PVC~~ STEEL & OPEN BORE HOLE
Total Well Depth (TD): 46.0
Static Water Level (WL): 8.79
One Casing Volume(gal): ~~6.4~~ 6x 54.7 gallons
Start Purge (hrs): 1246
End Purge (hrs): 1346
Total Purge Time (min): 60
Total Vol. Purged (gal): 7.0

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	9 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	6 Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	6 Qt. Amber Glass	✓
TCL PAH	4° C	6 Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	3 L PE	✓

OBSERVATIONS / NOTES:

6" open borehole.
Extra volume for MS/MSD.

Circle if Applicable:

MS/MSD: YES
Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW6D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-10-00
WEATHER: Sunny, breezy, 50's.
PERSONNEL: S. Neil

OPEN BORE HOLE
Well ~~Screen~~ Depth: 30.5 / 46.0 ft.
Initial Water Level: 8.79 @ 1246 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 38.0 TC

Tide Cycle: ☐ High @ ☐ Low @ ☒ Not Affected

Total Purge Volume= 7.0 (gal) L) **Total Purge Time=** 60 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1246	8.79			25 PSI							→	Begin purging.
1251	8.80	370	444	30D/20R	11.1	7.25	3.794	5.94	24	2.01	5	Water has an orange tint.
1256	8.81	370	444		11.0	6.61	3.838	3.50	35	2.04	35	
1301	8.82				10.6	5.87	3.848	1.84	56	2.04	65	
1306	8.83				10.7	5.73	3.841	1.36	49	2.04	75	
1311	8.83				10.6	5.67	3.837	1.42	41	2.04	82	
1316	8.82				10.6	5.66	3.836	1.00	43	2.04	85	
1321	8.82				10.6	5.64	3.835	1.09	41	2.04	88	
1326	8.82				10.7	5.64	3.832	1.35	39	2.03	90	
1331	8.83				10.5	5.63	3.834	1.26	35	2.04	91	
1336	8.82				10.5	5.62	3.826	1.23	33	2.03	92	
1341	8.82				10.6	5.62	3.824	1.19	29	2.03	93	
1346	8.82	2660	↓	↓	10.6	5.62	3.820	1.29	31	2.03	94	End purging.

Water Quality Meter (S/N): YSI / 97K1095
Control Box Type (S/N): QED / 16789
T[illegible]imeter (S/N): LaMotte 2020 / 0301 - 3997

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW 9S GW-08
Sample Location: GMW 9S
Sampled By: S. NEIL
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Eh	Salinity
Date: 4-11-00	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	ppt
Time: 1405								
Method: Low Flow/Bladder Pump	CLEAR	5.04	0.045	8.8	0.0	7.60	224	0.02

PURGE DATA:

Date: 4-11-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 11.75
Static Water Level (WL): 3.85
One Casing Volume(gal): 1.3
Start Purge (hrs): 1318
End Purge (hrs): 1358
Total Purge Time (min): 40
Total Vol. Purged (gal): 3.5

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	(3) 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	(1) Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	(1) Qt. Amber Glass	✓
TCL PAH	4° C	(1) Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	(1) L PE	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW9S

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-11-00
WEATHER: Light rain, low 40's.
PERSONNEL: S. NEIL

Well Screen Depth: 7.8 / 11.8 ft.
Initial Water Level: _____ @ _____ hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 10.0 PVC

Tide Cycle: ☐ High @ _____ ☐ Low @ _____ ☒ Not Affected

Total Purge Volume= 3.5 (gal / L) **Total Purge Time=** 40 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1318	3.85			40 PSI							→	Begin purging
1323	3.85	330	330	300/30L	8.9	~~8~~ 5.42	0.049	9.38	7.9	0.02	164	
1328	3.86	↓	↓	↓	8.9	5.22	0.047	8.20	4.5	0.02	186	
1333	3.85				8.9	5.12	0.046	7.95	1.9	0.02	197	
1338	3.86				8.8	5.08	0.046	7.85	0.2	0.02	204	
1343	3.86				8.8	5.07	0.046	7.78	0.2	0.02	209	
1348	3.86				8.8	5.07	0.046	7.72	0.0	0.02	217	
1353	3.85				8.8	5.06	0.045	7.64	0.0	0.02	221	
1358	3.85	13,200			8.8	5.04	0.045	7.60	0.0	0.02	224	End purging

Water Quality Meter (S/N): YSI / 97K1095
Control Box Type (S/N): WELL WIZARD / 16789
T[illegible]dimeter (S/N): La Motte / 0301-3997

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW 10S GW-08
Sample Location: GMW 10S
Sampled By: S. NEIL
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 4-10-00								
Time: 0930								
Method: Low Flow/Bladder Pump	CLEAR	7.05	8.979	10.9	0.6	1.15	-281	5.04

PURGE DATA:

Date: 4-10-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 13.31
Static Water Level (WL): 4.55
One Casing Volume(gal): 1.4
Start Purge (hrs): 0854
End Purge (hrs): 0929
Total Purge Time (min): 35
Total Vol. Purged (gal): 3.9

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	(3) 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	(2) Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	(2) Qt. Amber Glass	✓
TCL PAH	4° C	(2) Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	(1) L PE	✓

OBSERVATIONS / NOTES:

Some black suspended fines in sample; water has sulphur odor.

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Scott W. Neil

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW 10S

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-10-00
WEATHER: Sunny, breezy, mid 40's.
PERSONNEL: S. NEIL

Well Screen Depth: 3.3 / 13.3 ft.
Initial Water Level: 4.55 @ 0854 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 9.0 TPVC

Tide Cycle: ☐ High @ ☒ Low @ ☐ Not Affected

Total Purge Volume= 3.9 (gal/L) **Total Purge Time=** 35 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
0854	4.55			20 PSI							→	BEGIN PURGING
0859	4.58	350	420	20 PSI/300	10.9	7.06	8.957	3.08	7.8	5.01	-240	Some black suspended
0904	4.66	↓	↓	↓	10.9	7.10	8.770	1.69	1.1	4.91	-251	fines in water.
0909	4.68				10.9	7.11	8.847	2.52	0.3	4.96	-265	↓
0914	4.72				10.9	7.09	8.943	1.19	0.6	5.02	-276	
0919	4.73				10.9	7.08	8.962	1.14	0.4	5.03	-278	
0924	4.75				10.9	7.06	8.983	1.09	0.8	5.04	-280	
0929	4.77	↓	↓	↓	10.9	7.05	8.979	1.15	0.6	5.04	-281	End purging

Water Quality Meter (S/N): YSI 6820 / 97K1095
Control Box Type (S/N): Well Wizard / 16789
Dilimeter (S/N): Lamotte 2020 / 0301-3997

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- 6MW10D GW-08
Sample Location: 6MW 10D
Sampled By: R. SIMPSON
C.O.C. No.: 041000-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 4-10-00								
Time: 0940								
Method: Low Flow/Bladder Pump	CLEAR	7.20	18.76	12.6	0.9	—	-153	11.16

PURGE DATA:

Date: 4-10-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 2" PVC
Total Well Depth (TD): 54.06
Static Water Level (WL): 2.41
One Casing Volume(gal): 8.4
Start Purge (hrs): 0850
End Purge (hrs): 0935
Total Purge Time (min): 45
Total Vol. Purged (gal): 3.9

CLEAR w/ NO ODOR

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	✓
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	Qt. Amber Glass	✓
TCL PAH	4° C	Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): R. S. Simpson

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW 10D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-10-00
WEATHER: SUNNY 43°F
PERSONNEL: K. SIMPSON

Well Screen Depth: 44.1 / 54.1 ft.
Initial Water Level: 2.41 @ 0848 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 49.0 PVC

Tide Cycle: ☐ High @ ☒ Low @ 0942 ☐ Not Affected

Total Purge Volume= 3.9 (gal/KL) **Total Purge Time=** 45 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh ORP mV	Comments
0856	2.43	0	325	350/30R	12.5	7.24	19.76	—	4.0	11.79	-130	START PURGE
0905	2.45	↓	↓	25 PSI	12.5	7.20	18.91	—	4.2	11.25	-136	
0910	2.41	↓	↓	↓	12.5	7.20	18.82	—	4.6	11.19	-141	
0915	↓	↓	↓	↓	12.6	7.20	18.76	—	2.4	11.18	-146	
0920	↓	↓	↓	↓	12.6	7.20	18.74	—	1.2	11.15	-149	
0925	↓	↓	↓	↓	12.6	7.20	18.74	—	1.0	11.16	-150	
0930	↓	↓	↓	↓	12.6	7.20	18.74	—	1.0	11.14	-153	
0935	↓	14,625	↓	↓	12.6	7.20	18.76	—	0.9	11.16	-153	END PURGE
						START	SAMPLING		0937			
						END	SAMPLING		0958			

Water Quality Meter (S/N): YSI 214561R
Control Box Type (S/N): QED 16078
T limeter (S/N): LAMOTTE 1298

Notes: DO PROBE IS NOT WORKING, WILL NOT CAL.

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW11S GW-08
Sample Location: GMW 11S
Sampled By: S. NEIL
C.O.C. No.: 041200-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh mV	Salinity ppt
Date: 4-12-00								
Time: 1157								
Method: Low Flow/Bladder Pump	CLEAR	7.44	8.526	10.6	6.1	1.24	-213	479

PURGE DATA:

Date: 4-12-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material
Type: 2" PVC
Total Well Depth (TD): 13.50
Static Water Level (WL): 3.68
One Casing Volume(gal): 1.6
Start Purge (hrs): 1055
End Purge (hrs): 1135
Total Purge Time (min): 40
Total Vol. Purged (gal): 2.6

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	(3) 40 ml Vial	✓
TCL SEMIVOLATILES	4° C	(2) Qt. Amber Glass	✓
TCL PEST/PCBs	4° C	(2) Qt. Amber Glass	✓
TCL PAH	4° C	(2) Qt. Amber Glass	✓
TAL METALS (TOTAL)	HNO_3 / 4° C	(1) L PE	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): Scott W. Neil

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW11S

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO
DATE: 4-12-00
WEATHER: Mostly sunny, breezy, 40's.
PERSONNEL: S. NEIL

Well Screen Depth: 3.5 / 13.5 ft.
Initial Water Level: 3.68 @ 1055 hrs.
Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 11.0 TPVC
Tide Cycle: ☐ High @ ☒ Low @ 1147 ☐ Not Affected
Total Purge Volume= 2.6 (gal / L) **Total Purge Time=** 40 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp ºC	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh mV	Comments
1055	3.68			20 PSI 450/45R								Begin purging
1100	3.74	370	247		10.5	7.32	10.71	2.98	24	6.07	-224	Suspended fines.
1105	3.76				10.5	7.38	8.883	2.09	40	4.97	-212	
1110	3.79				10.5	7.39	8.440	1.71	19	4.72	-203	
1115	3.83				10.4	7.41	8.547	1.51	10	4.78	-208	
1120	3.85				10.4	7.42	8.488	1.30	7.3	4.74	-208	
1125	3.88				10.4	7.42	8.511	1.30	6.0	4.76	-208	
1130	3.90				10.5	7.44	8.516	1.26	6.4	4.79	-211	
1135	3.91	14,800			10.6	7.44	8.526	1.24	6.1	4.79	-213	End purging.

Water Quality Meter (S/N): YSI / 97K1095
Control Box Type (S/N): QED / 16789
Turbidimeter (S/N): LaMotte 2020 / 0301-3997

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSB-NLON / DRMO
Project No.: 7363

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: DRMO- GMW11D GW-08
Sample Location: GMW11D
Sampled By: R. SIMPSON
C.O.C. No.: 041200-08
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA:

Date: 4-12-00 Time: 1145	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Eh ORP mV	Salinity ppt
Method: Low Flow/Bladder Pump	CLEAR	6.96	33.03	12.9	3.7	0.04	-131	20.68

PURGE DATA:

Date: 4-12-00
Method: Low Flow/Bladder Pump
Monitor Reading (ppm):
Well Casing Diameter & Material Type: 2" PVC
Total Well Depth (TD): 85.0
Static Water Level (WL): 2.19
One Casing Volume(gal): 13.5
Start Purge (hrs): 1053
End Purge (hrs): 1143
Total Purge Time (min): 50
Total Vol. Purged (gal): 4.9

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOLATILES (LOW-LEVEL)	HCL / 4° C	40 ml Vial	—
TCL SEMIVOLATILES	4° C	Qt. Amber Glass	—
TCL PEST/PCBs	4° C	Qt. Amber Glass	—
TCL PAH	4° C	Qt. Amber Glass	—
TAL METALS (TOTAL)	HNO_3 / 4° C	L PE	—

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc. **LOW FLOW PURGE DATA SHEET** **Well No.:** GMW11D

PROJECT: NSB-NLON, DRMO
PROJECT NUMBER: 7363
SITE: DRMO

DATE: 4-12-00
WEATHER: OVERCAST 60 °F
PERSONNEL: K. SIMPSON

Well Screen Depth: 75.0 / 85.0 ft.
Initial Water Level: 2.19 @ 1053 hrs.

Pump Type/Material: BLADDER/PVC
Pump Intake Depth: 82.0 PVC

Tide Cycle: ☐ High @ ☒ Low @ 1147 ☐ Not Affected

Total Purge Volume= 4.9 (gal)
Total Purge Time= 50 (min)

Time	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Pump Settings	Temp °C	pH	Sp Cond mS/cm	DO mg/L	Turbidity NTU	Salinity ppt	Eh ORP mV	Comments
1057	2.19	0	370	35R/35D	12.8	7.47	33.15	0.02	14	20.64	68.7	START PURGE
1105	↓	↓	↓	50 PSI	13.0	6.97	33.03	0.02	11	20.69	-105	
1110	↓	↓	↓	↓	12.8	6.97	33.02	0.02	8.8	20.67	-110	
1115	2.22	↓	↓	↓	12.9	6.97	33.01	0.02	7.0	20.67	-113	
1120	↓	↓	↓	↓	12.7	6.97	33.06	0.05	7.5	20.69	-120	
1125	2.28	↓	↓	↓	12.8	6.96	33.03	0.03	6.3	20.68	-125	
1130	↓	↓	↓	↓	12.9	6.96	32.96	0.03	4.9	20.65	-128	
1135	↓	↓	↓	↓	12.9	6.96	33.01	0.04	4.2	20.66	-130	
1140	↓	18,500	↓	↓	12.9	6.96	33.03	0.04	3.7	20.68	-131	END PURGE

Water Quality Meter (S/N): YSI 214561B
Control Box Type (S/N): QED 16078
T[illegible]limeter (S/N): LAMOTTE 1298

Notes:

APPENDIX B

STATISTICS

TETRA TECH NUS, INC. **CALCULATION WORKSHEET**

CLIENT NSB-NLON	JOB NUMBER 7363
SUBJECT SAMPLE CALCULATION OF STATISTICAL ANALYSES	
BASED ON GW DOWNGRADIENT ARSENIC RND 5-8	DRAWING NUMBER
BY BEL / CHECKED BY	APPROVED BY / DATE 10/24/00

ARSENIC RESULTS FROM THE DOWNGRADIENT WELLS:

LOCATION	ROUND	DUPLICATE	RESULT	QUAL	VALUE *
6MW1S	5		1.1	U	0.55
	6		3.8	U	1.9
	7		2.6	UJ	1.3
	8		2.3	U	1.15
6MW2D	5		1.5	J	1.5
	6		3.8	U	1.9
	7		2.6	UJ	1.3
	8		2.3	U	1.15
6MW2S	5		1.1	U	0.55
	6		3.9	J	3.9
	7		2.6	UJ	1.3
	8		2.3	U	1.15
6MW10D	5		4.3		4.3
	6		7.5	J	7.5
	7		4.2	J	4.2
	8		4.5	U	2.25
6MW10S	5		1.1	U	0.55
	6		3.8	U	1.9
	7		2.6	U	1.3
	8		2.3	U	1.15
6MW11D	5		2.3		2.3
	6		3.8	J	3.8
	7		2.6	UJ	1.3
	8		7.4	U	3.7
6MW11S	5		1.1	U	0.55
	5	DUP	1.1	U	0.55
	6		3.8	U	1.9
	7		2.6	U	1.3
	8		2.3	U	1.15

$\sum_{i=1}^{28} X_i = 56.80$

* NON-DETECTS ARE REPLACED WITH HALF THE DETECTION LIMIT

CLIENT NSB-NLON	JOB NUMBER 7363
SUBJECT SAMPLE CALCULATION OF STATISTICAL ANALYSES	
BASED ON GW DOWNGRADIENT ROUND 5-8	DRAWING NUMBER
BY BEL / CHECKED BY	APPROVED BY / DATE 10/24/00

THE ARITHMETIC MEAN ($\bar{X}$) CAN BE CALCULATED BY:

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{56.80}{28} = 2.029 \text{ ug/L}$$

COMPUTE THE SHAPIRO-WILK W STATISTIC (W_{CALC}):

$$W_{CALC} = \left[\frac{b}{S_X\sqrt{n-1}}\right]^2$$

$$\text{where } b = \sum_{i=1}^{k} a_{n-i+1}(X_{n-i+1} - X_i) = \sum_{i=1}^{k} b_i$$

MAKE A TABLE WITH 5 COLUMNS

COLUMN 1 = DATA FROM SMALLEST TO LARGEST VALUE (X_i)
COLUMN 2 = DATA FROM LARGEST TO SMALLEST VALUE (X_{n-i+1})
COLUMN 3 = COLUMN 2 - COLUMN 1 ($X_{n-i+1} - X_i$)
COLUMN 4 = SHAPIRO-WILK COEFFICIENT (a_{n-i+1}) FROM TABLE 1
COLUMN 5 = COLUMN 3 x COLUMN 4 = $b_i = a_{n-i+1}(X_{n-i+1} - X_i)$

X_i	X_{n-i+1}	$X_{n-i+1} - X_i$	a_{n-i+1}	b_i	i
0.55	7.5	6.95	0.4328	3.0080	1
0.55	4.3	3.75	0.2992	1.1220	2
0.55	4.2	3.65	0.2510	0.9162	3
0.55	3.9	3.35	0.2151	0.7206	4
1.$5	3.8	2.65	0.1857	0.4921	5
1.$5	3.7	2.55	0.1601	0.4083	6
1.$5	2.3	1.15	0.1372	0.1578	7
1.$5	2.25	1.10	0.1162	0.1278	8
1.$5	1.9	0.75	0.0965	0.0724	9
1.3	1.9	0.60	0.0778	0.0467	10
1.3	1.9	0.60	0.0598	0.0359	11
1.3	1.9	0.60	0.0424	0.0254	12
1.3	1.5	0.20	0.0253	0.0051	13
1.3	1.3	0.00	0.0084	0.0000	14=k
			b=	7.1381	

CLIENT NSB-NLON	JOB NUMBER 7363
SUBJECT SAMPLE CALCULATION OF STATISTICAL ANALYSES	
BASED ON GW DOWNGRADIENT ARSENIC S-8	DRAWING NUMBER
BY BEL / CHECKED BY	APPROVED BY / DATE 10/24/00

COMPUTE THE STANDARD DEVIATION (S_X):

$$S_X = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

$$\sum_{i=1}^{28} (x_i - \bar{x})^2 = (7.5-2.029)^2 + (4.3-2.029)^2 + (4.2-2.029)^2 + (3.9-2.029)^2 + (3.8-2.029)^2 + (3.7-2.029)^2 + (2.3-2.029)^2 + (2.25-2.029)^2 + (1.9-2.029)^2 + (1.9-2.029)^2 + (1.9-2.029)^2 + (1.9-2.029)^2 + (1.5-2.029)^2 + (1.3-2.029)^2 + (1.3-2.029)^2 + (1.3-2.029)^2 + (1.3-2.029)^2 + (1.3-2.029)^2 + (1.3-2.029)^2 + (1.15-2.029)^2 + (1.15-2.029)^2 + (1.15-2.029)^2 + (1.15-2.029)^2 + (0.55-2.029)^2 + (0.55-2.029)^2 + (0.55-2.029)^2 + (0.55-2.029)^2$$

$$= 29.9365 + 5.1594 + 4.7151 + 3.5022 + 3.1380 + 2.7937 + 0.0737 + 0.0490 + 0.0165 + 0.0165 + 0.0165 + 0.0165 + 0.2794 + 0.5308 + 0.5308 + 0.5308 + 0.5308 + 0.5308 + 0.7719 + 0.7719 + 0.7719 + 0.7719 + 0.7719 + 2.1862 + 2.1862 + 2.1862 + 2.1862$$

$$= 65.5021$$

$$S_X = \sqrt{\frac{65.5021}{27}} = \sqrt{2.426} = 1.5576$$

$$W_{CALC} = \left[\frac{b}{S_X\sqrt{n-1}}\right]^2 = \left[\frac{7.1381}{(1.5576)(27)^{1/2}}\right]^2 = (0.8820)^2 = 0.7779$$

COMPARE W_{CALC} WITH W_{TEST} FROM TABLE 2:

$$W_{CALC} = 0.7779 < 0.9240 = W_{TABLE}$$

SINCE $W_{CALC} < W_{TEST}$, WE REJECT THE NULL HYPOTHESIS (H_0) THAT THE DATA HAS A NORMAL DISTRIBUTION AND ACCEPT THE ALTERNATIVE HYPOTHESIS (H_A) THAT THE POPULATION DOES NOT HAVE A NORMAL DISTRIBUTION

CLIENT NSB-NLON	JOB NUMBER 7363
SUBJECT SAMPLE CALCULATION OF STATISTICAL ANALYSIS	
BASED ON GW ARSENIC RUNNOS 5-8	DRAWING NUMBER
BY BEL / CHECKED BY	APPROVED BY / DATE 10/24/00

PERFORM THE WILCOXON RANK-SUM NON-PARAMETRIC ANOVA:
RANK THE RESULTS FROM LOWEST TO HIGHEST

VALUE	GRADIENT	RANK	ADJUSTED RANK	VALUE	GRADIENT	RANK	ADJUSTED RANK
0.55	DOWN	1	4	1.3	UP	24	23
0.55	DOWN	2	4	1.3	UP	25	23
0.55	DOWN	3	4	1.3	UP	26	23
0.55	DOWN	4	4	1.3	UP	27	23
0.55	UP	5	4	1.3	UP	28	23
0.55	UP	6	4	1.5	DOWN	29	29
0.55	UP	7	4	1.9	DOWN	30	34
1.15	DOWN	8	12.5	1.9	DOWN	31	34
1.15	DOWN	9	12.5	1.9	DOWN	32	34
1.15	DOWN	10	12.5	1.9	DOWN	33	34
1.15	DOWN	11	12.5	1.9	UP	34	34
1.15	DOWN	12	12.5	1.9	UP	35	34
1.15	UP	13	12.5	1.9	UP	36	34
1.15	UP	14	12.5	1.9	UP	37	34
1.15	UP	15	125	1.9	UP	38	34
1.15	UP	16	12.5	2.25	DOWN	39	59
1.15	UP	17	12.5	2.3	DOWN	40	40
1.3	DOWN	18	23	3.7	DOWN	41	41
1.3	DOWN	19	23	3.8	DOWN	42	42
1.3	DOWN	20	23	3.9	DOWN	43	43
1.3	DOWN	21	23	4.2	DOWN	44	44
1.3	DOWN	22	23	4.3	DOWN	45	45
1.3	DOWN	23	23	7.5	DOWN	46	46

SUM THE RANKS:

$$WTS = \sum_{down} RANK = 4(4) + 5(12.5) + 6(23) + 29 + 4(34) + 39 + 40 + 41 + 42 + 43 + 44 + 45 + 46 = 721.5$$

$$\sum_{up} RANK = 3(4) + 5(12.5) + 5(23) + 34 + 35 + 36 + 37 + 38 = 359.5$$

CLIENT NSB-NLON	JOB NUMBER 7363
SUBJECT SAMPLE CALCULATION OF STATISTICAL ANALYSIS	
BASED ON GW ARSENIC ROUNDS 8	DRAWING NUMBER
BY BGL / CHECKED BY	APPROVED BY / DATE 10/24/00

CALCULATE THE Z SCORE (Z_{rs}):

$$Z_{rs} = \frac{W_{rs} - \frac{n_1(m+1)}{2}}{\sqrt{\frac{n_1 n_2 (m+1)}{12}}}$$

$$Z_{rs} = \frac{721.5 - (28)(47)/2}{\sqrt{\frac{(28)(18)(47)}{12}}} = \frac{63.5}{44.43} = +1.429$$

FROM TABLE 3, A Z SCORE OF +1.429 CORRESPONDS TO A P LEVEL OF 0.1530

SINCE $0.1530 > 0.05$

THE DOWNGRADIENT ARSENIC CONCENTRATIONS ARE NOT STATISTICALLY HIGHER THAN THE UPGRADIENT ARSENIC CONCENTRATIONS AT A 95% LEVEL OF SIGNIFICANCE

PARAMETRIC ANOVA

	Summary of all Effects; design: (anova.sta) 1-SITE						
	Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
CIS-1,2-DICHLOROETHENE	1	1	31.0406666	44	22.8267784	1.35983574	0.24984807
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
TRICHLOROETHENE	1	1	23.14528	44	8.333208	2.777476	0.102703
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
BIS(2-ETHYLHEXYL)PHTHALATE	1	1	947.2253	44	846.1736	1.119422	0.295817
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
BARIUM	1	1	59000.52	44	4314.628	13.67453	0.0006
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
COPPER	1	1	21.63944	44	6.312304	3.428137	0.070813
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
ZINC	1	1	216.3382	44	2190.411	0.098766	0.754801
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
ARSENIC, FILTERED	1	1	3.73751	13	1.878313	1.989823	0.181838
	Summary of all Effects; design: (anova.sta) 1-SITE						
		df Effect	MS Effect	df Error	MS Error	F	p-level
COPPER, FILTERED	1	1	3.220167	13	0.742756	4.335428	0.057646

WILCOXON RANK-SUM NON-PARAMETRIC ANOVA

Mann-Whitney U Test (wrs.sta)
By variable SITE
Group 1: 100-DOWN Group 2: 101-UP

	Rank Sum DOWN	Rank Sum UP	U	Z	p-level	Z adjusted	p-level	Valid N DOWN	Valid N UP	2*1sided exact p
TRANS-1,2-DICHLOROETHENE	613	468	207	-1.0128355	0.31114638	-1.8744907	0.0608719	28	18	0.31999508

Mann-Whitney U Test (wrs.sta)
By variable SITE
Group 1: 100-DOWN Group 2: 101-UP

	Rank Sum DOWN	Rank Sum UP	U	Z	p-level	Z adjusted	p-level	Valid N DOWN	Valid N UP	2*1sided exact p
VINYL CHLORIDE	703	378	207	1.012836	0.311146	1.875085	0.06079	28	18	0.319995

Mann-Whitney U Test (wrs.sta)
By variable SITE
Group 1: 100-DOWN Group 2: 101-UP

	Rank Sum DOWN	Rank Sum UP	U	Z	p-level	Z adjusted	p-level	Valid N DOWN	Valid N UP	2*1sided exact p
PYRENE	628.5	452.5	222.5	-0.66397	0.506714	-0.723035	0.469664	28	18	0.510557

Mann-Whitney U Test (wrs.sta)
By variable SITE
Group 1: 100-DOWN Group 2: 101-UP

	Rank Sum DOWN	Rank Sum UP	U	Z	p-level	Z adjusted	p-level	Valid N DOWN	Valid N UP	2*1sided exact p
ARSENIC	721.5	359.5	188.5	1.429224	0.15295	1.454608	0.145788	28	18	0.154362

Mann-Whitney U Test (wrs.sta)
By variable SITE
Group 1: 100-DOWN Group 2: 101-UP

	Rank Sum DOWN	Rank Sum UP	U	Z	p-level	Z adjusted	p-level	Valid N DOWN	Valid N UP	2*1sided exact p
LEAD	644	437	238	-0.315104	0.752684	-0.321906	0.747526	28	18	0.763609

Mann-Whitney U Test (wrs.sta)
By variable SITE
Group 1: 100-DOWN Group 2: 101-UP

	Rank Sum DOWN	Rank Sum UP	U	Z	p-level	Z adjusted	p-level	Valid N DOWN	Valid N UP	2*1sided exact p
BARIUM, FILTERED	105	15	9	1.299038	0.19394	1.299038	0.19394	12	3	0.232967

Table B-1
COEFFICIENTS A_i FOR W TEST OF NORMALITY FOR N=2 to 50

i/n	2	3	4	5	6	7	8	9	10
1	0.7071	0.7071	0.6872	0.6646	0.6431	0.6233	0.6052	0.5888	0.5739
2			0.1677	0.2413	0.2806	0.3031	0.3164	0.3244	0.3291
3					0.0875	0.1401	0.1743	0.1976	0.2141
4							0.0561	0.0947	0.1224
5									0.0399

i/n	11	12	13	14	15	16	17	18	19	20
1	0.5601	0.5475	0.5359	0.5251	0.5150	0.5056	0.4968	0.4886	0.4808	0.4734
2	0.3315	0.3325	0.3325	0.3318	0.3306	0.3290	0.3273	0.3253	0.3232	0.3211
3	0.2260	0.2347	0.2412	0.2460	0.2495	0.2521	0.2540	0.2553	0.2561	0.2565
4	0.1429	0.1586	0.1707	0.1802	0.1878	0.1939	0.1988	0.2027	0.2059	0.2085
5	0.0695	0.0922	0.1099	0.1240	0.1353	0.1447	0.1524	0.1587	0.1641	0.1686
6		0.0303	0.0539	0.0727	0.0880	0.1005	0.1109	0.1197	0.1271	0.1334
7				0.0240	0.0433	0.0593	0.0725	0.0837	0.0932	0.1013
8						0.0196	0.0359	0.0496	0.0612	0.0711
9								0.0163	0.0303	0.0422
10										0.0140

i/n	21	22	23	24	25	26	27	28	29	30
1	0.4643	0.4590	0.4542	0.4493	0.4450	0.4407	0.4366	0.4328	0.4291	0.4254
2	0.3185	0.3156	0.3126	0.3098	0.3069	0.3043	0.3018	0.2992	0.2968	0.2944
3	0.2578	0.2571	0.2563	0.2554	0.2543	0.2533	0.2522	0.2510	0.2499	0.2487
4	0.2119	0.2131	0.2139	0.2145	0.2148	0.2151	0.2152	0.2151	0.2150	0.2148
5	0.1736	0.1764	0.1787	0.1807	0.1822	0.1836	0.1848	0.1857	0.1864	0.1870
6	0.1399	0.1443	0.1480	0.1512	0.1539	0.1563	0.1584	0.1601	0.1616	0.1630
7	0.1092	0.1150	0.1201	0.1245	0.1283	0.1316	0.1346	0.1372	0.1395	0.1415
8	0.0804	0.0878	0.0941	0.0997	0.1046	0.1089	0.1128	0.1162	0.1192	0.1219
9	0.0530	0.0618	0.0696	0.0764	0.0823	0.0876	0.0923	0.0965	0.1002	0.1036
10	0.0263	0.0368	0.0459	0.0539	0.0610	0.0672	0.0728	0.0778	0.0822	0.0862
11		0.0122	0.0228	0.0321	0.0403	0.0476	0.0540	0.0598	0.0650	0.0697
12				0.0107	0.0200	0.0284	0.0358	0.0424	0.0483	0.0537
13						0.0094	0.0178	0.0253	0.0320	0.0381
14								0.0084	0.0159	0.0227
15										0.0076

i/n	31	32	33	34	35	36	37	38	39	40
1	0.4220	0.4188	0.4156	0.4127	0.4096	0.4068	0.4040	0.4015	0.9689	0.3964
2	0.2921	0.2898	0.2876	0.2854	0.2834	0.2813	0.2794	0.2774	0.2755	0.2737
3	0.2475	0.2463	0.2451	0.2439	0.2427	0.2415	0.2403	0.2391	0.2380	0.2368
4	0.2145	0.2141	0.2137	0.2132	0.2127	0.2121	0.2116	0.2110	0.2104	0.2098
5	0.1874	0.1878	0.1880	0.1882	0.1883	0.1883	0.1883	0.1881	0.1880	0.1878
6	0.1641	0.1651	0.1660	0.1667	0.1673	0.1678	0.1683	0.1686	0.1689	0.1691
7	0.1433	0.1449	0.1463	0.1475	0.1487	0.1496	0.1503	0.1513	0.1520	0.1526
8	0.1243	0.1265	0.1284	0.1301	0.1317	0.1331	0.1344	0.1356	0.1366	0.1376
9	0.1066	0.1093	0.1118	0.1140	0.1160	0.1179	0.1196	0.1211	0.1225	0.1237
10	0.0899	0.0931	0.0961	0.0988	0.1013	0.1036	0.1056	0.1075	0.1092	0.1108
11	0.0739	0.0777	0.0821	0.0844	0.0873	0.0900	0.0924	0.0947	0.0967	0.0986
12	0.0585	0.0629	0.0669	0.0706	0.0739	0.0770	0.0798	0.0824	0.0848	0.0870
13	0.0435	0.0485	0.0530	0.0572	0.0610	0.0645	0.0677	0.0706	0.0733	0.0759
14	0.0289	0.0344	0.0395	0.0441	0.0484	0.0523	0.0559	0.0592	0.0622	0.0651
15	0.0144	0.0206	0.0262	0.0314	0.0361	0.0404	0.0444	0.0481	0.0515	0.0546
16		0.0068	0.0131	0.0187	0.0239	0.0287	0.0331	0.0372	0.0409	0.0444
17				0.0062	0.0119	0.0172	0.0220	0.0264	0.0305	0.0343
18						0.0057	0.0110	0.0158	0.0203	0.0244
19								0.0053	0.0101	0.0146
20										0.0049

i/n	41	42	43	44	45	46	47	48	49	50
1	0.3940	0.3917	0.3894	0.3872	0.3850	0.3830	0.3808	0.3789	0.3770	0.3751
2	0.2719	0.2701	0.2684	0.2667	0.2651	0.2635	0.2620	0.2604	0.2589	0.2574
3	0.2357	0.2345	0.2334	0.2323	0.2313	0.2302	0.2291	0.2281	0.2271	0.2260
4	0.2091	0.2085	0.2078	0.2072	0.2065	0.2058	0.2052	0.2045	0.2038	0.2032
5	0.1876	0.1874	0.1871	0.1868	0.1865	0.1862	0.1859	0.1855	0.1851	0.1847
6	0.1693	0.1694	0.1695	0.1695	0.1695	0.1695	0.1695	0.1693	0.1692	0.1691
7	0.1531	0.1535	0.1539	0.1542	0.1545	0.1548	0.1550	0.1551	0.1553	0.1554
8	0.1384	0.1392	0.1398	0.1405	0.1410	0.1415	0.1420	0.1423	0.1427	0.1430
9	0.1249	0.1259	0.1269	0.1278	0.1286	0.1293	0.1300	0.1306	0.1312	0.1317
10	0.1123	0.1136	0.1149	0.1160	0.1170	0.1180	0.1189	0.1197	0.1205	0.1212
11	0.1004	0.1020	0.1035	0.1049	0.1062	0.1073	0.1085	0.1095	0.1105	0.1113
12	0.0891	0.0909	0.0927	0.0943	0.0959	0.0972	0.0986	0.0998	0.1010	0.1020
13	0.0782	0.0804	0.0824	0.0842	0.0860	0.0876	0.0892	0.0906	0.0919	0.0932
14	0.0677	0.0701	0.0724	0.0745	0.0775	0.0785	0.0801	0.0817	0.0832	0.0846
15	0.0575	0.0602	0.0628	0.0651	0.0673	0.0694	0.0713	0.0731	0.0748	0.0764
16	0.0476	0.0506	0.0534	0.0560	0.0584	0.0607	0.0628	0.0648	0.0667	0.0685
17	0.0379	0.0411	0.0442	0.0471	0.0497	0.0522	0.0546	0.0568	0.0588	0.0608
18	0.0283	0.0318	0.0352	0.0383	0.0412	0.0439	0.0465	0.0489	0.0511	0.0532
19	0.0188	0.0227	0.0263	0.0296	0.0328	0.0357	0.0385	0.0411	0.0436	0.0459
20	0.0094	0.0136	0.0175	0.0211	0.0245	0.0277	0.0307	0.0335	0.0361	0.0386
21		0.0045	0.0087	0.0126	0.0163	0.0197	0.0229	0.0259	0.0288	0.0314
22				0.0042	0.0081	0.0188	0.0153	0.0185	0.0215	0.0244
23						0.0039	0.0076	0.0111	0.0143	0.0174
24								0.0037	0.0071	0.0104
25										0.0350

TABLE B-2
PERCENTAGE POINTS OF THE W TEST FOR N=3 to 50

n	0.01	0.05
3	0.753	0.767
4	0.687	0.748
5	0.686	0.762
6	0.713	0.788
7	0.730	0.803
8	0.749	0.818
9	0.764	0.829
10	0.781	0.842
11	0.792	0.850
12	0.805	0.859
13	0.814	0.866
14	0.825	0.874
15	0.835	0.881
16	0.844	0.887
17	0.851	0.892
18	0.858	0.897
19	0.863	0.901
20	0.868	0.905
21	0.873	0.908
22	0.878	0.911
23	0.881	0.914
24	0.884	0.916
25	0.888	0.918
26	0.891	0.920
27	0.894	0.923
28	0.896	0.924
29	0.898	0.926
30	0.900	0.927

n	0.01	0.05
31	0.902	0.929
32	0.904	0.930
33	0.906	0.931
34	0.908	0.933
35	0.910	0.934
36	0.912	0.935
37	0.914	0.936
38	0.916	0.938
39	0.917	0.939
40	0.919	0.940
41	0.920	0.941
42	0.922	0.942
43	0.923	0.943
44	0.924	0.944
45	0.926	0.945
46	0.927	0.945
47	0.928	0.946
48	0.929	0.947
49	0.929	0.947
50	0.930	0.947

Table B-3
95th PERCENTILES OF F-DISTRIBUTION WITH v_1 and v_2 DEGREES OF FREEDOM

v_1/v_2	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.72
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35

NOTE: v_1: Degrees of Freedom for numerator
v_2: Degrees of freedom for denominator