Action Memorandum
for
Building 31
Naval Submarine Base
New London
Groton, Connecticut

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0112

May 1993

Halliburton NUS
CORPORATION

R-49-3-93-4

ACTION MEMORANDUM
FOR
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 1823
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop 82
Lester, Pennsylvania 19113-2090

Submitted by:
HALLIBURTON NUS Corporation
993 Old Eagle School Road, Suite 415
Wayne, Pennsylvania 19087-1710

CONTRACT NUMBER N62472-90-D-1298
CONTRACT TASK ORDER 0112

MAY 1993

SUBMITTED BY:

Willis C. Isner

WILLIS C. ISNER, P.E.
PROJECT MANAGER
HALLIBURTON NUS CORPORATION
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMISSION BY:

Debra M. Wroblewski for

JOHN J. TREPANOWSKI, P.E.
PROGRAM MANAGER
HALLIBURTON NUS CORPORATION
WAYNE, PENNSYLVANIA

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1.0 PURPOSE

The purpose of this action memorandum is to document the decision for the action described herein for Building 31 of Naval Submarine Base New London (SUBASE NLON), located in Groton, Connecticut. The action at Building 31 consists of the onsite solidification of contaminated soil having lead concentrations equal to or greater than 500 ppm. At those select areas where it is necessary to provide access to existing underground utilities, the contaminated soil will be excavated to the cleanup level (500 ppm), transported off site for solidification at an approved treatment facility, and disposed at an appropriate offsite landfill. The Northern Division Naval Facilities Engineering Command is the lead agency for this time-critical action at the Naval Submarine Base New London.

2.0 SITE CONDITIONS AND BACKGROUND

The National Contingency Plan (NCP) states that a removal action may be conducted at a site when a threat to human health or the environment is determined. An appropriate removal action is undertaken to abate, minimize, stabilize, mitigate, or eliminate the release or threat of release at a site.

The following sections provide a physical description and information on the characteristics of the site at Building 31 of SUBASE NLON.

2.1 SITE DESCRIPTION

2.1.1 Removal Site Evaluation

SUBASE NLON consists of approximately 547 acres of land and associated buildings in southeastern Connecticut, in the towns of Ledyard and Groton. SUBASE NLON is situated on the east bank of the Thames River, approximately 6 miles north of Long Island Sound. The property was officially established as a permanent submarine base in 1916 and currently provides a base command for naval submarine fleet activities in the Atlantic Ocean.

SUBASE NLON was placed on the National Priorities List (NPL) on August 28, 1991 by the U.S. Environmental Protection Agency (U.S. EPA) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. Building 31 of SUBASE NLON is used as a hazardous materials storage building (only hazardous materials which are ready for issue are stored in this building) and is listed as a study area in the Federal Facilities Agreement for future investigation. It was built in 1917 and was originally used as a battery shop. The SUBASE NLON was in the process of replacing the concrete foundation to comply with fire, health, and safety codes when a yellow discoloration was discovered underneath on the concrete slab. Soil samples were taken at depths of 18 inches and 60 inches below the floor and elevated lead levels were found. Lead leachate levels ranged from 0.1 to 400 ppm based on the Toxicity Characteristic Leaching Procedure (TCLP). Materials that exhibit a TCLP lead concentration of 5.0 mg/L or greater are classified as a hazardous waste under RCRA (40 CRF 261.24). As a result of this initial soil testing, an additional soil and groundwater investigation was undertaken in February of 1993 to better define the extent of lead and related battery contamination at Building 31 of SUBASE NLON. The results of this soil and groundwater investigation are presented in Section 2.1.4 of this report.

2.1.2 Physical Location

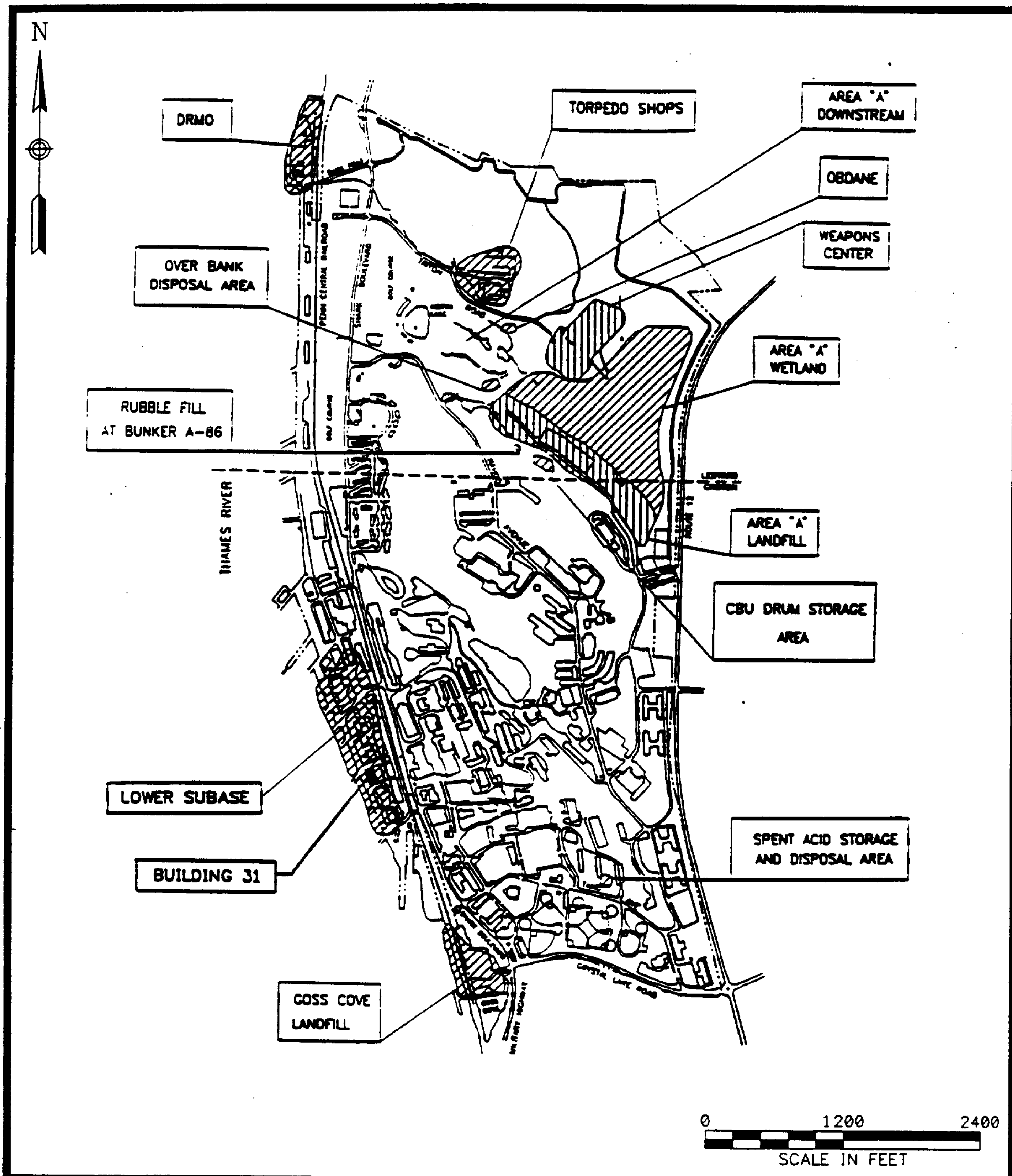
The SUBASE NLON contains naval housing, submarine training facilities, military offices, medical facilities, and facilities for the maintenance, repair and overhaul of submarines. Building 31 is located in the lower SUBASE area on Albacore Road as shown in Figure 2-1. The lower SUBASE is located along the western edge of SUBASE NLON, adjacent to the Thames River. It is bound by the Thames River to the west and by the Penn Central Railroad to the east.

2.1.3 Site Characteristics

2.1.3.1 Site History

The lower SUBASE is the original subase, and its history dates back to 1867. Most of the construction took place in the early 1900s with major expansion between 1935 and 1945. Extensive portions of this area have been filled. The lower SUBASE has always been used for operations and maintenance. Building 31 was constructed in 1917 and was used as a battery overhaul facility. Some time after the second world war, the building was converted to use as a hazardous materials storage building. Recently, the floor slab was to be replaced to comply with fire, health, and safety codes. It was during the removal of a portion of the floor slab that the lead contamination was first discovered in the soil underneath the slab. Building 31 was used to store numerous products including, but not limited to: paint thinners, paints (enamels, lacquers, white lead), epoxy coatings, lubricating oils, adhesives, welding flux, solder, photographic supplies, batteries, antifreeze, detergents, bleach, disinfectants, and many chemicals.

Some of the chemicals stored include: mercuric nitrate, hydrazine sulfate, ammonium hydroxide, potassium iodide, sodium sulfate, hydrochloric acid, sodium thiosulfate, sodium hydroxide, potassium chromate, trichloroethylene, 1,1,1-trichloroethane, freon, sodium chromate, desiccant anhydrous, toluene, tricresyl phosphate, sodium bicarbonate, glycerol, ammonium chloride, molybdenum, isopropyl alcohol, sodium bisulfate, sodium hypochlorite, ammonium hydroxide, sodium phosphate, lithium bromide, sodium sulfate, lithium hydride, potassium hydroxide, triethanolamine, ethylenediaminetetra-acetic acid, formaldehyde,



SOURCE: DRAFT NSB-NLON WORK PLAN, NOVEMBER 1992, ATLANTIC ENVIRONMENTAL SERVICES, INC.

FIGURE 2-1

SITE MAP
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

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potassium iodide, orthophosphate, sulfuric acid, 2-ethylbutyric acid calcium salt, dichloromethane, acetone, alcohol (denatured), xylene, octyl alcohol, methyl ethyl ketone, sodium nitrate, potassium chromate, mercuric nitrate, cupric sulfate, calcium hypochlorite, silver nitrate, sodium silicate, petrolatum liquid, dimethyglycine, phenolphthalein, and hydrogen peroxide.

2.1.3.2 Structural Integrity

Building 31 was built in 1917 and underwent many alterations over its history. The eastern portion of the Building 31 was constructed in approximately 1950. The building is approximately 140 feet long by 76 feet wide (see Figure 2-2).

For the addition, the eastern exterior wall is of masonry construction consisting of 8-inch concrete block and brick pilasters (8 inches by 17 inches) at overhead girder locations. The masonry wall is supported by a concrete wall (approximately 12 inches wide) and plain concrete footing (1 foot deep by approximately 2 feet wide). The bottom of the footing is approximately 4 feet below the exterior grade. The floor slab in this portion of the building was 5 inches thick and reinforced with wire mesh (6" x 6" - #10/10). The floor slab in this area has been broken up in preparation for the replacement of the floor slab.

For the original portion of the building, the exterior walls are brick with pilasters at overhead girder locations (20-foot spacing on center). Concrete girders spanning east to west support concrete spandial beams that in turn support the roof. The girders are supported by two rows of concrete columns which are supported by concrete pedestals and footings. Drawings indicate that all of the interior and exterior column footings are supported by four timber piles at each footing. The exterior masonry wall is supported by a concrete wall at grade and concrete wall footing. An exploratory excavation was conducted on April 27, 1993 to determine the depths of three types of footings (interior column footing, exterior column footings, and exterior wall footing). Based on the excavation, the footing depths are approximately 7.0 feet, 7.5 feet, and 3.3 feet, respectively.

Based on a drawing dated July 6, 1918, the wood piles supporting the interior and exterior column footings consisted of hemlock, pine, chestnut, and oak piles. The length of the piles varied from approximately 4 feet-6 inches to 29 feet-5 inches below the bottom of the footing. The diameter of the tip and butt of the piles varied from 6 inches to 14 inches and 11.5 inches to 19 inches, respectively. The penetration for the last 10 blows per pile during driving ranged from 2.25 inches to 10 inches. Based on the type of pile (wood), variation in pile length below the footing, and the penetrations during the last 10 blows, the piles

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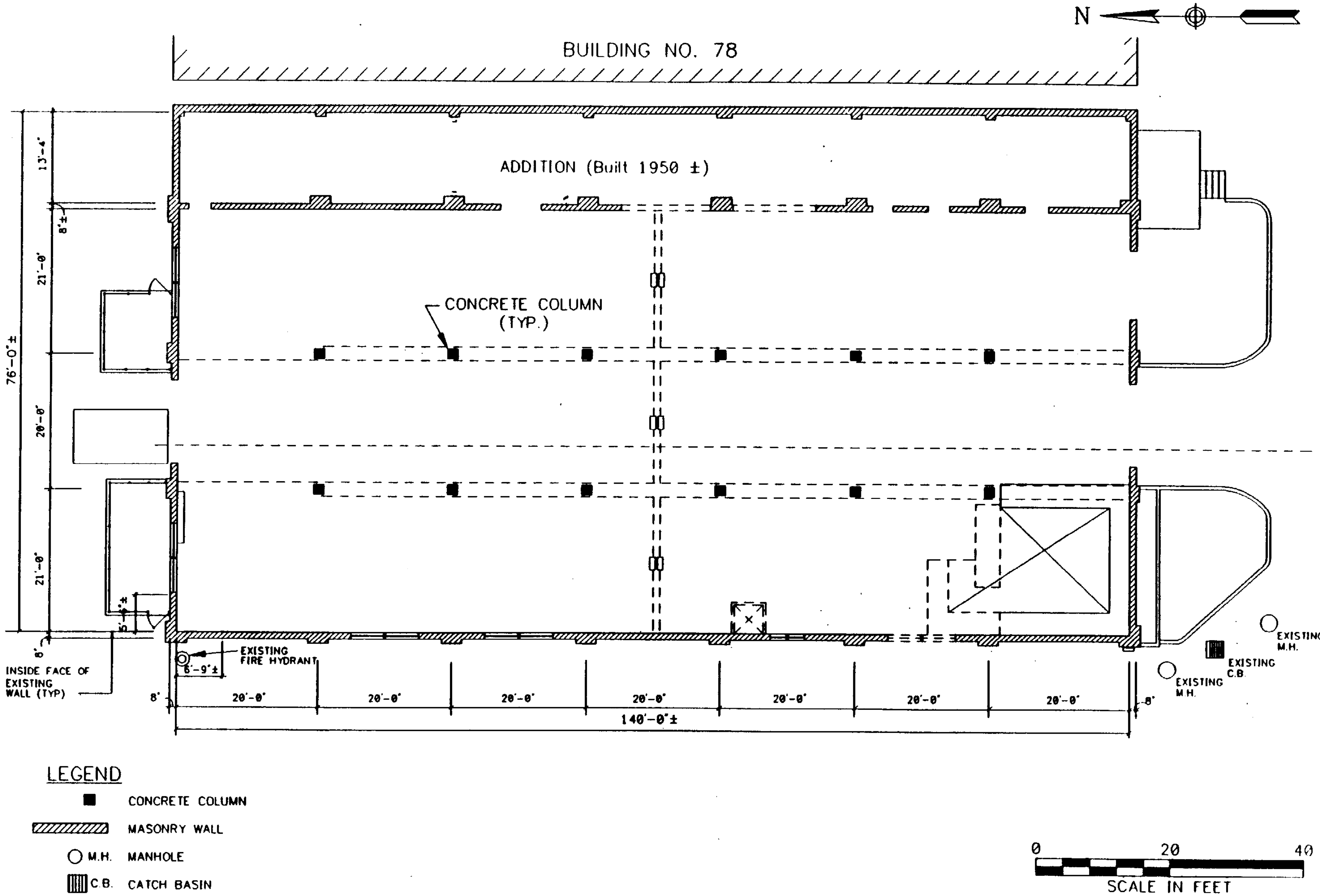

FIGURE 2-2

BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

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were most likely designed as friction piles. Friction piles developed most of their load-bearing capacity by tangential skin friction along the surface of the pile, as opposed to bearing piles, which develop most of their load capacity from under the bottom of the pile (tip).

Piles are used to support structures through weak, unsuitable soils or in fill materials (extensive portions of the lower subase were filled). Wood piles are good as friction piles but are not so desirable as end-bearing ones because the compressive strength of the wood is relatively small. Wood piles are also relatively flexible and laterally springy. Thus, any excavation exposing substantial portions of the wood piles would require special measures to provide lateral support for the piles and could potentially jeopardize the load-bearing capability of the pile. Also, the condition of the wood piles is not known; their usefulness may be destroyed by fungi or marine borers. Fungi cause what is ordinarily termed "rotting" and requires air and moisture to exist. If the piles are continuously immersed in water, the necessary air is excluded. If the wood is perpetually and thoroughly dry, the requisite moisture is missing Since Building 31 is within the tidal zone, the water elevation is continuously changing by approximately 1.2 feet underneath the building. If the piles are completely immersed below this zone, or if the piles were originally treated to kill the organisms, fungus growth may not be a current problem. However, if the water table was lowered (such as dewatering during remedial excavation of contaminated soil or during pump and treatment of the groundwater), then the wood piles would be at risk to fungi organisms, if they were not previously adequately pressure treated (impregnated with preservative).

A structural inspection of the building was not conducted as part of the most recent sampling activities, but no obvious structural deficiencies were noticed. No visible cracks were observed in the masonry walls and the walls, columns, and girders appeared to be structurally sound.

To protect the structural integrity of the building, it is recommended that no action be implemented that would expose the existing wood piles. This would limit the depth of any removal action to the bottom of the footings supporting the interior and exterior columns. At this time, it is estimated that this depth varies from approximately 7 to 7.5 feet. The estimated depth of the exterior wall footings varies from approximately 3.3 to 4 feet. Excavation in these areas could be extended if the existing wall footing is underpinned or shored to prevent undermining of the footing. However, the close proximity of Building 78 to the east (approximately 3.5 feet between walls) would not permit shoring of any footing on the outside, between Building 31 or Building 78, in this area. Thus, excavation in this area would be limited to approximately 4-foot depth unless both footings (Building 31 and Building 78) were underpinned.

2.1.3.3 Catch Basins and Floor Drains

No inspection or sampling of the existing floor drains and catch basins was undertaken during the recent sampling of Building 31 in February 1993. A large potion of the existing concrete floor, including floor drains, has been removed and piled as debris in portions of the building. At the eastern side of the building (the addition to the original building), the existing concrete floor slab has been broken up in preparation for replacement. A review of the existing drawings available for Building 31 indicate that the building underwent many alterations over the years and that new floors with additional drains and catch basins were installed in the northern portion of the building in approximately 1928 and 1945. Also, when the addition was added to the building (approximately 1950), floor drains and catch basins were provided with the new 5-inch concrete floor in this area. Several utility lines (based on existing drawings) also run through this area (6-inch sanitary sewer and a fresh water line). The size of the water line is not certain as it is shown as 2 inches and 4 inches on separate drawings. The locations of the floor drains, catch basins, and utilities were summarized and plotted on Figure 2-3 based on the drawings available for Building 31. The areas where the lead contamination exceeds 500 ppm is also shown on this figure, indicating there are several areas where the lead contamination and the floor drains overlap, suggesting that the existing drains may have provided a path for subsurface contamination.

2.1.3.4 Groundwater

2.1.3.4.1 <u>Well Locations and Construction</u>

Four temporary well points were installed to determine groundwater quality within the Building 31 area. All four of the well points were installed to a total depth of 9.5 feet, using hollow-stem auger drilling methods. The wells consisted of a 5-foot section of continuous 10-slot wire wound stainless steel screen and a 5-foot steel riser pipe. The wells were installed to monitor the uppermost water-bearing zone, which was encountered approximately 6 feet below the Building 31 floor surface. A lockable cap was installed on top of the riser pipe upon completion of the well. The location of these wells are shown on Figure 2-4. A summary of the wells is shown in Table 2-1. Well construction diagrams have been provided in Appendix E.

All four well points were developed upon completion using a Brainard-Kilman pump. Two rounds of groundwater samples were taken at low tide and submitted to the laboratory for analysis. Analytical results are discussed in Section 2.1.4.

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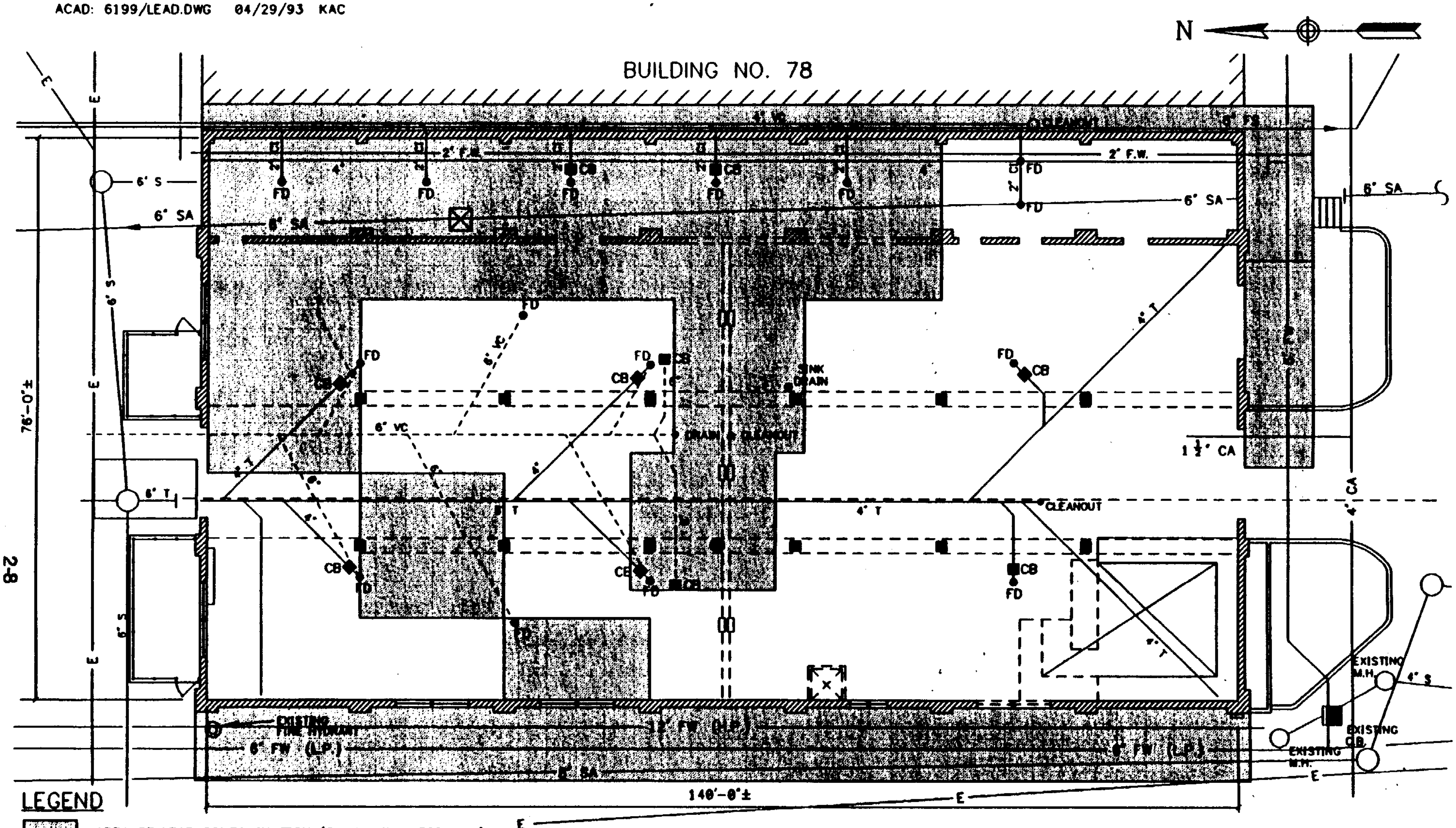

LEGEND

AREA OF LEAD CONTAMINATION (Greater than 500 ppm)

CI –	CAST IRON PIPE	CA –	COMPRESSED AIR	CB –	CATCH BASIN
VC –	VITRIFIED CLAY PIPE	SA –	SANITARY	FD –	FLOOR DRAIN
T –	TILE	FS –	FORCED SANITARY	S –	STORM
HP –	HIGH PRESSURE WATER	FW –	FRESH WATER	E –	ELECTRIC

0 20 40
SCALE IN FEET

FLOOR DRAINS, CATCH BASINS, & UTILITIES
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE 2-3

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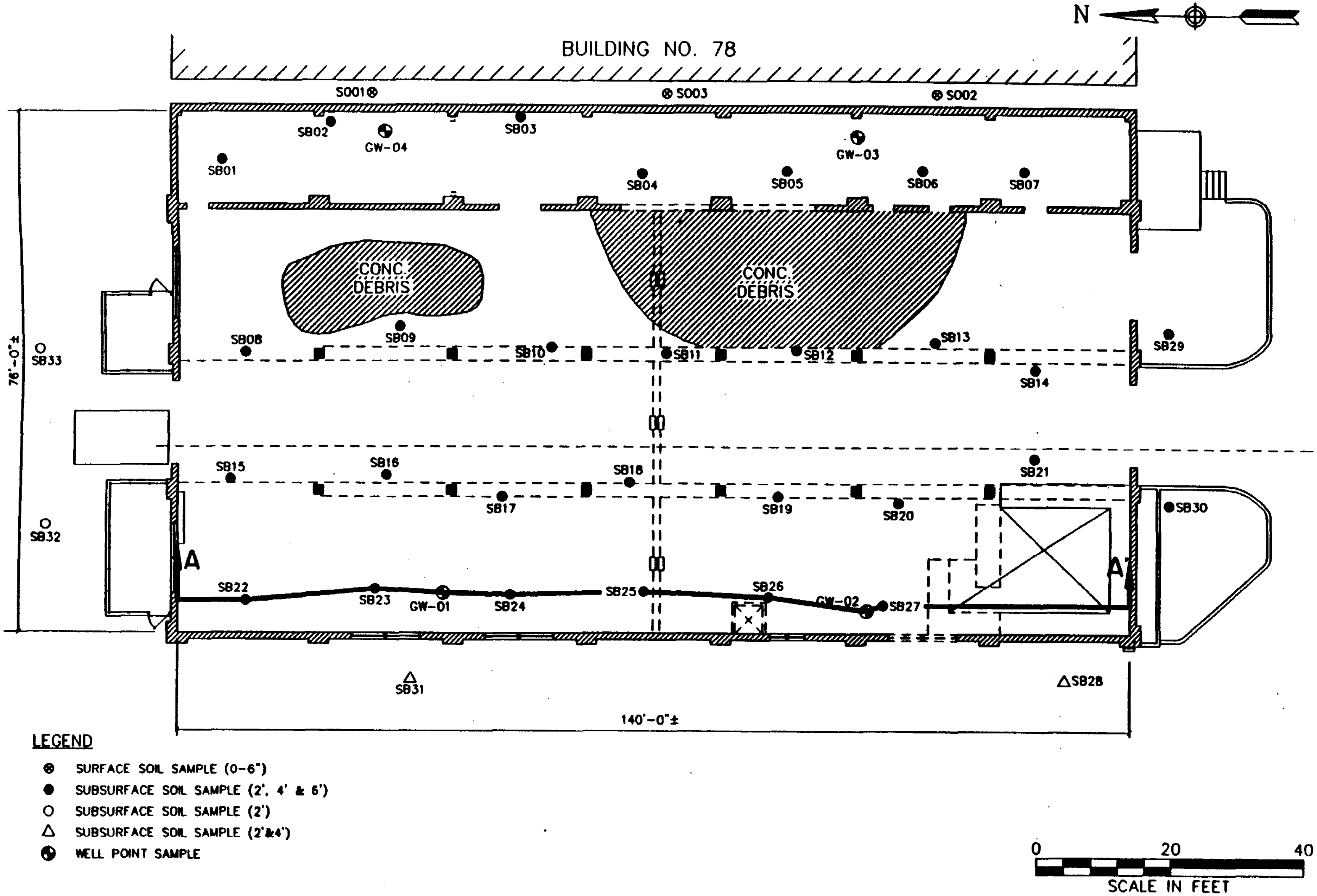

WELL POINTS & CROSS SECTION LOCATION MAP

BUILDING No. 31

NAVAL SUBMARINE BASE - NEW LONDON

GROTON, CT.

FIGURE 2-4

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TABLE 2-1

TEMPORARY WELL POINT SUMMARY - BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Well Number	Date Completed	Ground Surface Elevation[1] (Ft) (Approximate)	Monitored Interval		Total Depth (Ft)	Well Construction[2]
			From (Ft)	To (Ft)		
GW-01	2/23/93	98.1	4.5	9.5	9.5	SS/Steel
GW-02	2/23/93	98.9	4.5	9.5	9.5	SS/Steel
GW-03	2/23/93	98.7	4.5	9.5	9.5	SS/Steel
GW-04	2/23/93	98.6	4.5	9.5	9.5	SS/Steel

1 Elevations are assumed datum.
2 Well Construction consists of stainless steel screen and Black Steel Riser Pipe.

2.1.3.4.2 Hydrogeology

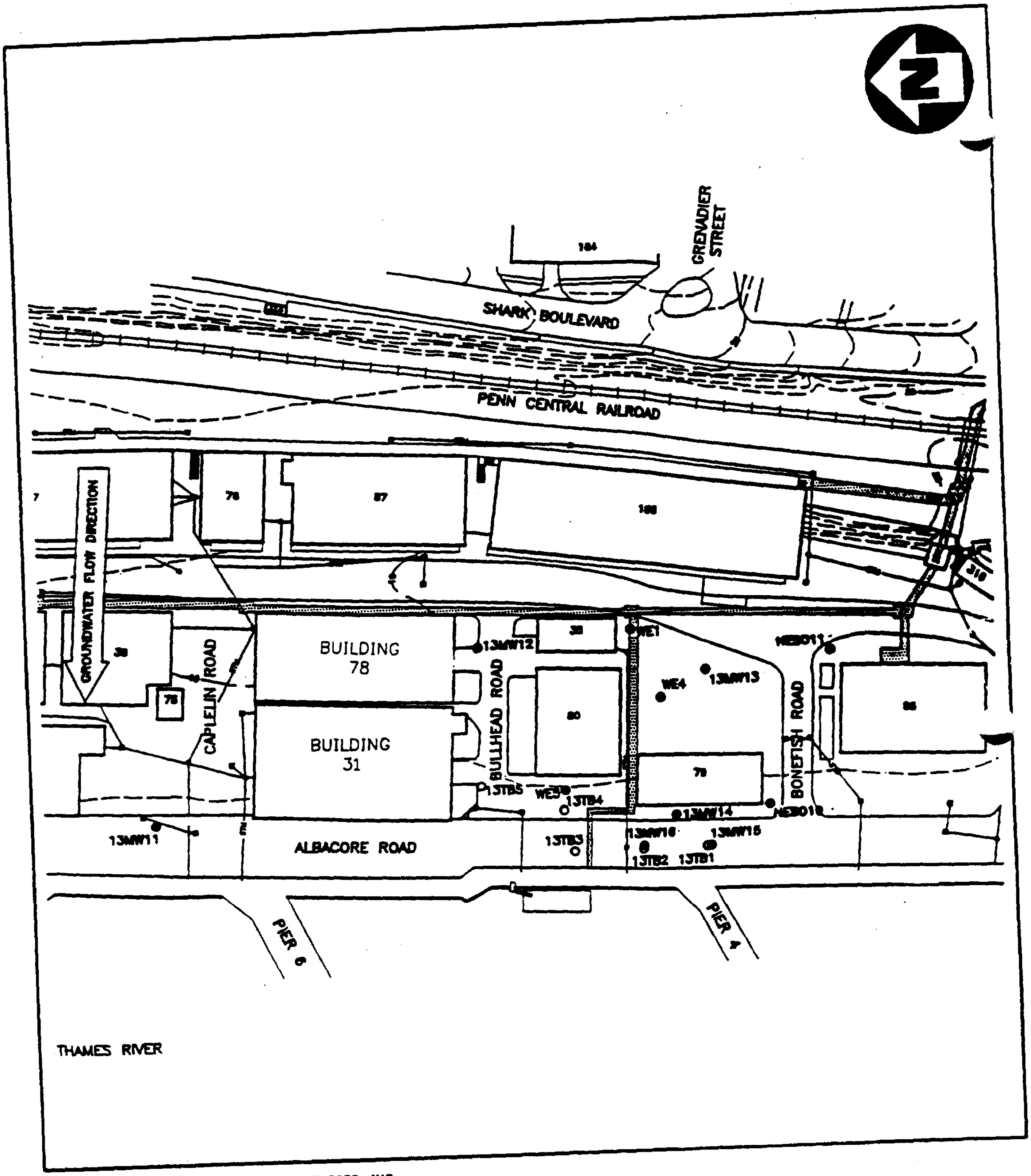
Building 31 is located approximately 55 feet east of the Thames River (see Figure 2-5). Groundwater flow directions within the Building 31 area were determined based on water level data obtained from the temporary well points and a point on the Thames River. Two rounds of water level measurements (Table 2-2) were taken. Round 2, taken on February 28, 1993, was used to generate the potentiometric surface map shown as Figure 2-6. As shown on this map, shallow groundwater flow is towards the west, toward the Thames River. However, based on previous studies, at high tide the groundwater flows east from the river in the western portion of the site. Thus, a small portion of the overburden aquifer at the lower SUBASE ebbs and flows with the tide. This tidal effect diminishes with the distance from the river, and reversal of groundwater flow direction at high tide does not extend further than 300 feet inland.

In order to provide a correlation between the groundwater elevation at Building 31 and the changing tides of the river, two Hermit data loggers and two transducers were installed. One was installed in temporary well GW-02 and the other was installed to monitor the surface elevation of the Thames River. GW-02 was monitored for 2,730 minutes (1.9 days). The tidal fluctuations of the surface water of the Thames River were only monitored for 390 minutes (6.5 hours), due to the freezing up of the Hermit data logger. The plot of both sets of data is presented in Figure 2-7.

Based on an arbitrary elevation datum, tidal fluctuations in GW-02 range in elevation from a high of 93.26 to a low of 92.07, resulting in a net change in elevation of 1.19 feet. Changes in elevation at the Thames River ranged from 93.36 to a low of 91.14, for a net change of 2.22 feet (based on the limited monitoring). The mean range of tide is 2.5 feet at Smith Cove entrance (located across the Thames River from the SUBASE), based on the figures in the National Oceanic and Atmospheric Administration Tide Tables 1993. Based on limited data of the surface water of the Thames River, it appears that both high and low tides at the Thames River exceed the high and low elevations at GW-02. This supports previous studies that, during high tide, a reversal of the groundwater flow occurs as mentioned above. Furthermore, during low tide an increase in flow gradient could occur between Building 31 and the Thames River.

2.1.3.5 Surface Geology - Building 31

Most of the surficial deposits on site are unconsolidated glacial materials deposited during the Pleistocene Age. The remainder of the surficial deposits are the products of post-glacial geologic processes and man-made modifications.



SOURCE: ATLANTIC ENVIRONMENTAL SERVICES, INC.

0 100 200
SCALE IN FEET

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FIGURE 2-5

SITE PLAN
LOWER SUBASE
NAVAL SUBMARINE BASE – NEW LONDON
GROTON, CT.

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TABLE 2-2

GROUNDWATER ELEVATIONS
TEMPORARY WELL POINTS - BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Well Number	Water Level Measuring Point Elevation (Ft)	February 27, 1993		February 28, 1993	
		Depth to Water (Ft)	Water Table Elevation (Ft)	Depth to Water (Ft)	Water Table Elevation (Ft)
GW-01	98.59	6.25	92.34	5.87	92.72
GW-02	99.82	7.67	92.15	7.17	92.65
GW-03	99.17	6.47	92.70	6.36	92.81
GW-04	99.08	6.49	92.59	6.27	92.81
PIER	97.82	6.68	91.14	6.15	91.67

All elevations are assumed datum.

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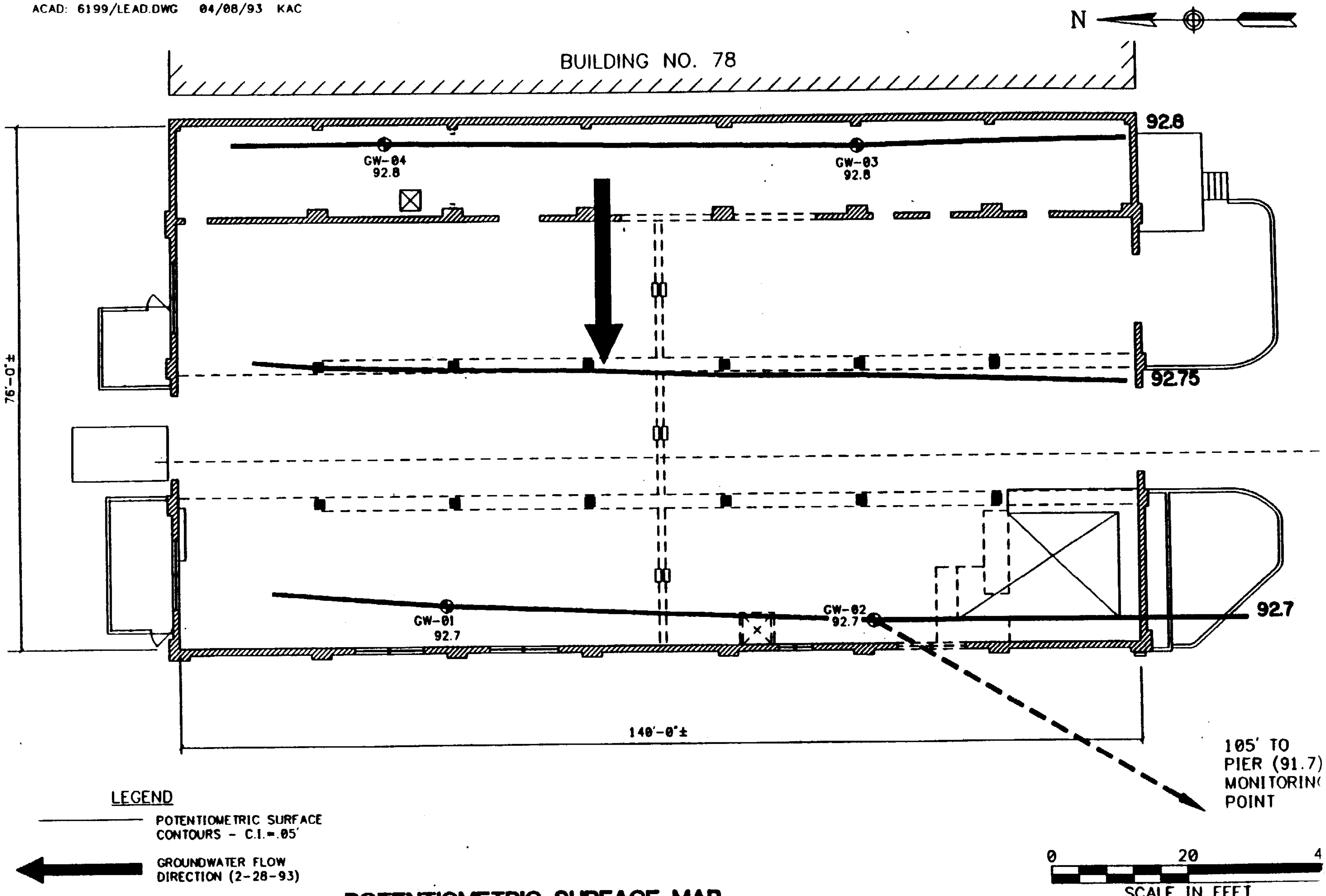

POTENTIOMETRIC SURFACE MAP
FEBRUARY 28, 1993
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE 2-(

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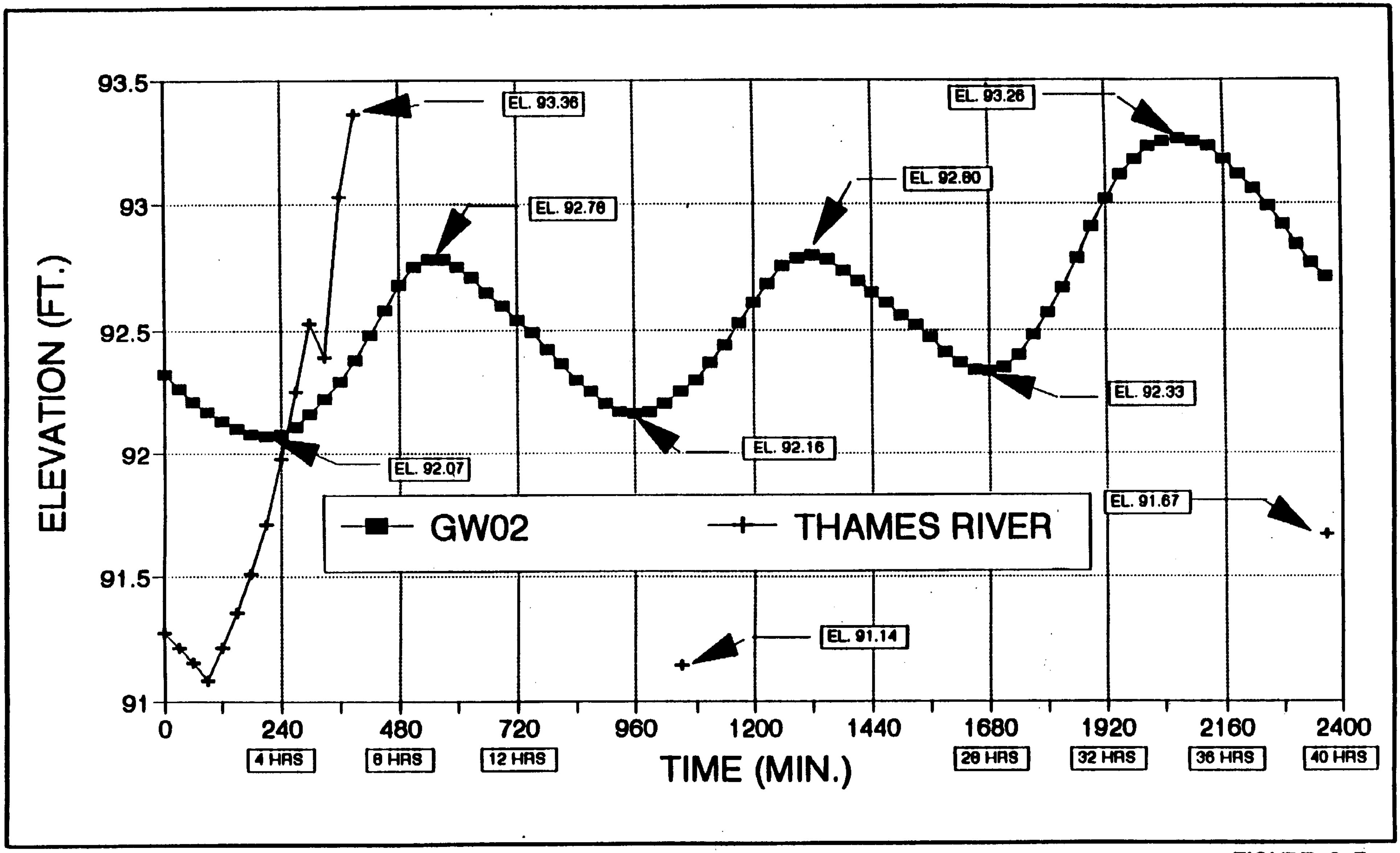

FIGURE 2-7

TIDAL DATA – GW-02, THAMES RIVER
BUILDING No. 31
NAVAL SUBMARINE BASE – NEW LONDON
GROTON, CT.

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Soils excavated from the soil borings consisted predominantly of brown silty sand and gravel, with minor amounts of fill materials. None of the soil borings exceeded 6 feet in depth and were terminated just above or near the water table. Maximum HNu readings were 8 ppm in borings SB23 and SB25.

The analytical results of the soil samples taken from the soil borings are discussed in Section 2.1.4. The boring logs have been provided in Appendix D.

The locations of the soil borings are shown in Figure 2-8. A total of 33 borings were drilled: 27 borings were drilled inside Building 31 and 6 borings were drilled outside. All borings drilled inside the building were drilled to 6 feet. The depth of sampling outside the building varied from that proposed in the Final Sampling Plan because of utility interferences. See Section 2.1.6 for the sampling depths at various locations outside the building.

A geologic cross section through the western portion of Building 31 is shown in Figure 2-9. The location of the cross section is indicated on Figure 2-4.

2.1.4 Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant, or Contaminant

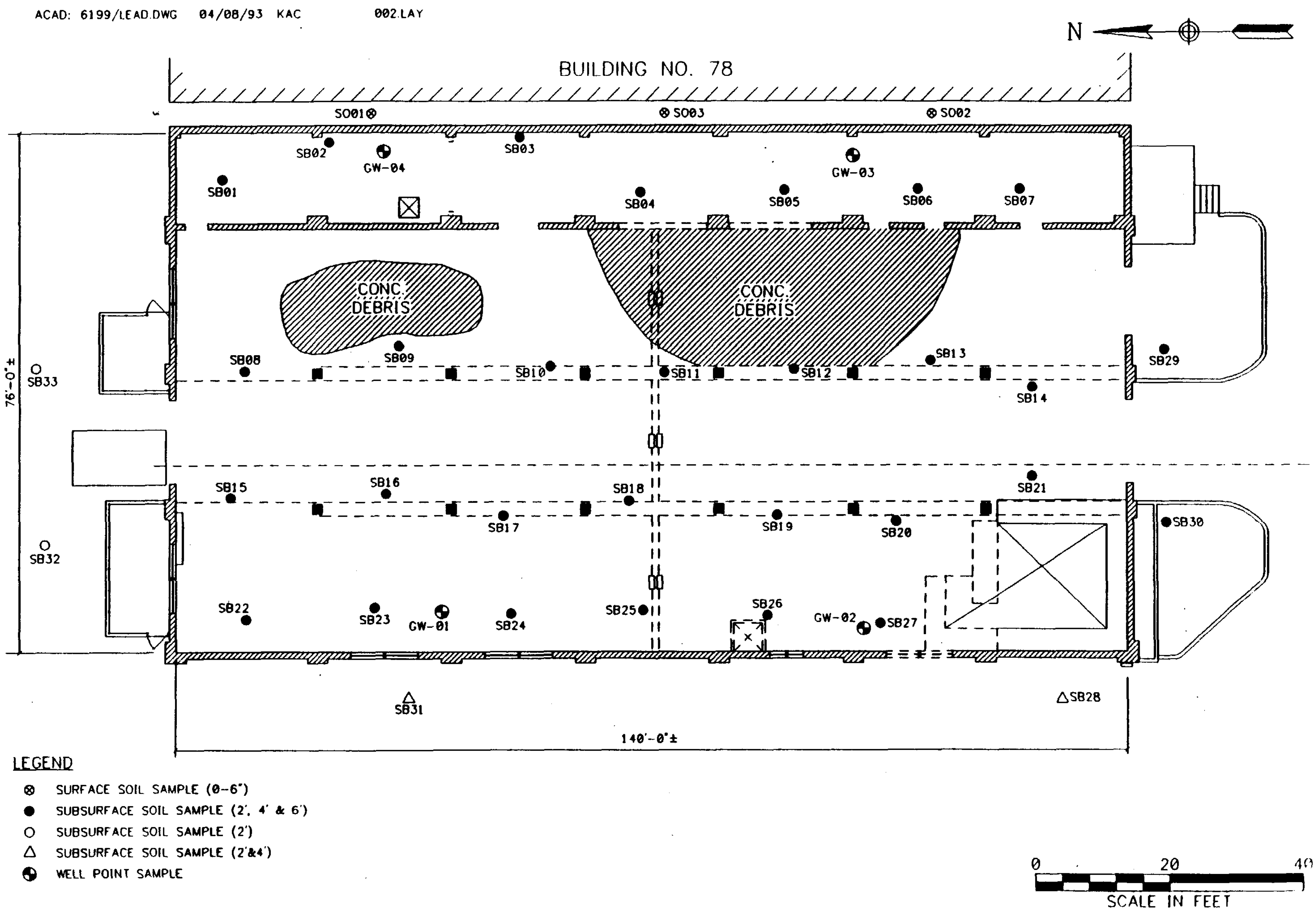
As indicated in Section 2.1.1, a soil and groundwater investigation was undertaken in February of 1993 to better define the extent of contamination in the vicinity of Building 31 at SUBASE NLON. During this investigation, the following samples were collected at the locations shown on Figure 2-8.

- Twenty-seven (27) subsurface soil samples within Building 31 at depths of 0 to 2 feet, 2 to 4 feet, and 4 to 6 feet.

- Six (6) subsurface soil samples outside Building 31 (depths vary as shown on Figure 2-8.).

- Three (3) surface soil samples between Building 31 and Building 78 at depths of 0 to 6 inches.

- Four (4) groundwater samples at well points located within Building 31 (two rounds of sampling).



SAMPLING LOCATIONS
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE 2-8

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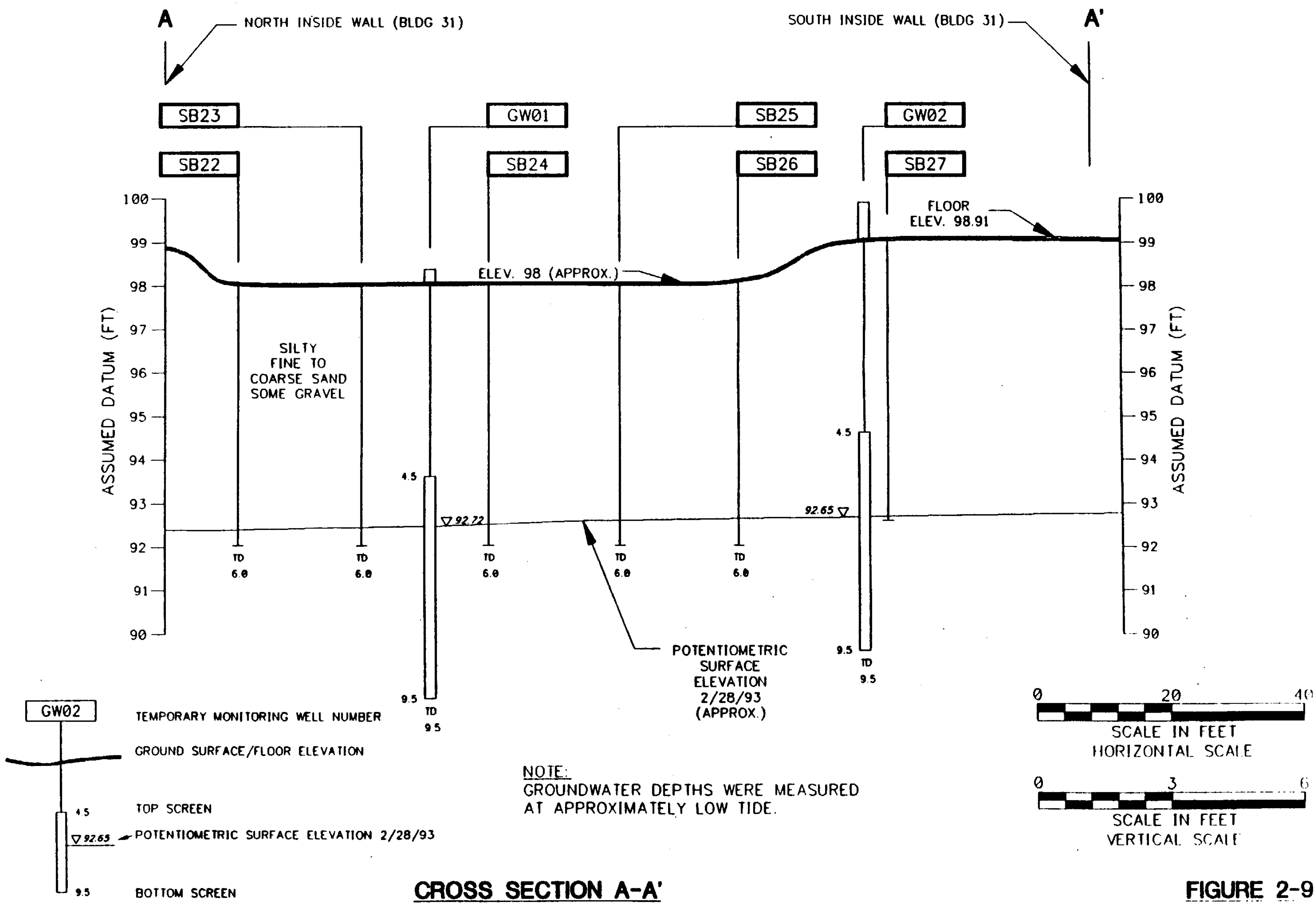

CROSS SECTION A-A'
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT

FIGURE 2-9

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In addition to the sampling locations shown on Figure 2-8, groundwater samples were collected from an existing background monitoring well screened for shallow groundwater (6MW5S) during the two rounds of sampling. This background well is located approximately 150 feet east of the Providence and Worcester Railroad and 700 feet north of Barb Road at the northern limits of SUBASE NLON (see Figure 2-10).

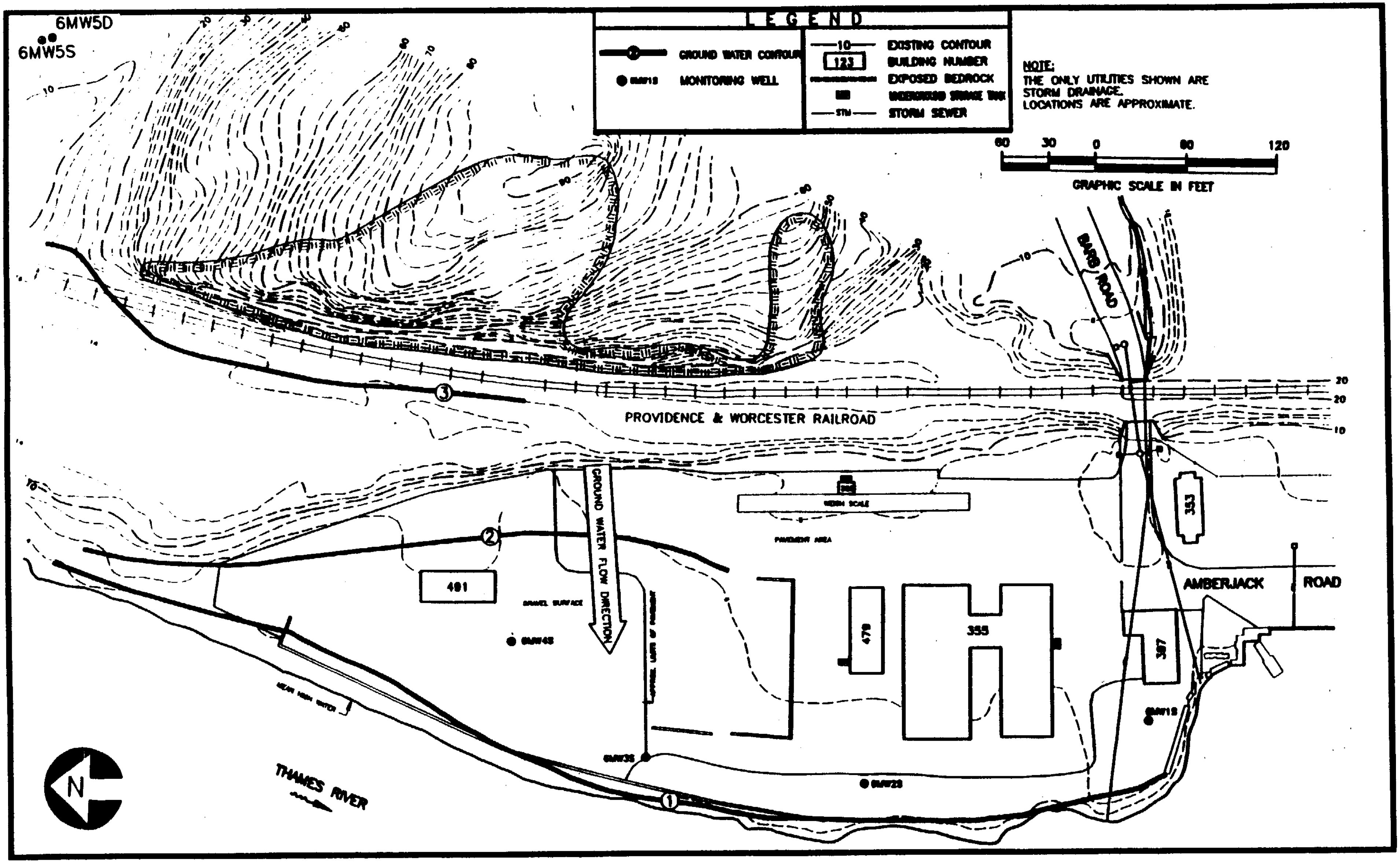
All of the subsurface soil samples collected were analyzed for lead. Eighty-one of the subsurface samples (all those collected within Building 31) were also analyzed for pH. Also, one-third of the samples (collected from within Building 31) were analyzed for TCLP lead. This analysis was only performed on one sample per boring (the sample having the highest lead concentration as determined by the laboratory). Four of the borings having the highest TCLP lead concentrations were also analyzed for Appendix VIII metals, Appendix VIII metals include arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. In addition, four of the subsurface samples collected were analyzed for full Target Compound List (TCL) and Target Analyte List (TAL) metals plus cyanide, based on field screening by the field sampling team using a HNu meter.

All of the surface soil samples (SO-01 to SO-03) were analyzed for lead.

Five groundwater wells were sampled during two rounds for total (unfiltered) and dissolved (filtered) metals. Dissolved analysis required the samples to be field filtered through a 0.45 μ filter immediately after sampling. Two well points and one background monitoring well were analyzed for the full Target Compound List (TCL) and the full Target Analyte List (TAL) plus cyanide during the first round of groundwater sampling (note that these samples were unfiltered). This sampling was proposed because the complete history of Building 31 is not available. The two remaining well points were analyzed for Appendix VIII metals during the first round of sampling and all five wells were analyzed for Appendix VIII metals during the second round.

An overview of the soil analytical results are presented in Tables 2-3 through 2-5. A summary of the groundwater inorganic analytical results are presented in Table 2-6. A summary of all of the raw analytical data collected and validation protocols are presented in Appendix A (approximately 15% of the raw analytical data was validated).

As the preceding tables show, a number of organic and inorganic contaminants were detected in the soil and/or groundwater samples collected at this site. While several organic compounds were detected in the soil, most are fairly insoluble. In addition, no organics were found in the groundwater, which indicates that migration of organic contaminants has not occurred.



SOURCE: ATLANTIC ENVIRONMENTAL SERVICES, INC.

FIGURE 2-10

BACKGROUND MONITORING WELL
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

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TABLE 2-3

SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SUBSURFACE SOIL			
SB01-2	7.49	1,490 J	NA
SB01-4	7.58	4,330 J	10.5
SB01-4D	7.50	1,590 J	NA
SB01-6	6.26	1,180 J	NA
SB02-2	9.95	3,390 J	22.8
SB02-4D	9.41	2,720	NA
SB02-4	9.41	3,160	NA
SB02-6	9.41	383 J	NA
SB03-2	4.74	4,790 J	NA
SB03-4	6.74	5,370 J	12.6
SB03-6	6.82	106 J	NA
SB04-2	8.75	492 J	0.591
SB04-4	9.04	177 J	NA
SB04-6	11.90	301 J	NA
SB05-2	7.24	11,900 J	27.5
SB05-4	7.45	2,990	NA
SB05-6	6.44	670	NA
SB06-2	6.49	5.9	NA
SB06-4	6.27	ND (19.3)	NA
SB06-4D	6.64	ND (4.8)	NA
SB06-6	6.50	134	1.7
SB07-2	8.46	13.7	NA
SB07-4	6.81	3.1	NA
SB07-6	7.59	39.5	0.0546
SB08-2	7.97	962	5.81
SB08-4	4.63	8.6	NA
SB08-6	4.95	30	NA
SB09-2	8.96	27.5	0.0293
SB09-4	5.54	9.8	NA
SB09-6	6.43	14.6	NA
SB10-2	7.67	7.9	NA
SB10-4	4.60	13.7	ND (0.026)
SB10-6	4.80	9.1	NA
SB10-6D	4.70	8.76	NA
SB11-2	6.16	9.7	NA

TABLE 2-3
SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE TWO

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SUBSURFACE SOIL (Continued)			
SB11-4	5.84	8.4	NA
SB11-6	11.20	799	6.0
SB12-2	7.70	2.8	NA
SB12-4	9.65	2.9	NA
SB12-6	8.83	8.8	0.0698
SB13-2	8.78	186	0.232
SB13-2D	8.67	463	NA
SB13-4	8.71	32.6	NA
SB13-6	10.10	42.9	NA
SB14-2	10.40	3.1	NA
SB14-4	11.80	6.3	ND (0.026)
SB14-6	10.80	5.1	NA
SB15-2	7.10	69.2	0.154
SB15-4	4.40	44.5	NA
SB15-6	5.24	40.0	NA
SB16-2	7.79	1,060	9.13
SB16-4	7.31	713	NA
SB16-6	4.86	339	NA
SB17-2	6.69	25.0	NA
SB17-4	5.67	77.3	NA
SB17-6	7.83	302	5.88
SB18-2	4.64	39.1	NA
SB18-4	4.53	53.9	NA
SB18-6	5.80	9,470J	13.6
SB19-2	5.11	9.7	NA
SB19-4	5.39	15.7	NA
SB19-6	11.00	144	0.815
SB20-2	11.00	229	1.02
SB20-4	8.67	26.4	NA
SB20-4D	9.20	25.8	NA
SB20-6	9.59	49.8	NA
SB21-2	11.60	69.8	0.0932
SB21-4	11.70	9.3	NA

TABLE 2-3
SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE THREE

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SUBSURFACE SOIL (Continued)			
SB21-6	10.90	6.8	NA
SB22-2	10.80	5.4	NA
SB22-4	11.50	8.1	NA
SB22-6	11.70	32.6	0.0709
SB23-2	4.51	2.8	NA
SB23-4	4.16	6.7	NA
SB23-6	4.47	7.7	ND (0.026)
SB24-2	6.45	16,900	4.87
SB24-4	5.16	4,550	NA
SB24-6	4.23	4.9	NA
SB25-2	7.80	389	2.89
SB25-4	8.84	26.8	NA
SB25-4D	8.83	351	NA
SB25-6	4.56	7.0	NA
SB26-2	11.50	30.1	0.125
SB26-4	10.10	3.0	NA
SB26-6	11.60	25.4	NA
SB27-2	11.10	19.8	0.196
SB27-4	10.90	4.0	NA
SB27-6	7.37	3.5	NA
SB28-2	6.78	5,840	113
SB28-4	7.20	3,330	NA
SB29-2	6.59	723	NA
SB29-2D	6.56	556	NA
SB29-4	6.90	238	NA
SB29-6	7.46	127	NA
SB30-2	6.45	413	NA
SB30-4	7.04	163	NA
SB30-6	7.84	57.2	NA
SB31-2	8.11	2,330	NA
SB31-2D	8.17	1,980	NA
SB32-2	7.75	31.4	NA
SB33-2	9.63	123	NA

TABLE 2-3
SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE FOUR

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SURFACE SOIL			
SO01-1	NA	4,640	NA
SO02-1	NA	2,030	NA
SO03-1	NA	2,290	NA
SO03-1D	NA	2,300	NA

1 Soil concentrations that exceed 500 mg/kg (the recommended EPA cleanup level) are shaded in the table.

2 TCLP lead concentrations of 5.0 mg/L or greater are classified as hazardous waste under RCRA (40 CFR Part 261.24) and are shaded in the table.

J Estimated value
D Duplicate sample
ND Not detected at detection limit shown in parentheses
NA Not analyzed

TABLE 2-4

SUMMARY OF INORGANIC ANALYTICAL RESULTS - SOIL (mg/kg)
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Analyte	Average Eastern U.S. Soils[1]	Regional Background[2]	Boring Number/Depth (Feet)								
			SB02-2	SB02-4	SB02-4D	SB05-2	SB14-2	SB18-4	SB18-6	SB22-6	SB28-2
Aluminum	57,000	272,000	NA	9,260	9,240	NA	8,790	10,800	NA	7,220	NA
Antimony	0.76	2.95	NA	10.4	8.4	NA	ND (5.2)	5.4	NA	ND (3.6)	NA
Arsenic	7.4	31.5	5.0J	3.0	2.8	4.8J	2.2	1.3	2.5J	1.6	4.6J
Barium	420	1,600	57.5J	55.6	55.8	37.1	43.8	52.9	46.5	37.9	35.8
Beryllium	0.85	3.52	NA	0.32	0.34	NA	0.38	0.36	NA	ND (0.22)	NA
Cadmium	NA	7	ND (0.46)	1.4	0.48	ND (0.43)	0.46	ND (0.69)	ND (0.43)	ND (0.67)	ND (0.42)
Calcium	6,300	32,300	NA	3,090	7,390	NA	2,500	3,060	NA	13,800	NA
Chromium	52	223	11.9	14.9	15.3	12.4	16.9	14.7	12.5	10.5	11.5
Cobalt	9.2	39	NA	5.7	5.9	NA	5.0	4.1	NA	3.7	NA
Copper	22	102	NA	36.6	33.2	NA	12.0	65.6	NA	12.4	NA
Iron	25,000	115,000	NA	10,500	9,990	NA	9,440	12,500	NA	7,560	NA
Lead	17	53.2	5,680	3,160	2,720	460	3.1	93.9	689	32.6	8,840
Magnesium	4,600	26,500	NA	2,790	2,670	NA	3,260	3,310	NA	2,660	NA
Manganese	640	3,790	NA	192	175	NA	155	188	NA	158	NA
Mercury	0.12	0.51	0.45J	0.35	0.56	ND (0.11)	ND (0.11)	0.13	ND (0.11)	ND (0.11)	0.12J
Nickel	18	76.7	NA	9.9	10.3	NA	13.4	11.2	NA	5.2	NA
Potassium	12,000	12,000	NA	2,080	1,870	NA	2,130	958	NA	1,280	NA
Silver	NA	5	ND (0.85)	ND (0.86)	ND (0.89)	ND (0.85)	ND (1.7)	2.5	ND (0.86)	1.7	ND (0.85)
Sodium	7,800	51,800	NA	644	886	NA	474	269	NA	530	NA
Vanadium	66	271	NA	20.3	19.8	NA	18.9	26.2	NA	14.7	NA
Zinc	52	178	NA	648	184	NA	20.4	24.1	NA	49.9	NA

1 Shacklette and Boerngen
2 Phase I RI Report (August 1992)
J Estimated value
ND Not detected at detection limit shown in parenthese
NA Not analyzed
[shaded] Values that exceed regional background.

TABLE 2-5

SUMMARY OF ORGANIC ANALYTICAL RESULTS - SOIL (µg/kg)
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Analyte	SB02-4	SB02-4D	SB14-2	SB18-4	SB22-6
Acetone	ND (120)	ND (55)	130	83	84
2-Butanone	7 J	2 J	ND (11)	ND (10)	ND (12)
4-Methyl-2-pentanone	ND (10)	ND (11)	ND (11)	1 J	ND (12)
Benzene	0.4 J	ND (11)	ND (11)	ND (10)	ND (12)
Toluene	ND (10)	ND (11)	ND (11)	1 J	0.8 J
Ethylbenzene	2 J	2 J	ND (11)	ND (10)	ND (12)
Xylenes	15 J	9 J	ND (11)	11	1 J
Tetrachloroethene	5 J	3 J	ND (11)	2 J	1 J
1,1-Dichloroethene	3 J	0.6 J	ND (11)	ND (10)	ND (12)
1,1,1-Trichloroethane	0.8 J	ND (11)	ND (11)	4 J	6 J
Methylene chloride	39 J	9 J	4 J	5 J	3 J
1,2,4-Trichlorobenzene	31 J	ND (350)	ND (360)	ND (340)	ND (380)
2,4-Dinitrotoluene	22 J	ND (350)	ND (360)	ND (340)	ND (380)
2-Chlorophenol	47 J	ND (350)	ND (360)	ND (340)	ND (380)
4-Chloro-3-methylphenol	45 J	ND (350)	ND (360)	ND (340)	ND (380)
Pentachlorophenol	60 J	ND (850)	ND (880)	ND (830)	ND (930)
Bis(2-ethylhexyl)phthalate	ND (350)	ND (350)	160 J	150 J	260 J
Di-n-octylphthalate	ND (350)	ND (350)	ND (360)	18 J	ND (380)
Di-n-butylphthalate	ND (350)	ND (350)	ND (360)	19 J	20 J
Acenaphthene	54 J	120 J	ND (360)	ND (340)	ND (380)
Acenaphthylene	ND (350)	22 J	ND (360)	ND (340)	ND (380)
Anthracene	100 J	280 J	ND (360)	ND (340)	34 J
Benzo(a)anthracene	260 J	530 J	ND (360)	ND (340)	21 J
Benzo(b)fluoranthene	360 J	560 J	ND (360)	ND (340)	ND (380)
Benzo(k)fluoranthene	310 J	510 J	ND (360)	ND (340)	ND (380)
Benzo(g,h,i)perylene	88 J	120 J	ND (360)	ND (340)	ND (380)
Benzo(a)pyrene	250 J	460 J	ND (360)	ND (340)	ND (380)
Chrysene	330 J	610 J	ND (360)	ND (340)	26 J
Dibenz(a,h)anthracene	58 J	96 J	ND (360)	ND (340)	ND (380)
Fluoranthene	720 J	1,400 J	ND (360)	ND (340)	89 J
Fluorene	26 J	92 J	ND (360)	ND (340)	ND (380)
Indeno(1,2,3-cd)pyrene	160 J	290 J	ND (360)	ND (340)	ND (380)
2-Methylnaphthalene	23 J	42 J	ND (360)	ND (340)	ND (380)
Phenanthrene	410 J	1,000 J	ND (360)	ND (340)	140 J
Pyrene	700 J	1,500 J	ND (360)	ND (340)	61 J
Carbazole	56 J	160 J	ND (360)	ND (340)	ND (380)
Dibenzofuran	19 J	66 J	ND (360)	ND (340)	38 J
Dieldrin	ND (3.5)	ND (3.5)	ND (3.6)	75	ND (3.8)
4,4'-DDT	6.21	4.8 J	ND (360)	ND (3.4)	ND (3.8)

J Estimated value
D Duplicate sample
ND Not detected at detection limit shown in parentheses.

TABLE 2-6

SUMMARY OF INORGANIC ANALYTICAL RESULTS - GROUNDWATER (ug/L)
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Analyte	GW01				GW02					GW03				GW04				Background			Maximum Contaminant Level/Goal
	Total			Dissolved	Total			Dissolved		Total		Dissolved		Total		Dissolved		Total		Dissolved	
	Round 1	Round 1 Dup.	Round 2	Round 2	Round 1	Round 2	Round 2 Dup.	Round 2	Round 2 Dup.	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 2	
Aluminum	25,000J	14,800J	NA	NA	75,000J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15,000J	NA	NA	50-200[2]
Arsenic	8.3 J	5.1 J	6.8	ND (2.0)	2.7 J	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	3.3	2.4	1.7	ND (2.0)	2.7	2.1	1.2	ND (2.0)	1.8 J	ND (2.0)	ND (2.0)	50/---
Barium	114	69.7	94.1	21.8	609	325	368	24.0	24.0	84.4	105	36.6	44.3	41.8	43.7	18.2	22.2	730	835	64.9	2,000/2,000
Beryllium	1.4	ND (1.0)	NA	NA	6.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2	NA	NA	1/0
Cadmium	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	4.8	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	5/5
Calcium	9,350	8,760	NA	NA	27,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14,800	NA	NA	---
Chromium	27.0	12.1	26.2	ND (6.0)	78.0	39.0	30.2	ND (6.0)	ND (6.0)	9.8	14.7	ND (6.0)	ND (6.0)	7.4	9.8	ND (6.0)	ND (6.0)	79.4	91.4	ND (6.0)	100/100
Cobalt	9.6	ND (6.0)	NA	NA	47.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.2	NA	NA	---
Copper	58.1	35.7	NA	NA	142	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	129	NA	NA	1,300
Iron	17,600J	11,400J	NA	NA	62,200J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27,400J	NA	NA	300[2]
Lead	73.4 J	47.5 J	41.6	1.1	392 J	220	216	ND (1.0)	1.0	312	136	7.3	2.2	186	84.0	ND (2.0)	1.2	18.2 J	18.0	ND (1.0)	15[1]
Magnesium	4,440	3,130	NA	NA	17,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,210	NA	NA	---
Manganese	454	391	NA	NA	3,890	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,200	NA	NA	50[2]
Mercury	0.36 J	0.32 J	0.3	ND (0.2)	1.2 J	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	5.5	ND (0.2)	ND (0.2)	ND (0.2)	0.21 J	ND (0.2)	ND (0.2)	2/2
Nickel	90.9	38.4	NA	NA	133	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38.9	NA	NA	100/100
Potassium	5,570	4,970	NA	NA	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7,210	NA	NA	---
Silver	ND (3.0)	ND (2.0)	2.0	ND (2.0)	ND (7.6)	4.2	2.9	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (3.6)	3.9	ND (2.0)	100[2]
Sodium	28,800J	28,200J	NA	NA	47,900J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22,400J	NA	NA	---
Vanadium	36.0	21.8	NA	NA	87.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	19.6	NA	NA	---
Zinc	141 J	93.2 J	NA	NA	338 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	161 J	NA	NA	5,000[2]

1 Action level.
2 Secondary MCL.
--- Not available.
J Estimated value.
NA Not analyzed.
ND Not detected at detection limit shown in parentheses.
(shaded) Values that exceed MCLs.

However, several metals (antimony, zinc, and lead, but most significantly lead) were detected in the soil at elevated concentrations (exceeded regional background concentrations. Site-specific background concentrations may vary considerably from the published regional values and may be significantly lower than the published values. Lead was also found in the unfiltered groundwater samples at concentrations that exceed drinking water standards. TCLP results indicate that lead concentrations in the leachate are high enough that at least some of the soil would be considered a hazardous waste based on the toxicity characteristic. In addition, the TCLP results may indicate a potential for leaching of lead from soil.

Releases from the site can occur in the following manner. First, exposed soil can be eroded (via storm runoff or wind), tracked from the building by workers, or some other bulk movement process. The existing concentrations of lead in the exposed surface soils are high enough to constitute a potential health hazard (see Section 3.1).

Releases could also occur via either infiltration of precipitation through contaminated soil (where samples with low pH could release lead or other metals) or via fluctuation of the water table into contaminated soil.

While there is little chance for direct contact with contaminated media as the site now exists (with the exception of construction/remediation workers: see Section 3.1), there is some indication that lead has been released into the soil (and potentially the groundwater) via site activities.

2.1.5 NPL Sites

SUBASE NLON was placed on the National Priorities List (NPL) on August 28, 1991 by the U.S. Environmental Protection Agency (U.S. EPA) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. Building 31 was used as a hazardous materials storage building and is currently listed as a study area in the Federal Facilities Agreement for future investigation.

A Phase I site investigation was completed in the lower SUBASE area, and a Phase II investigation is scheduled to start in August of 1993. Currently, there is a site investigation underway at Berth 16 and Pier 33 in the lower SUBASE area. For some Phase I sites (approximately 3 sites), it is anticipated that design activities will be initiated for interim remedial actions in 1993, based on the results of these investigations. However, none of these investigations focused on Building 31.

2.1.6 Maps, Pictures, and Other Graphic Representations

All soils samples within Building 31 were collected at 0- to 2-foot, 2- to 4-foot, and 4- to 6-foot depths. Based on the analytical results of these samples (see Table 2-3), those areas where the lead concentrations in soil exceeded the proposed action level of 500 ppm are shown for sample depths of 0 to 2 feet, 2 to 4 feet, and 4 to 6 feet in Figures 2-11, 2-12, and 2-13, respectively. The areas shown for the 0- to 2-foot and 2- to 4-foot depths are almost identical inside Building 31. For the 4- to 6-foot depth samples, the areas with high lead concentrations was substantially reduced except at soil borings 11 and 18, where high lead contamination was encountered. The contamination at the lower depths (4 and 6 feet) may have been the result of the floor drains being a pathway for the migration of the contaminants.

For the areas outside of the building, the soil sampling depths were limited to the following depths:

- **East Side.** Because of the reduced horizontal clearance between buildings, and the obstructions encountered with a hand auger, the sample depths were limited to 0 to 6 inches.

- **South Side.** Samples were collected at 0- to 2-foot, 2- to 4-foot, and 4- to 6-foot depths.

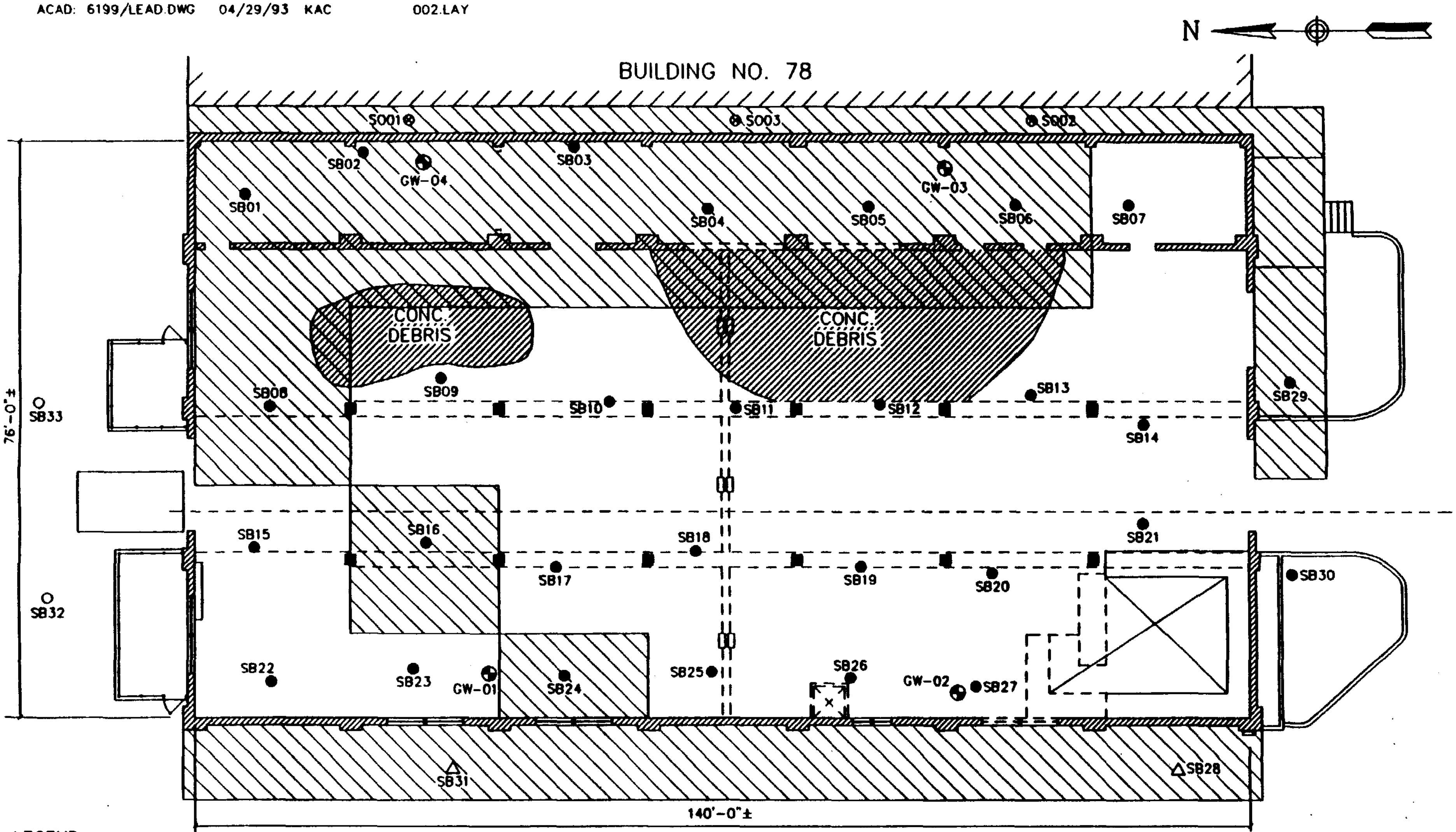
- **West Side.** Because of the many utilities in this area, the sampling depth was limited to 4 feet, except at boring 31 where, because of an obstruction, the depth was only 2 feet.

- **North Side.** Because of electrical vaults and utilities in this area, the sampling depth was limited to 2 feet.

2.2 OTHER ACTIONS TO DATE

To date, there have been no other actions taken to abate, minimize, stabilize, or eliminate the contamination at Building 31.

ACAD: 6199/LEAD.DWG 04/29/93 KAC 002.LAY



LEGEND

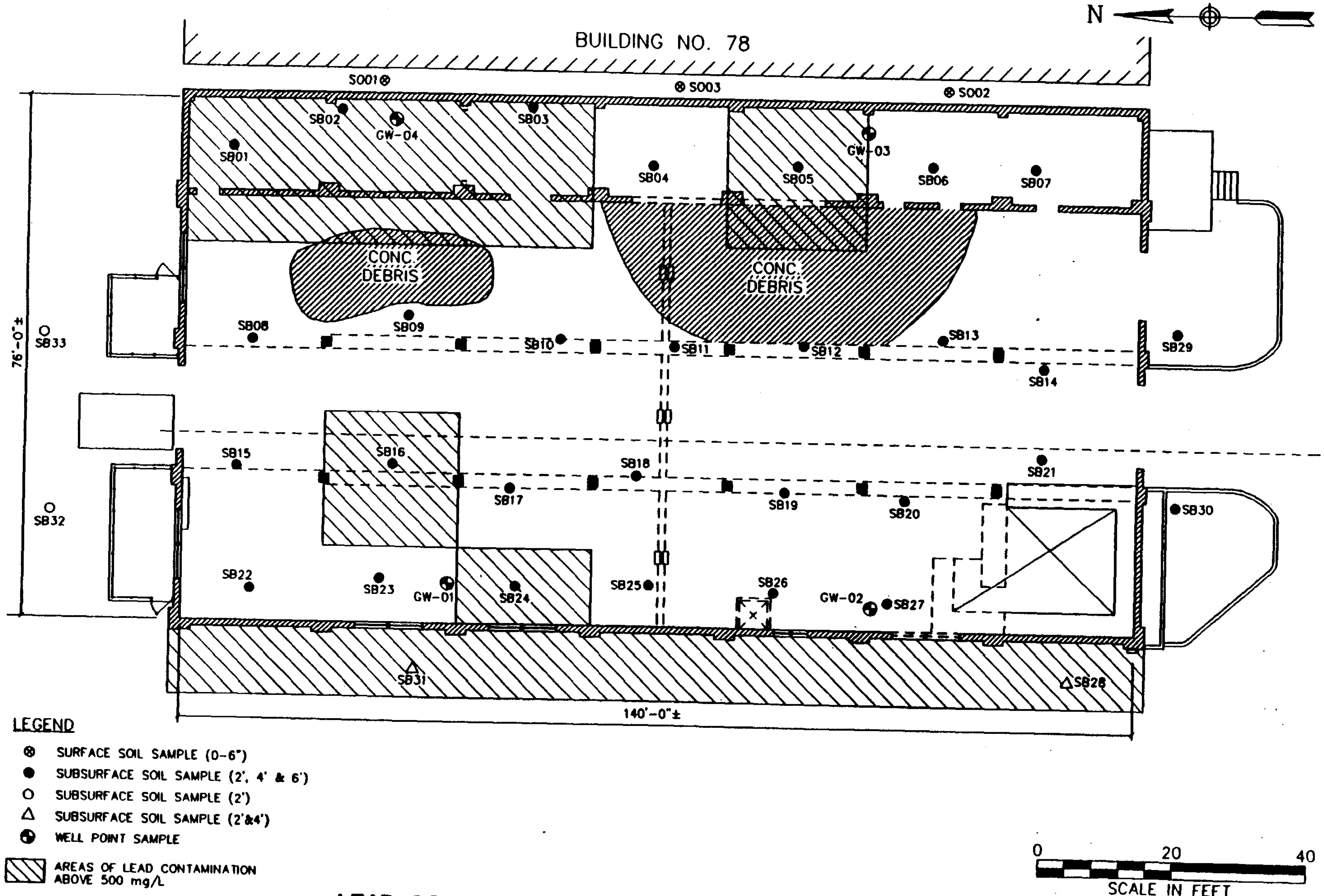
- ⊗ SURFACE SOIL SAMPLE (0-6")
- ● SUBSURFACE SOIL SAMPLE (2', 4' & 6')
- ○ SUBSURFACE SOIL SAMPLE (2')
- △ SUBSURFACE SOIL SAMPLE (2'&4')
- WELL POINT SAMPLE
- AREAS OF LEAD CONTAMINATION ABOVE 500 mg/L

LEAD CONTAMINATION (0-2 FEET)
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE 2-11

Halliburton NUS CORPORATION

ACAD: 6199/LEAD.DWG 04/29/93 KAC 002.LAY

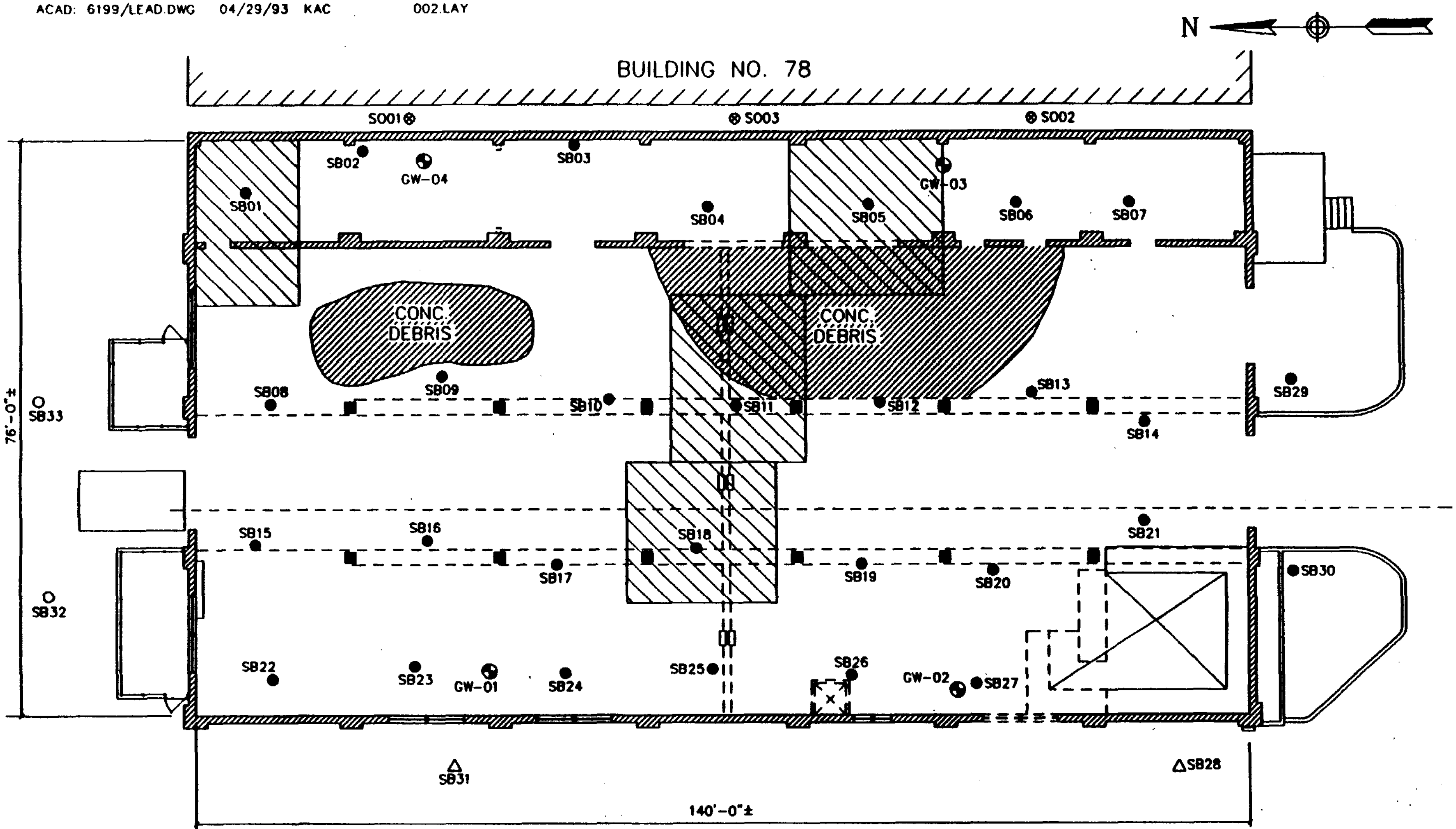


LEAD CONTAMINATION (2-4 FEET)
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE 2-12

Halliburton NUS CORPORATION

ACAD: 6199/LEAD.DWG 04/29/93 KAC 002.LAY



LEGEND

- ⊗ SURFACE SOIL SAMPLE (0-6")
- ● SUBSURFACE SOIL SAMPLE (2', 4' & 6')
- ○ SUBSURFACE SOIL SAMPLE (2')
- △ SUBSURFACE SOIL SAMPLE (2'&4')
- ◕ WELL POINT SAMPLE
- ▨ AREAS OF LEAD CONTAMINATION ABOVE 500 mg/L

0 20 40
SCALE IN FEET

LEAD CONTAMINATION (4-6 FEET)
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE 2-13

Halliburton NUS CORPORATION

2.3 STATE AND LOCAL AUTHORITY'S ROLE

The proposed remediation for Building 31 will be reviewed by the U.S. Environmental Protection Agency (U.S. EPA) Region I and the Connecticut Department of Environmental Protection (CDEP) prior to implementation. To date, no emergency response action or requests for U.S. EPA assistance have been made.

3.0 THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT

This section outlines potential threats to human health and the environment associated with the contaminants identified in the soil and groundwater at Building 31. The presence of high concentrations of lead in the soil (both surface and subsurface) greater than the Agency for Toxic Substances and Disease Registry (ATSDR) action level of 500 mg/kg to 1,000 mg/kg in combination with elevated lead concentrations in the groundwater indicates that releases have occurred at this facility. Under current conditions, several potential receptors have been identified.

3.1 THREATS TO PUBLIC HEALTH OR WELFARE

The criteria used to determine whether a removal action is necessary are presented in Section 300.415(b) of the NCP. Exposure of either human or ecological receptors to onsite contaminants is the first criterion, and the actual or potential contamination of groundwater is the second. Other criteria include the presence of contamination in surficial material that could be released (e.g., via wind) or the existence of weather conditions that could cause a release (e.g., storm runoff). All these criteria apply to this site. Two criteria which do not apply are the presence of bulk storage containers and the threat of fire or explosion.

3.1.1 Actual or Potential Exposure by Humans or Food Chain

At the current time, the only human receptors who could be exposed to the identified contamination are those base personnel involved in the onsite construction activities. Access to the building is restricted and limited to adults working in the area. Under actual site use conditions, the floor is/will be covered with concrete and outside areas are paved and/or vegetated, and therefore exposures would be minimal. Exposure could occur via ingestion and direct dermal contact with contaminated soil, although exposures are expected to be of short duration.

As shown in Tables 2-3 through 2-5, a number of contaminants were identified in the soil samples collected at the site. These contaminants are primarily metals, however, a few polycyclic aromatic hydrocarbons (PAHs), chlorinated phenolic compounds, phthalate esters, and pesticides were also detected. The concentrations of most of the organic compounds are relatively low (i.e., below 500 μg/kg), except for several of the PAHs, which were found at concentrations as high as 1,500 μg/kg. PAHs are not highly soluble contaminants, and therefore are unlikely to adversely affect the groundwater. The more mobile volatile organics were all found at concentrations below 40 μg/kg, with the exception of three detections of acetone ranging from 83 to 130 μg/kg. These results indicate that there is no significant source area of organic chemicals in the soil at this site. In fact, no organic chemicals were detected in any of the groundwater samples collected at this site.

However, several metals were found at notable concentrations in the soil. For the most part, concern centers on lead, although antimony, copper, mercury, and zinc were detected in one or more samples at concentrations that could be considered to be elevated given literature values of uncontaminated natural soils. These metals can also be found in batteries.

Exposure to lead can only be addressed qualitatively for adults, as at the current time, the U.S. EPA has no endorsed model to evaluate exposure to lead for receptors other than small children. The U.S. EPA has revoked the Reference Dose for lead, which was based on the original Primary Drinking Water Standard of 50 μg/L, pending review of its carcinogenicity. Based on observed health effects, particularly changes in certain blood enzymes and neurobehavioral development of children, it appears as though there is no threshold (and therefore lead behaves as a carcinogen). Rat and mouse bioassays have shown statistically significant increases in renal tumors.

Fetuses and small children are most susceptible to the effects of lead. A correlation has been noted between elevated blood lead levels and delays in early neurobiological and physical development, cognitive and behavioral alterations, alterations in red blood cell metabolism and vitamin D synthesis, and kidney impairment.

A positive association has been observed between elevated blood lead levels in adult males and hypertension and increased risk of cardiovascular disease. Lead may be mobilized from the bones in which it is stored in times of stress, during pregnancy, and in people suffering from osteoporosis. Lead may also play a role in miscarriages and damage to the male reproductive system (EPA, February 21, 1991).

The Agency for Toxic Substances and Disease Registry (ATSDR) has proposed that these effects occur when the lead concentration in soil or indoor dust exceeds 500 to 1,000 mg/kg. This range has been adopted by the U.S. EPA as a cleanup level for lead in soil at CERCLA sites. Typically, the lower end of the range is applied to residential settings, while the higher end is applied to industrial settings, however, this is not specifically stated in the EPA guidance (OSWER Directive 9355.4-02A, "Supplement to Interim Guidance on Establishing Lead Soil Cleanup Levels at Superfund Sites, January 26, 1990").

The U.S. EPA has also developed an exposure model (the Uptake/Biokinetic Model) that is currently available only in draft form. This model can be used to determine blood lead levels in small children (up to the age of 7 years) using standard default assumptions in combination with site-specific data. However, since small children are not considered to be potential receptors at the SUBASE NLON, this model is not appropriate to use unless land use changes to residential.

3.1.2 Actual or Potential Contamination of Drinking Water

The state of Connecticut has classified the aquifer beneath the site as a Class GB/GA aquifer. However, it should be noted that the groundwater is brackish and is not currently used for potable purposes either at the site or downgradient of the site.

It is unclear from the existing data whether the lead in the soil at the site is contributing to the lead levels observed in the unfiltered groundwater samples collected during this investigation. However, several observations can be made. First, several soil samples failed the TCLP test (see Table 2-3), that is, leachate concentrations exceeded 5.0 mg/L. This fact indicates that there is some potential for lead migration under the slightly acidic conditions under which the test is performed. Second, the lead concentrations in the unfiltered groundwater samples exceeds the Safe Drinking Water Act action level for lead (15 μg/L) in all cases, but the filtered results are all below this standard. Under current risk assessment methodologies, the unfiltered results must be used to assess risks associated with exposure at a site.

It should be noted that the filtered sample results are considered more representative of potential human and environmental exposures. Lead contamination associated with suspended particulates (i.e., the unfiltered sample results) is not as susceptible to migration to environmental or human receptor locations and will typically be removed via filtration or settling in domestic water wells.

3.1.3 Contaminants in Bulk Storage Containers

No tanks, drums, or other bulk storage containers have been identified on site.

3.1.4 High Concentrations in Surface Soils

Several soil samples collected at this site from either the surface (0 to 6 inches) or shallow subsurface (0 to 2 feet) contained lead at concentrations greater than 500 mg/kg. These concentrations were as high as 16,900 mg/kg, and in general showed some decrease with depth. These materials, under current site conditions, could be released from the site (e.g., tracked from the site by workers or released via wind from areas outside the building where not paved).

3.1.5 Weather Conditions that Could Cause Migration or Release

The exposed surficial soils could conceivably be released from the site during storms. In addition, the daily tidal fluctuations could also encourage the migration of soluble lead from the subsurface soil into the groundwater, although available analytical results indicate that lead is primarily present in insoluble form (i.e., dissolved lead concentrations in groundwater are significantly lower than total concentrations).

3.1.6 Threat of Fire or Explosion

No threat of fire or explosion has been identified at this site.

3.2 THREATS TO THE ENVIRONMENT

The site itself lies in an industrialized area of the SUBASE. The site is constructed on sand and gravel backfill behind a sheetpile bulkhead. There is no natural habitat, with the exception of a small grassy area outside the building, in the immediate site vicinity.

The threats to the environment posed by this site center around the observed and potential additional degradation of groundwater by metals, particularly lead.

Lead is toxic to plants and animals at varying concentrations. However, most lead in natural soil with neutral pH is sparingly soluble and is largely unavailable to plants. Lead at this site does not appear to be mobile in spite of its presence in both soil and the unfiltered groundwater samples (lead was below the Safe Drinking Water Act action level in all filtered samples, which represent the dissolved fraction).

Lead is reported to occur in soils of the eastern United States at concentrations ranging up to 300 mg/kg (Shacklette and Boerngen, 1984). The concentrations of lead in surficial soil samples at the site were as high as 16,900 mg/kg. Therefore, the concentrations on site are clearly elevated over natural conditions.

Most lead in natural soils is sparingly soluble and is largely unavailable to plants. Lead is generally immobilized by humus and high soil pH. At this site, lead does not appear to be mobile, based on its distribution, primarily in the upper few feet of soil.

In areas with high concentrations of lead in the soil (>10,000 mg/kg), a shift toward more lead-tolerant species has been reported in the literature. Other plants experience reduced growth rates under these conditions (EPA, 1984) because the presence of lead inhibits the nitrification process. Lead phytotoxicity is characterized by the darkening of leaves, the wilting of older leaves, stunted growth, and short brown roots (Kabata-Pendias and Pendias, 1984). The phytotoxicity of lead is low when compared to other metals such as cadmium, cobalt, nickel, and arsenic (Adriano, 1986). However, lead-related adverse effects on vegetation were not observed during the site activities.

Further effects on the food chain are minimized by the fact that most lead is retained by the plant roots and is not transported to the shoots. For example, barley grown in soil containing 800 mg/kg lead contained 800 mg/kg lead in the roots and less than 3 mg/kg in the foliage (Adriano, 1986). Similar patterns were observed in evergreens and deciduous trees in the northeastern United States, where roots were found to contain 49 percent of the lead in the trees (Smith and Siccama, 1981). Exceptions to this rule are plants subjected to atmospheric deposition of lead in urban or industrial areas, which is not the primary concern at this site.

Because of its presence in the roots, lead is not readily ingested by most herbivores or ruminants consumed by humans. The lead that is taken up by mammals through vegetation appears to be retained in the bones (Jones and Clement, 1973). Bioaccumulation in plants is not usually high enough to cause adverse effects in browsing animals (Gough et al., 1979).

Lead introduced to animals by humans can be toxic. For example, cattle and horses grazing near smelters have been poisoned, and zoo animals have been adversely affected by atmospheric fallout (Gough et al., 1979). A regular diet of 2 to 8 mg/kg/day will cause death in most animals (EPA, 1984).

Animals of the decomposer food chain are indirectly affected by lead in the soil, which reduces the populations of many microorganisms. Invertebrates may accumulate lead at concentrations toxic to their predators. Lead body burdens have been reported as follows:

Insectivores > Herbivores > Granivores (EPA, 1984)

The analytical results for soil at this site indicate that the average onsite concentration of lead in surface soils is about 1,000 mg/kg. This level indicates that adverse effects on plants may not be expected to occur. In addition, because most lead is retained in plant roots, effects on biota would be minimal. Therefore, while lead concentrations are elevated in soil, doses incurred by terrestrial biota are unlikely to be high enough to cause adverse effects. For example, survival of laboratory rats is reduced at acute oral doses of 5 mg/kg body weight (Eisler, 1984). In addition, the organic lead compounds are more toxic than inorganic compounds.

In the aquatic environment, concentrations of lead between 0.1 mg/L and 50 mg/L are lethal to some fish and can immobilize Daphnia magna. However, no surface water samples were collected during this site investigation. It would be difficult to relate elevated lead concentrations in the Thames River to Building 31 in particular, as the Thames is a large tidally-influenced body of water. A source the size of Building 31 could not be related to any measured lead levels without a detailed hydraulic study.

4.0 ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.

5.0 PROPOSED ACTIONS AND ESTIMATED COSTS

5.1 PROPOSED ACTION

5.1.1 Proposed Action Description

5.1.1.1 Excavation, Onsite and Offsite Solidification

The proposed action at Building 31 consists of the onsite solidification of contaminated soil having lead concentrations equal to or greater than 500 ppm. The contaminated soil could be solidified by either: (1) blending the cement/pozzolans in place with the soil (insitu) through the use of soil augers or shear mixer attachments for excavating equipment, or (2) by excavating the contaminated soil, mixing it with the cement/pozzolans either in the excavation or a container, and placing the soil/cement mixture back into the open excavation. To permit confirmatory sampling verifying that the cleanup level (500 ppm) is achieved, and to permit the removal of utilities that require relocation, only the second method will be employed at Building 31. For this method, the Land Disposal Restrictions require that the soil meet the required treatment standards. Since solidification is the Best Demonstrated Available Technology (BDAT) for lead contamination, the treated soil can be placed back on site if it meets the treatment standards. The proposed treatment standard for lead is 5 mg/L. By immobilizing the lead contamination and minimizing the potential for leaching, this action would be protective of human health and the environment and would be cost effective.

At those select areas where it is necessary to provide access to existing utilities (utilities located outside Building 31), the contaminated soil will be excavated to the cleanup level (500 ppm), transported off site for offsite solidification at an approved treatment facility, and disposed at an appropriate offsite landfill in accordance with regulatory requirements. The estimated quantity of soil requiring offsite stabilization and treatment is 460 yd^3. For the location of the areas to be solidified on site and off site, see Figure B-3 in Appendix B.

Solidification of the contaminated soils within Building 31 would increase the volume of the treated soil by approximately 15% (146 yds^3). If this additional treated soil is placed uniformly over the interior area of Building 31, the existing floor elevation would be raised by approximately 4.5 inches.

To verify that the cleanup level and treatment standards are achieved, a Field Sampling Plan and Quality Assurance/Quality Control (QA/QC) Plan will be prepared during the design phase and submitted to EPA and CDEP for review prior to implementing the action. Confirmation testing will be performed during the removal and treatment of the soil. The treatment testing will include strength tests, lead TCLP, and possible other testing as may be determined during the design phase.

The depth of the remediation will be based on the cleanup level, but will not extend below the top of the groundwater table or the bottom of the interior and exterior column footings (whichever is higher). To excavate below the bottom of the footings supported by wood piles would jeopardize the structural integrity of the building (see Section 2.1.3.2, Structural Integrity). To excavate and treat contaminated soil below the water table is not technically implementable within the confines of Building 31. The horizontal limits of remediation will not exceed 10 feet from the exterior wall of Building 31 under this action. The horizontal limit between Building 31 and Building 78 will be limited to the actual clearance between the buildings (approximately 3.5 feet). The depth of excavation between Buildings 31 and 78 will be limited to 4 feet to prevent undermining the footing at Building 78. Additional soil sampling will be required outside of the buildings to determine if the lead contamination extends beyond the current remediation limits. This sampling could be implemented as part of the Study Area Screening Evaluation (SASE). It is anticipated that groundwater monitoring will be required to verify the continued effectiveness of this alternative. Its is proposed that this groundwater monitoring be addressed as part of the SASE under the Federal Facilities Agreement.

All soil removed from the site must be handled in accordance to Federal, state, and local regulations. All appropriate permits and approvals must be secured prior to their offsite treatment and disposal. A separate environmental permit report will be prepared during the design phase documenting the permits required for the proposed action.

Institutional controls such as land use or deed restrictions will be required to prevent incompatible future activities at Building 31. It is the intent of the Navy to continue to use Building 31 for the storage of hazardous materials after the remedial action and building renovations (to meet current codes) are completed.

During the remediation of Building 31, a direct-reading carbon monoxide monitor will be used to monitor the level of carbon monoxide inside Building 31. The monitor will be selective to carbon monoxide and will be capable of measuring concentrations between 0.0 ppm and 100 ppm. It will be equipped with an alarm and positioned in the work area to represent the worst-case exposures. Use of this monitor will only be required while machinery is in operation. No other monitoring equipment is required provided particulate emissions are adequately suppressed with water spray. If water spray is not used to control particulate emissions during excavation and treatment of the soil, the work area will be monitored with a direct-reading particulate monitor. This instrument will provide a real-time, as well as an 8-hour average, measurement of total airborne particulate; therefore, it will be used in estimating the concentration of airborne lead. It is anticipated that work in the exclusion zone (potentially contaminated areas of the site) will be performed in Level D protection; however, the contractor will have the capability to upgrade the level of protection (respiratory protection) if the need arises during the removal action.

5.1.2 Contribution to Remedial Performance

The onsite stabilization of lead-contaminated soil and at select areas (utility corridors), the excavation, offsite stabilization, and offsite landfilling will meet the following action objectives.

- Prevent exposure to contaminated soil having lead concentrations greater than 500 ppm.
- Prevent migration of contaminants that would result in additional groundwater contamination.
- Not interfere with any future remedial action at the site based upon available information.
- Not jeopardize the structural integrity of Building 31 and the adjacent buildings.

Therefore, the proposed action would be appropriate for any long-term remedial action that may be required for this site.

Building 31 is currently listed as a study area in the Federal Facilities Agreement for future investigation. For this NPL site, investigations are still being implemented and no remedial action has been selected to date.

5.1.3 Description of Alternative Technologies

The action described in this Action Memorandum will be conducted as a time-critical action, however, several alternative actions were considered prior to selecting the proposed action (see Appendix B).

5.1.4 Applicable or Relevant and Appropriate Requirements (ARARs)

This section outlines the Applicable or Relevant and Appropriate Regulations that apply to this site activity. The U.S. EPA recognizes three categories of ARARs, as discussed below. Guidance that covers these issues are items To Be Considered (TBCs).

5.1.4.1 Chemical-Specific ARARs

There is little guidance available for soil. However, the U.S. EPA has applied a range of cleanup levels for lead in soil that were developed by the Agency for Toxic Substances and Disease Registry (ATSDR) that indicates that concentrations of lead in soil greater than 500 to 1,000 mg/kg can result in adverse health effects, especially in children. While this criterion is not a regulation, it is applied by the U.S. EPA at numerous CERCLA sites, and will therefore be applied as a TBC at this site. The state of Connecticut also has informal guidance on soil cleanup levels. This guidance from the Connecticut Department of Environmental Protection (CTDEP) will also be considered.

U.S. EPA and CTDOHS Maximum Contaminant Levels are chemical-specific ARARs that are relevant and appropriate to this site. Normally, if the groundwater was not used as a potable water source and was of insufficient quality for such future use, MCLs would not be considered to be applicable or relevant and appropriate. The groundwater beneath the site is considered to be brackish and as such is not suitable for human consumption because of natural conditions. However, the state of Connecticut has indicated that the shallow aquifer at this site is considered to be a Class GB/GA aquifer. The designation of GA indicates that the groundwater is within the influence of wells and that the water is suitable for consumption without treatment. The state's goal for GA waters is to maintain the groundwater quality.

Class GB waters are located in urban or industrial areas where public water is available. This water may not be suitable for human consumption without treatment. However, the state's goal for these waters is to prevent further degradation.

The Safe Drinking Water Act (40 CFR 141-143) action level for lead in groundwater is 15 μg/L, which is exceeded in all wells in the unfiltered aliquots. The state standard is 50 μg/L (RCSA 19-13-B101 and B102). In addition to lead, state and/or Federal MCLs are sporadically exceeded for several other metals (beryllium, chromium, and nickel), as well as the state notification level for sodium. It should be noted that both the lead and beryllium concentrations in the unfiltered background well samples exceed the action level/MCL.

5.1.4.2 Location-Specific ARARs

Potential location-specific ARARs for the site include the following:

- Federal Clean Water Act, Section 404 (40 CFR 130 and 33 CFR 320-330)
- Federal Executive Order 11988 (Floodplain Management)
- Federal and State Coastal Zone Management Act (16 USC Part 1451; 22a-92 and 94 CGS)

5.1.4.3 Action-Specific ARARs

RCRA (40 CFR 260-272) would be considered to be an action-specific ARAR, depending on the selected alternative. The TCLP results indicated that the soil is a hazardous waste by the toxicity characteristic, and therefore, removal of this material would require compliance with appropriate sections of RCRA, particularly the Land Disposal Restrictions and Hazardous Waste Manifesting requirements.

It is currently planned that solidification of the soils will be conducted. Therefore, assuming that the TCLP requirements are met in the solidified soils, placement of the soils on site (i.e., backfilling) or offsite disposal in an appropriate landfill could be implemented.

RCRA Subtitle C regulates the treatment, storage, and disposal of hazardous waste from its generation until its ultimate disposal. In general, RCRA Subtitle C requirements for the treatment, storage, or disposal of hazardous waste will be applicable if:

- The waste is a listed or characteristic waste under RCRA, and

- The waste was treated, stored, or disposed (as defined in 40 CFR 260.10) after the effective date of the RCRA requirements under consideration, or

- The activity at the CERCLA site constitutes current treatment, storage, or disposal as defined by RCRA.

RCRA Subtitle C requirements may be relevant and appropriate when the waste is sufficiently similar to a hazardous waste and/or the onsite remedial action constitutes treatment, storage, or disposal, and the particular RCRA requirement is well suited to the circumstances of the contaminant release and site. RCRA

Subtitle C requirements may also be relevant and appropriate when the remedial action constitutes generation of a hazardous waste. Onsite activities, mandated by a Federally ordered Superfund cleanup, must comply with the substantive requirements of RCRA Subtitle C but not with the administrative requirements (i.e., permits) of RCRA. All RCRA Subtitle C requirements must be met if the cleanup is not under Federal order and/or when the hazardous waste moves off site.

The following requirements included in the RCRA Subtitle C regulations may pertain to the SUBASE NLON site:

- Hazardous waste generator requirements (40 CFR Part 262).

- Transportation requirements (40 CFR Part 263).

- Standards for owners and operators of hazardous waste treatment, storage, and disposal facilities (40 CFR Part 264).

- Interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities (40 CFR Part 265).

- Land Disposal Restrictions (40 CFR Part 268).

A generator who treats, stores, or disposes of hazardous waste on site must comply with RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262). These standards include manifest requirements, pre-transport requirements (i.e., packaging, labeling, placarding), recordkeeping, and reporting hazardous waste. The standards are applicable to actions taken at the SUBASE NLON site that constitute generation of a hazardous waste (i.e., movement of hazardous waste out of the area of contamination).

Standards Applicable to Transporters of Hazardous Waste (40 CFR Part 263) are applicable to offsite transportation of hazardous waste from the SUBASE NLON site. These regulations include requirements for compliance with the manifest and recordkeeping systems and requirements for immediate action and cleanup of hazardous waste discharges (spills) during transportation.

Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDFs) (40 CFR Part 264) are applicable to remedial actions taken at the SUBASE NLON site and to offsite facilities receiving hazardous waste from the site for treatment and/or disposal and have a RCRA Part B permit. Since the SUBASE NLON is a Federally ordered CERCLA cleanup, a RCRA Part B permit is not required for onsite facilities, but the substantive requirements of RCRA Part B must be addressed. Standards for TSDFs include requirements for preparedness and prevention, releases from solid waste management units (i.e., corrective action requirements), closure and post-closure care.

RCRA Land Disposal Restrictions (LDR) requirements (40 CFR Part 268) restricts certain wastes from being placed or disposed on the land unless they meet specific Best Demonstrated Available Technology (BDAT) treatment standards (expressed as concentrations, total or in the TCLP extract, or as specified technologies). Removal and treatment of a RCRA hazardous waste or movement of the waste out of the Area of Contamination (AOC), thereby constituting "placement," will trigger the LDR requirements. The treatment standard for lead is 5 ppm in TCLP leachate. During the implementation of the selected treatment, periodic analysis using the appropriate testing procedure (TCLP for inorganics) would be required to ensure the treatment levels for the contaminants are being attained and thus can be land disposed without further treatment.

DOT Rules for Hazardous Materials Transport (49 CFR Parts 107 and 171-179) regulate the transport of hazardous materials, including packaging, shipper equipment, and placarding. These rules are considered applicable to wastes shipped off site for laboratory analysis, treatment, or disposal.

Occupational Health and Safety Act (OSHA) regulations (29 CFR Parts 1904, 1910, and 1926) provide occupational safety and health requirements applicable to workers engaged in onsite field activities. The regulations are applicable to onsite work performed during implementation of a remedial action. Threshold Limit Values (TLVs) refer to airborne concentrations of substances and represent conditions under which it is believed that workers may be repeatedly exposed without adverse effect. TLVs are based on the best available information from industrial experience and experimental studies. These ARARs are the jurisdiction of the onsite health and safety officer.

5.1.5 Project Schedule

The U.S. Navy intends to address the contaminated soil at Building 31 as a "time-critical" removal action. Thus, the remediation will begin within 6 months of determining that the removal action is appropriate (date the Action Memorandum is approved as final by EPA). The time estimated to complete the action after start of construction is approximately 2 months.

5.2 ESTIMATED COST

The estimated construction cost for this alternative is $1,011,172 (see Appendix C for the cost estimate of Alternative 3). Only construction costs are included in this estimate. No monitoring or engineering costs have been included in this estimate. Any required monitoring can be addressed under the ongoing NPL investigation at the site.

6.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Should the action be delayed or not taken, the following scenario would exist:

- Humans working in or near Building 31 would potentially be exposed to high levels of lead contamination in the surface and subsurface soils.
- Lead contamination in the soils could potentially migrate.
- Potential for additional contamination of the groundwater would continue.

7.0 OUTSTANDING POLICY ISSUES

The Naval Submarine Base New London (SUBASE NLON) has been proposed as one of the military bases under consideration for closing. The proposal is for the realignment of activities at the SUBASE and a complete closing of the base will not occur. Under the proposed realignment, the submarines would be relocated and only support facilities for the submarines would be closed. Also, any final decisions regarding possible implementations are not expected for 2 to 3 years. Thus, the time-critical action proposed in the Action Memorandum should not be influenced by this outstanding issue.

8.0 ENFORCEMENT

The NORTHNAVFACENGCOM of the Navy is the lead agency for Naval Submarine Base New London (SUBASE NLON). The removal action will not be financed through Superfund; all funding will be provided by the Navy with Defense Environmental Restoration Account (DERA) funds. Therefore, enforcement strategies do not apply to this removal action.

9.0 RECOMMENDATION

This document presents the proposed action for remediating the lead-contaminated soils in Building 31 and adjacent to Building 31 at SUBASE NLON, Groton, Connecticut, developed in accordance with CERCLA as amended by SARA, and is consistent with the NCP.

Conditions at this site meet the NCP Section 300.415(b)(2) criteria for a removal action. Therefore, the removal action is recommended for Building 31.

____________________________________ ____________________

Installation Commander Date

APPENDIX A

ANALYTICAL DATA

Validation

The data from the following SUBASE NLON analyses were reported as NEESA level D:

- Contract Laboratory Program (CLP) lead
- full Target Compound List (TCL) organics
  (volatiles, semivolatiles, pesticides/PCBs)
- Target Analyte List (TAL) metals (including some dissolved TAL metals)
- CLP cyanide

The data from the Toxicity Characteristic Leaching Procedure (TCLP) lead analyses, and selected Appendix VIII metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) analyses were reported as NEESA level C. Data from the pH analyses were reported as NEESA level E.

NEESA level D analyses are equivalent to EPA Data Quality Objective (DQO) Level IV (i.e., full CLP data deliverables; suitable for risk assessment). NEESA level C analyses are equivalent to EPA DQO Level III (i.e., modified CLP data deliverables; quantitative). NEESA level E analyses are equivalent to EPA DQO Level II (i.e., wet chemistry, geotechnical procedures).

Requirements pertaining to the designated QA/QC levels are defined in the NEESA guidance document "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (20.2-047B), dated June 1988 (Martin Marietta Energy Systems, Inc.). All analyses were performed by Southwest Laboratories of Oklahoma.

Approximately 15 percent of the analytical results were evaluated (validated) to substantiate the level of quality of the data generated, and to determine potential bias or limitations in use of the data for its intended purpose. As prescribed in the NEESA guidelines, the data are to be validated in accordance with the data validation protocols released by the U.S. EPA Region in which the site is located. Because U.S. EPA Region I has not yet formally released updated modifications pertaining to the current 3/90 analytical protocol, the uniform, non-Regional specific National Functional Guidelines documents were used for validation. Existing U.S. EPA Region I policies, however, such as the format of the data validation memorandum report and use of U.S. EPA Region I data validation worksheets were observed. Were applicable, method-specific quality control criteria were also considered during the data evaluation process.

The quality parameters against which the data were evaluated include the following:

- completeness
- holding times until preparation/analysis
- calibration
- instrument tuning and/or performance
- laboratory and field quality control blank analyses
- matrix spike recoveries
- Laboratory Control Sample (LCS) analysis results
- field duplicates
- laboratory duplicates (inorganic fractions only)
- surrogate spike recoveries (organic fractions only)
- internal standards performance
  (volatile and semivolatile organic fractions only)
- Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) results (metals analyses only)
- ICP serial dilution results (metals analyses only)
- Graphite Furnace Atomic Absorption (GFAA) data

(metals analyses only)
- detection limits
- analyte identification
- analyte quantitation

Data which were compromised were flagged (qualified) in accordance with data validation protocol. Findings of the data validation process were summarized in letter reports (memoranda) to the Project Manager. These reports discuss the flags that were applied to the data and the rationale behind the qualification. All data (both validated and unvalidated) generated for this sampling event conducted at SUBASE NLON are presented in Appendix A of this report.

All of the 15 percent of the data which were validated were rated as acceptable and suitable for the use intended. Levels of acetone, chloroform, bis(2-ethylhexyl)phthalate, butylbenzyl phthalate, arsenic, cadmium, barium, and selenium contamination, within contractually acceptable limits, were noted in laboratory method blank analyses. Affected validated sample results which were considered to be false positives were qualified as such accordingly. Some contamination occurring in the field quality control blanks is considered to be a consequence of laboratory blank contamination. Other compounds noted in the associated field quality control blanks include toluene, phenol, and diethyl phthalate. Validated sample results for these compounds occurring in associated environmental samples were qualified as false positives where applicable.

Minor volatile and semivolatile fraction calibration exceedances were noted for some compounds. Recoveries for some volatile and semivolatile fraction LCS analyses were greater than the established upper quality control limits. Likewise, some Contract Required Detection Limit (CRDL) Standard analysis recoveries for lead exceeded the upper quality control limit. Field duplicate imprecision was noted for several semivolatile compound and metals analytes. Sample matrix effects were noted in several instances, such as:

- the inability of some semivolatile and pesticide/PCB fraction compounds and lead, in some instances, to meet matrix spike quality control criteria

- performance criteria not met for internal standards in some volatile and/or semivolatile samples despite reanalyses

- some pesticide/PCB fraction surrogate recoveries outside of advisory control limits

Affected validated data were qualified as estimated. Additionally, an error was noted in the raw data reported for one pesticide/PCB sample in SDG 12748, PKG 7; the laboratory was contacted for confirmation and the validator annotated the data correction in the analytical data package. The laboratory also made a Form I reporting error of the analytical results for sample SO-03-R, which the laboratory rectified by resubmitting a corrected Form I analytical results report.

CTO #112: NSB NEW LONDON
DATA QUALIFIER KEY

U	–	Value is a nondetect as reported by the laboratory.
J	–	Positive value is considered to be estimated because the concentration is reported at a level which is below that of the Contract Required Quantitation Limit (CRQL).
U(b)	–	Positive value is considered to be a false positive attributable to associated blank contamination.
J(f)	–	Quantitation of positive value is considered to be estimated based on imprecision demonstrated by the associated field duplicate pair.
UJ(f)	–	Exact value of nondetect is considered to be estimated based on imprecision demonstrated by the associated field duplicate pair.
J(d)	–	Quantitation of positive value is considered to be estimated based on imprecision noted in the associated lab duplicate pair.
UJ(d)	–	Exact value of nondetect is considered to be estimated based on imprecision noted in the associated lab duplicate pair.
J(a)	–	Quantitation of positive value is considered to be estimated because of poor associat internal standard performance.
UJ(a)	–	Exact value of nondetect is considered to be estimated because of poor associated internal standard performance.
J(s)	–	Quantitation of positive value is considered to be estimated because of poor associat surrogate recovery.
UJ(s)	–	Exact value of nondetect is considered to be estimated because of poor associated surrogate recovery.
J(o)	–	Quantitation of positive value is considered to be estimated based on imprecision demonstrated by the serial dilution anlaysis results.
J(m)	–	Quantitation of positive value is considered to be estimated based on matrix spike analysis data outside of quality control limits.
UJ(m)	–	Exact value of nondetect is considered to be estimated based on matrix spike analysis data outside of quality control limits.
J(p)	–	Quantitation of positive value is considered to be estimated based on recovery of the GFAA Post Digestion Spike analysis outside of quality control limits.
UJ(p)	–	Exact value is of nondetect is considered to be estimated based on recovery of the GFAA Post Digestion Spike analysis outside of quality control limits.

CTO #112: NSB NEW LONDON
CLP SOIL LEAD (mg/kg)

CLIENT ID		LAB ID	% SOLIDS	pH	CLP LEAD		
SB01-2.0		12760.01	93.3	7.49	1490	J(f)	[VALIDATED RESULT]
SB01-4.0		12760.02	92	7.58	4330	J(f)	[VALIDATED RESULT]
SB01-4.0D		12760.03	92.1	7.50	1590	J(f)	[VALIDATED RESULT]
SB01-6.0		12760.04	91.9	6.26	1180	J(f)	[VALIDATED RESULT]
SB02-2.0		12760.05	94.2	9.95	3390	J(f)	[VALIDATED RESULT]
SB02-4.0	(a)	12760.06	95	9.41	3160		
SB02-4.0D	(a)	12760.07	94	9.41	2720		
SB02-6.0		12760.08	92.5	9.41	383	J(f)	[VALIDATED RESULT]
SB03-2.0		12760.09	92.3	4.74	4790	J(f)	[VALIDATED RESULT]
SB03-4.0		12760.10	87.2	6.74	5370	J(f)	[VALIDATED RESULT]
SB03-6.0		12760.11	91.2	6.82	106	J(f)	[VALIDATED RESULT]
SB04-2.0		12760.12	93.6	8.75	492	J(f)	[VALIDATED RESULT]
SB04-4.0		12760.13	92.1	9.04	177	J(f)	[VALIDATED RESULT]
SB04-6.0		12760.14	90.1	11.90	301	J(f)	[VALIDATED RESULT]
SB05-2.0		12760.15	93.2	7.24	11900	J(f)	[VALIDATED RESULT]
SB05-4.0		12760.18	92.8	7.45	2990		
SB05-6.0		12760.19	90.3	6.44	670		
SB06-2.0		12760.20	90.6	6.49	5.9		
SB06-4.0		12760.21	93.6	6.27	19.3	U(b)	[VALIDATED RESULT]
SB06-4.0D		12760.22	90.7	6.64	4.8	U(b)	[VALIDATED RESULT]
SB06-6.0		12760.23	94	6.50	134		
SB07-2.0		12760.24	95.0	8.46	13.7		
SB07-4.0		12760.25	89.9	6.81	3.1		
SB07-6.0		12760.26	83.7	7.59	39.5		
SB08-2.0		12745.17	91.8	7.97	962		
SB08-4.0		12745.18	93.4	4.63	8.6		
SB08-6.0		12745.19	90.2	4.95	30		
SB09-2.0		12745.20	93.7	8.96	27.5		
SB09-4.0		12745.21	92.1	5.54	9.8		
SB09-6.0		12745.22	75.8	6.43	14.6		
SB10-2.0		12745.01	92.8	7.67	7.9		
SB10-4.0		12745.02	89.8	4.60	13.7		
SB10-6.0		12745.03	84.7	4.80	9.1		
SB10-6.0D		12745.05	87.1	4.70	8.76		
SB11-2.0		12745.06	90.7	6.16	9.7		
SB11-4.0		12745.07	89.3	5.84	8.4		
SB11-6.0		12745.08	85.5	11.20	799		
SB12-2.0		12745.09	91.1	7.70	2.8		
SB12-4.0		12745.10	94.9	9.65	2.9		
SB12-6.0		12745.11	91.1	8.83	8.8		
SB13-2.0		12745.12	92.5	8.78	186		
SB13-2.0D		12745.14	91.7	8.67	463		
SB13-4.0		12745.15	93	8.71	32.6		
SB13-6.0		12745.16	83.7	10.10	42.9		
SB14-2.0	(a)	12760.49	92.3	10.40	3.1		
SB14-4.0		12760.50	94.2	11.80	6.3		
SB14-6.0		12760.51	79.1	10.80	5.1		
SB15-2.0		12760.30	92.4	7.10	69.2		
SB15-4.0		12760.31	85.6	4.40	44.5		
SB15-6.0		12760.32	92.0	5.24	40		
SB16-2.0		12760.33	91.8	7.79	1060		
SB16-4.0		12760.34	92.5	7.31	713		
SB16-6.0		12760.35	90.1	4.86	339		
SB17-2.0		12745.37	92.0	6.69	25		
SB17-4.0		12745.38	89.5	5.67	77.3		
SB17-6.0		12745.39	90.9	7.83	302		
SB18-2.0		12760.36	92.5	4.64	39.1		
SB18-4.0	(a)	12760.37	86.8	4.53	53.9		
SB18-6.0		12760.38	92.0	5.80	9470	J(m)	[VALIDATED RESULT]

(a) These samples received full TAL metals analyses. No CLP Lead only results were reported by the laboratory.

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
CLP SOIL LEAD (mg/kg)

CLIENT ID		LAB ID	% SOLIDS	pH	CLP LEAD	
SB19-2.0		12760.39	92.8	5.11	9.7	
SB19-4.0		12760.40	94.9	5.39	15.7	
SB19-6.0		12760.41	94.5	11.00	144	
SB20-2.0		12760.42	91.2	11.00	229	
SB20-4.0		12760.43	95.0	8.67	26.4	
SB20-4.0 D		12760.44	94.3	9.20	25.8	
SB20-6.0		12760.45	91.2	9.59	49.8	
SB21-2.0		12760.46	94.9	11.60	69.8	
SB21-4.0		12760.47	94.4	11.70	9.3	
SB21-6.0		12760.48	92.3	10.90	6.8	
SB22-2.0		12760.27	87.8	10.80	5.4	
SB22-4.0		12760.28	91.8	11.50	8.1	
SB22-6.0	(a)	12760.29	89.1	11.70	32.6	
SB23-2.0		12745.40	91.0	4.51	2.8	
SB23-4.0		12745.41	85.1	4.16	6.7	
SB23-6.0		12745.42	93.0	4.47	7.7	
SB24-2.0		12745.34	88.8	6.45	16900	
SB24-4.0		12745.35	91.1	5.16	4550	
SB24-6.0		12745.36	91.4	4.23	4.9	
SB25-2.0		12745.29	97.2	7.80	389	
SB25-4.0		12745.30	96.3	8.84	26.8	
SB25-4.0D		12745.32	96.6	8.83	351	
SB25-6.0		12745.33	81.9	4.56	7	
SB26-2.0		12745.26	96.1	11.50	30.1	
SB26-4.0		12745.27	96.6	10.10	3	
SB26-6.0		12745.28	96.9	11.60	25.4	
SB27-2.0		12745.23	93.4	11.10	19.8	
SB27-4.0		12745.24	93.4	10.90	4	
SB27-6.0		12745.25	90.6	7.37	3.5	
SB28-2.0		12760.59	94.4	6.78	5840	[VALIDATED RESULT]
SB28-4.0		12760.60	93.4	7.20	3330	
SB29-2.0		12760.55	84	6.59	723	
SB29-2.0 D		12760.56	93.7	6.56	.556	
SB29-4.0		12760.57	89.1	6.90	238	
SB29-6.0		12760.58	89.3	7.46	127	
SB30-2.0		12760.52	85.5	6.45	413	
SB30-4.0		12760.53	98.7	7.04	163	
SB30-6.0		12760.54	90.4	7.84	57.2	
SB31-2.0		12760.61	95.9	8.11	2330	
SB31-2.0 D		12760.62	95.5	8.17	1980	
SB32-2.0		12760.63	94.8	7.75	31.4	
SB33-2.0		12760.64	79.4	9.63	123	
S001-1.0		12760.65	91.5	N/A	4640	
S002-1.0		12760.66	94	N/A	2030	
S003-1.0		12760.67	94	N/A	2290	
S003-1.0 D		12760.68	94	N/A	2300	

CLP AQUEOUS LEAD (ug/L)

CLIENT ID	LAB ID	QC DESIGNATION	CLP LEAD		
S0-01-F	12745.44	FIELD BLANK	6.8	J(f)	[VALIDATED RESULT]
S0-02-F	12745.45	FIELD BLANK	2	UJ(f)	[VALIDATED RESULT]
S0-01-R	12745.43	RINSATE BLANK	2	U	
S0-02-R	12760.69	RINSATE BLANK	29.3	J(f)	[VALIDATED RESULT]
S0-04-R	12760.70	RINSATE BLANK	2	U	

(a) These samples received full TAL metals analyses. No CLP Lead only results were reported by the laboratory.

N/A Analysis not requested.

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

U	–	Value is a nondetect as reported by the laboratory.
J	–	Positive value is considered to be estimated because the concentration is reported at a level which is below that of the Contract Required Quantitation Limit (CRQL).
U(b)	–	Positive value is considered to be a false positive attributable to associated blank contamination.
J(f)	–	Quantitation of positive value is considered to be estimated based on imprecision demonstrated by the associated field duplicate pair.
UJ(f)	–	Exact value of nondetect is considered to be estimated based on imprecision demonstrated by the associated field duplicate pair.
J(d)	–	Quantitation of positive value is considered to be estimated based on imprecision noted in the associated lab duplicate pair.
UJ(d)	–	Exact value of nondetect is considered to be estimated based on imprecision noted in the associated lab duplicate pair.
J(a)	–	Quantitation of positive value is considered to be estimated because of poor associat internal standard performance.
UJ(a)	–	Exact value of nondetect is considered to be estimated because of poor associated internal standard performance.
J(s)	–	Quantitation of positive value is considered to be estimated because of poor associat surrogate recovery.
UJ(s)	–	Exact value of nondetect is considered to be estimated because of poor associated surrogate recovery.
J(o)	–	Quantitation of positive value is considered to be estimated based on imprecision demonstrated by the serial dilution anlaysis results.
J(m)	–	Quantitation of positive value is considered to be estimated based on matrix spike analysis data outside of quality control limits.
UJ(m)	–	Exact value of nondetect is considered to be estimated based on matrix spike analysis data outside of quality control limits.
J(p)	–	Quantitation of positive value is considered to be estimated based on recovery of the GFAA Post Digestion Spike analysis outside of quality control limits.
UJ(p)	–	Exact value is of nondetect is considered to be estimated based on recovery of the GFAA Post Digestion Spike analysis outside of quality control limits.

CTO #112: NSB NEW LONDON
TAL SOILS METALS (mg/kg)

CLIENT ID:			SB02-4.0		SB02-4.0 D		SB14-2.0		SB18-4.0		SB22-6.0	
LABORATORY ID:			12760.06		12760.07		12760.49		12760.37		12760.29	
ANALYTE	CRQL	MDL/IDL					[VALIDATED]					
ALUMINUM	40	6.8	9260		9240		8790		10800		7220	
ANTIMONY	12	3.2	10.4		8.4		5.2	U	5.4		3.6	U
ARSENIC	2	0.4	3		2.8		2.2		1.3		1.6	
BARIUM	40	1.8	55.6		55.8		43.8		52.9		37.9	
BERYLLIUM	1	0.2	0.32		0.34		0.38		0.36		0.22	U
CADMIUM	1	0.6	1.4		0.48		0.46		0.69	U	0.67	U
CALCIUM	1000	46	3090		7390		2500		3060		13800	
CHROMIUM	2	1.2	14.9		15.3		16.9		14.7		10.5	
COBALT	10	1.2	5.7		5.9		5		4.1		3.7	
COPPER	5	0.4	36.6		33.2		12		65.6		12.4	
IRON	20	1.6	10500		9990		9440		12500		7560	
LEAD	0.6	0.4	3160		2720		3.1		53.9		32.6	
MAGNESIUM	1000	38.6	2790		2670		3260		3310		2660	
MANGANESE	3	0.4	192		175		155		188		158	
MERCURY	0.1	0.1	0.35		0.56		0.11	U	0.13		0.11	U
NICKEL	8	3	9.9		10.3		13.4		11.2		5.2	
POTASSIUM	1000	149	2080		1870		2130		958		1280	
SELENIUM	1	0.2	0.21	U	0.22	U	0.22	U	0.23	U	0.22	U
SILVER	2	0.4	0.86	U	0.89	U	1.7	U(b)	2.5		1.7	
SODIUM	1000	199	644		886		474		269		530	
THALLIUM	2	0.6	0.43	U	0.44	U	0.43	U	0.69	U	0.67	U
VANADIUM	10	1.2	20.3		19.8		18.9		26.2		14.7	
ZINC	4	0.4	648		184		20.4		24.1		49.9	
CYANIDE	10	10	0.54	U	0.55	U	0.54	U	0.58	U	0.56	U
% SOLIDS:			95		94		92.3		86.8		89.1	

CTO #112: NSB NEW LONDON
RCRA SOILS METALS (mg/kg)

CLIENT ID:			SB02-2.0		SB06-2.0		SB18-6.0		SB28-2.0	
LABORATORY ID:			12847.01		12847.02		12847.03		12847.04	
ANALYTE	CRQL	MDL/IDL								
			[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]	
ARSENIC	2	0.4	5	J(m)	4.8	J(m)	2.5	J(m)	4.6	J(m)
BARIUM	40	1.8	57.5		37.1		46.5		35.8	
CADMIUM	1	0.6	0.46	U(b)	0.43	U	0.43	U	0.42	U
CHROMIUM	2	1.2	11.9		12.4		12.5		11.5	
LEAD	0.6	0.4	5860		460		689		8840	
MERCURY	0.1	0.1	0.45	J(m)	0.11	UJ(m	0.11	UJ(m)	0.12	J(m)
SELENIUM	1	0.2	0.27	U(b)	0.21	UJ(m	0.21	UJ(m)	0.5	U(b)
SILVER	2	0.4	0.85	U	0.85	U	0.86	U	0.85	U
% SOLIDS:			93.9		93.6		93.5		94.4	

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
TAL AQUEOUS METALS (ug/L)

CLIENT ID:			GW01-1		GW01-1 D		GW02-1	
LABORATORY ID:			12748.02		12748.03		12748.04	
ANALYTE	CRQL	MDL/IDL	FIELD DUPLICATE PAIR					
			[VALIDATED]		[VALIDATED]		[VALIDATED]	
ALUMINUM	200	34	25000	J(f)	14800	J(f)	75000	J(f)
ANTIMONY	60	16	17.1	U(b)	16	UJ(m)	16	UJ(m)
ARSENIC	10	2	8.3	J(m)	5.1	J(m)	2.7	J(m,p)
BARIUM	200	9	114		69.7		609	
BERYLLIUM	5	1	1.4		1	U	6.9	
CADMIUM	5	3	3	U	3	U	4.8	
CALCIUM	5000	230	9350		8760		27000	
CHROMIUM	10	6	27		12.1		78	
COBALT	50	6	9.6		6	U	47.6	
COPPER	25	2	58.1		35.7		142	
IRON	100	8	17600	J(f)	11400	J(f)	62200	J(f)
LEAD	3	2	73.4	J(f)	47.5	J(f)	392	J(f)
MAGNESIUM	5000	193	4440		3130		17200	
MANGANESE	15	2	454		391		3890	
MERCURY	0.2	0.2	0.36	J(d)	0.32	J(d)	1.2	J(d)
NICKEL	40	15	90.9		38.4		133	
POTASSIUM	5000	743	5570		4970		11000	
SELENIUM	5	1	3	U	3	U	3	UJ(p)
SILVER	10	2	3	U(b)	2	U	7.6	U(b)
SODIUM	5000	252	28800	J(o)	28200	J(o)	47900	J(o)
THALLIUM	10	3	3	UJ(m)	3	UJ(m)	3	UJ(m.p)
VANADIUM	50	6	36		21.8		87.2	
ZINC	20	2	141	J(f)	93.2	J(f)	338	J(f)
CYANIDE	10	NA	10	U	10	U	10	U

CTO #112: NSB NEW LONDON
TAL AQUEOUS METALS (ug/L)

CLIENT ID:			GW-BG-1		GW-1F		SO-03-R	
LABORATORY ID:			12759.01		12748.09		12760.71	
ANALYTE	CRQL	MDL/IDL						
			[VALIDATED]		[VALIDATED]		[VALIDATED]	
ALUMINUM	200	34	15000	J(f)	113	J(f)	142	J(f)
ANTIMONY	60	16	16	UJ(m)	16	UJ(m)	16	UJ(m)
ARSENIC	10	2	1.8	J(m)	1	J(m,p)	1.0	UJ(m,p)
BARIUM	200	9	730		9	U	9	U
BERYLLIUM	5	1	2.2		1	U	1	U
CADMIUM	5	3	3	U	3	U	3	U
CALCIUM	5000	230	14800		230	U	230	U
CHROMIUM	10	6	79.4		6	U	6	U
COBALT	50	6	25.2		6	U	6	U
COPPER	25	2	129		2	U	2	U
IRON	100	8	27400	J(f)	17.7	U(b)	65.6	U(b)
LEAD	3	2	19.2	J(f)	2	UJ(f)	2.3	J(f)
MAGNESIUM	5000	193	6210		193	U	193	U
MANGANESE	15	2	2200		2.9		5.4	
MERCURY	0.2	0.2	0.21	J(d)	0.21	J(d)	0.20	UJ(d)
NICKEL	40	15	36.9		15	U	15	U
POTASSIUM	5000	743	7210		743	U	743	U
SELENIUM	5	1	3	U	3	UJ(p)	3.0	U
SILVER	10	2	3.6	U(b)	2	U	2	U
SODIUM	5000	252	22400	J(o)	704	J(o)	779	J(o)
THALLIUM	10	3	3	UJ(m,p)	3	UJ(m)	3	UJ(m)
VANADIUM	50	6	19.8		6	U	6	U
ZINC	20	2	161	J(f)	2.9	U(b)	4.7	U(b)
CYANIDE	10	NA	10	U	10	U	10	U

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
RCRA AQUEOUS METALS (ug/L)

CLIENT ID:			GW03-1		GW03-1 DISS		GW04-1		GW04-1 DISS	
LABORATORY ID:			12748.05		12748.06		12748.07		12748.08	
ANALYTE	CRQL	MDL/IDL								
ARSENIC	10	2	3.3		1.7		2.7		1.2	
BARIUM	200	9	84.4		36.6		41.8		18	
CADMIUM	5	3	3	U	3	U	3	U	3	U
CHROMIUM	10	6	9.8		6	U	7.4		6	U
LEAD	3	2	312		7.3		199		2	U
MERCURY	0.2	0.2	0.2	U	0.2	U	8.9		0.2	U
SELENIUM	5	1	3	U	3	U	3	U	3	U
SILVER	10	2	2	U	2	U	2	U	2	U

CTO #112: NSB NEW LONDON
RCRA AQUEOUS METALS (ug/L)

CLIENT ID:			GW-01-2		GW-01-2 DISS		GW-02-2		GW-02-2 DISS	
LABORATORY ID:			12783.07		12783.08		12783.03		12783.04	
ANALYTE	CRQL	MDL/IDL								
ARSENIC	10	2	6.8		2	U	2	U	2	U
BARIUM	200	9	94.1		21.8		325		24	
CADMIUM	5	3	3	U	3	U	3	U	3	U
CHROMIUM	10	6	26.2		6	U	39		6	U
LEAD	3	2	41.5		1.1		220		1	U
MERCURY	0.2	0.2	0.3		0.2	U	0.2	U	0.2	U
SELENIUM	5	1	10	U	1	U	10	U	1	U
SILVER	10	2	2		2	U	4.2		2	U

CTO #112: NSB NEW LONDON
RCRA AQUEOUS METALS (ug/L)

CLIENT ID:			GW-02-2D		GW-02-2D DISS		GW-03-2		GW-03-2 DISS	
LABORATORY ID:			12783.05		12783.06		12783.11		12783.12	
ANALYTE	CRQL	MDL/IDL	FIELD DUPLICATE OF GW-02-2							
ARSENIC	10	2	2	U	2	U	2.4		2	U
BARIUM	200	9	368		24		105		44	
CADMIUM	5	3	3	U	3	U	3	U	3	U
CHROMIUM	10	6	30.2		6	U	14.7		6	U
LEAD	3	2	216		1		136		2.2	
MERCURY	0.2	0.2	0.2	U	0.2	U	0.2	U	0.2	U
SELENIUM	5	1	10	U	1	U	1	U	1	U
SILVER	10	2	2.9		2	U	2	U	2	U

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
RCRA AQUEOUS METALS (ug/L)

CLIENT ID:			GW-04-2		GW-04-2 DISS		GW-BG-2		GW-BG-2 DISS	
LABORATORY ID:			12783.09		12783.10		12783.01		12783.02	
ANALYTE	CRQL	MDL/IDL					BACKGROUND			
ARSENIC	10	2	2.1		2	U	2	U	2	U
BARIUM	200	9	43.7		22.2		835		65	
CADMIUM	5	3	3	U	3	U	3	U	3	U
CHROMIUM	10	6	9.8		6	U	91.4		6	U
LEAD	3	2	84		1.2		18		1	U
MERCURY	0.2	0.2	0.2	U	0.2	U	0.2	U	0.2	U
SELENIUM	5	1	1	U	1	U	1	U	1	U
SILVER	10	2	2	U	2	U	3.9		2	U

CTO #112: NSB NEW LONDON
RCRA AQUEOUS METALS (ug/L)

CLIENT ID:			DC-01		DC-01 DISS	
LABORATORY ID:			12783.13		12783.14	
ANALYTE	CRQL	MDL/IDL	RINSATE BLANK			
ARSENIC	10	2	6.5		2	U
BARIUM	200	9	115		18.4	
CADMIUM	5	3	11.3		6.7	
CHROMIUM	10	6	40.1		6	U
LEAD	3	2	2870		815	
MERCURY	0.2	0.2	0.31		0.2	U
SELENIUM	5	1	1	U	1	U
SILVER	10	2	2	U	2	U

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
TCL SOIL VOLATILES (ug/kg)

CLIENT ID:			SB02-4.0		SB02-4.0 D		SB14-2.0		SB16-4.0		SB22-6.0	
LABORATORY ID:			127600.06		127600.07		127600.49		127600.37		127600.29	
ANALYTE	CRQL	MDL/IDL										
			[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]	
CHLOROMETHANE	10	0.7	10	U	11	U	11	U	10	U	12	U
BROMOMETHANE	10	0.7	10	U	11	U	11	U	10	U	12	U
VINYL CHLORIDE	10	0.4	10	U	11	U	11	U	10	U	12	U
CHLOROETHANE	10	0.4	10	U	11	U	11	U	10	U	12	U
METHYLENE CHLORIDE	10	0.7	39	J(f)	9	J(f)	4	J	5	J	3	J
ACETONE	10	4.2	120	U(b)	55	U(b)	130		83		84	
CARBON DISULFIDE	10	0.7	10	U	11	U	11	U	10	U	12	U
1,1-DICHLOROETHENE	10	0.7	3	J(f)	0.6	J(f)	11	U	10	U	12	U
1,1-DICHLOROETHANE	10	0.5	10	U	11	U	11	U	10	U	12	U
1,2-DICHLOROETHENE (TOTAL)	10	1	10	U	11	U	11	U	10	U	12	U
CHLOROFORM	10	0.6	10	U(b)	11	U(b)	1	J	10	U	12	U
1,2-DICHLOROETHANE	10	0.8	10	U	11	U	11	U	10	U	12	U
2-BUTANONE	10	3.2	7	J(a,f)	2	J(f)	11	U	10	U	12	U
1,1,1-TRICHLOROETHANE	10	0.5	0.8	J	11	U	11	U	4	J	6	J
CARBON TETRACHLORIDE	10	0.9	10	U	11	U	11	U	10	U	12	U
BROMODICHLOROMETHANE	10	0.8	10	U	11	U	11	U	10	U	12	U
1,2-DICHLOROPROPANE	10	0.7	10	U	11	U	11	U	10	U	12	U
CIS-1,3-DICHLOROPROPENE	10	0.5	10	U	11	U	11	U	10	U	12	U
TRICHLOROETHENE	10	2.6	10	U	11	U	11	U	10	U	12	U
DIBROMOCHLOROMETHANE	10	1.3	10	U	11	U	11	U	10	U	12	U
1,1,2-TRICHLOROETHANE	10	1.4	10	U	11	U	11	U	10	U	12	U
BENZENE	10	0.4	0.4	J	11	U	11	U	10	U	12	U
TRANS-1,3-DICHLOROPROPENE	10	0.8	10	U	11	U	11	U	10	U	12	U
BROMOFORM	10	1.6	10	U	11	U	11	U	10	U	12	U
4-METHYL-2-PENTANONE	10	4.8	10	U	11	U	11	U	1	J	12	U
2-HEXANONE	10	4.1	10	UJ(a)	11	U	11	U	10	U	12	U
TETRACHLOROETHENE	10	0.9	5	J(a)	3	J	11	U	2	J	1	J
1,1,2,2-TETRACHLOROETHANE	10	0.7	10	U	11	U	11	U	10	U	12	U
TOLUENE	10	2.7	10	U(b)	11	U	11	U	1	J	0.8	J
CHLOROBENZENE	10	1	10	UJ(a)	11	U	11	U	10	U	12	U
ETHYLBENZENE	10	0.7	2	J(a)	2	J	11	U	10	U	12	U
STYRENE	10	1.1	10	UJ(a)	11	U	11	U	10	U	12	U
XYLENE (TOTAL)	10	1.7	15	J(a)	9	J	11	U	11		1	J
% SOLIDS:			95		94		92.3		86.8		89.1	
DILUTION FACTOR:			1		1		1		1		1	

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:			GW01-1		GW01-1 D		GW02-1		GW-BG-1		SO-03-R		DC-01	
LABORATORY ID:			12748.02		12748.03		12748.04		12759.01		12760.71		12783.13	
ANALYTE	CRQL	MDL/IDL	FIELD DUPLICATE PAIR						BACKGROUND		RINSATE BLANK		RINSATE BLANK	
			[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]	
CHLOROMETHANE	10	2.1	10	U	10	U	10	U	10	U	10	U	10	U
BROMOMETHANE	10	3.1	10	U	10	U	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.3	10	U	10	U	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	1.8	10	U	10	U	10	U	10	U	10	U	10	U
ACETONE	10	7.1	10	U	10	U	10	U	10	U	76		20	
CARBON DISULFIDE	10	1.9	10	U	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	2.5	10	U	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE (TOTAL)	10	1.5	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROFORM	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U(b)
1,2-DICHLOROETHANE	10	1.6	10	U	10	U	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.9	10	U	10	U	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.8	10	U	10	U	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.3	10	U	10	U	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.1	10	U	10	U	10	U	10	U	10	U	3	J
1,2-DICHLOROPROPANE	10	1.2	10	U	10	U	10	U	10	U	10	U	10	U
CIS-1,3-DICHLOROPROPENE	10	2.3	10	U	10	U	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	1.3	10	U	10	U	10	U	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.2	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	1.8	10	U	10	U	10	U	10	U	10	U	10	U
BENZENE	10	2.3	10	U	10	U	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	1.7	10	U	10	U	10	U	10	U	10	U	10	U
BROMOFORM	10	6.2	10	U	10	U	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	4.9	10	U	10	U	10	U	10	U	10	U	10	U
2-HEXANONE	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	2.2	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	1.9	10	U	10	U	10	U	10	U	10	U	10	U
TOLUENE	10	2.3	10	U	10	U	10	U	10	U	1	J	10	U
CHLOROBENZENE	10	1.1	10	U	10	U	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	1	10	U	10	U	10	U	10	U	10	U	2	J
STYRENE	10	5.8	10	U	10	U	10	U	10	U	10	U	10	U
XYLENE (TOTAL)	10	1.5	10	U	10	U	10	U	10	U	10	U	1	J
DILUTION FACTOR:			1		1		1		1		1		1	

CTO #112: NSB NEW LONDON
TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:			TB-01		TB-02		TB-03		TB-04		GW-1F	
LABORATORY ID:			12748.01		12760.72		12759.05		12783.15		12748.09	
ANALYTE	CRQL	MDL/IDL	TRIP BLANK		TRIP BLANK		TRIP BLANK		TRIP BLANK		FIELD BLANK	
			[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]	
CHLOROMETHANE	10	2.1	10	U	10	U	10	U	10	U	10	U
BROMOMETHANE	10	3.1	10	U	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2	10	U	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.3	10	U	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	1.8	10	U	10	U	10	U	10	U	10	U
ACETONE	10	7.1	10	U	10	U	10	U	10	U	81	
CARBON DISULFIDE	10	1.9	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	2.5	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE (TOTAL)	10	1.5	10	U	10	U	10	U	10	U	10	U
CHLOROFORM	10	0.7	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.6	10	U	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.9	10	U	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.8	10	U	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.3	10	U	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.1	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	1.2	10	U	10	U	10	U	10	U	10	U
CIS-1,3-DICHLOROPROPENE	10	2.3	10	U	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	1.3	10	U	10	U	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.2	10	U	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	1.8	10	U	10	U	10	U	10	U	10	U
BENZENE	10	2.3	10	U	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	1.7	10	U	10	U	10	U	10	U	10	U
BROMOFORM	10	6.2	10	U	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	4.9	10	U	10	U	10	U	10	U	10	U
2-HEXANONE	10	0.7	10	U	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	2.2	10	U	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	1.9	10	U	10	U	10	U	10	U	10	U
TOLUENE	10	2.3	10	U	10	U	10	U	10	U	2	J
CHLOROBENZENE	10	1.1	10	U	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	1	10	U	10	U	10	U	10	U	1	J
STYRENE	10	5.8	10	U	10	U	10	U	10	U	10	U
XYLENE (TOTAL)	10	1.5	10	U	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1		1		1	

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED IS NOT VALIDATED.

CTO #112: NSB NEW LONDON
TCL AQUEOUS SEMIVOLATILES (ug/L)

CLIENT ID:			GW01-1		GW01-1 D		GW02-1		GW-BG-1		GW-1F		S0-03-R	
LABORATORY ID:			1274802		1274803		1274804		1275901		1274809		1276071	
ANALYTE	CRQL	MDL/IDL	FIELD DUPLICATE PAIR						BACKGROUND		FIELD BLANK		RINSATE BLANK	
			[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]	
PHENOL	10	1.2	10	U	10	U	10	U	10	U	10	U	8	J
BIS(2-CHLOROETHYL)ETHER	10	0.8	10	U	10	U	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	0.8	10	U	10	U	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	0.6	10	U	10	U	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U	1	J	10	U
BIS(2-CHLOROISOPROPYL)ETHER	10	0.9	10	U	10	U	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U	10	U	10	U
N-NITROSO-DI-N-PROPYLAMINE	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	0.8	10	U	10	U	10	U	10	U	10	U	10	U
NITROBENZENE	10	0.6	10	U	10	U	10	U	10	U	10	U	10	U
ISOPHORONE	10	0.5	10	U	10	U	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	0.5	10	U	10	U	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U	10	U	10	U
NAPHTHALENE	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY) METHANE	10	0.4	10	U	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	0.6	10	U	10	U	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	0.6	10	U	10	U	10	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	NA	10	U	10	U	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1.5	10	U	10	U	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	0.8	25	U	25	U	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
2-NITROANILINE	25	1	25	U	25	U	25	U	25	U	25	U	25	U
DIMETHYL PHTHALATE	10	0.5	10	U	10	U	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1.2	10	U	10	U	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1.3	10	U	10	U	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.4	25	U	25	U	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1.5	10	U	10	U	10	U	10	U	10	U	10	U
2,4-DINITROPHENOL	25	1.1	25	U	25	U	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.4	25	U	25	U	25	U	25	U	25	U	25	U
DIBENZOFURAN	10	1.3	10	U	10	U	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1.6	10	U	10	U	10	U	10	U	10	U	10	U
DIETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	2	J	3	J
4-CHLOROPHENYL-PHENYLETHER	10	1.1	10	U	10	U	10	U	10	U	10	U	10	U
FLUORENE	10	1.2	10	U	10	U	10	U	10	U	10	U	10	U
4-NITROANILINE	25	1.4	25	U	25	U	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.1	25	U	25	U	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMIN(1)	10	1.3	10	U	10	U	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYLETHER	10	1.8	10	U	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1.8	10	U	10	U	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	1.6	25	U	25	U	25	U	25	U	25	U	25	U
PHENANTHRENE	10	3.1	10	U	10	U	10	U	10	U	10	U	10	U
ANTHRACENE	10	2.1	10	U	10	U	10	U	10	U	10	U	10	U
CARBAZOLE	10	2.6	10	U	10	U	10	U	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	10	2.5	10	U	10	U	10	U	10	U	1	J	10	U
FLUORANTHENE	10	2.1	10	U	10	U	10	U	10	U	10	U	10	U
PYRENE	10	1.2	10	U	10	U	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1.5	10	U	10	U	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	0.7	10	U	10	U	10	U	10	U	10	U	10	U
BENZO(A)ANTHRACENE	10	1.4	10	U	10	U	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1.9	10	U(b)	10	U(b)	10	U(b)	10	U(b)	10	U(b)	10	U(b)
DI-N-OCTYL PHTHALATE	10	1.2	10	U	10	U	10	U	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	10	2.7	10	U	10	U	10	U	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	10	2.6	10	U	10	U	10	U	10	U	10	U	10	U
BENZO(A)PYRENE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
INDENO(1,2,3-CD)PYRENE	10	2	10	U	10	U	10	U	10	U	10	U	10	U
DIBENZ(A,H)ANTHRACENE	10	2.3	10	U	10	U	10	U	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE	10	2.1	10	U	10	U	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1		1		1		1	

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED IS NOT VALIDATED.

CTO #112: NSB NEW LONDON
TCL SOILS SEMIVOLATILES (ug/kg)

CLIENT ID:			SB02-4.0		SB02-4.0 D		SB14-2.0		SB18-4.0		SB22-6.0	
LABORATORY ID:			12760.06 RA		12760.07 RA		12760.49		12760.37		12760.29	
ANALYTE	CRQL	MDL/IDL										
			[VALIDATED]		[VALIDATED]							
PHENOL	330	36	350	U	350	U	360	U	340	U	380	U
BIS(2-CHLOROETHYL)ETHER	330	27	350	U	350	U	360	U	340	U	380	U
2-CHLOROPHENOL	330	37	47	J	350	U	360	U	340	U	380	U
1,3-DICHLOROBENZENE	330	40	350	U	350	U	360	U	340	U	380	U
1,4-DICHLOROBENZENE	330	43	350	U	350	U	360	U	340	U	380	U
1,2-DICHLOROBENZENE	330	47	350	U	350	U	360	U	340	U	380	U
2-METHYLPHENOL	330	47	350	U	350	U	360	U	340	U	380	U
BIS(2-CHLOROISOPROPYL)ETHER	330	27	350	U	350	U	360	U	340	U	380	U
4-METHYLPHENOL	330	53	350	U	350	U	360	U	340	U	380	U
N-NITROSO-DI-N-PROPYLAMINE	330	40	350	U	350	U	360	U	340	U	380	U
HEXACHLOROETHANE	330	33	350	U	350	U	360	U	340	U	380	U
NITROBENZENE	330	77	350	U	350	U	360	U	340	U	380	U
ISOPHORONE	330	40	350	U	350	U	360	U	340	U	380	U
2-NITROPHENOL	330	40	350	U	350	U	360	U	340	U	380	U
2,4-DIMETHYLPHENOL	330	47	350	U	350	U	360	U	340	U	380	U
2,4-DICHLOROPHENOL	330	57	350	U	350	U	360	U	340	U	380	U
1,2,4-TRICHLOROBENZENE	330	47	31	J	350	U	360	U	340	U	380	U
NAPHTHALENE	330	47	350	U	350	U	360	U	340	U	380	U
4-CHLOROANILINE	330	57	350	U	350	U	360	U	340	U	380	U
BIS(2-CHLOROETHOXY)METHANE	330	47	350	U	350	U	360	U	340	U	380	U
HEXACHLOROBUTADIENE	330	110	350	U	350	U	360	U	340	U	380	U
4-CHLORO-3-METHYLPHENOL	330	53	45	J	350	U	360	U	340	U	380	U
2-METHYLNAPHTHALENE	800	80	23	J(f)	42	J(f)	360	U	340	U	380	U
HEXACHLOROCYCLOPENTADIENE	330	73	350	U	350	U	360	U	340	U	380	U
2,4,6-TRICHLOROPHENOL	800	77	840	U	850	U	360	U	340	U	380	U
2,4,5-TRICHLOROPHENOL	330	83	350	U	350	U	880	U	830	U	930	U
2-CHLORONAPHTHALENE	330	70	350	U	350	U	360	U	340	U	380	U
2-NITROANILINE	330	60	350	U	350	U	880	U	830	U	930	U
DIMETHYL PHTHALATE	800	55	840	U	850	U	360	U	340	U	380	U
ACENAPHTHYLENE	330	97	350	U	22	J	360	U	340	U	380	U
2,6-DINITROTOLUENE	800	43	350	U	350	U	360	U	340	U	380	U
3-NITROANILINE	800	120	840	U	850	U	880	U	830	U	930	U
ACENAPHTHENE	330	73	54	J(f)	120	J(f)	360	U	340	U	380	U
2,4-DINITROPHENOL	800	57	840	U	850	U	880	U	830	U	930	U
4-NITROPHENOL	800	50	840	U	850	U	880	U	830	U	930	U
DIBENZOFURAN	330	40	19	J(f)	66	J(f)	360	U	340	U	38	J
2,4-DINITROTOLUENE	330	37	22	J	350	U	360	U	340	U	380	U
DIETHYLPHTHALATE	330	43	350	U	350	U	360	U	340	U	380	U
4-CHLOROPHENYL-PHENYLETHER	330	160	350	U	350	U	360	U	340	U	380	U
FLUORENE	330	53	26	J(f)	92	J(f)	360	U	340	U	380	U
4-NITROANILINE	800	57	840	U	850	U	880	U	830	U	930	U
4,6-DINITRO-2-METHYLPHENOL	800	93	840	U	850	U	880	U	830	U	930	U
N-NITROSODIPHENYLAMIN(1)	330	77	350	U	350	U	360	U	340	U	380	U
4-BROMOPHENYL-PHENYLETHER	330	73	350	U	350	U	360	U	340	U	380	U
HEXACHLOROBENZENE	330	47	350	U	350	U	360	U	340	U	380	U
PENTACHLOROPHENOL	800	80	60	J	850	U	880	U	830	U	930	U
PHENANTHRENE	330	73	410	J(f)	1000	J(f)	360	U	340	U	140	J
ANTHRACENE	330	80	100	J(f)	280	J(f)	360	U	340	U	34	J
CARBAZOLE	330	47	56	J(f)	160	J(f)	360	U	340	U	380	U
DI-N-BUTYLPHTHALATE	330	30	350	U	350	U	360	U	19	J	20	J
FLUORANTHENE	330	57	720	J(f)	1400	J(f)	360	U	340	U	89	J
PYRENE	330	47	700	J(f)	1500	J(f)	360	U	340	U	61	J
BUTYLBENZYLPHTHALATE	330	120	350	U	350	U	360	U	340	U	380	U
3,3'-DICHLOROBENZIDINE	330	150	350	U	350	U	360	U	340	U	380	U
BENZO(A)ANTHRACENE	330	77	260	J(f)	530	J(f)	360	U	340	U	21	J
CHRYSENE	330	57	330	J(f)	610	J(f)	360	U	340	U	26	J
BIS(2-ETHYLHEXYL)PHTHALATE	330	67	350	U(b)	350	U(b)	160	J	150	J	260	J
DI-N-OCTYL PHTHALATE	330	47	350	UJ(a)	350	UJ(a)	360	U	18	J	380	U
BENZO(B)FLUORANTHENE	330	97	360	J(a,f)	560	J(a,f)	360	U	340	U	380	U
BENZO(K)FLUORANTHENE	330	40	310	J(a,f)	510	J(a,f)	360	U	340	U	380	U
BENZO(A)PYRENE	330	47	250	J(a,f)	460	J(a,f)	360	U	340	U	380	U
INDENO(1,2,3-CD)PYRENE	330	33	160	J(a,f)	290	J(a,f)	360	U	340	U	380	U
DIBENZ(A,H)ANTHRACENE	330	50	58	J(a,f)	96	J(a,f)	360	U	340	U	380	U
BENZO(G,H,I)PERYLENE	330	43	88	J(a,f)	120	J(a,f)	360	U	340	U	380	U
% SOLIDS:			95		94		92.3		86.8		89.1	
DILUTION FACTOR:			1		1		1		1		1	

UNLESS OTHERWISE INDICATED. THE DATA AS PRESENTED ARE NOT VALIDATED.

CTO #112: NSB NEW LONDON
TCL SOIL PESTICIDES/PCBS (ug/kg)

CLIENT ID:			SB02-4.0		SB02-4.0 D		SB14-2.0		SB18-4.0		SB22-6.0	
LABORATORY ID:			1276006		1276007		1276049		1276037		1276029	
ANALYTE	CRQL	MDL/IDL										
			[VALIDATED]		[VALIDATED]							
ALPHA-BHC	1.7	0.06	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
BETA-BHC	1.7	0.12	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
DELTA-BHC	1.7	0.06	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
GAMMA-BHC (LINDANE)	1.7	0.06	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
HEPTACHLOR	1.7	0.06	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
ALDRIN	1.7	0.03	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
HEPTACHLOR EPOXIDE	1.7	0.03	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
ENDOSULFAN I	1.7	0.06	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
DIELDRIN	3.3	0.06	3.5	U	3.5	UJ(s)	3.6	U	75	D	3.8	U
4,4'-DDE	3.3	0.06	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
ENDRIN	3.3	0.15	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
ENDOSULFAN II	3.3	0.12	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
4,4'-DDD	3.3	0.09	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
ENDOSULFAN SULFATE	3.3	0.12	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
4,4'-DDT	3.3	0.12	6.21		4.6	J(s)	3.6	U	3.4	U	3.8	U
METHOXYCHLOR	17	0.57	18	U	18	UJ(s)	19	U	18	U	20	U
ENDRIN KETONE	3.3	0.09	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
ENDRIN ALDEHYDE	3.3	0.09	3.5	U	3.5	UJ(s)	3.6	U	3.4	U	3.8	U
ALPHA-CHLORDANE	1.7	0.06	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
GAMMA-CHLORDANE	1.7	0.09	1.8	U	1.8	UJ(s)	1.9	U	1.8	U	2	U
TOXAPHENE	170	0.9	180	U	180	UJ(s)	190	U	180	U	200	U
AROCLOR-1016	33	0.9	35	U	35	UJ(s)	36	U	34	U	38	U
AROCLOR-1221	67	0.12	71	U	71	UJ(s)	74	U	70	U	78	U
AROCLOR-1232	33	0.3	35	U	35	UJ(s)	36	U	34	U	38	U
AROCLOR-1242	33	0.3	35	U	35	UJ(s)	36	U	34	U	38	U
AROCLOR-1248	33	1.2	35	U	35	UJ(s)	36	U	34	U	38	U
AROCLOR-1254	33	1.5	35	U	35	UJ(s)	36	U	34	U	38	U
AROCLOR-1260	33	1.2	35	U	35	UJ(s)	36	U	34	U	38	U
% SOLIDS:			95.0		94.0		92.3		88.8		89.1	
DILUTION FACTOR:			1		1		1		1		1	

CTO #112: NSB NEW LONDON
TCL AQUEOUS PESTICIDES/PCBS (ug/L)

CLIENT ID:			GW01-1		GW01-1 D		GW02-1		GW-BG-1		GW-1F		S0-03-R	
LABORATORY ID:			1274802		1274803		1274804		1275901		1274809		1276071	
ANALYTE	CRQL	MDL/IDL	FIELD DUPLICATE PAIR						BACKGROUND		FIELD BLANK		RINSATE BLANK	
			[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]		[VALIDATED]	
ALPHA-BHC	0.05	0.002	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
BETA-BHC	0.05	0.004	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
DELTA-BHC	0.05	0.002	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
GAMMA-BHC (LINDANE)	0.05	0.002	0.05	U	0.05	U	0.05	U	0.05	UJ(m)	0.05	U	0.05	U
HEPTACHLOR	0.05	0.002	0.05	U	0.05	U	0.05	U	0.05	UJ(m)	0.05	U	0.05	U
ALDRIN	0.05	0.001	0.05	U	0.05	U	0.05	U	0.05	UJ(m)	0.05	U	0.05	U
HEPTACHLOR EPOXIDE	0.05	0.001	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
ENDOSULFAN I	0.05	0.002	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
DIELDRIN	0.1	0.002	0.1	U	0.1	U	0.1	U	0.1	UJ(m)	0.1	U	0.1	U
4,4'-DDE	0.1	0.002	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
ENDRIN	0.1	0.005	0.1	U	0.1	U	0.1	U	0.1	UJ(m)	0.1	U	0.1	U
ENDOSULFAN II	0.1	0.004	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4'-DDD	0.1	0.003	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
ENDOSULFAN SULFATE	0.1	0.004	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4'-DDT	0.1	0.004	0.1	U	0.1	U	0.1	U	0.1	UJ(m)	0.1	U	0.1	U
METHOXYCHLOR	0.5	0.019	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
ENDRIN KETONE	0.1	0.003	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
ENDRIN ALDEHYDE	0.1	0.003	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
ALPHA-CHLORDANE	0.05	0.002	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
GAMMA-CHLORDANE	0.05	0.003	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
TOXAPHENE	5	0.03	5	U	5	U	5	U	5	U	5	U	5	U
AROCLOR-1016	1	0.03	1	U	1	U	1	U	1	U	1	U	1	U
AROCLOR-1221	2	0.004	2	U	2	U	2	U	2	U	2	U	2	U
AROCLOR-1232	1	0.01	1	U	1	U	1	U	1	U	1	U	1	U
AROCLOR-1242	1	0.01	1	U	1	U	1	U	1	U	1	U	1	U
AROCLOR-1248	1	0.04	1	U	1	U	1	U	1	U	1	U	1	U
AROCLOR-1254	1	0.05	1	U	1	U	1	U	1	U	1	U	1	U
AROCLOR-1260	1	0.04	1	U	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR			1		1		1		1		1		1	

UNLESS OTHERWISE INDICATED, THE DATA AS PRESENTED ARE NOT VALIDATED.

APPENDIX B

RESPONSE ACTION ALTERNATIVES

TABLE OF CONTENTS

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FIGURES

NUMBER		PAGE

1.0 SITE CHARACTERIZATION

1.1 SITE CONDITIONS THAT JUSTIFY A REMOVAL ACTION

Conditions at the site meet the NCP Section 300.415(b)(2) criteria for a removal action. The following criteria are relevant to Building 31 at the SUBASE NLON:

- Actual or potential exposure to nearby human populations.
- Actual or potential contamination of drinking water supplies.
- High levels of hazardous substances in soils at or near the surface that may migrate.

As shown in Section 2.1.4 of the Action Memorandum, both the surface soil and subsurface soil are contaminated with high levels of lead that are classified as hazardous waste under RCRA 40 CFR Part 261.24 (materials that exhibit a TCLP lead concentration of 5.0 mg/L or greater are hazardous). The contaminated soil poses a risk to humans working in or adjacent to Building 31. The contaminated soil also poses a risk to the groundwater. The groundwater is currently contaminated with sporadic levels of antimony, beryllium, nickel and high levels of lead that exceed the Maximum Contaminant Levels (MCLs) as per the drinking water regulations.

2.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

2.1 STATUTORY LIMITS ON REMOVAL ACTIONS

Removal actions are generally limited by statute to a maximum cost of $2 million and a maximum duration of 12 months, except as provided for under two types of exemptions available ("emergency" and "consistency"). As described in this report, the proposed removal action is well within both of these limits.

2.2 REMOVAL ACTION SCOPE

The scope of this removal action is limited to the surface and subsurface soil located above the groundwater table (approximately 6 feet below the ground surface) at Building 31 and immediately adjacent to Building 31 (within 10 feet of the outside wall of the building). The groundwater contamination will not be addressed under the scope of this removal action, but will be covered as part of the Study Area Screening Evaluation (SASE) under the Federal Facilities Agreement. Generally, removal actions do not attempt to reduce contamination levels in the groundwater due to the time and cost constraints. Also, at this time, the extent of the groundwater plume is not defined horizontally or vertically.

As discussed in Section 3 of the Action Memorandum, routine exposure to the contaminated soil and to the contaminated groundwater present the greatest potential public health risks. To protect the public from these health risks, as well as to protect the environment, the following remedial action objectives were developed for Building 31:

- Prevent exposure (inhalation, ingestion, dermal contact) to contaminated soil having lead concentrations greater than 500 ppm.

- Prevent migration of contaminants that would result in additional groundwater contamination.

- The proposed action should not interfere with any future remedial actions at the site.

- The proposed action should not jeopardize or risk the structural integrity of Building 31 and adjacent buildings.

The U.S. EPA (in correspondence to the Navy, Dec. 23, 1993) has recommended a cleanup level of 500 parts per million (ppm) for lead in the soil. The cleanup level would reduce the potential for additional remedial actions at Building 31. Thus, any removal actions developed within this report use 500 ppm as the proposed cleanup level.

2.3 REMOVAL ACTION SCHEDULE

The U.S. Navy intends to address the contaminated soil at Building 31 as a "time-critical" removal action. Thus, the remediation must begin within 6 months of determining that the removal action is appropriate (date the Action Memorandum is approved as final by EPA). Major factors that will influence the schedule include:

- Completion of the design
- Procurement of a remediation contractor
- Approval of applicable treatment/disposal facilities
- Permitting requirements
- Weather during remediation

2.4 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

See Section 5.1.4 of Action Memorandum.

3.0 IDENTIFICATION OF RESPONSE ACTION ALTERNATIVES

This section identifies and describes the applicable alternatives for remediation of the lead contaminated soil in and around Building 31. Technologies for containment, treatment, and removal have been identified which are appropriate for the contaminants of concern. Included under these technologies are four alternatives which are: capping, containment, onsite solidification, and offsite solidification.

During the development of these alternatives, items were identified which are common to all four. The first of these is (prior to start of the work described for each alternative), that the remaining intact portions of the concrete floor and the existing rail line in Building 31 must be demolished and all demolition debris must be cleaned and hauled offsite for disposal.

The second assumption is that the existing floor drains in the building will not be replaced when removed in order to eliminate a potential pathway for the migration of contaminants.

Assumptions which were made during the development of the alternatives include:

- Remediation is limited to those areas where lead contamination exceeds 500 ppm.
- Any soil remediation outside of the building is limited to a width of 10 feet beyond the building.
- Soil contamination outside of the building, to the east and west, is limited to a depth of no more than 4 feet.
- No action will be taken for the soils west of Building 31 for Alternative 1 because the existing paving acts as a cap.
- Any floor drains, catch basins, and related piping which are encountered within Building 31 will either be removed or filled with grout.

3.1 ALTERNATIVE 1 - CONCRETE CAP

The purposes of concrete capping are to reduce the mobility of the contaminant through the reduction of infiltration, and the elimination of exposure to humans by direct contact with the contaminant through dermal contact or inhalation of particulates.

Capping would be accomplished through placement of a 4-inch layer of stone which will provide a firm base for the cap and will also provide a capillary break to help prevent water from reaching the underside of the cap. A 6-inch layer of reinforced concrete will then be placed using standard equipment and procedures.

No specialized equipment will be necessary for the performance of this alternative other than those normally associated with hazardous waste work (i.e., decontamination stations, personal protective equipment).

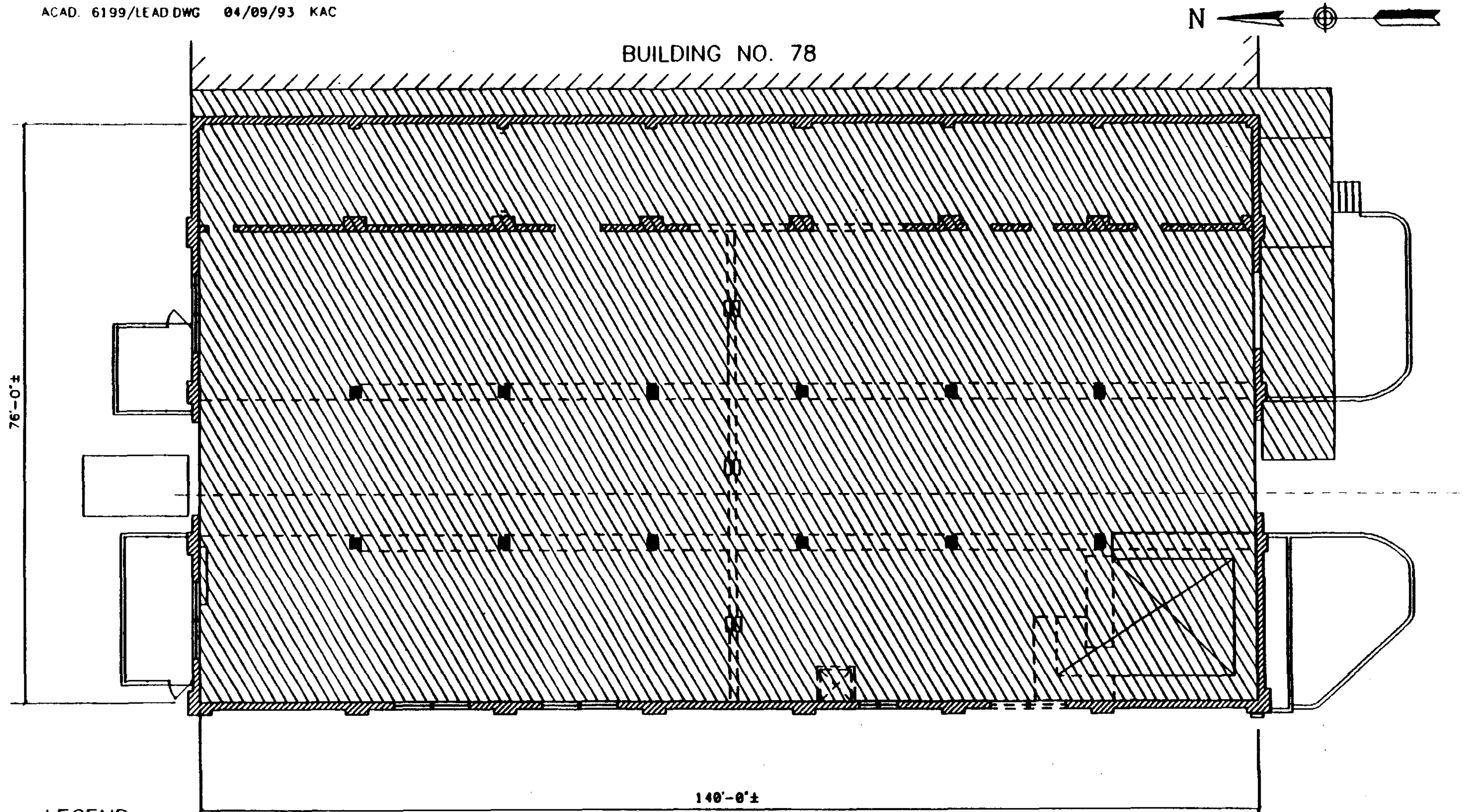
Under this alternative it has been assumed that no work will have to be performed outside of the west wall of Building 31 because of the paving which is currently in place. For the extent of the cap for Building 31 see Figure B-1.

3.2 ALTERNATIVE 2 - INSITU JET GROUTING AND OFFSITE SOLIDIFCATION

The purpose of insitu jet grouting is to reduce the mobility of the contaminant through containment by enclosing the contaminated soil in a box of grout/soil. This will prevent the migration of contaminants to groundwater, and eliminate exposure to humans by direct contact or inhalation of particulates. To provide future access to existing utilities, this alternative also includes (for select areas) excavating the contaminated soil (in excess of 500 ppm for lead), transporting the material off site to an approved facility for solidification, and disposing of the stabilized material at an offsite landfill. For the location of the utilities (those remaining in place and those relocated), see Figure B-3. For the location of the areas to be jet grouted or solidified offsite, see Figure B-2. For a more detailed description of the alternative encompassing excavation, offsite solidification, and offsite disposal, see Section 3.4 of the Response Action Alternatives.

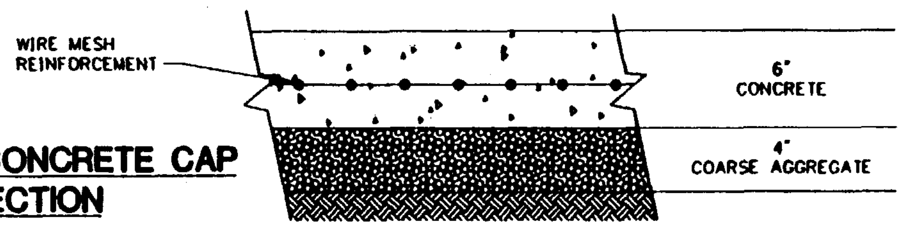
Insitu jet grouting as used in this application will provide an impermeable vault to contain the lead contaminated soil and prevent migration into the groundwater. Jet grouting is performed by drilling a 2-inch-diameter hole to the design depth using air or water. Next the bit is closed to flow, and the grout

ACAD. 6199/LEAD DWG 04/09/93 KAC



LEGEND

EXTENT OF CONCRETE CAP



TYPICAL CONCRETE CAP SECTION

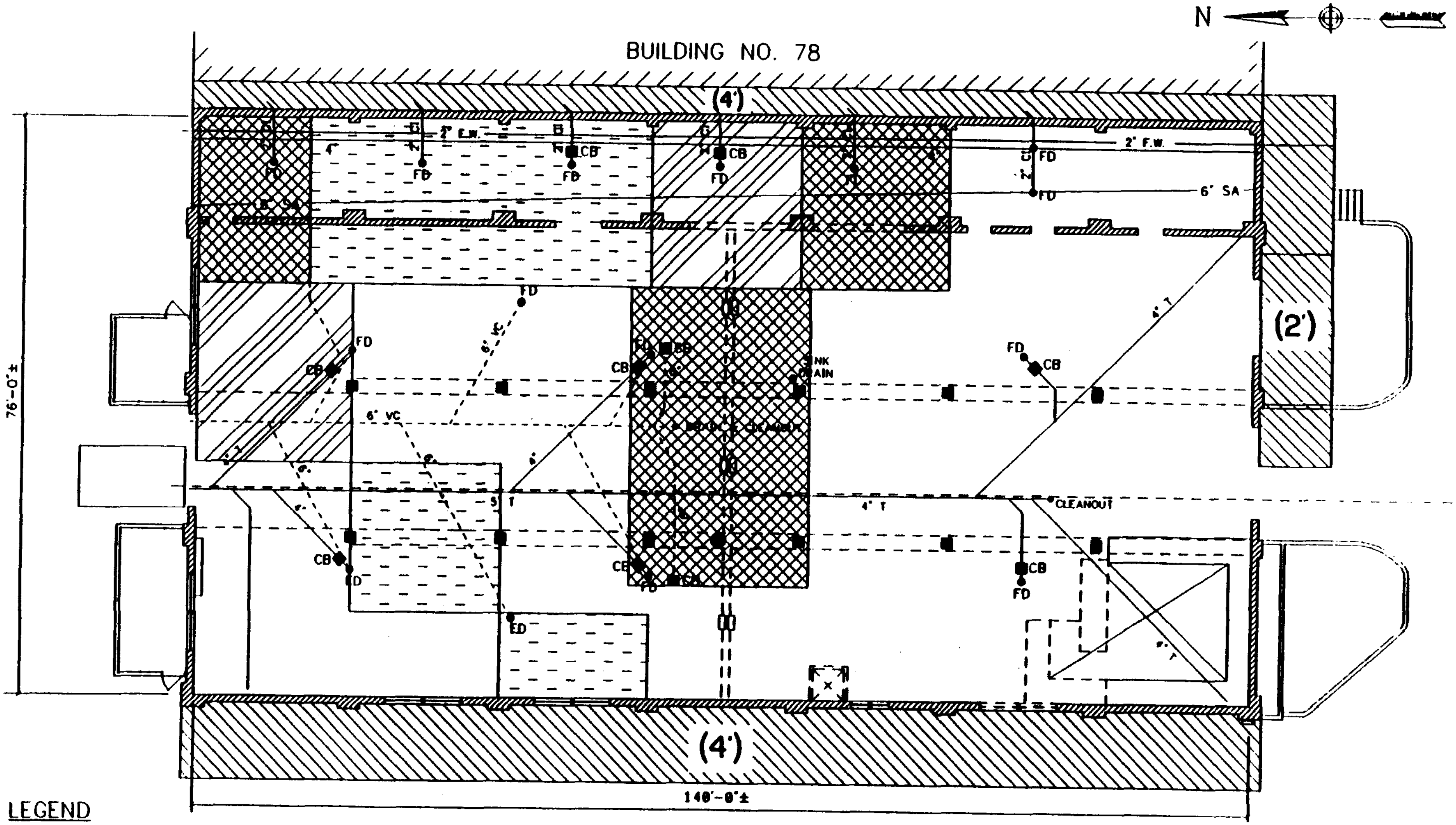
0 20 40
SCALE IN FEET

FIGURE B-1

ALTERNATIVE 1 - CONCRETE CAP
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

Halliburton NUS CORPORATION

ACAD. 6199/LEAD DWG 04/09/93 KAC



LEGEND

2 FEET DEPTH TO INSIDE OF VAULT

4 FEET DEPTH TO INSIDE OF VAULT

6 FEET DEPTH TO INSIDE OF VAULT

(4') REMOVAL DEPTH FOR OFFSITE TREATMENT

CI - CAST IRON PIPE
VC - VITRIFIED CLAY PIPE
T - TILE
SA - SANITARY

FW - FRESH WATER
CB - CATCH BASIN
FD - FLOOR DRAIN

NOTE:
ALL EXISTING UNDERGROUND PIPING WITHIN BUILDING 31 TO BE GROUTED FULL AND LEFT IN PLACE.

0 20 40
SCALE IN FEET

ALTERNATIVE 2 - CONTAINMENT, INSITU JET GROUTING, AND OFFSITE SOLIDIFICATION

BUILDING No. 31

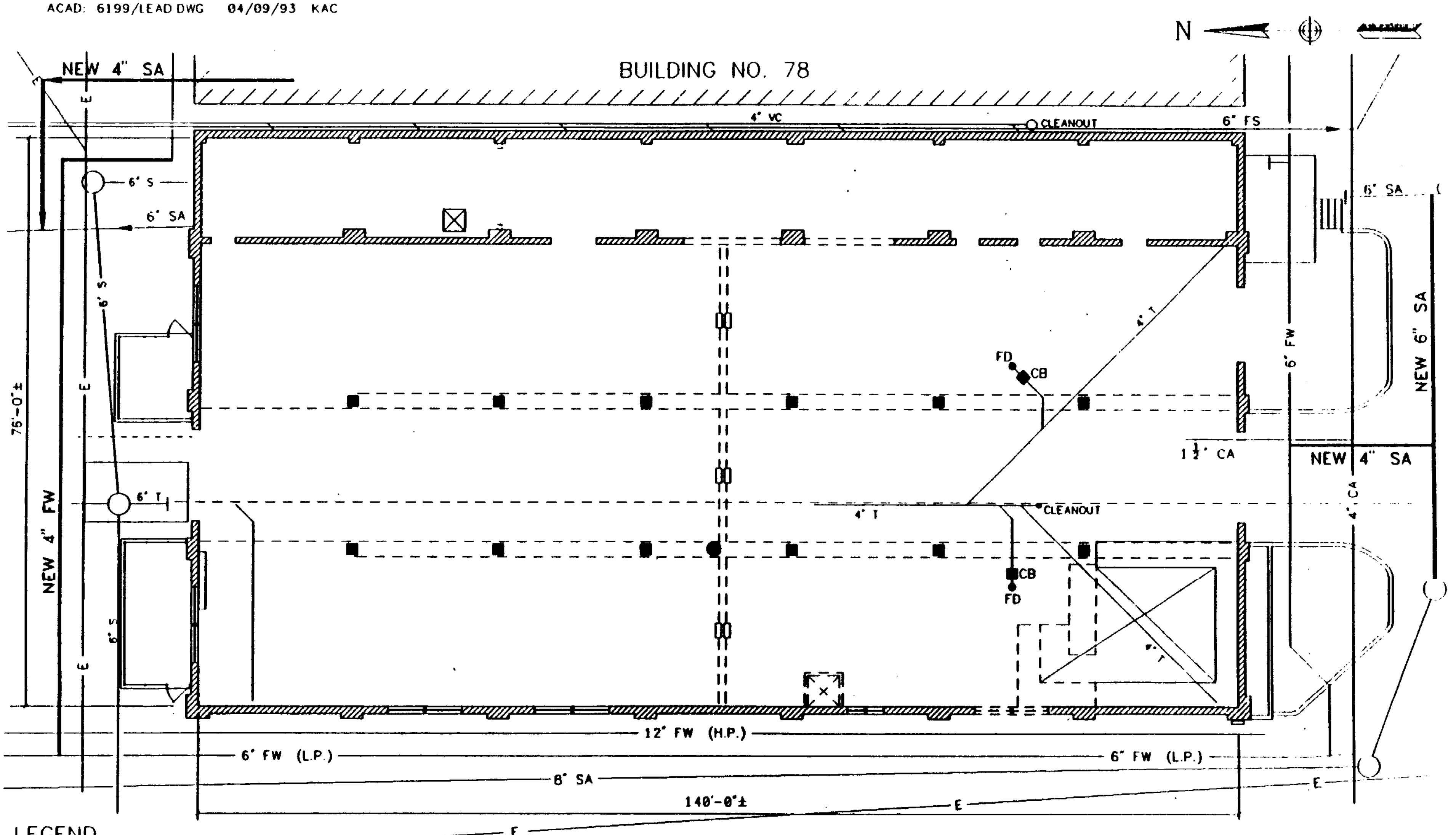
NAVAL SUBMARINE BASE - NEW LONDON

GROTON, CT.

FIGURE B-2

Halliburton NUS CORPORATION

ACAD: 6199/LEAD DWG 04/09/93 KAC



LEGEND

CI – CAST IRON PIPE
VC – VITRIFIED CLAY PIPE
T – TILE
HP – HIGH PRESSURE WATER

CA – COMPRESSED AIR
SA – SANITARY
FS – FORCED SANITARY
FW – FRESH WATER

CB – CATCH BASIN
FD – FLOOR DRAIN
S – STORM
E – ELECTRIC

NOTE:
LINES INSIDE OF BUILDING 31 TO BE GROUTED FULL DURING CONSTRUCTION

0 20 40
SCALE IN FEET

RELOCATION OF UTILITIES
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE B-3

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slurry is pumped out laterally through jets immediately above the bit using pressures between 4,000 and 6,000 psi. The drill pipe is then rotated continuously and withdrawn with the grout slurry exiting at high velocity. This shatters the soil and provides for uniform and intimate mixing of the grout and soil.

The floor of the vault will be constructed by drilling to below the depth of contamination and grouting in 24- to 48-inch-diameter sections which are 3 feet thick. The walls will be constructed by drilling down to the floor of the vault, outside the limits of contamination, and grouting in approximately 36-inch-diameter sections up to the surface. Each adjacent area will be overlapped, and the walls will be connected to the vault floor, so that an impermeable barrier is formed.

Following construction of the 3-foot-thick floor and walls of the vault, placement of a reinforced concrete cap will complete the encapsulation of the contaminated soil.

Implementation of this alternative will require disposal of waste soils and grout which are displaced during placement of the vault. This volume has been estimated as 70% of the original volume of soil which is solidified. However, since much of the grout will be placed outside the horizontal and vertical limits of contamination it is assumed that the waste soil/grout mix will pass the TCLP test for lead and may be disposed of in a demolition landfill.

Although this is a specialized technology, the drilling/grouting equipment is available and may be implemented through the use of standard drilling rigs, or in specialized cases with fork lifts or small front end loaders.

3.3 ALTERNATIVE 3 - EXCAVATION, ONSITE AND OFFSITE SOLIDIFICATION

The purpose of solidification is to immobilize the contaminants, minimize the potential for leaching, and/or detoxify the materials. This is achieved through a combination of chemical/physical reactions which binds the contamination into a soil/cement matrix which resists leaching. Prior to the start of work, a treatability study is necessary to determine the proper mix of reagents, to see if any additives are needed for the type of soil and contamination present, and to determine the volume increase after the soil is solidified. To provide future access to existing utilities that are remaining (utilities outside of Building 31), this alternative also includes (for select areas) excavating the contaminated soil (in excess of 500 ppm for lead), transporting the material off site to an approved facility for solidification, and disposing of the stabilized material at an offsite landfill. For the location of the utilities (those remaining in place and those relocated), see Figure B-3. For the location of the areas to be solidified on site or off site, see Figure B-4. For a more detailed description of the alternative encompassing excavation, offsite solidification, and offsite disposal, see Section 3.4 of the Response Action Alternatives.

This alternative would consist of either: (1) blending the cement mixture and soil in place or (2) by excavation of defined areas to remove all soils containing lead above the action level. Under the second method, the soil would then be mixed with cement/pozzolans either in the excavation or in a container. Following mixing the soil/cement mixture would be placed in discrete layers in the open excavation and the process will be moved to the next area. Only the second method will be considered for this alternative to permit the collection of verification samples (to meet the cleanup level of 500 ppm) and to permit the removal of utilities that require relocation.

During excavation, areas exist where the depth of excavation is expected to be deeper than the building foundation. Therefore, sheet piling or underpinning will be necessary to protect the structure from undermining of the footing. For the purpose of cost estimating, the use of sheet piling was assumed. All sheet piling will be remove during backfilling operations.

No specialized equipment will be necessary for the performance of this alternative other than those normally associated with hazardous waste work (i.e., decontamination stations, personal protective equipment.) A power blender could be utilized to aid the mixing of the soil and cement.

As previously mentioned prior to the start of work, a treatability study will be required (to be performed by the subcontractor) to determine the proper mix of reagents. During the actual remediation, the solidified material will be tested to verify that the treatment standards for the contamination are being met. Following receipt of the analyses if the material passes the treatment standards, it may be placed into the excavation. Otherwise it must be crushed and retreated until it passes the treatment standards.

Depending on the actual solidification process used, solidification may produce a solid block of waste material with high structural integrity (referred to as a monolith) or it may produce a soil-like product by "microencapsulating" the waste particles. The contaminants do not necessarily interact chemically with the solidification reagents (typically cement/lime) but are primarily mechanically locked within the solidified matrix. In many cases, a monolith is not the end product of the solidification process; however, after placement, the materials may continue to cure into a facsimile of a monolith. Most solidification processes employed are proprietary systems which involve the addition of absorbents and solidifying agents to a

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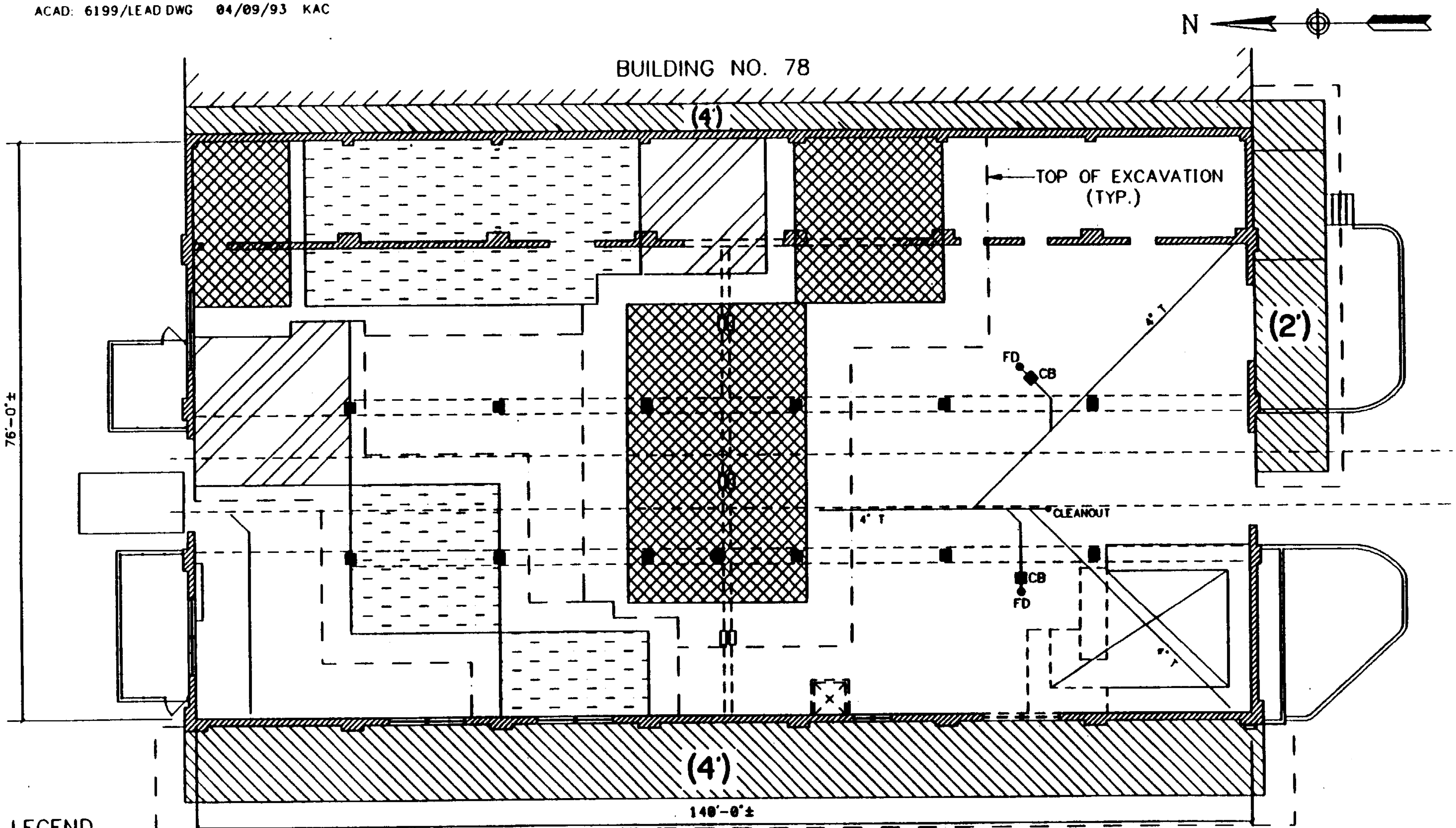

LEGEND

2 FEET DEPTH OF EXCAVATION

4 FEET DEPTH OF EXCAVATION

6 FEET DEPTH OF EXCAVATION

(4') REMOVAL DEPTH FOR OFFSITE TREATMENT

NOTE:
ALL EXISTING UNDERGROUND PIPING WITHIN BUILDING 31 (OUTSIDE OF REMEDIATION AREAS) TO BE GROUTED FULL AND LEFT IN PLACE.

0 20 40
SCALE IN FEET

ALTERNATIVE 3 - ONSITE & OFFSITE SOLIDIFICATION
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE B-

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waste. The type of solidification systems that will be considered for the remediation of Building 31 include cement/pozzolan-based processes. Cement/pozzolan-based processes use Portland cement and/or other pozzolanic materials, such as fly ash, kiln dust, and soluble silicates, to produced a solidified and/or stabilized product.

3.4 ALTERNATIVE 4 - EXCAVATION, OFFSITE SOLIDIFICATION, AND OFFSITE DISPOSAL

The purpose of solidification is to immobilize the contaminants, minimize the potential for leaching, and/or detoxify the materials. Offsite treatment and disposal will eliminate all hazards associated with migration and contact at the site. The Land Disposal Restrictions (LDRs) require the treatment of all lead contaminated soils having TCLP values equal to or greater than 5 mg/L. For the extent of soil to be excavated and hauled off site (see Figure B-5).

This alternative will consist of excavation of defined areas of lead contamination (greater than 500 ppm) and hauling off site to a treatment/disposal facility where solidification will be performed. Following excavation clean fill will be placed and compacted to original subgrade.

No specialized equipment will be necessary for the performance of this alternative other than those normally associated with hazardous waste work (i.e., decontamination stations, personal protective equipment.) Treatment facilities exist which could accept the waste for treatment (solidification) and landfill disposal.

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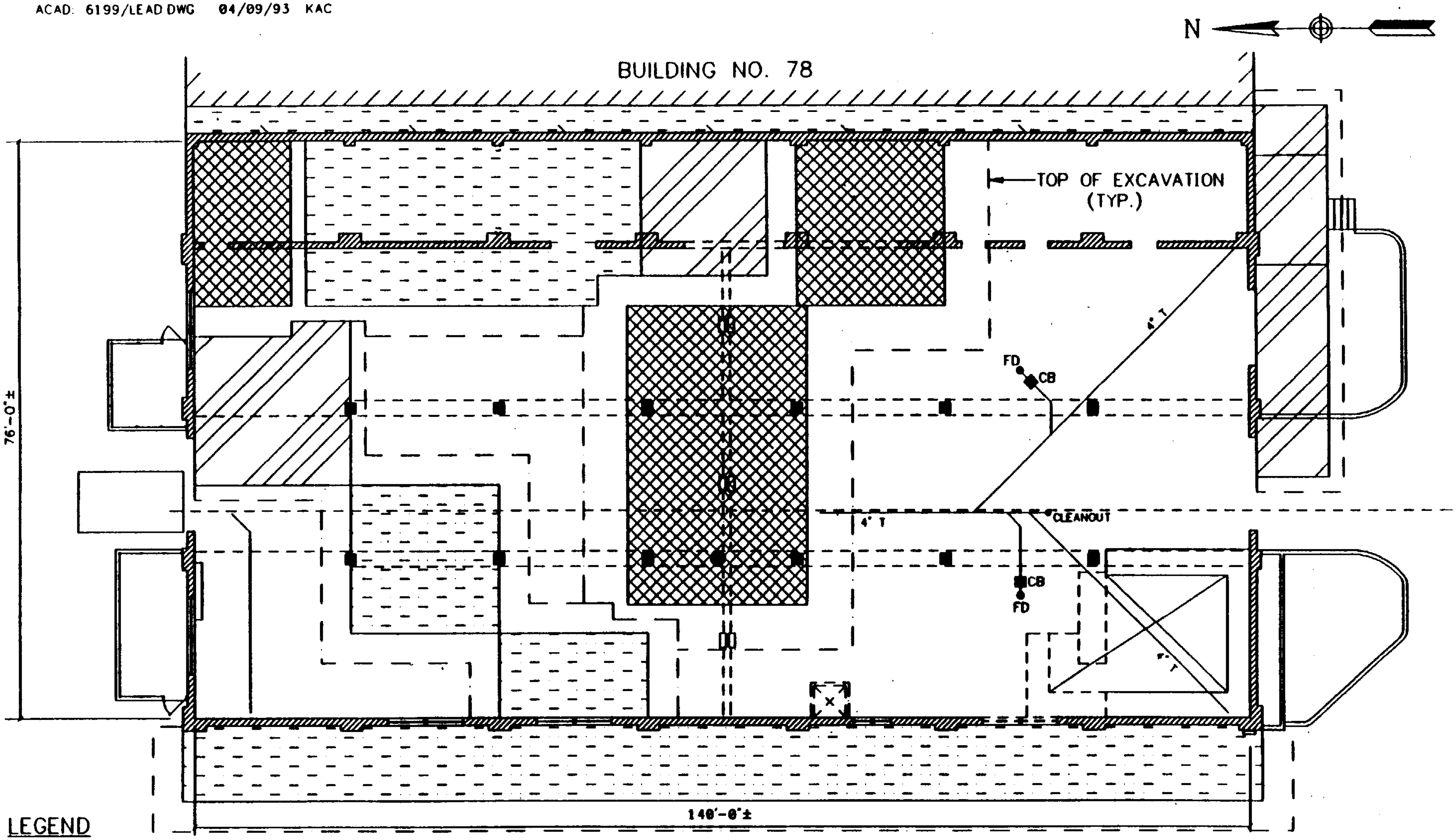

LEGEND

2 FEET DEPTH OF EXCAVATION

4 FEET DEPTH OF EXCAVATION

6 FEET DEPTH OF EXCAVATION

NOTE:
ALL EXISTING UNDERGROUND PIPING WITHIN BUILDING 31 (OUTSIDE OF REMEDIATION AREA) TO BE GROUTED FULL AND LEFT IN PLACE.

0 20 40

SCALE IN FEET

ALTERNATIVE 4 - EXCAVATION/OFFSITE SOLIDIFICATION

BUILDING No. 31

NAVAL SUBMARINE BASE - NEW LONDON

GROTON, CT.

FIGURE B-5

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4.0 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Analysis of the four removal action alternatives with regard to effectiveness, implementability, and cost are presented in this section of the report.

- Effectiveness is the ability of the alternative to reduce the risks of the site and includes:
  - **Protectiveness.** Protectiveness includes protecting the community and workers during the removal action, threat reduction and potential exposure to remaining risks, time until protection is achieved, compliance with ARARs and other criteria, environmental impacts (overall protection of human health and the environment), and long-term reliability for providing continued protection.
- Implementability is the ability of the alternative to be carried out at the site and includes:
  - **Technical Feasibility.** The ability to physically implement the alternative as designed and in a manner that complies with the removal action objectives.
  - **Availability.** The availability of equipment, material, personnel, and facilities to implement the alternative, and provide any necessary post-removal site control.
- Costs. Only construction costs associated with the alternatives have been included. No future sampling, monitoring, or engineering costs have been included. Appendix C contains calculations and cost estimates for the alternatives.

  Costs which are common to all of the alternatives include:

  - Dismantling, cleaning, disposal, and replacement of the existing concrete floor
  - Health and safety
  - Environmental air sampling
  - Provision of decontamination facilities and decontamination services

4.1 ALTERNATIVE 1 - CONCRETE CAP

Effectiveness: Under this alternative no removal of contaminants would occur, but placement of the cap would reduce migration due to infiltration and will eliminate the risk associated with direct contact and inhalation by humans. A concrete cap would provide long-term reliability for providing continued protection against direct contact by humans. This alternative would not meet the ATSDR cleanup level for lead in soil of 500 to 1,000 mg/kg, which is a To Be Considered (TBC), commonly applied by U.S. EPA at CERCLA sites. Nor would this alternative prevent the possible migration of the lead contamination by the fluctuation of the groundwater and tidal flow under the cap. The groundwater currently exceeds the MCLs for lead and several other inorganics at Building 31. Protection from this alternative would be achieved within 1 month following start of construction.

During placement of the cap, some fugitive emissions may be generated, but these could be easily controlled by implementing standard dust control measures, such as keeping the soil moist.

Implementability: This alternative is technically feasible and can be readily implemented. The equipment necessary for performance of this work would be standard equipment normally available at construction companies.

Following completion of the concrete cap, long-term monitoring of cap integrity and the groundwater would be necessary. Institutional controls, such as land use or deed restrictions, would be required to prevent interference with cap integrity.

Cost: The estimated construction cost for this alternative is $436,453. The estimated amount of concrete needed is 229 cubic yards.

4.2 ALTERNATIVE 2 - CONTAINMENT/INSITU JET GROUTING AND OFFSITE SOLIDIFICATION

Effectiveness: Under this alternative removal of contaminants would not occur, except at those select areas where existing utilities are to remain. Construction of the containment vault would prevent migration and eliminate the risk associated with contact with contaminated soils by humans. This alternative would prevent migration of the contaminated soil from both infiltration and fluctuation of the groundwater under the cap. The alternative would also be protective of the environment, but it would not meet the TBC for the removal of lead from soil in concentrations greater than 500 to 1,000 mg/kg (except at those select locations where existing utilities are to remain). Protection from this alternative would be achieved within 2 months following start of construction.

During construction of the containment vault, some fugitive emissions would be generated, but these could be easily controlled by implementing standard control measures.

Implementability: This alternative is technically feasible and can be implemented. The equipment necessary for performance of this work would be standard except for the jet grouting drill bit. The drilling bit is available and could be procured. Implementation of this alternative will require disposal of waste soils and grout which are displaced during construction.

While equipment is available which will work in close quarters, construction of the vault will require more caution due to the number of footings, piles, and underground utilities which will be encountered.

Following completion of the containment system, long-term monitoring of the cap and groundwater would be necessary. Institutional controls, such as land use or deed restrictions, would be required to protect the integrity of the containment vault.

Cost: The estimated construction cost for this alternative is $1,251,576. The estimated amount soil which must be grouted to construct the vault is 798 yds^3, the estimated amount of waste generated by the grouting process is 560 yds^3 and the estimated amount of soil to be treated off site is 460 yds^3.

4.3 ALTERNATIVE 3 - EXCAVATION, ONSITE AND OFFSITE SOLIDIFICATION

Effectiveness: Under this alternative no removal of contaminants would occur, except at those selected areas where existing utilities are to remain. Solidification of the contaminated soils would reduce migration and reduce the risk associated with direct contact by humans because the contamination would be bound in the soil/cement matrix. This alternative would prevent migration of the contaminated soil from both infiltration and fluctuation of the groundwater under the cap. The alternative would prevent human contact with the contaminants and be protective of the environment, but it would not meet the TBC for the removal of lead from soil in concentrations greater than 500 to 1,000 mg/kg, except at those select locations where existing utilities are to remain. Protection from this alternative would be achieved within 3 months following start of construction.

During solidification of the lead contaminated soil, fugitive emissions may be generated, but these could be controlled by implementing standard construction control measures.

Implementability: This alternative is implementable. It will require mobilization of mixing equipment which is not unusual and can be obtained by local construction companies. It will require a staging area where material can be stockpiled prior to mixing and backfilling in the open excavation. It will also require underpinning or shoring to protect the integrity of the building at those areas where the depth of remediation is deeper than building footings.

While equipment is available which will work in close quarters, stabilization would require more caution due to the number of footings, piles, and underground utilities which will be encountered.

Following completion of the onsite solidification, long-term monitoring of the groundwater would be necessary. Institutional controls, such as land use or deed restrictions, would be required to protect the integrity of the stabilized soil.

Cost: The estimated construction cost for this alternative is $1,011,172. The estimated amount soil which must be solidified on site is 974 yds^3 and the estimated amount of soil which must be solidified off site is 460 yds^3.

4.4 ALTERNATIVE 4 - EXCAVATION, OFFSITE SOLIDIFICATION AND OFFSITE DISPOSAL

Effectiveness: This alternative would be effective in completely removing the lead-contaminated soils (greater than 500 ppm) from in and around Building 31. Once excavation is complete, risks associated with migration and direct contact would be minimal. Because of the groundwater fluctuation (due to the tidal influence of the Thames River), it is possible that the rising groundwater could recontaminate the clean soil placed as backfill. This alternative would comply with the TBC for the removal of lead from soil in concentrations greater than 500 to 1,000 mg/kg. This alternative would prevent the migration of additional contamination to the groundwater. Protection from this alternative would be achieved within 3 months following start of construction.

During excavation of the lead-contaminated soil, fugitive emissions may be generated, but these could be controlled through standard construction dust control measures.

Implementability: This alternative is readily implementable. The wastes generated from the excavation of the contaminated soils would be transported offsite to a treatment/disposal facility.

While equipment is available which will work in close quarters, excavation will require more caution due to the number of footings and underground utilities which will be encountered. Also, due to the depth of excavation near some of the foundations sheet piling or underpinning will be necessary to protect the structural integrity of the building.

Following completion of the excavation and offsite solidification, long-term monitoring and institutional controls would not be necessary since the contaminated soil had been removed.

Cost: The estimated construction cost for this alternative is $1,983,302. The estimated amount soil which must be transported to the disposal facility is 1,434 yds^3.

5.0 COMPARATIVE ANALYSIS

Table 5-1 compares the effectiveness, implementability, and cost of the four alternatives which are presented below:

- **Alternative 1, Concrete Capping**, while readily available and implementable, does not provide an acceptable long-term threat reduction for migration of the contaminants to the groundwater since the groundwater table can contact contaminated soil underneath the cap. This alternative is the least expensive of the alternatives.

- **Alternative 2, Containment/Insitu Jet Grouting and Offsite Solidification**, provides the next level of assurance against migration and elimination of the threat of human contact. However, due to the tidal nature of the area to be remediated, migration of the contamination may occur in the future if the containment vault is breached.

- **Alternative 3, Excavation, Onsite and Offsite Solidification**, is effective at eliminating the risk involved with direct contact by humans. In addition, the risk of migration of the contamination is potentially eliminated through the chemical/physical binding of the contamination in the soil/cement matrix. This alternative is more costly than Alternative 1, but is less expensive than Alternatives 2 and 4, and is cost effective for the additional protection it provides to the groundwater.

- **Alternative 4, Excavation, Offsite Solidification, and Offsite Disposal**, is the most effective at eliminating the risks involved with direct contact by humans and migration of the contamination. However, because of the groundwater fluctuation (due to the tidal influence of the Thames River), it is possible that the rising groundwater could recontaminate the clean soils used for backfill. This alternative is the most expensive of the alternatives.

TABLE 5-1

COMPARISON OF ALTERNATIVES - BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Alternative	Effectiveness	Implementability	Cost
Alternative 1: Concrete Cap	• Protection: Workers may be exposed to minimal amounts of dust emissions during construction. Long-term reliability is very high due to the amount of construction experience with concrete slabs. • Threat Reduction: The threat of human contact will be eliminated while the cap is in place. The threat of migration due to infiltration will be reduced. The threat of migration by tidal action will remain because the contamination will not be removed. • ARARs: Does not meet the ATDSR cleanup levels for lead. Land Disposal Restrictions do not apply because material is not removed from the ground (i.e., no placement is occurring). Further degradation of the groundwater, which is regulated under the SDWA, may occur. • Time: Protection will be achieve within 1 month of the start of construction.	• Feasibility: Readily implementable and technically feasible utilizing standard construction equipment. • Availability: All equipment and personnel necessary should be available locally due to the standard nature of the work. • Controls: Institutional controls such as land use or deed restrictions, along with long-term groundwater and cap monitoring will be necessary.	$436,453

TABLE 5-1
COMPARISON OF ALTERNATIVES - BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE TWO

Alternative	Effectiveness	Implementability	Cost
Alternative 2: Containment/Insitu Jet Grouting and Offsite Solidification	• Protection: Workers will be exposed to minimal amounts of dust emissions during construction. Long-term reliability is uncertain due to the limited amount of experience with this technique. • Threat Reduction: The threat of human contact will be eliminated. The threat of migration due to infiltration will be reduced. The threat of migration by tidal action will be eliminated while the containment is intact (the vault integrity is not breached). However, the contamination will remain. • ARARs: Does not meet the ATDSR cleanup level for lead. Land Disposal Restrictions would apply to the significant volumes of waste soil displaced by this technology. No further degradation of the groundwater will occur. • Time: Protection will be achieve within 2 months of the start of construction.	• Feasibility: Readily implementable and technically feasible utilizing standard construction equipment. The grouting bit may be used with standard equipment, but may not be available locally. • Availability: Most equipment and personnel necessary should be available locally . • Controls: Institutional controls such as land use or deed restrictions, along with long-term groundwater monitoring will be necessary.	$1,251,576

TABLE 5-1
COMPARISON OF ALTERNATIVES - BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE THREE

Alternative	Effectiveness	Implementability	Cost
Alternative 3: Excavation, Onsite and Offsite Solidification	• Protection: Workers may be exposed to dust emissions during construction which will have to be controlled. Long-term reliability is expected to be good based on the limited amount of information and relatively recent use of the technique under controlled conditions. • Threat Reduction: The threat of human contact will be eliminated. The threat of migration due to infiltration will be reduced. The threat of migration by tidal action will be reduced. • ARARs: Does not meet the ATDSR cleanup level for lead. Restrictions for Land Disposal Restrictions are satisfied because the material is rendered nonhazardous prior to backfilling. No further degradation of the groundwater should occur. • Time: Protection will be achieve within 3 months of the start of construction.	• Feasibility: Readily implementable and technically feasible utilizing standard construction equipment. • Availability: Most equipment and personnel necessary should be available locally . • Controls: Institutional controls such as land use or deed restrictions, along with groundwater monitoring will be necessary.	$1,011,172

TABLE 5-1
COMPARISON OF ALTERNATIVES - BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE FOUR

Alternative	Effectiveness	Implementability	Cost
Alternative 4: Excavation, Offsite Stabilization, Offsite Disposal	• Protection: Workers may be exposed to dust emissions during construction which will have to be controlled. Long-term reliability is very high since contamination is removed from the site. • Threat Reduction: The threat of human contact will be eliminated. The threat of migration due to infiltration will be eliminated. The threat of migration by tidal action will be reduced. Because of the tidal fluctuations, it is possible that the rising groundwater could recontaminate the clean soil used for backfill. • ARARs: Meets the ATDSR cleanup level for lead. Restrictions for the Land Disposal Restrictions are satisfied because the material is removed from the site for treatment and disposal. No further degradation of the groundwater will occur. • Time: Protection will be achieve within 3 months of the start of construction.	• Feasibility: Readily implementable and technically feasible utilizing standard construction equipment. • Availability: Equipment and personnel necessary should be available locally. • Controls: No institutional controls such as land use or deed restrictions, will be necessary due to the removal of the contamination.	$1,983,302

5.1 RECOMMENDED ALTERNATIVE

Based on the comparison of alternatives, the recommended alternative is Alternative 3: Excavation, Onsite and Offsite Solidification. This alternative provides the best balance (with respect to the evaluation criteria) among the four alternatives considered for this Action Memorandum. See Section 5.0 (Proposed Actions and Estimated Costs) of the Action Memorandum for additional information on this alternative.

APPENDIX C

CALCULATIONS AND COST ESTIMATES

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Concrete Cap
Alternative 1
Sheet 1 of 2
(NSBN1121)
3/31/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer	.75	MO	500.00				375				375	
2) Construction Survey		LS	5000.00				5000				5000	
3) Portable Communication Equipment	2	SETS	1500.00				3000				3000	
4) Equipment Mobilization/Demobilization		LS	10000.00				10000				10000	
5) Site Utilities	.75	MO	4000.00				3000				3000	
6) Decontamination Trailer	.75	MO	1500.00				1125				1125	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	3	WKS	250.00				750				750	
2) Truck Decon Area		LS		2000.00	500.00	500.00		2000	500	500	3000	
3) Decontamination Services	.75	MO	1200.00				900				900	
4) Decon Water	25000	GAL	.20				5000				5000	
5) Personnel Decon Pad		LS		1000.00	100.00	100.00		1000	100	100	1200	
6) Clean Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
7) Spent Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
DISMANTLING												
1) Floor Foundation Removal	56	CY			7.84	10.80			439	605	1044	
2) Floor Foundation Demolition - 6"	6006	SF			6.48	1.17			38919	7027	45946	
3) Railroad Track Removal	286	LF			16.60	3.60			4748	1030	5777	
DEBRIS DECONTAMINATION/DISPOSAL												
1) Concrete Debris Decontamination		LS			2500.00	1500.00			2500	1500	4000	
2) Concrete Debris Loading	207	CY			.92	1.30			190	269	460	
3) Concrete Debris Hauling	650	MI	5.00				3250				3250	13 Tr. @ 50 mi.
4) Concrete Debris Disposal	207	CY	50.00				10350				10350	Local Landfill
CONCRETE CAP												
1) Grading	1372	SY			1.34	2.10			1838	2881	4720	
2) Proofrolling	1372	SY			.68	1.22			933	1674	2607	
3) Aggregate - 4"	1372	SY		2.90	.42	.54		3979	576	741	5296	Place & Compact
4) Concrete Cap - 6"	229	CY		70.00	125.00	5.00		16030	28625	1145	45800	
5) Grouting Pipes	560	LF	1.50				840				840	
SITE RESTORATION												
1) Curbing	50	LF		3.00	3.06	.10		150	153	5	308	Concrete
2) Topsoil - 6"	10	CY		12.00	5.40	14.86		120	54	149	323	
a) Place & Spread	10	CY			1.26	1.14			13	11	24	
3) Revegetation	.5	MSF		75.00	24.00	20.00		38	12	10	60	
AIR MONITORING												
1) Air Monitoring												
a) Sampling Equipment - Pumps	2	KITS	4100.00				8200				8200	
b) Sampling Equipment - Calibrator	1		1100.00				1100				1100	
c) Sample Analysis	30		30.00				900				900	2 samples/Day
d) Sample Shipping	30		40.00				1200				1200	
							54990	25316	79800	17646	177753	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Concrete Cap
Alternative 1
Sheet 2 of 2
(NSBN1121)
3/31/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							54990	25316	79800	17646	177753	
Burden @ 30% of Labor Cost									23940		23940	
Labor @ 15% of Labor Cost									11970		11970	
Material @ 10% of Material Cost								2532			2532	
SubContract @ 10% of Sub. Cost							5499				5499	
Total Direct Cost							60489	27848	115710	17646	221694	
Indirects @ 75% of Total Direct Labor Cost									86783		86783	
Profit @ 10% of Total Direct Cost											22169	
											330646	
Health & Safety Monitoring @ 10%											33065	
Total Field Cost											363710	
Contingency @ 20% of Total Field Cost											72742	
TOTAL COST THIS PAGE											436453	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Containment, Insitu Jet Grouting & Offsite Solidification
Alternative 2
Sheet 1 of 2
(NSB1122a)
4/5/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer	1.5	MO	500.00				750				750	
2) Construction Survey		LS	5000.00				5000				5000	
3) Portable Communication Equipment	2	SETS	1500.00				3000				3000	
4) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
5) Site Utilities	1.5	MO	4000.00				6000				6000	
6) Decontamination Trailer	1.5	MO	1500.00				2250				2250	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	6	WKS	250.00				1500				1500	
2) Truck Decon Pad		LS		2000.00	500.00	500.00		2000	500	500	3000	
3) Decontamination Services	1.5	MO	1200.00				1800				1800	
4) Decon Water	35000	GAL	.20				7000				7000	
5) Personnel Decon Pad		LS		1000.00	100.00	100.00		1000	100	100	1200	
6) Clean Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
7) Spent Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
DISMANTLING												
1) Floor Foundation Removal	56	CY			7.84	10.80			439	605	1044	
2) Floor Foundation Demolition - 6"	6006	SF			6.48	1.17			38919	7027	45946	
3) Railroad Track Removal	286	LF			16.60	3.60			4748	1030	5777	
DEBRIS DECONTAMINATION/DISPOSAL												
1) Concrete Debris Decontamination		LS			2500.00	1500.00			2500	1500	4000	
2) Concrete Debris Loading	207	CY			.92	1.30			190	269	460	
3) Concrete Debris Hauling	650	MI	5.00				3250				3250	13 Tr. @ 50 mi.
4) Concrete Debris Disposal	207	CY	50.00				10350				10350	Local Landfill
OFFSITE SOLIDIFICATION/DISPOSAL												
1) Utility Piping Temporary Support		LS			7000.00	7000.00			7000	7000	14000	
2) Excavate Contaminated Soil	460	CY			8.00	11.00			3680	5060	8740	
3) Hauling Contaminated Soil	1400	MI	5.00				7000				7000	28 Tr. @ 50 mi.
4) Solidification/Landfill Disposal	687	TON	425.00				291975				291975	
5) Clean Backfill	460	CY		4.00	2.70	7.43		1840	1242	3418	6500	
a) Place, Spread & Compact	460	CY			.84	2.67			386	1228	1615	
CONTAINMENT/JET GROUTING												
1) Containment/Jet Grouting	798	CY	100.00				79800				79800	
2) Generated Waste												
a) Hauling	1300	MI	5.00				6500				6500	26 Tr. @ 50 mi.
b) Disposal	559	TON	50.00				27950				27950	Local Landfill
UTILITY RELOCATION												
1) Removal Existing Water Line - 4"	145	LF			3.00				435		435	
2) Relocated Water Line - 4"	90	LF		7.35	3.41			662	307		968	
3) Pipe Hot Tap	2			300.00	500.00			600	1000		1600	
4) Relocated Sanitary Sewer												
a) 4"	90	LF		4.95	8.65			446	779		1224	
b) 6"	60	LF		8.15	10.05			489	603		1092	
c) Manhole	3			920.00	845.00			2760	2535		5295	
d) Excavation, Backfill, Compaction	150	LF			.75	6.40			113	960	1073	
e) Pipe Bedding	150	LF		1.12	1.55			168	233		401	
CONCRETE FLOOR												
1) Grading	1372	SY			1.34	2.10			1838	2881	4720	
2) Proofrolling	1372	SY			.68	1.22			933	1674	2607	
3) Aggregate - 4"	1372	SY		2.90	.42	.54		3979	576	741	5296	Place & Compact
4) Concrete Cap - 6"	229	CY		70.00	125.00	5.00		16030	28625	1145	45800	
5) Grouting Pipes	560	LF	1.50				840				840	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Containment, Insitu Jet Grouting & Offsite Solidification
Alternative 2

(NSB1122a)
4/5/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE RESTORATION												
1) Curbing	50	LF		3.00	3.06	.10		150	153	5	308	Concrete
2) Topsoil - 6"	10	CY		12.00	5.40	14.86			54	149	203	
a) Place & Spread	10	CY			1.26	1.14			13	11	24	
3) Revegetation	.5	MSF		75.00	24.00	20.00		38	12	10	60	
4) Paving	3100	SF	2.70				8370				8370	
AIR MONITORING												
1) Air Monitoring												
a) Sampling Equipment - Pumps	2	KITS	4100.00				8200				8200	
b) Sampling Equipment - Calibrator	1		1100.00				1100				1100	
c) Sample Analysis	60		30.00				1800				1800	2 Samples/Day
d) Sample Shipping	60		40.00				2400				2400	
							501835	32160	98112	35312	667420	
Burden @ 30% of Labor Cost									29434		29434	
Labor @ 15% of Labor Cost									14717		14717	
Material @ 10% of Material Cost								3216			3216	
SubContract @ 10% of Sub. Cost							50184				50184	
Total Direct Cost							552019	35376	142262	35312	764970	
Indirects @ 75% of Total Direct Labor Cost									106697		106697	
Profit @ 10% of Total Direct Cost											76497	
											948164	
Health & Safety Monitoring @ 10%											94816	
Total Field Cost											1042980	
Contingency @ 20% of Total Field Cost											208596	
TOTAL COST THIS PAGE											1251576	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Excavation, Onsite & Offsite Solidifiaction
Alternative 3

(NSB1122b)
4/5/93

Item	Qty	Unit	Unit Cost				Total Cost				Total Direct	Comments
			Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	Cost	
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer	2	MO	500.00				1000				1000	
2) Construction Survey		LS	5000.00				5000				5000	
3) Portable Communication Equipment	2	SETS	1500.00				3000				3000	
4) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
5) Site Utilities	2	MO	4000.00				8000				8000	
6) Decontamination Trailer	2	MO	1500.00				3000				3000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	8	WKS	250.00				2000				2000	
2) Truck Decon Pad		LS		2000.00	500.00	500.00		2000	500	500	3000	
3) Decontamination Services	2	MO	1200.00				2400				2400	
4) Decon Water	35000	GAL	.20				7000				7000	
5) Personnel Decon Pad		LS		1000.00	100.00	100.00		1000	100	100	1200	
6) Clean Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
7) Spent Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
DISMANTLING												
1) Floor Foundation Removal	56	CY			7.84	10.80			439	605	1044	
2) Floor Foundation Demolition - 6"	6006	SF			6.48	1.17			38919	7027	45946	
3) Railroad Track Removal	286	LF			16.60	3.60			4748	1030	5777	
DEBRIS DECONTAMINATION/DISPOSAL												
1) Concrete Debris Decontamination		LS			2500.00	1500.00			2500	1500	4000	
2) Concrete Debris Loading	207	CY			.92	1.30			190	269	460	
3) Concrete Debris Hauling	650	MI	5.00				3250				3250	13 Tr. @ 50 mi.
4) Concrete Debris Disposal	207	CY	50.00				10350				10350	Local Landfill
ONSITE SOLIDIFICATION												
1) Onsite Solidification	974	CY	50.00				48700				48700	
2) Sheet Piling	480	SF	14.00				6720				6720	
3) Grouting Pipes	200	LF	2.00				400				400	
OFFSITE SOLIDIFICATION/DISPOSAL												
1) Utility Piping Temporary Support		LS			7000.00	7000.00			7000	7000	14000	
2) Excavate Contaminated Soil	460	CY			8.00	11.00			3680	5060	8740	
3) Hauling Contaminated Soil	1400	MI	5.00				7000				7000	
4) Solidification/Landfill Disposal	687	TON	425.00				291975				291975	
5) Clean Backfill	460	CY		4.00	2.70	7.43		1840	1242	3418	6500	
a) Place, Spread & Compact	460	CY			.84	2.67			386	1228	1615	
UTILITY RELOCATION												
1) Removal Existing Water Line - 4"	145	LF			3.00				435		435	
2) Relocated Water Line - 4"	90	LF		7.35	3.41			662	307		968	
3) Pipe Hot Tap	2			300.00	500.00			600	1000		1600	
4) Relocated Sanitary Sewer												
a) 4"	90	LF		4.95	8.65			446	779		1224	
b) 6"	60	LF		8.15	10.05			489	603		1092	
c) Manhole	3			920.00	845.00			2760	2535		5295	
d) Excavation, Backfill, Compaction	150	LF			.75	6.40			113	960	1073	
e) Pipe Bedding	150	LF		1.12	1.55			168	233		401	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Excavation, Onsite & Offsite Solidifiaction
Alternative 3

(NSB1122b)
4/5/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE RESTORATION												
1) Curbing	50	LF		3.00	3.06	.10		150	153	5	308	Concrete
2) Topsoil - 6"	10	CY		12.00	5.40	14.86			54	149	203	
a) Place & Spread	10	CY			1.26	1.14			13	11	24	
3) Revegetation	.5	MSF		75.00	24.00	20.00		38	12	10	60	
4) Paving	3100	SF	2.70				8370				8370	
AIR MONITORING												
1) Air Monitoring												
a) Sampling Equipment - Pumps	2	KITS	4100.00				8200				8200	
b) Sampling Equipment - Calibrator	1		1100.00				1100				1100	
c) Analysis	80		30.00				2400				2400	2 Samples/Day
d) Shipping	80		40.00				3200				3200	
							448065	12152	66139	28872	555227	
Burden @ 30% of Labor Cost									19842		19842	
Labor @ 15% of Labor Cost									9921		9921	
Material @ 10% of Material Cost								1215			1215	
SubContract @ 10% of Sub. Cost							44807				44807	
Total Direct Cost							492872	13367	95902	28872	631012	
Indirects @ 75% of Total Direct Labor Cost									71927		71927	
Profit @ 10% of Total Direct Cost											63101	
											766039	
Health & Safety Monitoring @ 10%											76604	
Total Field Cost											842643	
Contingency @ 20% of Total Field Cost											168529	
TOTAL COST THIS PAGE											1011172	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Excavation, Offsite Solidification, Offsite Disposal
Alternative 4
Sheet 1 of 2
(NSBN1123)
3/31/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer	2	MO	500.00				1000				1000	
2) Construction Survey		LS	5000.00				5000				5000	
3) Portable Communication Equipment	2	SETS	1500.00				3000				3000	
4) Equipment Mobilization/Demobilization		LS	30000.00				30000				30000	
5) Site Utilities	2	MO	4000.00				8000				8000	
6) Decontamination Trailer	2	MO	1500.00				3000				3000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	8	WKS	250.00				2000				2000	
2) Truck Decon Pad		LS		2000.00	500.00	500.00		2000	500	500	3000	
3) Decontamination Services	2	MO	1200.00				2400				2400	
4) Decon Water	35000	GAL	.20				7000				7000	
5) Personnel Decon Pad		LS		1000.00	100.00	100.00		1000	100	100	1200	
6) Clean Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
7) Spent Water Storage Tank	1			1000.00	100.00			1000	100		1100	1000 Gallon
DISMANTLING												
1) Floor Foundation Removal	56	CY			7.84	10.80			439	605	1044	
2) Floor Foundation Demolition - 6"	6006	SF			6.48	1.17			38919	7027	45946	
3) Railroad Track Removal	286	LF			16.60	3.60			4748	1030	5777	
DEBRIS DECONTAMINATION/DISPOSAL												
1) Concrete Debris Decontamination		LS			2500.00	1500.00			2500	1500	4000	
2) Concrete Debris Loading	207	CY			.92	1.30			190	269	460	
3) Concrete Debris Hauling	650	MI	5.00				3250				3250	13 Tr. @ 50 mi.
4) Concrete Debris Disposal	207	CY	50.00				10350				10350	Local Landfill
OFFSITE SOLIDIFICATION/DISPOSAL												
1) Sheet Piling	480	SF	14.00				6720				6720	
2) Utility Piping Temporary Support		LS			7000.00	7000.00			7000	7000	14000	
3) Excavate Contaminated Soil	1434	CY			8.00	11.00			11472	15774	27246	
4) Hauling Contaminated Soil	4400	MI	5.00				22000				22000	88 Tr. @ 50 mi.
5) Solidification/Landfill Disposal	2140	TON	425.00				909500				909500	
6) Grouting Pipes	200	LF	2.00				400				400	
SITE RESTORATION												
1) Clean Backfill	1434	CY		4.00	2.70	7.43		5736	3872	10655	20262	
a) Place, Spread & Compact	1434	CY			.84	2.67			1205	3829	5033	
2) Curbing	50	LF		3.00	3.06	.10		150	153	5	308	Concrete
3) Topsoil - 6"	10	CY		12.00	5.40	14.86			54	149	203	
a) Place & Spread	10	CY			1.26	1.14			13	11	24	
4) Revegetation	.5	MSF		75.00	24.00	20.00		38	12	10	60	
AIR MONITORING												
1) Air Monitoring												
a) Sampling Equipment - Pumps	2	KITS	4100.00				8200				8200	
b) Sampling Equipment - Calibrator	1		1100.00				1100				1100	
c) Sample Analysis	80		30.00				2400				2400	2 Samples/ Day
d) Sample Shipping	80		40.00				3200				3200	
							1028520	10924	71376	48463	1159282	

NAVAL SUBMARINE BASE NEW LONDON
Groton, Connecticut
CTO 112
Excavation, Offsite Solidification, Offsite Disposal
Alternative 4
Sheet 2 of 2
(NSBN1123)
3/31/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							1028520	10924	71376	48463	1159282	
Burden @ 30% of Labor Cost									21413		21413	
Labor @ 15% of Labor Cost									10706		10706	
Material @ 10% of Material Cost								1092			1092	
SubContract @ 10% of Sub. Cost							102852				102852	
Total Direct Cost							1131372	12016	103495	48463	1295346	
Indirects @ 75% of Total Direct Labor Cost									77621		77621	
Profit @ 10% of Total Direct Cost											129535	
											1502502	
Health & Safety Monitoring @ 10%											150250	
Total Field Cost											1652752	
Contingency @ 20% of Total Field Cost											330550	
TOTAL COST THIS PAGE											1983302	

CLIENT Navy Clean CTO112	JOB NUMBER 7873
SUBJECT Quantity Takeoffs	
BASED ON	DRAWING NUMBER
BY JRE / CHECKED BY T.J. Riley (3/29)	APPROVED BY / DATE

Alternative 1

Assumptions:

Addition has been 100% demolished = 40cy
Main bldg has been 33% demolished
Concrete Floor is 6" thick
Thickness of Aggregate Base is 4" of d<2"

Area to be demolished

A=(143')(63')(.66) = **6006 sf**

V=(6006 SF)(0.5 ft) = 3003 CF = **111 CY**

Area Already Demolished

A=(143')(63')(.33) = 3003 sf

V= (3003 SF)(0.5ft) = 1501 CF = **56cy**

Total Volume of Concrete For Disposal

V= 111cy + 56 cy + 40cy = **207 cy**

Rail Line To Be Dismantled

One Rail is 143' long

Total Rail length = (143')(2) = **286 ft**

CLIENT Navy Clean CTO 112		JOB NUMBER 7873	
SUBJECT Quantity Takeoffs			
BASED ON		DRAWING NUMBER	
BY JRE	CHECKED BY T.J.Riley (3/29)	APPROVED BY	DATE

Capping of Inside of Bldg

Total Area To Be Capped
Area Inside of Bldg 31
$A = (143')(78') = 11,154$ SF

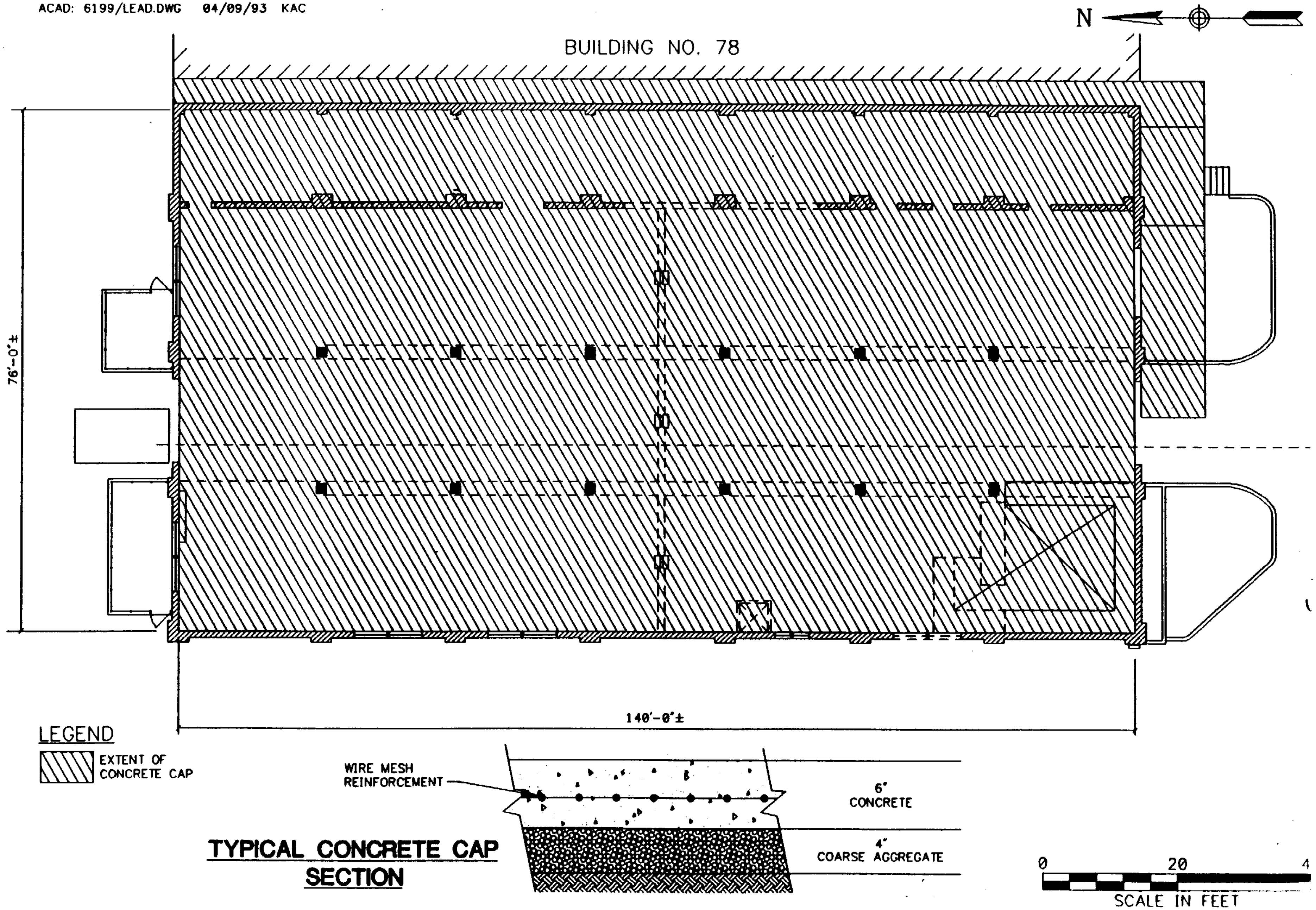
Area outside of Bldg 31 To Be Capped
$A = (143')(5') + (10')(48') = 1195$ SF

$A_{TOTAL} = 11,154$ SF $+ 1195$ SF $= 12,349$ SF $=$ **1372 SY**

VOLUME OF GRAVEL FOR BASE UNDER CAP
$V = (1372\ SY)(.33\ Ft)(Yd/3Ft) =$ **153 CY**

VOLUME OF CONCRETE NEEDED FOR CAP
$V = (1372\ SY)(0.5\ Ft)(Yd/3Ft) =$ **229 CY**

ACAD: 6199/LEAD.DWG 04/09/93 KAC



ALTERNATIVE 1 - CONCRETE CAP
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE B-

Halliburton NUS CORPORATION

CALCULATION WORKSHEET Order No. 19116 (01-81)

CLIENT Navy Clean CTO 112	JOB NUMBER 7873	
SUBJECT Quantity Takeoffs		
BASED ON	DRAWING NUMBER	
BY	CHECKED BY TJ Riley (3/29)	APPROVED BY	DATE

ALTERNATIVE 2a
Assume 70% of Soil Treated Must Be Disposed
TOTAL HORIZONTAL AREA TO BE GROUTED

A = (102')(23') + (25')(42') + (20')(20') + (20')(20') + (20')(15') + (143')(15') + (10')(48')
A = 2346 + 1050 + 400 + 400 + 300 + 2145 + 480
A = 7121 SF = **790 SY**

TOTAL AREA OF WALLS TO BE GROUTED (See Pg 5)
- 2 Foot Deep Walls
  20' + 10' + 10' + 48' + 48' + 20' + 20' + 20' = 196 Linear Feet
  A = (2 Ft)(196 Ft) = 392 SF = **44 SY**

- 4 Foot Deep Walls
  46' + 46' + 20' + 20' + 20' + 20' + 20' + 13' + 13' + 40' + 83' + 143' + 15' + 15'
  = 514 Linear Feet
  A = (4 Ft)(514 Ft) = 2056 SF = **228 SY**

- 6 Foot Deep Walls
  15' + 22' + 20' + 20 + 20 + 22 + 22 + 20 + 20 + 42 + 42 = 265 Linear Feet
  A = (6 Ft)(265 Ft) = 1590 SF = **177 SY**

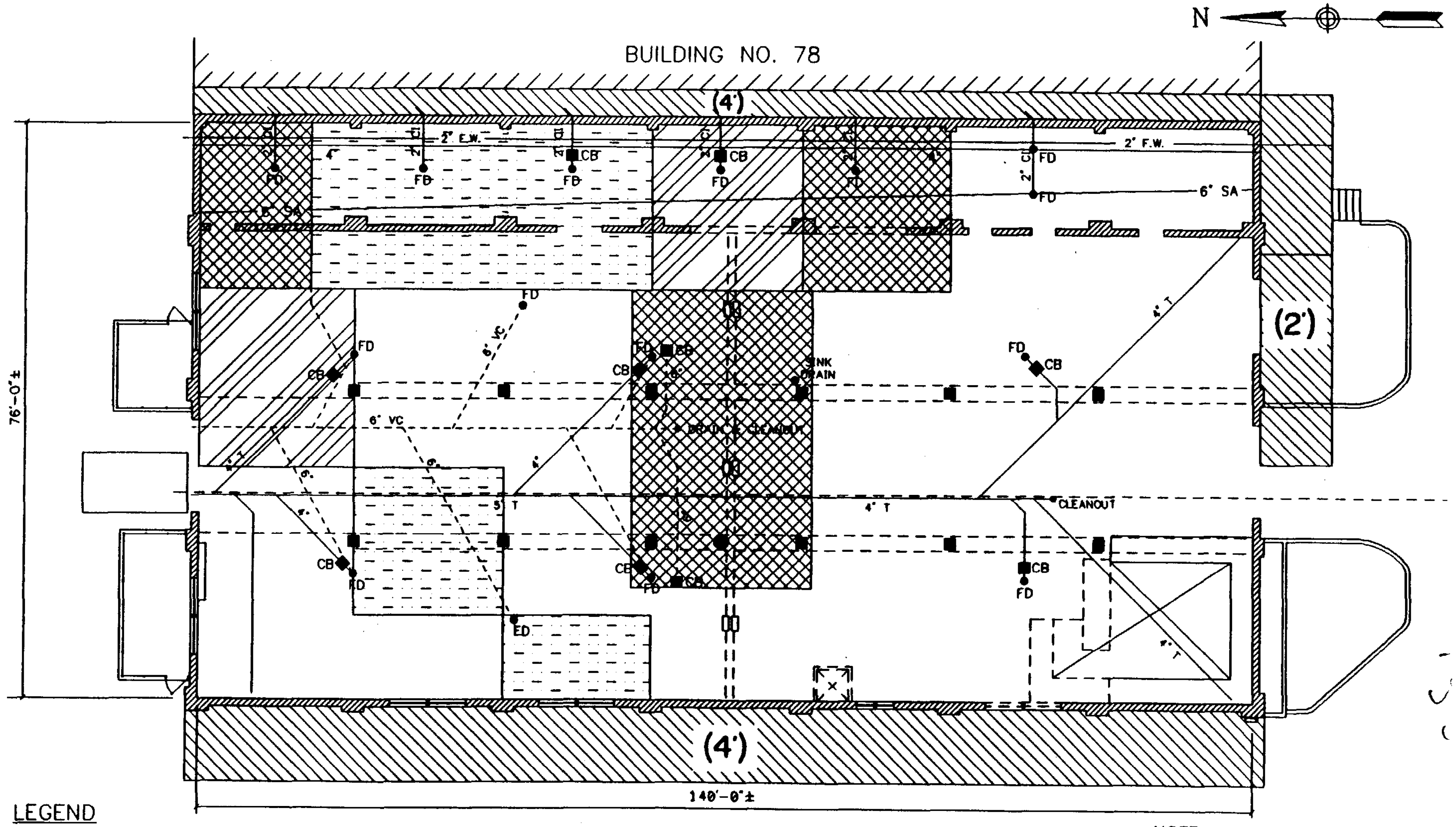
VOLUME OF SOIL TO BE GROUTED
Assume Thickness of Vault to Be Grouted is 3 Feet

Total Area = 790 SY + 44 SY + 228 SY + 177 SY = 1239 SY

Total Volume = (1239 SY)(1 YD) = **1239 CY**

Volume of Waste Generated During Grouting
V = (1239 CY)(0.7) = (867 CY)

ACAD: 6199/LEAD.DWG 04/09/93 KAC



LEGEND

2 FEET DEPTH TO INSIDE OF VAULT	6 FEET DEPTH TO INSIDE OF VAULT
4 FEET DEPTH TO INSIDE OF VAULT	(4') REMOVAL DEPTH FOR OFFSITE TREATMENT

CI – CAST IRON PIPE
VC – VITRIFIED CLAY PIPE
T – TILE
SA – SANITARY

FW – FRESH WATER
CB – CATCH BASIN
FD – FLOOR DRAIN

NOTE:
ALL EXISTING UNDERGROUND PIPING WITHIN BUILDING 31 TO BE GROUTED FULL AND LEFT IN PLACE.

0 20 4
SCALE IN FEET

ALTERNATIVE 2 - CONTAINMENT, INSITU JET GROUTING, AND OFFSITE SOLIDIFICATION

BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE B-

Halliburton NUS CORPORATION

CALCULATION WORKSHEET Order No. 19116 (01-81)

CLIENT Navy Clean CTO 112	JOB NUMBER 7873
SUBJECT Quantity Takeoffs	
BASED ON	DRAWING NUMBER
BY JRE / CHECKED BY T.J. Riley (3/25)	APPROVED BY / DATE

Alternative 2b

Volume of Soil To Be Excavated (See Pg 7)

−2 Foot Level

$V = (20\times18\times2)+(2\times2\times16\times.5)+(2\times2\times13\times.5)+(47\times10\times2)+(2\times2\times12\times.5)+(2\times2\times12\times.5)+(52\times2\times2\times.5)$

$V = 720CF + 32CF + 26CF + 940CF + 24CF + 24CF + 104CF$

$V_{2Ft} = 1870\ CF =$ **69 CY**

−4 Foot Level

$V = (5\times145\times4)+(60\times18\times4)+(36\times4\times4)+(36\times4\times4\times.5)+(20\times20\times4)+(28\times4\times4\times.5)4+(20\times13\times4)+(10\times4\times4\times.5)2+(15\times143\times4)+(151\times4\times4\times.5)+(18\times4\times4\times.5)2$

$V = 2900+4320+576+288+1600+896+1040+160+8580+1208+288$

$V_{4Ft} = 21{,}856\ CF =$ **809 CY**

−6 Foot Level

$V = (17\times22\times6)+(18\times4\times4\times.5)+(26\times2\times2\times.5)+(22\times20\times6)+(28\times6\times6\times.5)+(22\times4\times4\times.5)+(24\times6\times6\times.5)+(25\times43\times6)+(48\times6\times6\times.5)2+(36\times6\times6\times.5)$

$V = 2244+144+52+2640+504+176+432+6450+1728+648$

$V_{6Ft} = 15{,}018\ CF =$ **556 CY**

TOTAL EXCAVATION = **1434 CY**

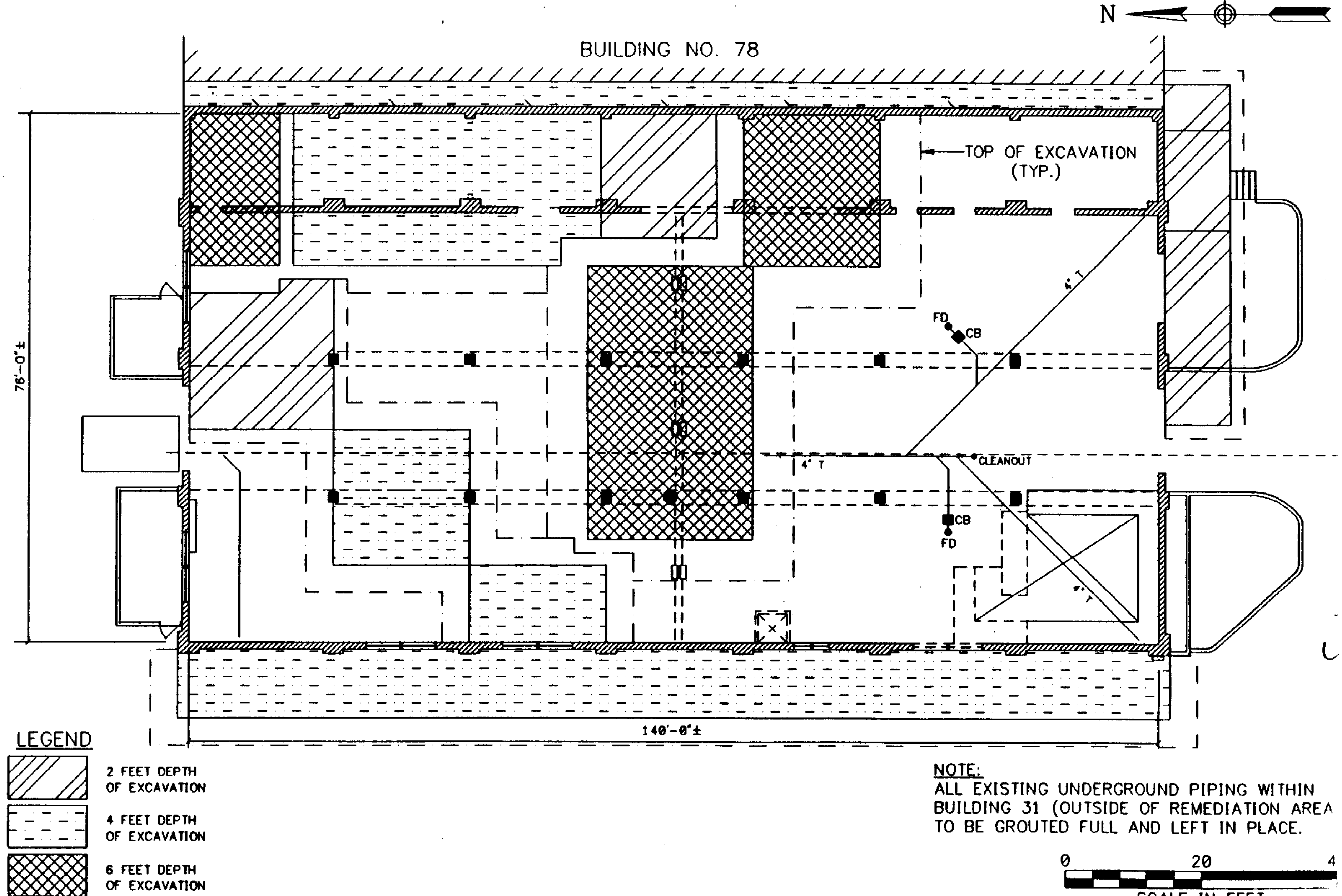
Length of Sheet Pile Needed

Assumptions: 6' heights will be used
Sheet pile will only be placed against walls where excavation is >6'

$L = 25+20+35 =$ **80 Ft**

Area of Paving (See Pg 8) **A = 3100 SF**

ACAD: 6199/LEAD.DWG 04/09/93 KAC



NOTE:
ALL EXISTING UNDERGROUND PIPING WITHIN BUILDING 31 (OUTSIDE OF REMEDIATION AREA TO BE GROUTED FULL AND LEFT IN PLACE.

ALTERNATIVE 4 - EXCAVATION/OFFSITE SOLIDIFICATION
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

FIGURE B-

Halliburton NUS CORPORATION

CLIENT Navy Clean CTO 112	JOB NUMBER 7873		
SUBJECT Quantity Takeoffs			
BASED ON	DRAWING NUMBER		
BY JKE	CHECKED BY T.J.Rily 8/20	APPROVED BY	DATE

Alternative 3

Volume of Soil To Be Excavated (See Page 6)

V_{TOTAL} = **1434 CY**

Length of Sheet Pile (See Page 6)

L = **80 Ft**

Area of Paving Needed West of Bldg 31

A = 155 × 20 = **3100 SF**

CLIENT Navy Clean CTO 112	JOB NUMBER 7873
SUBJECT Quantity Takeoffs	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JRE	T.J. Riley (3/26)		

All Alternatives

Air Sampling for lead during work

Assume 2 samples/day during whole duration

CLIENT Navy Clean CTO #112	JOB NUMBER 6199
SUBJECT Quantity Takeoffs	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JEE	T.J. Riley 4/5		4-5-93

Alternatives 2 + 3

Volume of Soil To Be Removed From site For Utility Relocation

Assume all Contamination outside of Bldg 31

$V = (14 \times 143 \times 4) + (15 \times 4 \times 4 \times .5) + (18 \times 4 \times 4 \times .5)2 + (10 \times 47 \times 2) + (2 \times 2 \times 13 \times .5)2 + (52 \times 2 \times 2 \times .5) + (5 \times 145 \times 4)$

$V = 8008 + 120 + 288 + 940 + 52 + 104 + 2900$

$V = 12412$ CF = 460 CY

Haul Offsite + Treat **460 CY**

Treat Onsite 1434 CY (Pg 6 of 9) − 460 = **974 CY**

Total Area of Wall From Pg 4 of 9 = 1239 CY

Subtract Area Hauled Offsite

$V_{off} = ((43+43+10+10)2 + (143+40+83+15+15)4)\,3'$ Thick $+ ((43 \times 10) + (143 \times 15))\,3$ Ft Thick

$V_{off} = (212 + 1184)\,3' + (430 + 2145)\,3' = 11{,}913$ CF = **441 CY**

Volume of Grout Curtain = 1239 (Pg 4 of 9) − 441 = 798 CY

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT Navy Clean CTO #112	JOB NUMBER 6199
SUBJECT Quantity Takeoffs	
BASED ON	DRAWING NUMBER

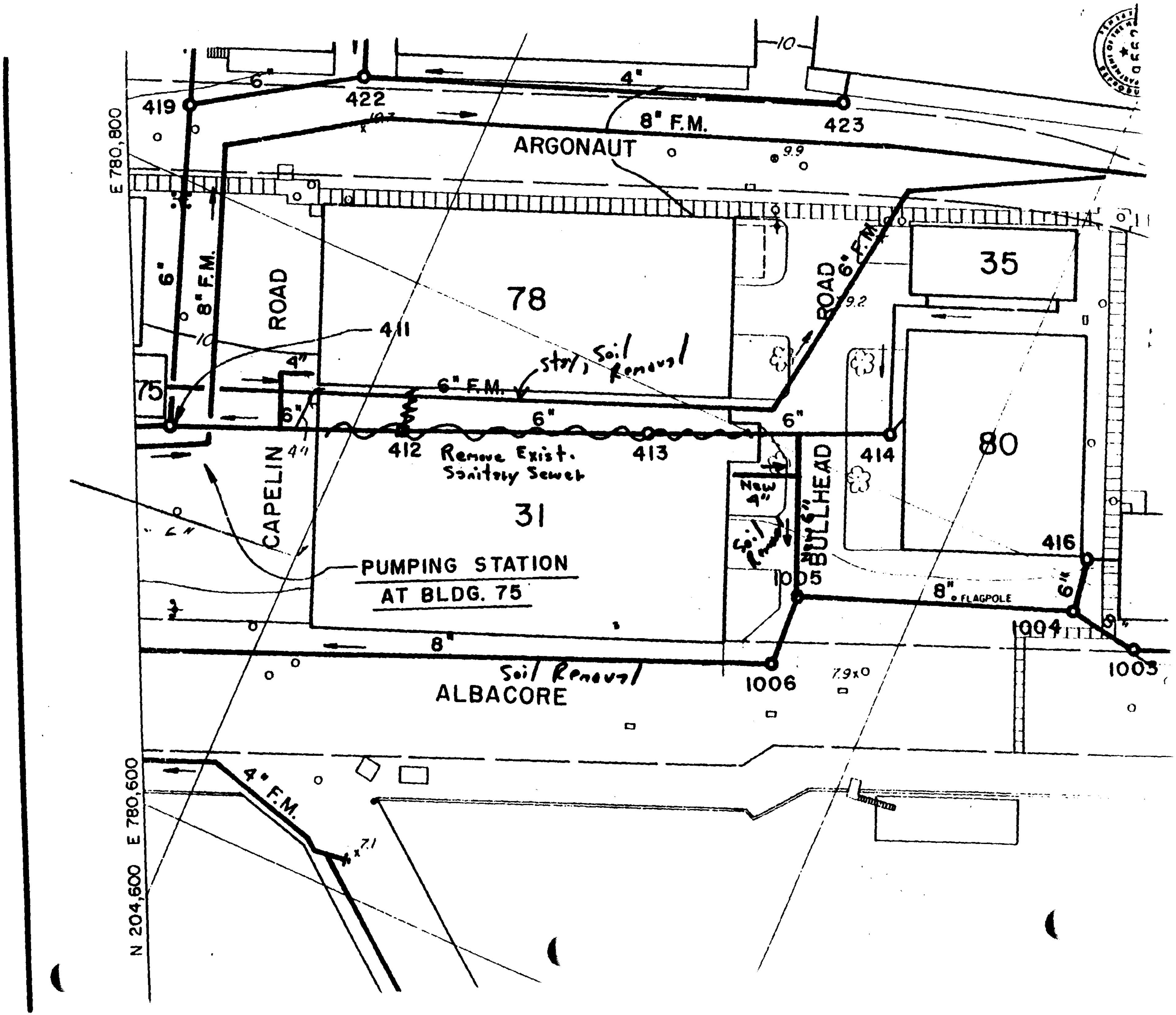
BY JRE	CHECKED BY T.J. Riley 4/8	APPROVED BY	DATE 4-5-93

Alternatives 2+3
Utilities To Be Relocated

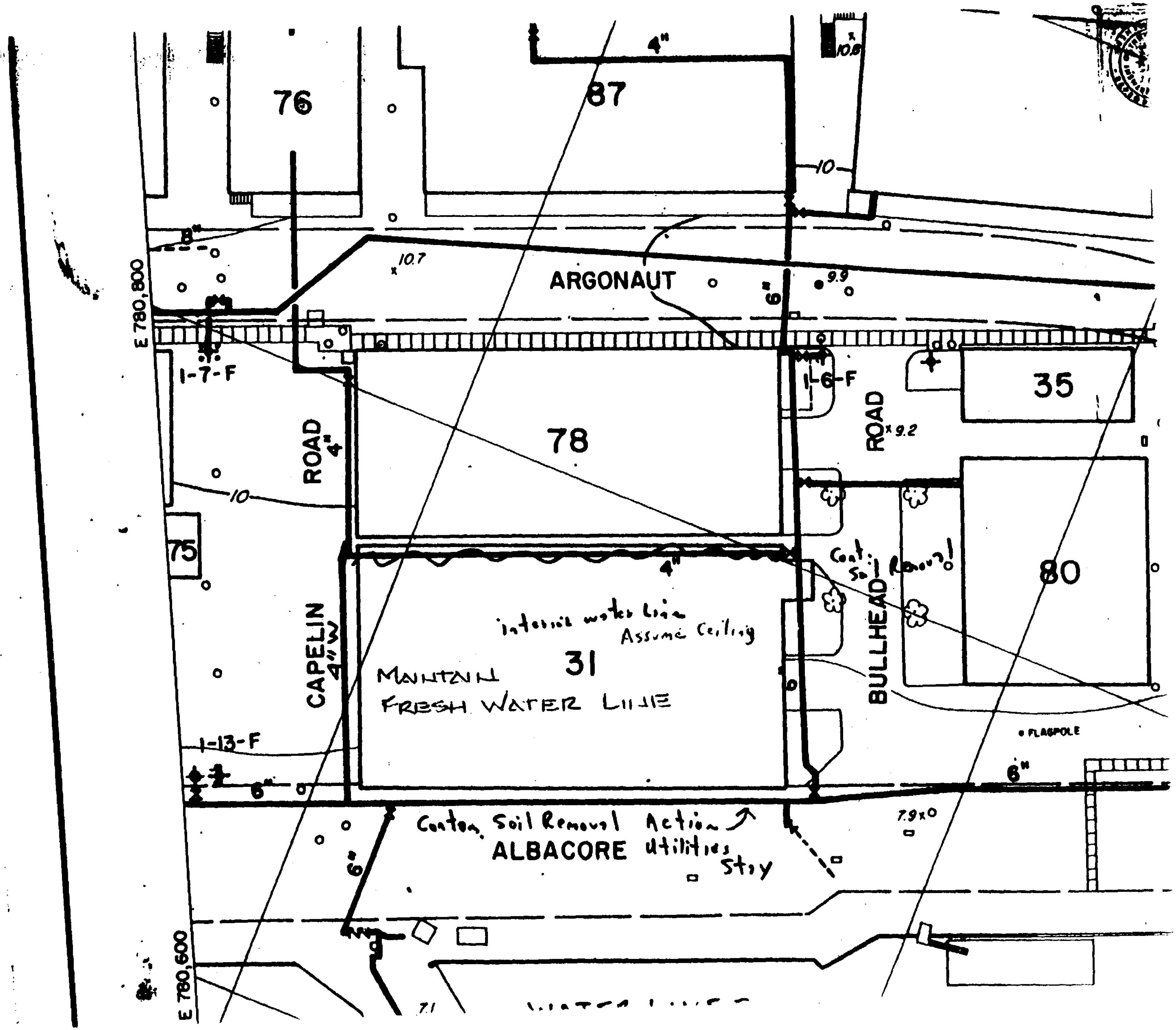
Sanitary Sewer
6" — 60' Tie into a 6" line + Manhole
4" — 25' From Bldg 31, Tie into New 6"
4" — 65' From Bldg 7B, Tie into existing 6"

Water Line
Demolish Existing 4" DIP - 145'

4" DIP - 90'
1 Wet Tap - 4" To 4"
1 Wet Tap - 4" To 6"



419
422
423
6"
4"
10
8" F.M.
ARGONAUT
E 780,800
6"
8" F.M.
ROAD
78
35
ROAD
6" F.M.
411
4"
6" F.M.
Soil Removal
75
6"
6"
6"
412
413
414
Remove Exist. Sanitary Sewer
CAPELIN
31
80
New 4"
BULLHEAD
Soil Removal
PUMPING STATION AT BLDG. 75
416
1005
8"
FLAGPOLE
6"
1004
1003
8"
1006
Soil Removal
ALBACORE
4" F.M.
N 204,600 E 780,600



76
87
4"
10.8
10
8"
10.7
ARGONAUT
6"
9.9
E 780,800
1-7-F
1-6-F
35
ROAD
4"
78
ROAD
9.2
10
75
4"
Cont. Soil Removal!
80
CAPELIN
4" W
interior water line
Assume Ceiling
31
MAINTAIN
FRESH WATER LINE
BULLHEAD
FLAGPOLE
1-13-F
6"
6"
Contam. Soil Removal Action
ALBACORE
Utilities Stay
7.9
6"
E 780,600
7.1

APPENDIX D

SOIL BORING LOGS

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB01
PROJECT NO.: 6199 DATE: 2/25/93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/ CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	21 / 21	1.0/2.0		DENSE	BRN	SILTY SAND - SOME GR.	SP	MOIST 0PPM
0926	2.0	18 / 24							
S-2		11 / 11	1.2/2.0		M DENSE	BRN	SILTY SAND - SOME GR	SP	MOIST "
0940	4.0	13 / 15							
S-3		12 / 14	1.1/2.0		M DENSE		" " "	SP	MOIST "
0950	6.0	21 / –		6.0					
							BOTM @ 6'		
									TOX SAMPLES:
									SB01-2.0
									SB01-4.0
									SB01-4.0 D
									SB01-6.0
							NO CONCRETE.		

REMARKS TRIPOD RIG
3" SPOON / 140 LB HAMMER

BORING SB-01

PAGE 1 OF 1

* See Legend on Back

BORING LOG — HALLIBURTON NUS

PROJECT: NSB-NLON BORING NO.: SB02
PROJECT NO.: 6199 DATE: 2/25/93 DRILLER: TDS
ELEVATION: ______ FIELD GEOLOGIST: CONTI
WATER LEVEL DATA: ______
(Date, Time & Conditions) ______

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	11 / 21	1.1/2.0		DENSE	BRN	SILTY SAND - SOME GRAVEL	SP	MOIST 0 PPM
1050	2.0	21 / 16					TR BRICK		
S-2		16 / 10	.8/2.0		M DENSE	BRN	SILTY SAND - SOME GR.	SP	MOIST 0 PPM
1107	4.0	10 / 10							
S-3		16 / 11	.9/2.0		M DENSE	BRN	" " "	SP	MOIST 0 PPM
1125	6.0	9 / 9		6.0					
							BOTM e 6.0		
									SAMPLES:
									SB02-2.0
									SB02-4.0
							TCL VOL TCL SEMI VOL " PEST/PCB TAL MET CN		SB02-6.0
									SB02-4.0 D

REMARKS: TRIPOD SET UP
3" SPOON 140 LB HAMMER

BORING SB02

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: SB03
PROJECT NO.: 6199
DATE: 2-25-93
DRILLER: TDS
ELEVATION:
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	8 / 11	1.%/2.0		DENSE	BRN	SILTY SAND - SOME	SP	MOIST 0 PPM
1320	2.0	16 / 14					GRAVEL		
S-2		6 / 6	1.1/2.0		LOOSE	BRN	SILTY SAND - SOME	SP	MOIST 0 PPM
1323	4.0	6 / 4					GR		
S-3		5 / 5	1.0/2.0		M DENSE	BRN	" " "	SP	MOIST 0 PPM
1330	6.0	8 / 9		6.0			TR - SANDY SILT		→ WET
									TOP 6" SILT - WET.
							BOTM @ 6'		
									SAMPLES
									SB03-2.0
									SB03-4.0
									SB03-6.0
							NO CONCRETE		

REMARKS: TRIPOD

BORING SB03

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: SB04
PROJECT NO.: 6199
DATE: 2/25/93
DRILLER: TDS
ELEVATION:
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	31 / 26	1.0/2.0		VDENSE	BRN	SILTY SAND AND GRAVEL	SP	MOIST 0 PPM
1402	2.0	12 / 21							
S-2		31 / 14	.8/2.0		MDENSE	BRN	SILTY SAND AND GRAV	SP	MOIST OPPM
1410	4.0	14 / 11							
S-3		12 / 11	1.1/2.0		MDENSE	BRN	" " "	SP	MOIST OPPM
1415	6.0	8 / 13		6.0					
							BOTM @ 6'		
									SAMPLES:
									SB04-2.0
							NO CONCRETE		SB04-4.0
									SB04-6.0

REMARKS TRIPOD SET UP

BORING SB04

PAGE 1 OF 1

* See Legend on Back

BORING LOG

HALLIBURTON NUS

PROJECT: NSB-NLON
BORING NO.: SB05
PROJECT NO.: 6199
DATE: 2-25-93
DRILLER: TDS
ELEVATION:
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/Ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	5 / 17	1.2/2.0		V DENSE	BRN	SILTY SAND - SOME	SP	MOIST 0PPM
1438	2.0	50 / 64					GRAVEL		
S-2		75 / 70	1.0/2.0		V DENSE	BRN	SILTY SAND "	SP	MOIST 0PPM
1450	4.0	25 / 16							
S-3		10 / 10	1.2/2.0		M DENSE	BRN	SILTY SAND AND	SP	MOIST 0PPM
1500	6.0	7 / 8		6.0			GRAVEL		3" GRAVEL IN
									SPOON
							BOTM @ 6'		
									SAMPLES
									SB05-2.0 (MS/MSD)
									SB05-4.0
									SB05-6.0
							NO CONCRETE.		

MATERIAL DESCRIPTION*

REMARKS: TRIPOD SET UP

BORING SB05

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB06
PROJECT NO.: 6199 DATE: 2-25-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	10 / 8	1.2/2.0		DENSE	BRN	SILTY SAND/SANDY SILT	SP	MOIST OPPM
1535	2.0	21 / 16					- SOME GRAVEL	/SM	
S-2		17 / 10	1.3/2.0		M DENSE	BRN	SILTY SAND - SOME	SP	MOIST OPPM
1555	4.0	9 / 8					GRAVEL		
S-3		7 / 7	.8/2.0		LOOSE	BRN	" " "	SP	
1600	6.0	5 / 3		6.0					
							BOTM @ 6.0		
									SAMPLES:
									SB06-2.0
									SB06-4.0
									SB06-6.0
							NO CONCRETE		
							3" SPOONS		
							140 LB HAMMER		

REMARKS: TRIPOD SET UP - START @ 1530 HRS 2/25/93

BORING SB06

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB07
PROJECT NO.: 6199 DATE: 2-25-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	29 / 36	1.2/2.0		V DENSE	BRN	SILTY SAND - SOME	SP	MOIST 0 PPM
1625	2.0	36 / 34					GRAVEL		
S-2		15 / 21	1.3/2.0		M DENSE	BRN	SILTY SAND / SANDY SILT	SP	MOIST 0 PPM
1630.	4.0	12 / 8					TR GRAVEL		
S-3		5 / 6	1.0/2.0			BRN		SP	MOIST 0 PPM
1640	6.0	6 / 5		6.0	LOOSE		SANDY SILT - SOME GR	SM / SP	→ WET
							BOTM @ 6.0		
									SAMPLES:
									SB07-2.0
									SB07-4.0
									SB07-6.0
							NO CONCRETE		

REMARKS TRIPOD SET UP
3" SPOON - 140 LB HAMMER.

BORING SB07

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB08
PROJECT NO.: 6199 DATE: 2-24-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	5 / 15	1.1/2.0		V DENSE	BRN	SILTY SAND - SOME GR	SP	MOIST 0 PPM
1415	2.0	25 / 25							
S-2		32 / 27	.9/2.0		DENSE	BRN	SILTY SAND - SOME GR	SP	MOIST 0PPM
1425	4.0	17 / 13							
S-3		10 / 19	.6/2.0		DENSE	BRN	SILTY SAND - SOME GR	SP	MOIST
1435	6.0	13 / 18		6.0					
							BOTM @ 6.0		
									TOOK SAMPLES:
									SB08-2.0
									SB08-4.0
									SB08-6.0
							NO CONCRETE		
							START ON DIRT.		

REMARKS: TRIPOD SET UP
3" SPOON 140 LB HAMMER

BORING SB08

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB09
PROJECT NO.: 6199 DATE: 2-24-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	20 / 32	1.5/2.0		V DENSE	BRN	SILTY SAND - SOME GR	SP	MOIST 0PPM
1500	2.0	34 / 36							
S-2		23 / 12	1.3/2.0		M DENSE	BRN	SILTY SAND AND GR	SP	MOIST 0PPM
1505	4.0	10 / 6							
S-3		5 / 2	1.2/2.0		LOOSE	GRAY BRN	SANDY SILT - TR GR	SM	MOIST → WET 0PPM
1510	6.0	2 / 5		6.0			TR ROOTS		ORGANIC
							BOTM @ 6'		
									TOOK SAMPLES
									SB09-2.0 @ 1500
									SB09-4.0 @ 1505
							START ON DIRT		SB09-6.0 @ 1510
							NO CONCRETE		

REMARKS: TRIPOD SET UP
3" SPOONS 140 LB HAMMER

BORING SB09
PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON — BORING NO.: SB10
PROJECT NO.: 6199 — DATE: 2-24-93 — DRILLER: TDS
ELEVATION: — FIELD GEOLOGIST: S CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	13 / 18	1.0/2.0		DENSE	BRN	SILTY SAND-TR GRAVEL	SP	DAMP → MOIST 0PPM
0830	2.0	16 / 22							
S-2		21 / 17	1.0/2.0		M DENSE	BRN	SILTY SAND-TR → SOME GRAVEL	SP	MOIST 0PPM
0842	4.0	17 / 13							
S-3		12 / 11	1.1/2.0		LOOSE	BRN	SILTY SAND-TR GRAVEL		MOIST → WET
0850	6.0	4 / 6		6.0					
							BOTM @ 6'		TOOK 3 SAMPLES + DUP
									SB10-2.0
									SB10-4.0
									SB10-6.0
									SB10-6.0D

REMARKS: ACKER TRUCK RIG AD-2 7" CONCRETE.
HSA - THRU CONCRETE
3" SPOON - 140 LB HAMMER

* See Legend on Back

BORING SB10

PAGE 1 OF 1

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB11
PROJECT NO.: 6199 DATE: 2-24-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: S CONTI
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth.ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	29 / 37	1.0/2.0		DENSE	BRN	SILTY SAND - TR GRAVEL	SP	MOIST 0 PPM
1012	2.0	27 / 26							
S-2		4 / 14	1.1/2.0		DENSE	BRN	SILTY SAND - TR → SOME GRAVEL	SP	MOIST 0 PPM
1016	4.0	10 / 16							
S-3		11 / 8	1.0/2.0		DENSE	BRN	SILTY SAND - SOME GRAVEL		MOIST → WET 0PPM
1020	6.0	11 / 22		6.0					
									→ 2 ATTEMPTS
							BOTM @ 6'		
									HSA THRU 18" CONC
									ALSO SOME DEAD FLEC. CONDUIT.
									TOOK SAMPLES
									SB11-2.0 @ 1012
									SB11-4.0 @ 1016
							1RST ATT: 18" CONC		SB11-6.0 @ 1020
							+ 18" CONC OR ?		
									2ND ATTEMP, 1RST HOLE 3' HSA
									SECOND HOLE 1 HSA

REMARKS ACKER AD-2 - TRUCK
HSA THRU CONC.
3" SPOON - 140 LB HAMMER

BORING SB11

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB12
PROJECT NO.: 6199 DATE: 2-24-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	10 / 9	1.1/2.0		V. DENSE	BRN TAN	SANDY SILT - TR GRAVEL	SM	DAMP 0 PPM
1110	2.0	36 / 21							
S-2		19 / 13	.8/2.0		M DENSE	BRN	SILTY SAND - SOME GR.	SM	MOIST 0PPM
1112	4.0	11 / 16							
S-3		8 / 6	.6/2.0		LOOSE	BRN	SILTY SAND - SOME	SM	MOIST 0PPM
1115	6.0	4 / 3		6.0			GR	/SP	
							BOTM @ 6'		
									TOOK
									SB12-2.0 @ 1110
									SB 12- 4.0 @ 1122
									SB 12- 6.0 @ 1115
							10" CONCRETE HERE		

REMARKS ACKER AD-2 (TRUCK)
HSA THRU CONC.
3" SPOON - 140 LB. HAMMER

BORING SB-12

PAGE 1 OF 1

* See Legend on Back

BORING LOG | **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: SB13
PROJECT NO.: 6199
DATE: 2-24-93
DRILLER: TDS
ELEVATION:
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY ·SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	7 / 9	1.0/2.0		V DENSE	BRN	SILTY SAND - TR GRAVEL	SM	MOIST - OPPM
1150	2.0	29 / 26					+ BRICKS		
S-2		18 / 15	1.1/2.0		M DENSE	BRN	SILTY SAND - TR GRAVEL	SP	MOIST - OPPM
1153	4.0	12 / 13							
S-3		19 / 15							
1155	6.0	14 / 10	.6/2.0	6.0	M DENSE	BRN	SILTY SAND - SOME GR	SP	WET - OPPM
							BOTM @ 6'		
									TOOK SAMPLES:
									SB13-2.0 @ 1150
									SB13-2.0D "
									SB13-4.0 @ 1153
									SB13-6.0 @ 1155
							6" CONCRETE		

REMARKS ACKER AD 2- TRUCK RIG
HSA THRU CONCRETE
3" SPOON 140 LB HAMMER

BORING SB13

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB14
PROJECT NO.: 6199 DATE: 2/25/93 DRILLER: BRAD BROCK
ELEVATION: FIELD GEOLOGIST: Young
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	Rock BR. or USCS	REMARKS
S-1	0.0	10 / 11	10" / 2.0'		Firm	Light Brown	Silty sand, fine to coarse sand w/ some gravel to 2" (SM)	SM	Damp, no HNU Readings
	2.0	13 / 9							
S-2		13 / 10	3" / 2.0'		Soft	Brown	Similar to S-1	SM	Damp, no HNU Readings
	4.0	9 / 9						SP	
S-3		7 / 4	4" / 2.0'		Soft	Brown	Similar to S-1		Wet, no HNU Readings
	6.0	4 / 5		6.0					
	6'						END OF Borehole		

REMARKS Samples collected by driving split-spoon w/ 140 LB hammer
10" concrete augered.

* See Legend on Back

BORING SB14

PAGE 1 OF 1

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: SB15
PROJECT NO.: 6199
DATE: 2/25/93
DRILLER: [illegible] BRECK
ELEVATION:
FIELD GEOLOGIST: Young
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	27 / 41	1.4 / 2.0'		Soft	Brown	Silty sand w/ fine - [illegible] sand and gravel to 2" (SM)	SM	no HNu reading Damp
	2.0	19 / 17					to SP		
S-2		9 / 9	6" / 2.0'		Soft to Firm	Brown	Similar to S-1, except 1 - 3" Layer of sandy silt (ML)	SP	no HNu [illegible]
	4.0	9 / 10							Damp
S-3		12 / 6	6" / 2.0'		Soft	Brown	Similar to S-1	SP	no HNu reading
	6.0	4 / 5		6.0					Damp
	6'						End of Borehole @ 6'		

REMARKS Samples collected by driving split-spoon w/ 140 LB [illegible] hammer.
No [illegible] in concrete surface

* See Legend on Back

BORING SB15
PAGE 1 OF 1

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: SB16
PROJECT NO.: 6199
DATE: 2/25/93
DRILLER: Brian Brock
ELEVATION:
FIELD GEOLOGIST: Young
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	1 / 2	6"/2.0'		Soft	Tan	Silty Sand, fine to coarse ... Trace (sm)	SM	Damp, no HCO...
	2.0	4 / 9							
S-2		15 / 15	5"/2.0'		Soft	Brown	similar to S-1	SP	Damp, no HNU readings
	4.0	17 / 14							
S-3		9 / 6	4"/2.0'		Firm	Brown	Similar to S-1, except with	SM	Damp, no HNU readings
	6.0	3 / 2		6.0			more silt.		
	6'						END OF BOREHOLE @6'		

REMARKS: Samples collected by driving split-spoon w/ 140 lb hammer. No augering / or concrete surface

BORING SB16

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB17
PROJECT NO.: 6199 DATE: 2/24/93 DRILLER: [illegible]
ELEVATION: FIELD GEOLOGIST: [illegible]
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY /SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/Ft.)	MATERIAL DESCRIPTION*			ROCK BR. OR USCS	REMARKS
					SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION		
S-1	0.0	25 / 12	16"/2.0'		Soft to medium	Tan, brown	Silty sand, fine to coarse; Silty sand w/ fine to coarse [illegible]		Damp. [illegible] on HNu
	2.0	18 / 38					Sand w/ gravel up to 1" [illegible] (SM)	SM	
S-2		35 / 21	5"/2.0'		Soft	Tan, brown	Silty sand, fine to coarse sand w/ gravel up to 1/4" (SM)		Damp. [illegible] on HNu
	4.0	17 / 12							
S-3		10 / 15	4"/2.0'		Soft	Tan	Similar to S-2	SM	Damp. [illegible] on HNu
	6.0	11 / 10	[illegible]	6.0					
	6'						End of Borehole		
							@ 6'		

REMARKS Samples collected by driving split-spoon w/ 140 LB. hammer. No augering [illegible] concrete on surface.

BORING SB17

PAGE 1 OF 1

* See Legend on Back

BORING LOG | **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB18
PROJECT NO.: 6199 DATE: 2/25/93 DRILLER: BIRND BROCK
ELEVATION: FIELD GEOLOGIST: Young
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	15 / 18	12"/2.0'		DENSE	Brown	SILTY SAND w Fine - COARSE Sand, and GRAVEL up to 3" (SM)	SM	DAMP, Slight HNU reading
	2.0	12 / 11							
S-2		12 / 11	12"/2.0'		DENSE	Brown Tan Brown	Similar to S-1 except 1 3" Layer ...		DAMP No HNU Reading
	4.0	13 / 13							
S-3			8"/2.0'		FIRM	Brown	Similar to S-1 but w more gravel	SM/SP	DAMP No HNU reading
	6.0	12 / 10 / 13 / 11		6.0					
	6'						END OF Borehole @ 6'		

REMARKS Samples collected by driving split-spoon w 140 LB hammer.
NO Augering of CONCRETE SURFACE

* See Legend on Back

BORING SB18
PAGE 1 OF 1

BORING LOG

HALLIBURTON NUS

PROJECT: NSB-NLON
BORING NO.: SB19
PROJECT NO.: 6199
DATE: 2/25/93
DRILLER: [illegible]
ELEVATION:
FIELD GEOLOGIST: Young
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BR.	REMARKS
S-1	0.0	9 / 10	13"/2.0'		SOFT	Red Brown	Silty Sand, little fines & medium-coarse, gravel pieces up	SM	Dry - no HNU reading
	2.0	10 / 11					than " to 1½" (sm)	/SP	
S-2		7 / 8	11"/2.0'		Soft	Red Brown	Similar to S-1, except [illegible]		Dry - no HNU reading
	4.0	9 / 11							
S-3		15 / 32	4"/[illegible] 19"		Soft	Red Brown	Similar to S-1 except, bottom 2" layer was black, less		Dry - no HNU readings
	6.0	34 / 100/1"	[illegible]	6.0		Black Brown	silt than S-1.	SP	obstruction at 5'4"
	6'						END OF BOREHOLE @ 6'		

REMARKS: Samples collected by driving split-spoon w/ 140 lb hammer. No augering of concreted surface.

BORING SB19

PAGE 1 OF 1

* See Legend on Back

BORING LOG	HALLIBURTON NUS

PROJECT: NSB-NLON BORING NO.: SB20
PROJECT NO.: 6199 DATE: 2/25/93 DRILLER: BRAD BLECK
ELEVATION: FIELD GEOLOGIST: YOUNG
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	9 / 8	5"/2.0'		SOFT	TAN	SAND, W/ TRACE OF SILT, FINE TO MEDIUM SAND (SW)	SW	DAMP, NO HNU Readings
	2.0	17 / 22							
S-2		12 / 8	6"/2.0'		SOFT	TAN	SILTY SAND, FINE TO COARSE SAND W/ GRAVEL TO 1" (SM)	SM	DAMP, NO HNU Reading
	4.0	8 / 4							
S-3		7 / 5	3"/2.0		SOFT	TAN/BRN	Similar to S-2	SM	DAMP, NO HNU Reading
	6.0	5 / 7		6.0					
	6'						END OF BOREHOLE @ 6'		

REMARKS Samples collected by driving split-spoon w/ 140 lb hammer.
10" concrete ~~cover~~ in augered.

* See Legend on Back

BORING SB 20

PAGE 1 OF 1

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB21

PROJECT NO.: 6199 DATE: 2/25/93 DRILLER: BRAD Brock

ELEVATION: ______ FIELD GEOLOGIST: Young

WATER LEVEL DATA: ______

(Date, Time & Conditions) ______

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY/ CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR- OR USCS	REMARKS
S-1	0.0	11 / 23	4" / 2.0		SOFT	Brown	SILTY SAND FINE TO COARSE [illegible] up to 1" (SM)	SM	~~Damp~~ Damp
	2.0	53 / 24							
S-2		11 / 14	8" / 2.0		SOFT	TAN	Similar to S-1.		Damp
	4.0	15 / 10							
S-3		5 / 7	12" / 2.0'		SOFT TO FIRM	TAN TO Brown	SAND, FINE TO COARSE [illegible] TRACE SILT [illegible], LAST [illegible]	SM	Damp TO WET
	6.0	6 / 4		6.0			Similar to S-1 but ~~[illegible]~~ [illegible] SANDSILT (SM-SM)		
	6'						END OF BOREHOLE		
							@ 6'		

REMARKS: Samples collected by driving split-spoons w/ 140 lb hammer.
10" CONCRETE AUGERED

BORING SB 21

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* See Legend on Back

BORING LOG

HALLIBURTON NUS

PROJECT: NSB-NLON
BORING NO.: SB22
PROJECT NO.: 6199
DATE: 2/25/93
DRILLER: [illegible]
ELEVATION:
FIELD GEOLOGIST: Young
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	23 / 60	12"/2.0'		FIRM	TAN	Silty Sand fine to coarse	SM	[illegible] at 0-12" [illegible] HNu [illegible]
	2.0	15 / 13					[illegible] up to 1/2" (SM)		
S-2		24 / 17	3"/2.0'		SOFT	TAN	Similar to S-1	SM	Large rock in [illegible] [illegible] HNu [illegible]
	4.0	12 / 11							
S-3		14 / 16	6"/2.0'		Firm	TAN	Similar to S-1	SM	Damp [illegible] [illegible] HNu [illegible]
	6.0	14 / 17		6.0					
	6'						End of Borehole		
							@ 6'		

REMARKS Samples collected by driving split-spoon w/ 140 LB hammer. Augered 5 inches of concrete.

* See Legend on Back

BORING SB22

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BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: SB 23
PROJECT NO.: 6199
DATE: 2/24/93
DRILLER: BRAD
ELEVATION:
FIELD GEOLOGIST: Young
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/ CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0.0	6 / 6	18"/20"		FIRM	TAN	SILTY SAND, FINE TO COARSE TOP 3" IS SANDY [illegible] TO 1" (SM)	SM	Damp, 7 ppm on HNU
	2.0	7 / 13						/SP	
S-2		12 / 13	4"/20"		SOFT - FIRM	Brown	Similar to S-1 but w more SILT		Damp, 8 ppm on HNU
	4.0	13 / 13							
S-3		18 / 19	6"/20"		FIRM	DARK BROWN	Similar to S-1 [illegible] with more SILT AND FEW PIECES OF GRAVEL, SMALL PLANT ROOTS	SM	WET, 5.5 ppm on HNU
	6.0	13 / 12		6.0				/SP	
	6'						END OF BOREHOLE @ 6'		

REMARKS Samples collected by driving split spoon w 140 lb hammer. No augering or concrete surface.

BORING SB 23

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB24
PROJECT NO.: 6199 DATE: 2/24/93 DRILLER: BERAD
ELEVATION: FIELD GEOLOGIST: YOUNG
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth.ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/ CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	19 / 12	18"/2.0'		MEDIUM	Brown, Gray, Yellow	SILTY SAND, fine - [illegible] w/ gravel to 2½"; Sand - Fine to Medium, GRAY 4" [illegible]		7" layer, No HNu, [illegible] [illegible]
	2.0	17 / 15				[illegible] Brown	SILTY Sand - Sand [illegible], [illegible] yellowish color 3" + Reddish [illegible] silty sand 5" (SM-SP)		
S-2		13 / 11	8"/2.0'		MEDIUM	Red-Brown	SILTY Sand, Fine to Coarse [illegible] w/ gravel up to 1½", (SM)		[illegible] No HNu damp
	4.0	14 / 13							
S-3		11 / 6	10"/2.0'		DENSE	Brown, Red-Brown	Similar to S-2, 5" layer [illegible] [illegible] [illegible], 4" layer Silty Sand (no rock)		No HNu [illegible]
	6.0	14 / 10		6.0			4" layer silty sand w/ gravel up to 3" (SM)	SM/SP	WET
	6'						END OF BOREHOLE @ 6'		

REMARKS Sample collected by driving split spoon w/ 140 lbs. hammer, no augering + no concrete at surface

* See Legend on Back

BORING SB24
PAGE 1 OF 1

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: ~~SB-3~~ SB35

PROJECT NO.: 6199 DATE: 3/24/93 DRILLER: [illegible]

ELEVATION: FIELD GEOLOGIST: Young

WATER LEVEL DATA:

(Date, Time & Conditions) [illegible]

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/Ft.)	MATERIAL DESCRIPTION* — SOIL DENSITY/ CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	12 / 27	10"/2.0		[illegible]	Tan-Brown	Silty Sand, Fine to coarse sand w/ gravel up to 1½" (SM)	SM	Slight [illegible] moist
	2.0	40 / 38						/SP	
S-2		15 / 13	12"/2.0		Stiff	Tan Brown	Similar to S-1		Moist Duplicate collected
	4.0	14 / 11							
S-3		11 / 7	80"/2.0		Medium	Brown, Dk. Brown	Similar to S-1 w/ 1" layer of Dk. Brown silty sand (SM)	SM	Moist to [illegible], [illegible]
	6.0	4 / 5		6.0'					
	6'						END OF BOREHOLE @ 6'		

REMARKS Samples collected by driving split-spoon w/ 140LB hammer. No Augering of concrete on surface

BORING SB35

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB26
PROJECT NO.: 6199 DATE: 2/24/93 DRILLER: [illegible]
ELEVATION: ____ FIELD GEOLOGIST: Young
WATER LEVEL DATA: ____
(Date, Time & Conditions) ~~2/24/93 [illegible]~~

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS (NSE 10" concrete flooring)
S-1	0.0	36 / 35	6/2.0		Soft	Brown	Silty sand w/ fine - coarse sand and gravel up to 1½" (SM)	SM	Moist
	2.0	39 / 38							
S-2		25 / 30	8/2.0		Soft	Brown	similar to S-1 except	SM/	Moist - 4ppm reading
	4.0	23 / 13					w/ gravel (up to 2½"	SP	on HNU
S-3		11 / 9	10/2.0		Soft	Brown	Similar to S-2		Moist - [illegible] Reading
	6.0	5 / 3		6.0					on HNU
	6'						END OF BOREHOLE @ 6'		

REMARKS Samples collected by driving split-spoon w/ 140 lb hammer - no augering.

* See Legend on Back

BORING SB26

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BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB-27

PROJECT NO.: 6199 DATE: 2-24-93 DRILLER: [illegible]

ELEVATION: FIELD GEOLOGIST: YOUNG

WATER LEVEL DATA:

(Date, Time & Conditions) ~~[illegible]~~ [illegible]

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS (10" Concrete Flooring)
S-1	0.0	6 / 10	10/2.0		SOFT	TAN	Silty Sand fine to	SM	MOIST
	2.0	10 / [illegible]				to Brown	coarse sand, gravel		
S-2		5 / 12	8/2.0		SOFT	TAN	up to 1½" (SM)		
	4.0	12 / 9					Silty Sand Fine		MOIST
S-3		11 / 14	12/2.0				to medium sand, trace		
	6.0	13 / 17		6.0			coarse sand. (SM)	SM	
						Brown	Silty Sand w/ fine to		MOIST to WET
							coarse sand, gravel		
							up to 3" (SM)		
									[illegible] NO HNU readings
	[illegible]						END OF DRILLING		
							@ 6'.	6	

REMARKS: Sample collected by driving split spoon w/ 140 lb hammer - no augering

BORING SB-27

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB 28
PROJECT NO.: 6199 DATE: 2/26/93 DRILLER: TDS
ELEVATION: ____ FIELD GEOLOGIST: CONTI
WATER LEVEL DATA: ____
(Date, Time & Conditions) ____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	96 / 24			V DENSE	BRN	SILTY SAND - SOME	SP	MOIST 0PPM
1150	2.0	21 / 14					GRAVEL		
S-2		18 / 16			M DENSE	BRN	" " TR BRKK	SP	MOIST 0PPM
1152	4.0	11 / 10		4.0					
							BOTM @ 4.0		
									SAMPLES
									SB28-2.0
									SB28-4.0
							ACKER RIG		
							USED HSA TO GO		
							THRU BLACKTOP		
							≈ 6" BLACKTOP		

REMARKS ____

BORING SB 28

PAGE 1 OF 1

* See Legend on Back

BORING LOG

HALLIBURTON NUS

PROJECT: NSB-NLON
BORING NO.: SB29
PROJECT NO.: 6199
DATE: 2-26-93
DRILLER: TDS
ELEVATION:
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY /SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	6 / 5	1.3/2.0		MDENSE	BRN	SANDY SILT - TR GR	SM	MOIST 0PPM
0930	2.0	4 / 9					TR ROOTS		
S-2		11 / 12	.5/2.0		DENSE	BRN	SILTY SAND - TR GRAVEL	SM	MOIST 0PPM
0935	4.0	18 / 16						/SP	
S-3		9 / 9	.3/2.0		M DENSE	BRN	" " "	SP	POOR REC
	6.0	10 / 11		6.0					WENT AFTER 2 TIMES.
0940									
							BOTM @ 6.0		
									SAMPLES
									SB29-2.0 + 2.0D
							START ON GRASS		SB29-4.0
									SB29-6.0
							ACKER RIG		
							3" SPOON 140 LB		
							HAMMER		

REMARKS

BORING SB29

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB 30
PROJECT NO.: 6199 DATE: 2-26-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	5 / 4	1.5/2.0		M DENSE	BRN	SANDY SILT - TR ROOTS	ML	MOIST 0PPM
0955	2.0	5 / 8							TOPSOIL
S-2		9 / 16	0.5/2.0		DENSE	BRN	SILTY SAND - SOME	SM	MOIST 0PPM
0900	4.0	17 / 21					GRAVEL	/SP	
S-3		15 / 15	1.3/2.0						
0905	6.0	21 / 23		6.0	DENSE	BRN	SILTY SAND - SOME GR	SP	MOIST 0PPM
							TR BRICKS		(FILL)
							BOTM @ 6.0		
									SB30-2.0
									SB30-4.0
									SB30-6.0
							START ON GRASS		
							W ACKER RIG		
							USE 3" SPOON - 140 LB		
							HAMMER		

REMARKS

* See Legend on Back

BORING SB30

PAGE 1 OF 1

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB 31
PROJECT NO.: 6199 DATE: 2-26-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	137 / 71	1.3/2.0		V DENSE	BRN	SILTY SAND SOME	SP	MOIST 0PPM
1215	2.0	41 / 38		2.0			GRAVEL		
		6	REFUSAL						
							BOTTOM @ 2'		HIT REF.
									TOOK
							ACKER RIG		SB31-2.0
							HSA THRU CONC.		SB31-2.0D
							6" ASPHALT		

REMARKS

BORING SB 31

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* See Legend on Back

BORING LOG

HALLIBURTON NUS

PROJECT: NSB-NLON
BORING NO.: SB32
PROJECT NO.: 6199
DATE: 2-26-93
DRILLER: TDS
ELEVATION:
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	51 / 16	1.0/2.0		M DENSE	TAN BRN	SAND - SOME GRAVEL	SP	DAMP 0PPM
1232	2.0	18 / 13		2.0					
							BOTTOM @ 2'		
									SB32-2.0
							ACKER RIG		
							ASPHALT = .5'		

REMARKS

* See Legend on Back

BORING SB32

PAGE 1 OF 1

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: SB 33
PROJECT NO.: 6199 DATE: 2-26-93 DRILLER: TDS
ELEVATION: FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-1	0.0	17 / 28	1.2/2.0		V DENSE	BRN	SANDY SILT - TR GRAVEL	SM	MOIST
1250	2.0	36 / 40		2.0					PARTIALLY FROZEN
							BOTTOM 2'		TOOK
									SB33-2.0
							ACKER RIG		
							ASPHALT = 6"		

REMARKS

BORING SB-33

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON
BORING NO.: GW-01
PROJECT NO.: 6199
DATE: 2-23-93
DRILLER: TDS
ELEVATION: 33.1 ≈ ASSUMED
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA: ~6' FROM - GRN. SUR
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	0.0				DENSE	BRN	SILTY SAND - SOME	SM/	HSA TO ADV.
					↓	↓	GRAVEL	SP	BORING FOR
							↓		INSTALLING A
									2"Φ TEMP WELL
									POINT
									NO SAMPLES
									TAKEN.
	10.0			10.0	↓	↓	↓		WELL SCR
							BOTM @ 10'		4.5 → 9.5

REMARKS: TEMP WELL

BORING: GW-01

PAGE 1 OF 1

* See Legend on Back

BORING LOG | **HALLIBURTON NUS**

PROJECT: NSB-NLON
PROJECT NO.: 6199
DATE: 2-23-93
BORING NO.: GW-02
DRILLER: TDS
ELEVATION: 78.9 (APPROX) - ASSUMED DATUM (GROUND SURF)
FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	0.0				DENSE	BRN	SILTY SAND - SOME	SM	~8" CONCRETE
							GRAVEL	/SP	THEN HSA TO
									10' FOR INSTALL
									OF 2" WELL
									POINT
									SCR 4.5 → 9.5
									NO SAMPLES
									TAKEN.
	10.0			10.0	↓	↓	↓		
							BOTM @ 10.0		

*MATERIAL DESCRIPTION

REMARKS: TEMP WELL

BORING GW-02

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: GW-03
PROJECT NO.: 6199 DATE: 2-23-93 DRILLER: TDS
ELEVATION: 98.7 (APPROX) FIELD GEOLOGIST: CONTI/YOUNG
WATER LEVEL DATA: ASSUMED DATUM @ GROUND SUR
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*: SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	0.0				MED DENSE	BRN	SILTY SAND - TR TO	SM/	DRIVE SPLIT-
					↓	↓	SOME GRAVEL	SP	SPOONS / DRIVE
									WELL PT TO
							↓		BOTM
									SCR 4.5→9.5
	10.0			10.0	↓	↓	↓		
							BOTM @ 10'		

REMARKS: TEMP WELL

BORING GW-03

PAGE 1 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NSB-NLON BORING NO.: GW-04
PROJECT NO.: 6199 DATE: 2-23-93 DRILLER: TDS
ELEVATION: 98.6 (APPROX) FIELD GEOLOGIST: CONTI / YOUNG
WATER LEVEL DATA: ASSUMED DATUM @ GROUND SUR.
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY / CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	Rock Br. or USCS	REMARKS
	0.0				SOFT	BRN	SILTY SAND - SOME	SM/	0-7 ADV USING
					TO		GRAVEL - TR	SP	3" SPLIT-SPOON
					MED		FILL MATLS		7-10 - DROVE
					DENSE				WELL POINT W/
									140 LB HAMMER
									SCREEN 4.5-9.5
	10.0			10.0					
							BOTM @ 10'		

REMARKS: TEMP WELL

BORING GW-04
PAGE 1 OF 1

* See Legend on Back

APPENDIX E

WELL CONSTRUCTION DIAGRAMS

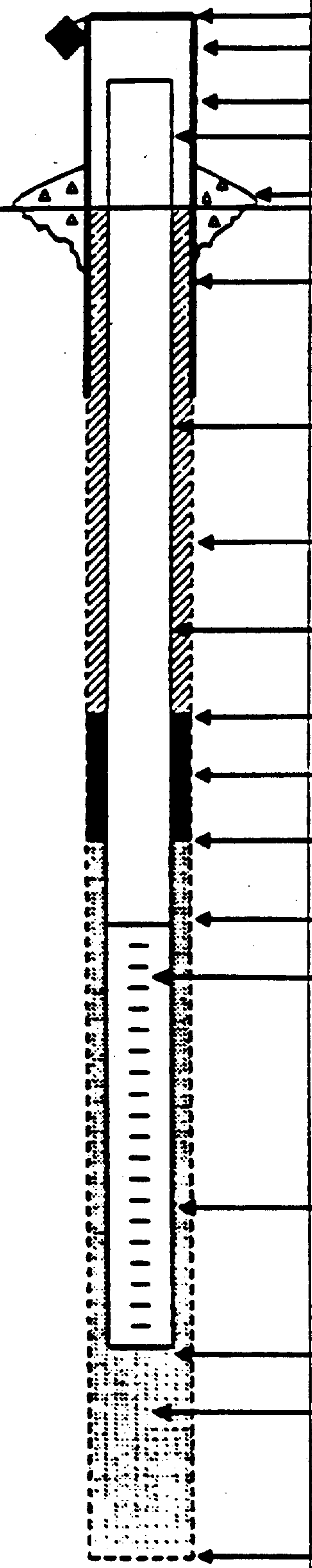
BORING NO GW-01

HALLIBURTON NUS
Environmental Corporation

TEMPORARY
MONITORING WELL SHEET

PROJECT NSB-NLON	LOCATION GROTON, CT.	DRILLER TDS
PROJECT NO. 6199	BORING GW-01	DRILLING METHOD HSA
ELEVATION	DATE 2-23-93	DEVELOPMENT METHOD PUMP
FIELD GEOLOGIST CONTI		

GROUND ELEVATION
≈ 98.1
ASSUMED DATUM



ELEVATION OF TOP OF SURFACE CASING:	NA
ELEVATION OF TOP OF RISER PIPE: * (ASSUMED DATUM)	93.59 *
STICK - UP TOP OF SURFACE CASING:	NA
STICK - UP RISER PIPE:	
TYPE OF SURFACE SEAL:	NA
I.D. OF SURFACE CASING:	NA
TYPE OF SURFACE CASING:	NA
RISER PIPE I.D.	2"
TYPE OF RISER PIPE:	STEEL
BOREHOLE DIAMETER:	6"
TYPE OF BACKFILL:	CUTTINGS
ELEVATION / DEPTH TOP OF SEAL:	NA
TYPE OF SEAL:	NA
DEPTH TOP OF SAND PACK:	NA
ELEVATION / DEPTH TOP OF SCREEN:	/4.5
TYPE OF SCREEN:	STAINLESS STEEL
SLOT SIZE x LENGTH:	10 SL x 5'
I.D. OF SCREEN:	2"
TYPE OF SAND PACK:	NA
ELEVATION / DEPTH BOTTOM OF SCREEN:	/9.5
ELEVATION / DEPTH BOTTOM OF SAND PACK:	NA
TYPE OF BACKFILL BELOW OBSERVATION WELL:	
ELEVATION / DEPTH OF HOLE:	/10.0

BORING NO GW-0_

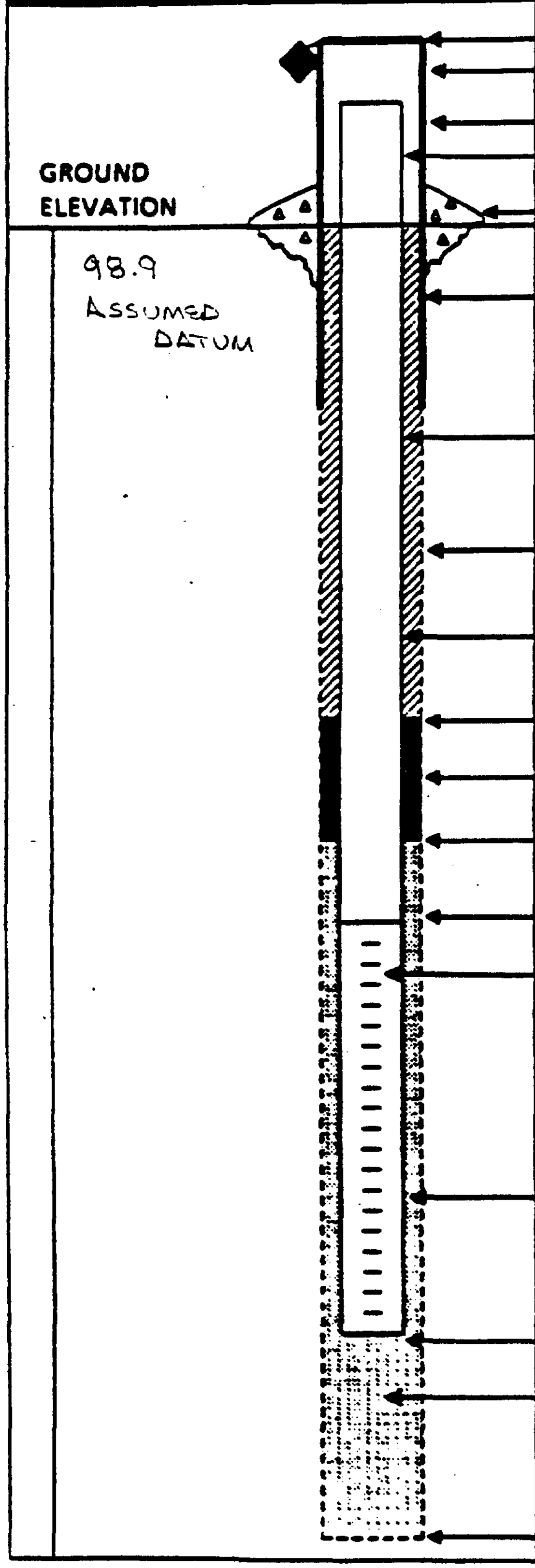
HALLIBURTON NUS
Environmental Corporation

TEMPORARY MONITORING WELL SHEET

PROJECT: NSB-NLON
PROJECT NO.: 6199
ELEVATION:
FIELD GEOLOGIST: CONTI

LOCATION: GROTON, CT.
BORING: GW-02
DATE: 2-23-93

DRILLER: TDS
DRILLING METHOD: HSA
DEVELOPMENT METHOD: PUMP



ELEVATION OF TOP OF SURFACE CASING: * NA
ELEVATION OF TOP OF RISER PIPE: (ASSUMED DATUM) 99.82 *
STICK - UP TOP OF SURFACE CASING: NA
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: NA
I.D. OF SURFACE CASING: NA
TYPE OF SURFACE CASING: NA
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: STEEL
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: CUTTINGS
ELEVATION / DEPTH TOP OF SEAL: NA
TYPE OF SEAL: NA
DEPTH TOP OF SAND PACK: NA
ELEVATION / DEPTH TOP OF SCREEN: /4.5
TYPE OF SCREEN: STAINLESS STEEL
SLOT SIZE x LENGTH: 10 SL x 5'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: NA
ELEVATION / DEPTH BOTTOM OF SCREEN: /9.5
ELEVATION / DEPTH BOTTOM OF SAND PACK: NA
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: /10.0

BORING NO GW-03

HALLIBURTON NUS
Environmental Corporation

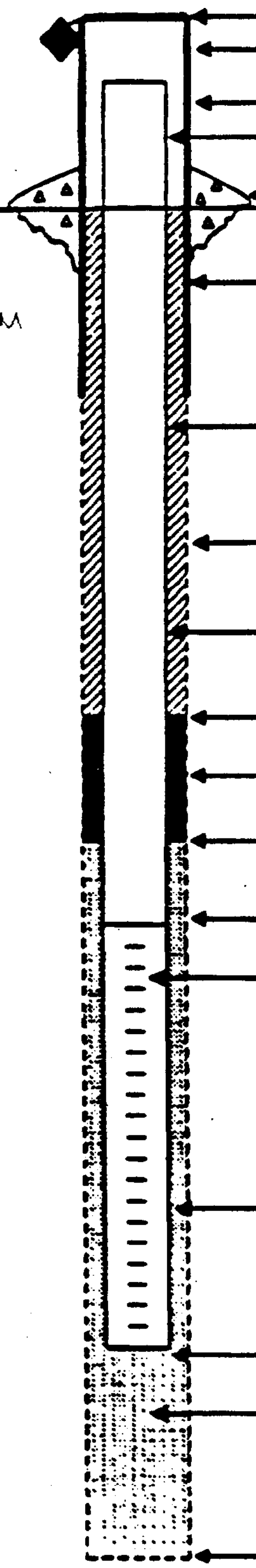
TEMPORARY MONITORING WELL SHEET

PROJECT NSB-NLON
PROJECT NO. 6199
ELEVATION
FIELD GEOLOGIST CONTI / YOUNG

LOCATION GROTON, CT.
BORING GW-03
DATE 2-23-93

DRILLER TDS
DRILLING METHOD DRIVE WELL PT.
DEVELOPMENT METHOD PUMP

GROUND ELEVATION
98.7 ASSUMED DATUM



ELEVATION OF TOP OF SURFACE CASING: * NA
ELEVATION OF TOP OF RISER PIPE: (ASSUMED DATUM) 99.17 *
STICK - UP TOP OF SURFACE CASING: NA
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: NA
I.D. OF SURFACE CASING: NA
TYPE OF SURFACE CASING: NA
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: STEEL
BOREHOLE DIAMETER: 3.5"
TYPE OF BACKFILL: CUTTINGS
ELEVATION / DEPTH TOP OF SEAL: NA
TYPE OF SEAL: NA
DEPTH TOP OF SAND PACK: NA
ELEVATION / DEPTH TOP OF SCREEN: /4.5
TYPE OF SCREEN: STAINLESS STEEL
SLOT SIZE x LENGTH: 10SLx 5'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: NA
ELEVATION / DEPTH BOTTOM OF SCREEN: /9.5
ELEVATION / DEPTH BOTTOM OF SAND PACK: NA
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: /10.0

BORING NO GW-04

HALLIBURTON NUS
Environmental Corporation

TEMPORARY
MONITORING WELL SHEET

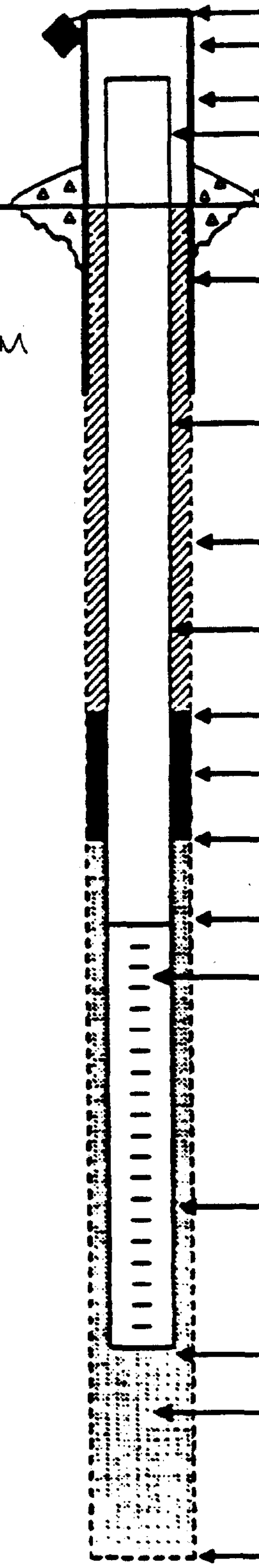
PROJECT NSB-NLON
PROJECT NO. 6199
ELEVATION
FIELD GEOLOGIST CONTI/YOUNG

LOCATION GROTON, CT.
BORING GW-04
DATE 2-23-93

DRILLER TDS
DRILLING METHOD DRIVE WELL PT
DEVELOPMENT METHOD PUMP

GROUND ELEVATION

98.6 ASSUMED DATUM



ELEVATION OF TOP OF SURFACE CASING: NA
ELEVATION OF TOP OF RISER PIPE: (* ASSUMED DATUM) 99.08*
STICK - UP TOP OF SURFACE CASING: NA
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: NA
I.D. OF SURFACE CASING: NA
TYPE OF SURFACE CASING: NA
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: STEEL
BOREHOLE DIAMETER: 3.5"
TYPE OF BACKFILL: CUTTINGS
ELEVATION / DEPTH TOP OF SEAL: NA
TYPE OF SEAL: NA
DEPTH TOP OF SAND PACK: NA
ELEVATION / DEPTH TOP OF SCREEN: /4.5
TYPE OF SCREEN: STAINLESS STEEL
SLOT SIZE x LENGTH: 10SL x 5'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: NA
ELEVATION / DEPTH BOTTOM OF SCREEN: /9.5
ELEVATION / DEPTH BOTTOM OF SAND PACK: NA
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: /10.0