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HYDROGEOLOGIC INVESTIGATION
UNDERGROUND STORAGE TANKS OT-4, OT-7, OT-8, OT-9 AND 54-H
U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

SEPTEMBER, 1989

PREPARED BY:

FUSS & O'NEILL, INC.
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040

87-143

FUSS&O'NEILL INC
consulting engineers

October 10, 1989

Mr. Duncan Schweitzer
Director, Engineering Division
Department of the Navy
Naval Submarine Base/New London
P. O. Box 36
Groton, CT 06349-5026

RE: Fuel Tank Monitoring - Contract N62472-87-C-3338, 11000 Ser 8201/212, SC #808K3 and 808E6

Dear Duncan:

Pursuant to our proposal dated June 16, 1988 as subsequently modified and authorized, we are herewith submitting our work product addressing the various tasks enumerated in the proposal. These submittals focus on two main areas. The first is a brief review of lining systems available for large concrete tanks and the second is a report of the hydrogeology and contamination discovered during the site work undertaken at the base.

Our review of lining systems indicates that, in general, it is quite expensive to place a lining system in the large OT tanks. We have received encouraging testimonials from persons who have had their tanks lined; however, we are concerned about the ability of being able to detect a leak in tanks such as the ones investigated. As you know, few methods are available for such leak detection on these tanks and those that are available would not meet the State's criteria for leak detection in any event. Therefore, we believe that the efficacy of a lining system is largely not measurable in the short term and might only be evaluated through long-term groundwater monitoring notwithstanding technological advancements in the field. Further, as discussed in the attached report, we cannot at present definitively state whether or not any particular tank itself is leaking without further data. Thus, at this time we believe that consideration of tank lining is premature and should not be pursued without further data.

Regarding the groundwater, we have determined that impacts have occurred as a result of petroleum product handling at the site. The impacts which have been found are not severe on the upper base but are more concentrated on the lower base. As alluded to

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above, we cannot determine with present data whether tank(s) are the source of the impacts or whether the piping and associated appurtenances gave rise to the impacts found. Pressure testing of the piping could provide additional information regarding specific sources.

We are available to answer any questions you may have on anything herein and appreciate the opportunity to have performed this work.

Sincerely,

Stanley E. Alexander

Stanley E. Alexander, P.E.
Associate

/sw

Enclosure

87-143/Corresp.
1004A89SEA3

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1.0 INTRODUCTION

1.1 Study Background

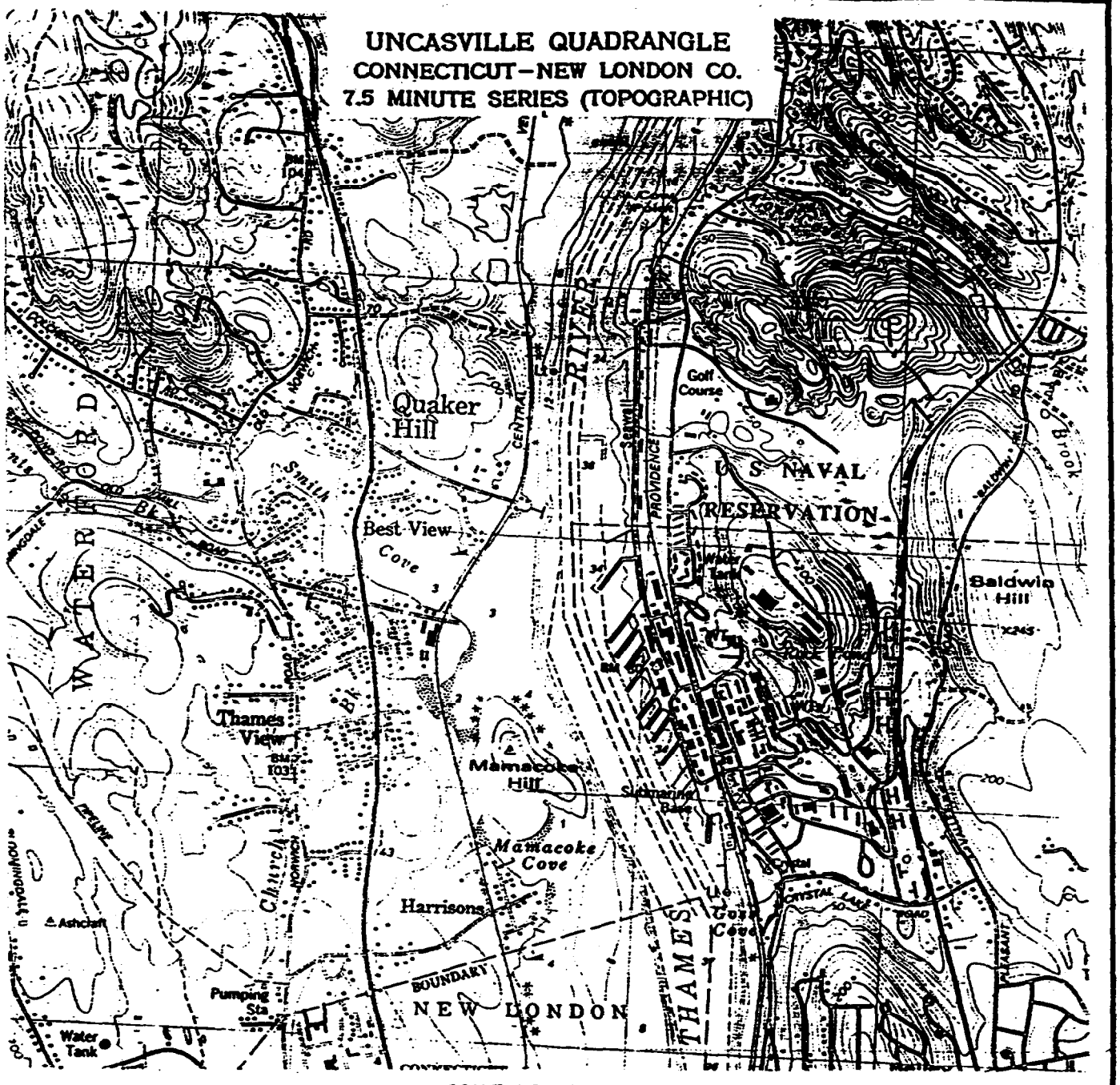
June, 1989, Fuss & O'Neill, Inc. was authorized to conduct a hydrogeologic investigation of two underground storage tank areas at the U.S. Naval Submarine Base - New London, located in Groton, Connecticut. Investigations of ground water and soil were made with emphasis placed on identifying possible environmental impacts which may have resulted from the loss of contents of the tanks into the ground. The following text outlines our investigation and presents our findings.

1.2 Site Location

The U.S. Naval Submarine Base - New London, is located on the east bank of the Thames River approximately five miles north of Long Island Sound. The Naval base is approximately 0.88 square miles in area and is bisected by the corporate boundary of the towns of Groton and Ledyard, Connecticut. The naval reservation is bounded by the Thames River to the west, Crystal Lake Road to the south, U.S. Route 12 to the east (although some minor facilities are east of U.S. Route 12) and a low ridge to the north which extends northwestward from Baldwin Hill. A site location map is provided in Figure 1.

1.3 Site Description

The U.S. Naval reservation at Groton serves as a base where submarines and small support vessels are docked, repaired and serviced. The naval reservation also provides a number of facilities and services for crew and support personnel including sleeping quarters, eating quarters, educational facilities, shopping centers, entertainment establishments, etc.



SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

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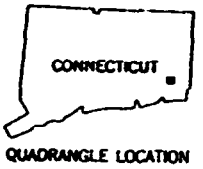
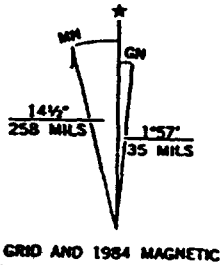
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FIGURE NO. 1



QUADRANGLE LOCATION



UTM GRID AND 1984 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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SITE LOCATION
NAVAL SUBMARINE BASE
NEW LONDON

GROTON CONNECTICUT

PROJ. NO. 87-143/25 DATE: SEPT 1989 SCALE: N.T.S.

The naval base is divided into upper base and lower base areas. The Providence and Worcester Railroad, which runs north to south through the reservation, forms the boundary between the two.

The upper base is the eastern, more elevated portion of the reservation and accommodates the administration facilities, living quarters, eating quarters, etc. The lower base, situated to the west of the railroad and directly adjacent to the Thames River, encompasses the piers and maintenance facilities used in the upkeep of naval vessels brought to the base.

Our investigation involved two underground storage tank areas; one located in the upper and one located in the lower base areas. The upper base tank area consists of eight concrete underground storage tanks buried approximately four feet below playing fields and adjacent parking areas in the southern portion of the upper base. The tanks are approximately 112 feet in diameter, 11 feet in height and have individual capacities of approximately 750,000 gallons. The location of these tanks is indicated on the naval base map presented in Figure 2.

Through conversations with employees of the naval base public works department, it was related that these tanks were constructed in 1942 in an area once occupied by a small shallow lake. During this construction event, the lake was drained and the tanks were constructed on the lake bed. The lake was then filled in and the tanks covered with material excavated from a small hill west and adjacent to the tank area.

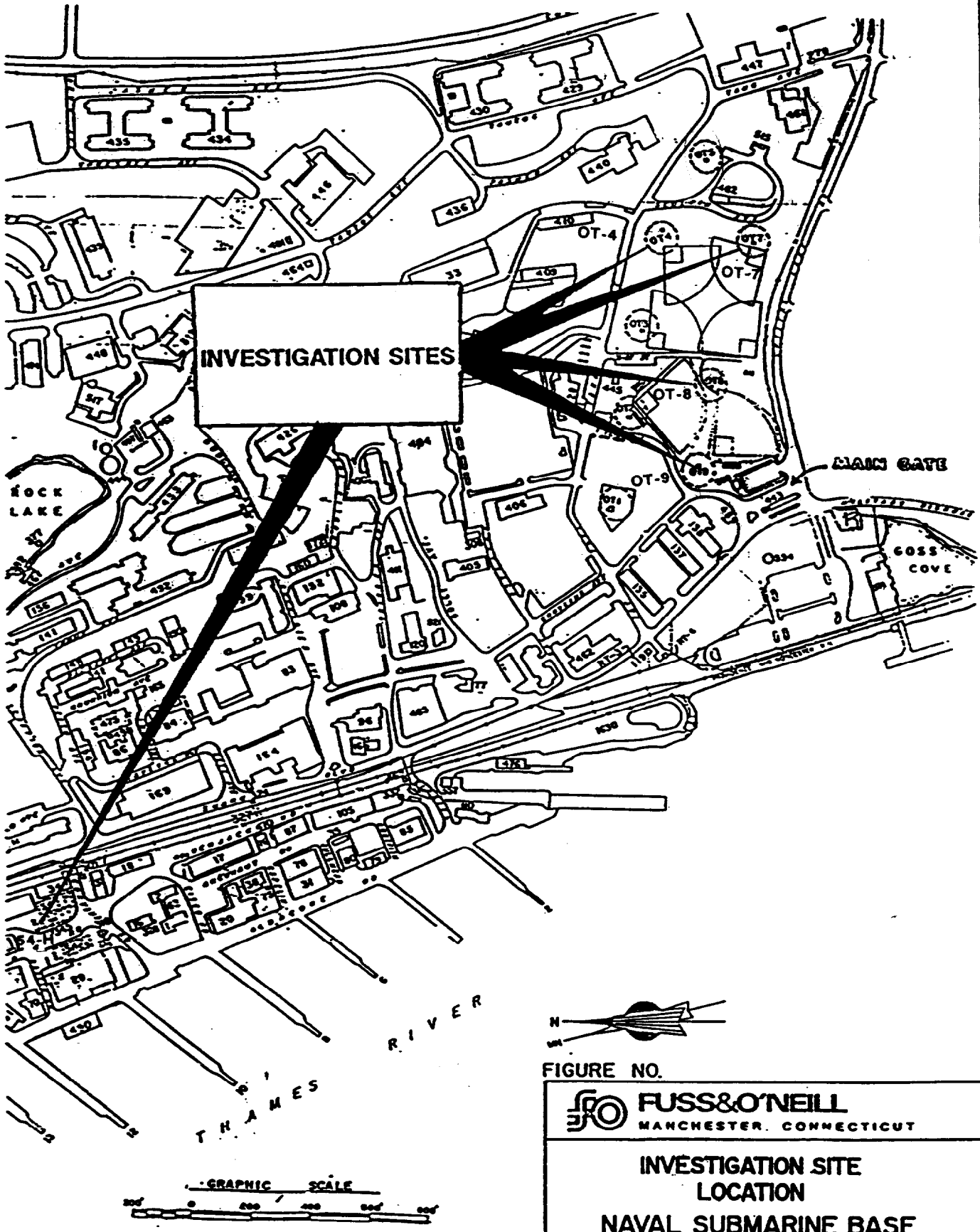

FIGURE NO.

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INVESTIGATION SITE LOCATION

NAVAL SUBMARINE BASE NEW LONDON

GROTON CONNECTICUT

PROJ. NO. 87-143/250 DATE: SEPTEMBER, 1989

BASE MAP COURTESY OF LOUREIRO ASSOC.

Tanks OT-4 and OT-5 were designed and used as oil reclamation tanks. The remaining tanks have been used to store diesel fuel, No. 2 and No. 6 fuel oil. Tanks OT-5 and OT-7 were the only two tanks reported to still be in operation at the time of this investigation.

Oil is delivered to the site by tanker ships via the Thames River. The tanks are filled through underground lines which run from the piers to the storage tank areas. Vessels are also fueled at the piers by pumping oil out from the tanks, back along the same lines.

The investigation in the lower base area was centered on a 30,000 gallon oil reclamation tank designated as tank 54-H. Tank 54-H is the northern most tank of a group of six concrete underground storage tanks located at the corner of Corvina Road and Amber Jack Road on the lower base. The locations of these tanks are indicated on the naval base map presented in Figure 2.

Tank 54-H is rectangular in shape and is 32 feet long, 22 feet wide and 10 feet in height. It is buried approximately 1.5 feet below the asphalt driveway and parking area of the fire station, which serves the naval base.

In conversations with employees at the public works department it was related that this group of storage tanks was constructed in 1942 by excavating the area where the tanks are located and assembling the tanks within the cavity. The tanks were then covered over with material excavated from the hole.

Tank 54-H is was used as an oil reclamation tank which serviced the three underground storage tanks located south and immediately adjacent to it. This tank was not in service at the time of this investigation. As was the case with the tanks located in the upper base, oil was pumped to this tank from off loading stations at the piers via underground lines.

2.0 AREA TOPOGRAPHY AND GEOLOGY

The submarine base occupies a low lying area on the east bank of the Thames River. Topographic highs are formed to the west and the north of the reservation by Baldwin Hill and a ridge extending to the west and to the south by Bailey's Hill. A small hill forms a topographic high in the center of the reservation and acts as a ground-water divide, creating two separate drainage basins.

The northern drainage basin is occupied in part by a wetland located at its southern end and is drained by a small stream which flows westward towards the Thames River. The stream has been dammed and a small man-made pond has been created between the wetlands and the river. The southern drainage basin has no stream or water body. The basin has been modified extensively through development and is now drained by a man-made storm drainage system.

Information from well data obtained from Connecticut Water Resource Bulletin No. 26 (Reference 1) indicates that a buried bedrock valley may occupy the water shed basin in the southern portion of the naval reservation. Well data indicates that the bedrock in this area is deepest at the

center of the basin. The valley becomes progressively deeper to the north, to a maximum of 92 feet below ground surface. The basin then thins somewhat past the center to 75 feet deep at the north end, adjacent to the Thames River. Well logs indicate that the southern-most section of the basin is partially filled with till changing to stratified drift material, consisting of layers of gravel, sand, silt and clay, proceeding northerly through the basin.

The bedrock underlying the Naval Reservation consists of metamorphic and intrusive rock of the Metacoke Formation, Hope Valley Alaskite Gneiss Formation and Potter Hill Granite Gneiss Formation all of proterozoic age. (Refence 2). These formations represent part of the extension of the Avalonian Anticlinorium, which underlies the southern and western corner of the State.

3.0 GROUND WATER AND SURFACE WATER CLASSIFICATIONS

The State of Connecticut has classified ground water at the U.S. Naval Reservation as GB/GA. Ground waters classified as GB/GA are presumed to be unfit for direct human consumption without treatment due to discharges, spills or leaks of chemicals, or from land use impact. The State's goal is to restore these ground waters to drinking water quality.

The Thames River in the vicinity of the site has been classified by the State of Connecticut as SC/SB. Surface waters classified as SC/SB are presently not meeting quality criteria for one or more designated uses. The goal of the State is to return these waters to class SB.

4.0 SCOPE OF WORK

In order to determine the magnitude and extent of possible environmental impacts of the underground tanks investigated, soil borings were conducted and monitoring wells installed in immediately vicinity of the tanks. These reports addresses items (7), (8), and (9) of our proposal dated 6/16/88, as amended.

Additionally, an overview of appropriate tank lining methodologies was performed. A summary of the overview is outlined in Appendix 7.

4.1 Subsurface Investigations

On July 22, 1989, soils samples were obtained at four locations adjacent to tank OT-4. Samples were collected continually at 2-foot intervals to the water table using a 24-inch split spoon sampler. The samples were screened in the field using a Foxboro Century Organic Vapor Analyzer (OVA).

Soil samples obtained immediately above the water table were placed in glass jars with teflon lined caps and submitted to a Connecticut certified laboratory for analysis of volatile aromatics, using EPA method 8020. Scanning for petroleum products using U.S. Coast Guard Method CG-D-52-77, was also performed.

Soil sample locations are indicated on Plate 1. Table 1 provies a list of sample locations, depth and OVA readings. Table 2 presents a list of sample location, sample depth and parameter level for those soils samples submitted for laboratory analysis. Laboratory reports and chain-of-custody forms are provided in Appendix 1.

TABLE 1

OVA READINGS
SOIL SAMPLES FROM TEST BORINGS
TANK OT-4

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

SAMPLE DEPTH	O.V.A. READING (ppm*)			
(FEET BELOW GROUND SURFACE)	TB-1	TB-2	TB-3	TB-4
0-2	ND	ND	ND	ND
2-4	ND	ND	ND	0.5 ppm
4-6	ND	ND	ND	0.5 ppm
6-8	ND	ND	ND	ND

ND - Valves are below detectable levels.

* Note values are given in ppm equivalence to methane.

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TABLE 2

LABORATORY ANALYSIS OF SOIL
SAMPLES FROM TEST BORINGS
TANK OT-4

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER 1989

SAMPLE LOCATION	DEPTH (feet)	PETROLEUM SCAN (mg/kg)	VOLATILE AROMATICS (mg/kg)
TB-1	6-8	ND	ND
TB-2	4-6	ND	ND
TB-3	6-8	ND	ND
TB-4	4-6	940	ND

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An investigation of soils was also conducted at monitor well locations in close proximity to underground storage tanks OT-7, OT-8, OT-9 and tank 54-H. Four monitor wells were placed near each tank, one in each quadrant, so as to detect any product that may have leaked from the tanks to the soil or ground water. The locations of monitor wells constructed in the upper base bare shown on Plate 1. Locations of monitor wells constructed on the lower base are shown on Plate 2. Soil samples were obtained at 5-foot intervals at each monitor well locations using a 24-inch split spoon sampler. All soil samples were screened in the field for volatile organic compounds using an OVA. Table 3 provides a list of sample location, depth and OVA reading.

4.2 Monitor Well Construction

A total of sixteen monitor wells were constructed within the unconsolidated deposits at localities in close proximity to tanks OT-7, OT-8, OT-9 and H. Locations of monitor wells MW-1 through MW-12 are provided on Plate 1. Locations of monitor wells MW-13 through MW-16 are provided on Plate 2.

The monitor wells were situated within the unconsolidated deposits so that approximately 5 feet of screen was placed into the saturated deposits with approximately 2 feet of screen remaining above.

Split spoons were decontaminated in the field before taking each soil sample to ensure proper quality control. Decontamination was undertaken by washing with detergent and water, rinsing in tap water, rinsing in 40 percent methanol solution and then rinsing a final time in deionized water.

TABLE 3

OVA READINGS
SOIL SAMPLES OBTAINED FROM
MONITOR WELL LOCATIONS
U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER 1989

MONITOR WELL* LOCATION	DEPTH (feet)	O.V.A. READING (ppm) **
MW-17	5-7	60
MW-7	10-12	4.3
MW-13	10-12	22
MW-14	10-12	800
MW-15	10-12	40
MW-16	10-12	410

* Note: Soils screened at all other locations were below detectable limits.

** Readings are given in ppm equivalence to methane.

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All monitor wells were constructed of 2-inch inside diameter schedule 40 PVC with No. 10 slotted screen. Well casings are composed of the same material and have equal nominal internal diameters. Screen and casing sections were joined using threaded couplings.

Bore holes for the monitor wells were excavated using a 3 7/8 inch inside diameter hollow stem auger.

A filter pack of New Jersey silica sand was installed in the annular space around the screen and continued to a height of 1 foot above the screen. The particle size of the filter pack was selected based on screen slot size and grain size of the unconsolidated deposits.

A 1-foot seal of bentonite pellets was placed on top of the filter pack. Bentonite grout or pellets were used to fill the annular space above the seal. A locking cap was then installed on the PVC well casing and covered with a 12 inch diameter steel curb box protector secured by 2 9/16-inch hex bolts. Both locking cap and steel protector were anchored into the ground in approximately 1 foot of concrete.

Concrete collars were placed around the steel curb box protectors covering monitor well MW-13, MW-14, MW-15 and MW-16 and reinforced with ASTM 185 welded wire fabric. These collars were reinforced as they were installed in the driveway and parking area in front of the fire house located on the lower base. The reinforced concrete collar design is detailed in the drawing presented in Appendix 4.

All down hole equipment and the entire working area of the drilling rig was steam cleaned before construction of each monitor well to ensure proper quality control.

Following completion, each monitor well was developed by pumping with a centrifugal pump and by bailing. Development was conducted in order to ensure a good hydraulic connection between the screened interval and aquifer was achieved.

Description and depths of materials encountered during well construction are provided in well logs in Appendix 2. Monitor well design and installation information is provided in the well logs and more specifically in well completion reports provided in Appendix 3.

4.3 Ground-Water Quality Sampling

Ground water was sampled at each monitor well location of July 12, 1989. Samples were obtained using stainless steel bailers with dedicated nylon cord. Approximately 3 monitor well volumes were evacuated prior to sampling to ensure that a representative ground-water sample was obtained.

Bailers were decontaminated in the field by washing in detergent and water, rinsing in tap water, rinsing in 40 present methanol solution and rinsing a final time in deionized water.

Ground-water samples obtained from each well were placed in containers and submitted to a certified laboratory for analysis for volatile aromatics, using EPA Method 8020 and screened for petroleum products using Coast Guard Petroleum Scan Method CG-D-52-77. A trip blank for

volatile aromatics was also submitted with the ground-water samples. Table 4 provides a list of samples locations and corresponding petroleum scan results for all ground-water samples in which petroleum products were detected. Table 5 provides an analysis for all ground-water samples in which volatile aromatic parameters were detected. Laboratory reports and chain-of-custody receipts of ground-water samples are presented in Appendix 5.

5.0 SITE GEOLOGY

The geology of the unconsolidated depostis at the site was established by obtaining soils sampels continuously at four locations near OT-4 and at five foot intervals at monitor well locations during well construction. Samples were obtained using a 24-inch split spoon sampler. Soil descriptions at depth are provided in the well logs presented in Appendix 2.

Well logs indicate that there exists a unit of light gray, fine to very fine sand and silt underlying a layer of dark brown, medium to coarse sand and gravel. The unit of gray fine sands and silt most likely represents lake bottom sediments which were depostied in this area prior to construction. The coarser mixed sands overlying the finer materials likely represent fill material brought to the area subsequent to tank construction.

In the lower base tank farm area, well logs indicate a change in material texture occurring between 7 and 10 feet below ground surface. The change from medium to coarse

TABLE 4

PETROLEUM SCAN ANALYSIS
GROUND-WATER SAMPLES
SAMPLING OF JULY 12, 1989

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER 1989

SAMPLE LOCATION*	PARAMETER	RESULT (mg/l)
MW-1	NO. 2 FUEL OIL	29
MW-6	NO. 2 FUEL OIL	5.0
MW-7	NO. 2 FUEL OIL	52
MW-9	NO. 2 FUEL OIL	10.6
MW-10	NO. 2 FUEL OIL	4.8
MW-11	NO. 2 FUEL OIL	14
MW-13	NO. 2 FUEL OIL	97
MW-14	NO. 2 FUEL OIL	1100
MW-15	NO. 2 FUEL OIL	750
MW-16	NO. 2 FUEL OIL	21

* Note: Soils obtained from all other monitor well locations were found to be below detectable limits.

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TABLE 5

VOLATILE AROMATIC ANALYSIS
GROUND WATER SAMPLES
SAMPLING OF JULY 12, 1989

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER 1989

LOCATION	PARAMETER	RESULT (ug/l)
MW-1	BENZENE	2.4
MW-5	BENZENE	2.2
MW-7	BENZENE	47
	TOLUENE	7.2
	EHYLBENZENE	55
	XYLENES	81
MW-13	TOLUENE	11
	XYLENES	9.6

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sand and gravel to coarse sand and fine gravel most likely represents a change from fill material to naturally deposited fluvial sediments. Bedrock was not encountered at any test boring or monitor well during the course of this investigation.

6.0 SITE HYDROLOGY

Depth to ground water below ground surface was measured at each monitor well location on August 24, 1989. Elevations of top of protector, top of casing and ground surface were surveyed and established relative to mean sea level. Ground-water elevations at these locations were then calculated and ground-water contours constructed. No ground-water measurements were made at monitor well locations MW-7 and MW-8 as water was found to have filled the manholes above the locking well cap. Monitor well MW-12 was found to be dry at the time of measurement.

Ground-water elevations, contours and flow lines of the upper base area are presented on the ground-water contour map in Plate 1. Plate 2 presents ground-water elevations, contours and flow lines in the area of tank 54-H, located in the lower base area.

Ground-water contours constructed in the upper base tank area indicate that ground-water flow is generally toward the north. Flow diverges slightly to the east and west near the center of the base. The divergence in flow lines is likely due to the drainage basin widening at this point.

Ground-water elevations calculated in the area of tank 54-H in the lower base are all essentially equal indicating that the study area is too small to accurately ascertain the ground-water gradient. Topographically this portion of the base slopes west and southwest towards the Thames River, therefore it is inferred that ground-water flows in this direction.

7.0 ANALYTICAL RESULTS

7.1 Soils

As indicated in Table 1, no organic vapors were detected in soil samples taken at test borings TB-1, TB-2 and TB-3. Soil samples collected at 2 to 4 feet and 4 to 6 feet depths at testing boring TB-4 showed readings of 0.5 parts per million (ppm) when screened with the OVA.

Table 2 shows that 940 milligrams per kilogram (mg/kg) of No. 2 fuel oil was present in the soil sample obtained at 4 to 6 feet at test boring TB-4. Soil samples at all other test boring locations showed no detectable levels of petroleum products. Volatile aromatics were below detectable limits in all soil samples obtained within proximity to this tank.

As indicated in Table 3, soil samples from the 10 to 12 foot interval at monitor well locations around tank 54-H all showed moderate to high levels of volatile organics. Field Screening of soil samples taken at this depth showed OVA readings of 22 ppm, 800 ppm, 40 ppm and 410 ppm at monitor well locations MW-13, MW-14, MW-15 and MW-16 respectively. Volatile organics were also detected in the soil near tank OT-8, at MW-7 at 5 to 7 and 10 to 12 foot depths. These samples yielded readings of 60 ppm and

4.3 ppm respectively, when screened with the OVA. No organic compounds were detected in soils at other monitor well locations when screened with the OVA.

7.2 Ground Water

During ground-water sampling an interface probe was used to measure water table height and to detect the presence of and the measure thickness of any floating product present above the water table. No floating product was found at any monitor wells investigated during this study.

No. 2. fuel oil was detected at one monitor well location in close proximity to Tank OT-7. Petroleum scan analysis of the ground-water sample obtained from monitor well MW-1 detected 29 milligrams per liter (mg/l) of No.2 fuel. Volatile aromatic analysis of this sample showed 2.4 ug/l benzene to be present as well. Ground-water contours in this area, as shown on Plate 1, indicate that MW-1 is situated downgradient of the tank. Therefore, tank OT-7 or appurtenances there to, constitute a likely source for this release.

No. 2 fuel oil was detected in the ground water near tank OT-8 at monitor wells MW-6 and MW-7 at 52 mg/l and 5.0 mg/l respectively. Benzene, toluene, ethylbenzene and xylenes were also detected in the ground-water sample from MW-7 at 47 micrograms per liter (ug/l), 7.2 ug/l, 55 ug/l and 81 ug/l respectively. No volatile aromatics were detected at other well locations constructed in proxomity to this tank.

No. 2 fuel was also detected in the ground water near tank OT-9. Water samples obtained from monitor wells MW-9, MW-10 and MW-11 showed levels of No. 2 fuel at 10.6 mg/l, 4.8 mg/l and 14 mg/l respectively. Monitor well MW-12 was

not sampled as it was found to be dry during this sampling event. No volatile aromatics were detected in ground water samples obtained from these wells.

Ground water sampled in proximity to Tank 54-H exhibited the highest concentrations of No. 2 fuel oil. Upgradient wells MW-13 and MW-15 showed concentrations of No. 2 fuel at 97 mg/l and 750 mg/l respectively. Monitor well MW-14 showed appreciably higher levels of No. 2 fuel oil at 1,100 mg/l. Monitor well MW-16 showed No. 2 fuel at 21 mg/l which is significantly lower than its corresponding upgradient well MW-13. Benzene and xylenes were detected at 11 ug/l and 9.6 ug/l respectively, at MW-13. No volatile aromatics were detected in ground water samples obtained from the other monitor wells located in proximity to this tank.

8.0 SUMMARY

An investigation of soils was made through test borings at locations in the immediate vicinity of underground storage tank OT-4. Soil samples were taken continuously at 2-foot intervals until ground water was encountered. Samples were screened in the field using an OVA and soil samples obtained immediately above ground water were submitted to a certified laboratory, analyzed for volatile aromatics and scanned for petroleum products.

Soils were also screened for volatile organic compounds, at sixteen monitor well locations constructed in close proximity to underground storage tanks OT-7, OT-8, OT-9 and tank 54-H. An investigation of the ground water in proximity to these tanks was also conducted.

Monitor wells were constructed to screen the upper portion of the aquifer at all locations. Ground-water samples were obtained from the monitoring wells and submitted to a certified laboratory for analysis of petroleum products and volatile aromatics.

Elevations of monitor well locations were established, depth to ground water measurements were made and ground-water contours were constructed.

9.0 CONCLUSIONS

Soil samples obtained near tank OT-4 indicate that No. 2 fuel oil is present in the soil at 940 mg/kg. No volatile aromatics were detected in the soils.

Field screening of soil samples at monitor well locations indicated that volatile organics are present in the soils at 5 to 7 feet and 10 to 12 feet at monitor well MW-7 and at 10 to 12 feet at monitor wells MW-13, MW-14, MW-15 and MW-16.

No floating product was found in any monitor well

Analysis of water samples indicated No. 2 fuel oil present in the ground water at monitor well locations MW-1, MW-6, MW-7, MW-9, MW-10, MW-11, MW-13, MW-14, MW-15 and MW-16. Volatile aromatics were detected in ground-water samples obtained from monitor wells MW-1, MW-5, MW-7 and MW-17.

Ground-water contours constructed from measurements at wells located in the upper base storage tank area indicate that ground-water flows in a general northward direction. Ground water flow in the vicinity of the lower base storage tank area investigated in this study is inferred to flow to the west southwest, toward the Thames River.

Therefore, contamination of the groundwater has occurred at the tank locations on the upper and lower base. The most significant contamination on the upper base was found at MW-7 (OT-8) while MW-14 registered the highest contaminant level of the lower base wells.

In reviewing the data, we find the levels of volatile organic contaminants are not great and no well exceeds the typical CT DEP criteria for groundwater quaility in a GB area. the typical criteria utilized is ten times the drinking water standard. The maximum contaminant level for benzene is 5 ppb, thus the criteria is 50 ppb. The benzene level quantified in MW-7 was 47 ppb. All remaining wells on the base were either well below the benzene criteria or had a non-detectable level of volatile organics. Overall, after 40 years of service there does not appear to have been significant impacts to the groundwater.

It is apparent however that some impact to the groundwater has occurred by petroleum products at the locations monitored. In the upper base area, we believe the contamination to be related to the storage of petroleum products in underground tanks and/or associated appurtenances. Data does not exist at this time to separate potential impacts from the tanks from impacts which could occur from piping or pump-house operations.

REFERENCES

1. Cervione, M.A.; Grossman, E.I.G.; Thomas, C.E., Jr.; Hydrologic Data for the Lower Thames and southeastern coastal Water Basins, 1968; Connecticut Water Resource Bulletin No. 16.

2. Rodgers, J.; Bedrock Geological Map of Connecticut, 1985; Connecticut Geological and Natural History Survey.

APPENDIX 1
SOIL SAMPLE
LABORATORY REPORTS

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER 1989

ALPHA ANALYTICAL LABORATORIES
Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

RECEIVED
JUL 10 1989
FUSS & O'NEILL, INC.

CERTIFICATE OF ANALYSIS

Client: Fuss & O'Neill

Address: 146 Hartford Road
Manchester, CT 06040

Attn: Chris Frey

Job Number: 891642

Invoice Number: 8170

Date In: 06/23/89

Date Reported: 07/07/89

Sample Description: Six soil samples

F&O Proj. #89-143 P25

REFERENCES:

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Revised March 1983.

4. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

Authorized by: Scott McLean
Scott McLean--Laboratory Director

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

TB-1
6 TO 8 FT

Client: Fuss & O'Neill

Sample Number: 891642.1

Analysis Requested: Volatile Aromatics (602) and Petroleum Scan

Date Received: 06/23/89

Date Reported: 07/07/89

Client Ident: 336980622-01
Sample Location: Groton, CT
Sample Description: Soil
Sample Container: Glass jar
Field Prep: None

# of Containers: 1

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Volatile Aromatics **	ND	ug/Kg	50	GC	1	8020	-----	06/29/89
Petroleum Scan	ND	mg/Kg	5	GC	4	----	-----	07/06/89

** Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

TB-2
4 TO 6 FT

Client: Fuss & O'Neill

Sample Number: 891642.2

Analysis Requested: Volatile Aromatics (602) and Petroleum Scan

Date Received: 06/23/89

Date Reported: 07/07/89

Client Ident: 336980622-02
Sample Location: Groton, CT
Sample Description: Soil
Sample Container: Glass jar
Field Prep: None

# of Containers: 1

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Volatile Aromatics **	ND	ug/Kg	50	GC	1	8020	———	06/29/89
Petroleum Scan	ND	mg/Kg	5	GC	4	———	———	07/06/89

** Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

TB-3
6 TO 8 FT

Client: Fuss & O'Neill

Sample Number: 891642.3

Analysis Requested: Volatile Aromatics (602) and Petroleum Scan

Date Received: 06/23/89

Date Reported: 07/07/89

Client Ident: 336980622-03
Sample Location: Groton, CT
Sample Description: Soil
Sample Container: Glass jar
Field Prep: None

# of Containers: 1

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Volatile Aromatics **	ND	ug/Kg	50	GC	1	8020	-----	06/29/89
Petroleum Scan	ND	mg/Kg	5	GC	4	----	-----	07/06/89

** Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

TB-4
4 TO 6 FT

Client: Fuss & O'Neill

Sample Number: 891642.4

Analysis Requested: Volatile Aromatics (602) and Petroleum Scan

Date Received: 06/23/89

Date Reported: 07/07/89

Client Ident: 336980622-04
Sample Location: Groton, CT
Sample Description: Soil
Sample Container: Glass jar
Field Prep: None

# of Containers: 1

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Volatile Aromatics **	ND	ug/Kg	50	GC	1	8020	----	06/29/89
Petroleum Scan								
Fuel Oil #2	940	mg/Kg	5	GC	4	----	----	07/06/89

** Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

VOLATILE AROMATICS by GC
Method 602 and 8020

PARAMETER

Benzene
Chlorobenzene
Ethylbenzene
Toluene
Xylenes
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene

Method Detection Limit: 50 ug/Kg

APPENDIX 2
GROUND WATER MONITOR WELL
DRILLING LOGS

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION
U. S. Naval Base New London
Groton, Connecticut

BORING NO. T-B-1
SHEET 1 **OF** 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION Tank OT-4
GROUND ELEVATION
DATE STARTED 6/22/89 **DATE FINISHED** 6/22/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ **HAMMER FALL (IN)** _____

WATER LEVEL MEASUREMENTS

DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A. * Reading FIELD TESTING	REMARKS
		1	0-2	24/24	3,5,5,4	Fine to V. Fine Sand Tan Brown			0 ppm	
		2	2-4	24/24	8,9,14,10	Med Sand, Little Gravel.			0 ppm	
		3	4-6	24/24	6,3,1,1	Medium to Fine Sand Tan Brown			0 ppm	
		4	6-8	24/24	2,0,0,1	medium to Fine Sand Tan Brown, Wet			0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note Readings given in ppm equivalence to methane

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. TB-2
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION Tank OT-4
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/22/89 DATE FINISHED 6/22/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A.* Reading FIELD TESTING	REMARKS
		1	0-2	24/24	1,3,5,6	Med. to Fine Sand, little gravel.			0 ppm	
		2	2-4	24/24	3,3,7,2	Med to Fine Sand, little gravel.			0 ppm	
		3	4-6	24/24	2,1,1,1	Med. to Fine Sand little gravel, Wet to Damp.			0 ppm	
		4	6-8	24/4	2,2,2,2	Med. to Coarse sand w/gravel Organic Matter, Wet.			0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note: Readings given in ppm equivalence to Methane

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. TB-3
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION Tank OT-4
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/22/89 DATE FINISHED 6/22/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A.* Reading FIELD TESTING	REMARKS
		1	0-2	24/24	1,5,5,5	Med. to Fine Sand, little gravel Tan Brown			0 ppm	
		2	2-4	24/4	5,4,2,1	Med. to Fine Sand, little gravel Tan Brown.			0 ppm	
		3	4-6	24/4	1,0,0,0	med to Fine Sand, Tan brown.			0 ppm	
		4	6-8	24/12	0,0,4,1	Fine to med gravel Stained Red.			0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note: Readings are made in ppm equivalence to Methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION: U. S. Naval Base - New London, Groton, Connecticut

BORING NO. TB-4
SHEET 1 OF 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION Tank OT-41
GROUND ELEVATION
DATE STARTED 6/22/89 DATE FINISHED 6/22/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS

DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A. Reading FIELD TESTING	REMARKS
		1	0-2	24/24	1,3,5,6	Fine to Med. Sand Dark Brown			0 ppm	
		2	2-4	24/24	7,11,4,4	Fine to V. Fine Sand light gray			0.5 ppm	
		3	4-6	24/24	1,2,1,1	Fine to V. Fine Sand light gray, wet			0.5 ppm	
		4	6-8	24/2	0001	Fine to V. Fine Sand Dark gray, wet			—	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: Readings are given in ppm equivalence to Methane

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION: U. S. Naval Base - New London, Groton, Connecticut

BORING NO. MW-1
SHEET 1 OF 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION N.W. Tank OT-7
GROUND ELEVATION
DATE STARTED 6/22/89 DATE FINISHED 6/22/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	PEN/REC.	BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A.* Reading FIELD TESTING	REMARKS
							medium to fine sand little gravel.	4 inch Fiberglass Stickup Flush Mount Curb Box. 1' Bentonite 2' 3' No. 10 Slotted Schedule 40 P.V.C. N.J. Sand Filter pack	0 ppm	
		1	5-7	24/18	5,5,4,5	Med. to fine sand, little gravel, end of spoon wet, Tan brown.				▽
		2	10-12	24/6	4,3,3,2	Medium to fine sand little gravel, light gray, wet.			0 ppm 10'	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note: Readings are made in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION: U. S. Naval Base - New London, Groton, Connecticut

BORING NO. MW-2
SHEET 1 OF 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION N. E. Tank OT-7
GROUND ELEVATION
DATE STARTED 6/26/89 DATE FINISHED 6/26/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS

DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA* Reading FIELD TESTING	REMARKS
								Cement 1' Bentonite 2' 2" SS Sch 40 PVC		
		1	5-7	24/24	2,1,1,0	Very fine Sand and Silt, light gray	Very fine Sand and Silt.	No. 10 Slotted PVC Screen; N.J. Silica Sand Filter Pack	0 ppm	▽
		2	10-12	24/24	1,0,0,1	Very fine Sand and Silt, little Clay			10' 0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note: O.V.A Readings are made in ppm equivalence to Methane

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. MW-3
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION S.E. Tank OT-7
GROUND ELEVATION
DATE STARTED 6/26/89 DATE FINISHED 6/26/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A.* Readings FIELD TESTING	REMARKS
							Very fine Sand and silt little clay	2" I.D. Schedule 40 PVC. Cement; Bentonite; 1'; 2'; 3'		
		1	5-7	24/24	1,1,1,3	Very fine sand and silt, little clay, wet light gray			0 ppm	
		2	10-12	24/24	1,2,1,2	Very fine sand and silt little clay, light gray wet.		No. 10 Slotted Screen, Schedule 40 PVC; 10'	0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note: Readings are given in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. MW-4
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-1413/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION S.W. Tank OT-7
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/26/89 DATE FINISHED 6/26/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA* Reading FIELD TESTING	REMARKS
								2" I.D. Schedule 40 PVC	Cement 1' Bentonite 2'	
		1	5-7	24/24	1,2,1,2	Med. to Coarse Sand, little gravel. Tan Brown, wet	Med. to Coarse Sand, little gravel	No. 10 Slotted Schedule 40 PVC Screen; N.J. Sand Filter Pack 3'	0 ppm	
		2	10-12	24/2	2,2,2,2	Med. to Coarse Sand little gravel. Tan Brown, Wet.			0 ppm 10'	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
* Note: Readings are given in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. MW-5
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION N.E. Tank OT-8
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/26/89 DATE FINISHED 6/26/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Reading FIELD TESTING	REMARKS
								Cement 1'		
								2" I.D. Schedule 40 PVC; Bentonite Pellets 3'		
		1	5-7	24/24	1,1,1,1	Very fine sand and silt Dark Gray, moist.	Very fine sand and silt.	5'	0 ppm	
		2	10-12	24/24	1,1,1,1	Very fine sand and silt Dark Gray, moist.		No slotted screen; Silica Sand Filter Pack	0 ppm	
		3	15-17	24/24	2,4,7,5	Med. to coarse sand, some fine gravel, wet Tan Brown	Med. Sand some fine gravel	10'	0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA Readings are made in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION: U. S. Naval Base New London, Groton, Connecticut

BORING NO. MW-6
SHEET 1 OF 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION S. E. Tank OT-8
GROUND ELEVATION
DATE STARTED 6/26/89 DATE FINISHED 6/26/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	Q. V. A Reading FIELD TESTING	REMARKS
							Very fine sand and silt, Dark gray.	2" I.D. Schedule 40 PVC; Cement Bentonite		
		1	5-7	24/24	1,2,1,2	Very fine sand and silt, Dark gray		No. 10 Slotted P.V.C. Screen; N.J. Silica Sand Filter Pack	0 ppm	▽
		2	10-12	24/3	1,0,0,0	Very fine sand and silt, Dark gray			0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION: U. S. Naval Base New London, Groton, Connecticut

BORING NO. MW-7
SHEET 1 OF 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION S.W. Tank OT-7
GROUND ELEVATION
DATE STARTED 6/27/89 DATE FINISHED 6/27/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Reading FIELD TESTING	REMARKS
								Cement		
								1'		
								Bentonite		
								2" ED Sch 40 PVC	2'	
								3'		
		1.	5-7	24/3	1,1,00	Very fine sand and silt. Dark gray. Wet Strong odor	Very fine sand and silt.	No. 10 Slotted PVC Screen; N.J. Silica Filter Pack	60ppm	
		2.	10-12	24/14	5,10,40+	Very fine sand and silt. Dark gray Wet			10' 4.3ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA Readings are made in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	
U. S. Naval Base - New London	BORING NO. MW-8
Groton, Connecticut	SHEET 1 OF 1
	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION N. W. TANK OT-8
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/27/89 DATE FINISHED 6/27/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Reading FIELD TESTING	REMARKS
								2" I.D. Sch 40 PVC	Cement 1'	
									Bentonite 2'	
		1	5-7	24/4	0,0,0,0	Fine Sand and Silt Tan brown. wet.	Fine Sand and Silt Tan brown	No. 10 Slotted PVC Screen; N.J. Silica Sand Filter Pack	0 ppm	
		2	10-12	24/4	0,0,0,0	Very fine sand and silt, Dark gray, organics wet	Very fine Sand and Silt Dark gray.		0 ppm 10'	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:

Note: OVA Readings are made in ppm equivalence to methane

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	
U. S. Naval Base · New London	BORING NO. MW-9
Groton, Connecticut	SHEET 1 OF 1
	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION N.E. Tank OT-9
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/27/89 DATE FINISHED 6/27/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. _____ HAMMER FALL (IN) _____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS (OVA Readings)	FIELD TESTING	REMARKS
								2" ID Schedule 40 PVC; Cement; Bentonite 2'		
		1.	5-7	24/4	1,1,1,0	Fine to med. Sand, little fine gravel Tan brown moist.	Fine to med. Sand, little fine gravel · Tan brown	PVC Screen No. 10 Slotted; U.S. Silica Sand Filter Pack 3'	0ppm	
		2	10-12	24/24	0,0,0,0	Fine to very fine Sand, light gray, organics wet	Fine to V. fine Sand · Light gray		10' 0ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA Readings are given in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	
U. S. Naval Base - New London	BORING NO. MW-10
Groton, Connecticut	SHEET 1 OF 1
	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION S.W. Tank OT-9
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/27/89 DATE FINISHED 6/27/89

DRILLING METHOD Hollow-Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	FIELD TESTING	REMARKS
								2" I.D. Schedule 40 PVC	Cement 1' Bentonite 2'	
		1.	5-7	24/20	2,1,1,1	Very fine sand and silt, little fine gravel light gray moist.	Very fine sand and silt.	No. 10 Slotted PVC Screen; N.J. Silica Sand Filter Pack	0 ppm	
		2	10-12	24/24	0,0,1,1	Very fine sand and silt light gray, organics wet.			0 ppm 10'	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION
U. S. Naval Base - New London
Groton, Connecticut

BORING NO. MW-11
SHEET 1 **OF** 1
JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc.
DRILLER M. M.
FUSS & O'NEILL REPRESENTATIVE C. Frey

BORING LOCATION S.E. Tank OT-9
GROUND ELEVATION
DATE STARTED 6/28/89 **DATE FINISHED** 6/28/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. **HAMMER FALL (IN)**

WATER LEVEL MEASUREMENTS

DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Reading FIELD TESTING	REMARKS
								2" I.D. Schedule 40 PVC; Cement 1'; Bentonite 2'		
		1	5-7	24/12	1,1,1,1	Very Fine to Fine Sand and silt, light gray, wet		No. 10 Slotted PVC Screen; NJ Silica Sand Filter Pack	0ppm	V
		2	10-12	24/9	1,1,1,1	Very Fine to Fine Sand and silt, light gray, wet.			10' 0ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS:
Note: OVA Readings are given in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. MW-12
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION N.W. of Tank OT-9
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/28/89 DATE FINISHED 6/28/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Readings FIELD TESTING	REMARKS
								2" ID Schedule 40 PVC	Cement 1' Bentonite 2'	
		1	5-7	24/18	6,6,6,9	Medium to coarse sand and gravel Dark Brown, wet at Tip.		No. 10 Slotted PVC Screen; N.J. Silica Sand Filter pack	0 ppm	
		2	10-12	24/24	5,5,5,5	Very fine sand and silt, light gray, wet Wet			10' 0 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA readings are made in ppm equivalence to Methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	
U. S. Naval Base - New London	BORING NO. MW-13
Groton, Connecticut	SHEET 1 OF 1
	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION S.E. of Tank H
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/28/89 DATE FINISHED 6/28/89
DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Readings FIELD TESTING	REMARKS
								Schedule 40 PVC 2" I.D.	Cement 1' Bentonite 2'	
		1	5-7	24/18	2,2,1,2	Med. Sand Some Fine gravel. Dark brown, moist.	Med. Sand, Some Fine gravel	No. 10 Slotted PVC Screen; N.J. Silica Sand Filter Pack	0 ppm	▽
		2	10-12	24/3	4,6,4,3	Fine to coarse Sand and gravel, Tan brown Moist, Strong diesel Odor	Fine to Coarse Sand and gravel		10' 22 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA reading are reads in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	
U. S. Naval Base - New London	BORING NO. MW-14
Groton, Connecticut	SHEET ____ OF ____
	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION S.W. Tank H
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/28/89 DATE FINISHED 6/28/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. ____ HAMMER FALL (IN) ____

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	O.V.A. Reading FIELD TESTING	REMARKS
		1	5-7	24/3	4,4,4,3	Med. To Coarse sand and fine to med gravel. Dark brown, moist.	Med to Coarse Sand and gravel	2" I.D. Schedule 40 PVC; Cement 1'; Bentonite 2'; No. 10 Slotted PVC Screen; U.S. Silica Sand Filter Pack	0ppm	
		2	10-12	24/18	1,4,4,1	Coarse sand and fine gravel. Dark gray. Strong petroleum smell	Coarse sand and fine gravel		10' 800ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: O.V.A. readings are given in ppm equivalence to methane

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. MW-15
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION N.E. of Tank H
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/28/89 DATE FINISHED 6/28/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Readings FIELD TESTING	REMARKS
								2" I.D. Schedule 40 PVC; Cement; Bentonite		
		1	5-7	24/4	3,3,4,3	Fine to Med. Sand and gravel. Dark Brown moist.	Fine to Med Sand and gravel	Nº. 10 Slotted PVC Screen; U.S. Silica Sand Filter Pack	0 ppm ▽	
		2	10-12	24/24	3,8,9,9	Coarse Sand and gravel. Dark gray, wet. Strong petroleum odor.	Coarse Sand and gravel.		10' 40 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA Readings are presented in ppm equivalence to methane.

BORING NO.

FUSS & O'NEILL, INC.
MANCHESTER, CT 06040
CONSULTING ENGINEERS

PROJECT/LOCATION	BORING NO. MW-16
U. S. Naval Base - New London	SHEET 1 OF 1
Groton, Connecticut	JOB. NO. 87-143/25

DRILLING CO. Connecticut Test Borings Inc. BORING LOCATION N.W. of Tank 14
DRILLER M. M. GROUND ELEVATION
FUSS & O'NEILL REPRESENTATIVE C. Frey DATE STARTED 6/28/89 DATE FINISHED 6/28/89

DRILLING METHOD Hollow Stem Auger
SAMPLING METHOD Split Spoon / Auto Hammer
HAMMER WT. HAMMER FALL (IN)

WATER LEVEL MEASUREMENTS			
DATE	MS. PT.	WATER AT	HR AFTER COMPLETION

DEPTH (ft.)	CASING blows/ft	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE PEN/REC.	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHANGE/ GEN. DESCRIP.	WELL CONST. DETAILS	OVA Readings FIELD TESTING	REMARKS
								Cement		
								2" I.D. Schedule 40 PVC	1'	
								Bentonite	2'	
		1	5-7	24/24	3,3,4,4	Fine to med. sand and gravel. Dark brown		No. 10 Slotted Screen Schedule 40 PVC; U.S. Silica Sand Filter Pack	0 ppm	▽
		2	10-12	24/24	4,5,3,3	Coarse sand and fine gravel. Strong ~~diesel~~ diesil odor.			10' 410 ppm	

PROPORTIONS USED	
TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

BORING METHOD	DEPTH

REMARKS: Note: OVA readings are given in ppm equivalence to methane

BORING NO.

APPENDIX 3
GROUND WATER MONITORING WELL COMPLETION REPORTS

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-1

Date of Completion: 06/22/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Northwest of Tank OT-7

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 22.33

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.92

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-1

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

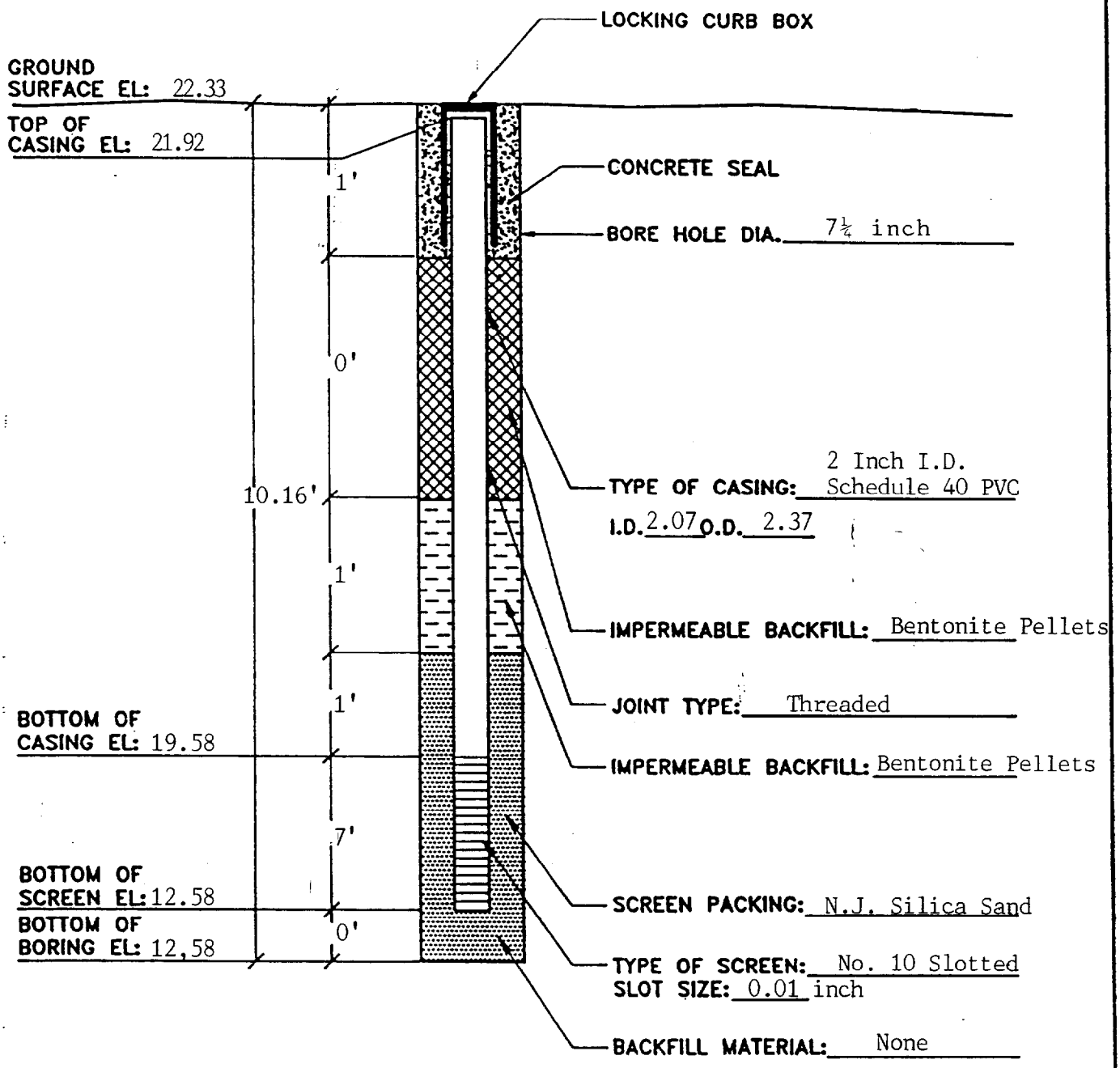
Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

FORMMW-1D

WELL NO. MW-1



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-2

Date of Completion: 06/26/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Northeast of Tank OT-7

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 22.33

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.84

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-2

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

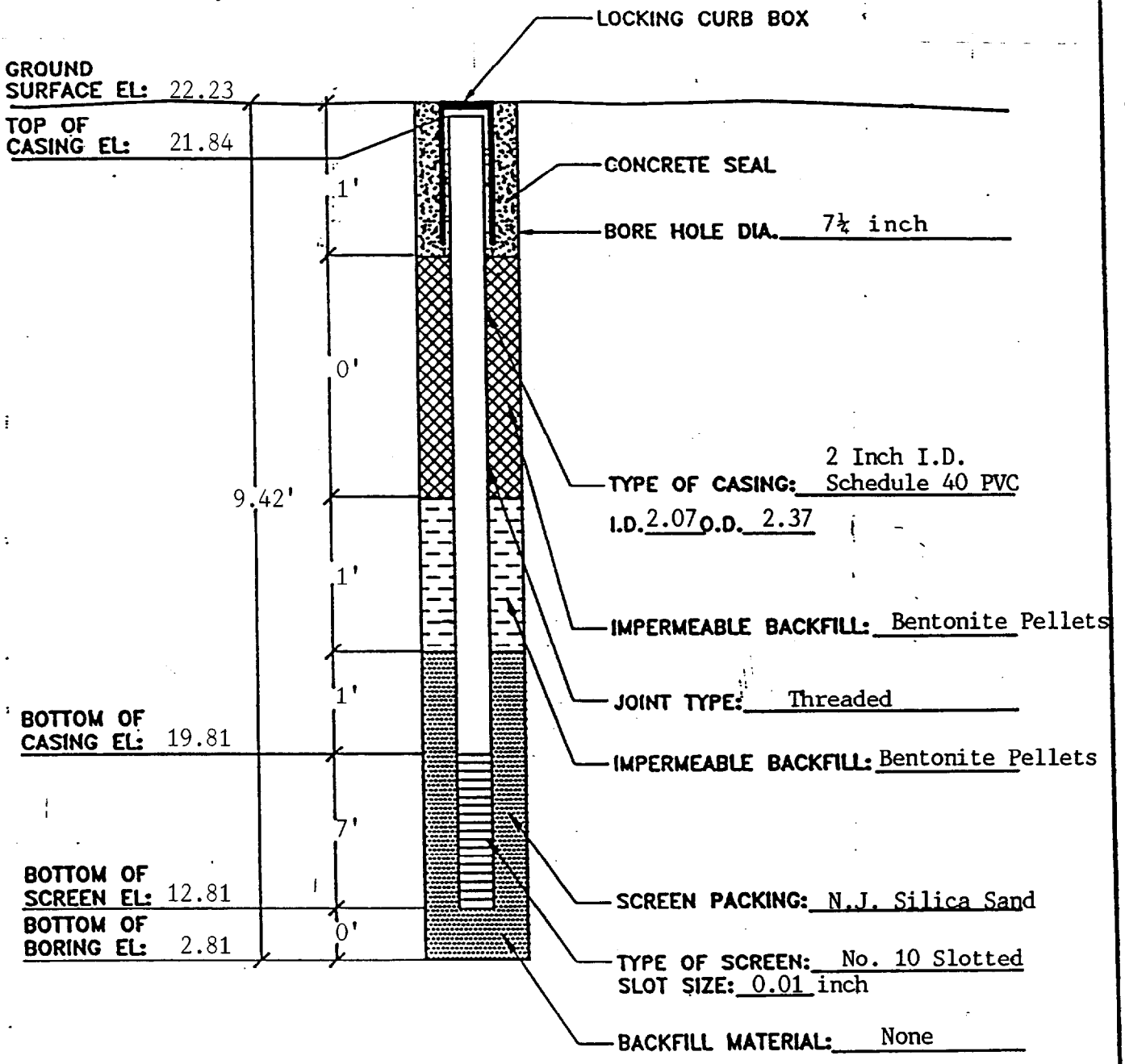
Inferred relationship to plume: _____ Within __X__ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-2



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-3

Date of Completion: 06/26/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southeast of Tank OT-7

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 21.83

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.56

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes _____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

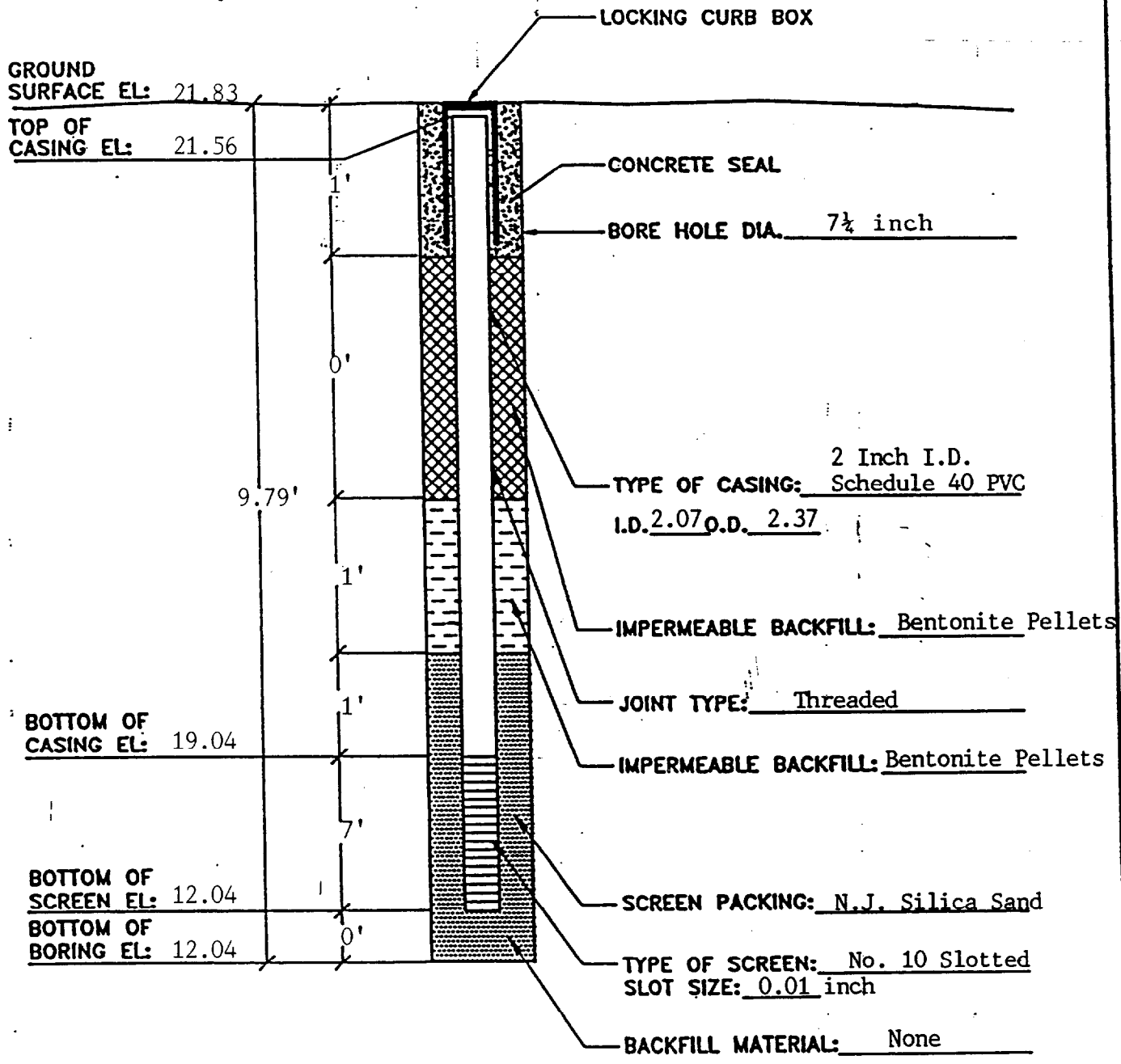
Inferred relationship to plume: _____ Within __X__ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. mw-3



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-4

Date of Completion: 06/26/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southwest of Tank OT-7

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 22.83

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 22.33

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-4

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

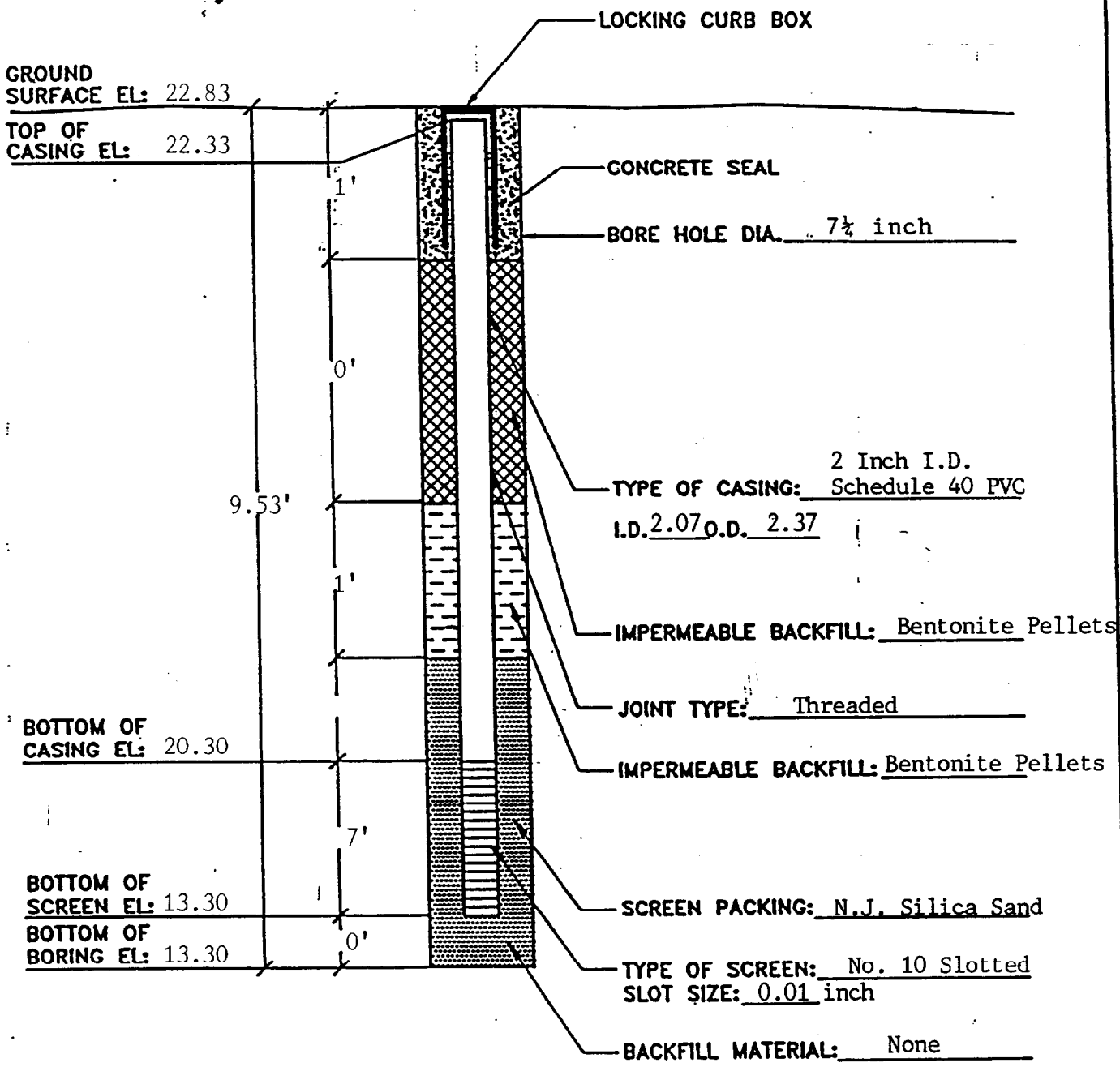
Inferred relationship to plume: _____ Within __X__ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-4



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-5

Date of Completion: 06/26/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Northeast of Tank OT-8

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 22.00

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.35

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-5

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes _____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

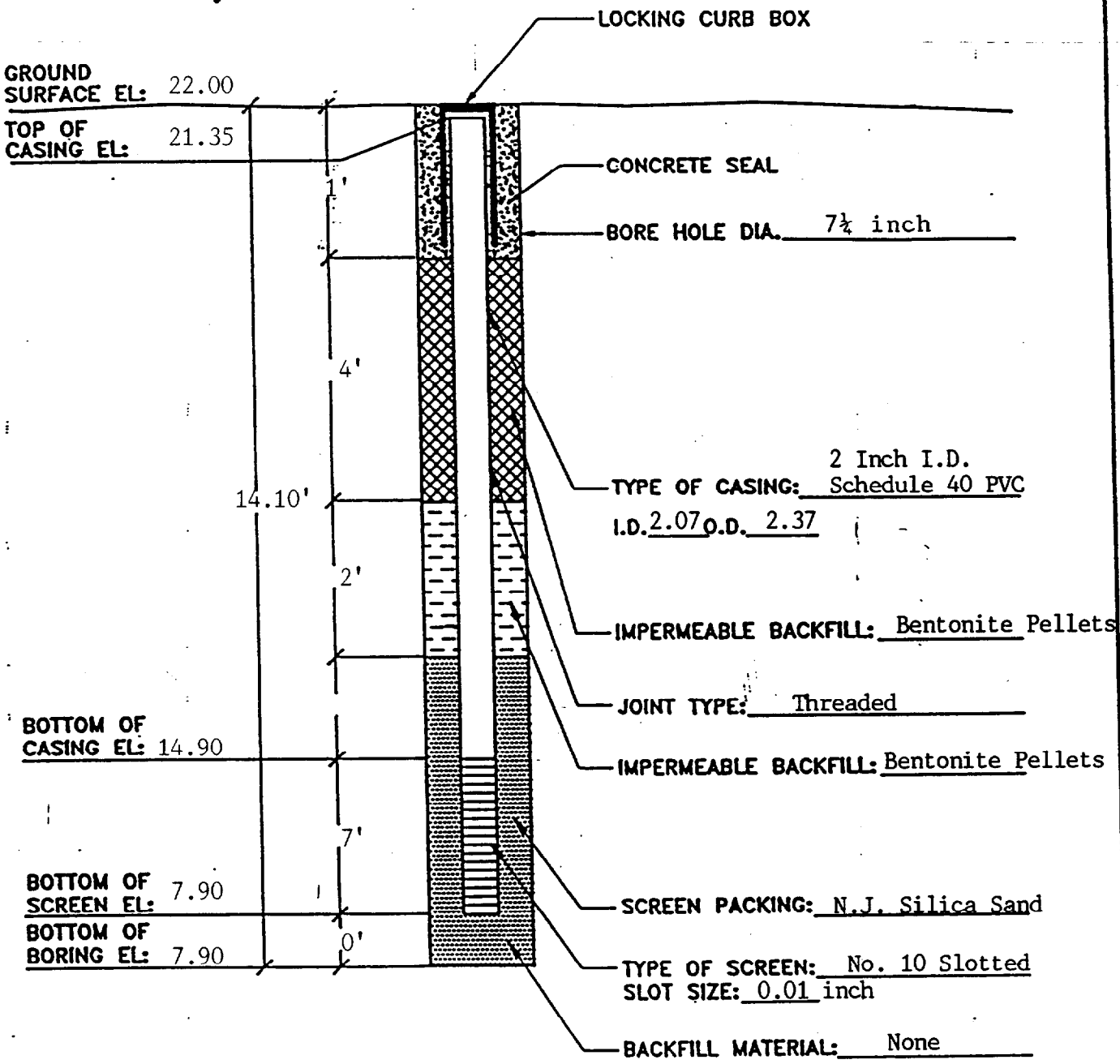
Inferred relationship to plume: _____ Within __X__ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-5



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-6

Date of Completion: 06/26/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southeast of Tank OT-8

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 22.30

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.89

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-6

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

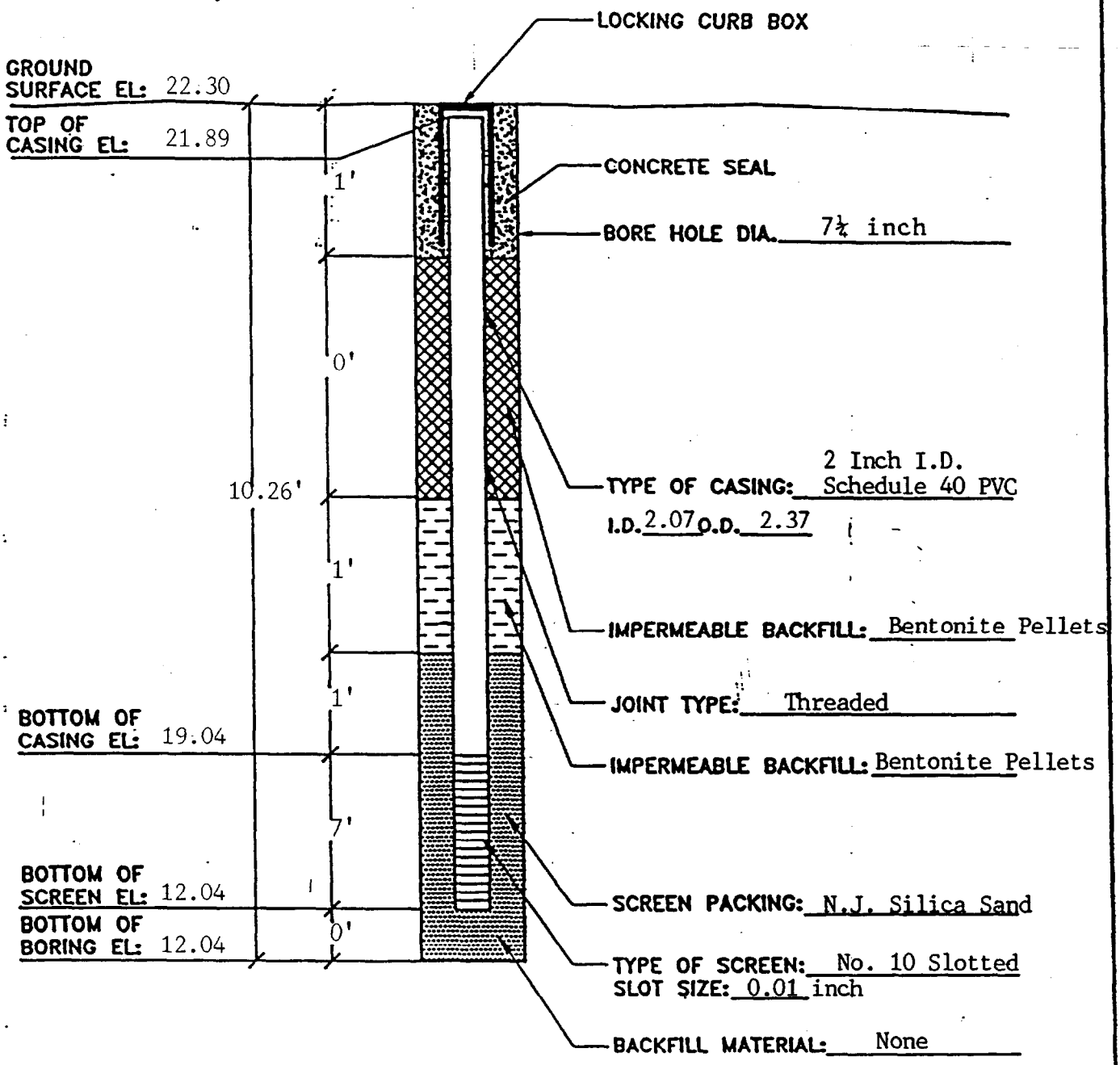
Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-6



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-7

Date of Completion: 06/26/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southwest of Tank OT-8

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 21.90

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.49

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap

Impermeable backfill: Bentonite

FORMMW-1D

MW-7

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

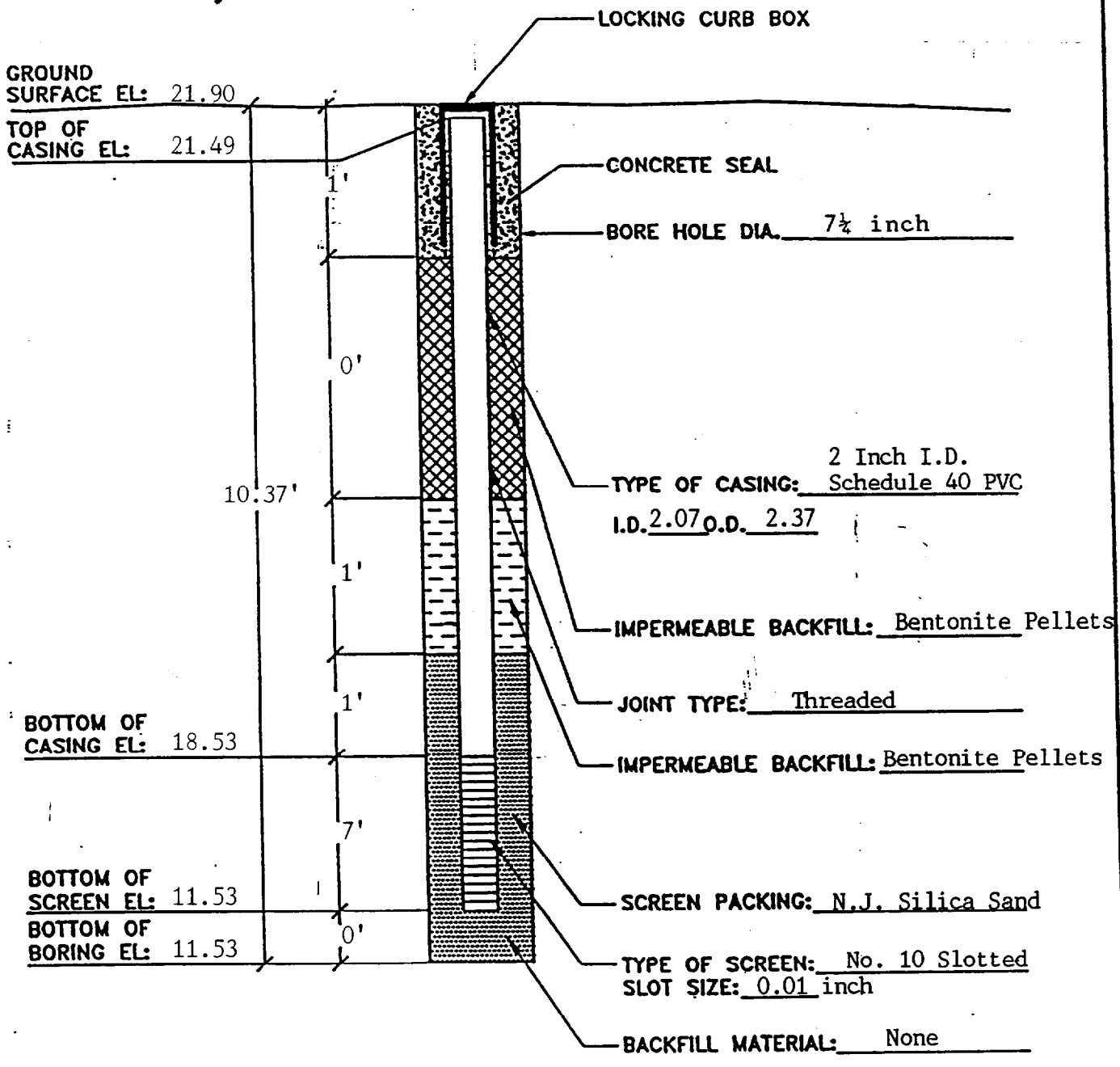
Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-7



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-8

Date of Completion: 06/27/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Northwest of Tank OT-8

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 21.90

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.56

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap

Impermeable backfill: Bentonite

FORMMW-1D

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

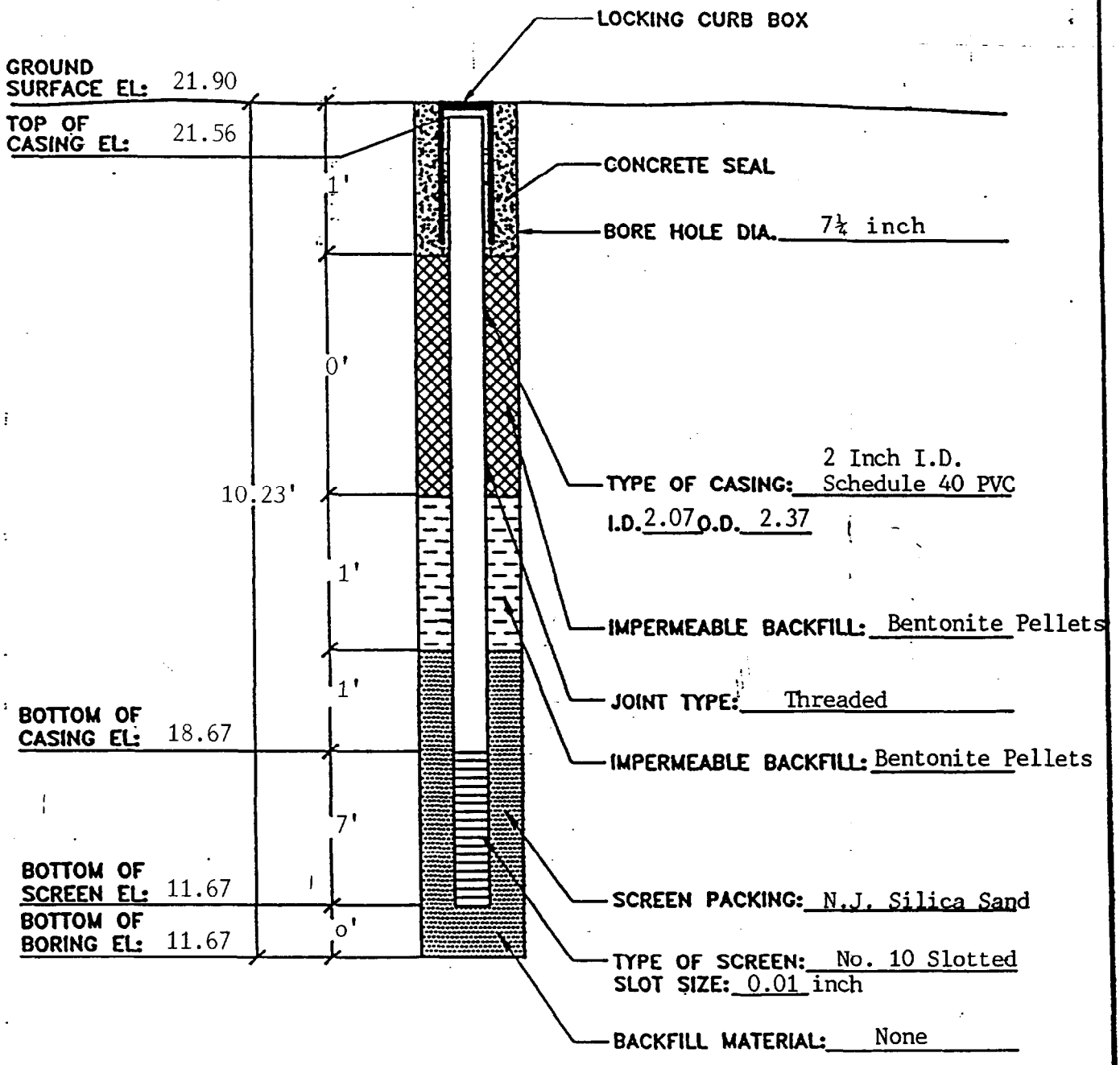
Inferred relationship to plume: _____ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-8



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September 1988 SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-9

Date of Completion: 06/27/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Northeast of Tank OT-9

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 21.88

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.57

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap

Impermeable backfill: Bentonite

_____ _____

FORMMW-1D

MW-9

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

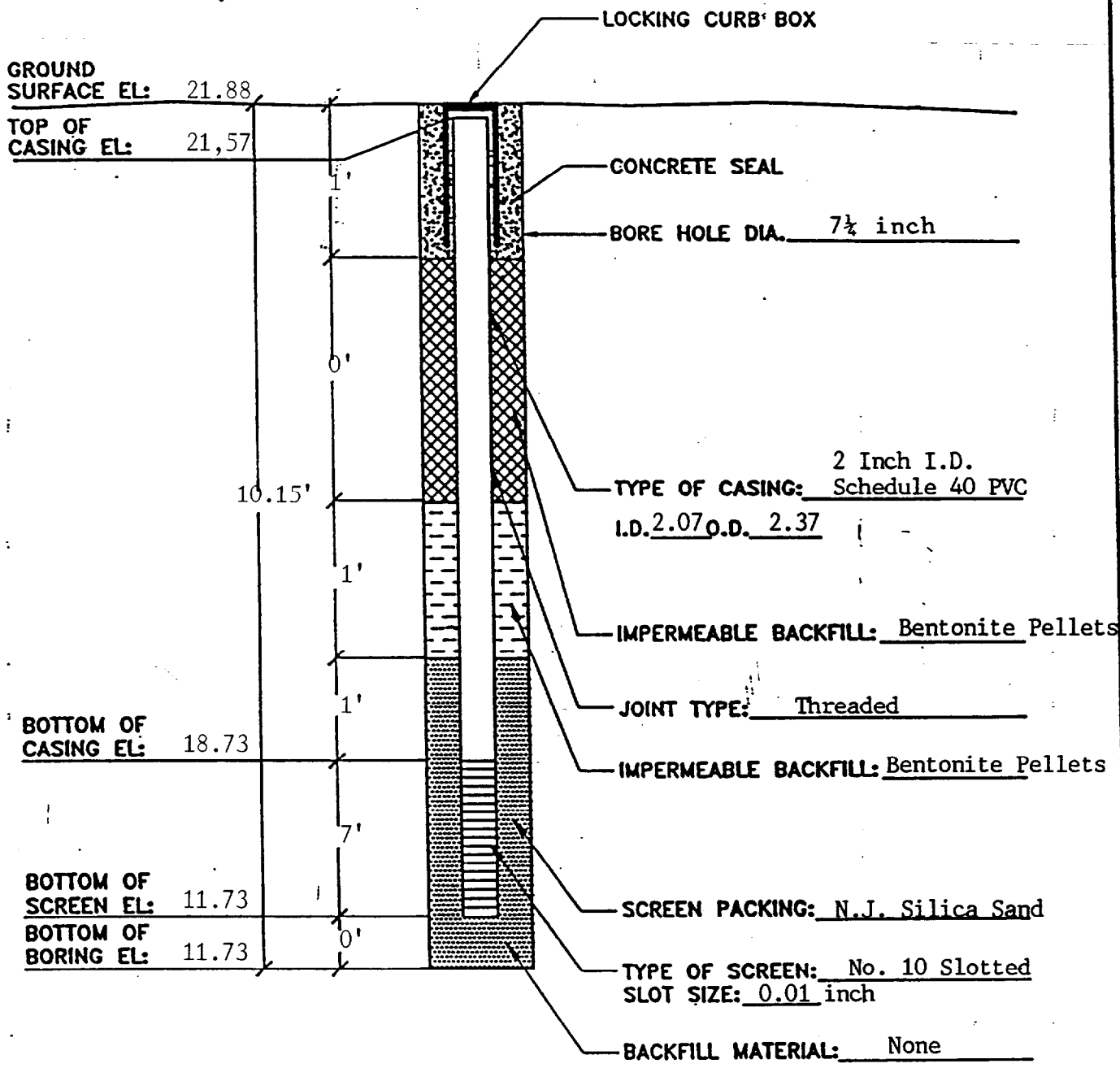
Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-9



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-10

Date of Completion: 06/27/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southwest of Tank OT-9

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 22.88

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 22.50

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-10

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

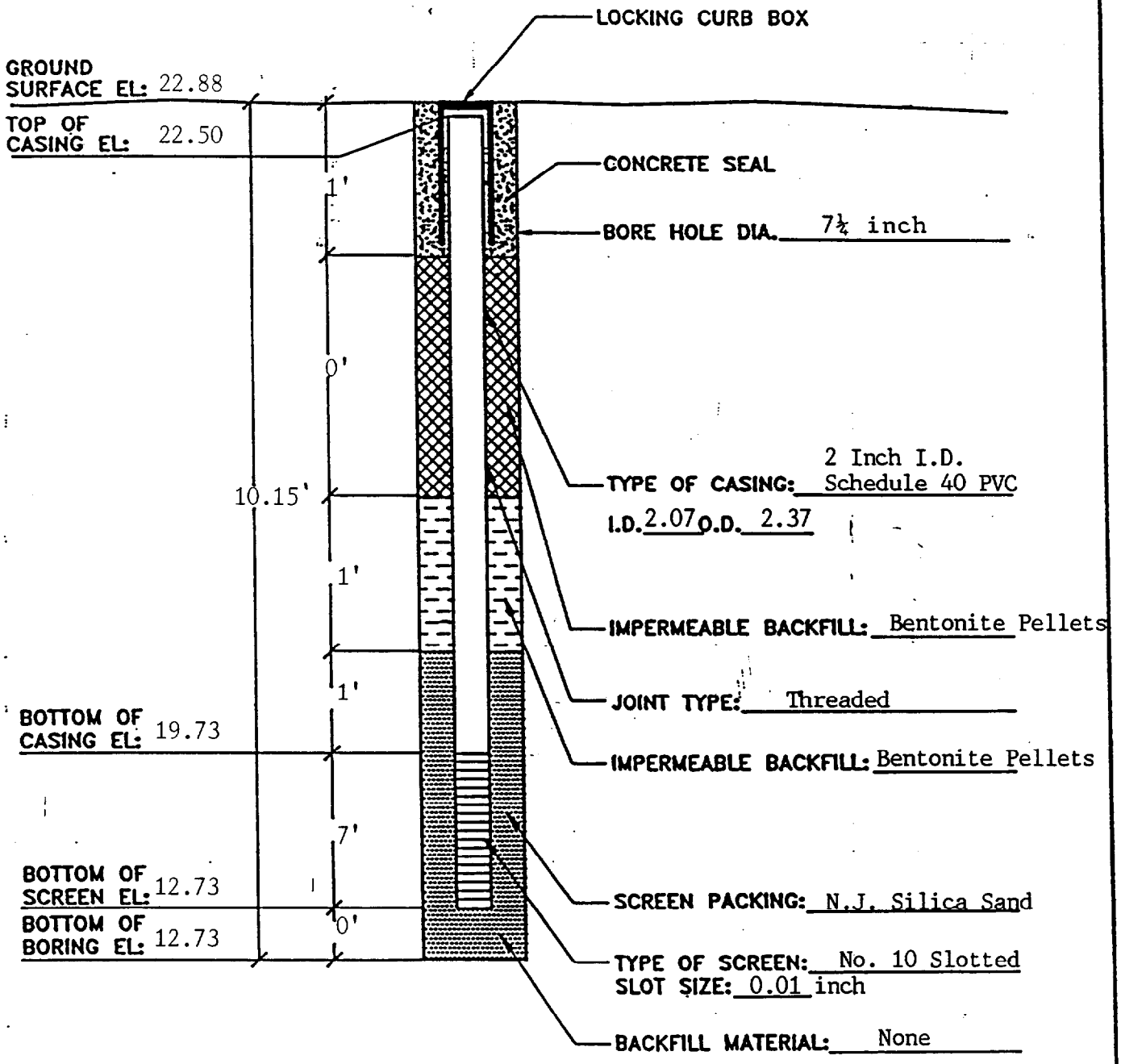
Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-10



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-11

Date of Completion: 06/28/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southeast of Tank OT-9

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 21.48

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 21.12

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap

Impermeable backfill: Bentonite

FORMMW-1D

MW-11

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

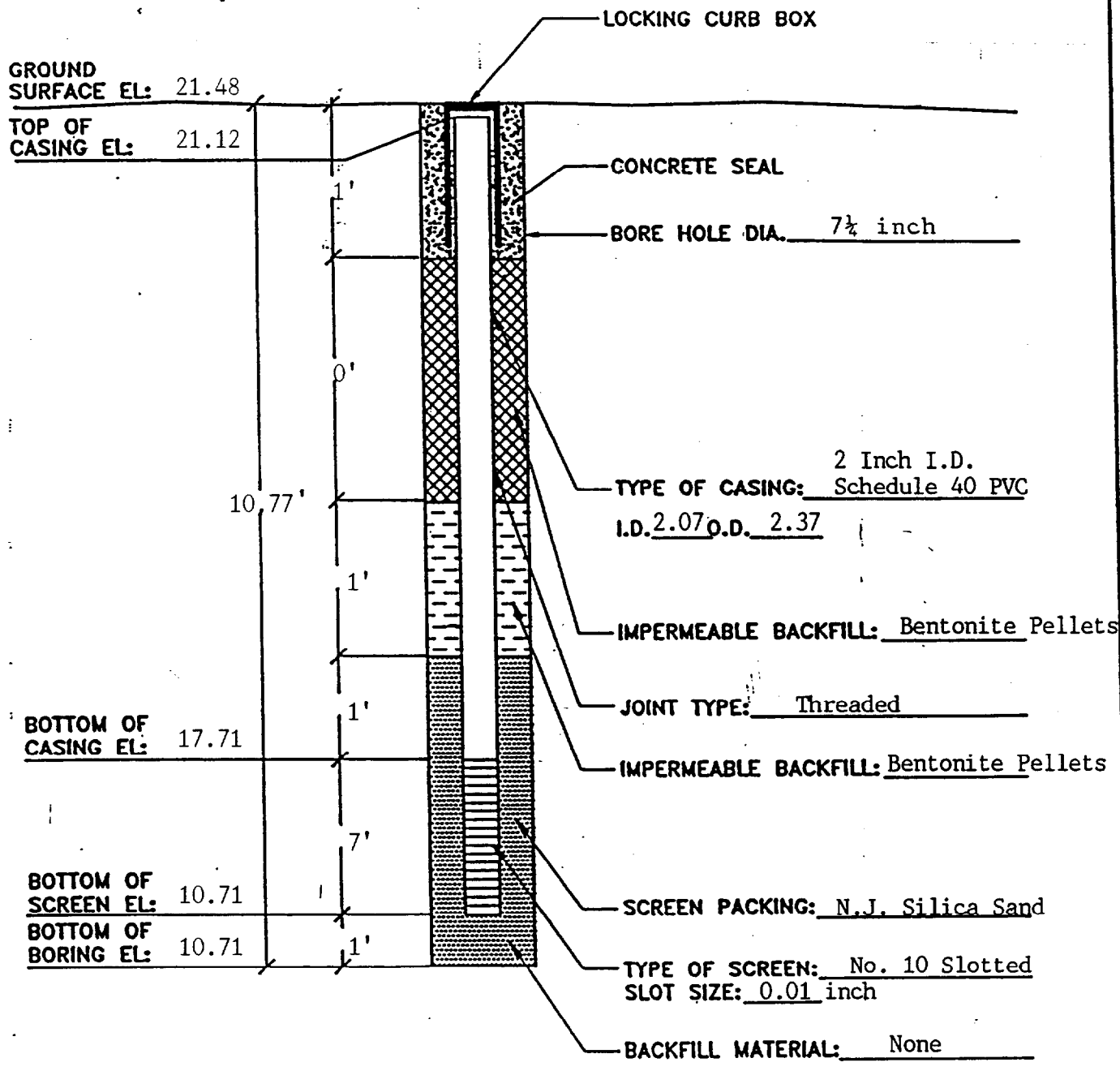
Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-11



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-12

Date of Completion: 06/28/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Northwest of Tank OT-9

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 27.88

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 27.62

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap
_____ _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-12

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes _____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

Inferred relationship to plume: _____ Within _____ Outside _____ Edge Unknown

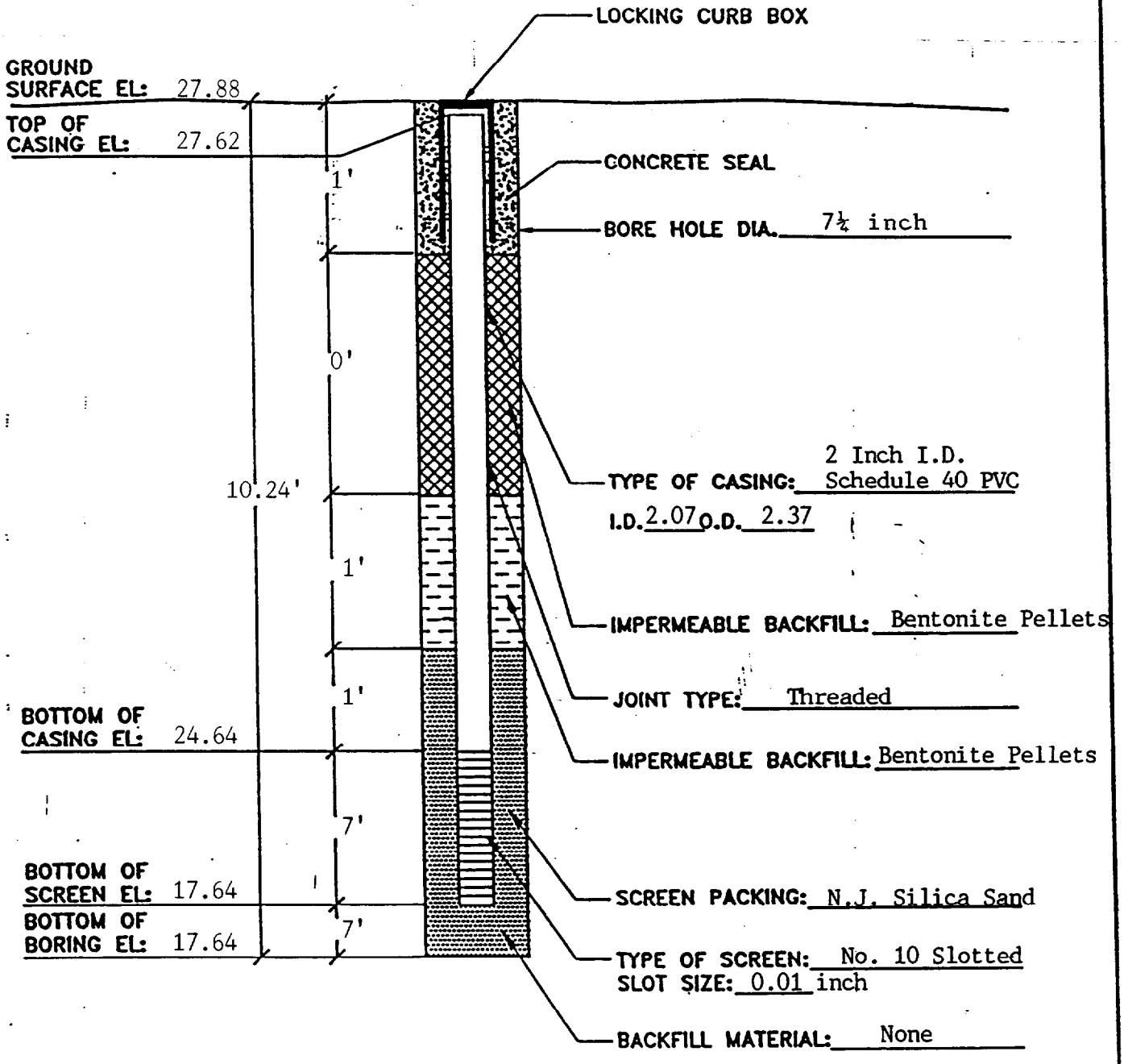
Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

FORMMW-1D

WELL NO. MW-12

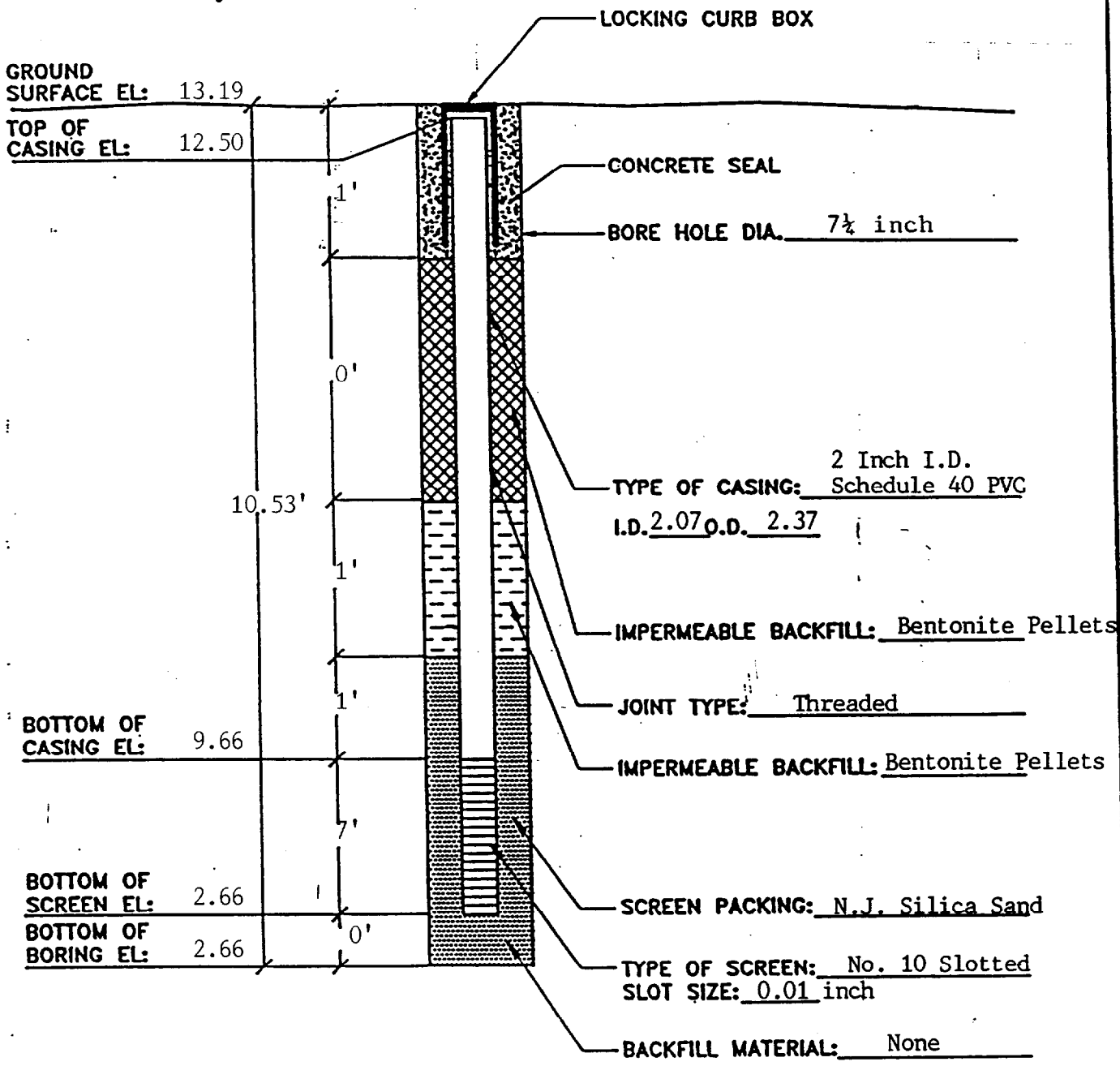


WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

WELL NO. MW-13



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-13

Date of Completion: 06/28/89

DEP/WPC I.D. No.:

Monitoring Point Location
(relative to site features): Southeast of Tank H

Drilling Contractor: CT Test Borings

Supervising Engineer/Geologist: Chris Frey

Well Construction Method: Hollow Stem Auger

WELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 13.19

Well depth below ground surface:

Refusal: ____ Yes __X__ No

Top of casing elevation (MSL): 12.50

Screened interval: 3 to feet Below Ground Suface

Length of Screen: 7 feet

Length of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.01 inch

Filter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

Well casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

Method of well development:
Pump and Bailer

Time spent developing: 1/2 hr

Locking X or threaded cap

Impermeable backfill: Bentonite

FORMMW-1D

MW-13

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes _____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

Inferred relationship to plume: __X__ Within _____ Outside _____ Edge

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

FORMMW-1D

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

ɔwn: Groton, Connecticut

Site: U.S. Naval Reservation

"ɔnitoring Point I.D. No.: MW-14

Date of Completion: 06/28/89

DEP/WPC I.D. No.:

ɔnitoring Point Location
(relative to site features): Southwest Tank 54-H

rilling Contractor: CT Test Borings

Supervising Engineer/Geologist: C. Frey

Well Construction Method: Hollow Stem Auger

ɛLL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 12.95

Well depth below ground surface:

Refusal: _____ Yes __X__ No

"ɔp of casing elevation (MSL): 12.68

Screened interval: 3-10 feet Below Ground Suface

Length of Screen: 7 feet

ɜngth of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.010 inch

ɪlter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

ɜll casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

ɜthod of well development:
Pump and Bailer

Time spent developing: 1/2 hr.

Locking __X__ or threaded cap _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-14

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes ____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

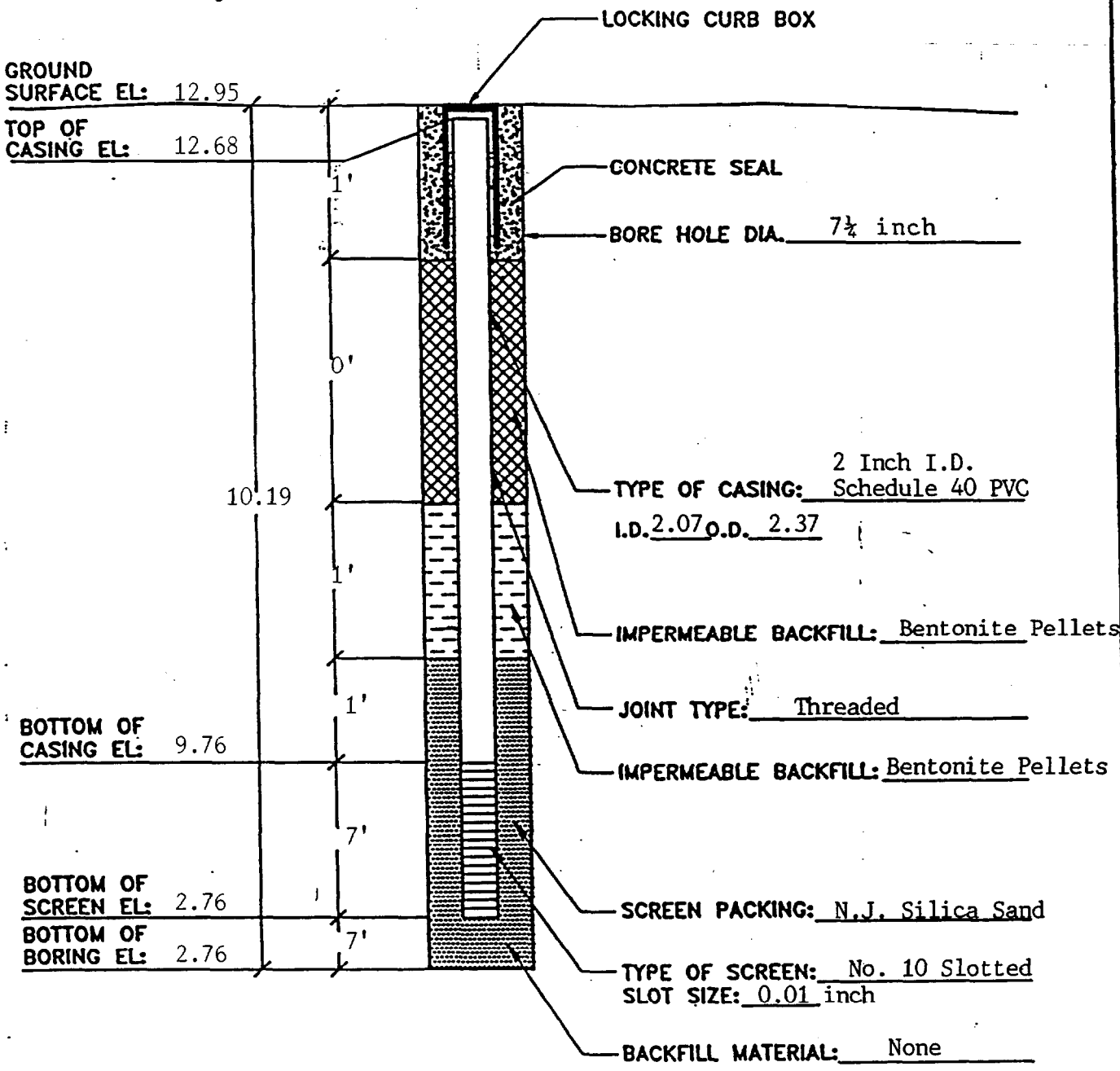
Inferred relationship to plume: __X__ Within _____ Outside _____

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-14



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

.own: Groton, Connecticut

Site: U.S. Naval Reservation

onitoring Point I.D. No.: MW-15

Date of Completion: 06/28/89

DEP/WPC I.D. No.:

onitoring Point Location
(relative to site features): Northwest Tank 54-H

rilling Contractor: CT Test Borings

Supervising Engineer/Geologist: C. Frey

Well Construction Method: Hollow Stem Auger

ELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 13.33

Well depth below ground surface:

Refusal: _____ Yes __X__ No

op of casing elevation (MSL): 12.68

Screened interval: 3-10 feet Below Ground Suface

Length of Screen: 7 feet

ength of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.010 inch

.ilter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

Well inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

ell casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

ethod of well development:
Pump and Bailer

Time spent developing: 1/2 hr.

Locking __X__ or threaded cap _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-15

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes _____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

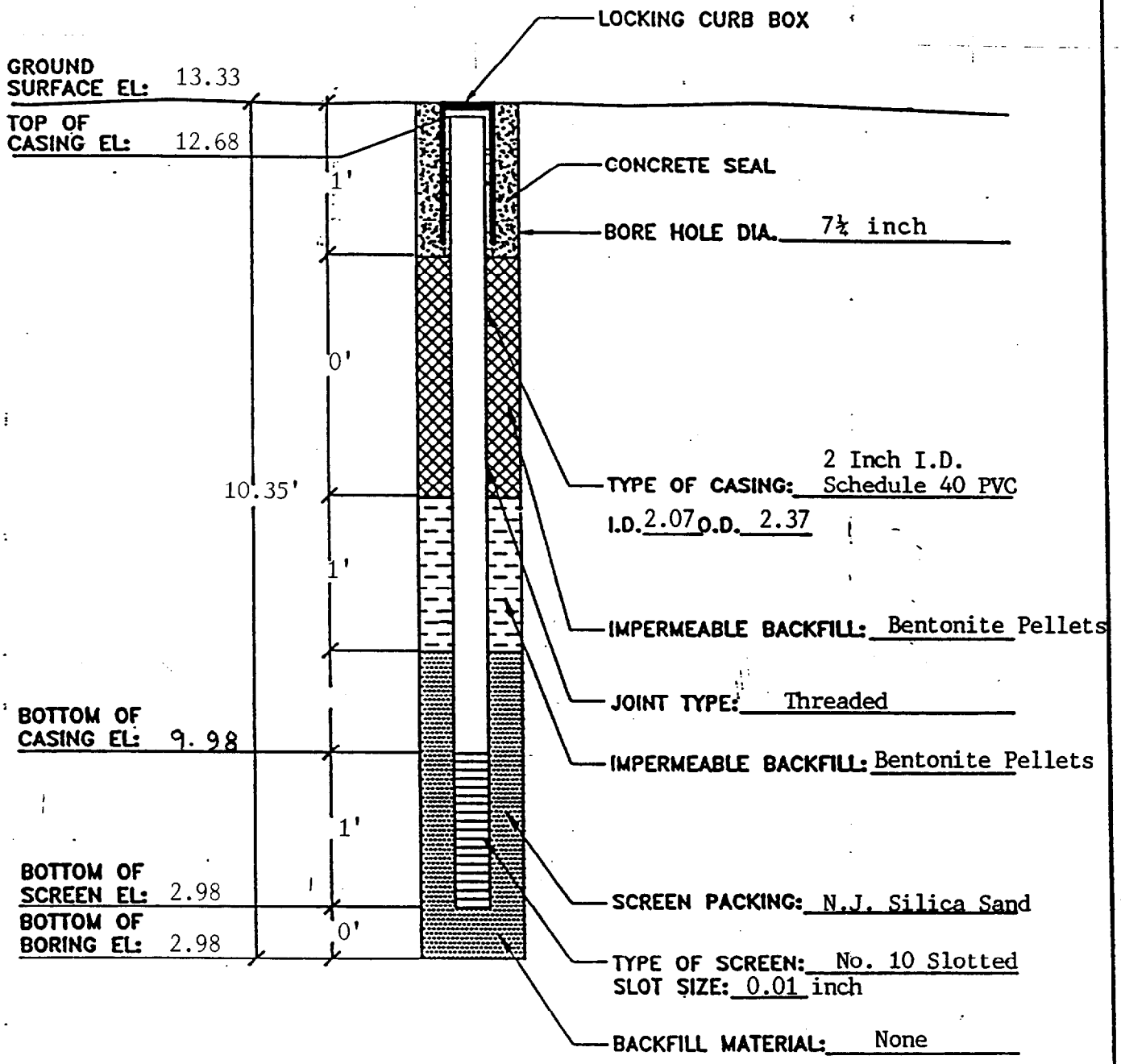
Inferred relationship to plume: __X__ Within _____ Outside _____

Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

WELL NO. MW-15



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

own: Groton, Connecticut

Site: U.S. Naval Reservation

Monitoring Point I.D. No.: MW-16

Date of Completion: 06/28/89

DEP/WPC I.D. No.:

onitoring Point Location
(relative to site features): Northwest of Tank 54-H

rilling Contractor: CT Test Borings

Supervising Engineer/Geologist: C. Frey

Well Construction Method: Hollow Stem Auger

ELL INFORMATION (ELEVATIONS TO NEAREST 0.1 FEET)

Ground surface elevation (MSL): 12.89

Well depth below ground surface:

Refusal: _____ Yes __X__ No

Top of casing elevation (MSL): 12.62

Screened interval: 3-10 feet Below Ground Suface

Length of Screen: 7 feet

ength of riser pipe: 3 feet

Screen type: No. 10 Slotted

Screen Slot size: 0.010 inch

ilter fabric _____ Yes __X__ No

Screen packing: __X__ Yes ____ No

If yes, Thickness: 8 feet

ell inside diameter: 2.03 inches

Material: Silica Sand

Grain Size: Coarse

Impermeable Backfill: Bentonite

ell casing material and schedule:
Schedule 40 PVC

Estimated K screened interval:

ethod of well development:
Pump and Bailer

Time spent developing: 1/2 hr.

Locking __X__ or threaded cap _____

Impermeable backfill: Bentonite

FORMMW-1D

MW-16

Bedrock wells

Casing length: NA

Water-bearing rock unit:

Water-bearing sections (depths and approximate yields):

Length of rock core:

Diameter of core hole:

Thickness and depth of impermeable backfill:

O-rings seals: _____ Yes _____ No

GEOLOGIC INFORMATION

Aquifer: Unconfined

Inferred relationship to plume: __X__ Within _____ Outside _____

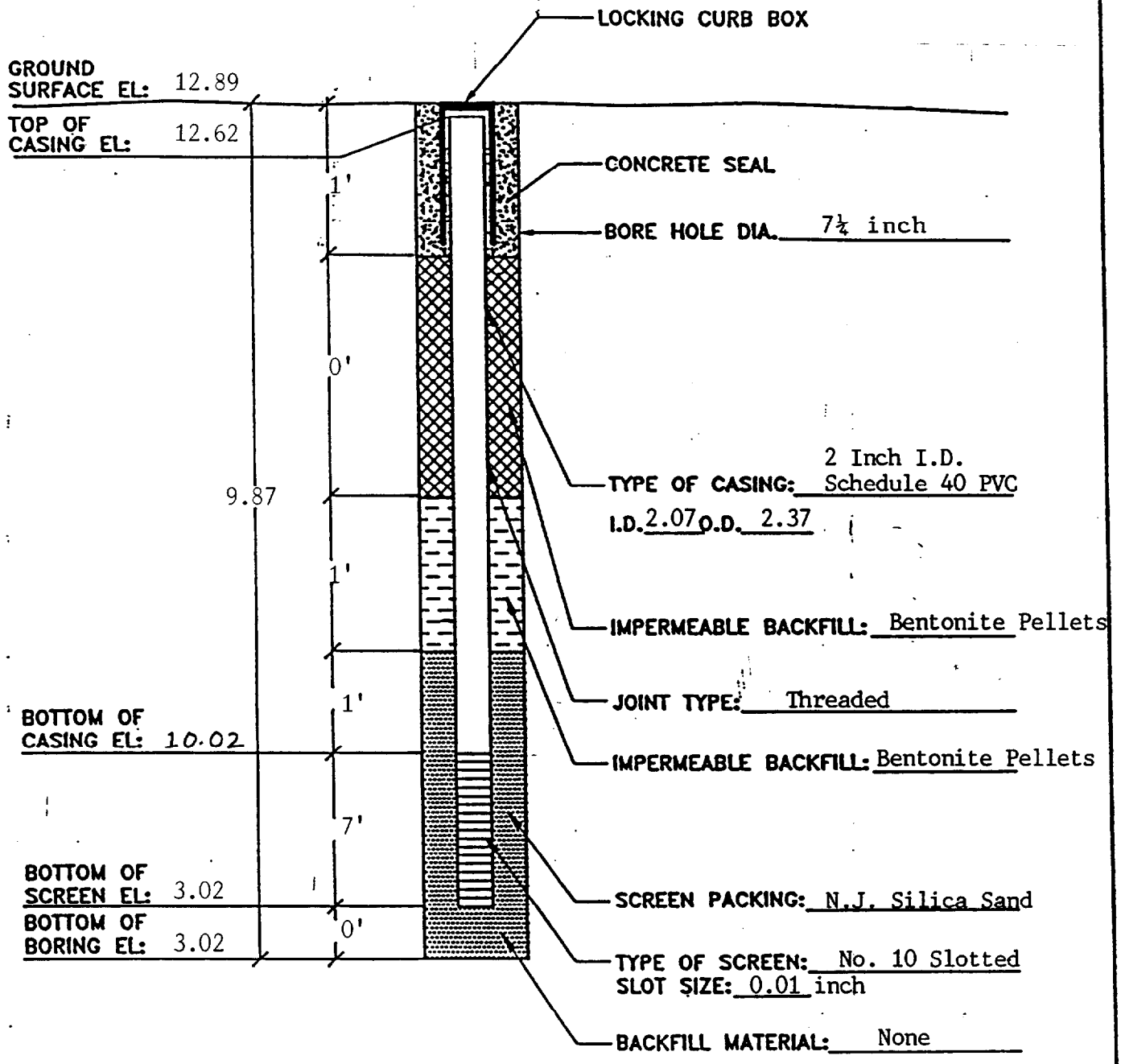
Watershed (plume discharge watercourse): Thames River

Aquifer materials (attach boring log): Well logs presented in Appendix A

Attach maps and plans required of G.1.j. and G.4.

FORMMW-1D

WELL NO. MW-16



WELL CONSTRUCTION DETAILS

U.S. Naval Submarine Base
Groton, Connecticut

PROJ. NO. 87-143 DATE: September SCALE: N.T.S

APPENDIX 4
GROUND WATER MONITORING WELL
REINFORCED CONCRETE COLLAR DESIGN

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

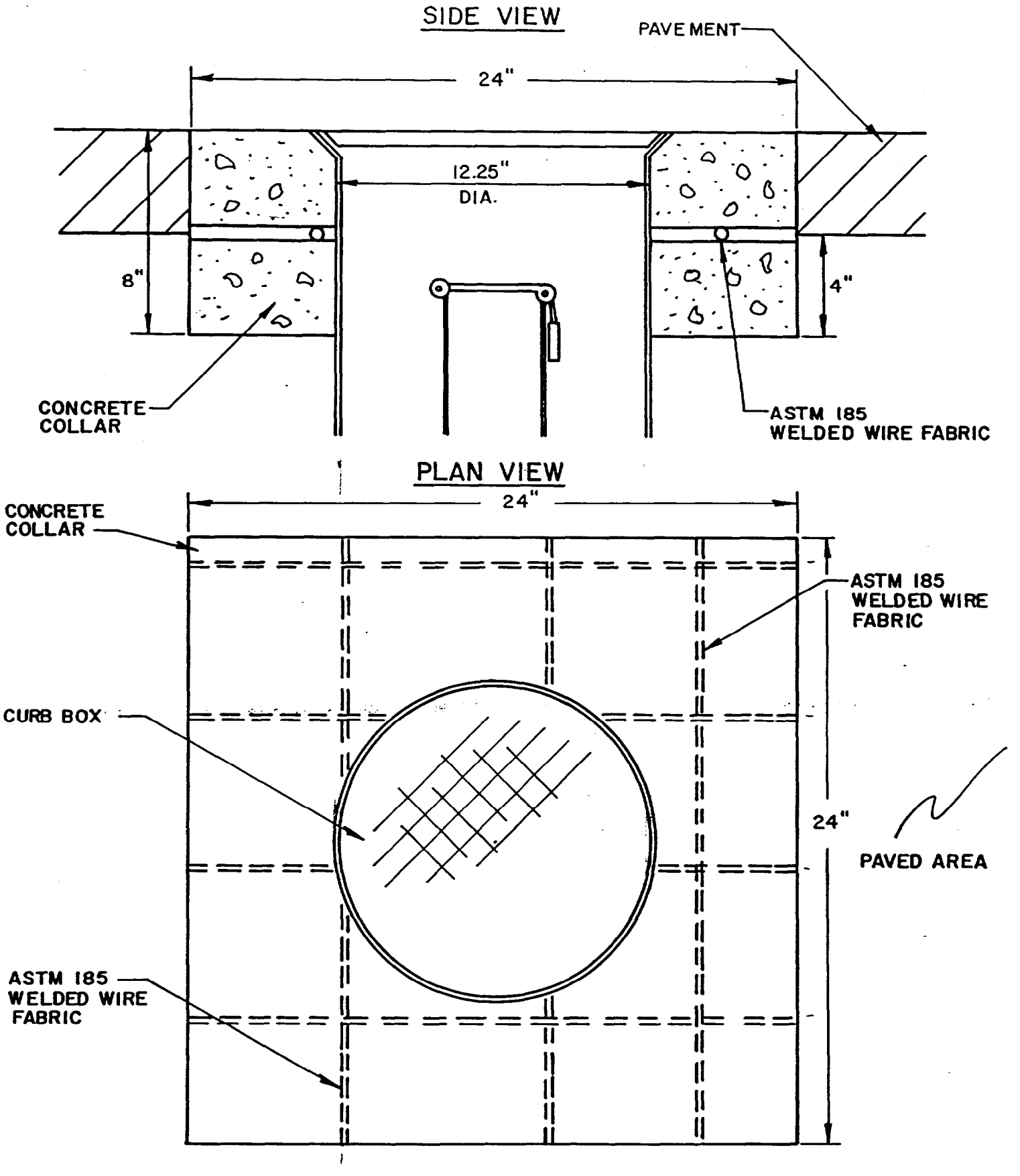


FIG. 2

DETAIL CURB BOX

REINFORCED CONCRETE COLLAR

APPENDIX 5
GROUND-WATER
LABORATORY REPORTS

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

APPENDIX 5
GROUND WATER
LABORATORY REPORTS

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

ALPHA ANALYTICAL LABORATORIES
Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

RECEIVED
JUL 31 1989
FUSS & O'NEILL, INC.

CERTIFICATE OF ANALYSIS

Client: Fuss & O'Neill

Address: 146 Hartford Road
Manchester, CT 06040

Attn: Chris Frey

Job Number: 891848

Invoice Number: 8395

Date In: 07/13/89

Date Reported: 07/27/89

Sample Description: Sixteen water samples

F&O Project 87-143-25

REFERENCES:

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

4. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

Authorized by: Scott McLean
Scott McLean--Laboratory Director

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-1

Client: Fuss & O'Neill

Sample Number: 891848.1

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071201
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	29	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics **								
Benzene	2.4	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-2

Client: Fuss & O'Neill

Sample Number: 891848.2

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071202
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan	ND	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-3

Client: Fuss & O'Neill

Sample Number: 891848.3

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071203
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan	ND	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-4

Client: Fuss & O'Neill

Sample Number: 891848.4

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071204
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan	ND	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-5

Client: Fuss & O'Neill

Sample Number: 891848.5

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071205
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan	ND	mg/L	0.1	GC	4	——	——	07/19/89
Volatile Aromatics **								
Benzene	2.2	ug/L	1	GC	1	8020	——	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-6

Client: Fuss & O'Neill

Sample Number: 891848.6

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071206
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	5.0	mg/L	0.1	GC	4	——	——	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	——	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-7

Client: Fuss & O'Neill

Sample Number: 891848.7

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071207
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	52	mg/L	0.1	GC	4	——	——	07/19/89
Volatile Aromatics **								
Benzene	47	ug/L	1	GC	1	8020	——	07/24/89
Toluene	7.2	ug/L	1	GC	1	8020	——	07/24/89
Ethylbenzene	55	ug/L	1	GC	1	8020	——	07/24/89
Xylenes	81	ug/L	1	GC	1	8020	——	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-8

Client: Fuss & O'Neill

Sample Number: 891848.8

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071208
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan	ND	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-9

Client: Fuss & O'Neill

Sample Number: 891848.9

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071209
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial

# of Containers: 2

Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	10.6	mg/L	0.1	GC	4	——	——	07/19/89
Volatile Aromatics	ND	ug/L	1	GC	1	8020	——	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-10

Client: Fuss & O'Neill

Sample Number: 891848.10

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071210
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	4.8	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-11

Client: Fuss & O'Neill

Sample Number: 891848.11

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071211
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	14	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-13

Client: Fuss & O'Neill

Sample Number: 891848.12

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071213
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	97	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics								
Toluene	11	ug/L	1	GC	1	8020	----	07/24/89
Xylenes	9.6	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-14

Client: Fuss & O'Neill

Sample Number: 891848.13

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071214
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	1,100	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-15

Client: Fuss & O'Neill

Sample Number: 891848.14

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071215
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	750	mg/L	0.1	GC	4	----	----	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MW-16

Client: Fuss & O'Neill

Sample Number: 891848.15

Analysis Requested: Petroleum Scan and Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071216
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: Glass bottle & VOA vial
# of Containers: 2
Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Petroleum Scan								
Fuel Oil #2	21	mg/L	0.1	GC	4	——	——	07/19/89
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	——	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: Fuss & O'Neill

Sample Number: 891848.16

Analysis Requested: Volatile Aromatics (602)

Date Received: 07/13/89

Date Reported: 07/27/89

Client Ident: 33689071217
Sample Location: US Navy Base, New London - Groton, CT
Sample Description: Water
Sample Container: VOA vial

# of Containers: 1

Field Prep: None

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Volatile Aromatics **	ND	ug/L	1	GC	1	8020	----	07/24/89

**Note: All compounds were below the detection limits except those listed above.

A list of volatile aromatics analyzed for and their detection limits accompanies this report.

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

VOLATILE AROMATICS by GC
Method 602 and 8020

PARAMETER

Benzene
Chlorobenzene
Ethylbenzene
Toluene
Xylenes
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene

Method Detection Limit: 1 ug/L

APPENDIX 6
GROUND WATER SAMPLING
FIELD DATA SHEETS

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Base, Groton
Project No.: 87-143/25 Date: 7/12/89
Location: Groton, CT Weather: Sunny, 80's

PAGE 1 a

Sampler (initials)	CJF/JPL →		
Sampling Point	MW-1	MW-2	MW-3
Sample Number	336890712-01	336890712-02	336890712-03
Well Diameter (ID, inches)	2" →		
Water level device (M-Scope, Tape, Elec. Tape)	Electric Tape →		
Correction Factor	6" →		
Measuring point (TPS, PVC)	PVC →		
Time of measurement	10:15		
Depth to Water, feet (show correction)	5.27	4.72	3.26
Measured Well Depth, feet (show correction)	9.75	9.03	9.52
Volume to be evacuated (gallons)	2	2.5	3
Method of evacuation (Bailer, Pump/Type)	Bailer →		
Dedicated, Non-dedicated	~~D~~ Non Ded.		
Evacuation Rate (Pump only)			
Time begun/Time completed	10:20 / 10:30	/	/
Total time purged (minutes)	10 mins		
Volume evacuated (gallons)	4+ gals	4	4+
Well yield (High or Low)	~~High~~ Low	low	yeild
Comments: (well condition, bailer size; if other than well diam., curb box key req'd, etc.)	Water in ~~w~~ Curb Box	Water in Curb Box	Water in Curb Box

dfh\rcra rev04

FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Base, Groton
Project No.: 87-143/25 Date: 7/12/89
Location: Groton, CT Weather: Sunny 80's

PAGE 1 b

Sampling Point	MW-1		MW-2		MW-3	
Sample Number	336890712 -01		336890712 -02		336890712 -03	
Sample withdrawl device (Bailer, Pump/Type)	Bailer					
Dedicated, Non-dedicated	Dedicated					
Bailer Cord Type (D, Non-D)	Ded.					
Time of sample collection	10:20		10:30		10:20	
Sample containers; quantity and preservatives used	1 EPA 40ml 1 Amber glass 1l.					
Temperature, oC	17°C		19.2°		16°C	
Specific Conductance, umhos/cm	283.4		339		242	
pH	6.86		6.33		6.16	
Appearance	Silty					
Filtered in the field (Y,N)	N					
Method of field filtration (Vacuum, Pressure)						
Field Decontamination (Bailer, Filter, Tubing,..)	Bailer					

dfh\rcra rev04

FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143/25 Date: 7/12/89
Location: Groton, CT Weather: Sunny 80's

PAGE 2 a

Sampler (initials)	CSF/JPL →		
Sampling Point	MW-4	MW-5	MW-6
Sample Number	33689072-04	33689072-05	33689072-06
Well Diameter (ID, inches)	2" →		
Water level device (M-Scope, Tape, Elec. Tape)	Electric Tape →		
Correction Factor	0" →		
Measuring point (TPS, PVC)	PVC →		
Time of measurement	10:15	11:20	11:05
Depth to Water, feet (show correction)	3.41	5.18	4.75
Measured Well Depth, feet (show correction)	9.03	13.45	9.85
Volume to be evacuated (gallons)	3	4	2 1/2
Method of evacuation (Bailer, Pump/Type)	Bailer →		
Dedicated, Non-dedicated	Dedicated →		
Evacuation Rate (Pump only)			
Time begun/Time completed	10:15 / 10:20	11:25 / 11:30	11:25 / 11:30
Total time purged (minutes)	5 min	5 min	5 mins
Volume evacuated (gallons)	3 gals to dry	4+ gals	3 gals
Well yield (High or Low)	low	High yield	low.
Comments: (well condition, bailer size; if other than well diam., curb box key req'd, etc.)	Water in Curb Box. →		

dfh\rcra rev04

FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143 Date: 7/12/89
Location: Groton, CT Weather: Sunny 80's

PAGE 2 b

Sampling Point	MW-4	MW-5	MW-6
Sample Number	336890712-04	336890712-05	336890712-06
Sample withdrawl device (Bailer, Pump/Type)	Bailer →	→	→
Dedicated, Non-dedicated	Dedicated →	→	→
Bailer Cord Type (D, Non-D)	Dedicated →	→	→
Time of sample collection	10:45	11:40	11:35
Sample containers; quantity and preservatives used	1 EPA 40 ml 1 Amber Glass 1l		
Temperature, oC	17.0	16.5°	18.5°
Specific Conductance, umhos/cm	650	345	900
pH	5.94	6.30	6.81
Appearance	Very Silty	V. Silty	V. Silty
Filtered in the field (Y,N)	N →	→	→
Method of field filtration (Vacuum, Pressure)			
Field Decontamination (Bailer, Filter, Tubing,..)	Bailer →	→	→

dfh\rcra rev04

FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143/25
Location: Groton, CT
Date: 7/12/89
Weather: Sunny 80's

PAGE 3 a

Sampler (initials)	CSF/JPL →		
Sampling Point	MW-8	MW-7	MW-9
Sample Number	33689071Z-08	33689071Z-07	33689071Z-09
Well Diameter (ID, inches)	2" →		
Water level device (M-Scope, Tape, Elec. Tape)	Electric Tape →		
Correction Factor	0" →		
Measuring point (TPS, PVC)	PVC →		
Time of measurement	11:10	11:05	14:00
Depth to Water, feet (show correction)	6.23	4.71	9.14
Measured Well Depth, feet (show correction)	9.96	9.89	9.84
Volume to be evacuated (gallons)	2	2.5	1
Method of evacuation (Bailer, Pump/Type)	Bailer →		
Dedicated, Non-dedicated	Ded →		
Evacuation Rate (Pump only)			
Time begun/Time completed	11:40 / 11:45	11:10 / 11:15	2:15 / 2:20
Total time purged (minutes)	5	5	5
Volume evacuated (gallons)	3+		
Well yield (High or Low)	V. High	High	Low Yield
Comments: (well condition, bailer size; if other than well diam., curb box key req'd, etc.)	Water in Curb Box →		No LOCK

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143 Date: 7/12/89
Location: Groton, CT Weather: Sunny 80's

PAGE 3 b

Sampling Point	MW-7	MW-8	MW-9
Sample Number	336890712-07	336890712-08	336890712-09
Sample withdrawl device (Bailer, Pump/Type)	Bailer →	→	→
Dedicated, Non-dedicated	Dedicated →	→	→
Bailer Cord Type (D, Non-D)	Dedicated →	→	→
Time of sample collection	12:00	12:00	2:20
Sample containers; quantity and preservatives used	1 EPA 40 ml 1 Amber Glass 1l		
Temperature, oC	17.6°	17.6°	15.4°
Specific Conductance, umhos/cm	928	243	183
pH	5.63	6.3	5.52
Appearance	Silty Some Fiesil odor	Silty	V. Silty
Filtered in the field (Y,N)	N →	→	→
Method of field filtration (Vacuum, Pressure)			
Field Decontamination (Bailer, Filter, Tubing,..)	Bailer →	→	→

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143/25
Location: Groton, CT
Date: 7/12/89
Weather: Sunny 80's

PAGE 4 a

Sampler (initials)	CSF/JPL →		
Sampling Point	MW-10	MW-11	MW-12
Sample Number	33689071 2-10	33689071 2-11	33689071 2-12
Well Diameter (ID, inches)	2" →		
Water level device (M-Scope, Tape, Elec. Tape)	Electric Tape →		
Correction Factor	0" →		
Measuring point (TPS, PVC)	PVC →		
Time of measurement	13:50	13:55	13:40
Depth to Water, feet (show correction)	6.69	7.83	DRY
Measured Well Depth, feet (show correction)	9.77	10.41	9.98
Volume to be evacuated (gallons)	2	2	0
Method of evacuation (Bailer, Pump/Type)	Bailer →		
Dedicated, Non-dedicated	Dedicated →		
Evacuation Rate (Pump only)			
Time begun/Time completed	14:05 / 14:09	14:10 / 14:13	/
Total time purged (minutes)	4 mins	3 mins	
Volume evacuated (gallons)	2+ gals	2 gals	
Well yield (High or Low)	low	low	
Comments: (well condition, bailer size; if other than well diam., curb box key req'd, etc.)	Water in Curb Box	Water in Curb Box	No Sample Well DRY

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143
Location: Groton, CT
Date: 7/12/89
Weather: Sunny 80's

PAGE 4 b

Sampling Point	MW-10	MW-11	MW-12
Sample Number	33689071 2-10	33689071 2-11	33689071 2-12
Sample withdrawl device (Bailer, Pump/Type)	Bailer →	→	→
Dedicated, Non-dedicated	Dedicated →	→	→
Bailer Cord Type (D, Non-D)	Dedicated →	→	→
Time of sample collection	14:15	14:15	
Sample containers; quantity and preservatives used	1 EPA 40 ml 1 Amber Glass 1l		
Temperature, oC	16.0°	16.0°	
Specific Conductance, umhos/cm	121	182	No Sample - well dry
pH	6.19	5.52	
Appearance	Very Silty	V. Silty	
Filtered in the field (Y,N)	N →	→	→
Method of field filtration (Vacuum, Pressure)			
Field Decontamination (Bailer, Filter, Tubing,..)	Bailer →	→	→

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143/25
Location: Groton, CT
Date: 7/12/89
Weather: Sunny 80's

PAGE 5 a

Sampler (initials)	CSF/JPL →		
Sampling Point	MW-13	MW-14	MW-15
Sample Number	33689071Z-	33689071Z-	33689071Z-
Well Diameter (ID, inches)	2" →		
Water level device (M-Scope, Tape, Elec. Tape)	Electric Tape →		
Correction Factor	0" →		
Measuring point (TPS, PVC)	PVC →		
Time of measurement	15:15	15:18	15:21
Depth to Water, feet (show correction)	9.14	9.32	9.31
Measured Well Depth, feet (show correction)	9.84	9.92	9.70
Volume to be evacuated (gallons)	/	/	/
Method of evacuation (Bailer, Pump/Type)	Bailer →		
Dedicated, Non-dedicated	Dedicated →		
Evacuation Rate (Pump only)			
Time begun/Time completed	/	/	/
Total time purged (minutes)	/	/	/
Volume evacuated (gallons)			
Well yield (High or Low)	V. low	low	V. low
Comments: (well condition, bailer size; if other than well diam., curb box key req'd, etc.)	Water in Curbboxes →		

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Naval Sub Base
Project No.: 87-143
Location: Groton, CT
Date: 7/12/89
Weather: Sunny 80'S

PAGE 5 b

Sampling Point	13	14	15
Sample Number	336890712-	336890712-	336890712-
Sample withdrawl device (Bailer, Pump/Type)	Bailer →	→	→
Dedicated, Non-dedicated	Dedicated →	→	→
Bailer Cord Type (D, Non-D)	Dedicated →	→	→
Time of sample collection			
Sample containers; quantity and preservatives used	1 EPA 40 ml 1 Amber Glass 1l		
Temperature, oC		23.8°	21.5°
Specific Conductance, umhos/cm		816	1284
pH		7.05	7.64
Appearance	Silty →	→	→
	Strong Petroleum Smell →	→	→
Filtered in the field (Y,N)	N →	→	→
Method of field filtration (Vacuum, Pressure)			
Field Decontamination (Bailer, Filter, Tubing,..)	Bailer →	→	→

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Navy Sub Base
Project No.: 87-143 Date: 7/12/89
Location: Groton, CT Weather: Sunny, 80's

PAGE 6 a

Sampler (initials)	CJF / JPL			
Sampling Point	MW-16			
Sample Number	336890712-16			
Well Diameter (ID, inches)	2"			
Water level device (M-Scope, Tape, Elec. Tape)	Electric Tape			
Correction Factor	0.0'			
Measuring point (TPS, PVC)	PVC			
Time of measurement	15:26			
Depth to Water, feet (show correction)	9.26			
Measured Well Depth, feet (show correction)	9.60			
Volume to be evacuated (gallons)	1			
Method of evacuation (Bailer, Pump/Type)	Bailer			
Dedicated, Non-dedicated	Ded			
Evacuation Rate (Pump only)				
Time begun/Time completed	15:37 /	/	/	/
Total time purged (minutes)	1			
Volume evacuated (gallons)	1			
Well yield (High or Low)	V. low			
Comments: (well condition, bailer size; if other than well diam., curb box key req'd, etc.)				

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FIELD DATA SHEET

FUSS&O'NEILL

Project Name: U.S. Navy Sub Base
Project No.: 87-143
Location: Groton, CT

Date: 7/12/89
Weather: Sunny, 80's

PAGE 6 b

Sampling Point	MW-16			
Sample Number	336890712-16			
Sample withdrawl device (Bailer, Pump/Type)	Bailer			
Dedicated, Non-dedicated	Ded.			
Bailer Cord Type (D, Non-D)	Ded.			
Time of sample collection				
Sample containers; quantity and preservatives used	1 EPA 40 ml 1 Amber Glass 1l.			
Temperature, oC	21.5°			
Specific Conductance, umhos/cm	1284			
pH	7.04			
Appearance	Silty Strong Diesil Odor			
Filtered in the field (Y,N)	N			
Method of field filtration (Vacuum, Pressure)	—			
Field Decontamination (Bailer, Filter, Tubing,..)	Bailer			

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APPENDIX 7
OPTIONS FOR LINING
UNDERGROUND TANKS AT NAVY SUBBASE

U.S. NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
SEPTEMBER, 1989

M E M O R A N D U M

TO: Stan Alexander

FROM: Brad Freeman

DATE: October 11, 1989

RE: OPTIONS FOR LINING UNDERGROUND TANKS AT NAVY SUBBASE

==========

FERROCEMENT - The advantages of the Ferrocement system is the minimization of tank cleaning prior to installation and structural support.

Fuss & O'Neill contacted Mr. Ronald Lee of General Electric who had his leaking 100,000 gallon Number 6 fuel oil tanks lined with the Ferrocement. He was very happy with the installation and said that the walls of the tank only had to be squeegied down to prepare for installation.

The system consists of installation of a galvanized steel mesh along the tank walls and then applying Portland Cement and crushed limestone mortar on the mesh. Finally the mortar is sealed with a finish compatible with diesel fuel. Price for this system runs about $10-$12 a square foot installed, but the price should drop because of the number and size of the tanks. General Electric was given a twelve year guarantee against leakage.

LINERS

JH WATER SYSTEMS, INC - Liner system is advantageous because, like the Ferrocement, the tank cleaning process prior to installation is minimized. The liner would be the XR-5

manufactured by Seaman Corp. and would be installed on the walls and floor of the tank. Finally, the base of each column would have to be fitted with a liner boot and anchored to the floor sections. The entire liner would be protected from the tank surface with a layer of filter fabric.

The tank might have to be squeegied or washed with a degreaser but only to a small extent. J.H. Water Systems have just completed a similar project at a Navy Base in Florida.

Fuss & O'Neill received an estimate of approximately $64,000 per tank with a 20 year guarantee for the liner and a 1 year guarantee on installation.

MPC

Sent us some plans for similar jobs and would like to bid on the job if we go with a liner.

FRED RIVAS COMPANY - This company out of Maine quoted $108,000 per tank for material and supervision only. They would supply a 30 mil single ply Hytryl liner.

COATINGS

FOSROC/PRECO - This company is suggesting the tanks be lined with a coal tar expoxy which is compatible with diesel fuel. The concrete surfaces would have to be cleaned fairly well to allow adhesion. The epoxy could be sprayed on but they suggest rolling it on. Two coats of the epoxy would probably be needed

and would cost approximately 50 cents a square foot. Total installation cost would probably be in the area of two dollars a square foot.

They would not be able to give a guarantee until they were able to inspect the tank and do an adhesive test inside.

TANK COATING SYSTEMS, INC. - This company is offering 2 different coating systems. The first is an epoxy resin-based product structurally reinforced with glass fibers produced by Bridgeport Chemical Corp. The design coat thickness is 125 mils and is applied in a single coat. The coating will qualify under EPA regulations and comes with a guarantee. Material cost per tank $77,000.

The other coating is a thin-film cross linked epoxy-phenolic lining produced by Plasite. Its suggested thickness is 12-15 mils but does not qualify under EPA regulations. This coating would be sprayed on in two coats. The tank walls would have to be cleaned well and then primed as preparation. Material cost per tank is $18,000 per tank.

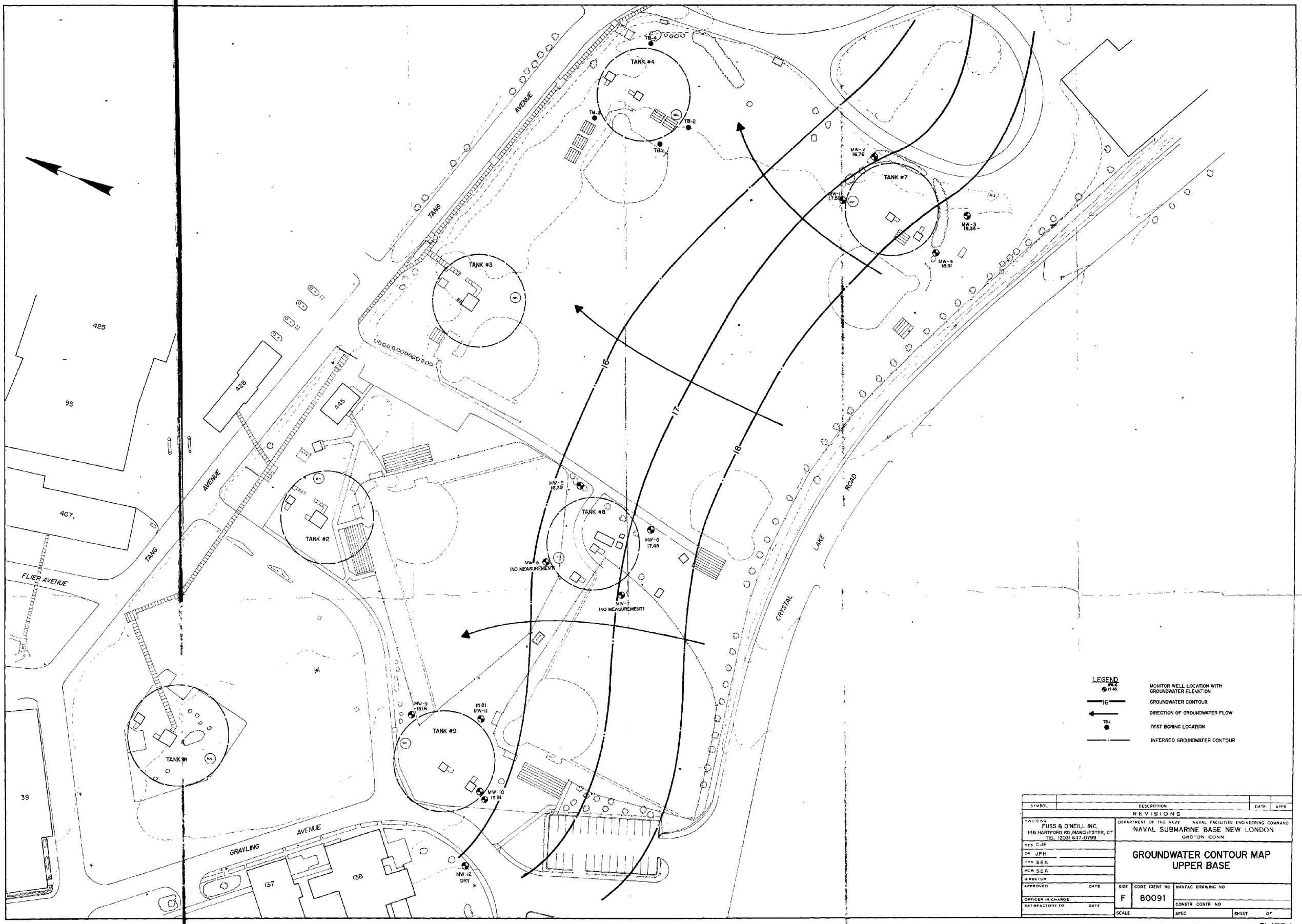

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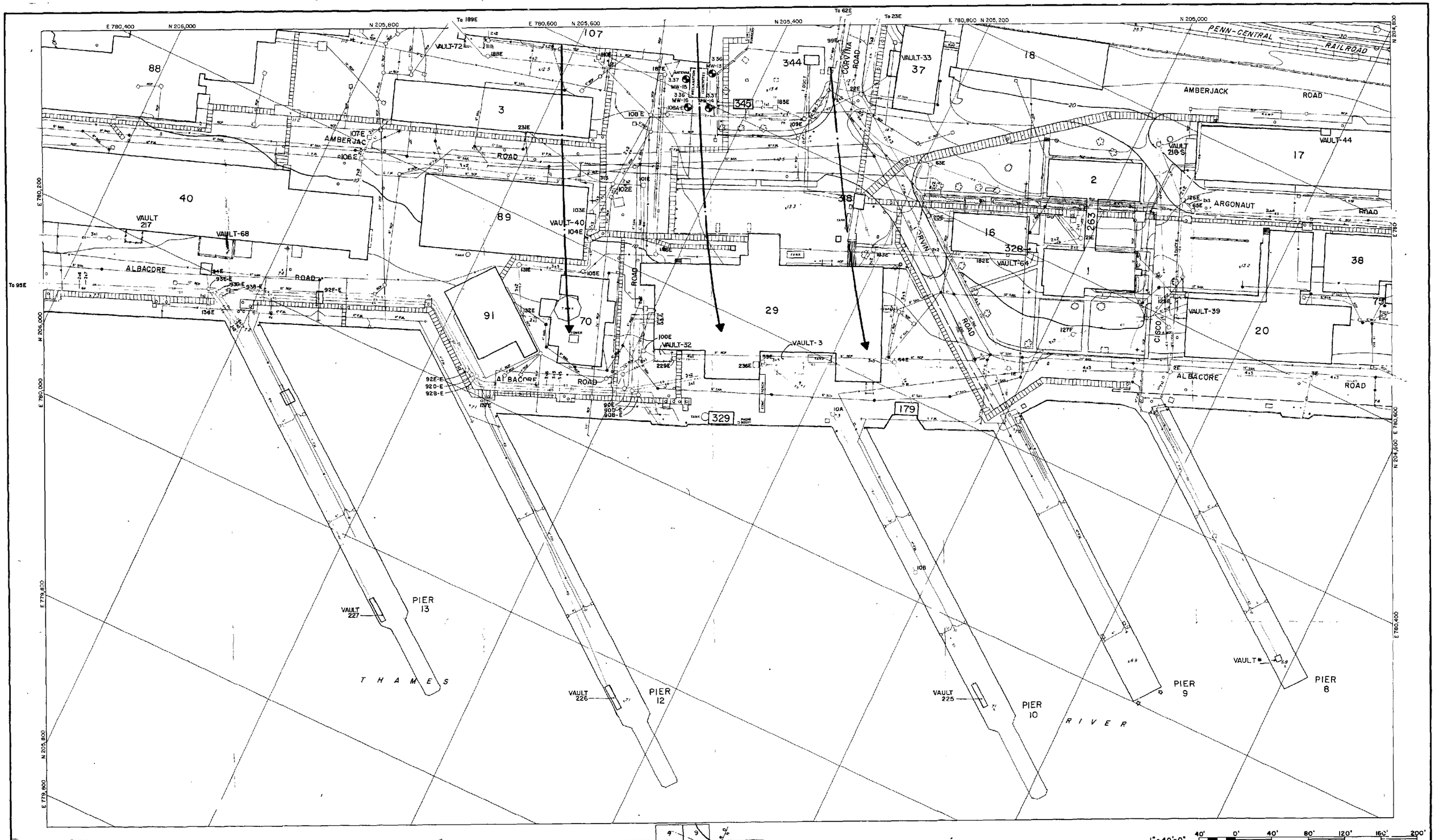
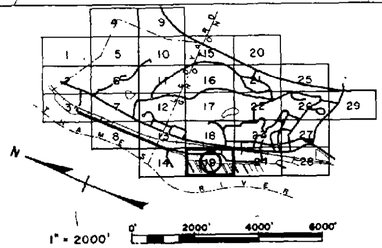
PLATE I



LEGEND

- EXISTING FRESH WATER LINES
- EXISTING STORM SEWER LINES
- EXISTING SANITARY SEWER LINES
- EXISTING ELECTRICAL DUCT LINES
- EXISTING TELEPHONES LINES
- EXISTING ELECTRICAL LINES
- EXISTING OIL LINES
- EXISTING SUPPLY AND RETURN PIPES UNDER TRENCH
- MONITOR WELL LOCATION WITH GROUNDWATER ELEVATIONS
- INFERRED GROUNDWATER FLOW



KEY MAP

1" = 40'-0" 40' 0' 40' 80' 120' 160' 200'

SYMBOL	DESCRIPTION	DATE	APPR

REVISIONS

FWO UNIT: FUSS & O'NEILL INC. 146 HARTFORD RD, MANCHESTER, CT TEL. (203) 647-0799

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONN.

DR CJF
DN JPH
CHK SEA
MGR SEA
DIRECTOR
APPROVED DATE
OFFICER IN CHARGE
SATISFACTORY TO DATE

GROUNDWATER CONTOUR MAP LOWER BASE

SIZE F | CODE IDENT NO 80091 | NAVFAC DRAWING NO
CONSTR CONTR NO
SCALE | SPEC | SHEET OF

0009102X

PLATE 2