

Phase II
Remedial Investigation
for
Naval Submarine Base
New London
Groton, Connecticut

Volume III - Drawings



Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0129

March 1997



Brown & Root Environmental

A Division of Halliburton NUS Corporation

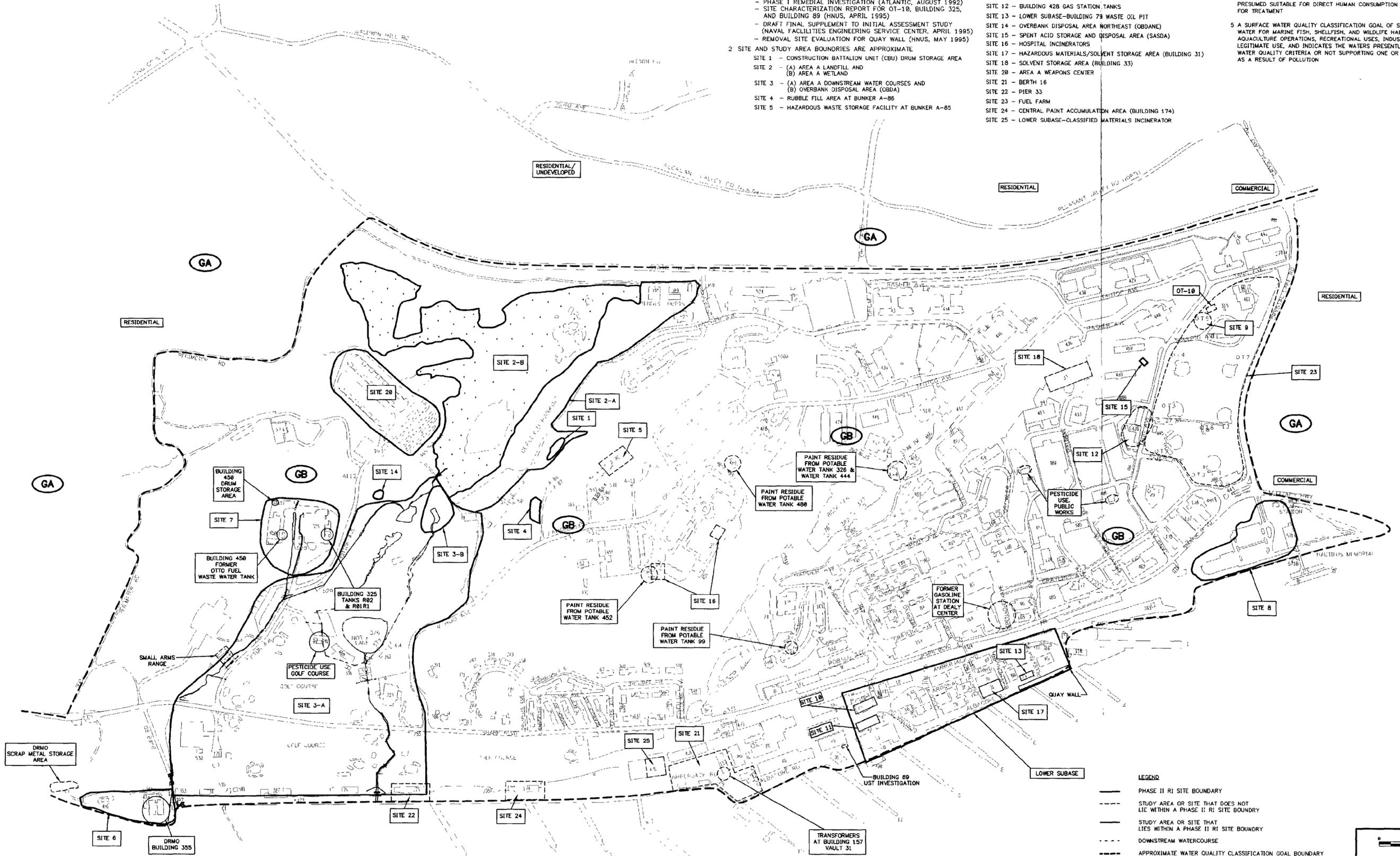


NOTES:

- 1 SITE AND STUDY AREA LOCATIONS WERE TAKEN FROM THE FOLLOWING REPORTS:
 - FEDERAL FACILITY AGREEMENT UNDER CERCLA 120, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT
 - FINAL INITIAL ASSESSMENT STUDY (ENVIRODYNE, MARCH 1983)
 - HYDROGEOLOGIC INVESTIGATION UNDERGROUND STORAGE TANKS OT-4, OT-7, OT-8, OT-9, AND 54-H (FUSS & O'NEILL, SEPTEMBER 1989)
 - PHASE I REMEDIAL INVESTIGATION (ATLANTIC, AUGUST 1992)
 - SITE CHARACTERIZATION REPORT FOR OT-10, BUILDING 325, AND BUILDING 89 (HNUS, APRIL 1995)
 - DRAFT FINAL SUPPLEMENT TO INITIAL ASSESSMENT STUDY (NAVAL FACILITIES ENGINEERING SERVICE CENTER, APRIL 1995)
 - REMOVAL SITE EVALUATION FOR QUAY WALL (HNUS, MAY 1995)
- 2 SITE AND STUDY AREA BOUNDARIES ARE APPROXIMATE
 - SITE 1 - CONSTRUCTION BATTALION UNIT (CBU) DRUM STORAGE AREA
 - SITE 2 - (A) AREA A LANDFILL AND (B) AREA A WETLAND
 - SITE 3 - (A) AREA A DOWNSTREAM WATER COURSES AND (B) OVERBANK DISPOSAL AREA (OBDA)
 - SITE 4 - RUBBLE FILL AREA AT BUNKER A-85
 - SITE 5 - HAZARDOUS WASTE STORAGE FACILITY AT BUNKER A-85

- SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO)
- SITE 7 - TORPEDO SHOPS
- SITE 8 - GOSS COVE LANDFILL
- SITE 9 - OILY WASTEWATER TANK (OT-5)
- SITE 10 - LOWER SUBBASE-FUEL STORAGE TANKS AND TANK 54-H
- SITE 11 - LOWER SUBBASE-POWER PLANT OIL TANKS
- SITE 12 - BUILDING 428 GAS STATION TANKS
- SITE 13 - LOWER SUBBASE-BUILDING 79 WASTE OIL PIT
- SITE 14 - OVERBANK DISPOSAL AREA NORTHEAST (OBDAE)
- SITE 15 - SPENT ACID STORAGE AND DISPOSAL AREA (SASDA)
- SITE 16 - HOSPITAL INCINERATORS
- SITE 17 - HAZARDOUS MATERIALS/SOLVENT STORAGE AREA (BUILDING 31)
- SITE 18 - SOLVENT STORAGE AREA (BUILDING 33)
- SITE 20 - AREA A WEAPONS CENTER
- SITE 21 - BERTH 16
- SITE 22 - PIER 33
- SITE 23 - FUEL FARM
- SITE 24 - CENTRAL PAINT ACCUMULATION AREA (BUILDING 174)
- SITE 25 - LOWER SUBBASE-CLASSIFIED MATERIALS INCINERATOR

- 3 A GROUNDWATER QUALITY CLASSIFICATION GOAL OF GB/GA INDICATES THAT THE GROUNDWATER MAY NOT BE SUITABLE FOR DIRECT HUMAN CONSUMPTION WITHOUT TREATMENT AS A RESULT OF WASTE DISCHARGES, SPILLS, CHEMICAL LEAKS, OR LAND USE IMPACTS. GB/GA WATERS MAY BE USEFUL FOR INDUSTRIAL PROCESS WATERS OR COOLING WATERS. THE STATE'S GOAL IS TO RESTORE THE WATER TO DRINKING WATER QUALITY (GA).
- 4 A GROUNDWATER QUALITY CLASSIFICATION GOAL OF GA SIGNIFIES GROUNDWATERS PRESUMED SUITABLE FOR DIRECT HUMAN CONSUMPTION WITHOUT THE NEED FOR TREATMENT.
- 5 A SURFACE WATER QUALITY CLASSIFICATION GOAL OF SC/SB DESIGNATES THE WATER FOR MARINE FISH, SHELLFISH, AND WILDLIFE HABITAT, CERTAIN AQUACULTURE OPERATIONS, RECREATIONAL USES, INDUSTRIAL AND OTHER LEGITIMATE USE, AND INDICATES THE WATERS PRESENTLY ARE NOT MEETING WATER QUALITY CRITERIA OR NOT SUPPORTING ONE OR MORE DESIGNATED USES AS A RESULT OF POLLUTION.



LEGEND

- PHASE II RI SITE BOUNDARY
- - - STUDY AREA OR SITE THAT DOES NOT LIE WITHIN A PHASE II RI SITE BOUNDARY
- STUDY AREA OR SITE THAT LIES WITHIN A PHASE II RI SITE BOUNDARY
- - - DOWNSTREAM WATERCOURSE
- - - APPROXIMATE WATER QUALITY CLASSIFICATION GOAL BOUNDARY (SEE NOTE 3)
- GB WATER QUALITY CLASSIFICATION GOAL FOR GROUNDWATER (SEE NOTE 3)
- GA WATER QUALITY CLASSIFICATION GOAL FOR GROUNDWATER (SEE NOTE 4)
- SC/SB WATER QUALITY CLASSIFICATION GOAL FOR SURFACE WATER (SEE NOTE 5)

REFERENCE

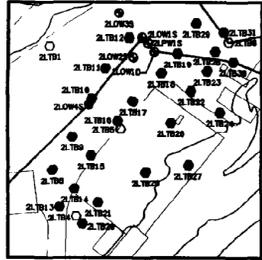
APPROXIMATE WATER QUALITY GOAL FOR GROUNDWATER BOUNDARY FROM THE DRAWING "ADOPTED WATER QUALITY CLASSIFICATIONS FOR THE THAMES, SOUTHEAST COAST, PANCACTUCK RIVER BASINS, CTDEP, WATER COMPLIANCE UNIT, DECEMBER 1986 SHEET 1 OF 2"

0 300 600
SCALE IN FEET

DRAWING 1
SITE LOCATIONS, STUDY AREAS
SURROUNDING LAND USE
AND CTDEP GROUNDWATER
QUALITY CLASSIFICATION GOALS
NSB-NLON
GROTON, CONNECTICUT

Brown & Root Environmental

0108628X



- NOTES**
- 1 WELLS BY OTHERS ARE PART OF COMPREHENSIVE ROUNDS OF WATER LEVEL MEASUREMENTS
 - 2 TOPOGRAPHIC CONTOURS ARE FROM NSB-NLON ENGINEERING DEPARTMENT
 - 3 CROSS-SECTIONS A-A' AND B-B' ARE SHOWN ON DRAWING 3 CROSS-SECTIONS C-C', D-D', AND E-E' ARE SHOWN ON DRAWING 19 CROSS-SECTIONS F-F', G-G', AND H-H' ARE SHOWN ON DRAWING 20 CROSS-SECTIONS I-I', J-J', AND K-K' ARE SHOWN ON DRAWING 21

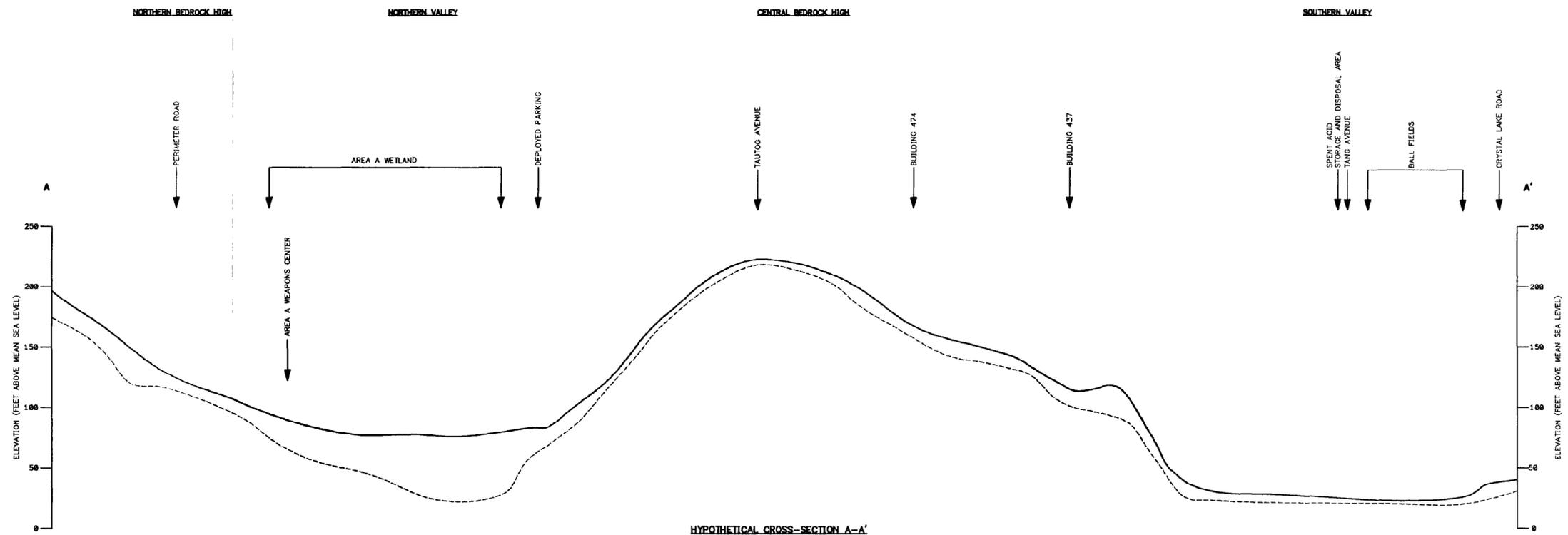
- LEGEND**
- ⊕ EXISTING MONITORING WELL
 - ⊙ PHASE II MONITORING WELL
 - EXISTING TEST BORING
 - PHASE II TEST BORING
 - ⊕ PHASE II STAFF GAUGE
 - ⊙ WELLS BY OTHERS
 - CROSS-SECTION

0 300 600
SCALE IN FEET

DRAWING 2
TOPOGRAPHIC SURFACE AND CROSS-SECTION LOCATION MAP
NSB-NLON
GROTON, CONNECTICUT

Brown & Root Environmental

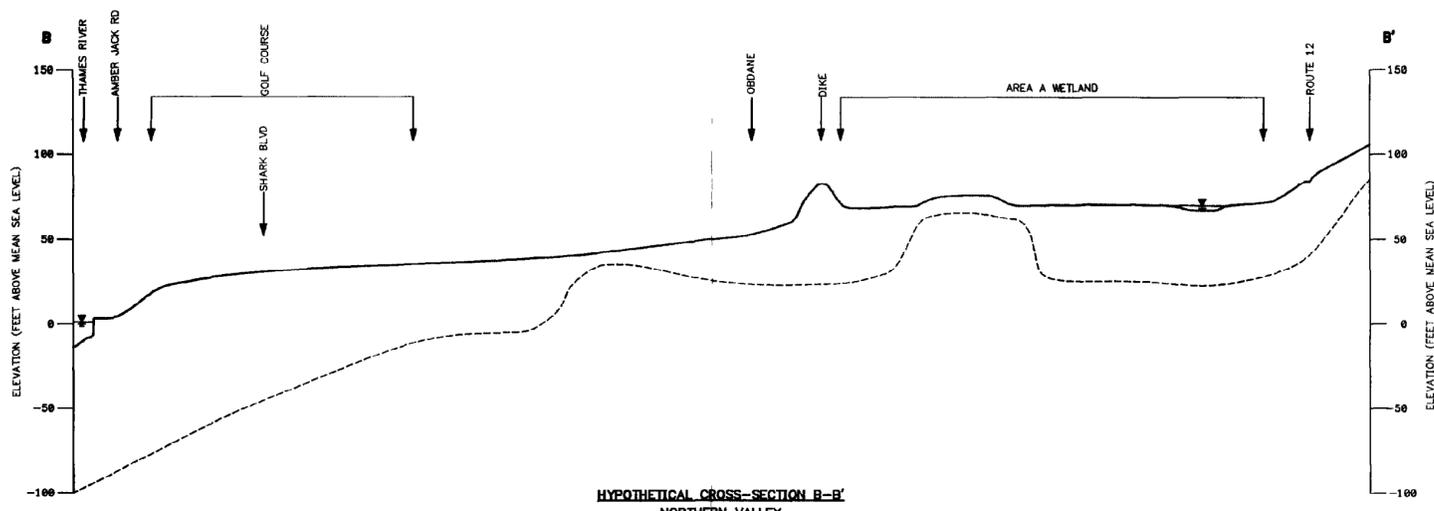
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HYPOTHETICAL CROSS-SECTION A-A'

0 200 400 600
HORIZONTAL SCALE IN FEET

0 50 100
VERTICAL SCALE IN FEET



HYPOTHETICAL CROSS-SECTION B-B'

NORTHERN VALLEY

0 200 400 600
HORIZONTAL SCALE IN FEET

0 50 100
VERTICAL SCALE IN FEET

LEGEND

— APPROXIMATE GROUND SURFACE

- - - APPROXIMATE BEDROCK SURFACE

▽ SURFACE OF WATER BODY

DRAWING 3

CROSS-SECTIONS

A-A' & B-B'

NSB-NLON

GROTON, CONNECTICUT

Brown & Root Environmental

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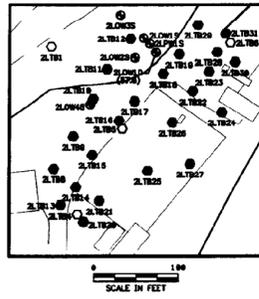


TABLE OF STRIKES/DIPS
(BEDDING, JOINT)

○	S76W/79S	(J)
○	N29W/34SW	(B)
○	N36E/74S	(J)
○	N34W/24E	(B)
○	N31E/30	(J)
○	N71E/90	(J)
○	N74W/42.5N	(B)
○	N51W/80N	(B)
○	N50W/32N	(B)
○	N39W/32N	(B)
○	N78W/14S	(B)

LEGEND

- EXISTING MONITORING WELL
- PHASE II MONITORING WELL
- FOCUSED FEASIBILITY STUDY MONITORING WELL
- EXISTING TEST BORING
- PHASE II TEST BORING
- WELLS BY OTHERS
- BEDDING
- JOINT
- 30- 30 FOOT CONTOUR INTERVAL

- NOTES
- 1 WELLS BY OTHERS ARE PART OF COMPREHENSIVE ROUNDS OF WATER LEVEL MEASUREMENTS
 - 2 DASHED LINES ARE INFERRED CONTOURS



DRAWING 4
BEDROCK SURFACE
CONTOURS
NSB-NLON
GROTON, CONNECTICUT

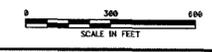


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NOTES

- 1 ONLY THE MAXIMUM CONCENTRATION OF TOTAL MANGANESE MEASURED IN GROUNDWATER DURING ROUND 1 OR 2 OF THE PHASE II RI IS REPORTED ON THIS DRAWING. LOW FLOW SAMPLING TECHNIQUES WERE USED DURING THE PHASE II RI
- 2 DASHED LINES ARE INFERRED CONTOURS
- 3 CTDEP GENERAL GUIDELINE FOR MANGANESE IS 1000 ug/L (BACKGROUND) AND 5000 ug/L (LEVEL OF CONCERN)



LEGEND

- 100— 100 ug/L CONTOUR
- ⊕ PHASE I MONITORING WELL
- ⊙ PHASE II MONITORING WELL

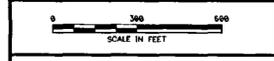
DRAWING 5
TOTAL MANGANESE (ug/L)
ISOCONCENTRATION MAP
SHALLOW OVERBURDEN
GROUNDWATER
NSB-NLON
GROTON, CONNECTICUT

Brown & Root Environmental

0108632X



- NOTES**
- 1 ONLY THE MAXIMUM CONCENTRATION OF DISSOLVED MANGANESE MEASURED IN THE GROUNDWATER DURING ROUND 1 OR 2 OF THE PHASE II RI IS REPORTED ON THIS DRAWING. NO DISSOLVED ANALYTICAL RESULTS ARE AVAILABLE FROM THE PHASE I RI.
 - 2 DASHED LINES ARE INFERRED CONTOURS.
 - 3 CTDOP GENERAL GUIDELINES FOR MANGANESE ARE 1000ug/L (BACKGROUND) AND 5000 ug/L (LEVEL OF CONCERN).



- LEGEND**
- 100- 100 ug/L CONTOUR
 - PHASE I MONITORING WELL
 - PHASE II MONITORING WELL

DRAWING 6
DISSOLVED MANGANESE (ug/L)
ISOCONCENTRATION MAP
SHALLOW OVERBURDEN GROUNDWATER
NSB-NLON
GROTON, CONNECTICUT





NOTES

- 1 ONLY THE MAXIMUM CONCENTRATION OF TOTAL MANGANESE MEASURED IN GROUNDWATER DURING ROUND 1 OR 2 OF THE PHASE II RI IS REPORTED ON THIS DRAWING. LOW FLOW SAMPLING TECHNIQUES WERE USED DURING THE PHASE II RI.
- 2 DASHED LINES ARE INFERRED CONTOURS.
- 3 CTDEP GENERAL GUIDELINES FOR MANGANESE ARE 1000ug/L (BACKGROUND) AND 5000ug/L (LEVEL OF CONCERN).



LEGEND

- 100— 100 ug/L CONTOUR
- ⊕ PHASE I MONITORING WELL
- PHASE II MONITORING WELL

DRAWING 7
TOTAL MANGANESE (ug/L)
ISOCONCENTRATION MAP
BEDROCK GROUNDWATER
NSB-NLON
GROTON, CONNECTICUT





NOTES

- 1 ONLY THE MAXIMUM CONCENTRATION OF TOTAL IRON MEASURED IN GROUNDWATER DURING ROUND 1 OR 2 OF THE PHASE II RI IS REPORTED ON THIS DRAWING. LOW FLOW SAMPLING TECHNIQUES WERE USED DURING THE PHASE II RI.
- 2 DASHED LINES ARE INFERRED CONTOURS.



- LEGEND**
- 10000— 10000 ug/L CONTOUR
 - 1000— 1000 ug/L CONTOUR
 - ⊕ PHASE I MONITORING WELLS
 - ⊙ PHASE II MONITORING WELL
 - DATA WAS NOT USED FOR CONTOURING

DRAWING 9
TOTAL IRON (ug/L)
ISOCONCENTRATION MAP
SHALLOW OVERBURDEN
GROUNDWATER
NSB-NLON
GROTON, CONNECTICUT

Brown & Root Environmental

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- NOTES**
- 1 ONLY THE MAXIMUM CONCENTRATION OF TOTAL IRON MEASURED IN GROUNDWATER DURING ROUND 1 OR 2 OF THE PHASE II RI IS REPORTED ON THIS DRAWING. LOW FLOW SAMPLING TECHNIQUES WERE USED DURING THE PHASE II RI.
 - 2 DASHED LINES ARE INFERRED CONTOURS.

- LEGEND**
- 10000 — 10000 ug/L CONTOUR
 - 1000 — 1000 ug/L CONTOUR
 - ⊕ PHASE I MONITORING WELL
 - ⊙ PHASE II MONITORING WELL



DRAWING 10
TOTAL IRON (ug/L)
ISOCONCENTRATION MAP
BEDROCK GROUNDWATER
NSB-NLON
GROTON, CONNECTICUT



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NOTES

- 1 ONLY THE pH OF THE GROUNDWATER MEASURED DURING ROUND 2 OF THE PHASE II RI IS PRESENTED ON THIS DRAWING
- 2 DASHED LINES ARE INFERRED CONTOURS



DRAWING 11
 pH OF
 GROUNDWATER IN
 SHALLOW OVERBURDEN
 NSB-NLON
 GROTON, CONNECTICUT

LEGEND

- 7.0 pH CONTOUR
- ⊕ PHASE I MONITORING WELLS
- ⊙ PHASE II MONITORING WELL





- NOTES**
- 1 ONLY THE pH OF THE GROUNDWATER MEASURED DURING ROUND 2 OF THE PHASE II RI IS PRESENTED ON THIS DRAWING
 - 2 DASHED LINES ARE INFERRED CONTOURS

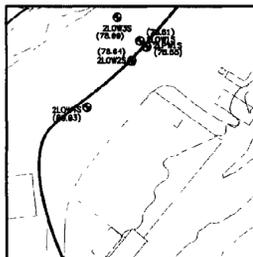


- LEGEND**
- pH of 7.0 CONTOUR
 - ⊕ PHASE I MONITORING WELL
 - ⊙ PHASE II MONITORING WELL

DRAWING 12
pH OF GROUNDWATER
IN BEDROCK
NSB-NLON
GROTON, CONNECTICUT



0108639V



SCALE IN FEET



NOTES

- 1 WELLS BY OTHERS ARE PART OF COMPREHENSIVE ROUNDS OF WATER LEVEL MEASUREMENTS
- 2 WD MEANS WELL DESTROYED OR DAMAGED
NL MEANS WELL NOT LOCATED
NT MEANS WELL NOT TESTED DUE TO ACCESS PROBLEMS
- 3 DASHED LINES ARE INFERRED CONTOURS
- 4 * GROUNDWATER ELEVATION WAS NOT USED FOR CONTOUR GENERATION

LEGEND

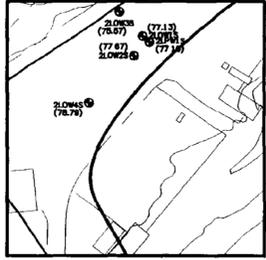
- 40- 10 FOOT CONTOUR INTERVAL
- 15- 5 FOOT CONTOUR INTERVAL
- 3- 1 FOOT CONTOUR INTERVAL
- ⊕ PHASE I MONITORING WELL
- ⊙ PHASE II MONITORING WELL
- ⊙ FFS MONITORING WELL
- ⊙ PHASE II STAFF GAUGE
- ⊙ WELLS BY OTHERS
- ⊙ OFFSITE RESIDENTIAL WELLS



DRAWING 13
SHALLOW OVERBURDEN
GROUNDWATER POTENTIOMETRIC
SURFACE MAP
MARCH 30, 1994
NSR-NILON
GROTON, CONNECTICUT

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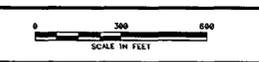


NOTES

- 1 WELLS BY OTHERS ARE PART OF COMPREHENSIVE ROUNDS OF WATER LEVEL MEASUREMENTS
- 2 ND MEANS WELL DESTROYED OR DAMAGED
NL MEANS WELL NOT LOCATED
NT MEANS WELL NOT TESTED DUE TO ACCESS PROBLEMS
- 3 DASHED LINES ARE INFERRED CONTOURS
- 4 * GROUNDWATER ELEVATION WAS NOT USED FOR CONTOUR GENERATION

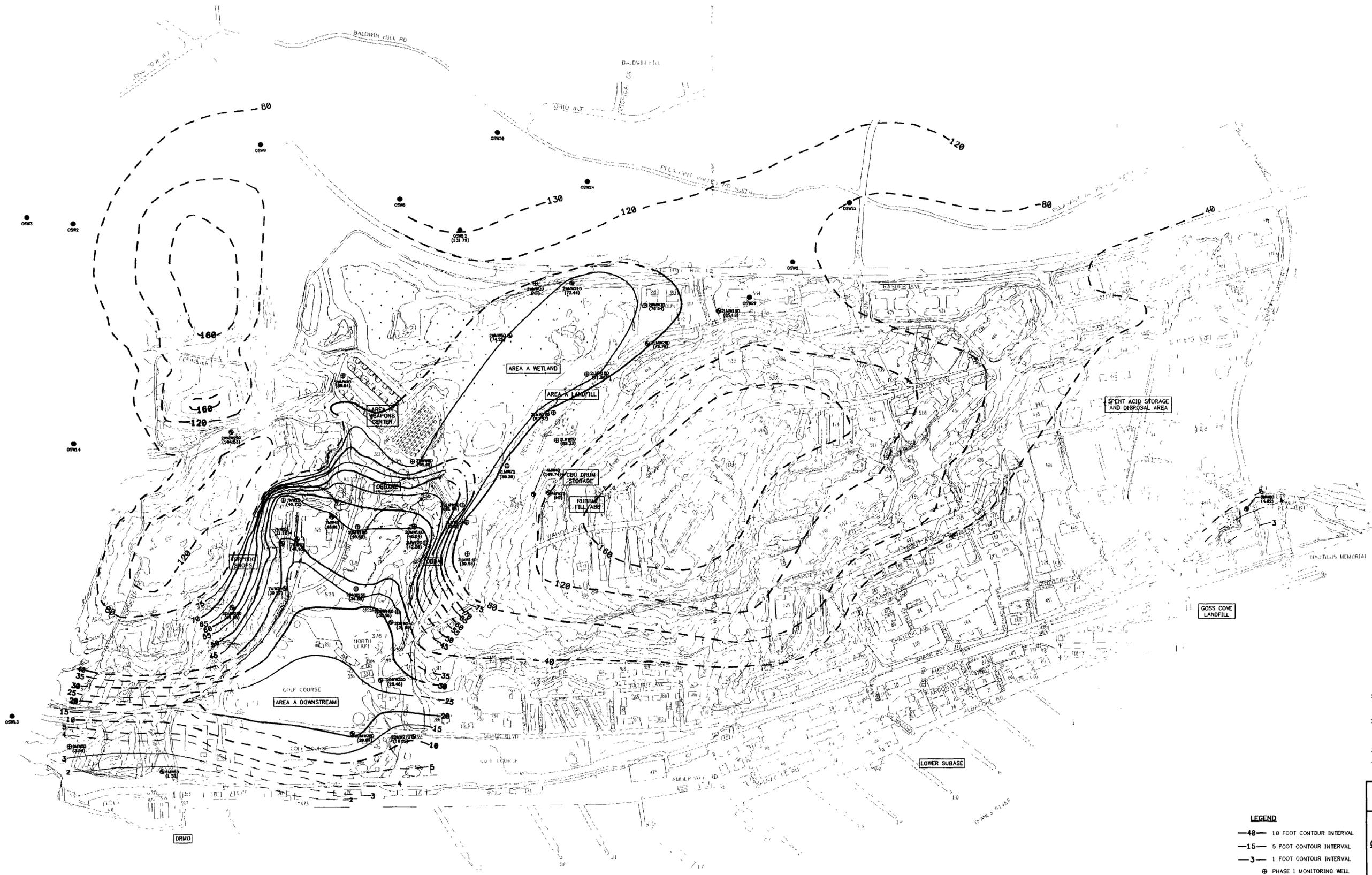
LEGEND

- 40— 10 FOOT CONTOUR INTERVAL
- 15— 5 FOOT CONTOUR INTERVAL
- 3— 1 FOOT CONTOUR INTERVAL
- ⊕ PHASE I MONITORING WELL
- ⊙ PHASE II MONITORING WELL
- ⊙ FF'S MONITORING WELL
- ⊙ PHASE II STAFF GAUGE
- ⊙ WELLS BY OTHERS
- ⊙ OFFSITE RESIDENTIAL WELL

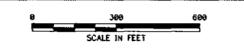


DRAWING 14
SHALLOW OVERBURDEN
GROUNDWATER POTENTIOMETRIC
SURFACE MAP
AUGUST 23-24, 1994
NSB-NILON
GROTON, CONNECTICUT

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- NOTES**
- 1 WELLS BY OTHERS ARE PART OF COMPREHENSIVE ROUNDS OF WATER LEVEL MEASUREMENTS
 - 2 WD MEANS WELL DESTROYED OR DAMAGED
NL MEANS WELL NOT LOCATED
NT MEANS WELL NOT TESTED
DU TO ACCESS PROBLEMS
 - 3 DASHED LINES ARE INFERRED CONTOURS
 - 4 * GROUNDWATER ELEVATION WAS NOT USED FOR CONTOUR GENERATION

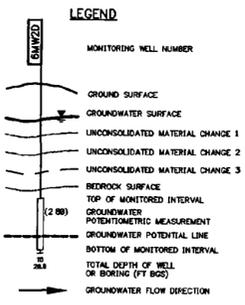


- LEGEND**
- 40— 10 FOOT CONTOUR INTERVAL
 - 15— 5 FOOT CONTOUR INTERVAL
 - 3— 1 FOOT CONTOUR INTERVAL
 - ⊕ PHASE I MONITORING WELL
 - ⊗ PHASE II MONITORING WELL
 - OFFSITE RESIDENTIAL WELL

DRAWING 16
BEDROCK
GROUNDWATER POTENTIOMETRIC
SURFACE MAP
MARCH 30, 1994
NSB-NLON
GROTON, CONNECTICUT

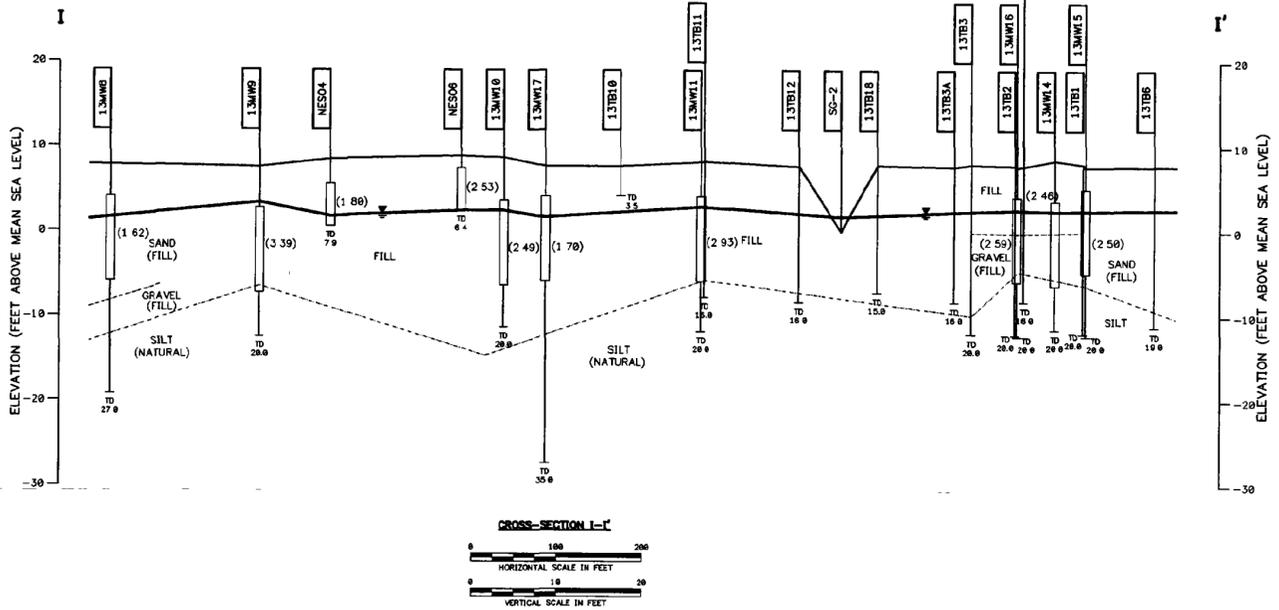
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LOWER SUBBASE

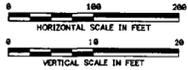


NOTES

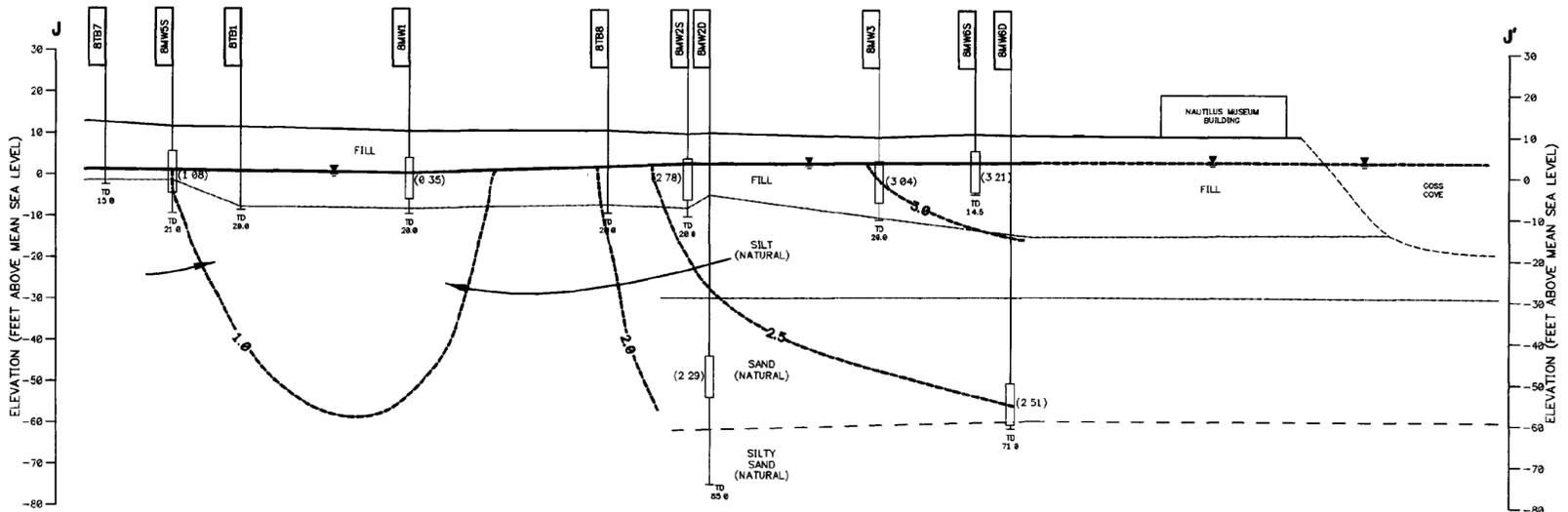
- 1. (ND) MEANS WELL HAS BEEN DESTROYED OR DAMAGED
- 2. (NL) MEANS WELL COULD NOT BE LOCATED
- 3. (NT) MEANS WELL WAS NOT TESTED DUE TO ACCESS PROBLEMS
- 4. GROUNDWATER LEVEL MEASUREMENTS WERE TAKEN AUGUST 23, 1994. GROUNDWATER FLOW DIRECTIONS ARE REPRESENTATIVE OF THESE MEASUREMENTS. SEASONAL VARIABILITY AND TIDAL VARIABILITY NEAR THE THAMES RIVER MAY CAUSE CHANGES IN GROUNDWATER FLOW DIRECTIONS



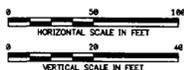
CROSS-SECTION I-I'



GOSS COVE LANDFILL



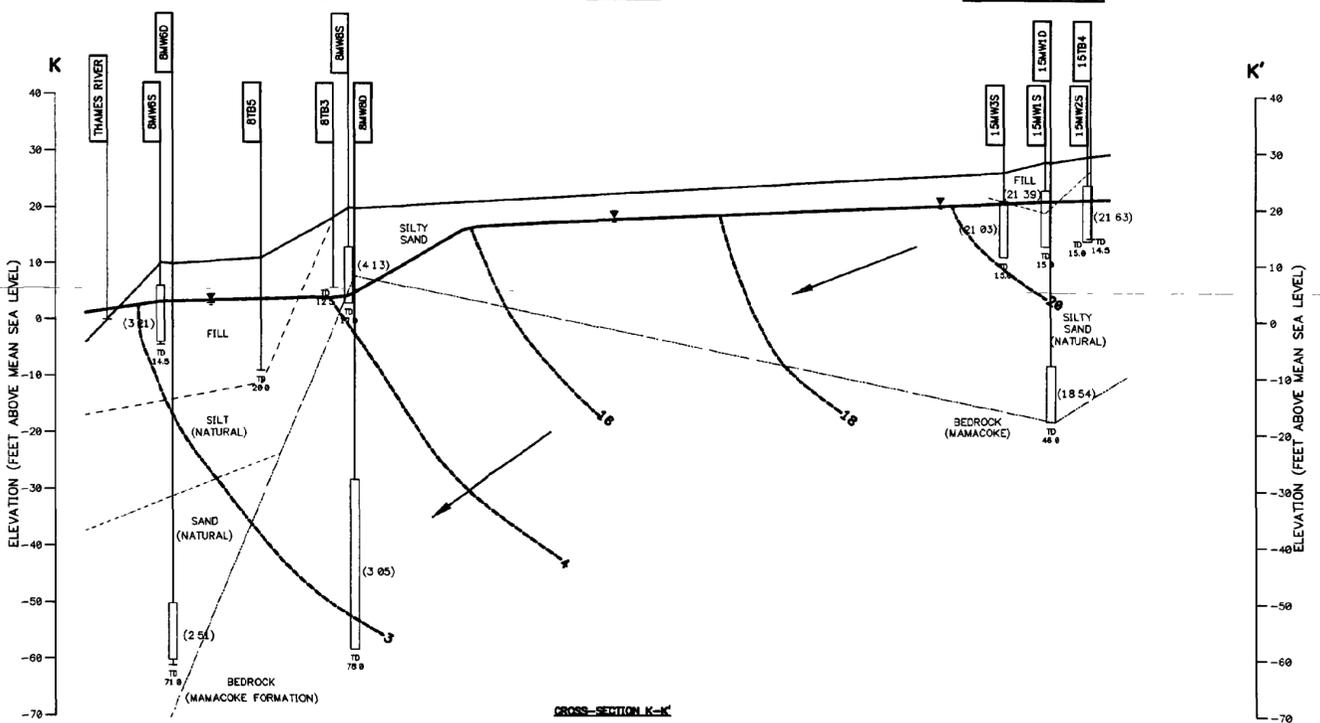
CROSS-SECTION J-J'



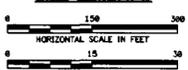
GOSS COVE LANDFILL

FUEL FARM

SPENT ACID STORAGE AND DISPOSAL AREA



CROSS-SECTION K-K'



DRAWING 21

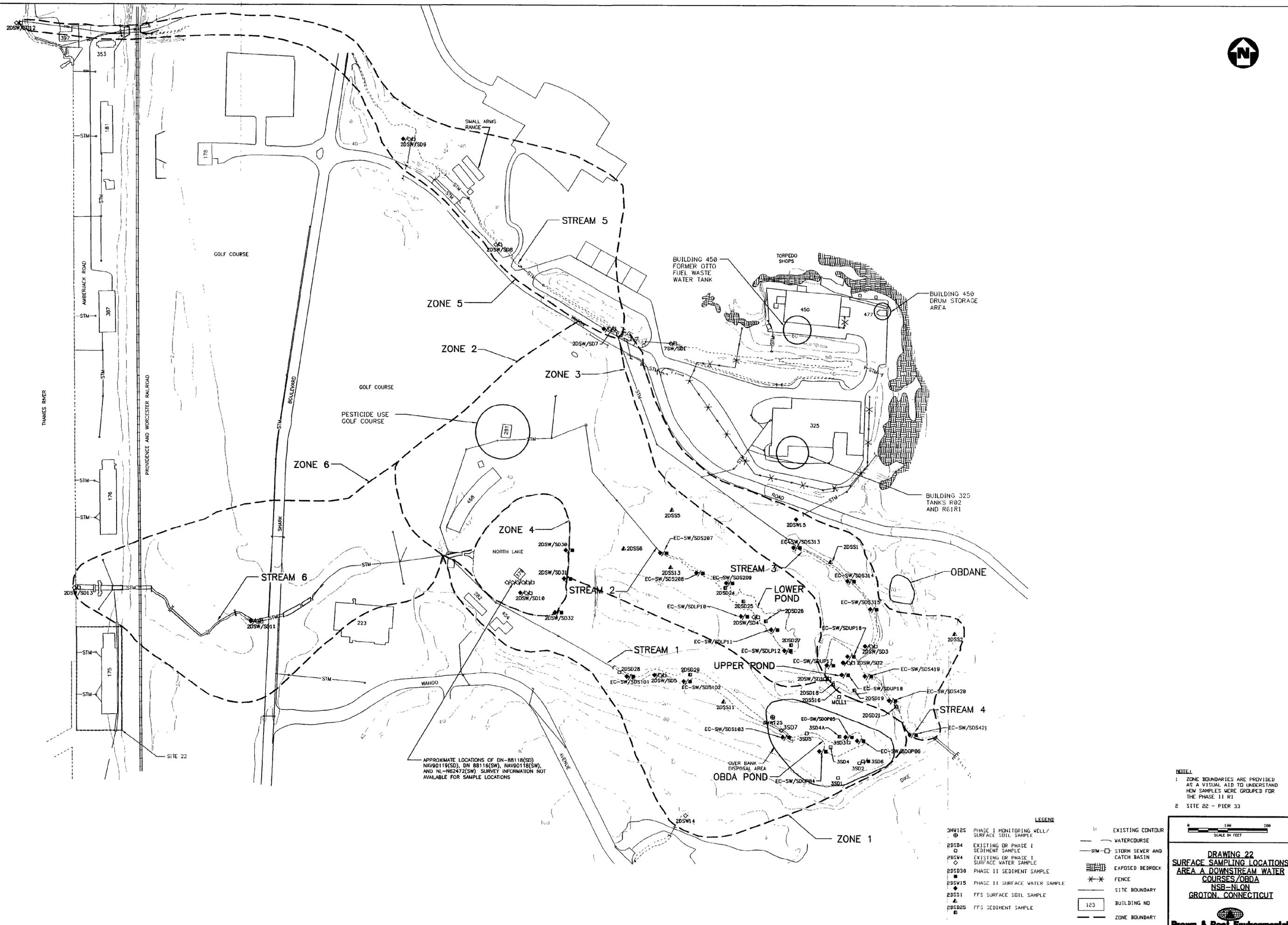
CROSS-SECTIONS
I-I', J-J', & K-K'
NSB-NLON
GROTON, CONNECTICUT

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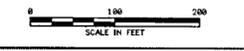
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APPROXIMATE LOCATIONS OF DN-8811R(SD)
 NAV90119(SD), DN 88116(SW), NAV90118(SW),
 AND NL-N62472(SW) SURVEY INFORMATION NOT
 AVAILABLE FOR SAMPLE LOCATIONS

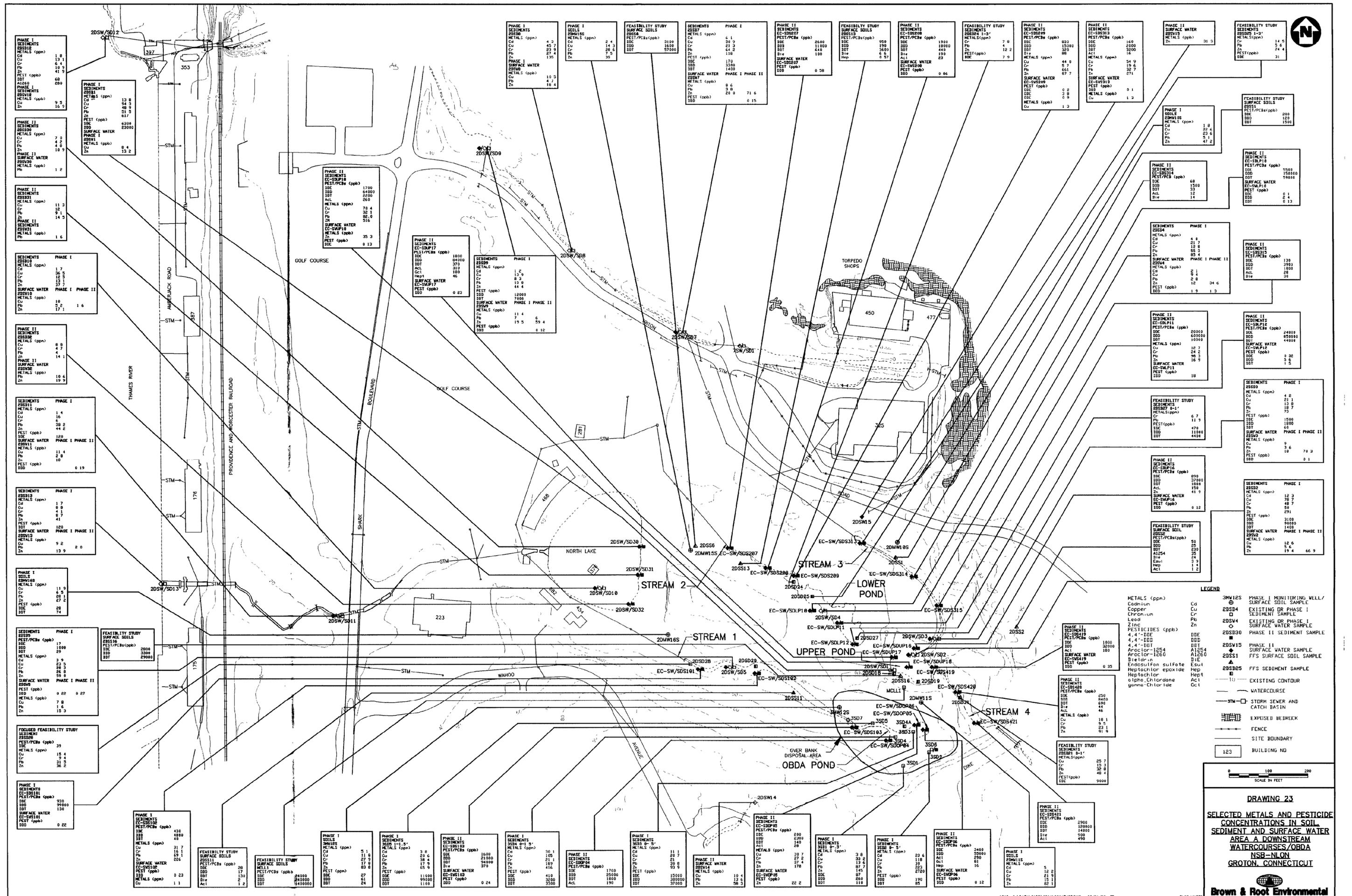
NOTE:
 1 ZONE BOUNDARIES ARE PROVIDED AS A VISUAL AID TO UNDERSTAND HOW SAMPLES WERE GROUPED FOR THE PHASE II R1
 2 SITE 22 - PIER 33

LEGEND	
3HW12S	PHASE I MONITORING WELL / SURFACE SOIL SAMPLE
2DSD4	EXISTING OR PHASE I SEDIMENT SAMPLE
2DSD4	EXISTING OR PHASE I SURFACE WATER SAMPLE
2DSD30	PHASE II SEDIMENT SAMPLE
2DSD15	PHASE II SURFACE WATER SAMPLE
2DSD1	FFS SURFACE SOIL SAMPLE
2DSD25	FFS SEDIMENT SAMPLE
---	EXISTING CONTOUR
---	WATERCOURSE
STM	STORM SEWER AND CATCH BASIN
---	EXPOSED BEDROCK
---	FENCE
---	SITE BOUNDARY
123	BUILDING NO
---	ZONE BOUNDARY



DRAWING 22
SURFACE SAMPLING LOCATIONS
AREA A DOWNSTREAM WATER
COURSES/OBDA
NSB-NLON
GROTON, CONNECTICUT





LEGEND

METALS (ppm)

Cadmium Cd
Copper Cu
Chromium Cr
Lead Pb
Zinc Zn

PESTICIDES (ppb)

4,4'-DDE DDE
4,4'-DDD DDD
4,4'-DDT DDT
Aroclor-1254 Aroclor-1254
Aroclor-1248 Aroclor-1248
Dieldrin Die
Endosulfon sulfate Esul
Heptachlor epoxide Hep
Heptachlor Hep
alpha-Chloroane Act
gamma-Chloroane Gc1

3MW125 PHASE I MONITORING WELL / SURFACE SOIL SAMPLE
2BSD4 EXISTING OR PHASE I SEDIMENT SAMPLE
2DSW4 EXISTING OR PHASE I SURFACE WATER SAMPLE
2SDS30 PHASE II SEDIMENT SAMPLE
2DSV15 PHASE II SURFACE WATER SAMPLE
2DS31 FFS SURFACE SOIL SAMPLE
2DS25 FFS SEDIMENT SAMPLE
2DS21 EXISTING CONTOUR
STM WATER SEWER AND CATCH BASIN
EXP EXPOSED BEDROCK
FENCE
SITE BOUNDARY
123 BUILDING NO

DRAWING 23
SELECTED METALS AND PESTICIDE CONCENTRATIONS IN SOIL, SEDIMENT AND SURFACE WATER AREA A DOWNSTREAM WATERCOURSES/OBDA NSB-NLON GROTON, CONNECTICUT

Brown & Root Environmental