08-0010
SDMS: 158669

Corporate Environmental Programs
General Electric Company
100 Woodlawn Ave., Pittsfield, MA 01201

Transmitted Via FedEx

July 11, 2000

Bryan Olson
EPA Project Coordinator
U.S. Environmental Protection Agency
EPA New England
One Congress Street, Suite 1100
Boston, MA 02214-2023

Re: GE-Pittsfield/Housatonic River Site
Upper ½-Mile Reach Removal Action (GECD800)
Results of Cell G1 DNAPL Investigation and Proposal to Address Presence of DNAPL in Cell G1

Dear Mr. Olson:

Enclosed is a document entitled *Results of Cell G1 DNAPL Investigation and Proposal to Address Presence of DNAPL in Cell G1*. This document presents the results of the recent investigation to delineate the extent of PCB-containing dense non-aqueous-phase liquid (DNAPL) encountered in Cell G1 during the Upper ½ Mile Reach Removal Action, and sets forth General Electric's proposal for further response actions to address that DNAPL. This proposal involves installation of a new sheetpile barrier wall and additional excavation of DNAPL-impacted materials. These actions will be implemented following the U.S. Environmental Protection Agency's approval of this proposal.

Please call me if you have any questions.

Sincerely yours,

Andrew T. Silfer /JJL

Andrew T. Silfer, P.E.
GE Project Coordinator

Enclosure

MOG/smr
F:\USERS\SMR\SMR00\58201938.doc

cc: Mark Barash, DOI
Robert Bell, MDEP
Jeffrey Bernstein, Bernstein, Cushner & Kimmel
James Bieke, Shea & Gardner
Michael Carroll, GE
Tim Conway, USEPA
J. Lyn Cutler, MDEP (2 copies)
Mayor Gerald Doyle, City of Pittsfield
Charles Fredette, CDEP
Jane Gardner, GE
Anton Giedt, NOAA
Ray Goff, USACE
Samuel Gutter, Sidley & Austin
William Horne, GE
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Dean Tagliaferro, USEPA
Andrew Thomas, GE
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Alan Weinberg, MDEP
Public Information Repositories ECL I-P-IV(A) (1)
GE Internal Repositories

GENERAL ELECTRIC COMPANY –PITTSFIELD MASSACHUSETTS
UPPER ½-MILE REMOVAL ACTION OF HOUSATONIC RIVER

RESULTS OF CELL G1 DNAPL INVESTIGATION AND PROPOSAL TO ADDRESS PRESENCE OF DNAPL IN CELL G1

I. INTRODUCTION

On May 25, 2000, during remediation of Cell G1, GE visually observed a small amount of DNAPL of unknown composition in the southwest corner of that cell. The observation was reported to the National Response Center (NRC), the United States Environmental Protection Agency (USEPA), and the Massachusetts Department of Environmental Protection (MDEP). A sample of the DNAPL was obtained on May 30, 2000 and the DNAPL was found to contain polychlorinated biphenyls (PCBs) at 449,000 parts per million (ppm) (Aroclor 1260), chlorobenzene at 266 ppm, and 1,2,4-trichlorobenzene at 159,000 ppm. In accordance with the requirements of the Removal Action Work Plan – Upper ½-Mile Reach of Housatonic River (Work Plan) (BBL, August 1999), on May 31, 2000 approximately one additional foot of sediment (beyond the limits identified in the Work Plan) was excavated in an approximate 20 foot by 40 foot area where the DNAPL was observed. The additional excavation did not completely remove the DNAPL-impacted materials and, in consultation with the USEPA, an investigation was proposed and implemented to further evaluate the lateral and vertical extent of DNAPL-impacted materials. This document presents the results of the investigation program and provides a proposal for installation of a sheetpile barrier wall and a proposal for additional excavation of DNAPL-impacted materials.

II. SUMMARY OF DNAPL INVESTIGATION AND RESULTS

The phased investigation program was performed between June 5, 2000 and June 28, 2000 by GE with oversight from USEPA representatives. Implementation of the program resulted in the installation of 33 soil borings, using mechanical and manual AMS probe and manual sediment core sampling techniques. The surveyed soil boring locations are shown on Figure 1. During advancement of the core barrel, the recovered soils/sediments were continuously logged and boring logs were developed and are included as Attachment A to this document. The soil samples were characterized with regard to the potential presence of DNAPL based on visual descriptions. Separate-phase DNAPL was only observed in the soil cores at five borings (HR-G1-SB4, HR-G1-SB15, HR-G1-SB17, HR-G1-SB24, and HR-G1-SB27). Geologic cross-sections of this area have also been developed and are shown in Figures 2 through 4. Sheens and odors were also observed at several locations throughout the investigation area and these observations are presented on Figure 5. In addition, various samples were selected, with concurrence of the USEPA, for analysis of PCBs. The analytical results indicated PCBs ranging in concentration from 0.12 to 8,670 ppm. These results are provided in Table 1 and on Figure 5. The results of the investigation indicate that DNAPL observations in the borings were limited to the area at the downstream end of Outfall 05B and in the sediment located in front of the headwall. Additionally, the observation of DNAPL is sporadic and does not appear to be associated with a significant source area. Based on these observations, with USEPA concurrence, an intermediate cut-off sheetpile wall was installed within Cell G1 (see Figure 1) to further isolate the DNAPL area from the upstream portion of Cell G1 and thus allow completion of restoration activities in the upstream portion of that cell.

Following completion of the soil boring investigation, three locations (PZ-1, PZ-2, and PZ-3) were selected for installation of well points (see Figure 1). Table 2 summarizes the well point

construction details and the locations are shown on Figure 1. The well points were installed on June 28, 2000, and monitored on June 30, July 3, and July 5, 2000 for the presence of DNAPL. The results are presented in Table 3. As indicated in Table 3, DNAPL has not been found in the well points, although a slight oily film has been observed on the probe in PZ-2.

Finally, on June 30, 2000, four additional soil borings (HR-G1-SB29, HR-G1-SB30, HR-G2-SB5, and HR-G2-SB6) were advanced along the top of the riverbank to determine the approximate elevation of till in this area. The borings indicated that till was present at an approximate elevation of 955 to 960 feet above mean sea level. The boring logs are also provided in Attachment A

III. PROPOSED SHEETPILE BARRIER WALL INSTALLATION

Based on the results of the above investigations and observation of DNAPL within the Cell G1 excavation area, supplemental containment measures are proposed to further address the known or potential presence of DNAPL within the subsurface soils in this area. The primary component of the proposed supplemental DNAPL containment measure is the installation of a physical containment barrier along and parallel to a portion of the Housatonic River riverbank. Specifically, GE proposes the installation of an approximately 105-foot long steel sheetpile wall parallel to and along the edge of the river, as shown on Figure 6.

The proposed containment barrier will be constructed of a steel sheetpile wall with sealable joints. This type of steel sheetpiling has been successfully installed at two previous locations at GE's Building 68 area and East Street Area 2 - South. The sheetpile wall will be constructed of Waterloo brand, heavy-wall, sealable sheetpiling (WEZ95) manufactured by Canadian Metal Rolling Mills under license to the University of Waterloo. The heavier gauge sheeting has been selected for this application, since it will be necessary to attempt to advance the sheeting into the subsurface till layer. The sheeting will be driven into place with a vibratory or impact hammer. Since there will be additional excavation activities performed in the vicinity of the containment barrier, and to avoid potential joint damage that may be caused by construction-related impacts, the sheetpile joints will be left un-grouted until the completion of the sediment excavation and restoration activities up to a minimum elevation of 967 feet. Structural calculations regarding the long-term stability of the sheetpile wall are provided in Attachment B. These calculations show that the sheetpile wall will be stable under long-term (restored) conditions.

Horizontal and Vertical Extent

The location and depth of the proposed containment barrier were conservatively selected, based on the results of field investigations, to include those areas (both vertically and horizontally) where DNAPL has been identified or may be potentially present. Once this area was determined, several other technical and operational factors were considered in the detailed design activities, such as possible impacts to the existing hydrogeologic conditions in the area, possible effects of future river flooding on the migration/containment of NAPL, laboratory analytical results, historic groundwater elevations, typical river elevations, and existing bank geometry. However, the actual alignment of the containment barrier may be adjusted somewhat during construction based on actual field conditions. These field adjustments are not anticipated to be significant.

The horizontal extent of the proposed containment barrier is shown on Figure 6. The wall will be located parallel to the river approximately 5 feet up the bank measured horizontally from the water edge (at elevation 972). This location has been selected based on a review of information obtained from the recent investigations summarized in Section II. Using this information, the

location of the proposed containment barrier was established to include known areas of NAPL that could potentially migrate toward the river. The location and alignment of the proposed containment barrier have also taken into account installation difficulties associated with the outfalls in this area. As shown on Figure 6, that barrier will encompass both outfalls.

Wing walls angled at 45° will extend up the bank approximately 15 feet at both ends of the proposed barrier wall. Based on these design parameters, the length of the proposed containment barrier along the riverbank will be approximately 75 feet. With the addition of the wing walls, the overall length of the proposed containment barrier will be approximately 105 feet.

Several considerations were taken into account in selecting the vertical extent of the proposed containment barrier, including the results from recent investigations; historic, current, and predicted groundwater hydraulics; and geotechnical considerations. From this information, it is anticipated that the vertical extent of the containment barrier will extend at least to the upper surface of the till unit (i.e., approximately 955 to 960 feet). In addition, the sheetpile will extend approximately 5 feet into the till if it is physically possible for the sheetpiling installation equipment to advance the sheetpile to this elevation.

The proposed upper elevation of the containment barrier is 975 feet. This top of sheetpile elevation was selected based on the existing bank elevations in this area and incorporation of the existing outfalls.

In addition to the presence of DNAPL, groundwater hydraulics were factored into the selection of the location and configuration (e.g., vertical extent) of the proposed containment barrier. The groundwater hydraulics associated with typical hydrogeologic conditions in this area were modeled by BBL using the publicly available and well-documented MODFLOW program (Attachment C). The results of the modeling effort indicate that the groundwater mounding caused by the installation of the sheetpile wall would be minor (approximately 0.5 feet). As a result, groundwater recovery behind the wall is not anticipated. In the event that groundwater recovery becomes necessary, the modeling indicates that a pumping rate of 10 gpm would reduce the groundwater mounding effects.

IV. PROPOSED ADDITIONAL EXCAVATION

Following installation of the sheetpile wall, additional excavation will be performed in Cell G1. In addition, another intermediate cut-off sheetpile wall will be installed to isolate the upper 25 feet of Cell G2 so that excavation activities in that area may be performed concurrently. The approximate extent of initial excavation is shown on Figures 6, 7 and 8. Excavation will be performed initially to a maximum depth of 4 feet, based on visual observations, in the downstream portion of Cell G1. A portion of this area will also be excavated further to an elevation of 965 feet. If it appears that the DNAPL-impacted materials have been removed, then the area will be restored in accordance with the requirements of the Work Plan. If it appears that additional DNAPL-impacted materials remain, then additional excavations will be performed until the maximum excavation depth has been reached. It is anticipated that maximum excavation depth in the interior portion of the Cell G1 DNAPL area will be an elevation of 963 feet based on the soil borings and structural considerations. However, if the excavation becomes unsafe due to "boils," the maximum excavation depth may be further limited. The Remediation Contractor will have responsibility for the structural stability of the excavation and will evaluate the maximum possible depth to which excavation may be performed, based on conditions observed in the field. Since there does not appear to be a significant source of DNAPL, it is not anticipated that a collection system will be required. However, in the event the maximum

excavation depth has been reached and DNAPL-impacted materials remain, a DNAPL collection system similar to the one installed in the river at East Street Area 2 - South may also be installed here.

Excavation activities in the upstream portion of Cell G2 will be initially performed to the limits required by the Work Plan. The need for additional excavation will be evaluated at that time based on the observations (if any) of DNAPL, consistent with the Work Plan. To facilitate excavation activities, Outfalls 005 and 05A will be re-routed. The outfall from the water treatment facility (005) will be piped around the work area and a 3,000 gallons per minute (gpm) pump will be installed in the outfall sump for the oil/water separator (05A) to pump the design discharge volume of water (2,800 gpm) around the work area.

Excavated materials that are observed to contain DNAPL will be separately managed and will be subject to off-site disposal. Excavated materials that are not observed to contain DNAPL will be placed in the On-Plant Consolidation Areas (OPCAs)

Following completion of excavation activities in Cells G1 and G2, the areas will be restored in a similar manner to the restoration at the East Street Area 2 - South source control area. Figures 7 and 8 provide cross-sections of the proposed restoration. To avoid potential joint damage that may be caused by construction-related impacts, the area in front of the sheetpile wall will be restored to a minimum elevation of 967 feet prior to grouting of the sheetpile joints. Following backfill to this level, the sheetpile joints will be grouted and restoration activities will be completed.

The existing outfalls will be extended to the sheetpile wall. Penetrations through the wall will be made as required to maintain proper operation of the outfalls. The penetrations will also be sealed as required to prevent leakage through the sheetpile wall. The area between the sheetpile wall and the existing outfall headwalls will be backfilled with general fill or grout to approximately 1 foot below the surrounding grade. Riprap will then be placed to the surrounding grade, as a measure of erosion protection. Additionally large diameter stones (greater than 12 inches) will be used below the outfalls for erosion protection

V. SCHEDULE AND ADDITIONAL ACTIVITIES

The proposed activities outlined herein will be implemented following USEPA's approval of this proposal. It is anticipated that, following USEPA's approval of this proposal, sheetpile wall installation, excavation, and restoration activities within Cell G1 and the upstream 25 feet of Cell G2 will be completed within a 3-4 week time frame. Until such time, GE will continue to monitor the well points three times per week and maintain oil absorbent booms and pads as needed.

Finally, following completion of restoration activities in the DNAPL portion of Cell G1 and the upstream portion of Cell G2, GE will evaluate the need for additional DNAPL collection measures in this area and propose any such measures to USEPA for approval.

Tables

TABLE 1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REMOVAL ACTION - UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

SUMMARY OF PCBs DETECTED IN CELL G1 AND G2 SOIL SAMPLES
(Results are presented in dry-weight parts per million, ppm)

GE Sample ID.	Sample Collection Date	Sample Depth (Feet)	Aroclors 1016 and 1232	Aroclor 1221	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total Aroclors
HR-G1-SB-19	6/14/00	8-10	ND (105)	ND (105)	ND (105)	ND (105)	ND (105)	2,080	2,080
HR-G1-SB-19	6/14/00	10-12	ND (3.06)	ND (3.06)	ND (3.06)	ND (3.06)	ND (3.06)	84.6	84.6
HR-G1-SB-20	6/14/00	2-4	ND (0.721)	ND (0.721)	ND (0.721)	1.32 PE	ND (0.721)	11.2 AG	12.52
HR-G1-SB-20	6/14/00	6-8	ND (0.0537)	ND (0.0537)	0.0605 PD	ND (0.0537)	ND (0.0537)	0.0602 AG	0.1207
HR-G1-SB-21	6/14/00	2-4	ND (0.0575)	ND (0.0575)	ND (0.0575)	0.382 PE	ND (0.0575)	0.586 AG	0.968
HR-G1-SB-21	6/14/00	8-10	ND (162)	ND (162)	ND (162)	ND (162)	ND (162)	4,200	4,200
HR-G1-SB-22	6/14/00	2-4	ND (0.0534)	ND (0.0534)	ND (0.0534)	ND (0.0534)	ND (0.0534)	0.191	0.191
HR-G1-SB-24	6/23/00	2-4	ND (7.0)	ND (7.0)	ND (7.0)	ND (7.0)	ND (7.0)	99	99
HR-G1-SB-24	6/23/00	4-6	ND (0.36)	ND (0.36)	ND (0.36)	ND (0.36)	ND (0.36)	3.6	3.6
HR-G1-SB-24	6/23/00	6-8	ND (180)	ND (180)	890	ND (180)	ND (180)	7,500	8,390
HR-G1-SB-24	6/23/00	8-10	ND (1.8)	ND (1.8)	3.7	ND (1.8)	ND (1.8)	40	43.7
HR-G1-SB-24	6/23/00	10-12	ND (0.047)	ND (0.047)	ND (0.047)	ND (0.047)	ND (0.047)	0.56	0.56
HR-G1-SB-24	6/23/00	12-14	ND (0.45)	ND (0.45)	0.43 J	ND (0.45)	ND (0.45)	4.6	5.03
HR-G1-SB-24	6/23/00	14-16	ND (19)	ND (19)	15 J	ND (19)	ND (19)	620	635
HR-G1-SB-26	6/23/00	8-10	ND (0.39)	ND (0.39)	0.35 J	ND (0.39)	ND (0.39)	3.3	3.65
HR-G1-SB-26	6/23/00	10-12	ND (0.036) [ND (0.036)]	ND (0.036) [ND (0.036)]	ND (0.036) [ND (0.036)]	ND (0.036) [ND (0.036)]	ND (0.036) [ND (0.036)]	0.14 [0.12]	0.14 [0.12]
HR-G1-SB-26	6/23/00	12-14	ND (0.037)	ND (0.037)	0.043	ND (0.037)	ND (0.037)	0.59	0.633
HR-G1-SB-27	6/23/00	0-2	ND (200)	ND (200)	170 J	ND (200)	ND (200)	8,500	8,670
HR-G1-SB-27	6/23/00	2-4	ND (43)	ND (43)	ND (43)	ND (43)	ND (43)	1,800	1,800
HR-G2-SB-1	6/16/00	4-6	ND (1.78)	ND (1.78)	ND (1.78)	ND (1.78)	ND (1.78)	41.8	41.8
HR-G2-SB-2	6/16/00	6-8	ND (2.48)	ND (2.48)	ND (2.48)	ND (2.48)	ND (2.48)	53	53
HR-G2-SB-4	6/16/00	12-14.5	ND (0.0619)	0.198 PB	ND (0.0619)	ND (0.0619)	ND (0.0619)	ND (0.0619)	0.198

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Incorporated, and submitted to Northeast Analytical and CT&E Environmental Services, Inc. for PCB analysis.
2. ND - Compound was not detected, associated detection limit presented in parentheses.
3. Duplicate sample results are presented in brackets.
4. J - Indicates an estimated value less than the associated detection limit.
5. PB - Aroclor 1221 is being used to report an altered PCB pattern exhibited by the sample. Actual Aroclor 1221 was not detected in the sample, but is reported to more accurately quantify PCB present in the sample that has undergone environmental alteration.
6. PD - Aroclor 1242 is being used to report an altered PCB pattern exhibited by the sample. Actual Aroclor 1242 was not detected in the sample, but is reported to more accurately quantify PCB present in the sample that has undergone environmental alteration.
7. PE - Aroclor 1248 is being used to report an altered PCB pattern exhibited by the sample. Actual Aroclor 1248 was not detected in the sample, but is reported to more accurately quantify PCB present in the sample that has undergone environmental alteration.
8. AG - Aroclor 1260 is being reported as the best Aroclor match. The sample exhibits an altered PCB pattern.

TABLE 2

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REMOVAL ACTION - UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

PIEZOMETER CONSTRUCTION DETAILS

Piezometer ID.	Ground Elevation (Feet AMSL)	Measuring Point Elevation (Feet AMSL)	Screen Depth (Feet)	Screen Elevation (Feet)
G1-PZ1	978.29	979.91	5-15	973.29-963.29
G1-PZ2	978.65	980.27	1-16	977.65-962.65
G1-PZ3	977.79	979.41	4-14	973.79-963.79

Notes:

1. Piezometers were installed by Blasland, Bouck & Lee, Incorporated on June 28, 2000, utilizing an AMS Power Probe direct push rig.
2. Piezometers were constructed with 1-inch inside diameter PVC screens and risers.

TABLE 3

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REMOVAL ACTION - UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

PIEZOMETER MONITORING RESULTS

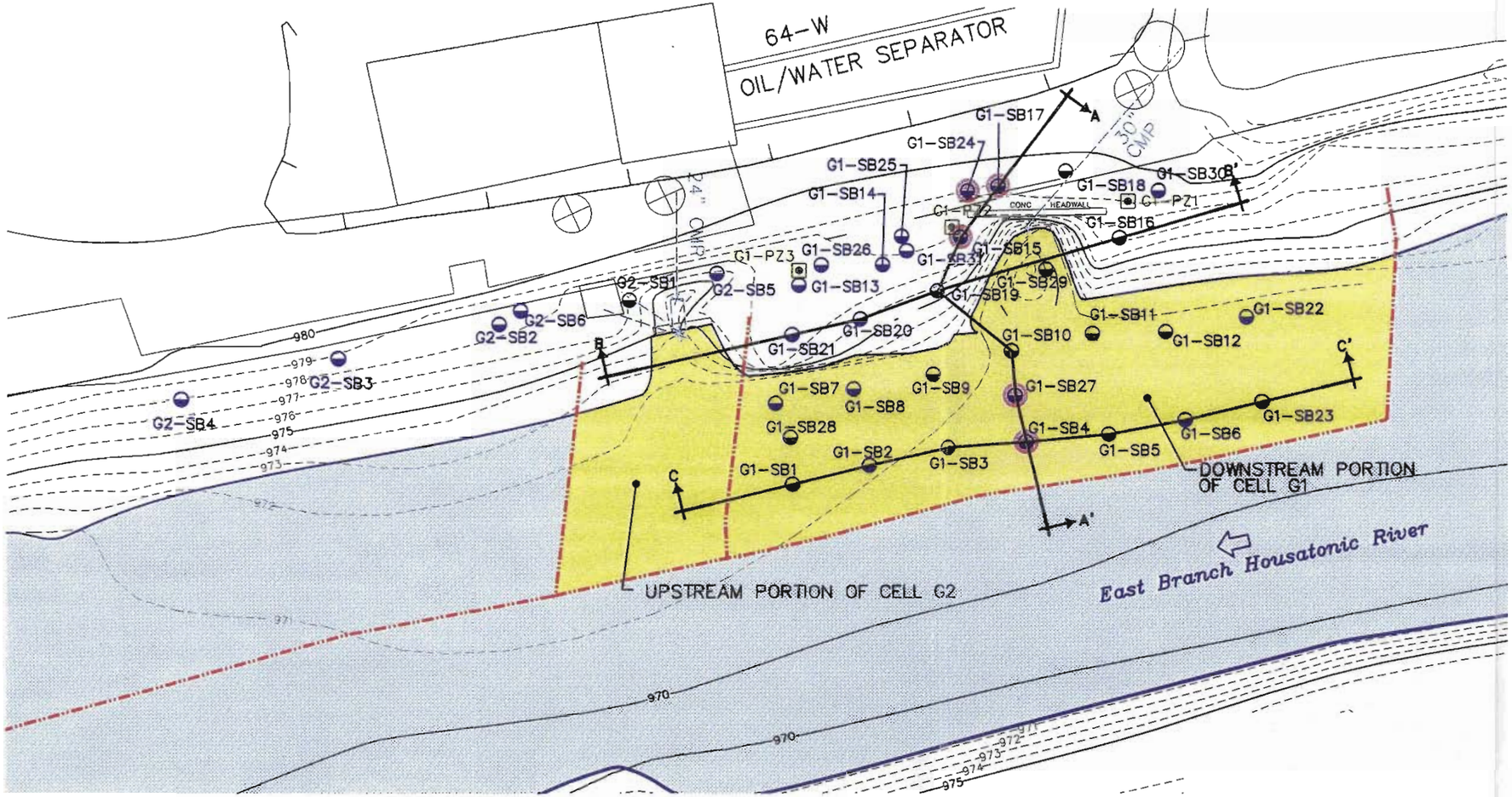
Piezometer ID.	Date	Ground Elevation (Feet AMSL)	Measuring Point Elevation (Feet AMSL)	Depth to Water (Feet below MP)	Depth to NAPL (Feet below MP)	NAPL Thickness (Feet)	Groundwater Elevation (Feet AMSL)
G1-PZ1	6/30/00	978.29	979.91	10.46	ND	0.00	969.45
G1-PZ1	7/3/00	978.29	979.91	10.46	ND	0.00	969.45
G1-PZ1	7/5/00	978.29	979.91	10.42	ND	0.00	969.49
G1-PZ2	6/30/00	978.65	980.27	10.89	ND	0.00	969.38
G1-PZ2	7/3/00	978.65	980.27	10.99	ND	0.00	969.28
G1-PZ2	7/5/00	978.65	980.27	10.92	ND	0.00	969.35
G1-PZ3	6/30/00	977.79	979.41	10.31	ND	0.00	969.10
G1-PZ3	7/3/00	977.79	979.41	10.39	ND	0.00	969.02
G1-PZ3	7/5/00	977.79	979.41	10.33	ND	0.00	969.08

Notes:

1. Piezometers were installed by Blasland, Bouck & Lee, Incorporated on June 28, 2000, utilizing an AMS Power Probe direct push rig.
2. Piezometers were constructed with 1-inch inside diameter PVC screens and risers.

Figures

BLASLAND, BOUCK & LEE, INC.
engineers & scientists



LEGEND:

- EXCAVATION SHEETPILE
- G1–SB1 — BORING LOCATION FOR DNAPL INVESTIGATION
- G1–SB17 — BORING LOCATION WHERE DNAPL OBSERVED
- G1–PZ1 — PIEZOMETER
- 980 — GROUND ELEVATION CONTOUR (PRIOR TO EXCAVATION)
- A A' — CROSS SECTION LOCATION
- WORK AREA

NOTE:

1. BASE MAP BY DESIGN GROUP, INC. 2 FEDERICO DRIVE, PITTSFIELD, MASSACHUSETTS 01201, "SKETCH PLAN OF G1 AND G2 BORING LOCATIONS", DATED JUNE 23, 2000.

0 20' 40'

GRAPHIC SCALE

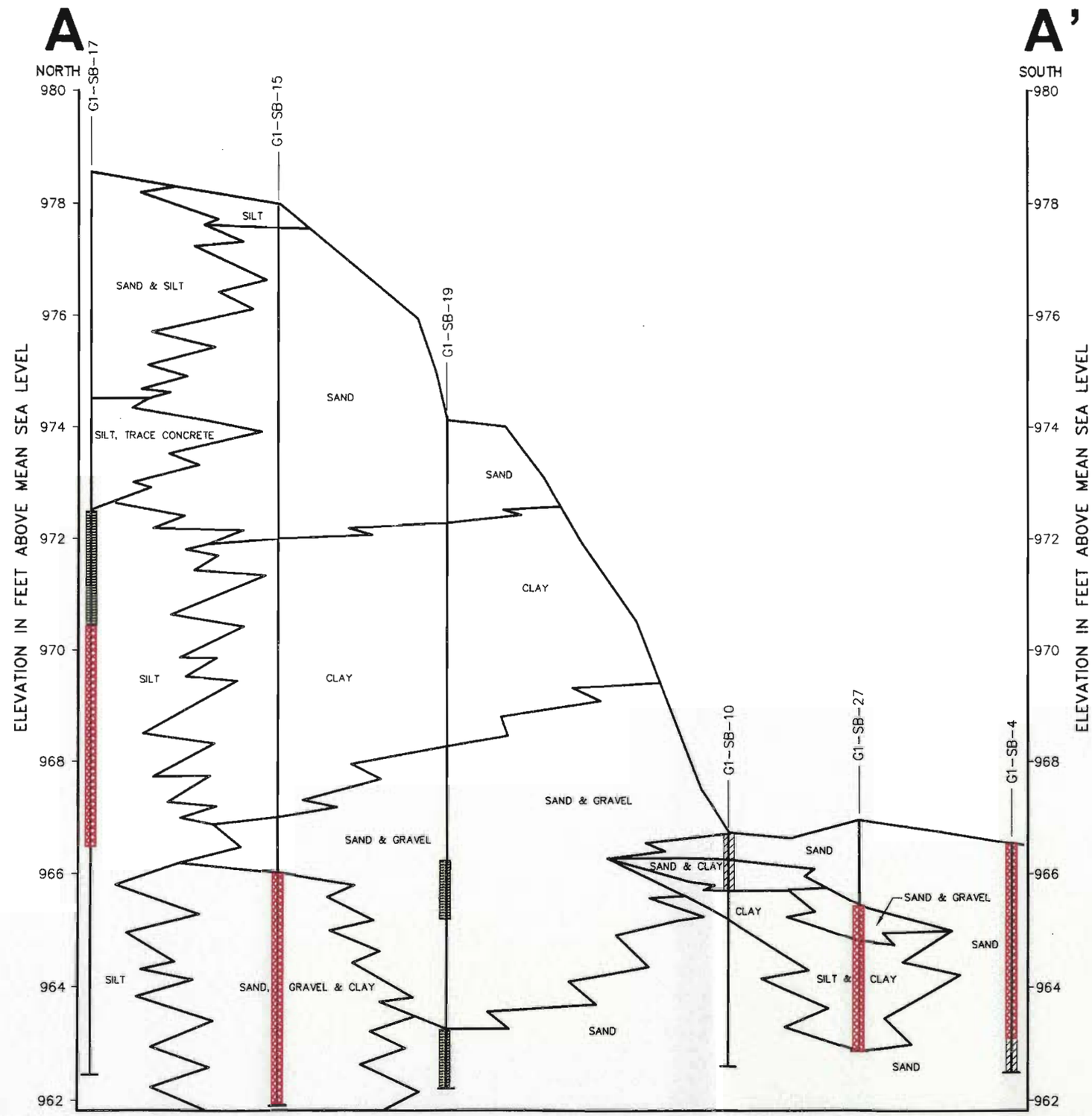
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

CELL G1 DNAPL AREA

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 1

X: NONE
L: ON=*, OFF=REF
P: STD-PCP/BL
7/11/00 SYR-54-JER KLN KMD
20197071/20197G01.DWG



LEGEND:

- SHEEN
- NAPL
- ODOR
- G1-SB-17 — SOIL BORING IDENTIFIER
- SOIL BORING
- BOTTOM OF BORING

0 6' 12'

HORIZONTAL GRAPHIC SCALE

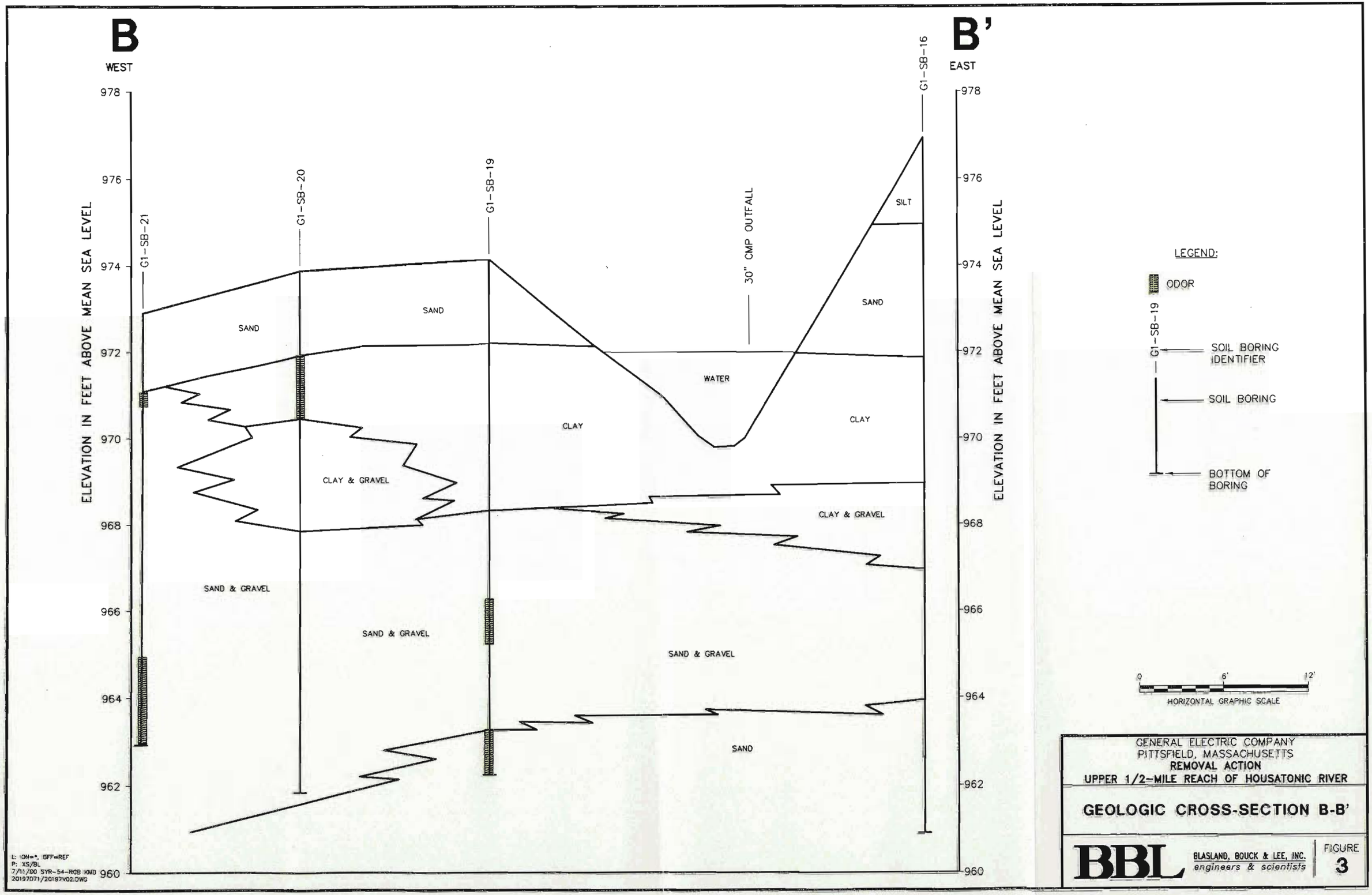
L: ON=*, OFF=REF
P: XS/BL
7/11/00 SYR-54-RCB KMD
20197071/20197V01.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

GEOLOGIC CROSS-SECTION A-A'

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 2

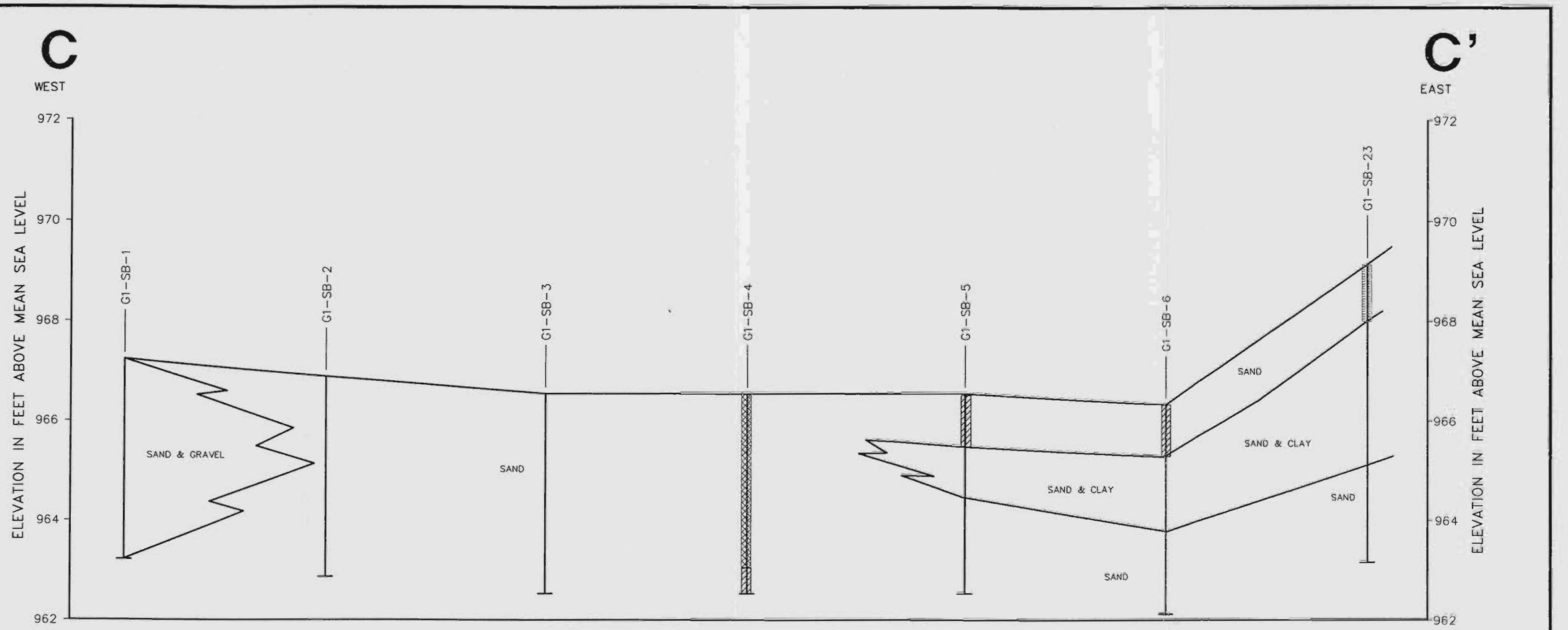


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

GEOLOGIC CROSS-SECTION B-B'

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 3



LEGEND:

- SHEEN
- NAPL
- ODOR

G1-SB-1 — SOIL BORING IDENTIFIER

SOIL BORING

BOTTOM OF BORING

0 6' 12'

HORIZONTAL GRAPHIC SCALE

L: ON=*, OFF=REF
P: XS/BL
7/11/00 SYR-54-RCB KMD
20197071/20197V03.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

GEOLOGIC CROSS-SECTION C-C'

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4

G1-SB19		
DEPTH (ft)	Total PCBs	OBSERVATIONS
8-10	2,080	ODOR (8-9')
10-12	84.6	ODOR

G1-SB15		
DEPTH (ft)	Total PCBs	OBSERVATIONS
12-16	N/A	NAPL, ODOR

G1-SB24		
DEPTH (ft)	Total PCBs	OBSERVATIONS
2-4	99	N/A
4-6	3.6	ODOR
6-8	8,390	ODOR
8-10	43.7	ODOR
10-12	0.56	ODOR
12-14	5.03	ODOR
14-16	635	ODOR, NAPL (15-16')

G1-SB17		
DEPTH (ft)	Total PCBs	OBSERVATIONS
6-8	N/A	ODOR
8-12	N/A	NAPL, ODOR

G1-SB18		
DEPTH (ft)	Total PCBs	OBSERVATIONS
4-6	N/A	STAIN, ODOR
6-8	N/A	SLIGHT ODOR

G1-SB22		
DEPTH (ft)	Total PCBs	OBSERVATIONS
2-4	0.191	N/A

G1-SB23		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-1	N/A	SLIGHT ODOR

G1-SB26		
DEPTH (ft)	Total PCBs	OBSERVATIONS
8-10	3.65	N/A
10-12	0.14 (0.12)	SLIGHT ODOR
12-14	0.633	N/A

G1-SB20		
DEPTH (ft)	Total PCBs	OBSERVATIONS
2-4	12.52	SLIGHT ODOR
6-8	0.1207	N/A

G2-SB5		
DEPTH (ft)	Total PCBs	OBSERVATIONS
20-22	N/A	SLIGHT ODOR

G1-SB21		
DEPTH (ft)	Total PCBs	OBSERVATIONS
2-4	0.968	SLIGHT ODOR
8-10	4,200	ODOR

G2-SB1		
DEPTH (ft)	Total PCBs	OBSERVATIONS
4-6	41.8	STAIN, SHEEN, ODOR
6-8	N/A	STAIN, SHEEN, ODOR

G2-SB2		
DEPTH (ft)	Total PCBs	OBSERVATIONS
6-8	53	SLIGHT ODOR

G2-SB4		
DEPTH (ft)	Total PCBs	OBSERVATIONS
12-14.5	0.198	SLIGHT ODOR

G1-SB7		
DEPTH (ft)	Total PCBs	OBSERVATIONS
2-4	N/A	SHEEN, ODOR

G1-SB9		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-2	N/A	SHEEN

G1-SB10		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-1	N/A	SHEEN

G1-SB27		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-2	8,670	NAPL (1.5-2')
2-4	1,800	NAPL

G1-SB4		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-3.5	N/A	NAPL
3.5-4	N/A	SHEEN

G1-SB11		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-0.5	N/A	SHEEN

G1-SB5		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-1	N/A	SHEEN

G1-SB12		
DEPTH (ft)	Total PCBs	OBSERVATIONS
2-4	N/A	SLIGHT SHEEN

G1-SB6		
DEPTH (ft)	Total PCBs	OBSERVATIONS
0-1	N/A	SHEEN

64-W

OIL/WATER SEPARATOR

30" CMP

CONC HEADWALL

G1-PZ1

G1-PZ2

G1-PZ3

G1-SB1 G1-SB2 G1-SB3 G1-SB4 G1-SB5 G1-SB6 G1-SB7 G1-SB8 G1-SB9 G1-SB10 G1-SB11 G1-SB12 G1-SB13 G1-SB14 G1-SB15 G1-SB16 G1-SB17 G1-SB18 G1-SB19 G1-SB20 G1-SB21 G1-SB22 G1-SB23 G1-SB24 G1-SB25 G1-SB26 G1-SB27 G1-SB28 G1-SB29 G1-SB30 G1-SB31

G2-SB1 G2-SB2 G2-SB3 G2-SB4 G2-SB5 G2-SB6

980 979 978 977 976 975 974 973 972 971 970

UPSTREAM PORTION OF CELL G2

DOWNSTREAM PORTION OF CELL G1

East Branch Housatonic River

X: NONE
L: ON=*, OFF=REF
P: STD-PCP/BL
7/11/00 SYR-54-GMS KLN KMD
20197071/20197G02.DWG

LEGEND:

- EXCAVATION SHEETPILE
- G1-SB1 — BORING LOCATION FOR DNAPL INVESTIGATION
- G1-SB17 — BORING LOCATION WHERE DNAPL OBSERVED
- G1-PZ1 — PIEZOMETER
- 980 — GROUND ELEVATION CONTOUR (PRIOR TO EXCAVATION)
- WORK AREA

NOTES:

1. BASE MAP BY DESIGN GROUP, INC. 2 FEDERICO DRIVE, PITTSFIELD, MASSACHUSETTS 01201, "SKETCH PLAN OF G1 AND G2 BORING LOCATIONS", DATED JUNE 23, 2000.
2. SOIL SAMPLES COLLECTED BY BBL, INC. AND SUBMITTED TO NORTHEAST ANALYTICAL AND CT&E ENVIRONMENTAL SERVICES, INC.
3. TOTAL PCB CONCENTRATIONS PRESENTED IN DRY WEIGHT PARTS PER MILLION (PPM).
4. N/A – A SOIL SAMPLE WAS NOT SUBMITTED FOR LABORATORY ANALYSIS FOR THE SPECIFIED DEPTH INTERVAL, OR NO SIGNIFICANT OBSERVATIONS WERE MADE DURING SAMPLING.

0 20' 40'

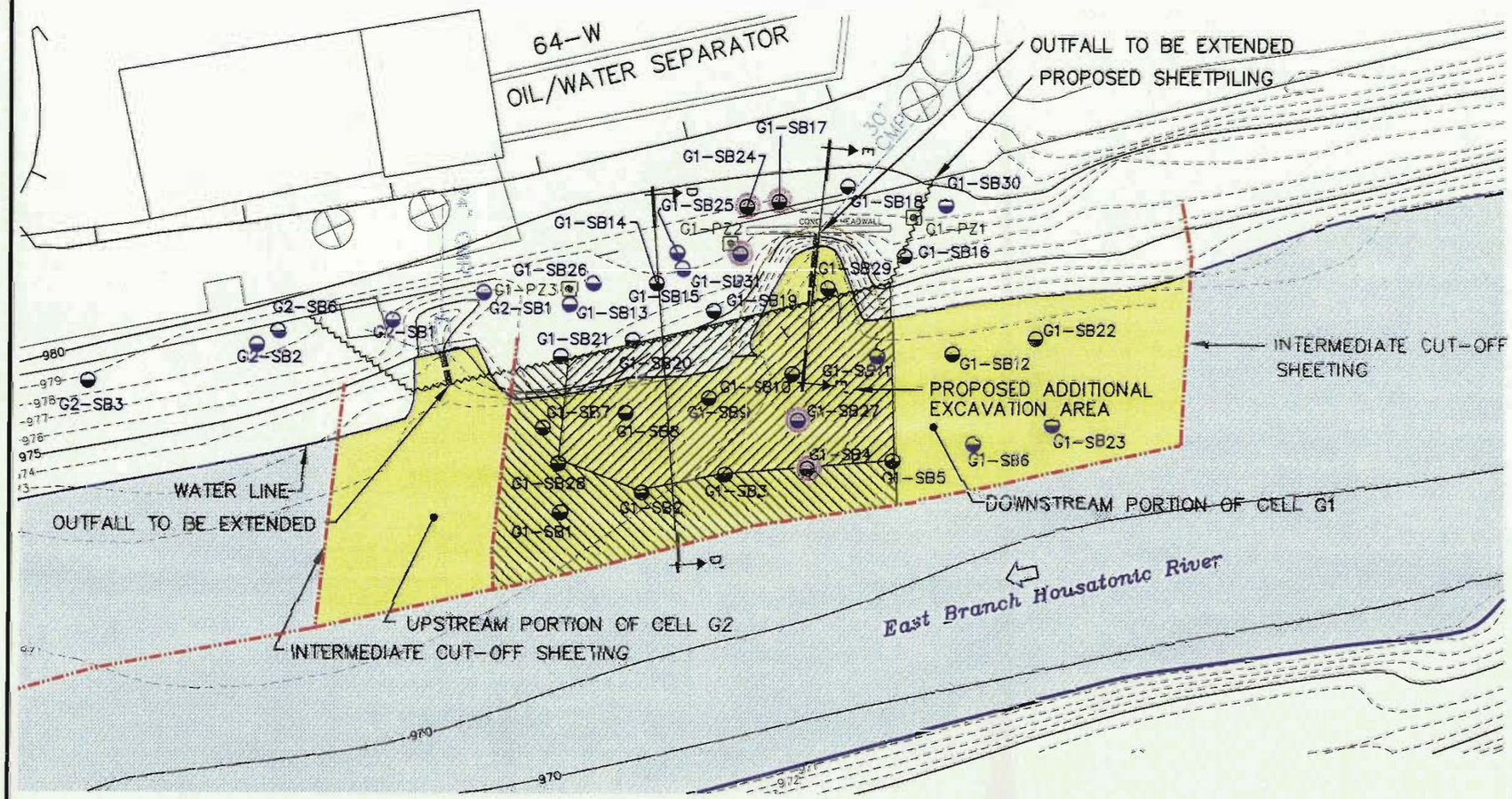
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

CELL G1 DNAPL AREA SOIL BORING RESULTS

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 5



LEGEND:

- EXCAVATION SHEETPILE
- G1-SB1 — BORING LOCATION FOR DNAPL INVESTIGATION
- G1-SB17 — BORING LOCATION WHERE DNAPL OBSERVED
- G1-PZ1 — PIEZOMETER
- 980 — GROUND ELEVATION CONTOUR (PRIOR TO EXCAVATION)
- PROPOSED ADDITIONAL EXCAVATION AREA TO MAXIMUM ELEVATION OF 963' BASED ON VISUAL OBSERVATIONS
- WORK AREA
- PROPOSED ADDITIONAL EXCAVATION AREA TO MAXIMUM DEPTH OF 4' BASED ON VISUAL OBSERVATIONS
- D D' — CROSS-SECTION LOCATION

NOTES:

1. BASE MAP BY DESIGN GROUP, INC. 2 FEDERICO DRIVE, PITTSFIELD, MASSACHUSETTS 01201, "SKETCH PLAN OF G1 AND G2 BORING LOCATIONS", DATED JUNE 23, 2000.

0 20' 40'

GRAPHIC SCALE

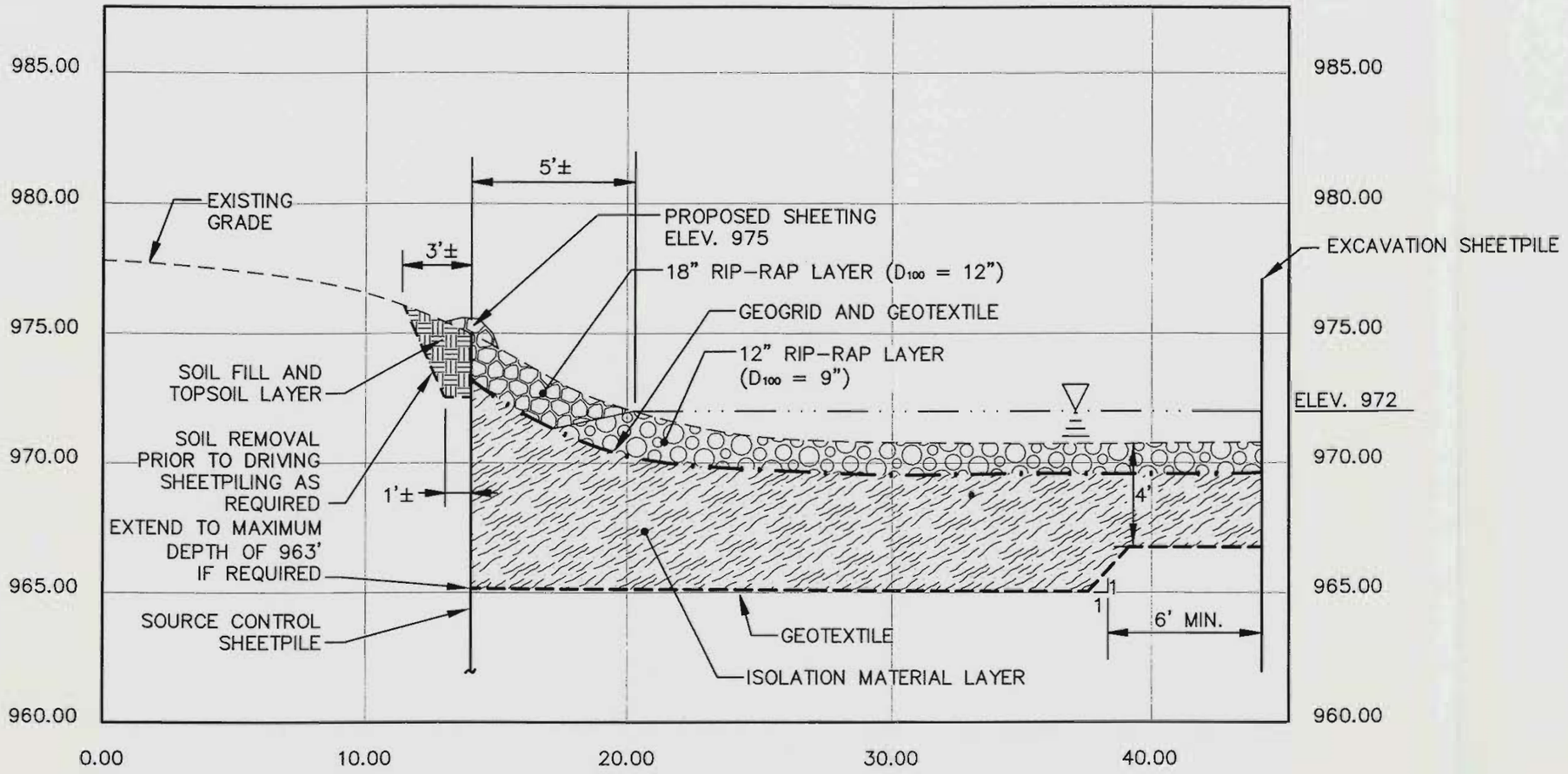
X: NONE
L: ON=*, OFF=REF
P: STD-PCP/BL
7/11/00 SYR-54-JER RCB KMD
20197071/20197G03.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

CELL G1 DNAPL AREA PROPOSED ACTIVITIES

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 6



SECTION D-D'

SCALE: HORIZ. 1"=5'
VERT. 1"=5'

0 5' 10'
GRAPHIC SCALE

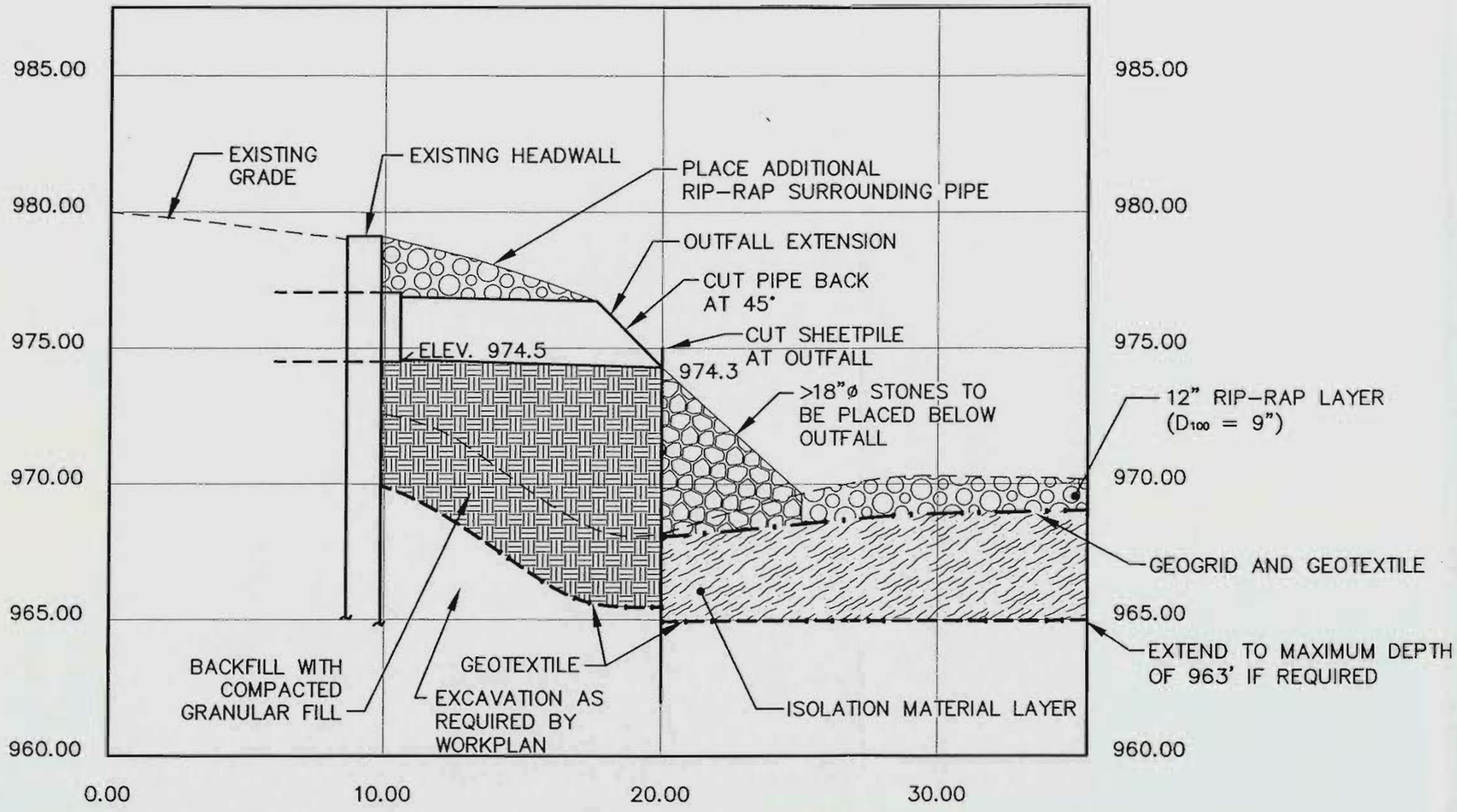
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

RESTORATION CROSS-SECTION D-D'

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 7

X: NONE
L: ON=*, OFF=REF
P: XS/BL
7/11/00 SYR-54-RCB PGL KMD
20197071/20197V04.DWG



0 5' 10'

GRAPHIC SCALE

SECTION E-E'

SCALE: HORIZ. 1"=5'
VERT. 1"=5'

X: NONE
L: ON=*, OFF=REF
P: XS/BL
7/11/00 SYR-54-RCB PGL KMD
20197071/20197V05.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

OUTFALL CROSS-SECTION E-E'

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 8

Attachments

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Attachment A

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Soil Boring Logs

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533041.31
EASTING: 132761.79
GROUND ELEVATION: 967.24

BORING ID: HR-G1-SB-1
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	967.24	0-4	2.7				Gray-brown fine-coarse SAND and GRAVEL.
1	966.24						
2	965.24						
3	964.24						
4	963.24						Boring terminated at 4.0 feet (963.24 feet)
5							
6							
7							
8							
9							
10							

REMARKS:
No sheens or NAPL observed.

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533048.24
EASTING: 132772.05
GROUND ELEVATION: 966.87

BORING ID: HR-G1-SB-2
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.87	0-4	2.2				Gray-brown fine SAND.
1	965.87						
2	964.87						1.8' (965.07')
							Gray-brown fine-coarse SAND.
3	963.87						
4	962.87						Boring terminated at 4.0 feet (962.87 feet)
5							
6							
7							
8							
9							
10							

REMARKS:
No sheens or NAPL observed.

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533055.12
EASTING: 132782.81
GROUND ELEVATION: 966.55

BORING ID: HR-G1-SB-3
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.55	0-4	3.8				Gray fine-coarse SAND.
							0.4' (966.15')
1	965.55						Gray fine SAND.
2	964.55						
							2.0' (964.55')
3	963.55						Gray fine-medium SAND.
4	962.55						
							Boring terminated at 4.0 feet (962.55 feet)
5							
6							
7							
8							
9							
10							

REMARKS:
No sheens or NAPL observed.

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533060.18
EASTING: 132794.00
GROUND ELEVATION: 966.54

BORING ID: HR-G1-SB-4
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.54	0-4	2.0				Gray fine SAND, oily sheen and oil droplets.
1	965.54						
2	964.54						
3	963.54						
4	962.54						3.5' (963.04') Gray fine-coarse SAND, oily sheen.
5							Boring terminated at 4.0 feet (962.54 feet)
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533065.71
EASTING: 132805.50
GROUND ELEVATION: 966.56

BORING ID: HR-G1-SB-5
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.56	0-4	3.0				Gray fine-coarse SAND, oil sheen.
							1.0' (965.56')
1	965.56						Gray fine SAND and CLAY.
							2.0' (964.56')
2	964.56						Gray fine SAND, compact.
3	963.56						
4	962.56						Boring terminated at 4.0 feet (962.56 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.2 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533071.91
EASTING: 132815.80
GROUND ELEVATION: 967.32

BORING ID: HR-G1-SB-6
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	967.32	0-4.2	4.1				Gray fine-coarse SAND, oily sheen.
1	966.32						1.0' (966.32') Gray CLAY, some fine Sand.
2	965.32						
3	964.32						2.5' (964.82') Gray fine SAND.
4	963.32						Boring terminated at 4.2 feet (963.12 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533052.36
EASTING: 132754.95
GROUND ELEVATION: 968.05

BORING ID: HR-G1-SB-7
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	968.05	0-4	2.4				Gray fine-coarse SAND.
1	967.05						
2	966.05						2.0' (966.05')
3	965.05						Dark gray fine-coarse SAND, oily sheen, odor.
4	964.05						Boring terminated at 4.0 feet (964.05 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533058.67
EASTING: 132765.63
GROUND ELEVATION: 967.20

BORING ID: HR-G1-SB-8
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	967.20	0-4	2.0				Gray-brown fine-medium SAND, some coarse Sand.
1	966.20						
2	965.20						2.0' (965.20')
							Gray fine-coarse SAND.
3	964.20						
4	963.20						Boring terminated at 4.0 feet (963.20 feet)
5							
6							
7							
8							
9							
10							

REMARKS:
No sheens or NAPL observed.

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533065.08
EASTING: 132776.55
GROUND ELEVATION: 966.55

BORING ID: HR-G1-SB-9

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.55	0-4	3.0				Gray fine SAND, some coarse Sand, oily sheen.
1	965.55						
2	964.55						
							2.0' (964.55')
							Gray fine-coarse SAND and GRAVEL.
3	963.55						
4	962.55						
							Boring terminated at 4.0 feet (962.55 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533072.81
EASTING: 132786.95
GROUND ELEVATION: 966.68

BORING ID: HR-G1-SB-10

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.68	0-4	3.9				Gray fine-medium SAND, oily sheen.
							0.5' (966.18')
1	965.68						Gray fine SAND and CLAY, oil sheen.
							1.0' (965.68')
2	964.68						Gray CLAY.
							1.5' (965.18')
3	963.68						Gray fine SAND.
							3.5' (963.18')
4	962.68						Gray fine-medium SAND.
							Boring terminated at 4.0 feet (962.68 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533079.67
EASTING: 132797.70
GROUND ELEVATION: 966.90

BORING ID: HR-G1-SB-11

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.90	0-4	3.2				Gray fine SAND, oily sheen.
							0.5' (966.40')
1	965.90						Gray CLAY.
2	964.90						
							2.0' (964.90')
3	963.90						Gray fine SAND.
							3.0' (963.90')
4	962.90						Gray fine-medium SAND.
							Boring terminated at 4.0 feet (962.90 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/5/2000
DATE FINISHED: 6/5/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533083.85
EASTING: 132808.20
GROUND ELEVATION: 967.25

BORING ID: HR-G1-SB-12

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	967.25	0-4.2	2.0				Gray fine SAND.
1	966.25						
2	965.25						2.0' (965.25')
							Dark gray fine-coarse SAND and GRAVEL, very slight sheen.
3	964.25						
4	963.25						Boring terminated at 4.0 feet (963.25 feet)
5							
6							
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE:AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533071.02
EASTING: 132751.99
GROUND ELEVATION: 977.73

BORING ID: HR-G1-SB-13

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	977.73	0-4	2.6				Brown SILT.
1	976.73						
2	975.73						
							2.0' (975.73')
							Light brown fine SAND.
3	974.73						
							3.0' (974.73')
							Gray fine SAND.
4	973.73	4-8	3.1				4.0' (973.73')
							Gray-brown fine SAND, wet at 4 feet.
5	972.73						
							5.0' (972.73')
							Gray CLAY.
6	971.73						
7	970.73						
							7.0' (970.73')
							Gray CLAY, some coarse Sand and Gravel.
8	969.73	8-12	2.1				
9	968.73						
10	967.73						
							10.0' (967.73')
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533071.02
EASTING: 132751.99
GROUND ELEVATION: 977.73

BORING ID: HR-G1-SB-13
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	967.73	8-12	2.1				Dark gray fine-coarse SAND and GRAVEL.
11	966.73						
12	965.73	12-16	2.1				
13	964.73						
14	963.73						
							14.0' (963.73') Gray-brown fine-coarse SAND and GRAVEL.
15	962.73						
16	961.73						
							Boring terminated at 16.0 feet (961.73 feet)
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533078.52
EASTING: 132763.19
GROUND ELEVATION: 978.41

BORING ID: HR-G1-SB-14
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.41	0-4	2.2				Brown SILT.
							0.5' (977.91')
1	977.41						Light brown fine SAND.
							1.0' (977.41')
							Brown SILT.
2	976.41						1.5' (976.91')
							Light brown fine SAND.
3	975.41						
4	974.41	4-8	3.2				
							4.0' (974.41')
5	973.41						Gray-brown fine SAND.
6	972.41						
							6.0' (972.41')
7	971.41						Gray CLAY.
							7.0' (971.41')
8	970.41	8-12	0.8				Gray CLAY, some Gravel.
9	969.41						
10	968.41						
							10.0' (968.41')
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE:AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533078.52
EASTING: 132763.19
GROUND ELEVATION: 978.41

BORING ID: HR-G1-SB-14
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.41	8-12	0.8				Gray CLAY, some Gravel.
11	967.41						
12	966.41	12-16	1.3				
							12.0' (966.41')
13	965.41						Gray coarse SAND and GRAVEL.
14	964.41						
15	963.41						
16	962.41						
							Boring terminated at 16.0 feet (961.73 feet)
17							
18							
19							
20							
11							

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533086.84
EASTING: 132773.35
GROUND ELEVATION: 977.95

BORING ID: HR-G1-SB-15

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	977.95	0-4	1.7				Brown SILT.
							0.5' (977.45')
1	976.95						Light brown fine SAND.
2	975.95						
3	974.95						
4	973.95	4-8	3.8				
							4.0' (973.95')
5	972.95						Gray-brown fine SAND.
6	971.95						
							6.0' (971.95')
7	970.95						Gray CLAY.
8	969.95	8-12	4.0				
9	968.95						
10	967.95						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE:AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533086.84
EASTING: 132773.35
GROUND ELEVATION: 977.95

BORING ID: HR-G1-SB-15
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	967.95	8-12	4.0				Gray CLAY.
							11.0' (966.95')
11	966.95						Gray coarse SAND and GRAVEL.
							12.0' (965.95')
12	965.95	12-16	2.9				Gray fine-coarse SAND, some Gravel and Clay, contains brown oil droplets, odor.
13	964.95						
14	963.95						
15	962.95						
16	961.95						Boring terminated at 16.0 feet (961.95 feet)
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533095.21
EASTING: 132796.47
GROUND ELEVATION: 976.92

BORING ID: HR-G1-SB-16

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	976.92	0-4	2.4				Brown SILT.
1	975.92						
2	974.92						2.0' (974.92') Light brown fine SAND.
3	973.92						
4	972.92	4-8	3.8				4.0' (972.92') Gray-brown fine SAND.
5	971.92						5.0' (971.92') Gray CLAY.
6	970.92						
7	969.92						
8	968.92	8-12	2.2				8.0' (968.92') Gray CLAY, some Gravel.
9	967.92						
10	966.92						10.0' (966.92')
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/6/2000
DATE FINISHED: 6/6/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:533095.21
EASTING:132796.47
GROUND ELEVATION:976.92

BORING ID: HR-G1-SB-16

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	966.92	8-12	2.2				Gray CLAY, some Gravel. 10.0' (966.92')
							Gray-brown fine-coarse SAND and GRAVEL.
11	965.92						
12	964.92	12-16	4.0				
13	963.92						
							13.0' (963.92') Gray fine SAND, compact.
14	962.92						
15	961.92						
16	960.92						
							Boring terminated at 16.0 feet (960.92 feet)
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/12/2000
DATE FINISHED: 6/12/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533096.38
EASTING: 132776.14
GROUND ELEVATION: 978.55

BORING ID: HR-G1-SB-17

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.55	0-4	3.0				Dark brown SILT and fine SAND.
1	977.55						
2	976.55						
							2.0' (976.55')
							Brown fine-coare SAND and SILT.
3	975.55						
4	974.55	4-8	3.2				
							4.0' (974.55')
							Brown SILT, trace concrete.
5	973.55						
6	972.55						
							6.0' (972.55')
							Dark brown SILT, odor.
7	971.55						
8	970.55	8-12	3.8				
							8.0' (970.55')
							Brown SILT, saturated, contains brown oil droplets, odor.
9	969.55						
10	968.55						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/12/2000
DATE FINISHED: 6/12/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533096.38
EASTING: 132776.14
GROUND ELEVATION: 978.55

BORING ID: HR-G1-SB-17
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.55	8-12	3.8				Brown SILT, saturated, contains brown oil droplets, odor.
11	967.55						
12	966.55	12-16	3.8				
							12.0' (966.55')
							Gray-brown SILT, saturated.
13	965.55						
14	964.55						
							14.0' (964.55')
							Gray-brown SILT, saturated.
15	963.55						
16	962.55						
							Boring terminated at 16.0 feet (962.55 feet)
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/12/2000
DATE FINISHED: 6/12/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533102.16
EASTING: 132785.05
GROUND ELEVATION: 978.72

BORING ID: HR-G1-SB-18

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.72	0-4	2.6				Brown SILT, trace fine Gravel.
1	977.72						
2	976.72						
							2.0' (976.72')
							Brown SILT, trace concrete.
3	975.72						
4	974.72	4-8	3.0				
							4.0' (974.72')
							Brown SILT, trace concrete, dark staining, odor.
5	973.72						
6	972.72						
							6.0' (972.72')
							Gray-brown SILT, slight odor.
7	971.72						
8	970.72	8-12	3.8				
							8.0' (970.72')
							Light gray-brown SILT, saturated.
9	969.72						
10	968.72						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/12/2000
DATE FINISHED: 6/12/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE:AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533102.16
EASTING: 132785.05
GROUND ELEVATION: 978.72

BORING ID: HR-G1-SB-18

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.72	8-12	3.8				Light gray-brown SILT, saturated.
11	967.72						
12	966.72	12-16	3.8				
							12.0' (966.72')
							Dark brown SILT and fine GRAVEL (till).
13	965.72						
14	964.72						
							14.0' (964.72')
							Dark brown SILT, coarse SAND, and fine GRAVEL (till).
15	963.72						
16	962.72						
							Boring terminated at 16.0 feet (962.72 feet)
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 12.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533077.62
EASTING: 132772.66
GROUND ELEVATION: 974.18

BORING ID: HR-G1-SB-19
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	974.18	0-4	2.9				Light brown-brown fine SAND, trace Organics.
1	973.18						
2	972.18						2.0' (972.18') Gray CLAY.
3	971.18						
4	970.18	4-8	2.8				
5	969.18						
6	968.18						6.0' (968.18') Gray fine SAND and GRAVEL.
7	967.18						
8	966.18	8-12	3.2				8.0' (966.18') Dark brown fine SAND and GRAVEL, odor to 9 feet.
9	965.18						
10	964.18						Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 8-10 feet and 10-12 feet.

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 12.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:533077.62
EASTING:132772.66
GROUND ELEVATION:974.18

BORING ID: HR-G1-SB-19

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	964.18	8-12	3.2				Dark brown fine SAND and GRAVEL.
11	963.18						
12	962.18						Brown fine SAND, odor.
							12.0' (966.72')
13							Boring terminated at 12.0 feet (962.18 feet)
14							
15							
16							
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 8-10 feet and 10-12 feet.

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 12.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533069.29
EASTING: 132762.80
GROUND ELEVATION: 973.92

BORING ID: HR-G1-SB-20

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	973.92	0-4	3.1				Brown fine SAND, some Organics.
1	972.92						
2	971.92						
							2.0' (971.92')
							Gray CLAY, slight odor.
3	970.92						
							3.5' (970.42')
4	969.92	4-8	1.8				Gray CLAY and GRAVEL, no odor.
5	968.92						
6	967.92						
							6.0' (967.92')
							Very dark brown fine SAND and GRAVEL.
7	966.92						
8	965.92	8-12	2.0				
							8.0' (969.72')
							Gray-brown fine SAND and GRAVEL.
9	964.92						
10	963.92						
							10.0' (963.92')
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 2-4 feet and 6-8 feet (duplicate sample HR-G1-SB-DUP-1 collected from 6-8 feet).

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 12.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533069.29
EASTING: 132762.80
GROUND ELEVATION: 973.92

BORING ID: HR-G1-SB-20

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	963.92	8-12	2.0				Gray-brown GRAVEL, some fine Sand.
11	962.92						
12	961.92						
							12.0' (961.92')
13							Boring terminated at 12.0 feet (961.92 feet)
14							
15							
16							
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 2-4 feet and 6-8 feet (duplicate sample HR-G1-SB-DUP-1 collected from 6-8 feet).

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 10.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533063.35
EASTING: 132753.66
GROUND ELEVATION: 972.92

BORING ID: HR-G1-SB-21

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	972.92	0-4	2.3				Brown fine SAND, trace Organics.
1	971.92						
2	970.92						
							2.0' (970.92')
							Gray-brown medium SAND and GRAVEL, slight odor from 2.0 to 2.25 feet.
3	969.92						
4	968.92	4-8	2.5				
							4.0' (968.92')
							Light gray-brown medium SAND and GRAVEL.
5	967.92						
6	966.92						
7	965.92						
8	964.92	8-10	1.9				
							8.0' (964.92')
							Gray SAND and GRAVEL, odor.
9	963.92						
10	962.92						
							Boring terminated at 10.0 feet (962.92 feet).

REMARKS:
Boring backfilled to to-surface with bentonite.
Analytical samples collected from 2-4 feet and 8-10 feet.

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.5 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533090.34
EASTING: 132819.20
GROUND ELEVATION: 968.58

BORING ID: HR-G1-SB-22
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	968.58	0-4.5	2.2				Gray fine SAND, some Organics.
1	967.58						
2	966.58						2.0' (966.58')
							Gray GRAVEL, some fine Sand.
3	965.58						
4	964.58						
5							Boring terminated at 4.5 feet (964.08 feet).
6							
7							
8							
9							
10							

REMARKS:
Analytical samples collected from 2-4 feet (14-16 inches from top of core).

DATE STARTED: 6/14/2000
DATE FINISHED: 6/14/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 6.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533078.71
EASTING: 132826.04
GROUND ELEVATION: 969.14

BORING ID: HR-G1-SB-23

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	969.14	0-6	3.7				Gray fine SAND, some Gravel, slight odor.
1	968.14						1.0' (968.14')
							Gray CLAY, some fine Sand.
2	967.14						
3	966.14						
4	965.14						4.0' (965.14')
							Gray fine-medium SAND.
5	964.14						
6	963.14						
							Boring terminated at 6.0 feet (963.14 feet).
7							
8							
9							
10							

REMARKS:

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 14.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533059.72
EASTING: 132728.06
GROUND ELEVATION: 977.01

BORING ID: HR-G2-SB-1

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	977.01	0-4	2.8				Dark brown fine SAND and SILT, trace fine Gravel.
1	976.01						
2	975.01						2.0' (975.01')
							Brown coarse-fine SAND, trace Silt and fine-medium Gravel.
3	974.01						
4	973.01	4-8	2.6				4.0' (973.01')
							Dark brown coarse SAND and fine GRAVEL, black stain and sheen, petroleum odor.
5	972.01						
6	971.01						
7	970.01						
8	969.01	8-12	2.2				8.0' (969.01')
							Dark brown coarse SAND and SILT, little fine Gravel, saturated.
9	968.01						
10	967.01						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from4-6 feet.

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 14.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533059.72
EASTING: 132728.06
GROUND ELEVATION: 977.01

BORING ID: HR-G2-SB-1
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	967.01	8-12	2.2				Dark brown coarse SAND and SILT, little fine Gravel, saturated.
11	966.01						
12	965.01	12-14	1.4				
							12.0' (965.01')
13	964.01						Brown-gray coarse SAND, some fine Gravel.
14	963.01						
							Boring terminated at 14.0 feet (963.01 feet)
15							
16							
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from4-6 feet.

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 14.5 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533049.15
EASTING: 132710.22
GROUND ELEVATION: 978.56

BORING ID: HR-G2-SB-2

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.56	8-12	3.4				Olive-gray SILT, saturated.
11	967.56						
12	966.56	12-14	2.0				
							12.0' (966.56')
13	965.56						Gray SILT and GRAVEL, saturated.
14	964.56						
15							Boring terminated at 14.5 feet (964.56 feet)
16							
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 6-8 feet.

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 14.5 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING: 533035.32
EASTING: 132688.69
GROUND ELEVATION: 978.56

BORING ID: HR-G2-SB-3

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.56	0-4	3.2				Dark brown fine-medium SAND, some Silt, trace fine Gravel and Organics.
1	977.56						
2	976.56						
							2.0' (976.56)
							Light brown coarse SAND, little fine Gravel.
3	975.56						
4	974.56	4-8	3.9				
5	973.56						
6	972.56						
							6.0' 972.56)
							Dark gray SILT and SAND, trace iron staining.
7	971.56						
8	970.56	8-12	4.0				
							8.0' (970.56)
							Gray fine-medium SAND, some Silt.
9	969.56						
10	968.56						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 14.5 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533035.32
EASTING: 132688.69
GROUND ELEVATION: 978.56

BORING ID: HR-G2-SB-3
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.56	8-12	4.0				Gray fine-medium SAND, some Silt.
11	967.56						
12	966.56	12-14	2.5				
13	965.56						
14	964.56						
15							Boring terminated at 14.5 feet (964.06 feet)
16							
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 14.5 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533145.05
EASTING: 132997.14
GROUND ELEVATION: 978.07

BORING ID: HR-G2-SB-4
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.07	0-4	3.4				Dark brown fine SAND and SILT.
1	977.07						
2	976.07						
							2.0' (976.07')
							Light brown fine SAND and SILT, trace fine Gravel.
3	975.07						
4	974.07	4-8	3.9				
							4.0' (974.07')
							Light gray coarse-fine SAND, saturated.
5	973.07						
6	972.07						
7	971.07						
8	970.07	8-12	3.8				
9	969.07						
10	968.07						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 12-14.5 feet.

DATE STARTED: 6/16/2000
DATE FINISHED: 6/16/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: Jackhammer

BOREHOLE DEPTH: 14.5 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING: 533145.05
EASTING: 132997.14
GROUND ELEVATION: 978.07

BORING ID: HR-G2-SB-4
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.07	8-12	3.8				Light gray coarse-fine SAND, saturated. 10.0' (968.07')
							Light brown SILT, some gray-brown coloring.
11	967.07						
12	966.07	12-14	2.5				
							12.0' (966.07')
13	965.07						Light brown fine SAND and SILT, slight odor.
14	964.07						
15	963.07						Boring terminated at 14.5 feet (963.57 feet)
16							
17							
18							
19							
20							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 12-14.5 feet.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:
EASTING:
GROUND ELEVATION: 978.29

BORING ID: HR-G1-SB-24

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST
0	978.29	0-4	3.5			
1	977.29					
2	976.29					
3	975.29					
4	974.29	4-8	2.0			
5	973.29					
6	972.29					
7	971.29					
8	970.29	8-12	3.75			
9	969.29					
10	968.29					

STRATIGRAPHIC DESCRIPTION

Cobbles - removed with shovel. 0.25' (978.04')
Brown fine-medium SAND.

3.5' (974.79')
Gray-brown fine-medium SAND and CONCRETE.

4.0' (974.29')
Gray-brown fine-medium SAND, odor.

8.0' (970.29')
Gray SILT and CLAY, odor, wet.

Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 2-4 feet, 4-6 feet, 6-8 feet, 8-10 feet, 10-12 feet, 12-14 feet, and 14-16 feet.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.29

BORING ID: HR-G1-SB-24
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.29	8-12	3.75				Gray SILT and CLAY, odor, wet.
11	967.29						
12	966.29	12-16	3.0				
							12.0' (966.29')
							Gray SILT and CLAY, some Gravel odor, wet.
13	965.29						
14	964.29						
15	963.29						
							15.0' (963.29')
							Gray GRAVEL odor, contains NAPL.
16	962.29						
							Boring terminated at 16.0 feet (962.29 feet)
17							
18							
19							
20							
11							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 2-4 feet, 4-6 feet, 6-8 feet, 8-10 feet, 10-12 feet, 12-14 feet, and 14-16 feet.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.36

BORING ID: HR-G1-SB-25
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.36	0-4	3.25				Brown fine-medium SAND.
1	977.36						
2	976.36						
							2.0' (976.36')
3	975.36						Brown-gray fine-medium SAND.
4	974.36	4-8	3.75				
5	973.36						
6	972.36						
							6.0' (972.36')
7	971.36						Gray SILT, some Clay.
8	970.36	8-12	3.5				
9	969.36						
10	968.36						
							Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.36

BORING ID: HR-G1-SB-25
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.36	8-12	3.5				Gray SILT, some Clay.
11	967.36						
							11.0' (967.36') Fine-coarse GRAVEL.
12	966.36	12-16	2.75				
13	965.36						
14	964.36						
							14.0' (964.36') Gray fine GRAVEL some Silt.
15	963.36						
							15.0' (963.36') Brown medium-coarse SAND and fine GRAVEL.
16	962.36						
							Boring terminated at 16.0 feet (962.36 feet)
17							
18							
19							
20							
11							

REMARKS:
Boring backfilled to to surface with bentonite.
No sheens or NAPL observed.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.01

BORING ID: HR-G1-SB-26
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.01	0-4	2.0				Brown fine SAND.
1	977.01						1.0' (977.01') Gray-brown fine SAND.
2	976.01						
3	975.01						
4	974.01	4-8	3.0				
5	973.01						5.0' (973.01') Brown very fine-fine SAND.
6	972.01						6.0' (972.01') Gray SILT, some Clay.
7	971.01						
8	970.01	8-12	2.0				8.0' (970.01') Gray SILT, some Clay and fine Gravel.
9	969.01						
10	968.01						10.0' (968.01') Description continued on Page 2.

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 8-10 feet, 10-12 feet, and 12-14 feet.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 16.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.01

BORING ID: HR-G1-SB-26
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
10	968.01	8-12	2.0				Gray SILT, some Clay and fine Gravel. 10.0' (968.01')
							Brown fine-coarse SAND, some fine-medium Gravel, slight odor.
11	967.01						
12	966.01	12-16	2.5				12.0' (966.01')
							Dark brown fine-coarse SAND and fine-medium GRAVEL, no odor.
13	965.01						
14	964.01						14.0' (964.01')
							Brown fine-coarse SAND and fine-medium GRAVEL.
15	963.01						
16	962.01						
							Boring terminated at 16.0 feet (962.01 feet)
17							
18							
19							
20							
11							

REMARKS:
Boring backfilled to to surface with bentonite.
Analytical samples collected from 8-10 feet, 10-12 feet, and 12-14 feet.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 966.94

BORING ID: HR-G1-SB-27
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	966.94	0-4	2.3				Brown fine SAND.
							1.5' (965.44')
1	965.94						Dark brown fine-coarse SAND and GRAVEL, contains NAPL.
							2.0' (964.94')
2	964.94						Gray SILT, some Clay, contains NAPL.
3	963.94						
4	962.94						
							Boring terminated at 4.0 feet (962.94 feet)
5							
6							
7							
8							
9							
10							

REMARKS:
Analytical samples collected from 0-2 feet and 2-4 feet.

DATE STARTED: 6/23/2000
DATE FINISHED: 6/23/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 2 Inch X 4 Feet Lexan Tube
RIG TYPE: Manual Core Driver

BOREHOLE DEPTH: 4.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 967.26

BORING ID: HR-G1-SB-28
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	967.26	0-4	2.3				Dark brown fine-coarse SAND and fine-medium GRAVEL.
1	966.26						
2	965.26						
3	964.26						
4	963.26						
							Boring terminated at 4.0 feet (963.26 feet)
5							
6							
7							
8							
9							
10							

REMARKS:
No sheens or NAPL observed.

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.37

BORING ID: HR-G1-SB-30
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.37						0- to 18-feet: Not Sampled.
18	960.37	18-20	2.0				18.0' (960.37')
							Olive-gray fine SAND and SILT, trace coarse Sand and fine Gravel (TILL).
19	959.37						
20	958.37	20-22	2.0				
21	957.37						
22	956.37	22-24	2.0				22.0' (956.37')
							Olive-gray fine SAND and SILT, trace coarse Sand and fine-medium Gravel (TILL).
23	955.37						
24	954.37						
							Boring terminated at 24.0 feet (954.37 feet)
25							
26							
27							

REMARKS:

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE:AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.63

BORING ID: HR-G1-SB-31
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.63						0- to 20-feet: Not Sampled.
20	958.63	20-22	2.0				20.0' (958.63')
							Dark brown coarse SAND, trace mediumGravel.
21	957.63						
22	956.63	22-23.5	1.5				22.0' (956.63')
							Olive-brown SILT and CLAY, trace coarse Sand and medium Gravel (TILL).
23	955.63						
24	954.63						
							Boring terminated at 24.0 feet (954.63 feet)
25	953.63						
26							
27							
28							
29							

REMARKS:

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 977.06

BORING ID: HR-G2-SB-5
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	977.06						0- to 20-feet: Not Sampled.
20	957.06	20-22					20.0' (957.06')
							Brown medium-coarse SAND, trace fine-medium Gravel, slight odor.
21	956.06						
22	955.06	22-24					
							22.0' (955.06')
23	954.06						Olive-brown SILT and CLAY, trace fine-coarse Gravel (TILL).
24	953.06						
							Boring terminated at 24.0 feet (953.06 feet)
25	952.06						
26							
27							
28							
29							

REMARKS:

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:
EASTING:
GROUND ELEVATION: 978.43

BORING ID: HR-G2-SB-6

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.43						0- to 20-feet: Not Sampled.
20	958.43	20-24	4.0				20.0' (958.43')
							Dark brown coarse SAND and medium GRAVEL, trace fine Sand.
21	957.43						
22	956.43						
23	955.43						23.0' (955.43')
							Olive-brown SILT and CLAY, little medium Gravel (TILL).
24	954.43						
							Boring terminated at 24.0 feet (954.43 feet)
25	953.43						
26							
27							
28							
29							

REMARKS:

Attachment B

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Structural Calculations

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CALCULATION SHEET

PROJECT NO. 20197.071

CLIENT: GE SUBJECT: Sheetpile Design Calculations
Case 1: Permanent Condition assuming ϕ = 35 degrees
PREPARED BY: SM DATE: 7/5/2000
REVIEWED BY: _____ DATE: _____

PROJECT: Cell G1 DNAPL Area, Upper 1/2-Mile Reach of Housatonic River

TASK

To calculate the required embedment depth, maximum moment, and section modulus for a sheetpile wall supporting a slope at elevation 975 (u/s contact) feet with a slope of 2H:1V with riverside at elevation 972 feet.

REFERENCES

1. NAVAFAC DM-7, March 1971.

2. Das, B. M. (1990). Principles of Foundation Engineering, 2nd Edition, PWS-Kent Publishing Company.

ASSUMPTIONS AND PARAMETERS

Soil friction angle, ϕ =	35	degree
Soil unit weight, γ =	125	pcf
Buoyant soil unit weight, γ' =	62.6	pcf
Unit weight of water =	62.4	pcf
U/S contact elevation =	975	feet
Groundwater elevation =	975	feet
Riverside contact elevation =	972	feet

FIGURES

Figure 1 - Net Pressure Diagram - Permanent Case
Note: Refer to Figure 6, Cell G1 DNAPL Area - Proposed Activities, for approximate location of the sheetpile wall.

ATTACHMENTS

Attachment 1 - Photocopies of pages from Reference 2
Attachement 2 - Photocopies of pages from reference 1
Attachement 3 - Site Geotechnical Information, contains borehole logs (BBL, June 2000), and interpreted top of till contours (Golder, September 1998).

CALCULATIONS

References	Calculations		Unit
	Global parameters:		
	Soil unit weight, γ	125	pcf
	Buoyant soil unit weight, γ'	62.6	pcf
	Calculate coefficient of passive pressure, Kp:		
Refer to Sheet 1, Attachment 2 (Ref. 1)	Wall friction angle, δ	14	degree
	Soil internal friction angle, ϕ	35	degree
	Slope angle on the riverside, β	0	degree
Refer to Figure 6, Sheet 2, Attachment 2 (Ref. 1)	for β/ϕ	0.00	
	for δ/ϕ	-0.4	
	Reduction factor, R	0.603	
	Kp for δ/ϕ = -1	10	
	Therefore, Kp = R*(Kp for δ/ϕ = -1)	[redacted]	
	Calculate coefficient of active pressure, Ka		
	Soil internal friction angle, ϕ	0.61	radians
	Slope angle on the u/s side, β	0.46	radians
	Wall friction angle, δ	0.24	radians
	Slope of wall agains vertical, θ	0	radians
Refer to Sheet 3, Attachment 2 (Ref. 1)	$ka = \cos^2\phi / \cos\delta*[1 + ((\sin(\phi + \delta)*\sin(\phi-\beta)/(\cos\delta*\cos(-\beta)))^{0.5}]^2$	[redacted]	
Refer to Figure 1	**Active pressures and forces acting on wall:**		
	Exposed wall height above water table, L1	0	feet
	Exposed wall height below water table, L2	3	
	$p1 = \gamma*L_1*Ka$	[redacted]	psf
	$p2 = p1 + \gamma'*L_2*Ka + \gamma_{H2O}*L_2$	[redacted]	psf
	Location of zero net pressure, L3 = p2/(γ'*(Kp-Ka))	[redacted]	feet
	P = 0.5p1*L1 +0.5*(p1+p2)*L2+ 0.5p2*L3	[redacted]	lb
	location, z1 = (0.5*p1*L1*(L3 +L2+ L1/3) + p1*L2*(L3+L2/2)+0.5*(γ'*Ka*L2)*L2*(L3+l2/3)+0.5*γ_{H2O}*L2^2*(L3+L2/3)+0.5*p2*L3*(2*L3/3))/P	[redacted]	feet
	$p5 = \gamma*L1*Kp + \gamma'*L2*Kp+\gamma_{H2O}*L2+\gamma'*L3*(Kp-Ka)$	[redacted]	psf

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CALCULATION SHEET

PROJECT NO. 20197.071

CLIENT: GE **SUBJECT:** Sheetpile Design Calculations
Case 1: Permanent Condition assuming ϕ = 35 degrees
PREPARED BY: SM **DATE:** 7/5/2000
REVIEWED BY: **DATE:**

PROJECT: Cell G I DNAPL Area, Upper 1/2-Mile Reach of Housatonic River

References	Calculations		Unit
	A1 = p5/(γ' *(Kp-Ka))	4.46	
	A2 = 8*P/(γ' *(Kp - Ka))	10.85	
	A3 = 6*P*(2*z1*γ' *(kp-Ka)+p5)/(γ')^2*(Kp-Ka)^2	60.49	
	A4 = P*(6*z1*p5+4P)/((γ')^2*(Kp-Ka)^2)	61.37	
	L4^4 + A1*L4^3 - A2*L4^2 -A3*L4 - A4 = 0		
	By Trial and error:		

L4	Equation for L4
6	1444
3.8	5
3	-139

Therefore, L4	3.8	feet
p3 = L4*(Kp-Ka)*γ'	[redacted]	psf
p4 = p5 + γ' *L4*(Kp-Ka)	[redacted]	psf
L5 = (0.5P3L4-P)/(0.5(p3+p4))	[redacted]	feet
Embedment depth, D = L3+L4	[redacted]	feet
Sheetpile botoom elevation at FS =1	[redacted]	feet
increase embedment depth by 40 percent for FS = 2.0	[redacted]	feet
Sheetpile botoom elevation at FS = 2.0	965.66	feet
Calculate maximum bending moment		
Location of maximum bending moment, z' = (2*P/((Kp-Ka)*γ')^0.5)	[redacted]	feet
Maximum bending moment, Mmax = P*(z1+z') - (0.5*γ' *(z')^2*(Kp-Ka))*1/3*z'	1242 [redacted]	lb-ft/ft lb-in/ft
Required Section Modulus, S = Mmax/fb	[redacted]	in^3
Where, fb = 25 ksi for allowable stress on σy = 36 ksi steel.		

Conclusions

For an u/s bank contact elevation of 975 feet and the riverside elevation of 972 feet, the required sheeting bottom elevationa are 967.47 ft for FS=1 and 965.66 feet for FS=2.0. Therefore, use 965.5 feet as the design bottom elevation of the sheeting based on geotechnical considerations.

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CALCULATION SHEET

PROJECT NO. 20197.071

CLIENT: GE SUBJECT: Sheetpile Design Calculations
Case 2: Permanent Condition assuming ϕ = 30 degrees
PREPARED BY: SM DATE: 7/5/2000
REVIEWED BY: DATE:

PROJECT: Cell G1 DNAPL Area, Upper 1/2-Mile Reach of Housatonic River

TASK

To calculate the required embedment depth, maximum moment, and section modulus for a sheetpile wall supporting a slope at elevation 975 (u/s contact) feet with a slope of 2H:1V with riverside at elevation 972 feet.

REFERENCES

1. NAVAFAC DM-7, March 1971.

2. Das, B. M. (1990). Principles of Foundation Engineering, 2nd Edition, PWS-Kent Publishing Company.

ASSUMPTIONS AND PARAMETERS

Soil friction angle, ϕ =	30	degree
Soil unit weight, γ =	125	pcf
Buoyant soil unit weight, γ' =	62.6	pcf
Unit weight of water =	62.4	pcf
U/S contact elevation =	975	feet
Groundwater elevation =	975	feet
Riverside contact elevation =	972	feet

FIGURES

Figure 1 - Net Pressure Diagram - Permanent Case
Note: Refer to Figure 6, Cell G1 DNAPL Area - Proposed Activities, for approximate location of the sheetpile wall.

ATTACHMENTS

Attachment 1 - Photocopies of pages from Reference 2
Attachement 2 - Photocopies of pages from reference 1
Attachement 3 - Site Geotechnical Information, contains borehole logs (BBL, June 2000), and interpreted top of till contours (Golder, September 1998).

CALCULATIONS

References	Calculations		Unit
	Global parameters:		
	Soil unit weight, γ	125	pcf
	Buoyant soil unit weight, γ'	62.6	pcf
	Calculate coefficient of passive pressure, Kp:		
Refer to Sheet 1, Attachment 2 (Ref. 1)	Wall friction angle, δ	14	degree
	Soil internal friction angle, ϕ	30	degree
	Slope angle on the riverside, β	0	degree
Refer to Figure 6, Sheet 2, Attachment 2 (Ref. 1)	for β/ϕ	0.00	
	for δ/ϕ	-0.47	
	Reduction factor, R	0.728	
	Kp for δ/ϕ = -1	6.5	
	Therefore, Kp = R*(Kp for δ/ϕ = -1)	[redacted]	
	Calculate coefficient of active pressure, Ka		
	Soil internal friction angle, ϕ	0.52	radians
	Slope angle on the u/s side, β	0.46	radians
	Wall friction angle, δ	0.24	radians
	Slope of wall agains vertical, θ	0	radians
Refer to Sheet 3, Attachment 2 (Ref. 1)	$ka = \cos^2\phi / \cos\delta * [1 + ((\sin(\phi+\delta)*\sin(\phi-\beta)/(\cos\delta*\cos(-\beta)))^{0.5}]^2$	[redacted]	
Refer to Figure 1	**Active pressures and forces acting on wall:**		
	Exposed wall height above water table, L1	0	feet
	Exposed wall height below water table, L2	3	
	$p1 = \gamma * L_1 * Ka$	[redacted]	psf
	$p2 = p1 + \gamma' * L_2 * Ka + \gamma_{H2O} * L_2$	[redacted]	psf
	Location of zero net pressure, L3 = p2/(γ' *(Kp-Ka))	[redacted]	feet
	P = 0.5p1*L1 +0.5*(p1+p2)*L2+ 0.5p2*L3	[redacted]	lb
	location, z1 = (0.5*p1*L1*(L3 +L2+ L1/3) + p1*L2*(L3+L2/2)+0.5*(γ' *Ka*L2)*L2*(L3+l2/3)+0.5*γ_{H2O}*L2^2*(L3+L2/3)+0.5*p2*L3*(2*L3/3))/P	[redacted]	feet
	$p5 = \gamma * L1 * Kp + \gamma' * L2 * Kp + \gamma_{H2O} * L2 + \gamma' * L3 * (Kp-Ka)$	[redacted]	psf

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CALCULATION SHEET

CLIENT: GE **SUBJECT:** Sheetpile Design Calculations
Case 2: Permanent Condition assuming ϕ = 30 degrees
PREPARED BY: SM **DATE:** 7/5/2000
REVIEWED BY: _____ **DATE:** _____
PROJECT: Cell G1 DNAPL Area, Upper 1/2-Mile Reach of Housatonic River

References	Calculations		Unit
	A1 = p5/(γ' *(Kp-Ka))	5.16	
	A2 = 8*P/(γ' *(Kp - Ka))	17.64	
	A3 = 6*P*(2*z1*γ' *(kp-Ka)+p5)/(γ')^2*(Kp-Ka)^2	113.76	
	A4 = P*(6*z1*p5+4P)/((γ')^2*(Kp-Ka)^2)	136.84	
	L4^4 + A1*L4^3 - A2*L4^2 -A3*L4 - A4 = 0		
	By Trial and error:		

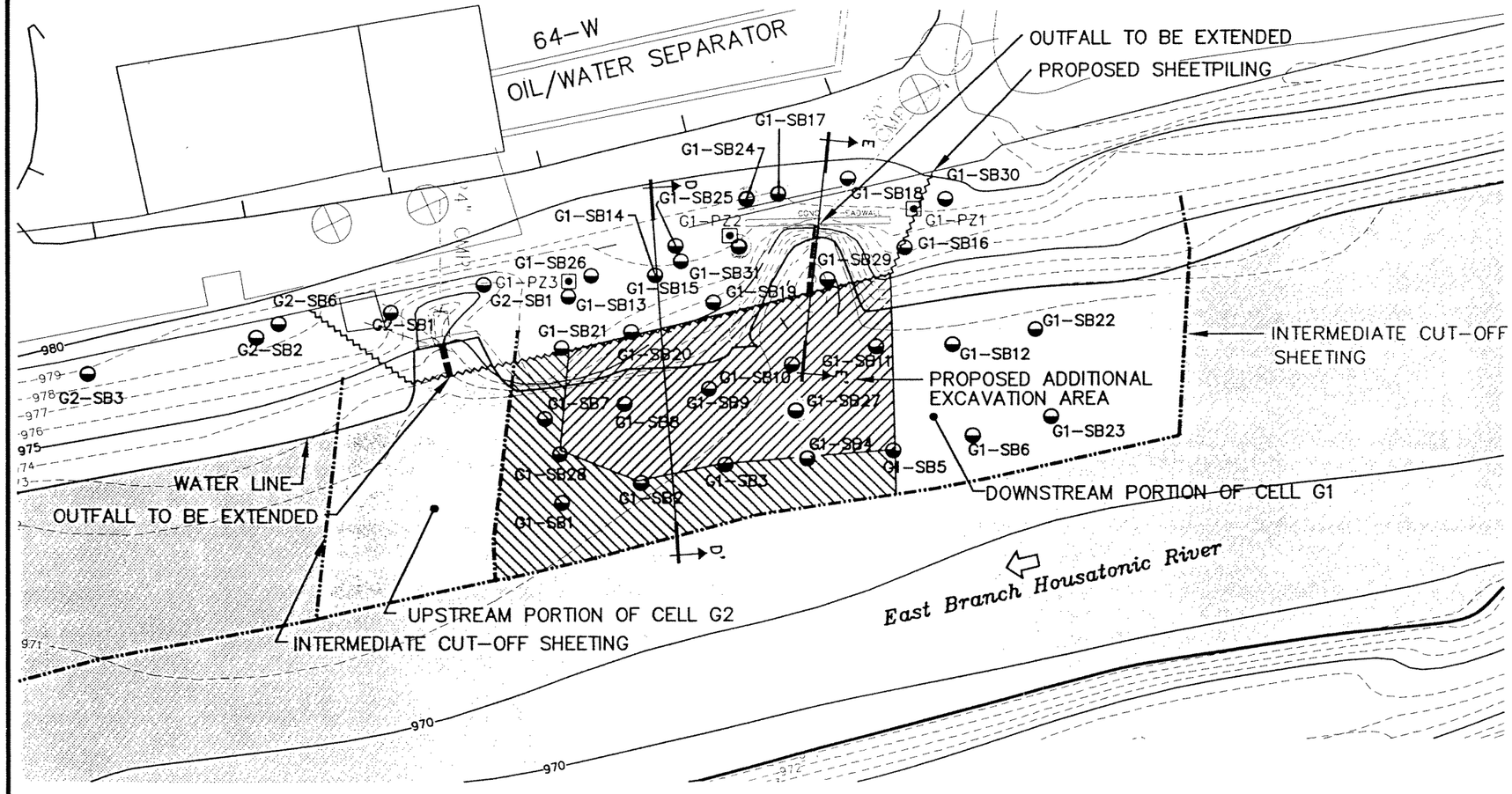
L4	Equation for L4
6	956
4.8	12
4	-288

	Therefore, L4	4.8	feet
	p3 = L4*(Kp-Ka)*γ'	[redacted]	psf
	p4 = p5 + γ' *L4*(Kp-Ka)	[redacted]	psf
	L5 = (0.5P3L4-P)/(0.5(p3+p4))	[redacted]	feet
	Embedment depth, D = L3+L4	[redacted]	feet
	Sheetpile botoom elevation at FS =1	[redacted]	feet
	Increase embedment depth by 40 percent for FS = 2.0	[redacted]	feet
	Sheetpile botoom elevation at FS = 2.0	963.77	feet
	Calculate maximum bending moment		
	Location of maximum bending moment, z' = (2*P/((Kp-Ka)*γ')^0.5)	[redacted]	feet
	Maximum bending moment, Mmax = P*(z1+z') - (0.5*γ' *(z')^2*(Kp-Ka))*1/3*z'	1813 [redacted]	lb-ft/ft lb-in/ft
	Required Section Modulus, S = Mmax/fb	[redacted]	in^3
	Where, fb = 25 ksi for allowable stress on σy = 36 ksi steel.		

Conclusions

For an u/s bank contact elevation of 975 feet and the riverside elevation elevation of 972 feet, the required sheeting bottom elevationa are 966.12 ft for FS=1 and 963.77 feet for FS=2.0. Therefore, use 963.50 feet as the design bottom elevation of the sheeting based on geotechnical considerations.

Figures



LEGEND:

- EXCAVATION SHEETPILE
- G1-SB1 — BORING LOCATION FOR DNAPL INVESTIGATION
- G1-SB17 — BORING LOCATION WHERE DNAPL OBSERVED
- G1-PZ1 — PIEZOMETER
- 980 — GROUND ELEVATION CONTOUR (PRIOR TO EXCAVATION)
- PROPOSED ADDITIONAL EXCAVATION AREA TO MAXIMUM ELEVATION OF 963' BASED ON VISUAL OBSERVATIONS
- WORK AREA
- PROPOSED ADDITIONAL EXCAVATION AREA TO MAXIMUM DEPTH OF 4' BASED ON VISUAL OBSERVATIONS
- D — D' CROSS-SECTION LOCATION

NOTES:

1. BASE MAP BY DESIGN GROUP, INC. 2 FEDERICO DRIVE, PITTSFIELD, MASSACHUSETTS 01201, "SKETCH PLAN OF G1 AND G2 BORING LOCATIONS", DATED JUNE 23, 2000.

0 20' 40'

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REMOVAL ACTION
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

CELL G1 DNAPL AREA PROPOSED ACTIVITIES

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 6

X: NONE
L: ON=*, OFF=REF
P: STD-PCP/BL
7/11/00 SYR-54-JER RCB KMD
20197071/20197G03.DWG

Attachment 1

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Photocopies of Pages from Ref. 2

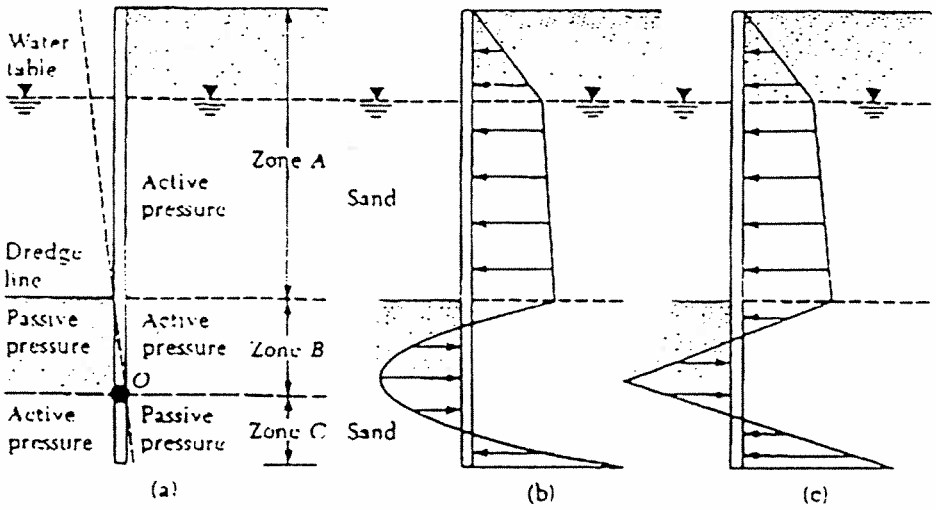

Figure 6.6 Cantilever sheet pile penetrating sand

The following sections (Sections 6.3 through 6.6) present the mathematical formulation of the analysis of cantilever sheet pile walls. Note that, in some waterfront structures, the water level may fluctuate as the result of tidal effects. Care should be taken in determining the water level that will affect the net pressure diagram.

6.3 Cantilever Sheet Piling Penetrating Sandy Soils

To develop the relationships for the proper depth of embedment of sheet piles driven into a granular soil, we refer to Figure 6.7a. The soil retained by the sheet piling above the dredge line is also sand. The water table is located at a depth of L_1 below the top of the wall. Let the angle of friction of the sand be ϕ. The intensity of the active pressure at a depth $z = L_1$ can be given as

$$p_1 = \gamma L_1 K_a \tag{6.1}$$

where K_a = Rankine active pressure coefficient = $\tan^2 (45 - \phi/2)$
γ = unit weight of soil above the water table

Similarly, the active pressure at a depth of $z = L_1 + L_2$ (that is, at the level of the dredge line) is equal to

$$p_2 = (\gamma L_1 + \gamma' L_2) K_a \tag{6.2}$$

where γ' = effective unit weight of soil = $\gamma_{sat} - \gamma_w$

Note that, at the level of the dredge line, the hydrostatic pressures from both sides of the wall are of the same magnitude and cancel each other.

2/8

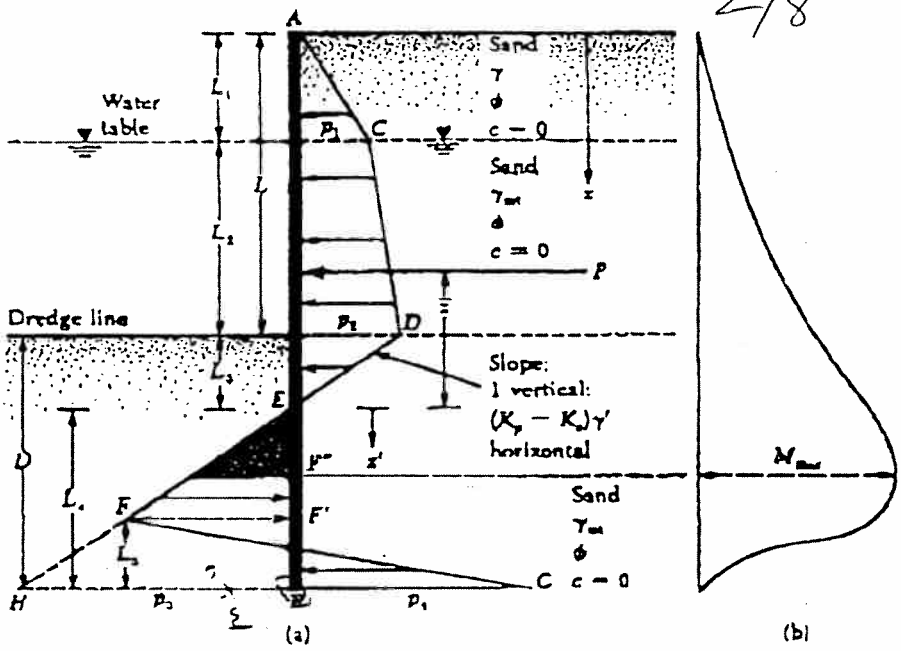

Figure 6.7 Cantilever sheet pile penetrating sand: (a) variation of net pressure diagram, (b) variation of moment

In order to determine the net lateral pressure below the dredge line up to the point of rotation O, as shown in Figure 6.6a, one has to consider the passive pressure acting from the left side (water side) toward the right side (land side) and also the active pressure acting from the right side toward the left side of the wall. For such cases, ignoring the hydrostatic pressure from both sides of the wall, the active pressure at a depth z can be given as

$$p_a = [\gamma L_1 + \gamma' L_2 + \gamma'(z - L_1 - L_2)]K_a \tag{6.3}$$

Also, the passive pressure at that depth z is equal to

$$p_p = \gamma'(z - L_1 - L_2)K_p \tag{6.4}$$

where K_p = Rankine passive pressure coefficient = $\tan^2(45 + \phi/2)$

Hence, combining Eqs. (6.3) and (6.4), the net lateral pressure can be obtained as

$$\begin{aligned} p &= p_a - p_p = (\gamma L_1 + \gamma' L_2)K_a - \gamma'(z - L_1 - L_2)(K_p - K_a) \\ &= p_2 - \gamma'(z - L)(K_p - K_a) \end{aligned} \tag{6.5}$$

where $L = L_1 + L_2$

3/8

The net pressure, p, becomes equal to zero at a depth L_3 below the dredge line; or

$$p_2 - \gamma'(z - L)(K_p - K_a) = 0$$

or

$$(z - L) = L_3 = \frac{p_2}{\gamma'(K_p - K_a)} \tag{6.6}$$

From the preceding equation, it is apparent that the slope of the net pressure distribution line DEF is 1 vertical to $(K_p - K_a)\gamma'$ horizontal. So, in the pressure diagram

$$\overline{HB} = p_3 = L_4(K_p - K_a)\gamma' \tag{6.7}$$

At the bottom of the sheet pile, passive pressure (p_p) acts from the right toward the left side, and active pressure acts from the left toward the right side of the sheet pile. So, at $z = L + D$

$$p_p = (\gamma L_1 + \gamma' L_2 + \gamma' D)K_p \tag{6.8}$$

At the same depth

$$p_a = \gamma' D K_a \tag{6.9}$$

Hence, the net lateral pressure at the bottom of the sheet pile is equal to

$$\begin{aligned} p_p - p_a = p_4 &= (\gamma L_1 + \gamma' L_2)K_p + \gamma' D(K_p - K_a) \\ &= (\gamma L_1 + \gamma' L_2)K_p + \gamma' L_3(K_p - K_a) + \gamma' L_4(K_p - K_a) \\ &= p_5 + \gamma' L_4(K_p - K_a) \end{aligned} \tag{6.10}$$

where $p_5 = (\gamma L_1 + \gamma' L_2)K_p + \gamma' L_3(K_p - K_a)$ (6.11)

$$D = L_3 + L_4 \tag{6.12}$$

For the stability of the wall, the principles of statics can now be applied; or

$$\sum \text{horizontal forces per unit length of wall} = 0$$

and

$$\sum \text{moment of the forces per unit length of wall about point } B = 0$$

For summation of the horizontal forces,

$$\text{area of the pressure diagram } ACDE - \text{area of } EFHB + \text{area of } FHBG = 0$$

or

$$P - \tfrac{1}{2}p_3 L_4 + \tfrac{1}{2}L_5(p_3 + p_4) = 0 \tag{6.13}$$

where P = area of the pressure diagram $ACDE$

4/8

Summing the moment of all the forces about point B

$$P(L_4 + \bar{z}) - \left(\frac{1}{2} L_4 p_3\right)\left(\frac{L_4}{3}\right) + \frac{1}{2} L_5(p_3 + p_4)\left(\frac{L_5}{3}\right) = 0 \tag{6.14}$$

From Eq. (6.13)

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} \tag{6.15}$$

Combining Eqs. (6.7), (6.10), (6.14), and (6.15) and simplifying them further, one obtains the following fourth-degree equation in terms of L_4.

$$\boxed{L_4^4 + A_1 L_4^3 - A_2 L_4^2 - A_3 L_4 - A_4 = 0} \tag{6.16}$$

where

$$A_1 = \frac{p_5}{\gamma'(K_p - K_a)} \tag{6.17}$$

$$A_2 = \frac{8P}{\gamma'(K_p - K_a)} \tag{6.18}$$

$$A_3 = \frac{6P[2\bar{z}\gamma'(K_p - K_a) + p_5]}{\gamma'^2(K_p - K_a)^2} \tag{6.19}$$

$$A_4 = \frac{P(6\bar{z}p_5 + 4P)}{\gamma'^2(K_p - K_a)^2} \tag{6.20}$$

Step-by-Step Procedure for Obtaining the Pressure Diagram

Based on the preceding theory, the step-by-step procedure for obtaining the pressure diagram for a cantilever sheet pile wall penetrating a granular soil is as follows:

1. Calculate K_a and K_p.
2. Calculate p_1 [Eq. (6.1)] and p_2 [Eq. (6.2)]. *Note:* L_1 and L_2 will be given.
3. Calculate L_3 [Eq. (6.6)].
4. Calculate P.
5. Calculate $\bar{z}$ (that is, the center of pressure for the area $ACDE$) by taking the moment about E.
6. Calculate p_5 [Eq. (6.11)].
7. Calculate A_1, A_2, A_3, and A_4 [Eqs. (6.17) to (6.20)].
8. Solve Eq. (6.16) by trial and error to determine L_4.
9. Calculate p_4 [Eq. (6.10)].

10. Calculate p_3 [Eq. (6.7)].
11. Obtain L_5 from Eq. (6.15).
12. Now the pressure distribution diagram as shown in Figure 6.7a can easily be drawn.
13. Obtain the theoretical depth [Eq. (6.12)] of penetration as $L_3 + L_4$. The actual depth of penetration is increased by about 20–30%.

Note: Some designers prefer to use a factor of safety on the passive earth pressure coefficient at the beginning. In that case, in Step 1

$$K_{p(\text{design})} = \frac{K_p}{FS}$$

where FS = factor of safety (usually between 1.5 to 2)

For this type of analysis, follow Steps 1 through 12 with the value of $K_a = \tan^2(45 - \phi/2)$ and $K_{p(\text{design})}$ (instead of K_p). The actual depth of penetration can now be determined by adding L_3, obtained from Step 3, and L_4, obtained from Step 8.

Calculation of Maximum Bending Moment

The nature of variation of the moment diagram for a cantilever sheet pile wall is shown in Figure 6.7b. The maximum moment will occur between the points E and F. To obtain the maximum moment (M_{max}) per unit length of the wall, one must determine the point of zero shear. Adopting a new axis z' (with origin at point E) for zero shear

$$P = \tfrac{1}{2}(z')^2(K_p - K_a)\gamma'$$

or

$$z' = \sqrt{\frac{2P}{(K_p - K_a)\gamma'}} \tag{6.21}$$

Once the point of zero shear force is determined (point F' in Figure 6.7a), the magnitude of the maximum moment can be obtained as

$$\boxed{M_{max} = P(\bar{z} + z') - [\tfrac{1}{2}\gamma' z'^2(K_p - K_a)](\tfrac{1}{3}z')} \tag{6.22}$$

The sizing of the necessary profile of the sheet piling is then made according to the allowable flexural stress of the sheet pile material, or

$$\boxed{S = \frac{M_{max}}{\sigma_{all}}} \tag{6.23}$$

6/8

where S = section modulus of the sheet pile required per unit length of the structure
σ_{all} = allowable flexural stress of the sheet pile

Example 6.1

Refer to Figure 6.7. For a cantilever sheet pile wall penetrating a granular soil, given: $L_1 = 2$ m, $L_2 = 3$ m. The granular soil has the following properties:

$$\phi = 32^\circ$$
$$c = 0$$
$$\gamma = 15.9 \text{ kN/m}^3$$
$$\gamma_{sat} = 19.33 \text{ kN/m}^3$$

Make the necessary calculations to determine the theoretical and actual depth of penetration. Also determine the miminum size of sheet pile (section modulus) necessary.

Solution

The step-by-step procedure given in Section 6.3 will be followed here.

Step 1

$$K_a = \tan^2\left(45 - \frac{\phi}{2}\right) = \tan^2\left(45 - \frac{32}{2}\right) = 0.307$$

$$K_p = \tan^2\left(45 + \frac{\phi}{2}\right) = 3.25$$

Step 2

$$p_1 = \gamma L_1 K_a = (15.9)(2)(0.307) = 9.763 \text{ kN/m}^2$$
$$p_2 = (\gamma L_1 + \gamma' L_2)K_a = [(15.9)(2) + (19.33 - 9.81)3]0.307$$
$$= 18.53 \text{ kN/m}^2$$

Step 3

$$L_3 = \frac{p_2}{\gamma'(K_p - K_a)} = \frac{18.53}{(19.33 - 9.81)(3.25 - 0.307)} = 0.66 \text{ m}$$

Step 4

$$P = \tfrac{1}{2}p_1 L_1 + p_1 L_2 + \tfrac{1}{2}(p_2 - p_1)L_3 + \tfrac{1}{2}p_2 L_3$$
$$= \tfrac{1}{2}(9.763)(2) + (9.763)(3) + \tfrac{1}{2}(18.53 - 9.763)3 + \tfrac{1}{2}(18.53)(0.66)$$
$$= 9.763 + 29.289 + 13.151 + 6.115 = 58.32 \text{ kN/m}$$

Step 5. Taking the moment about E

$$\bar{z} = \frac{1}{58.32}\left[9.763\left(0.66 + 3 + \frac{2}{3}\right) + 29.289\left(0.66 + \frac{3}{2}\right) + 13.151\left(0.66 + \frac{3}{3}\right) + 6.115\left(0.66 \times \frac{2}{3}\right)\right] = 2.23 \text{ m}$$

Step 6

$$p_3 = (\gamma L_1 + \gamma' L_2)K_p + \gamma' L_3(K_p - K_a)$$
$$= [(15.9)(2) + (19.33 - 9.81)3]3.25 + (19.33 - 9.81)(0.66)(3.25 - 0.307)$$
$$= 196.17 + 18.49 \approx 214.66 \text{ kN/m}^2$$

Step 7

$$A_1 = \frac{p_3}{\gamma'(K_p - K_a)} = \frac{214.66}{(9.52)(2.943)} = 7.66$$

$$A_2 = \frac{8P}{\gamma'(K_p - K_a)} = \frac{(8)(58.32)}{(9.52)(2.943)} = 16.65$$

$$A_3 = \frac{6P[2\bar{z}\gamma'(K_p - K_a) + p_3]}{\gamma'^2(K_p - K_a)^2}$$
$$= \frac{(6)(58.32)[(2)(2.23)(9.52)(2.943) + 214.66]}{(9.52)^2(2.943)^2} = 151.93$$

$$A_4 = \frac{P(6\bar{z}p_3 + 4P)}{\gamma'^2(K_p - K_a)^2}$$
$$= \frac{58.32[(6)(2.23)(214.66) + (4)(58.32)]}{(9.52)^2(2.943)^2} = 230.72$$

Step 8. From Eq. (6.16)

$$L_4^4 + 7.66L_4^3 - 16.65L_4^2 - 151.39L_4 - 230.72 = 0$$

The following table shows the solution of the preceding equation by trial and error.

Assumed L_4 (m)	Left side of Eq. (6.16)
4	−356.44
5	+178.58
4.8	+36.96

So, $L_4 \approx 4.8$ m

Step 9

$$p_4 = p_3 + \gamma' L_4(K_p - K_a)$$
$$= 214.66 + (9.52)(4.8)(2.943) = 349.14 \text{ kN/m}^2$$

Step 10

$$p_3 = \gamma'(K_p - K_a)L_4 = (9.52)(2.943)(4.8) = 134.48 \text{ kN/m}^2$$

Step 11

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} = \frac{(134.48)(4.8) - 2(58.32)}{134.48 + 349.14} = 1.09 \text{ m}$$

Step 12. The net pressure distribution diagram can now be drawn, as shown in Figure 6.7a.

Step 13. The actual depth of penetration $= 1.3(L_3 + L_4) = 1.3(0.66 + 4.8) = 7.1$ m. The theoretical depth of penetration $= 0.66 + 4.8 = 5.46$ m.

8/8

Size of Sheet Piling

Using Eq. (6.21)

$$z' = \sqrt{\frac{2P}{\gamma'(K_p - K_a)}} = \sqrt{\frac{(2)(58.32)}{9.52(2.943)}} = 2.04 \text{ m}$$

From Eq. (6.22)

$$M_{max} = P(\bar{z} + z') - \left[\frac{1}{2}\gamma' z'^2(K_p - K_a)\right]\left(\frac{z'}{3}\right)$$

$$= (58.32)(2.23 + 2.04) - \frac{1}{2}(9.52)(2.04)^2(2.943)\left(\frac{2.04}{3}\right)$$

$$= 249.03 - 39.64 = 209.39 \text{ kN-m}$$

The required section modulus of the sheet pile

$$S = \frac{M_{max}}{\sigma_{all}}$$

With $\sigma_{all} = 172.5 \text{ MN/m}^2$

$$S = \frac{209.39 \text{ kN-m}}{172.5 \times 10^3 \text{ kN/m}^2} = 1.214 \times 10^{-3} \text{ m}^3/\text{m of wall}$$

6.4 Special Cases for Cantilever Wall (Penetrating a Sandy Soil)

Following are two special cases of the mathematical formulation shown in Section 6.3.

Case 1: Sheet Pile Wall with the Absence of Water Table

In the absence of the water table, the net pressure diagram on the cantilever sheet pile wall will be as shown in Figure 6.8, which is a modified version of Figure 6.7. For this figure

$$p_2 = \gamma L K_a \tag{6.24}$$

$$p_3 = L_4(K_p - K_a)\gamma \tag{6.25}$$

$$p_4 = p_3 + \gamma L_4(K_p - K_a) \tag{6.26}$$

$$p_5 = \gamma L K_p + \gamma L_3(K_p - K_a) \tag{6.27}$$

$$L_3 = \frac{p_2}{\gamma(K_p - K_a)} = \frac{LK_a}{(K_p - K_a)} \tag{6.28}$$

$$P = \tfrac{1}{2}p_2 L + \tfrac{1}{2}p_2 L_3 \tag{6.29}$$

$$\bar{z} = L_3 + \frac{L}{3} = \frac{LK_a}{K_p - K_a} + \frac{L}{3} = \frac{L(2K_a + K_p)}{3(K_p - K_a)} \tag{6.30}$$

Attachment 2

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engineers & scientists

Photocopies of Pages from Ref. 1

TABLE 1
Ultimate Friction Factors and Adhesion for Dissimilar Materials

Interface Materials	Friction factor, tan δ	Friction angle, δ degrees
Mass concrete on the following foundation materials:		
Clean sound rock	0.70	35
Clean gravel, gravel-sand mixtures, coarse sand	0.55 to 0.60	29 to 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	0.45 to 0.55	24 to 29
Clean fine sand, silty or clayey fine to medium sand	0.35 to 0.45	19 to 24
Fine sandy silt, nonplastic silt	0.30 to 0.35	17 to 19
Very stiff and hard residual or preconsolidated clay	0.40 to 0.50	22 to 26
Medium stiff and stiff clay and silty clay	0.30 to 0.35	17 to 19
(Masonry on foundation materials has same friction factors.)		
Steel sheet piles against the following soils:		
Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls	0.40	22
Clean sand, silty sand-gravel mixture, single size hard rock fill	0.30	17
Silty sand, gravel or sand mixed with silt or clay	0.25	14
Fine sandy silt, nonplastic silt	0.20	11
Formed concrete or concrete sheet piling against the following soils:		
Clean gravel, gravel-sand mixture, well-graded rock fill with spalls	0.40 to 0.50	22 to 26
Clean sand, silty sand-gravel mixture, single size hard rock fill	0.30 to 0.40	17 to 22
Silty sand, gravel or sand mixed with silt or clay	0.30	17
Fine sandy silt, nonplastic silt	0.25	14
Various structural materials:		
Masonry on masonry, igneous and metamorphic rocks:		
Dressed soft rock on dressed soft rock	0.70	35
Dressed hard rock on dressed soft rock	0.65	33
Dressed hard rock on dressed hard rock	0.55	29
Masonry on wood (cross grain)	0.50	26
Steel on steel at sheet pile interlocks	0.30	17

Interface Materials (Cohesion)	Adhesion C_a (psf)
Very soft cohesive soil (0 - 250 psf)	0 - 250
Soft cohesive soil (250 - 500 psf)	250 - 500
Medium stiff cohesive soil (500 - 1000 psf)	500 - 750
Stiff cohesive soil (1000 - 2000 psf)	750 - 950
Very stiff cohesive soil (2000 - 4000 psf)	950 - 1,300

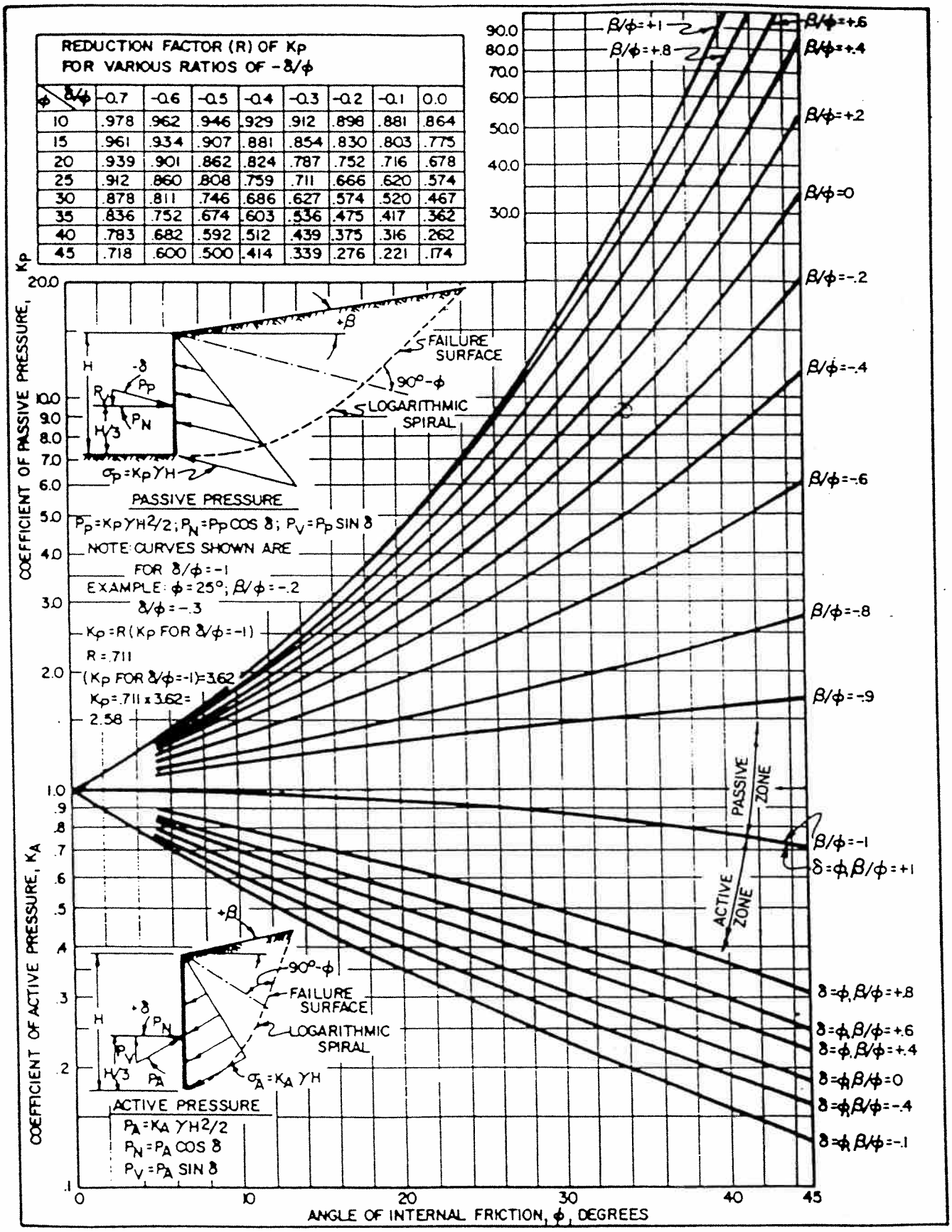
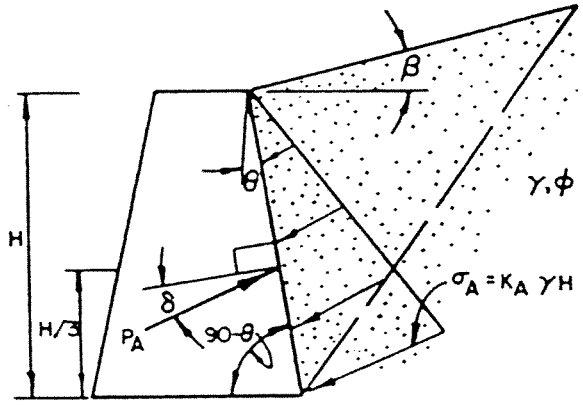
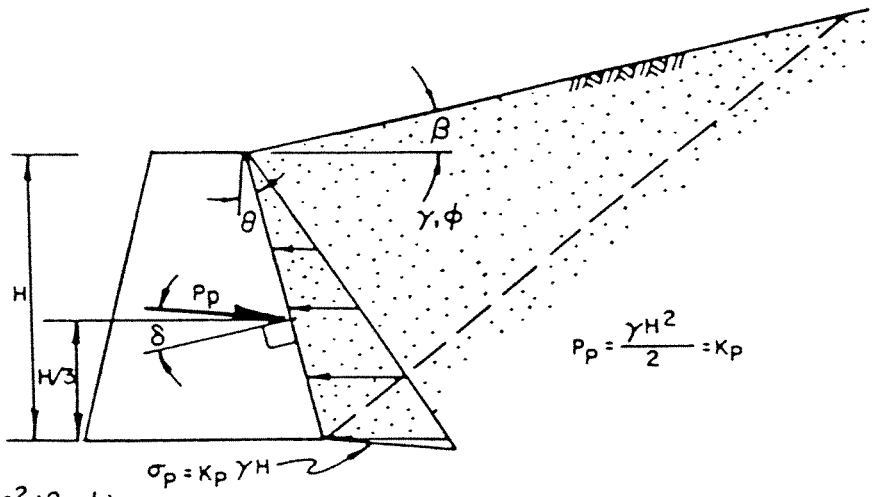


FIGURE 6
Active and Passive Coefficients with Wall Friction
(Sloping Backfill)



$$P_A = \frac{\gamma H^2}{2} K_A$$

$$K_A = \frac{\cos^2(\phi-\theta)}{\cos^2\theta\cos(\theta+\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\cos(\theta+\delta)\cos(\theta-\beta)}}\right]^2}$$



$$P_p = \frac{\gamma H^2}{2} = K_p$$

$$K_p = \frac{\cos^2(\theta+\phi)}{\cos^2\theta\cos(\theta-\delta)\left[1-\sqrt{\frac{\sin(\phi+\delta)\sin(\phi+\beta)}{\cos(\theta-\delta)\cos(\theta-\beta)}}\right]^2}$$

K_p VALUES ARE SATISFACTORY FOR $\delta \leq \phi/3$ BUT ARE UNCONSERVATIVE FOR $\delta > \phi/3$ AND THEREFORE SHOULD NOT BE USED.

FIGURE 8
Coefficients K_A and K_p for Walls with Sloping Wall and Friction, and Sloping Backfill

Attachment 3

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Site Geotechnical Information

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet
DESCRIPTIONS BY: Alex Marconi
NORTHING:
EASTING:
GROUND ELEVATION: 978.37

BORING ID: HR-G1-SB-30
CLIENT: General Electric Company
Pittsfield, MA
SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.37						0- to 18-feet: Not Sampled.
18	960.37	18-20	2.0				18.0' (960.37')
							Olive-gray fine SAND and SILT, trace coarse Sand and fine Gravel (TILL).
19	959.37						
20	958.37	20-22	2.0				
21	957.37						
22	956.37	22-24	2.0				22.0' (956.37')
							Olive-gray fine SAND and SILT, trace coarse Sand and fine-medium Gravel (TILL).
23	955.37						
24	954.37						
							Boring terminated at 24.0 feet (954.37 feet)
25							
26							
27							

REMARKS:

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:
EASTING:
GROUND ELEVATION: 978.63

BORING ID: HR-G1-SB-31

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.63						0- to 20-feet: Not Sampled.
20	958.63	20-22	2.0				20.0' (958.63')
							Dark brown coarse SAND, trace mediumGravel.
21	957.63						
22	956.63	22-23.5	1.5				22.0' (956.63')
							Olive-brown SILT and CLAY, trace coarse Sand and medium Gravel (TILL).
23	955.63						
24	954.63						
25	953.63						Boring terminated at 24.0 feet (954.63 feet)
26							
27							
28							
29							

REMARKS:

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:
EASTING:
GROUND ELEVATION: 977.06

BORING ID: HR-G2-SB-5

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	977.06						0- to 20-feet: Not Sampled.
20	957.06	20-22					20.0' (957.06')
							Brown medium-coarse SAND, trace fine-medium Gravel, slight odor.
21	956.06						
22	955.06	22-24					
							22.0' (955.06')
23	954.06						Olive-brown SILT and CLAY, trace fine-coarse Gravel (TILL).
24	953.06						
							Boring terminated at 24.0 feet (953.06 feet)
25	952.06						
26							
27							
28							
29							

REMARKS:

DATE STARTED: 6/30/2000
DATE FINISHED: 6/30/2000
DRILLING COMPANY: BBL
DRILLING METHOD: Direct Push
BIT SIZE: 1.5 Inch X 4 Feet
RIG TYPE: AMS Power Probe

BOREHOLE DEPTH: 24.0 Feet

DESCRIPTIONS BY: Alex Marconi

NORTHING:
EASTING:
GROUND ELEVATION: 978.43

BORING ID: HR-G2-SB-6

CLIENT: General Electric Company
Pittsfield, MA

SITE: Housatonic River

DEPTH (ft)	ELEVATION (ft)	SAMPLE DEPTH INTERVAL (ft)	RECOVERY (ft)	SCREENING DEPTH INTERVAL (ft)	PID HEADSPACE (ppm)	SHAKE TEST	STRATIGRAPHIC DESCRIPTION
0	978.43						0- to 20-feet: Not Sampled.
20	958.43	20-24	4.0				20.0' (958.43')
21	957.43						Dark brown coarse SAND and medium GRAVEL, trace fine Sand.
22	956.43						
23	955.43						23.0' (955.43')
24	954.43						Olive-brown SILT and CLAY, little medium Gravel (TILL).
25	953.43						Boring terminated at 24.0 feet (954.43 feet)
26							
27							
28							
29							

REMARKS:

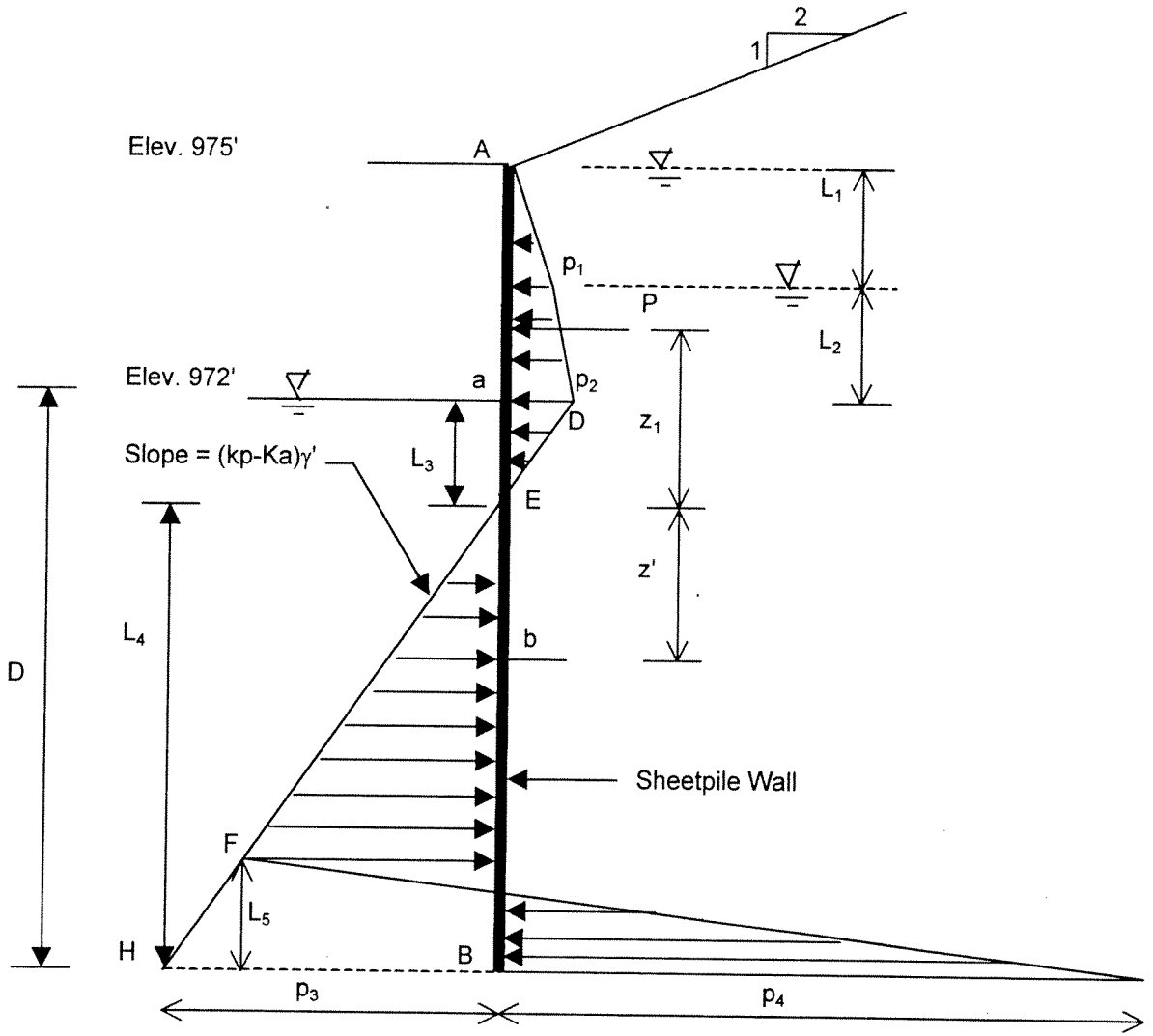


FIGURE 1 - NET PRESSURE DIAGRAM - PERMANENT CASE
(NOT TO SCALE)

Attachment C

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Summary of Groundwater Modeling

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
BUILDING 64-W AREA SOURCE CONTROL

SUMMARY OF GROUNDWATER MODELING

Introduction

The publicly available and well-documented Visual MODFLOW™ program was used for the groundwater modeling effort associated with the Building 64-W Area Source Control activities. Visual MODFLOW™ is a proprietary pre- and post-processing program (Waterloo Hydrogeologic, Inc., 1996) formulated to allow quick and efficient model setup and graphical presentation of model results for the MODFLOW, MODPATH, and MT3D groundwater programs. MODFLOW is a three-dimensional groundwater flow model developed by the USGS to simulate groundwater movement (McDonald, M. G. and A.W. Harbaugh, 1988). MODPATH is a three-dimensional advective particle tracking program designed for use with MODFLOW steady-state flow simulations. MODPATH was also developed by the USGS (Pollack, D. W., 1989). MT3D is a three-dimensional solute transport program developed by S. S. Papadopolus & Associates, Inc. (Zheng, C., 1992) for use with programs such as MODFLOW that accounts for advection, dispersion, and chemical reactions. For this model application, only MODFLOW and MODPATH were applied.

Model Setup

The area subject to modeling extends in a north-south direction from East Street to the Housatonic River. In the east-west direction, the model extends from, and includes, the East Street Area 2 - South recharge pond westward to just east of the Buildings 63/65. Portions of the model grid (Figure 1) that extend beyond these model boundaries (i.e., south of the Housatonic River) are set as inactive and are not incorporated in the model calculations. The model grid is designed with 188 rows, 268 columns, and 3 layers (Figure 1).

Horizontally, the grid spacing is a uniform 5 feet in the X and Y directions. Vertically (Z direction), Model Layer 1 is 13 feet thick, and Model Layers 2 and 3 are each 10 feet thick. There is no differentiation between the different geologic deposits encountered above the till. Since the till has a substantially lower hydraulic conductivity than the overlying fill and alluvium, the top of till surface has been modeled as the impermeable base of the model. For most of the model domain, this impermeable surface is the base of Model Layer 3, which was set at an elevation of 955 feet. This includes the Building 64-W area and the location of the proposed sheetpile wall. In the northern and central portion of the model domain (where the top of till is observed at higher elevations), this impermeable till surface is the base of Model Layer 2, which was set at an elevation of 965 feet (Figure2).

The input data required for the model includes stratigraphic, groundwater elevations, and hydraulic properties for each layer, estimates regarding the amount of water entering and leaving the hydrogeologic system, and the description of the model boundary conditions. Much of this input was duplicated from the East Street Area 2 - South model and the Lyman Street model, and supplemented with data from borings and monitoring wells within the modeled area.

Layer hydrostratigraphic elevations were chosen to discretize the fill and alluvial materials between ground

surface elevation and the top of till elevation between Building 64-W and the East Branch of the Housatonic River. The top of Layer 1 was set at 988 feet amsl and the base of Layer 3 was set to an elevation of 955.0 feet amsl.

Based on the East Street Area 2 - South model, and site geologic logs, the top of till is a sloping surface (from north to south), with till elevations range from 940.0 feet amsl along the Housatonic River to 970 feet amsl closer to East Street. A sloping till surface was not used in this model partly due to time constraints and the lack of sensitivity to a sloping till surface that was demonstrated in the East Street Area 2 - South model. However, and as indicated above, a portion of Model Layer 3 was inactivated (made impermeable) in those areas where the till elevation was greater than the elevation of the top of Layer 3 (Figure 2).

The horizontal hydraulic conductivity for all the saturated overburden materials above the till was set to 2 x 10^{-2} cm/sec (56.7 feet/day) and the vertical hydraulic conductivity was set 10 times less. This approach and hydraulic conductivity values were the same as used in the East Street Area 2 - South model. The model boundary conditions include recharge, the Housatonic River, the recharge pond, the till, and regional groundwater flow lines.

Recharge due to precipitation was set to 10 inches per year based on the previous modeling efforts. The eastern and western model boundaries were impermeable or 'no flow' boundaries presumed to correspond with groundwater flow lines. The till also was modeled as a no flow boundary on the bottom and northern side wall of model. Constant heads were used to represent the Housatonic River with the river stage held constant at 971.6 feet amsl all along the southern edge of the model, which was the high stage value used in the Lyman Street model prepared by HSI GeoTrans (1999). Constant heads were also set along the northern model boundary in Layer 1 to allow upgradient inflow of groundwater. This line of constant heads was set at 979.5 feet amsl, generally parallel to the 980.0 foot contour shown on the April 1998 groundwater elevation contour map. The recharge pond was simulated with a lower permeability pond bottom. The elevation of the recharge pond was set to 983.0 feet amsl and the bottom of recharge pond (set as 3 feet thick) was assigned conductance values ranging from 225 feet^2/day. This conductance value is reflective of a vertical hydraulic conductivity of approximately 28.35 feet/day (1 x 10^{-2} cm/sec) applied across the area of each grid block.

Additional boundary features incorporated into the model include the existing recovery wells and the proposed sheetpile wall. The well was set at the location shown on the site map. The wells included in the model and the pumping rates used for each well are as follows:

Well ID	Pumping Rate
64S	25 gpm
RW-1(S)	20 gpm
RW-1(X), RW-2(X), 64X(W) combined	20 gpm

The actual pumping rates for RW-1(X), RW-2(X), 64X(W) were combined and then half that amount was input into the model (assuming symmetry) as a single well since these recovery wells are all along the models eastern boundary. Standard vertical tubular well designs were used for all the pumping wells.

The proposed sheetpile wall was incorporated with the MODFLOW wall option. The sheetpile wall was placed across all three model layers, and wing walls were incorporated. The width of the sheetpile wall was 0.021 feet (0.25 inches) and the hydraulic conductivity was set at 1 x 10^{-9} cm/sec (0.00000284 feet/day). Figures 3 and 4 shows the simulated sheetpile wall configuration.

A limited calibration was implemented since calibration of the East Street Area 2 - South model already helped identify appropriate hydraulic input parameters. The model was calibrated to approximate the April 1998 ground water elvation contours primarily by adjusting the recharge pond elevation (from 984 to 983 feet amsl), by removing a portion of Model Layer 3 to represent areas with higher till elvations, and slightly adjusting the pumping rates of RW-1(S) and combined the RW-1(X), RW-2(X), and 64(X)W wells. The pumping rate of these simulated wells were reduced by 5 gpm (from 25 to 20 gpm) because the higher pumping rate dried out the grid blocks where the wells were located.

Preliminary analysis of the mounding potential following sheetpile emplacement is that the ground water north of the sheet pile wall would mound by approximately 0.5 feet. This mounding has the potential to divert ground water flow around the wall. The mound, and ground water flow around the sheetpile wall could be averted by pumping ground water immediately north of the wall at a rate of approximately 10 gpm. The pre-sheetpile wall groundwater ("calibrated") contours elevations are shown on Figure 5. The post-sheet pile wall ground water elevation contours are shown on Figure 6. The increase in the ground water elevation (mounding) due to emplacement of the sheetpile wall is shown on Figures 7 and 8.

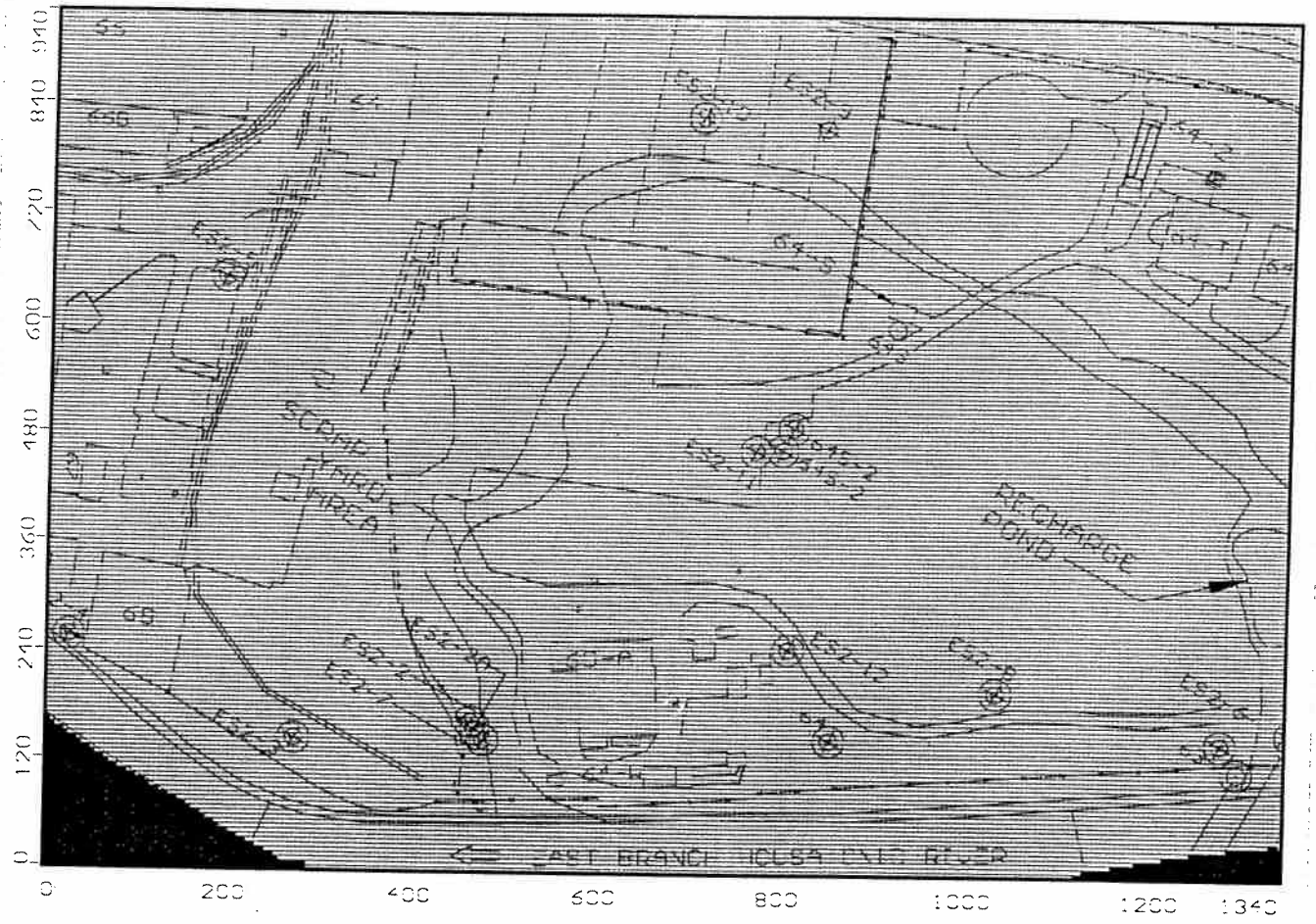


Figure 1 - Model finite-difference grid

Blasland, Bouck & Lee, Inc.
Project: 64w20 GE 1/2-Mile Reach
Description: Finite-Difference Grid
11 Jul 00

Visual MODFLOW v.2.8.2. (C) 1995-1999
Waterloo Hydrogeologic, Inc.
NC: 268 NR: 188 NL: 4
Current Layer: 2

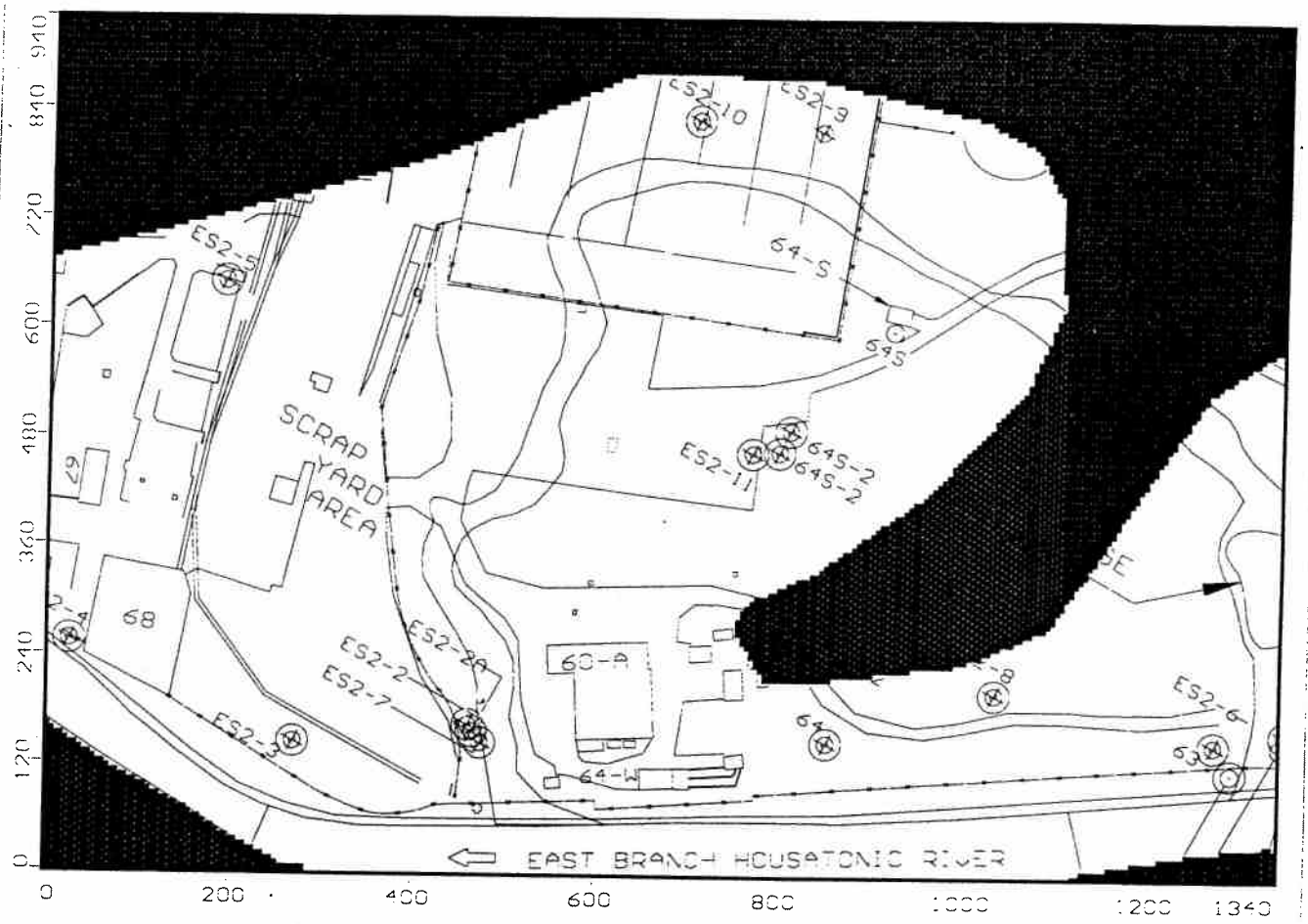


Figure 2 - Model Layer 3 inactive zones representing areas of higher till elevations

Blasland, Bouck & Lee, Inc. Project: 64w20 GE 1/2-Mile Reach Description: Layer 3 Inactive Zone 11 Jul 00	Visual MODFLOW v.2.8.2. (C) 1995-1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 3

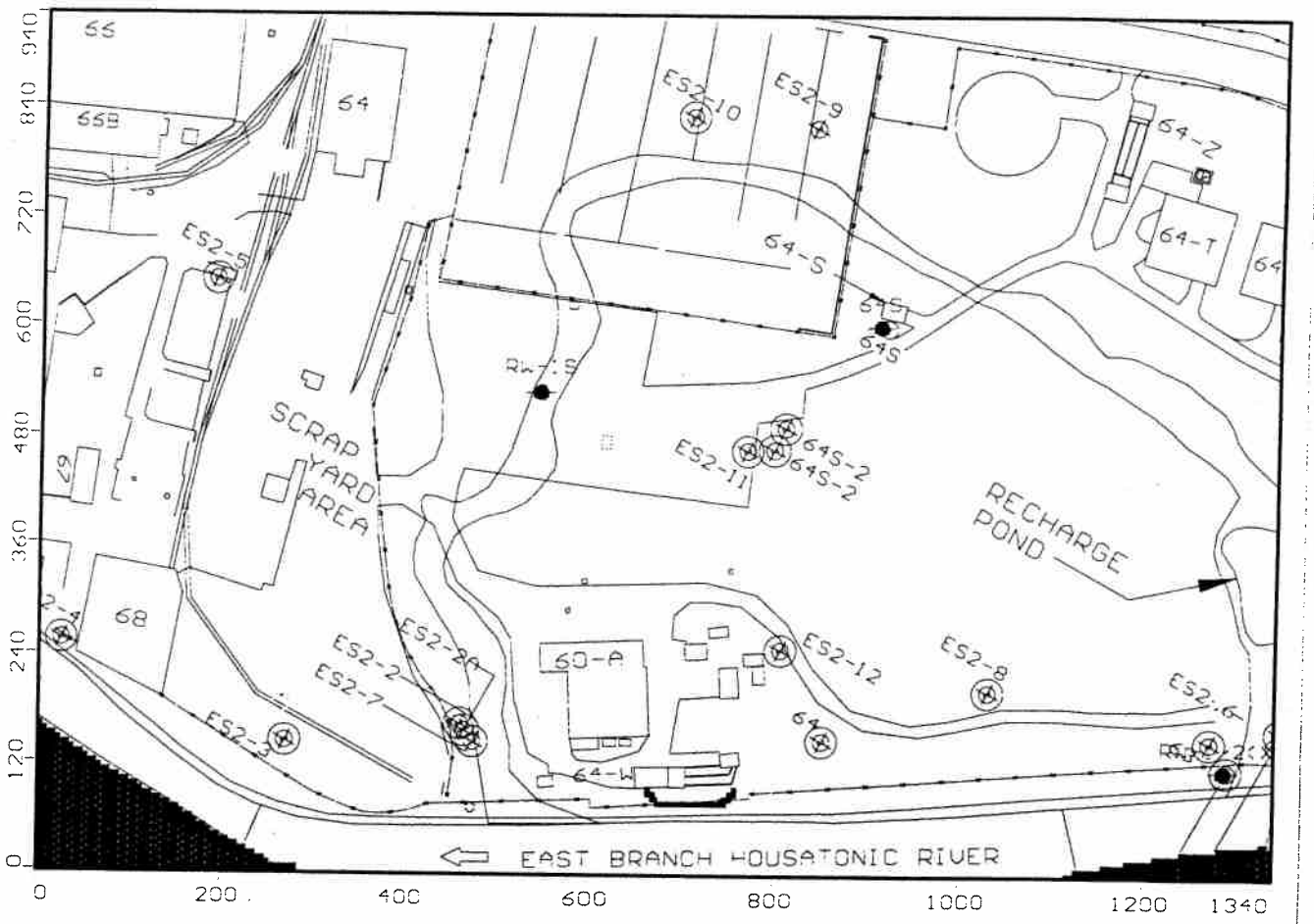


Figure 3 - Simulated sheet pile wall

Blasland, Bouck & Lee, Inc. Project: 64W21 – GE 1/2–Mile Reach Description: Simulated Sheetpile Wall 11 Jul 00	Visual MODFLOW v.2.8.2, (C) 1995–1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 2

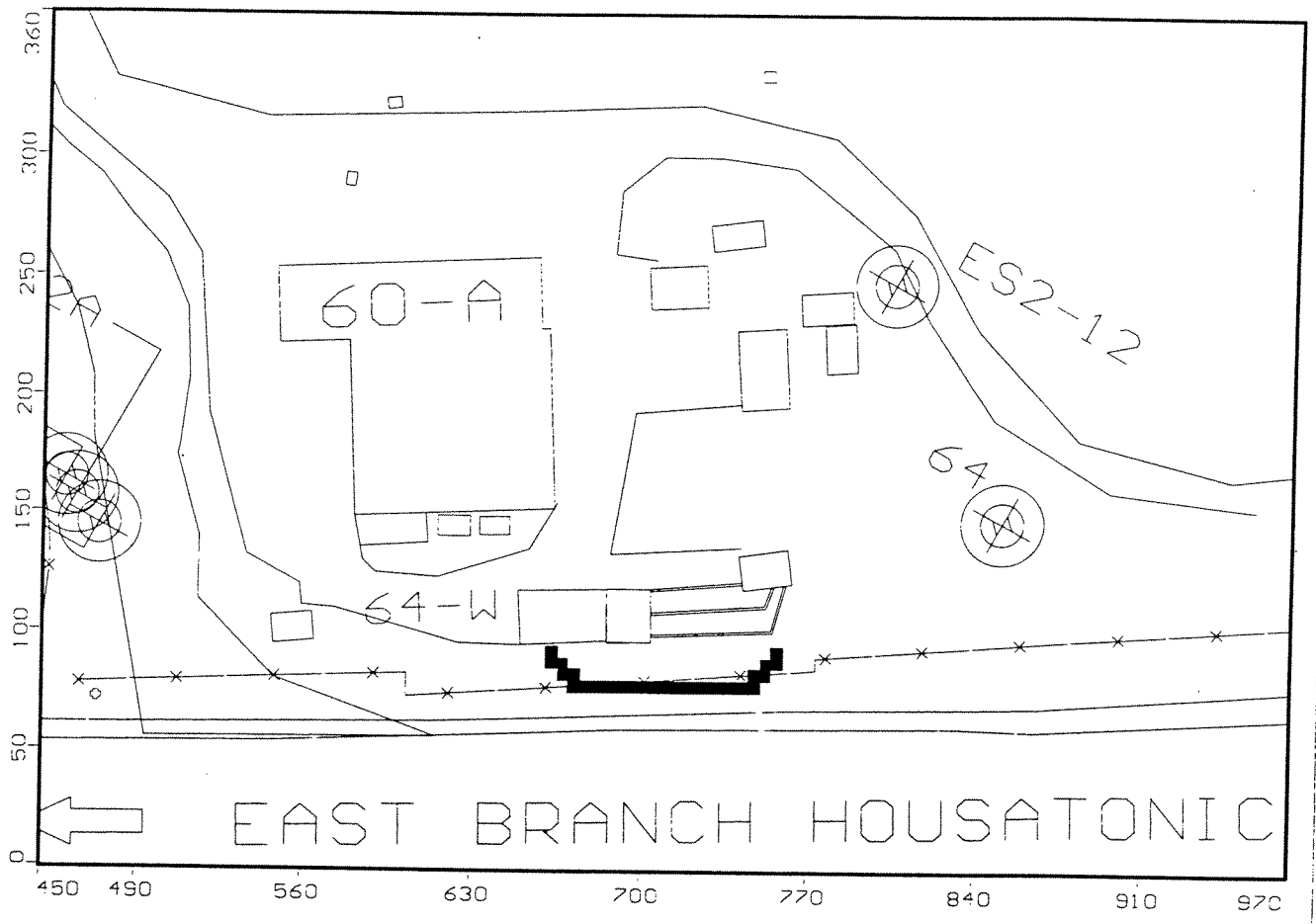


Figure 4 - Close-up of simulated sheet pile wall

Blasland, Bouck & Lee, Inc. Project: 64W21 – GE 1/2-Mile Reach Description: Simulated Sheetpile Wall 11 Jul 00	Visual MODFLOW v.2.8.2, (C) 1995-1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 2

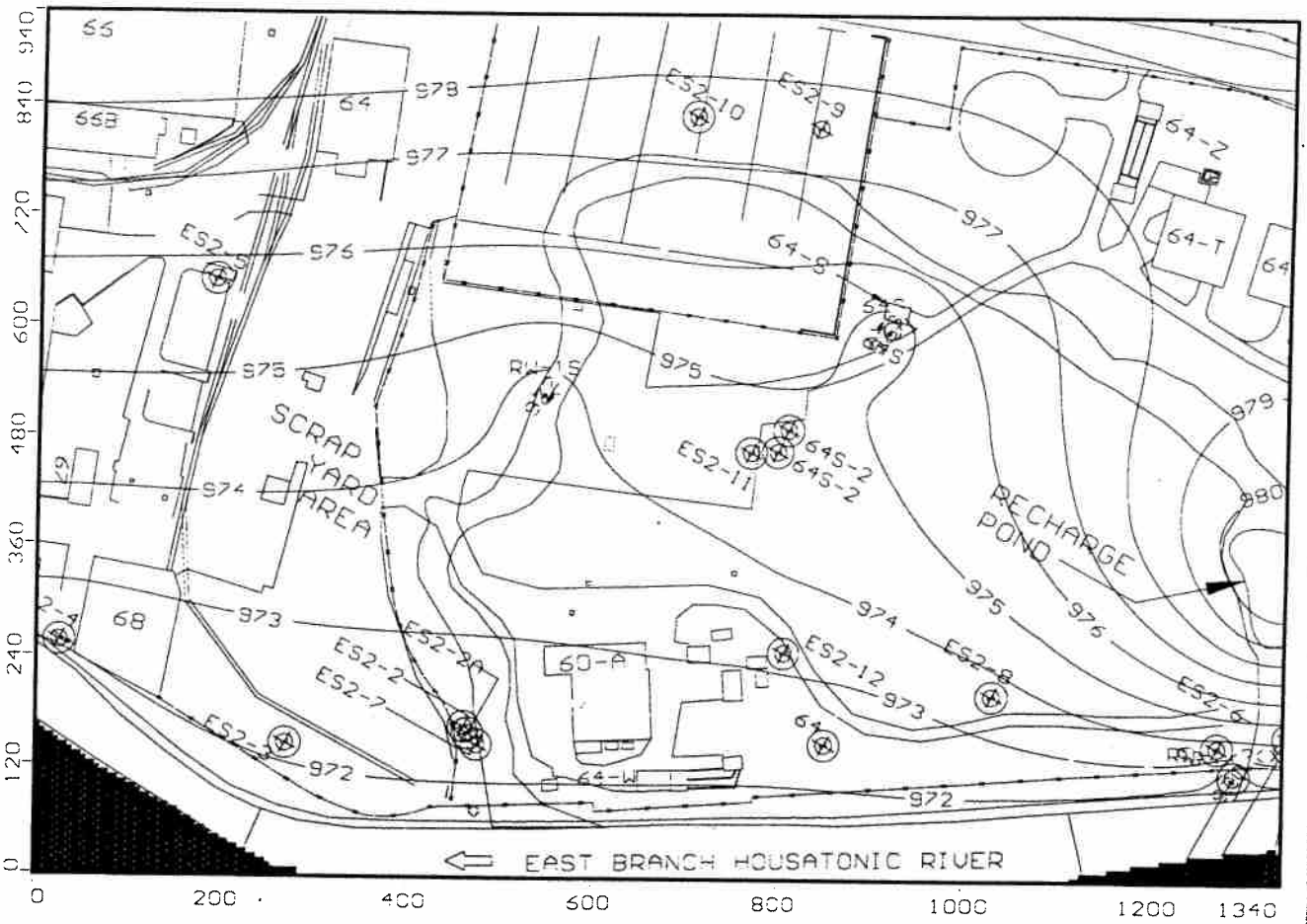


Figure 5 - Simulated pre-sheet pile wall groundwater elevation contours

Blasland, Bouck & Lee, Inc. Project: 64w20 GE 1/2-Mile Reach Description: Pre-Wall GW Contours 11 Jul 00	Visual MODFLOW v.2.8.2, (C) 1995-1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 2

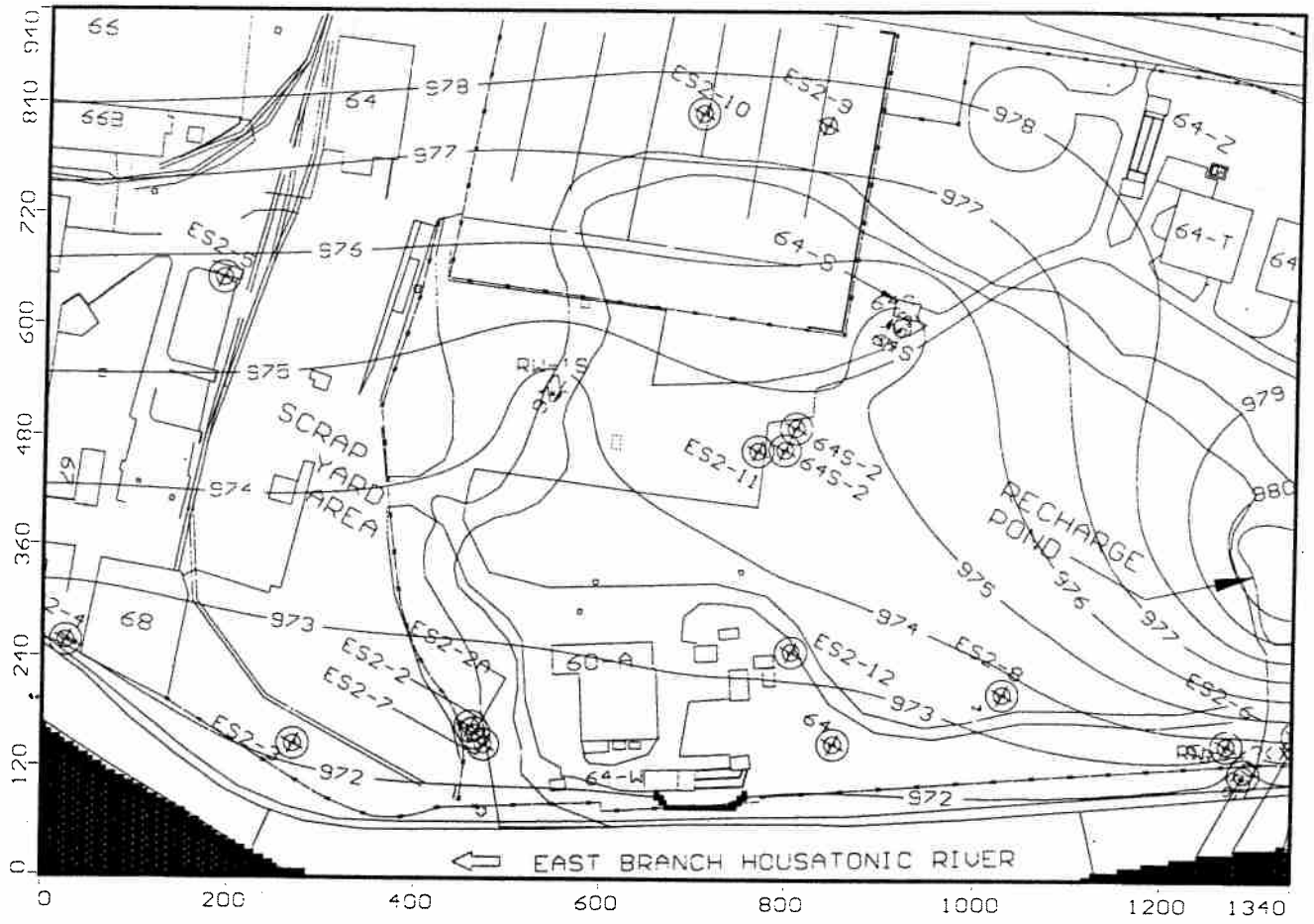


Figure 6 - Simulated post-sheet pile wall groundwater elevation contours

Blasland, Bouck & Lee, Inc. Project: 64W21 – GE 1/2–Mile Reach Description: Post–Wall GW Contours 11 Jul 00	Visual MODFLOW v.2.8.2, (C) 1995–1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 2

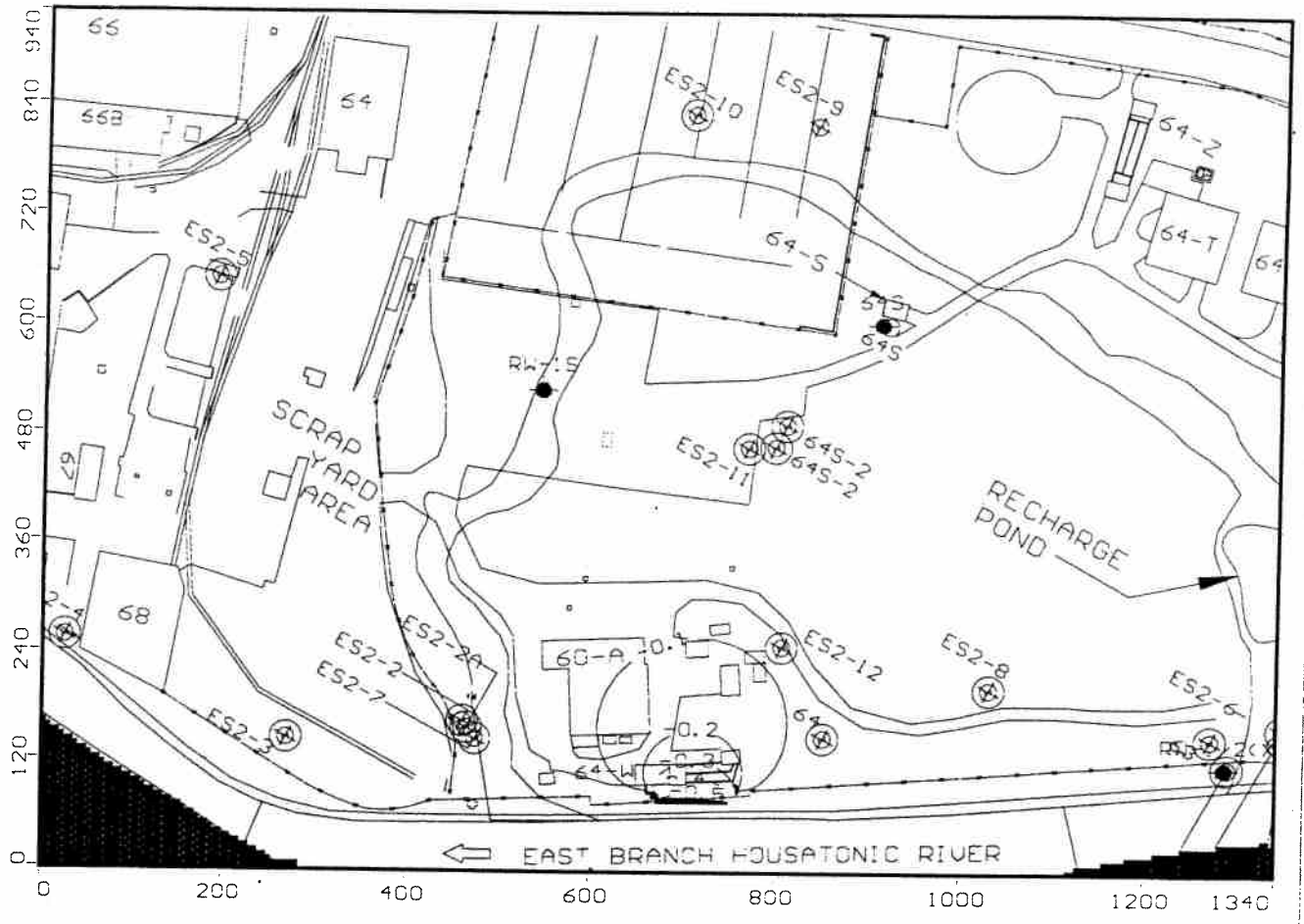


Figure 7 - Simulated groundwater elevation increase (mounding) due to emplacement of sheet pile wall

Blasland, Bouck & Lee, Inc. Project: 64W21 – GE 1/2–Mile Reach Description: Mounding Due to Wall 11 Jul 00	Visual MODFLOW v.2.8.2. (C) 1995–1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 2

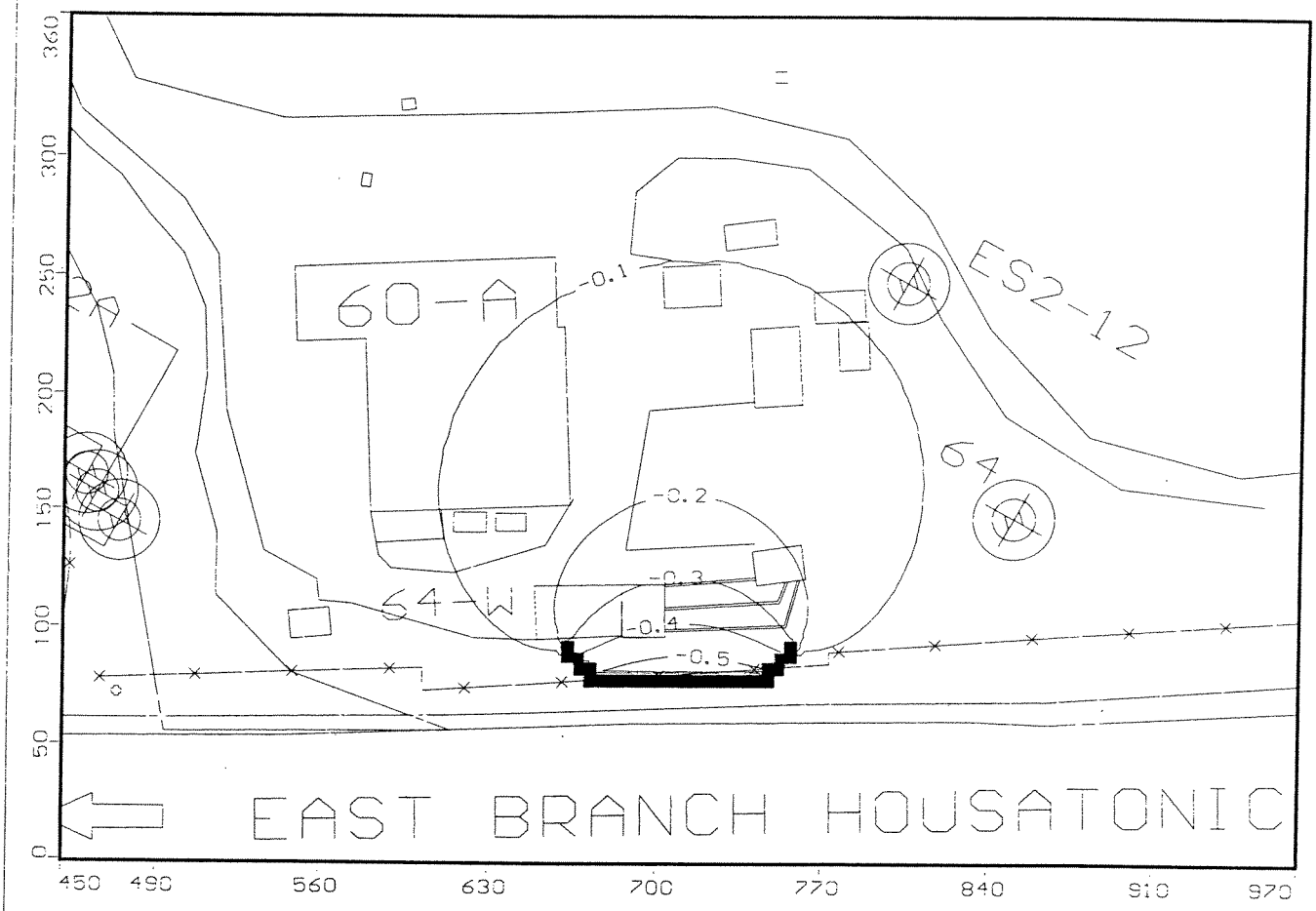


Figure 8 - Close-up of simulated groundwater elevation increase (mounding) due to emplacement of sheet pile wall

Blasland, Bouck & Lee, Inc. Project: 64W21 – GE 1/2–Mile Reach Description: Mounding Due to Wall 11 Jul 00	Visual MODFLOW v.2.8.2, (C) 1995–1999 Waterloo Hydrogeologic, Inc. NC: 268 NR: 188 NL: 4 Current Layer: 2