SDMS: 287033

WESTON Ref. No.
08-0012

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

September 23, 1999

Mr. Dean Tagliaferro
US Environmental Protection Agency
One Congress Street, Suite 1100
Boston, MA 02114-2023

Ms. Susan Steenstrup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: Upper 1/2-Mile Reach of Housatonic River Removal Action
Submission of Contractor's Operations Plan

Dear Mr. Tagliaferro and Ms. Steenstrup:

Enclosed please find copies of Maxymillian Technologies revised operations plan for the aforementioned project. This document addresses the comments discussed in EPA's September 15, 1999 letter from Mr. Tagliaferro. A revised schedule with applicable dates will be submitted under separate cover once the Consent Decree has been lodged.

Please call with any questions.

Yours truly,

Andrew T. Silfer, P.E.
Senior Technical Manager

cc: J.R. Bieke, Esquire, Shea & Gardner
R. Cavagnero, EPA
M.T. Carroll, GE
R. Goth, ACOE
W.A. Horne, GE
J. Kullberg, ACOE
J.H. Maxymillian, Maxymillian Technologies
S. Messur, BBL
T. O'Brien, MA EOEA
A.J. Thomas, Esquire, GE
A. Weinberg, DEP

REMOVAL ACTION OPERATIONS PLAN

UPPER 1/2-MILE REACH OF THE HOUSATONIC RIVER

GENERAL ELECTRIC COMPANY

PITTSFIELD, MA

Prepared by:

Maxymillian Technologies, Inc.
1801 East Street
Pittsfield MA 01201

SEPTEMBER 1999

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GENERAL

The work on this project will be performed in accordance with the Removal Action Work Plan – Upper 1/2-Mile Reach of the Housatonic River [Work Plan] prepared by Blasland, Bouck & Lee, Inc. (BBL), August 1999. This Operations Plan has been prepared by Maxymillian Technologies, Inc. (MT) to supplement the Work Plan. Specifically, as described in section 12.1.3 of the Work Plan, this Operations Plan has been developed to provide supplemental information on the following aspects of the removal action:

- Site preparation;
- Excavation stability / water diversion methods;
- Site restoration;
- East Street Area 2 remaining source control activities;
- Demobilization and cleanup items;
- Materials handling and staging;
- Equipment cleaning procedures;
- List of equipment to be used on site;
- Work schedule.

These topics, along with a description of various site preparation activities, are described in this plan.

SITE PREPARATION

Prior to any removal activities, several preliminary tasks must be performed, including:

- Mobilization of equipment, temporary storage facilities, sanitary facilities, and construction supplies;
- Removal and storage for reinstallation of the existing chain link fence in the work area.

Construction activities will begin at the eastern end of the project (Newell Street Bridge) and proceed downstream in the following work areas:

- Newell Street Bridge to the East Street Area II containment barrier;
- Upstream of Building 68;
- South side of the river at Building 68;
- General Electric Company (GE) footbridge to the Lyman Street Bridge.

These work areas may be further divided as necessary due to changing field conditions during the project.

Site preparation will include the following:

- Erosion control;
- Clearing;
- Temporary access roads;
- Utility relocation.

Erosion control will consist of trenched-in silt fence along the top of the slope, reinforced with double-staked hay bales to prevent erosion of the cleared bank. The silt fence will be installed prior to clearing operations in areas where it will not interfere with the removal of the trees and brush. In other areas it will be installed immediately after the trees and brush are removed, and at all times the bank soil will be protected from erosion, including the temporary placement of silt fence at the end of the day during clearing operations. Additional silt fence will be installed where necessary, such as the toe of the slope, where there is the possibility of erosion of soil from the cleared bank into the river. Erosion controls will be inspected and maintained until the surface is restored.

During construction of the excavation cells, an absorbent boom in combination with a floating silt curtain will be installed downstream of the work area.

Clearing of the site will include the removal of trees and brush to the extent necessary to access the work area from the north side riverbank. This removal is necessary to allow for the safe operation of the excavation and sheetpile installation equipment. Tree and brush removal on the south riverbank will be limited to the bank areas to be excavated and/or restored. Trees and brush will be cut flush with the existing ground surface; only those stumps in bank excavation areas will be removed when the soil is excavated and will be disposed of with the surrounding soil. Care will be taken during the clearing operation to prevent the removed trees from contacting contaminated soil so that the material may be disposed of as non-regulated waste. Trees and brush will be chipped on-site for disposal at an approved location.

Temporary access roads will be installed, as field conditions require, to expedite the work in each area. Most of the work will be performed from the northern bank of the river and the existing GE site provides adequate access in most areas. Temporary access roads will be constructed using a geotextile fabric over the existing soil and a layer of gravel. These temporary access areas will be removed and disposed of in conjunction with the restoration activities.

Aboveground utilities within the work areas, including electric and steam lines, will be relocated as necessary by GE. Below-grade utilities will be located within the GE property through the use of GE facility's site utility plans and the City of Pittsfield utility plans. A Dig Safe notification will also be filed to locate any utilities on public property. Any utilities that present a line or grade conflict will be physically located during the excavation process by hand excavation when mechanical excavation approaches within two feet of the utility.

As part of the site preparation, temporary safety fence and barriers will be installed and relocated as necessary to isolate the work areas.

EXCAVATION STABILITY / WATER DIVERSION METHODS

MT proposes to use steel sheet piling to achieve the desired excavation stability/water diversion to allow for the removal of the river sediments and bank soil. All sheetpile installation will be performed using a crane stationed on the northern bank of the river.

In each work area MT will install approximately 500 to 1,000 lineal feet of 20-foot long sheets (16' below the existing river bottom) down the approximate center of the river. The calulations supporting this embedment depth are included in Appendix A. Upon completion of this sheetpile line, additional 20-foot long sheets will be driven at each end extending into the south bank of the river, thus diverting the river flow to the north side of the river. By installing the centerline of sheets in 500 to 1,000 lineal-foot sections and then installing the cell division sheets, the cells can be tailored to the site conditions of each section of the river by either shortening or lengthening the cell. Excavation of the protected area will then begin.

The top of the sheetpile wall will be elevation 975, between the eastern end of the project and cross section 53233 (approximately 1,000 feet downstream of Newell Street). Between cross sections 53233 and 52923 (just downstream of the GE footbridge) the elevation will be 974.5. Elevation 974 will be maintained between cross sections 52923 and 52490; from 52490 to the western end of the project (the last 500 feet) the elevation of the top of the sheeting will be 973.5. These elevations are based upon a hydraulic evaluation performed by BBL, for the one-year event using 15-minute peak flow measurements.

Upon completion of the restoration activities, the walls extending to the south bank will be removed. These sheetpile walls will then be reinstalled extending from the centerline sheets to the north bank in a similar configuration. With the river diverted to the south side, excavation and restoration work will be performed on the north riverbank and sediment removal areas. Upon completion of the restoration activities, the walls and centerline sheetpiles will be removed and reinstalled at the next downstream work area. This process will be repeated until all areas have been excavated and restored.

The only exception to the sheetpile method of excavation stability / water diversion will be in the East Street Area II containment area and under the GE footbridge. In the East Street Area II containment area MT proposes to divert the water using a combination of eight-foot tall shoring boxes (30' long × 8' wide) and eight-foot by twenty-foot steel plates. The shoring box will be installed parallel to the riverbank, approximately twenty feet from the Waterloo sheetpile wall. The steel plates will then be installed from the Waterloo sheetpile wall to the end of the shoring box. This configuration will form a cell that can be dewatered, excavated and restored. The shoring box and steel plates will be forced into the river sediment to limit the infiltration of river water. The eight-foot height of the shoring box and plate will allow them to be imbedded into the sediment and still be tall enough for one-year flood conditions. Under the GE footbridge, it will not be practical to drive sheet piling. A similar approach to that used adjacent to the East Street Area II containment area will be used under the footbridge.

EXCAVATION, REPLACEMENT, AND RESTORATION

All excavation will be preformed under "dry" conditions, that is, not through a standing water column. To achieve this, the cells will be dewatered individually upon completion of the sheetpile walls. Initial draw down of the water in each cell will consist of pumping the impounded water back into the river with a pump whose intake is suspended six inches above the river bottom. All remaining water generated during the excavation and restoration activities will be transferred to the GE treatment facility at Building 64G.

Cell dewatering will be accomplished with a large electric submersible pump placed in an excavated sump located within the cell as determined by field conditions. Surface and subsurface water will be directed/transferred to this sump by either excavating trenches or the use of smaller submersible pumps as the excavation proceeds. Changing field conditions may require

modifications including the relocation and/or lowering the elevation of this main sump. The dewatering system will be maintained at all times to ensure the dewatering of each cell.

Water transfer from the main sump will be accomplished through the use of plastic piping installed along the north bank of the river, with temporary lines across the river to the southern cells. All lines crossing the river will be continuous in length and supported by a steel beam from the riverbank to the center sheetpile line to eliminate the possibility of leakage of the pumped water. The pumped water will then flow through a baffled setting tank with sufficient capacity to allow for 10-minute settling time for the estimated flow of 350 gallons per minute. The baffle tank will be outfitted with absorbent pads to remove any oil that may accumulate; the absorbents will be monitored and disposed of as necessary. From the settling tank the water will then be transferred to a 22,000-gallon frac tank for additional settling and temporary storage until it is pumped to the GE treatment plant in Building 64G. These tanks will be located east of GE Building 68, approximately midpoint of the 1/2-mile work area and rigid plastic pipe will be used to transfer the water from the frac tank to Building 64G.

As the work progresses downstream from Newell Street, the riverbank pipe will be moved as necessary and unused portions capped as required. All pipelines will be inspected daily and repaired immediately to minimize the chance of leakage.

Excavation of the river sediment and bank soils will commence once the cell is sufficiently dewatered. Surveyors will establish the horizontal limits of the areas to be excavated delineating the TSCA and non-TSCA areas and indicating the depth of removal required through the appropriate use of benchmarks. The excavation will proceed until the area and depth are achieved, the depth and location will then be verified and recorded for use in the as-built drawings.

Saturated soil removed as river sediment will be stockpiled in each cell for initial dewatering; water will be transferred through the previously described dewatering system. Dewatered soil will then be transferred to lined trucks for either additional dewatering at the temporary storage area or for disposal at the GE On-plant Consolidation areas. Similar methods will be used for the saturated and unsaturated bank soil.

All soil handling and loading operations will be conducted from the north bank of the river through the use of a large capacity crane, which will be used to lower a small excavator into the south side cells. The crane will then be used to assist in stockpiling and transferring the soil to waiting trucks positioned on the north bank. Sufficient care will be used to ensure that there will be no spillage of soil from the south cells into the river. This will be accomplished through the use of tight containers or other appropriate equipment.

Excavation will continue in a given cell until all soil has been removed to the given line and elevation shown on the contract drawings. Each cell will then be restored as shown in the drawings including geotextile, soil fill, additional geotextile, geogrid and armoring stone. Bank

removal areas will simultaneously be restored including topsoil seeding and erosion control fabric. Restoration of trees and plantings will be done at the appropriate time.

Upon completion of the south cells for a given work area the process will then be transferred to the northern side of the river and be accomplished in a similar fashion with the excavation equipment located on the north bank of the river.

During the excavation any indication of NAPL oil, electrical equipment or buried drums will cause excavation to cease and GE will be notified. If necessary, appropriate measures such as overpacking removal drums and additional soil removal will be preformed as directed by the GE representative.

SITE RESTORATION

Once excavation depth and horizontal limits have been confirmed in the sediment and bank removal areas, the areas will be restored. Restoration will consist of geotextiles, soil and a protective layer of stone as specified on Work Plan Figure 7-2. Installation of these materials will be as shown in the cross sections detailed on Work Plan Figures 7-1A, 7-1B, and 7-1C.

The sequence of restoration will be as follows: the geotextile and soil will be placed in the river sediment removal area extending to the toe of the bank removal area. In the south side removal areas the bank will then be restored including the soil and rip rap as shown on the above mentioned cross sections; the river bottom restoration will then be completed. On the north side removal area the sediment area can be restored first, followed by the rip rap at the toe and the restoration of the remainder of the bank removal area.

The restoration of the bank areas will include the placement of topsoil, seeding and placement of the erosion control fabric. Planting of trees and shrubs will be done during the appropriate planting seasons.

EAST STREET AREA 2 – REMAINING SOURCE CONTROL ACTIVITIES

Upon completion of the sediment and bank soil removal in this area the river bottom will be restored as shown in the sections found on Figure 7-1A, including the rip rap along the Waterloo barrier sheeting. This concrete headwall shown on Figure 8-1 will be installed as soon as the area is excavated. Bank restoration north of the barrier wall will then be performed.

DEMOBILIZATION AND CLEAN-UP ITEMS

- At the job's end, all support material (from access roads, stockpile areas, etc.) will be removed and stockpiled for sampling by others to determine disposal location.
- Following analytical results, all support materials will be hauled and disposed of at the appropriate On-plant Consolidation areas (OPCA), if necessary.
- Upon removal and disposal of all support materials, MT will clean the site of any miscellaneous debris, leave the site in a neat and orderly fashion, and demobilize all equipment and personnel from the site.

MATERIALS HANDLING AND STORAGE

The following description shall encompass both river sediment and excavated bank soils along with additional soils from temporary construction, such as access roads if necessary. At all times TSCA and non-TSCA soils will be segregated during excavation, loaded into separate trucks for transfer to the OPCA (78- non-TSCA, 71- TSCA) or to temporary stockpiles where they will remain segregated until final disposition in the consolidation areas.

Soils / sediments that may be direct loaded into trucks for transportation to the appropriate OPCA will be subject to passing the paint filter test. The frequency of testing these materials will be determined in the field based on the physical appearance of the materials. The frequency will not exceed one test per truckload. Materials stockpiled in Building 65 will be subject to passing the paint filter test prior to transportation to the appropriate OPCA. The frequency of testing of these materials will be one sample per five truckloads unless additional testing is warranted based on the physical appearance of the materials.

The temporary storage areas inside of Building 65 will consist of impermeable plastic sheeting over a perimeter berm of hay bales to contain any water. The construction will allow for the placement of the soil with dump trucks, consolidation with an excavator or front-end loader and the transfer to transport vehicles with either the loader or excavator. Water drained from the soil will be collected and removed with a small submersible pump and transferred to the Building 64G treatment plant with a tank trailer dedicated to this purpose. The temporary storage area will be divided into TSCA and non-TSCA areas to maintain segregation of the materials. Storage piles when not actively being used will be covered with poly tarps. Storage piles will be inspected daily and any deficiencies corrected immediately.

The transfer of any soils, direct loaded or loaded from the stockpile into dump trucks, will include the use of poly sheeting draped from the loading side of the vehicle onto the loading surface. This will be done to contain any spillage during loading activities. All poly and other protective materials (temporary hay bales, PPE, etc.) will be loaded with the soil they came in

contact with for final disposition at the OPCA. Dust control when necessary will be accomplished with water spray.

FLOOD CONTROL CONTINGENCY PLAN

The proposed sheetpile walls will extend to an elevation of approximately the one-year flood level under restricted conditions (based on 15-minute peak flow data). Based on data presented in the Work Plan, this elevation should provide a reasonable assurance that the sheet piling will not overtop during anything up to the 1-year event during the construction period. In the unlikely event that an event of a magnitude greater than the 1-year event occurs, the following plan will address potential flood impacts.

To minimize the effects of potential flooding, it is important that the excavation begin at the east, upstream end to prevent contaminated material from being washed downstream into an excavated area.

As a contingency plan, in the event that flooding is anticipated, the work area will be protected, if feasible, as follows:

- Remove all excavations equipment from the cell.
- Place a layer of geotextile (and adequately anchor using sand bags) over the areas where:
  - Sediment removal or capping/armoring is in progress and/or has been completed; and
  - Clean areas where sediment removal is not proposed.

  If removal and replacement activities have not yet commenced, it will not be necessary to place the geotextile.
- After the water has receded, pump impounded river water within the water diversion/containment structure area over the structure, back into the flowing portion of the river, using a pump suspended a minimum of 6" above the bottom of the river. When the depth of water in the work area approaches the sediment, the water will be subject to handling as described in the dewatering section of this plan.
- Remove the geotextile and recommence removal activities.
- The work area will then be inspected, including verification of the elevation of restored/excavated areas; any deficiencies will then be corrected prior to resuming the work remaining in the work area.

Work within the sheet piling will not resume until the river level has subsided and the sheetpile area has been dewatered. At that time the site will be assessed, and if necessary, corrective measures will be performed.

EQUIPMENT CLEANING PROCEDURES

Depending on the equipment and its involvement in the project, specific individualized cleaning methods shall be employed.

Over-the-road trucks and trailers used for OPCA disposal will not come in contact with contaminated surfaces and polyethylene will be placed under and around them during loading to catch any spilled material. These vehicles will therefore require only a visual inspection prior to leaving the site.

Onsite excavating equipment will require a more thorough cleaning and inspection procedure. Specifically, equipment that is involved in the excavation of contaminated material before being moved from one contaminated excavation area to another, will be manually cleaned of any soil to prevent spillage of this soil while moving over clean surfaces such as the concrete pavement in this area. In addition, any contaminated equipment surfaces, excavator buckets, loader buckets, etc., will be decontaminated prior to being utilized for clean material or being removed from the site. The decontamination procedure will be conducted in a temporarily constructed area built for this purpose. The area will consist of a diked impermeable membrane surface with a collection sump from which the decontamination liquids will be removed and containerized for disposal. Decontamination procedures for equipment leaving the site will involve scrubbing the contaminated areas with a detergent solution and a pressure wash rinse. A wipe test will then be performed to ensure that the area has a PCB level of less than 10μg/100 cm^2, re-cleaning will be required until this level is achieved.

EQUIPMENT TO BE USED ON-SITE

The following equipment is anticipated to be used onsite during some or all of the 1/2-Mile Area Removal Action:

Sheet Piling installation:

- Link Belt 150-ton Crane
- Link Belt 82-ton Truck Crane
- Grove 45 Ton Rough Terrain Crane
- ICE Vibratory Sheeting Driver

Excavation:

- Koehring 1166 Excavator
- Caterpillar 235 Extended Boom Excavator
- Caterpillar 225 Excavator
- Komatsu PC 200 Excavator
- Komatsu PC 90 Excavator
- Caterpillar 966D Rubber Tired Loader
- Caterpillar 950 Rubber Tired Loader
- Mack DM 800, Ten Wheel Dump Trucks
- Settling tank
- Frac tank

Backfill and Restoration:

In addition to the above listed equipment the following will also be used:

- Caterpillar D-4 Bulldozer

Since MT is based on East Street in Pittsfield, approximately 2 miles from the project, mobilization of additional equipment in the event of an emergency could be accomplished in a timely manner.

Appendix A

Sheeting Design

ASSUMPTIONS & CONDITIONS :

(1) SHEETING WILL BE DRIVEN AT MIDPOINT OF RIVER. SHEETING LENGTH WILL BE 20 FT.

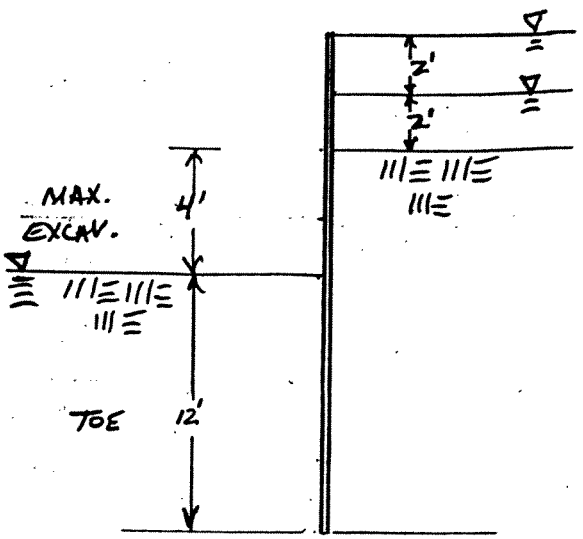
(2) SHEETING WILL BE DESIGNED FOR A ONE-YEAR FLOOD LEVEL. THE ONE-YEAR FLOOD LEVEL WILL BE ASSUMED TO BE 2' ABOVE THE NORMAL WORKING LEVEL OF THE RIVER BECAUSE THE SHEETING WILL BE INSTALLED AT THE MIDPOINT OF THE RIVER. THE NORMAL WORKING LEVEL OF THE RIVER WILL BE ASSUMED AT 2' ABOVE RIVER BOTTOM.

(3) DESIGN WILL BE FOR A MAXIMUM RIVER BED EXCAVATION OF 4'.

(4) DESIGN WILL PARALLEL THE PREVIOUSLY SUBMITTED AND APPROVED DESIGN FOR SHEETING AT BUILDING 68. THE SOIL WILL BE ASSUMED AS A SILTY SAND WITH ALL THE SAME PROPERTIES AS WERE USED IN THE PREVIOUS DESIGN.

(5) DESIGN FOR PZ-27 (OR EQUAL) STEEL SHEETING

ACTUAL CONDITIONS



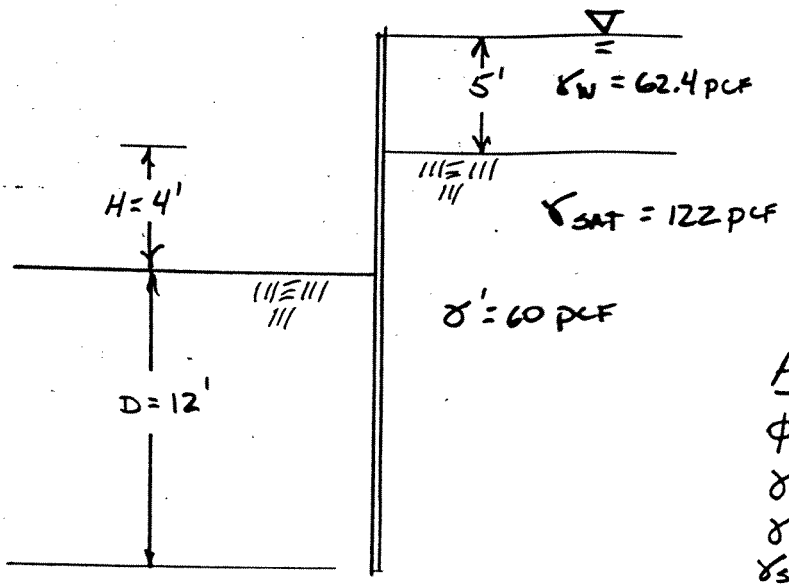
SILTY SAND

$\phi = 28^\circ$ (ESTIMATED)

$\gamma = 110$ PCF

$\gamma' = 60$ PCF

DESIGN CONDITIONS



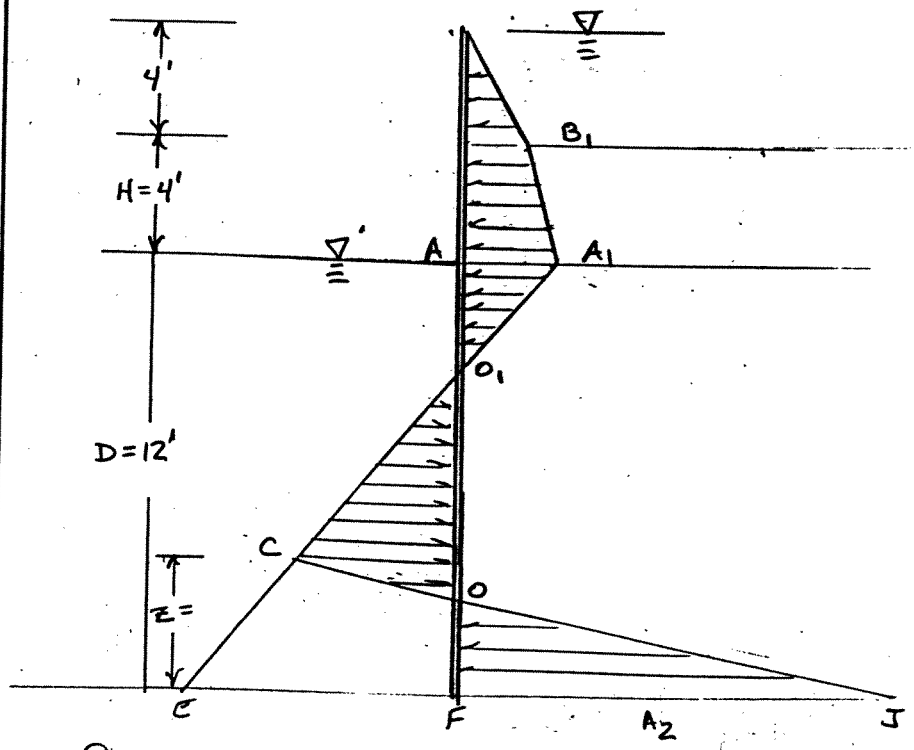
ASSUME:

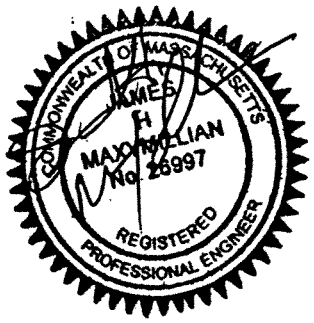
$\phi = 28^\circ$ (ESTIM.)	$\beta = 0$
$\gamma = 110$ PCF	$\beta/\phi = 0$
$\gamma' = 60$ PCF	
$\gamma_{SAT} = 122$ PCF	$\delta/\phi = .5$
$K_a = .35$	$\delta = 14^\circ$
$K_p = 5.50$	
$(K_p - K_a) = 5.15$	

ASSUME SAME GRANULAR MAT'L THROUGHOUT

CONVENTIONAL ASSUMED PRESSURE DIAGRAM

DETERMINE WALL PRESSURES -





$P_{B_1} = \gamma_w (4') = 250$ psf

$P_{A1} = P_{B_1'} + K_a \gamma_{SAT} (4') = (62.4)(4) + (35)(122)(4) = 421$ psf

$P_{A_2} = P_{A1} + K_a \gamma'_D = 421 + (.35)(60)(12') = 673$ psf

$P_E = \gamma'_D (K_p - K_a) - P_{A_1} = (60)(12)(5.15) - 421 = 3287$ psf

$P_J = \gamma'_D (K_p - K_a) + \gamma_{SAT} (4') K_p = 60(12)(5.15) + (122)(4)(5.5) = 6392$ psf

$\Sigma F_x = 0$ (SOLVE FOR Z)

$$4'\left(\frac{P_{B_1}}{2}\right) + \left(\frac{P_{B_1} + P_{A1}}{2}\right)(4') + \frac{P_{A1} + P_{A_2}}{2}(12') + \left(\frac{P_E + P_J}{2}\right)\frac{Z}{2} - (P_E + P_{A_2})\frac{D}{2} = 0$$

$$4\left(\frac{250}{2}\right) + \frac{671}{2}(4) + \frac{1094}{2}(12) + \frac{9679}{2}(Z) - 3960(6) = 0$$

$$500 + 1342 + 6564 + 4840Z - 23{,}760 = 0$$

$$Z = 3.17 \text{ FT.}$$

CHECK STABILITY AGAINST OVERTURNING

$\Sigma M_F = 0^{+\circlearrowleft}$ (M < 0 MEANS OVERTURNING IS OK)

$$\frac{P_{B_1}}{2}(H)\left(D+H+\frac{H}{3}\right) + P_{B_1}(H)\left(D+\frac{H}{2}\right) + (P_{A_1}-P_{B_1})\left(\frac{1}{2}\right)(H)\left(D+\frac{H}{3}\right) + P_{A_1}(D)\left(\frac{D}{2}\right)$$

$$+ (P_{A_2}-P_{A_1})\left(\frac{D}{2}\right)\left(\frac{D}{3}\right) + (P_E+P_J)\left(\frac{z^2}{6}\right) - (P_E+P_{A_2})\left(\frac{D^2}{6}\right)$$

$$500\left(12+4+\frac{4}{3}\right) + 250(4)\left(12+\frac{4}{2}\right) + (171)\left(\frac{1}{2}\right)(4)\left(12+\frac{4}{3}\right) + 421(12)\left(\frac{12}{2}\right)$$

$$+ 252\left(\frac{12}{2}\right)\left(\frac{12}{3}\right) + 9679\left(\frac{3.17^2}{6}\right) - 3960\left(\frac{12^2}{6}\right) = 0$$

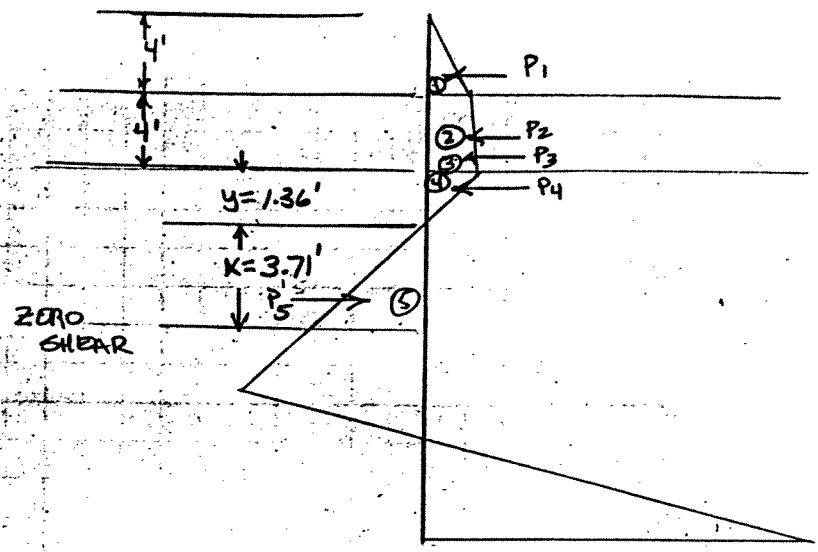
$$8667 + 14{,}000 + 4560 + 30{,}312 + 6048 + 16{,}211 - 95{,}040 = 0$$

$\Sigma M_F = -15{,}242$ FT-LBS

∴ OVERTURNING O.K.

COMMONWEALTH OF MASSACHUSETTS
JAMES H. MAHONEY
No. 23697
REGISTERED PROFESSIONAL ENGINEER

DETERMINE MAXIMUM MOMENT



$$y = \frac{P_{A_1}}{\gamma'(K_p - K_a)} = \frac{421}{60(5.15)} = 1.36'$$

$$P_{①} = \frac{1}{2} P_{B_1}(4') = 500 \text{ LBS}$$

$$P_{②} = P_{B_1}(4') = 1000 \text{ LBS}$$

$$P_{③} = \frac{1}{2}(P_{A_1} - P_{B_1})(4') = \frac{1}{2}(171)4 = 342 \text{ LBS}$$

$$P_{④} = \frac{1}{2} P_{A_1}(y) = \frac{1}{2}(421)(1.36) = 286 \text{ LBS}$$

$$P_{①} + P_{②} + P_{③} + P_{④} = \tfrac{1}{2}\gamma'(K_p - K_a)x^2$$

$$x^2 = \frac{2(2128)}{(60)(5.15)}$$

$$X = 3.71 \text{ FT}$$

MAXIMUM MOMENT - CONT'D

$P_{⑤} = \frac{1}{2}\gamma'(K_P - K_a)(X^2) = P_① + P_② + P_③ + P_④ = 2128$ LBS

$l_1 = X + Y + 4 + 4/3 = 10.4'$

$l_2 = X + Y + \frac{4}{2} = 7.07'$

$l_3 = X + Y + \frac{4}{3} = 6.4'$

$l_4 = X + \frac{2Y}{3} = 4.62'$

$l_5 = \frac{X}{3} = 1.24'$

$\Sigma M_x = 0$

$500(10.4) + 1000(7.07) + 342(6.4) + 286(4.62) - 2128(1.24) = 0$

$5200 + 7070 + 2189 + 1321 - 2639 = 0$

$M_{MAX} = 13,141$ FT-LBS

DETERMINE S_X REQ'D: TRY PZ-27 (OR EQUAL) A-328 STEEL $F_b = 25$ KSI

$$S_{REQ'D} = \frac{M_{MAX}}{F_b} = \frac{(13,141 \text{ FT-LBS})(12 \text{ IN/FT})\left(\frac{1 \text{ KIP}}{1000 \text{ LBS}}\right)}{25 \text{ KSI}}$$

$S_{REQ'D} = 6.31$ IN^3

$S_{PZ-27} = 30.2$ IN^3/LF OF WALL $\therefore$ OK

USE PZ-27 GRADE A-328 (OR EQUAL) SHEETS

COMMONWEALTH OF MASSACHUSETTS JAMES W. MACMILLAN 25997 REGISTERED PROFESSIONAL ENGINEER

Appendix B

Work Area Plan
(BBL Figure 6-1, 06/24/99)