

**MALCOLM
PIRNIE**

DRAFT FINAL

**FINAL WORK PLAN
PERMEABLE REACTION WALL
PILOT TREATMENT SYSTEM
WATERVLIET ARSENAL,
Siberia Area, NE Quadrant
Watervliet, New York**

**Baltimore Corps of Engineers
Baltimore, Maryland**

Prepared by:

Malcolm Pirnie, Inc.
15 Cornell Road
Latham, New York 12110



**US Army Corps
of Engineers**

Baltimore District

DRIVEN BY A VISION...to be the BEST

**September 1998
0285-709**

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1-1
1.1	Background and Purpose of Document	1-1
2.0	FINAL SELECTION OF REACTIVE WALL LOCATION AND CONFIGURATION	2-1
2.1	Decision on Polishing Wall	2-1
2.2	Selection of Alternative 2 for Implementation of Pilot Treatment System	2-3
2.3	Confirmation of Bedrock and Groundwater Elevations	2-4
2.4	Groundwater Monitoring System	2-5
2.5	Anticipated Iron Life in Permeable Reactive Barrier	2-5
2.6	Dewatering During Construction	2-5
3.0	FINAL LAYOUT FOR PERMEABLE REACTION WALL PILOT TREATMENT SYSTEM	3-1
3.1	Reaction Wall Design	3-1
3.2	Revised Cost Estimate	3-1
3.3	Proposed Schedule	3-1

LIST OF TABLES

Table No.	Description	Following Page
2-1	Water Quality Sampling Results Monitoring Wells Along Proposed Reactive Wall Alignment	2-4
2-2	Historic Water Levels in Overburden and Weathered Rock	2-4
3-1	Watervliet Arsenal, Siberia Area - Alternative 2 Draft Final Work Plan, Reactive Trench Construction Opinion of Probable Construction Cost	3-1

LIST OF FIGURES

Figure No.	Description	Following Page
2-1	Test Pit Locations Along Storm Sewers	2-1
2-2	Soil Borings and Monitoring Wells	2-3

TABLE OF CONTENTS (Continued)

LIST OF FIGURES (Continued)

Figure No.	Description	Following Page
2-3	Overburden Potentiometric Contour Map 6/22/98	2-4
3-1	Site Plan	3-1
3-2	Details	3-1

LIST OF APPENDICES

Appendix	Description
A	Soil Boring and Well Construction Logs
B	EnviroMetal Technologies, Inc. Memo on Anticipated Iron Lifetime
C	Draft Construction Documents

1.0 INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF DOCUMENT

On May 8, 1998, a Draft Work Plan for the installation of a permeable reaction wall pilot treatment system at the Watervliet Arsenal was submitted to the United States Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC) for review and comments. This document entitled, "Draft Work Plan, Permeable Reaction Wall Pilot Treatment System, Watervliet Arsenal, Siberia Area, NE Quadrant, Watervliet, New York, April 1998, was prepared by Malcolm Pirnie, Inc. for the Baltimore Corps of Engineers and presented conceptual designs for two alternative configurations of the reactive wall pilot treatment system as follows:

- **Alternative 1** - A single, 320-foot long reactive wall extending across the plume of contaminated groundwater just east of the concrete loading dock as shown in Figure 2-1 of the Draft Work Plan.
- **Alternative 2** - Two separate segments of reactive wall extending across the plume of contaminated groundwater, one near the suspected source of contamination and the second close to the access road through the area near the northerly property line of the site as shown in Figure 2-2 of the Draft Work Plan. The total length of wall under this alternative was to be approximately 270 linear feet.

The presence of a concrete loading dock, buried electrical lines and sewers along the access road through the area prevent the construction of the reactive wall immediately adjacent to the roadway without extensive utility relocation work, and a portion of the plume of contaminated groundwater would be downgradient from the reactive wall under each alternative. An optional, 30-foot long polishing wall was considered for construction perpendicular to the access road and the adjacent storm sewers near the northerly property line of the site to treat the downgradient portion of the plume. However, it was not clear whether this optional wall segment would be effective, as it was considered likely that the con-

taminated groundwater was infiltrating into the storm sewers and flowing off the site within these pipes.

The Draft Work Plan provided preliminary cost estimates which indicated that Alternative 2 offered a more cost-effective approach to treating the VOCs in the groundwater of the NE Quadrant than Alternative 1, and presented the results of modeling efforts which indicated that the permeable reactive wall configuration proposed under Alternative 2 would intercept any new contamination in the plume originating from the source. However, no firm recommendation was made regarding the final selection of the preferred configuration for the wall or for construction of the optional, polishing wall. The final decision on the selection of the preferred wall configuration was deferred until comments could be obtained on the conceptual design alternatives from the USEPA and the NYSDEC.

Written comments on the Draft Work Plan were received from the USEPA and the NYSDEC in June and July, 1998. A number of comments focused on the potential effectiveness of the polishing wall option while others concerned methods of monitoring the degree of treatment achieved by the reaction wall. Comments were also received on the potential degradation of the granular iron in the wall, the potential effects on groundwater flow directions and depths following the construction of a groundwater collection trench in the easterly portion of the northeast quadrant near the Perfection Plating Company property, and on construction methods including the handling of groundwater from dewatering operations. Most comments indicated a preference for the construction of Alternative 2 over Alternative 1 and suggested that additional information be obtained on the groundwater flow pattern in the vicinity of the storm sewers to form a basis for deciding upon the installation of the polishing wall. During July and early August, 1998, additional field work was conducted at the site to support the selection of a final plan for the permeable reaction wall pilot treatment system.

This Draft Final Work Plan documents the field work conducted since submittal of the April, 1998 Draft Work Plan, describes the permeable reaction wall pilot treatment system selected for implementation, and provides more detailed information on the design of the selected reaction wall than was contained in the earlier document. It does not

supersede the April, 1998 Draft Work Plan, but supplements it. The reader is referred to the April, 1998 document for information on site background information, groundwater modeling, bench-scale treatability testing, and other basic information.

2.0 FINAL SELECTION OF REACTIVE WALL LOCATION AND CONFIGURATION

2.1 DECISION ON POLISHING WALL

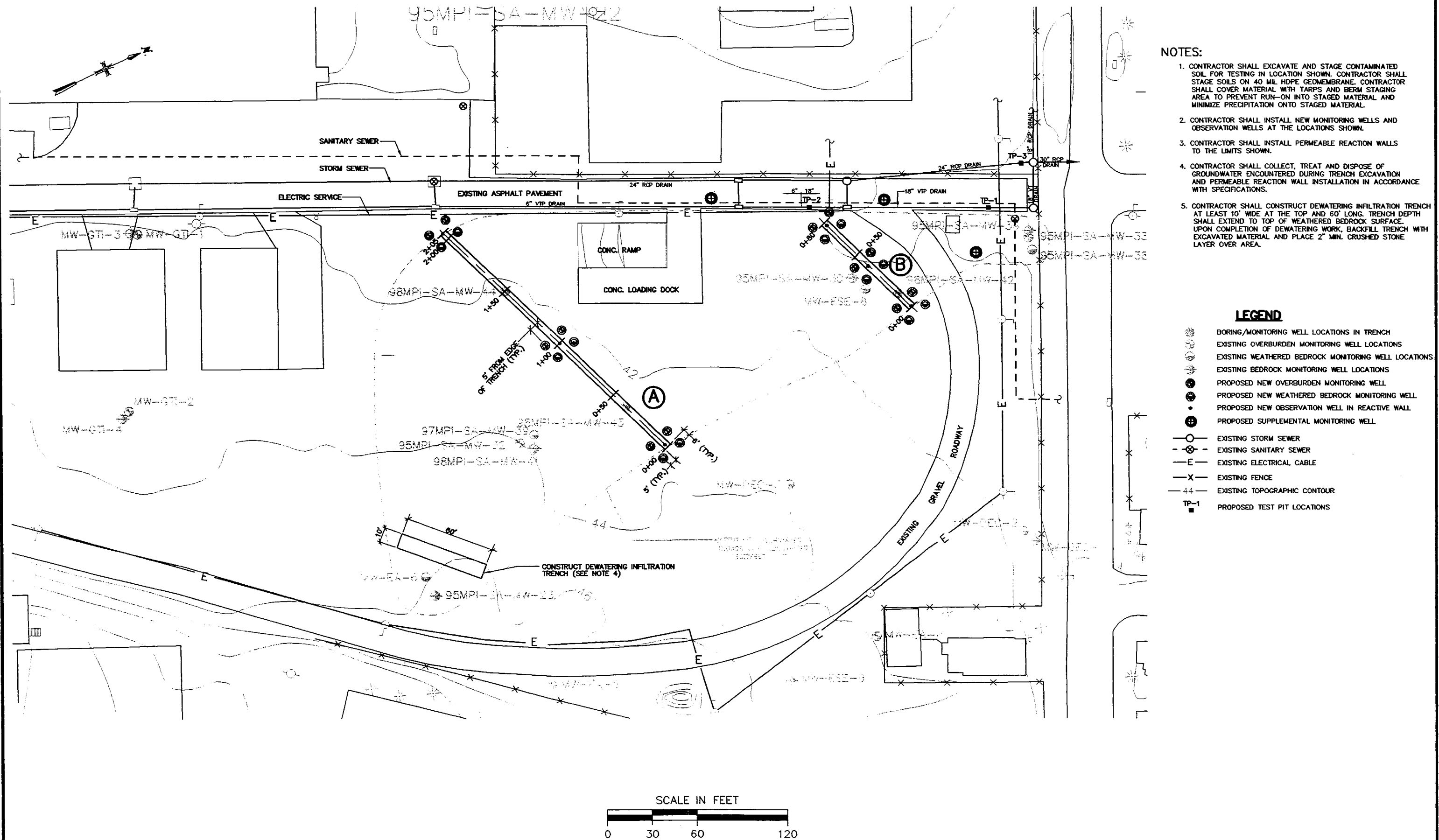
In order to evaluate the potential effectiveness of the polishing reactive wall option in treating the contaminated groundwater in the plume downgradient from the proposed, permeable reaction walls considered in the April, 1998 Draft Work Plan, test pits were excavated along the storm sewers adjacent to the access road. These test pits verified the diameters, locations and depths of the storm sewers along both the east and west sides of the road and permitted an assessment to be made of their condition and construction.

Three test pits were excavated on July 21, 1998. Two of the test pits were excavated to expose the storm sewer located on the east side of the main access road in the Siberia Area. The third test pit was excavated over the storm sewer on the west side of the road. Figure 2-1 shows the locations of the test pits.

Test Pit 1 (TP-1) was excavated approximately 22 feet south of manhole #120. As anticipated, an 18-inch, vitrified clay pipe storm sewer was encountered at this location. The bedding material surrounding the pipe consisted of shale fragments and coarse to fine grained fill. Typical bedding materials used for installation of sewer pipes (i.e., uniform sands or gravels) were not encountered. After five hours, groundwater was measured in the test pit at approximately 6 feet below grade. The depth of the test pit was approximately 7.5-8.0 feet. The depth to the crown of the 18-inch pipe was approximately 5.6 feet below grade. Bedrock was not encountered.

TP-2 was excavated along the 18-inch storm sewer approximately 55 feet south of TP-1. The depth of this test pit was approximately 7 feet below grade, the depth at which bedrock was encountered. The crown of the pipe was encountered at approximately 5.6 feet below grade. The bedding materials around the pipe were the same as those encountered in TP-1. The 18-inch pipe was found to consist of 4 foot lengths with bell and spigot joints. A

3705 0285709960 1A-04AD-PROJ\02857099\709-15 Scale: 1:1 Date: 09/01/1998 Time: 14:18



NOTES:

1. CONTRACTOR SHALL EXCAVATE AND STAGE CONTAMINATED SOIL FOR TESTING IN LOCATION SHOWN. CONTRACTOR SHALL STAGE SOILS ON 40 MIL HDPE GEOMEMBRANE. CONTRACTOR SHALL COVER MATERIAL WITH TARPS AND BERM STAGING AREA TO PREVENT RUN-ON INTO STAGED MATERIAL AND MINIMIZE PRECIPITATION ONTO STAGED MATERIAL.
2. CONTRACTOR SHALL INSTALL NEW MONITORING WELLS AND OBSERVATION WELLS AT THE LOCATIONS SHOWN.
3. CONTRACTOR SHALL INSTALL PERMEABLE REACTION WALLS TO THE LIMITS SHOWN.
4. CONTRACTOR SHALL COLLECT, TREAT AND DISPOSE OF GROUNDWATER ENCOUNTERED DURING TRENCH EXCAVATION AND PERMEABLE REACTION WALL INSTALLATION IN ACCORDANCE WITH SPECIFICATIONS.
5. CONTRACTOR SHALL CONSTRUCT DEWATERING INFILTRATION TRENCH AT LEAST 10' WIDE AT THE TOP AND 60' LONG. TRENCH DEPTH SHALL EXTEND TO TOP OF WEATHERED BEDROCK SURFACE. UPON COMPLETION OF DEWATERING WORK, BACKFILL TRENCH WITH EXCAVATED MATERIAL AND PLACE 2" MIN. CRUSHED STONE LAYER OVER AREA.

LEGEND

- BORING/MONITORING WELL LOCATIONS IN TRENCH
- EXISTING OVERBURDEN MONITORING WELL LOCATIONS
- EXISTING WEATHERED BEDROCK MONITORING WELL LOCATIONS
- EXISTING BEDROCK MONITORING WELL LOCATIONS
- PROPOSED NEW OVERBURDEN MONITORING WELL
- PROPOSED NEW WEATHERED BEDROCK MONITORING WELL
- PROPOSED NEW OBSERVATION WELL IN REACTIVE WALL
- PROPOSED SUPPLEMENTAL MONITORING WELL
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING ELECTRICAL CABLE
- EXISTING FENCE
- EXISTING TOPOGRAPHIC CONTOUR
- PROPOSED TEST PIT LOCATIONS



US Army Corps
of Engineers

PERMEABLE REACTION WALL - PILOT SYSTEM CONSTRUCTION
TEST PIT LOCATIONS
ALONG STORM SEWERS
WATERVLIET ARSENAL
USACE CONTRACT NO. DACA31-94-D-0017

MALCOLM PIRNIE, INC.

FIGURE 2-1

bell joint was exposed and, upon visual inspection, it was determined that the joint was not sealed with mortar.

Approximately five hours after excavating the test pit, groundwater had risen to approximately 6.5 feet below grade and was entering the sewer pipe bell joint. The pipe was damaged during excavation and subsequently had to be repaired. When the pit was extended approximately 3 feet to the south for the repair, it was found that the 18-inch pipe ended and continued as a 6-inch diameter vitrified clay pipe. Although old drawings provided by the Arsenal indicated the presence of a 6-inch perforated pipe in this area, the 6-inch pipe found was not perforated. The joints were not sealed with mortar, however, so it also functions to lower the groundwater in the area. When the damaged section of 18-inch pipe was replaced, it was noted that the sewer was over half full of soil and debris which would indicate that soil is entering the pipe through the open joints.

TP-3 was excavated over the storm sewer on the west side of the access road in the northeast corner of the Chip Handling Area. The excavation was made approximately 4 feet south of manhole #116, as shown on Figure 2-1. The depth of the pit was approximately 6.8 feet below grade, the depth at which bedrock was encountered. The crown of a 24-inch concrete storm sewer was encountered at a depth of approximately 5.2 feet below grade. After five hours, the depth to groundwater was approximately 6 feet below grade. As was the case with the 18-inch storm sewer on the east side of the road, no special bedding material was encountered around this pipe.

The test pits showed that the 18-inch diameter vitrified clay storm sewer pipe located on the east side of the road in the Northeast Quadrant of Siberia Area, and its extension to the south as a 6-inch vitrified clay pipe, are acting as a line sink for groundwater. The construction of these pipes with open joints allows groundwater to infiltrate into the sewers and flow off the site to the Watervliet sewer system. Although there may be a minor component of groundwater flow and solute transport along the fill materials encountered around these pipes, the majority of flow and solute transport is into the sewer pipe.

A groundwater sample obtained from TP-1 on July 21, 1998 (labeled WVA-SA-ST-2) detected the presence of chlorinated organic compounds. Vinyl Chloride (VC) was

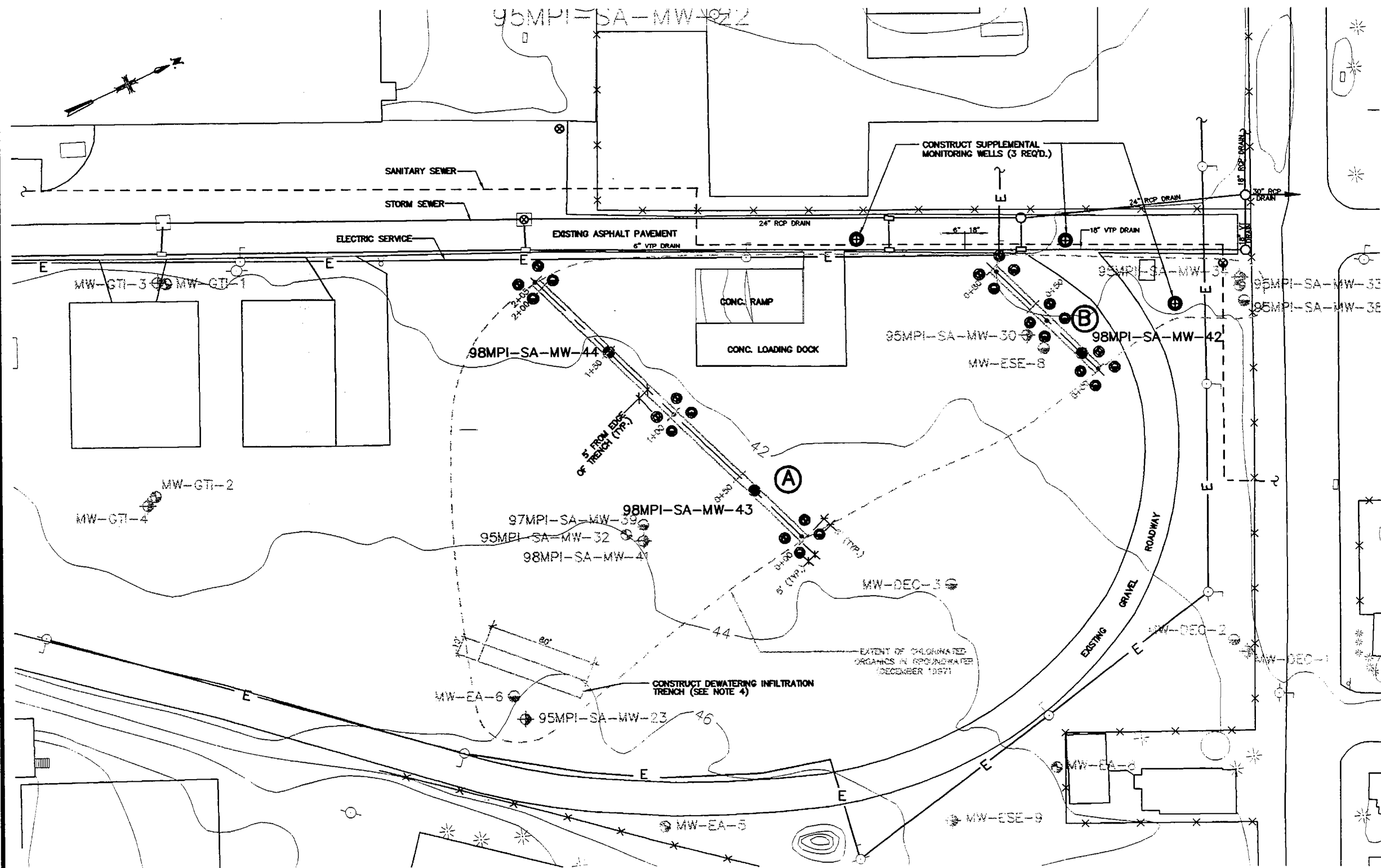
detected at an estimated concentration of 9 ug/l. Total 1, 2-Dichloroethene (DCE) was detected at 15 ug/l. Trichloroethene (TCE) and Perchloroethene (PCE) were detected at estimated concentrations of 2 ug/l and 0.6 ug/l, respectively. Although these concentrations exceed NYSDEC Class GA standards for VC and DCE, they are considered low concentrations.

The water sample from the test pit confirms the presence of the contaminated groundwater plume at the location of the storm sewer, but the observation that the groundwater was entering the pipe through the joints rather than flowing along the outside of the pipe indicates that a polishing wall constructed perpendicular to the sewer would have little or no value in treating the contamination. Historic water quality results from monitoring wells 95MPI-SA-MW-33 (overburden) and 95MPI-SA-MW-38 (weathered bedrock) installed downgradient of manhole #120 on the 18-inch storm sewer and from sampling the water in the storm sewer further substantiate the results of the test pits, which indicate contaminants are migrating into the storm sewer and that the storm sewer effects/controls the migration of the contaminant plume in the Northeast Quadrant of Siberia Area. Previous samples showed low (less than 5 ug/l) concentrations of the chlorinated organic compounds detected in the groundwater plume in both the sewer and the groundwater at the two monitoring wells. On the basis of these facts, it has been decided that the polishing wall will not be constructed as part of this pilot treatment system.

2.2 SELECTION OF ALTERNATIVE 2 FOR IMPLEMENTATION OF PILOT TREATMENT SYSTEM

Based upon comments received from the USEPA and NYSDEC, and in consideration of cost issues and the need to intercept as much of the plume of contaminated groundwater as possible prior to its entrance into the storm sewer along the site access road, Alternative 2 has been selected for implementation of the permeable reaction wall pilot treatment system. The conceptual design configuration shown for Alternative 2 in the April, 1998 Draft Work Plan has been modified slightly to intercept the full width of the plume near its source, as shown on Figure 2-2 included herein. This configuration provides a permeable reaction wall

3705 0285709900 I:\ACAD\PROJ\02857099\709-14 Scale: 1:11 Date: 09/01/1998 Time: 14:06

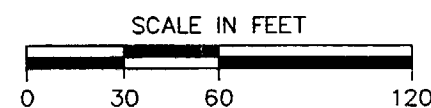


NOTES:

1. CONTRACTOR SHALL EXCAVATE AND STAGE CONTAMINATED SOIL FOR TESTING IN LOCATION SHOWN. CONTRACTOR SHALL STAGE SOILS ON 40 MIL HDPE GEOMEMBRANE. CONTRACTOR SHALL COVER MATERIAL WITH TARPS AND BERM STAGING AREA TO PREVENT RUN-ON INTO STAGED MATERIAL AND MINIMIZE PRECIPITATION ONTO STAGED MATERIAL.
2. CONTRACTOR SHALL INSTALL NEW MONITORING WELLS AND OBSERVATION WELLS AT THE LOCATIONS SHOWN.
3. CONTRACTOR SHALL INSTALL PERMEABLE REACTION WALLS TO THE LIMITS SHOWN.
4. CONTRACTOR SHALL COLLECT, TREAT AND DISPOSE OF GROUNDWATER ENCOUNTERED DURING TRENCH EXCAVATION AND PERMEABLE REACTION WALL INSTALLATION IN ACCORDANCE WITH SPECIFICATIONS.
5. CONTRACTOR SHALL CONSTRUCT DEWATERING INFILTRATION TRENCH AT LEAST 10' WIDE AT THE TOP AND 60' LONG. TRENCH DEPTH SHALL EXTEND TO TOP OF WEATHERED BEDROCK SURFACE. UPON COMPLETION OF DEWATERING WORK, BACKFILL TRENCH WITH EXCAVATED MATERIAL AND PLACE 2" MIN. CRUSHED STONE LAYER OVER AREA.

LEGEND

- BORING/MONITORING WELL LOCATIONS IN TRENCH
- EXISTING OVERBURDEN MONITORING WELL LOCATIONS
- EXISTING WEATHERED BEDROCK MONITORING WELL LOCATIONS
- EXISTING BEDROCK MONITORING WELL LOCATIONS
- PROPOSED NEW OVERBURDEN MONITORING WELL
- PROPOSED NEW WEATHERED BEDROCK MONITORING WELL
- PROPOSED NEW OBSERVATION WELL IN REACTIVE WALL
- PROPOSED SUPPLEMENTAL MONITORING WELL
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING ELECTRICAL CABLE
- EXISTING FENCE
- EXISTING TOPOGRAPHIC CONTOUR



PERMEABLE REACTION WALL - PILOT SYSTEM CONSTRUCTION
SOIL BORINGS AND
MONITORING WELLS
WATERVLIET ARSENAL
USACE CONTRACT NO. DACA31-94-D-0017



US Army Corps
of Engineers

MALCOLM PIRNIE, INC.

FIGURE 2-2

which is oriented nearly perpendicular to the flow path of the contaminated groundwater and provides for the treatment of as much of the contaminated water on the site as reasonably possible given the presence of buried utilities and aboveground structures which would be very expensive to relocate.

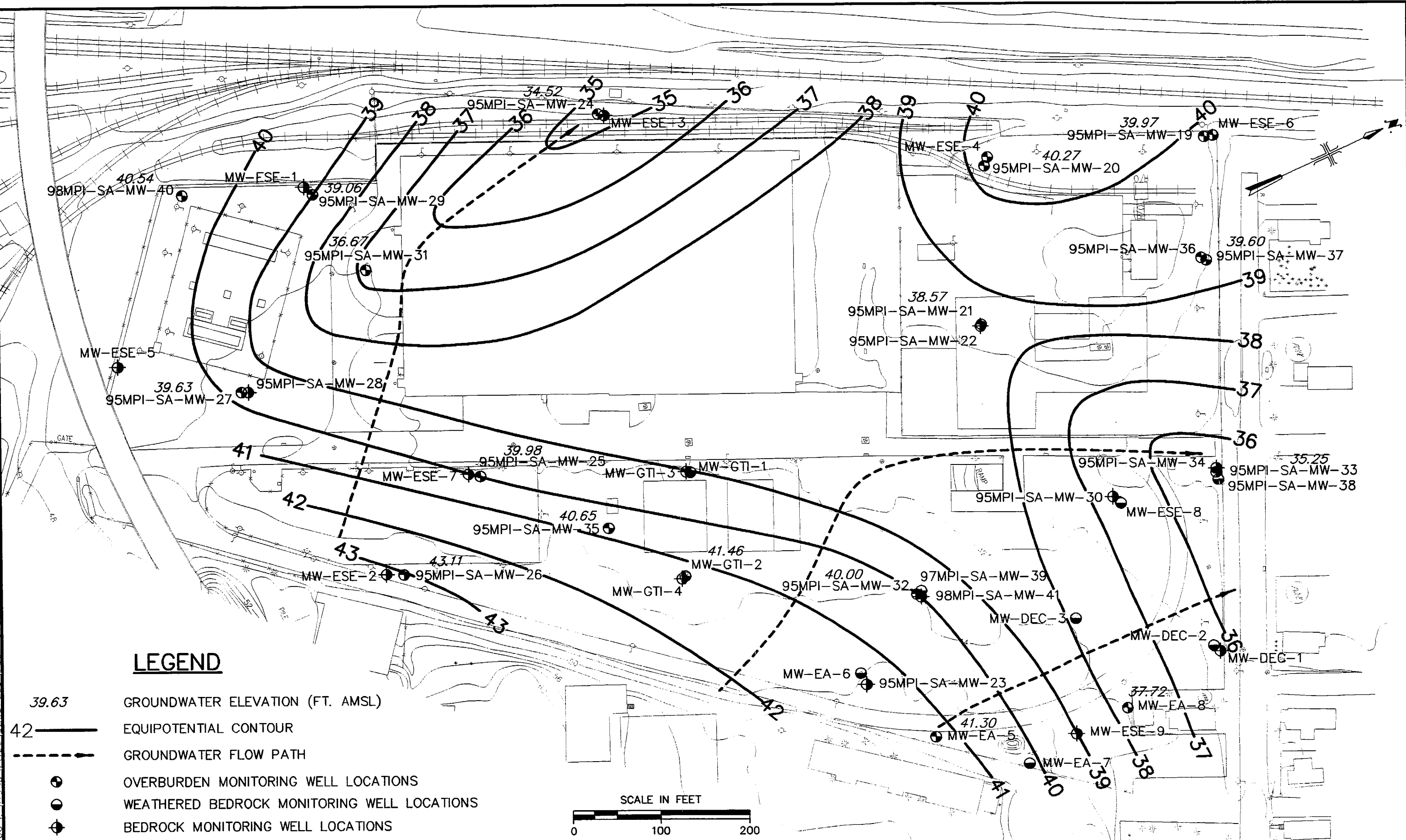
2.3 CONFIRMATION OF BEDROCK AND GROUNDWATER ELEVATIONS

Three soil borings were made along the proposed alignment of the reactive wall to confirm the depth to bedrock and provide additional information on the soils to be excavated in constructing the trench. Two borings were installed along the longer segment of the wall (Segment A) and one along the shorter segment (Segment B.) as shown on Figure 2-2. All three of these borings were converted to temporary monitoring wells to facilitate the collection of groundwater samples and to determine the groundwater elevation in the immediately vicinity of the wall. Soil boring and well construction logs are included in Appendix A.

One round of groundwater samples was collected from the wells along the proposed wall alignment and one round of groundwater elevations was taken from all wells in the area on June 22, 1998. The analytical results are presented in Table 2-1 and indicate that the concentrations of VOCs at the wall will be within parameters used for bench scale testing of the reactive wall technology as described in the April, 1998 Draft Work Plan. An overburden potentiometric contour map prepared from the water level data is shown in Figure 2-3 and indicates that the groundwater collection trench constructed in the northeast corner of the site near the Perfection Plating Company property line has not significantly affected the groundwater flow direction near the proposed reactive walls. However, the pumping of the recovery trench constructed in the northeast corner of the site could not be verified and therefore the groundwater contours may be indicative of a non-pumping scenario.

Historic water level information was used to estimate the maximum water table elevation as shown in Table 2-2. The granular iron reactive material will be installed in the reactive wall to an elevation 6 inches higher than the maximum groundwater elevations recorded on the site in the vicinity of the wall.

3705 028570990 1\ACAD\PROJ\02857099\709-13 Scale: 1:100 Date: 09/01/1998 Time: 12:42



US Army Corps
of Engineers

SIBERIA AREA
OVERBURDEN POTENTIOMETRIC CONTOUR MAP 6/22/98
WATERVLIET ARSENAL
USACE CONTRACT NO. DACA31-94-D-0017

COPYRIGHT © 1998
MALCOLM PIRNIE, INC.

FIGURE 2-3

TABLE 2-1
Water Quality Sampling Results
Monitoring Wells Along Proposed Reactive Wall Alignment

Site Location Matrix Units	WVA-SA-MW42 Aqueous ug/L 8/17/98	WVA-SA-MW43 Aqueous ug/L 8/17/98	WVA-SA-MW44 Aqueous ug/L 8/17/98	WVA-SA-MW44A Duplicate of MW44 ug/L 8/17/98
Date Sampled				
Benzene	ND	7	ND	ND
trans-1,2-Dichloroethene	ND	ND	3 J	3 J
Methylene Chloride	ND	ND	7 J	7 J
Toluene	ND	0.3 J	ND	ND
Trichloroethene	ND	0.4 J	26 J	30 J
Vinyl Chloride	42	4	290	350

Notes:

- 1.) J = Estimated concentration
- 2.) ND = Non-detect

TABLE 2-2
Historic Water Levels in Overburden and Weathered Rock

Well ID	Well Type	Approximate Bedrock Elevation	Minimum GW Elevation	Maximum GW Elevation	Mean GW Elevation	Minimum Saturated Thickness (ft)	Maximum Saturated Thickness (ft)	Mean Saturated Thickness (ft)
MW-ESE-8	Weathered Rock	32.89	34.32	35.82	35.39	1.43	2.93	2.5
MW-DEC-2	Weathered Rock	30.4	35.65	37.8	36.3	5.25	7.4	5.9
MW-EA-8	Overburden	32.72	36.78	37.95	37.62	4.06	5.23	4.9
MW-EA-7	Weathered Rock	38.7	40.17	41.41	41.03	1.47	2.71	2.33
MW-EA-6	Weathered Rock	37.54	39.84	41.7	40.87	2.3	4.16	3.33
MW-EA-5	Overburden	39.69	40.53	41.74	41.35	0.84	2.05	1.66
95MPI-SA-MW-32	Overburden	37	38.04	40.28	39.49	1.04	3.28	2.49
95MPI-SA-MW-33	Overburden	32.07	33.64	36.03	35.18	1.57	3.96	3.11
95MPI-SA-MW-38	Weathered Rock	32.07	32.84	33.07	33.06	0.77	1	0.99

Note: Elevations are ft amsl

2.4 GROUNDWATER MONITORING SYSTEM

To address concerns raised by the USEPA and NYSDEC staff who reviewed the April, 1998 Draft Work Plan, three additional wells will be installed downgradient from the permeable reaction wall. Two of these wells will be installed in the roadway on the west side of the 18-inch diameter storm drain to detect any contamination which might cross under that pipe. The third well will be constructed downgradient from the northeast end of the shorter segment of the reaction wall to detect any contamination which might pass around the end of this segment of the wall. The locations of these proposed wells is shown in Figure 2-2. Low flow purging will be used during sampling of these wells.

2.5 ANTICIPATED IRON LIFE IN PERMEABLE REACTIVE BARRIER

To address concerns about the probable useful life of the iron in the proposed reactive wall, Environmental Technologies, Inc. performed some calculations of reaction rates between the iron and VOCs in the groundwater, iron and water, and iron and dissolved oxygen. A memo describing the results of these calculations is included in Appendix B. The calculations indicate that the useful life of the granular iron to be installed at this site will be at least several decades.

2.6 DEWATERING DURING CONSTRUCTION

The April, 1998 Draft Work Plan proposed that water from dewatering operations be collected in a frac tank and then passed through granular activated carbon pressure filters and discharged to the sanitary sewer. The frac tank would be equipped with a skimmer to remove any floating oils and would serve as a settling basin to remove some settleable solids in the water. The Arsenal requested that consideration be given to discharging the water, untreated, back to the groundwater up gradient from the reactive wall trench construction.

The NYSDEC and USEPA reviewed this request and agreed that such a discharge would be permissible as long as it meets the conditions outlined below:

- The area to which the discharge will be directed is contained, either by a physical barrier or a hydraulic gradient, such that the discharged water goes through the permeable reaction wall system;
- There is no net increase in the concentration of any chemical pollutant in the collected water prior to discharge;
- The groundwater is monitored sufficiently, both within and outside of the contained area, to ensure that there is no further degradation of groundwater quality as a result of the discharge; and
- The Arsenal shall submit a proposed design of the groundwater discharge system including procedures, location(s) and rates of discharge and procedures for sampling the water prior to discharge.

To take advantage of the possible cost savings offered by discharging water from dewatering operations to the groundwater, the Draft Final Work Plan proposes that a trench approximately 60-feet long and 10-feet wide be excavated to the top of weathered bedrock up gradient from the reaction wall as shown on Figure 3-1. Water from the dewatering operation will be pumped into a 18,000 to 20,000 gallon frac tank, located adjacent to the trench, to permit some settling of suspended solids and the removal of any floating petroleum products encountered during dewatering. The overflow from the frac tank will be sampled once per day and analyzed for VOCs in accordance with SW 8260. Water meeting effluent standards will be discharged to the trench, and the depth of water in the trench will be monitored visually. Dewatering is anticipated to require pumping at increasing rates as the permeable reaction wall is constructed. Initially, the pumping rate is anticipated to be very low, less than 10 gallons per minute. However, as the permeable reaction wall is extended, it will begin to act as a groundwater collection trench and the pumping rate will increase substantially. It is anticipated that the discharge trench will work until at least one half of the southern portion of the reaction wall is completed and may function until the entire wall is built if construction proceeds at a fast enough pace. However, if the discharge trench fills with water or any of the conditions imposed by the USEPA and NYSDEC on water quality

cannot be met, the contractor will be directed to furnish temporary, granular activated carbon filters to treat the water and the discharge will be redirected to the storm sewer along the access road. Additional details on the carbon treatment system and sampling are provided in Appendix C.

3.0 FINAL LAYOUT FOR PERMEABLE REACTION WALL PILOT TREATMENT SYSTEM

3.1 REACTION WALL DESIGN

The proposed configuration and location of the permeable reaction wall pilot treatment system is shown in Figure 3-1 in the pocket at the back of this report. A profile along the proposed system is shown in Figure 3-2. This location is essentially the same as shown in the conceptual design for Alternative 2 in the April, 1998, Draft Work Plan, except that the length of Segment A of the wall has been extended from 190 linear feet to 205 linear feet to intercept the full width of the plume of contaminated groundwater and Segment B of the wall has been moved along its original alignment about 5 feet to the west. The depths of the two segments of the reaction wall have been adjusted slightly based on the addition bedrock elevation data obtained from the borings installed along the wall alignments. The width of the trench remains the same as in the conceptual design presented in the April, 1998 Draft Work Plan. However, the amount of iron in the trench has been increased slightly to provide a minimum of one volume of granular iron to three volumes of concrete sand.

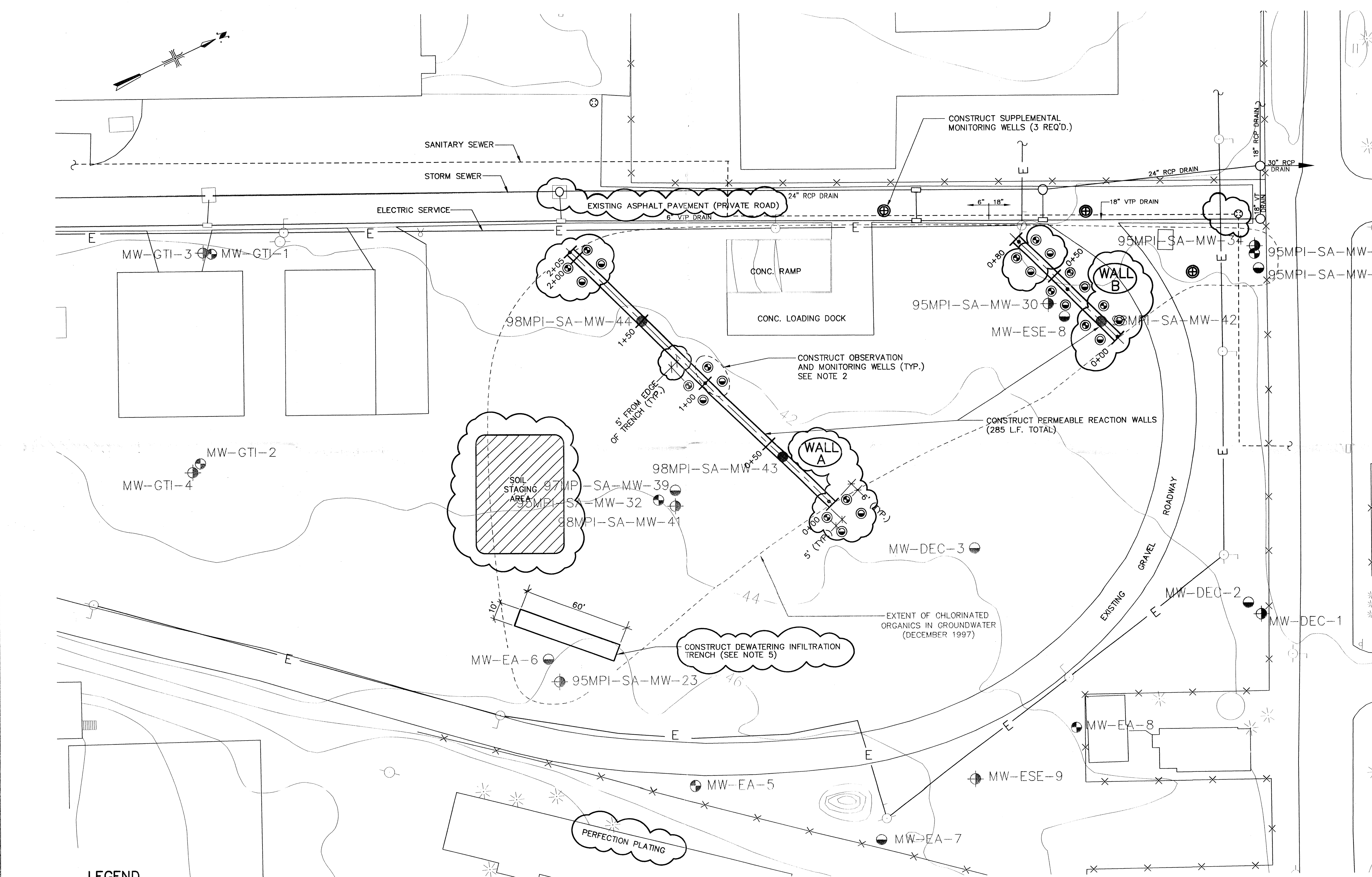
3.2 REVISED COST ESTIMATE

A revised opinion of probable construction cost has been prepared for the final wall configuration. The probable construction cost is now estimated at approximately \$400,000 as shown in Table 3-1.

3.3 PROPOSED SCHEDULE

Draft construction contract drawings and specifications are attached as Appendix C. These documents have been prepared to obtain bids for the work from local contractors. As soon as these documents are approved by the NYSDEC and USEPA they will be finalized,

4871 0285709100 1:1 Date: 09/15/1998 Time: 09:44 Scale: 1:1 Date: 09/15/1998 Time: 09:44 Scale: 1:1 Date: 09/15/1998 Time: 09:44 Scale: 1:1

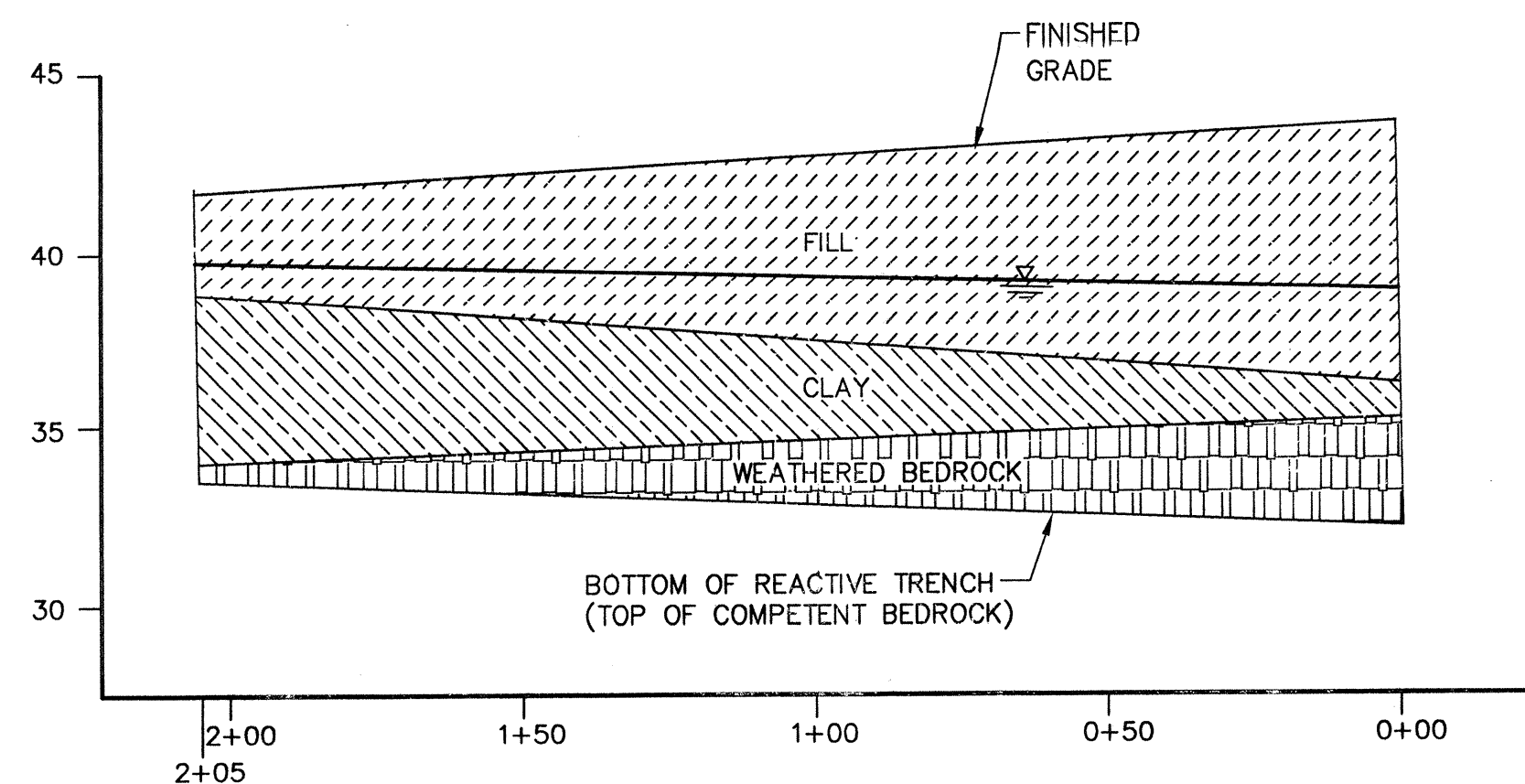


- NOTES:**
1. CONTRACTOR SHALL EXCAVATE AND STAGE CONTAMINATED SOIL FOR TESTING IN LOCATION SHOWN. CONTRACTOR SHALL STAGE SOILS ON 40 MIL HDPE GEOMEMBRANE. CONTRACTOR SHALL COVER MATERIAL WITH TARPS AND BERM STAGING AREA TO PREVENT RUN-ON INTO STAGED MATERIAL AND MINIMIZE PRECIPITATION ONTO STAGED MATERIAL.
 2. CONTRACTOR SHALL INSTALL NEW MONITORING WELLS AND OBSERVATION WELLS AT THE LOCATIONS SHOWN.
 3. CONTRACTOR SHALL INSTALL PERMEABLE REACTION WALLS TO THE LIMITS SHOWN.
 4. CONTRACTOR SHALL COLLECT, TREAT AND DISPOSE OF GROUNDWATER ENCOUNTERED DURING TRENCH EXCAVATION AND PERMEABLE REACTION WALL INSTALLATION IN ACCORDANCE WITH SPECIFICATIONS.
 5. CONTRACTOR SHALL CONSTRUCT DEWATERING INFILTRATION TRENCH AT LEAST 10' WIDE AT THE TOP AND 60' LONG. TRENCH DEPTH SHALL EXTEND TO TOP OF WEATHERED BEDROCK SURFACE. UPON COMPLETION OF DEWATERING WORK, BACKFILL TRENCH WITH EXCAVATED MATERIAL AND PLACE 2" MIN. CRUSHED STONE LAYER OVER AREA.

- LEGEND**
- BORING/MONITORING WELL LOCATIONS IN TRENCH
 - EXISTING OVERBURDEN MONITORING WELL LOCATIONS
 - ⊙ EXISTING WEATHERED BEDROCK MONITORING WELL LOCATIONS
 - ⊙ EXISTING BEDROCK MONITORING WELL LOCATIONS
 - ⊙ PROPOSED NEW OVERBURDEN MONITORING WELL
 - ⊙ PROPOSED NEW WEATHERED BEDROCK MONITORING WELL
 - ⊙ PROPOSED NEW OBSERVATION WELL IN REACTIVE WALL
 - ⊙ PROPOSED SUPPLEMENTAL MONITORING WELL
 - EXISTING STORM SEWER
 - EXISTING SANITARY SEWER
 - E- EXISTING BURIED ELECTRICAL CABLE
 - X- EXISTING FENCE
 - 44- EXISTING TOPOGRAPHIC CONTOUR

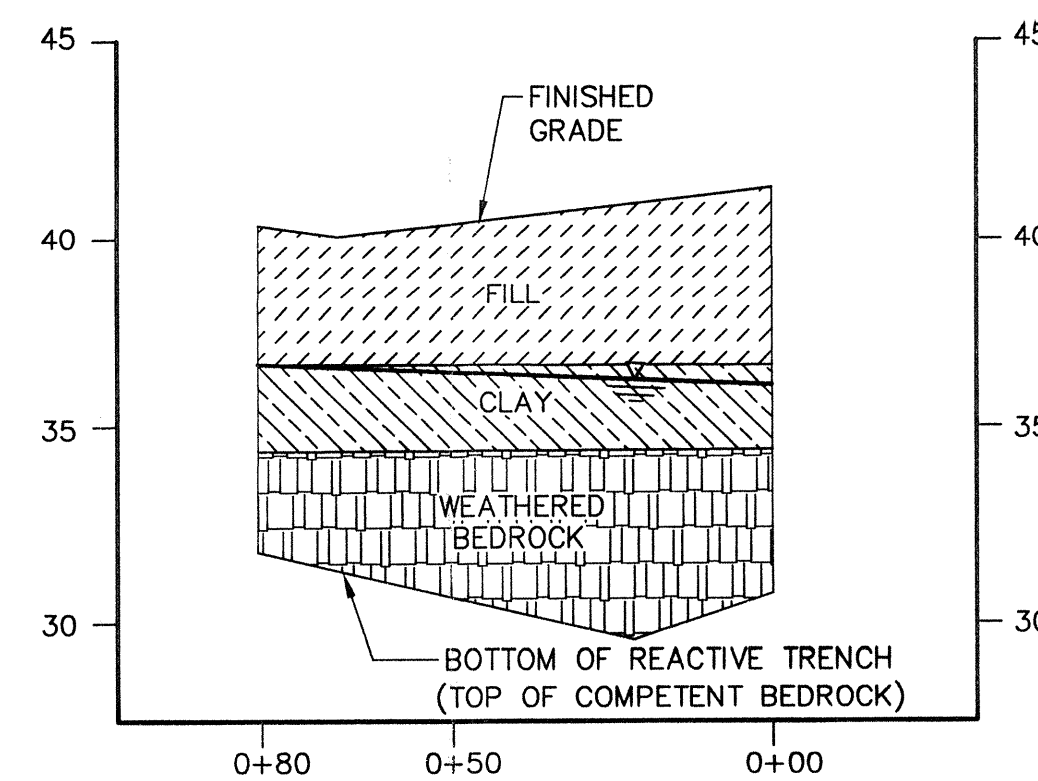
FIGURE 3-1

 US Army Corps of Engineers		REVISIONS		DES TAM	DWN JJN	CKD JBM	WATERVLIET ARSENAL PERMEABLE REACTION WALL PILOT SYSTEM CONSTRUCTION	SITE PLAN	SCALE IN FEET 0 15 30 60	MALCOLM PIRNIE, INC.	
		NO.	BY							DATE	REMARKS
		1	TAM	9/14/98	USACE COMMENTS - REVISION						SHEET 1 OF 2
											DWG. NO. 709-08R1



EXISTING CONDITIONS
TRENCH A

SCALE: HORZ. 1"=30'
VERT. 1"=5'

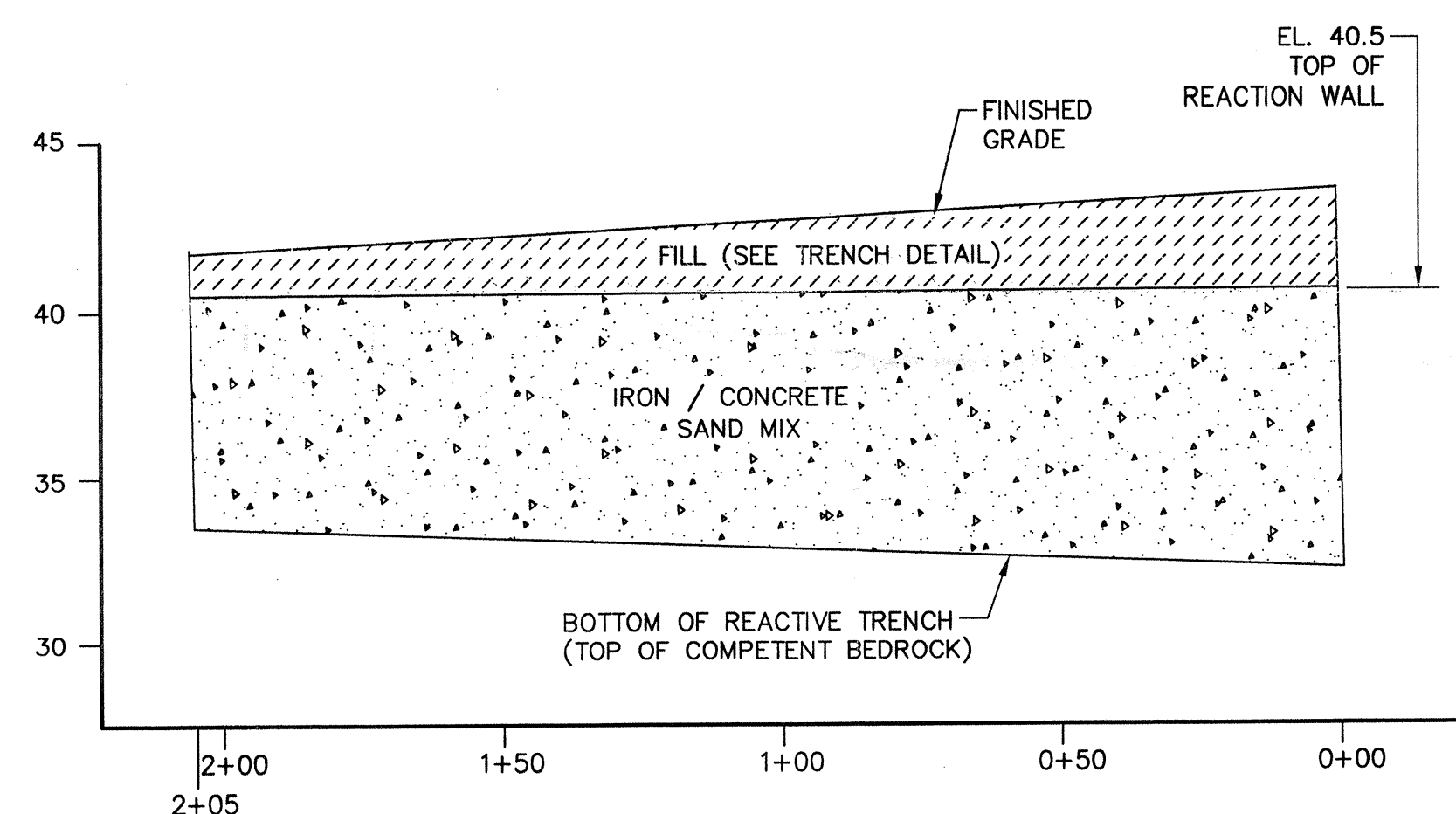


EXISTING CONDITIONS
TRENCH B

SCALE: HORZ. 1"=30'
VERT. 1"=5'

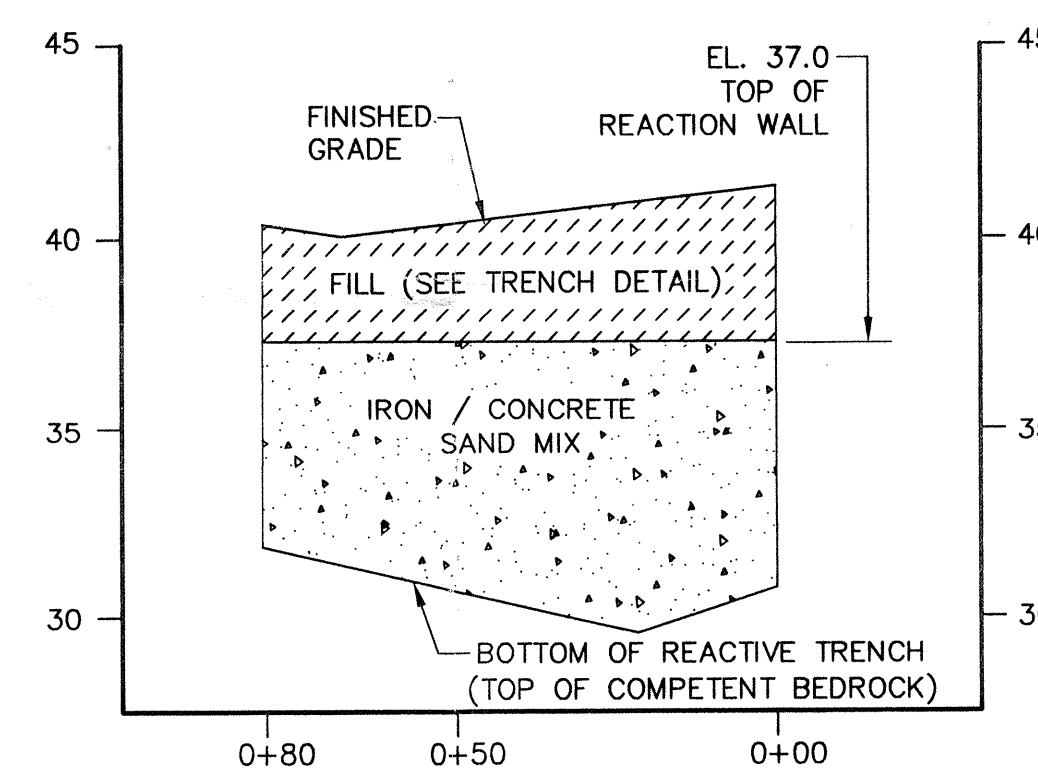
NOTE:

WATER ELEVATIONS ARE HIGHEST RECORDED
A 2-3 FT. VARIATION IN GROUNDWATER
ELEVATION DUE TO SEASONAL FLUCTUATION
IS EXPECTED.



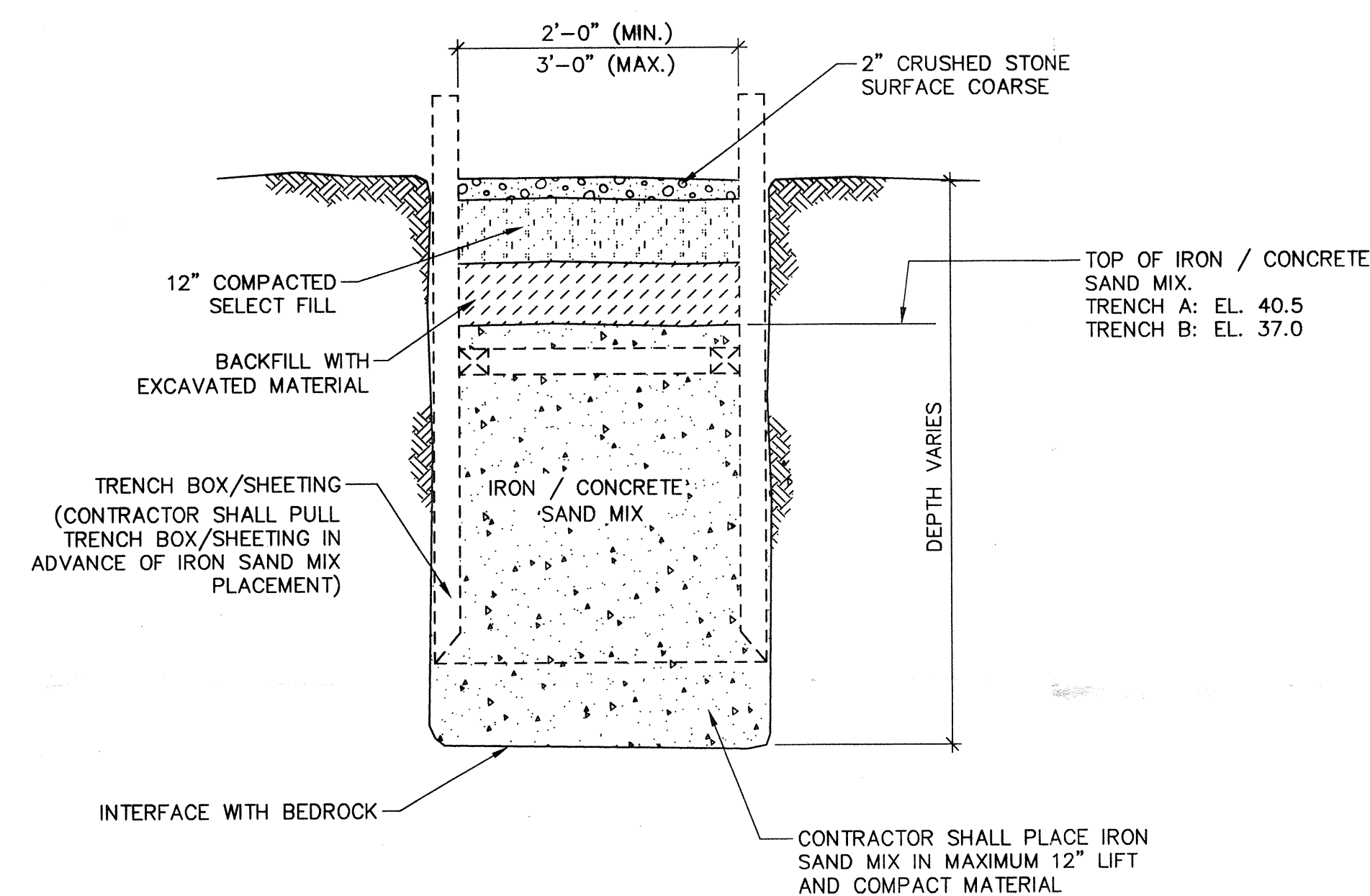
PERMEABLE REACTION WALL
TRENCH A

SCALE: HORZ. 1"=30'
VERT. 1"=5'

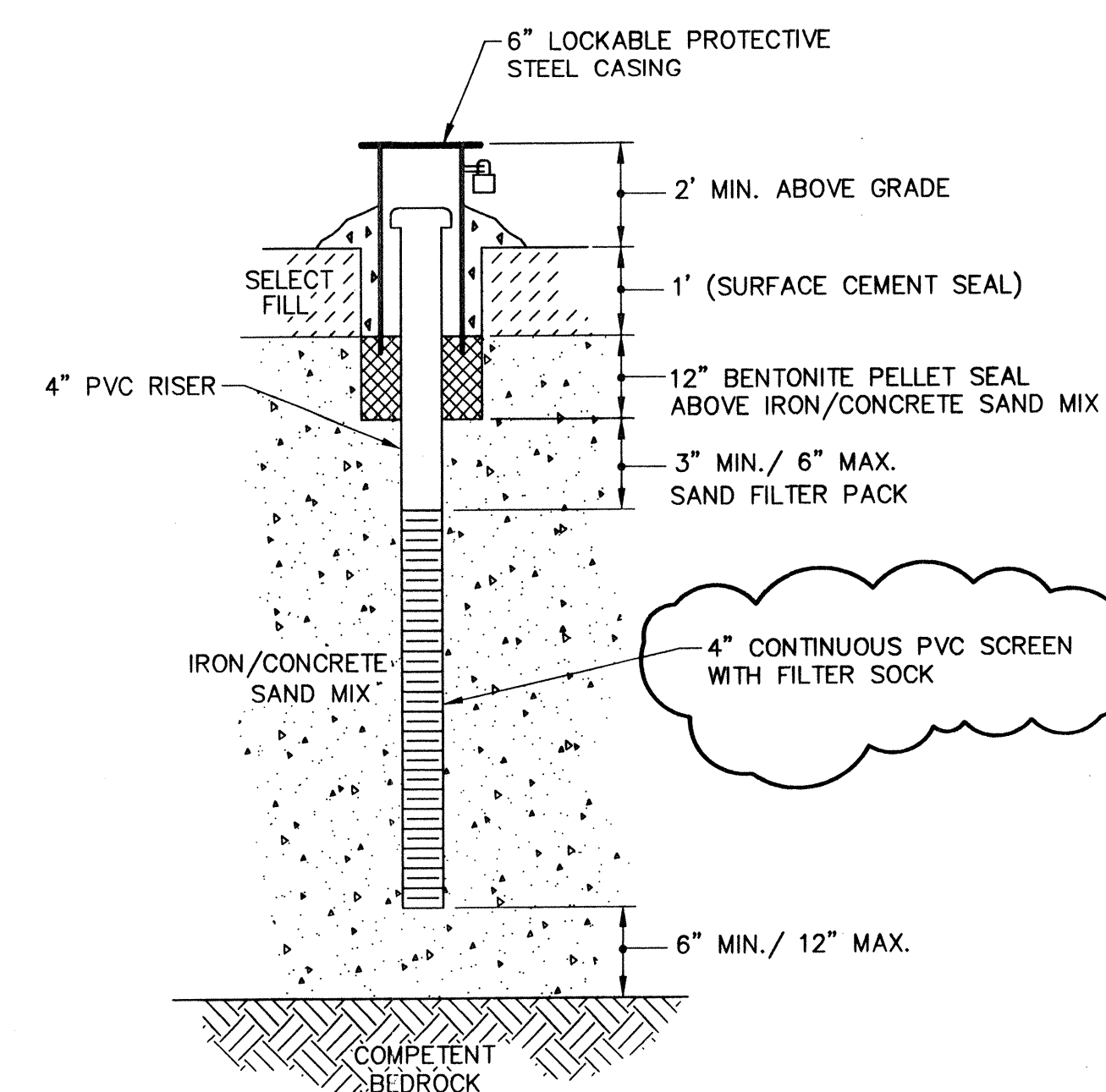


PERMEABLE REACTION WALL
TRENCH B

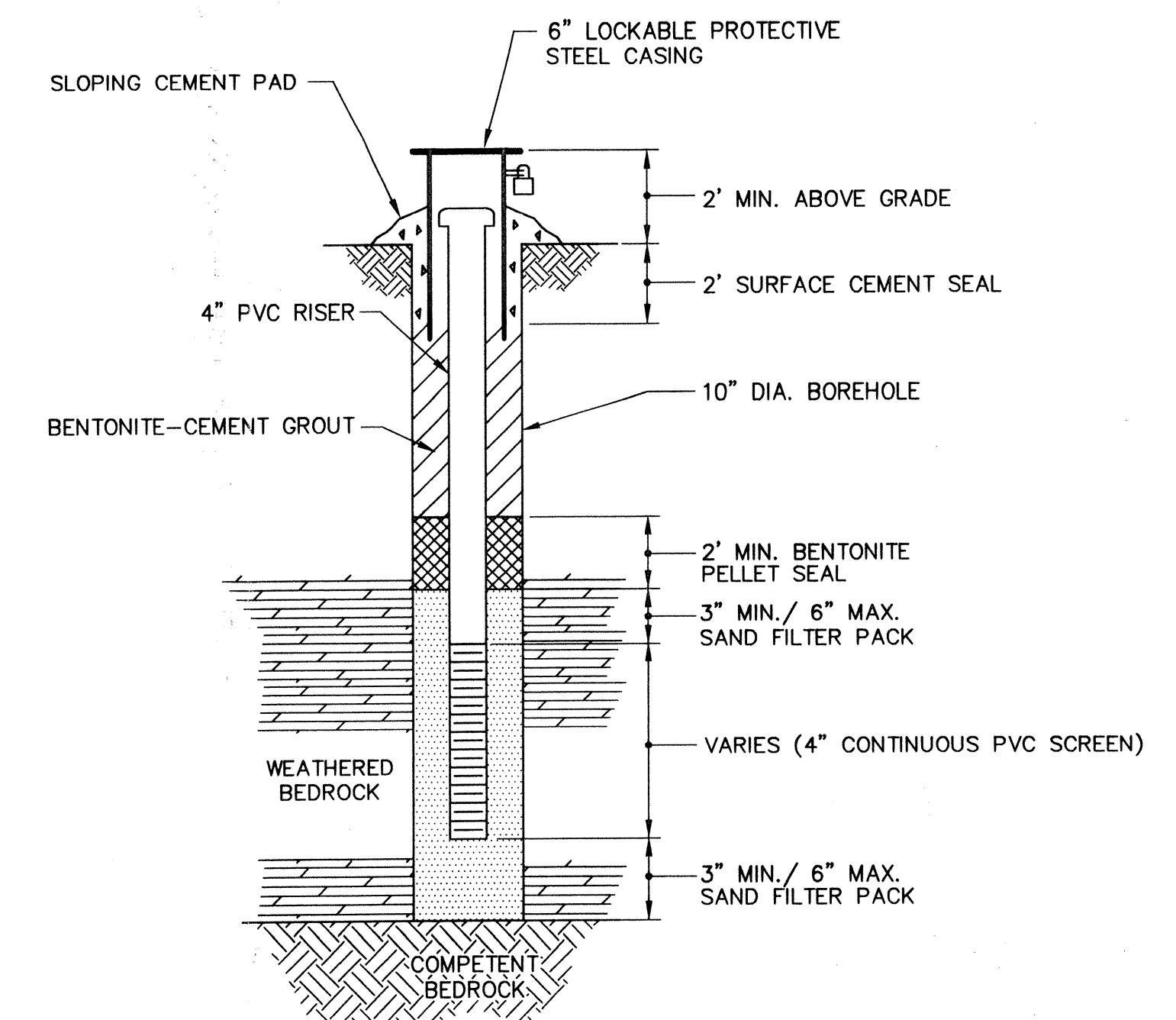
SCALE: HORZ. 1"=30'
VERT. 1"=5'



TRENCH DETAIL
NOT TO SCALE



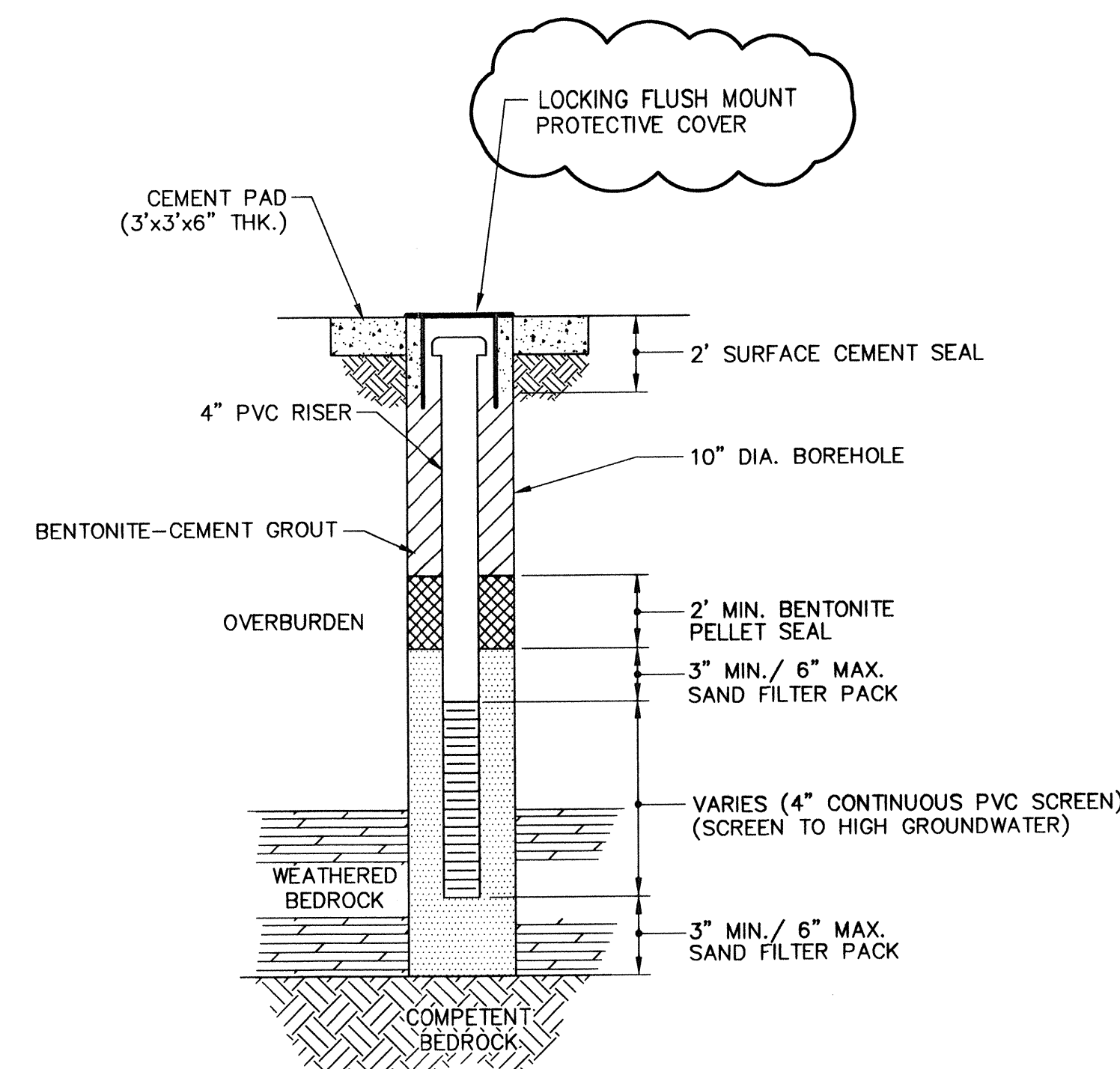
IN-TRENCH
OBSERVATION WELL DETAIL
NOT TO SCALE



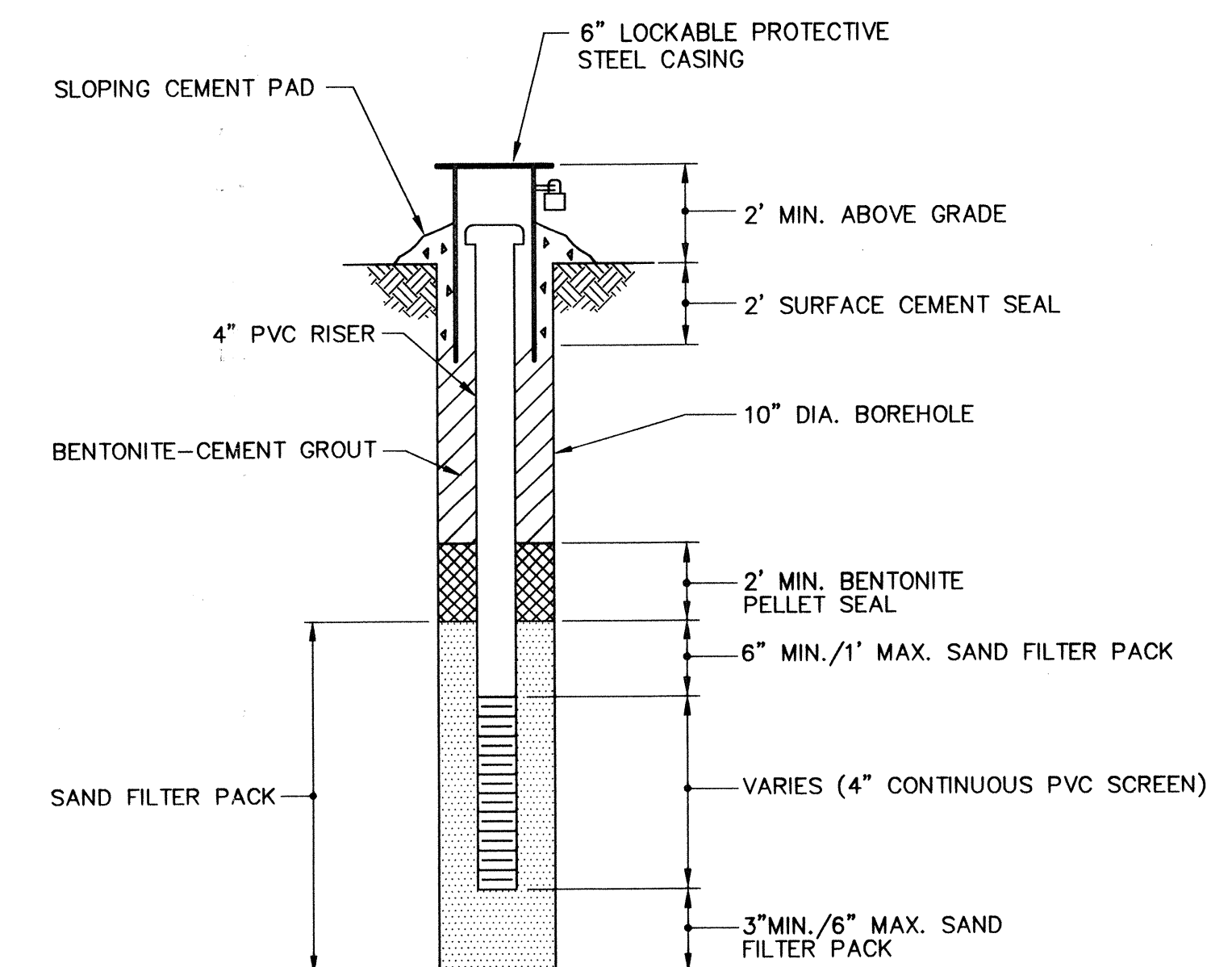
TYPICAL WEATHERED BEDROCK
MONITORING WELL DETAIL
NOT TO SCALE

NOTE:

IN-TRENCH OBSERVATION WELLS SHALL BE
INSTALLED IN CONJUNCTION WITH THE
INSTALLATION OF THE IRON/CONCRETE SAND.
ALL OTHER WELLS SHALL BE INSTALLED USING
HOLLOW STEM AUGER OR OTHER APPROVED
DRILLING METHODS.

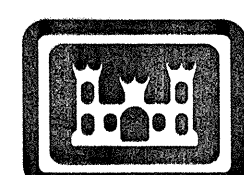


TYPICAL SUPPLEMENTAL
MONITORING WELL DETAIL
NOT TO SCALE



TYPICAL OVERBURDEN
MONITORING WELL DETAIL
NOT TO SCALE

FIGURE 3-2



US Army Corps
of Engineers

MALCOLM
PIRNIE

REVISIONS				
NO.	BY	DATE	USACE COMMENTS - REVISION	REMARKS
1	TAM	9/14/98		

DES TAM
DWN JJN
OKD JBM

WATERVIET ARSENAL
PERMEABLE REACTION WALL CONSTRUCTION
PILOT SYSTEM CONSTRUCTION

DETAILS

SCALE: AS SHOWN

MALCOLM PIRNIE, INC.

DATE AUGUST 1998

SHEET 2 OF 2

DWG. NO. 709-09R1

TABLE 3-1
WATERVLIET ARSENAL
SIBERIA AREA - ALTERNATIVE 2
DRAFT FINAL WORK PLAN
REACTIVE TRENCH CONSTRUCTION
OPINION OF PROBABLE CONSTRUCTION COST

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
GENERAL CONDITIONS/MOBILIZATION	1	LS	\$20,000.00	\$20,000
TRENCH EXCAVATION				
Trench - 48-inch wide	422	CY	\$18.50	\$7,800
BACKFILL OF TRENCH				
Iron Filings - Furnish	240	TON	\$450.00	\$108,000
Concrete Sand - Furnish	430	TON	\$10.00	\$4,300
Mix Sand Materials	670	TON	\$3.30	\$2,200
Install Material	670	TON	\$5.00	\$3,400
SELECT BACKFILL TO GRADE				
Select Fill - Furnish & Install	45	CY	\$15.00	\$700
General Backfill of Excavated Material	40	CY	\$8.00	\$300
DISPOSE OF EXCESS SPOILS				
Load & Truck to Local Landfill	710	TON	\$10.00	\$7,100
Assume Disposal at Local Permitted Landfill	710	TON	\$55.00	\$39,100
DEWATERING & WATER TREATMENT	1	LS	\$10,000.00	\$10,000
MONITORING WELLS				
Trench Observation Well	6	EA	\$1,000.00	\$6,000
Overburden Well	12	EA	\$1,200.00	\$14,400
Weathered Bedrock Well	12	EA	\$1,500.00	\$18,000
Supplemental Monitoring Well	3	EA	\$1,500.00	\$4,500
SITE RESTORATION	1	LS	\$10,000.00	\$10,000
SUBTOTAL				\$255,800
20% OH&PROFIT				\$51,200
SUBTOTAL				\$307,000
20% CONTINGENCY				\$61,400
SUBTOTAL				\$368,400
REACTIVE WALL SITE LICENSING FEE				\$31,600
TOTAL				\$400,000

Note:
 Site licensing fee is 15% of construction cost exclusive of disposal of soil,
 monitoring wells and site restoration.

bids will be obtained, and a budget will be prepared for installation of the system. It is currently anticipated that the construction work will begin in the latter half of October and be completed by the end of November, 1998.

APPENDIX A

Soil Boring and Well Construction Logs

PROJECT REACTIVE WALL DESIGN START DATE 8/12/98 END DATE 8/12/98

PROJECT NO. 0285709 FIELD GEOLOGIST N. FOLEY

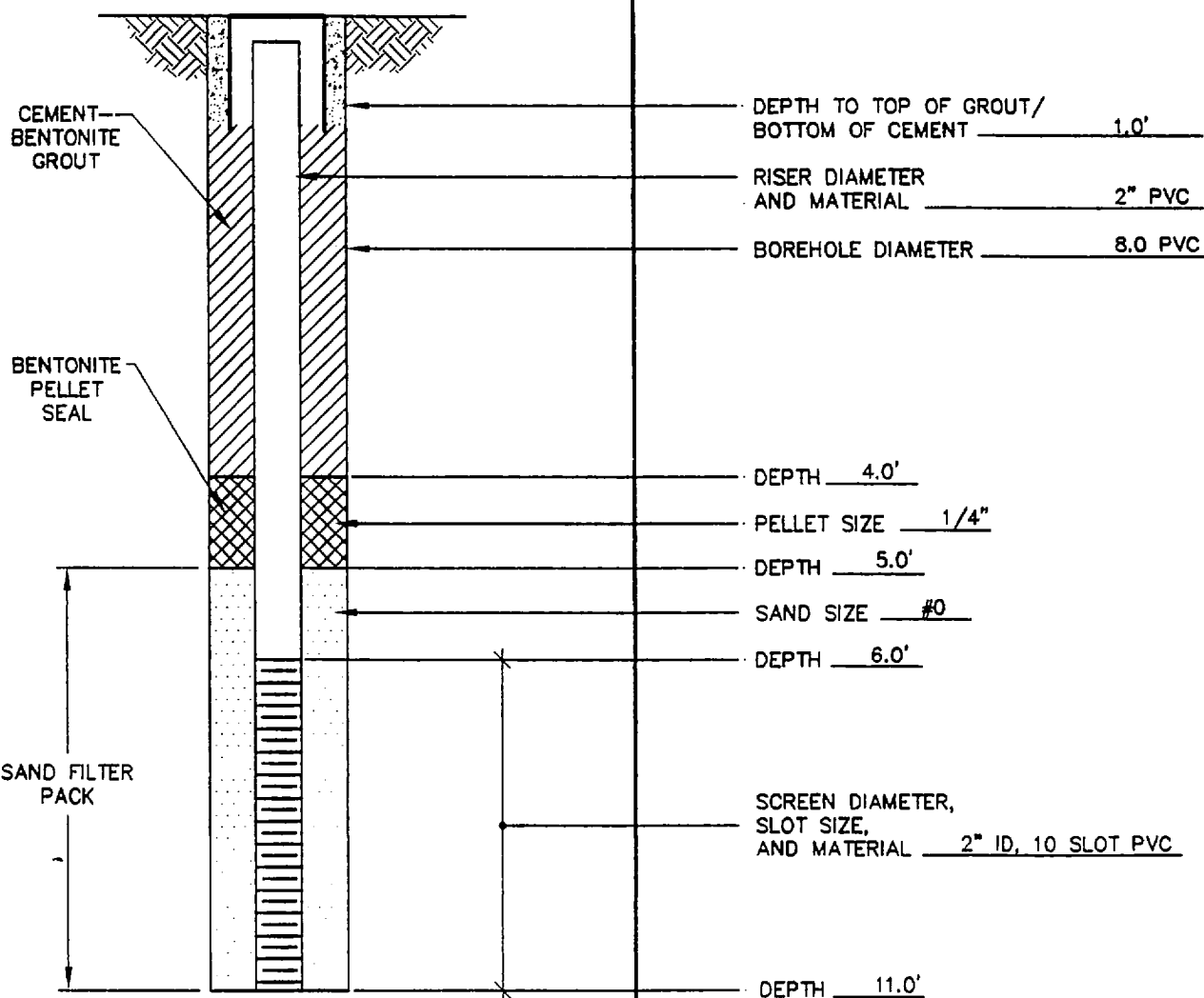
LOCATION WATERVLIET ARSENAL, WATERVLIET, NEW YORK

DRILLING CO. SJB

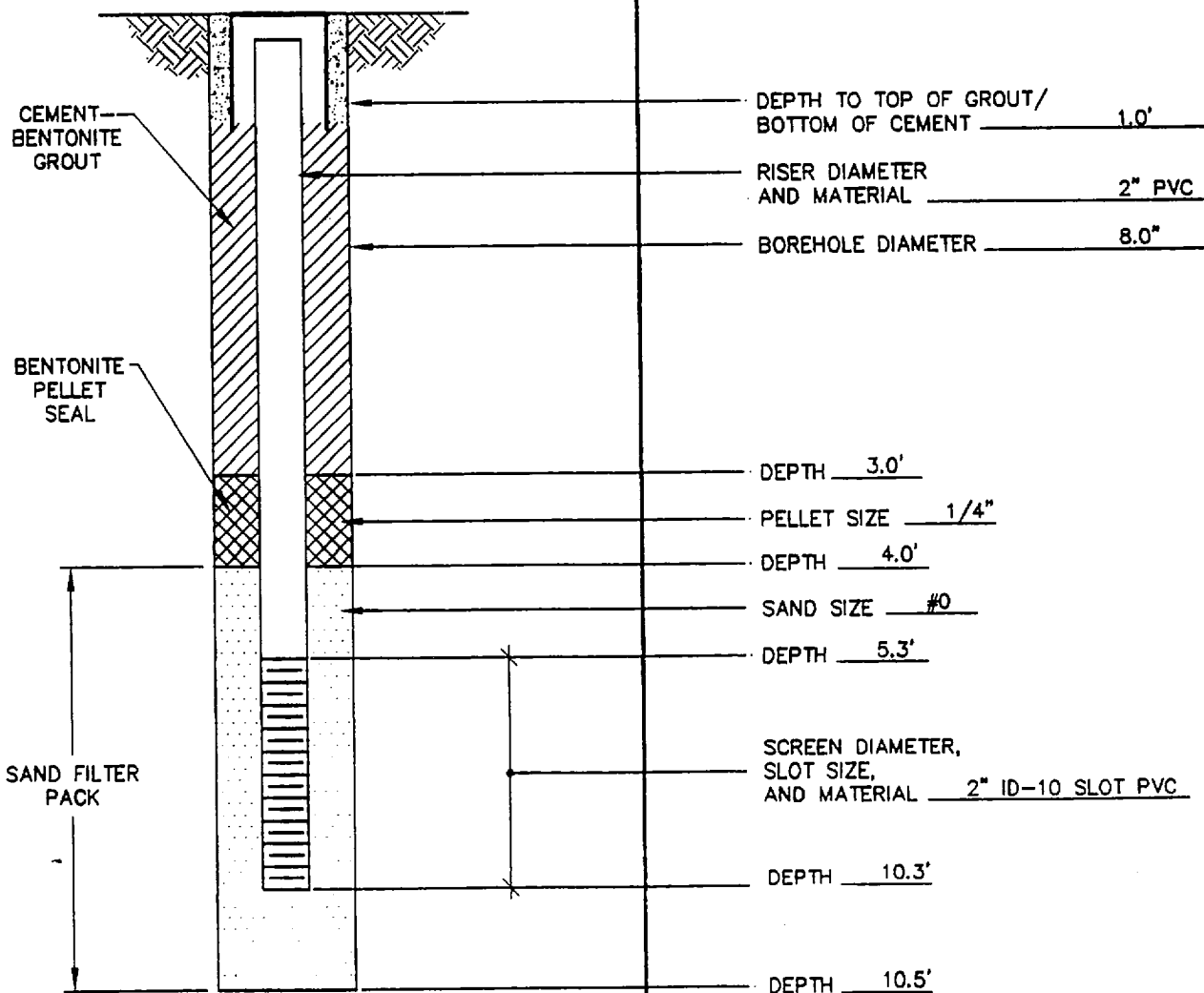
DRILLER(S) T. FARRELL

DRILLING METHOD(S) 4 1/4 HSA, 2" SS

DEVELOPMENT METHOD(S) BAILER



NOTE: DEPTHS ARE FEET BELOW GRADE

PROJECT REACTIVE WALL DESIGN START DATE 8/12/98 END DATE 8/12/98PROJECT NO. 0285709 FIELD GEOLOGIST N. FOLEYLOCATION WATERVLIET ARSENAL, WATERVLIET, NEW YORKDRILLING CO. SJBDRILLER(S) T. FARRELLDRILLING METHOD(S) 4 1/4 HSA, 2" SSDEVELOPMENT METHOD(S) BAILER

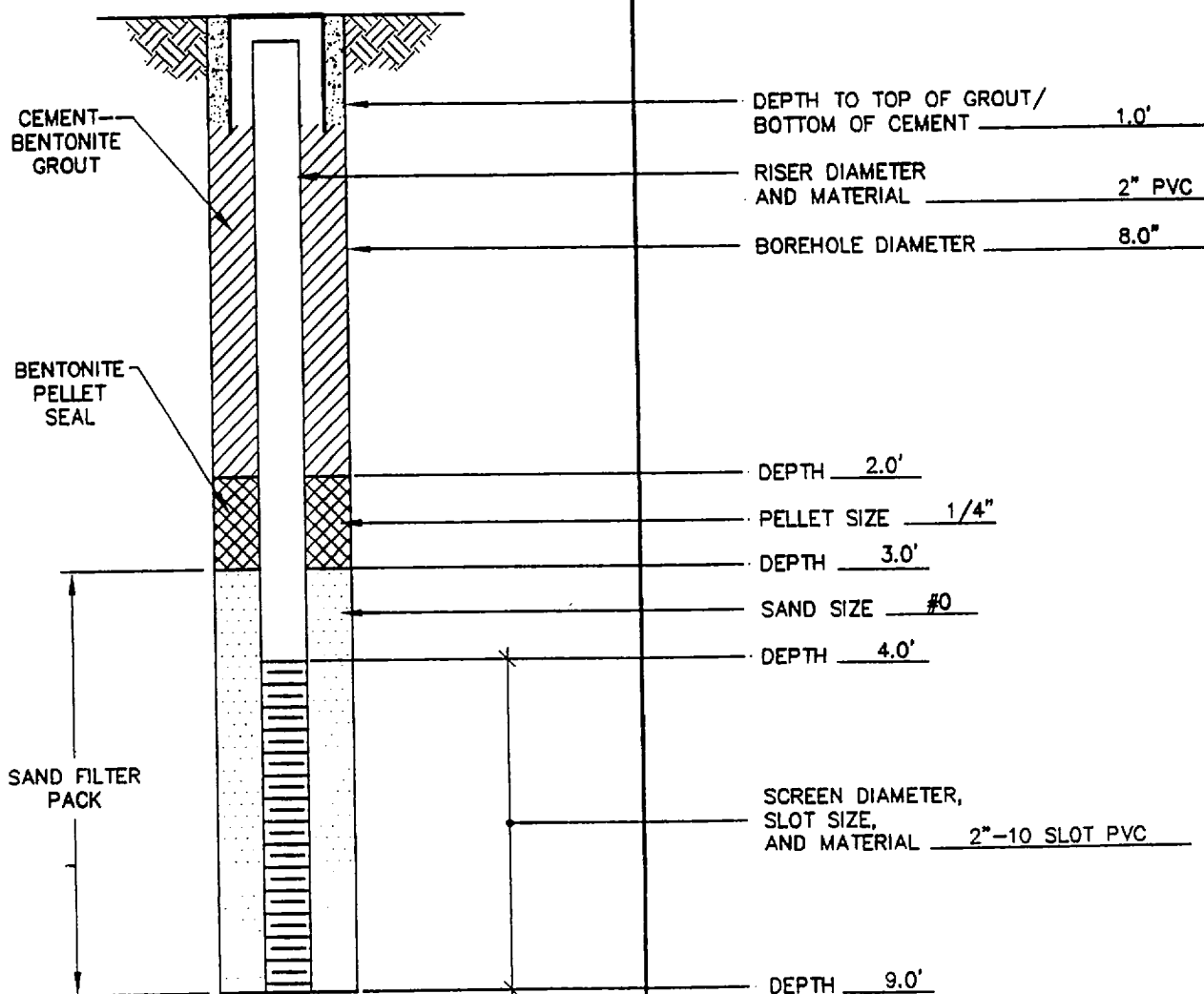
NOTE: DEPTHS ARE FEET BELOW GRADE

HYBRID MONITORING WELL SHEET

WELL NO. 98MPI-SA-MW-44

PROJECT REACTIVE WALL DESIGN START DATE 8/12/98 END DATE 8/12/98
 PROJECT NO. 0285709 FIELD GEOLOGIST N. FOLEY
 LOCATION WATERVLIET ARSENAL, WATERVLIET, NEW YORK

DRILLING CO. SJB
 DRILLER(S) T. FARRELL
 DRILLING METHOD(S) 4 1/4 HSA, 2" SS
 DEVELOPMENT METHOD(S) BAILER



NOTE: DEPTHS ARE FEET BELOW GRADE

HTW DRILLING LOG

HOLE NO.
98MPI-SA-MW-42

1. COMPANY NAME Malcolm Pirnie, Inc.		2. DRILLING CONTRACTOR SJB		SHEET 1 OF 2 SHEETS	
3. PROJECT Reactive Wall Design			4. LOCATION Watervliet Arsenal-Siberia Area		
5. NAME OF DRILLER T. FARRELL			6. MANUFACTURER'S DESIGNATION OF DRILL CME 550		
7. SIZES & TYPES OF DRILLING & SAMPLING EQUIPMENT 8"		4 1/4" HSA		8. HOLE LOCATION North East	
		2" SS		9. SURFACE ELEVATION .	
				10. DATE STARTED 08/12/98	
				11. DATE COMPLETED 08/12/98	
12. OVERBURDEN THICKNESS 6.0			15. DEPTH GROUNDWATER ENCOUNTERED 7.5'		
13. DEPTH DRILLED INTO ROCK			16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED		
14. TOTAL DEPTH OF HOLE 11.0			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) 5.20' bmp (08/13/98)		
18. GEOTECHNICAL SAMPLES		DISTURBED		UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES					
20. SAMPLES FOR CHEMICAL ANALYSIS		VOC		METALS	
		OTHER (SPECIFY)		OTHER (SPECIFY)	
		X			
21. TOTAL CORE REC %					
22. DISPOSITION OF HOLE		BACKFILLED		MONITORING WELL	
				X	
		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR	

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	0	Fill - f/sand and silt, grey w/orange (rust staining?), some f/gravel. Dry	1 ppm			7	Rec: 18"
	1					10	
						11	
						12	
	2	Fill - c/sand, black, charred appearance. Charred wood fragments. Dry	1.2 ppm			9	Rec: 6"
						10	
	3					12	
						8	
	4	Silty-clay, dk gry w/orange veins, trace subrounded f/gravel, some f/m/c sand. Dry.	1 ppm			4	Rec: 18"
						6	
	5						

HTW DRILLING LOG

HOLE NO.
98MPI-SA-MW-42

PROJECT Reactive Wall Design
Watervliet Arsenal-Siberia Area

INSPECTOR

SHEET 2
OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	6	Weathered Bedrock	BG			40 9	Rec: 12"
						32 20	
	7					22	
						34	
	8		BG			11	Rec: 14"
						11	
	9					25	
						38	
	10	Auger refusal @ 11.0'	BG			26	Rec: 6"
						50/0.3	
	11						
	12						
	13						
	14						

HTW DRILLING LOG

HOLE NO.
98MPI-SA-MW-43

1. COMPANY NAME Malcolm Pirnie, Inc.		2. DRILLING CONTRACTOR SJB		SHEET 1 OF 2 SHEETS	
3. PROJECT Reactive Wall Design		4. LOCATION Watervliet Arsenal-Siberia Area			
5. NAME OF DRILLER T. FARRELL		6. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
7. SIZES & TYPES OF DRILLING & SAMPLING EQUIPMENT 8"	4 1/4" HSA		8. HOLE LOCATION North East		
	2" SS		9. SURFACE ELEVATION 1		
			10. DATE STARTED 08/12/98		
			11. DATE COMPLETED 08/12/98		
12. OVERBURDEN THICKNESS 8.0		15. DEPTH GROUNDWATER ENCOUNTERED approx. 4.0'			
13. DEPTH DRILLED INTO ROCK		16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED			
14. TOTAL DEPTH OF HOLE 10.5		17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) 3.32' bmp (08/13/98)			
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE REC %
	X				
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	
		X			

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	0	Fill - gravel (1/4" - 1") angular, some sand f/m/c dk brn. Dry. No odor	BG			19	REC: 12"
						29	
	1					28	
						17	
	2	Fill - sand f/m/c grey to dk grey, angular c/sand to f/gravel inclusions, trace organic matter, little silt grey. Dry to moist @ 4'	BG			11	REC: 12"
						8	
	3					7	
						7	
	4	Fill - gravel f grey (shale) w/sand f/m and silt, trace organic matter, little silty clay. Saturated				3	REC: 4"
						2	
	5						

HTW DRILLING LOG

HOLE NO.
98MPI-SA-MW-43

PROJECT Reactive Wall Design
Watervliet Arsenal-Siberia Area

INSPECTOR

SHEET 2
OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	6	Clay grey. Moist	BG			2 5	REC: 14"
	7					3 26	
						13	
						28	
	8	Weather bedrock grey (shale) @ approx 7.75' Moisture Weathered Bedrock	BG			5	REC: 22"
	9					9	
						50	
						50/1	
	10						
		Auger refusal @ 10.5					
	11						
	12						
	13						
	14						

HTW DRILLING LOG

HOLE NO.
98MPI-SA-MW-44

1. COMPANY NAME Malcolm Pirnie, Inc.		2. DRILLING CONTRACTOR SJB		SHEET 1 OF 2 SHEETS	
3. PROJECT Reactive Wall Design			4. LOCATION Watervliet Arsenal-Siberia Area		
5. NAME OF DRILLER T. FARRELL			6. MANUFACTURER'S DESIGNATION OF DRILL CME 550		
7. SIZES & TYPES OF DRILLING & SAMPLING EQUIPMENT 8"	4 1/4" HSA		8. HOLE LOCATION North East		
	2" SS		9. SURFACE ELEVATION 1		
			10. DATE STARTED 08/12/98		
			11. DATE COMPLETED 08/12/98		
12. OVERBURDEN THICKNESS 8.0			15. DEPTH GROUNDWATER ENCOUNTERED 8.5'		
13. DEPTH DRILLED INTO ROCK			16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED		
14. TOTAL DEPTH OF HOLE 9.0			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) 4.51' bmp (08/13/98)		
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
	X				
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	
		X			

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	0	Fill - sand f/m/c lt brn and gravel f. Piece of screen. No odor. Dry	BG			22	REC: 18"
	1					21	
						24	
						11	
	2	Fill - sand f/m/c dk brn, gravel, little silt. No odor. Dry to moist @ 4'	BG			8	REC: 8"
						5	
	3					6	
						4	
	4	Silty-clay lt grey w/dk grey marble some orange veins, trace gravel f grades to silt and sand brn some clay grey.	BG			3	REC: 19"
						4	
	5						

HTW DRILLING LOG

HOLE NO.
98MPI-SA-MW-44

PROJECT Reactive Wall Design
Watervliet Arsenal-Siberia Area

INSPECTOR

SHEET 2
OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	6	Sand and silt some silty-clay lt brn to dk brn some grey and orange (rust staining?)	1 PPM			19 6 17 14 19 20	REC: 12"
	8	Silty-clay grey, trace quartz. Weathered rock @ bottom of spoon	1 PPM			6 50/0.2	REC: 9.5"
	9	Auger refusal @ 9.0'					
	10						
	11						
	12						
	13						
	14						

APPENDIX B

EnviroMetal Technologies, Inc.
Memo on Anticipated Iron Lifetime



Memorandum

To: Ken Goldstein, Malcom Pirnie, Inc.

From: Robert Focht, EnviroMetal Technologies Inc.
Stephanie O'Hannesin, EnviroMetal Technologies Inc.

Date: 22 June 1998

Re: Anticipated Iron Lifetime in a Permeable Reactive Barrier, Watervliet Arsenal,
Watervliet, NY - 31263.10

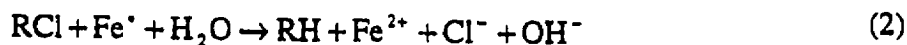
Further to your request, EnviroMetal Technologies Inc. has performed the following calculations to determine the theoretical lifetime of iron metal placed in a permeable reactive barrier (PRB). These calculations are based on measured iron corrosion rates with water and volatile organic compound (VOC) degradation rates.

When iron is exposed to water containing dissolved VOCs, several reactions occur which corrode or "consume" the iron. One reaction is the iron corrosion reaction by water to produce hydrogen and hydroxide ions.



By equating the measured hydrogen gas production rate to the rate of iron corrosion in the laboratory, corrosion rates for granular iron have been determined to be 0.05 to 0.7 mmol/kg Fe/day (Reardon, 1995 and Reardon, 1997). Using the molecular weight of iron (55.847 g/mol), 0.05 mmol is equivalent to 2.8 mg and 0.7 mmol is equivalent to 39 mg. If each day, 2.8 of 1 kg of iron are converted from Fe to Fe²⁺, then it would take about (1,000,000 ÷ 2.8 =) 357,000 days or 978 years for the 1 kg of iron to be consumed by this reaction. Using the same calculation and the higher corrosion rate, 1 kg of iron would be consumed in about 70 years.

Iron corrosion is not the only iron consuming reaction occurring in these systems. Iron also serves as the electron donor in the reduction of chlorinated VOCs. This reaction can be represented by the equation:



The amount of iron consumed in this reaction is dependent on the mass flux of VOCs entering the PRB. From equation (2) 1 mol of iron is consumed for 1 mol of chloride released into solution. For example, 1L of water containing 10 mg/L trichloroethene (0.076 mols) would consume 13 mg (0.23 mols) of iron. At this rate, 1 kg of iron could treat about 77,000 L of water before being consumed. Most PRBs will contain several hundreds to thousands of tons of iron, and therefore the amount of iron consumed due to VOC degradation should be insignificant over the life of the system.

A third reaction that consumes iron is the aerobic reaction with dissolved oxygen (DO).



From the reaction, 2 mols of iron are consumed for 1 mol of DO. As an example, 1 L of water containing 10 mg/L (0.31 mmol) of DO will consume 35 mg of iron. At this rate, it would take about 29,000 L of water to consume 1 kg of iron. Given these numbers, it would take months to years to consume 1 kg of iron at most sites. Note that 1 kg of iron is equivalent to a volume of about 385 cm³.

As mentioned briefly above, the amount of iron consumed over time will depend considerably on site conditions. In particular, the groundwater flow rate, VOC concentration and DO concentration will play a significant role in the lifetime of the iron. Other factors such as desaturation of the iron and oxidation by atmospheric oxygen would also affect the lifetime of the iron. Although there is some uncertainty in the above calculations and the conditions that may exist decades in the future, it seems reasonable to expect the iron in the PRB to last for many decades.



envirometal
technologies
inc.

K36

Memorandum

To: Ken Goldstein, Malcolm Pirnie, Inc.

From: Robert Focht, EnviroMetal Technologies Inc.
Stephanie O'Hannesin, EnviroMetal Technologies Inc.

Date: 22 June 1998

Re: Anticipated VOC Concentrations and Residence Time Calculations,
Watervliet Arsenal, Watervliet, NY - 31263.20

Further to our conversation of 18 June 1998, EnviroMetal Technologies Inc. (ETI) has prepared the following memorandum discussing potential volatile organic concentrations (VOC) that could be treated by the treatment zone proposed for the Watervliet Arsenal site. This evaluation was performed using our degradation model as described in our March 1998 bench-scale report.

Table 1 lists the anticipated field scale half-lives as the assumed molar conversion factors from one VOC to another. This approach is the same as used in the bench-scale report. Listed in Table 1 are the two sets of initial concentrations that were input into the degradation model, and NYSDEC groundwater guidance values used to determine residence time. The first set of concentrations were those anticipated by Malcolm Pirnie Inc (MPI) to be the maximum concentrations within the overburden and weathered bedrock of the NE Quadrant (MPI Work Plan, April 1998). The second set of influent concentrations are a factor of ten greater than these anticipated maximums.

The degradation model results are shown in Figures 1 and 2. Listed in Table 1 are the individual residence times for each VOC to reach its NYSDEC groundwater guidance value. For both sets of initial concentrations, the longest required residence time was needed for vinyl chloride (VC) to reach 2 µg/L. This residence time was 63 hr and 83 hr for the

42 Arrow Road
Guelph, Ontario
Canada N1K 1S6
Tel: (519) 824-0432
Fax: (519) 763-2378

References:

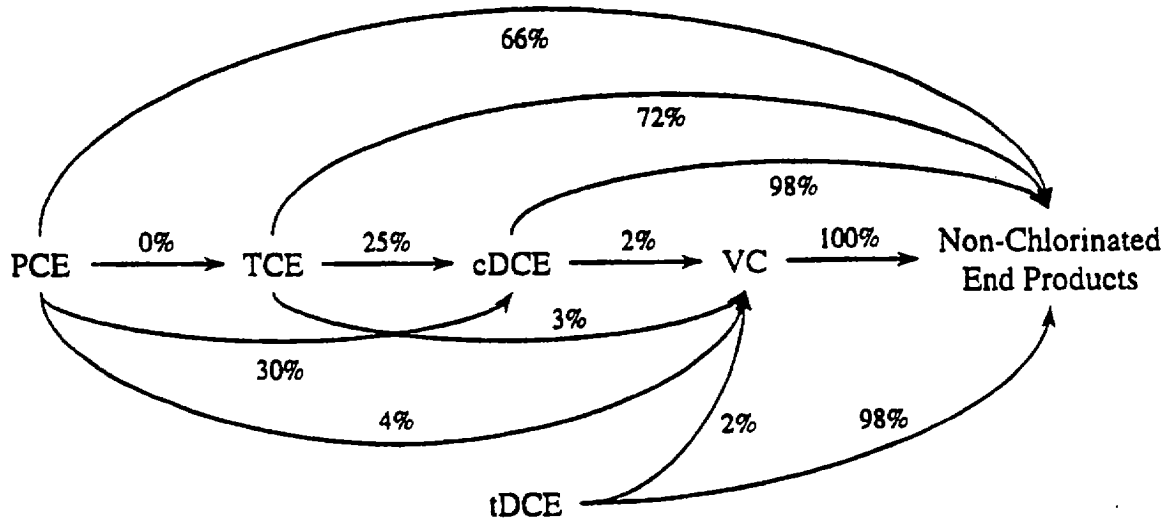
Reardon, E.J., 1995. Anaerobic Corrosion of Granular Iron: Measurement and Interpretation of Hydrogen Evaluation Rates, Environ. Sci. Technol., Vol. 29, No. 12. pp. 2936-2945.

Reardon, E.J., 1997. Department of Earth Sciences, University of Waterloo. Personal Communication.

E:\R\Focht\PROJECTS\31200\31263\31263 Corrosion Memo.doc

Table 1: Degradation Model Parameters and Results, Watervliet Arsenal, Watervliet, NY

Assumed Molar Conversions:



VOC	Field Anticipated Half-Life (hr)	NYDEC Groundwater Guidance Values (µg/L)	Historical Maximum Concentrations		Ten Times Historical Maximum Concentrations	
			Initial Concentration (µg/L)	Residence Time (hr)	Initial Concentration (µg/L)	Residence Time (hr)
PCE	3.6	5	1,100	29	11,000	41
TCE	2.2	5	1,500	19	15,000	26
cDCE	5	5	4,200	51	42,000	68
tDCE	10	5	11	12	110	45
VC	6.2	2	1,700	63	17,000	83
Maximum Residence Time (hr)			63		83	
Flow-Through Thickness ¹ (ft)			0.40		0.52	

¹ Determined using a groundwater velocity of 0.15 ft/day.

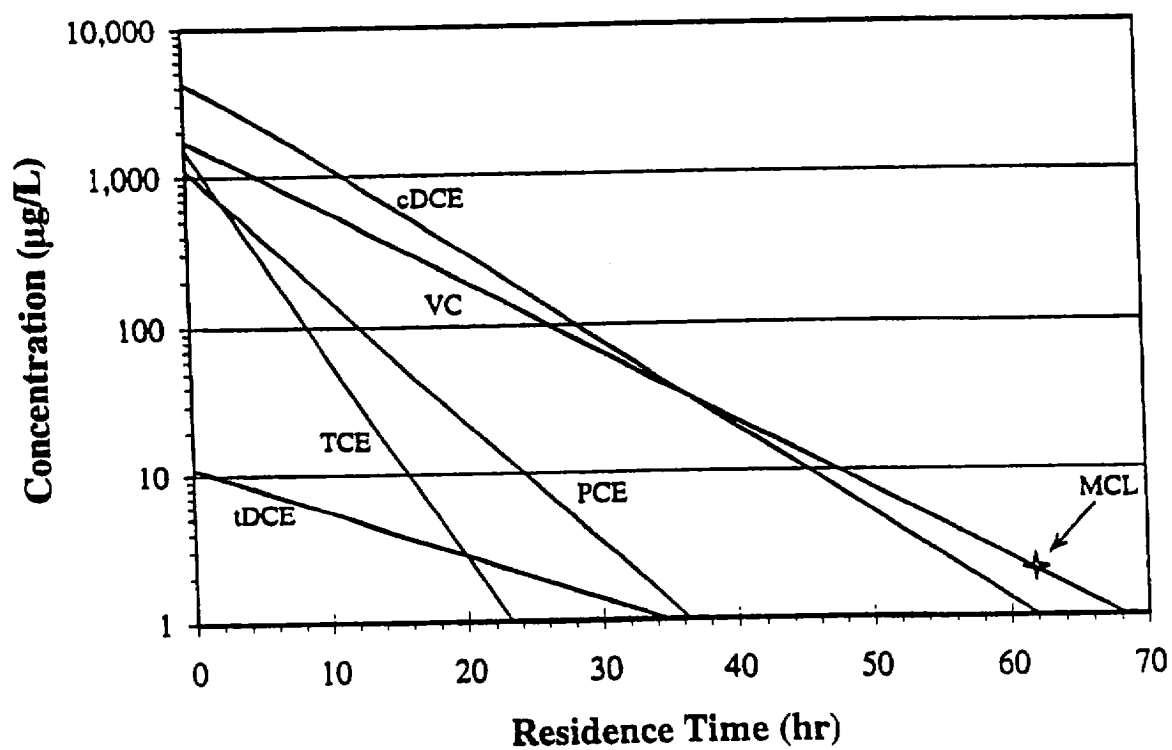


Figure 1: Degradation model results using historical maximum VOC concentrations.

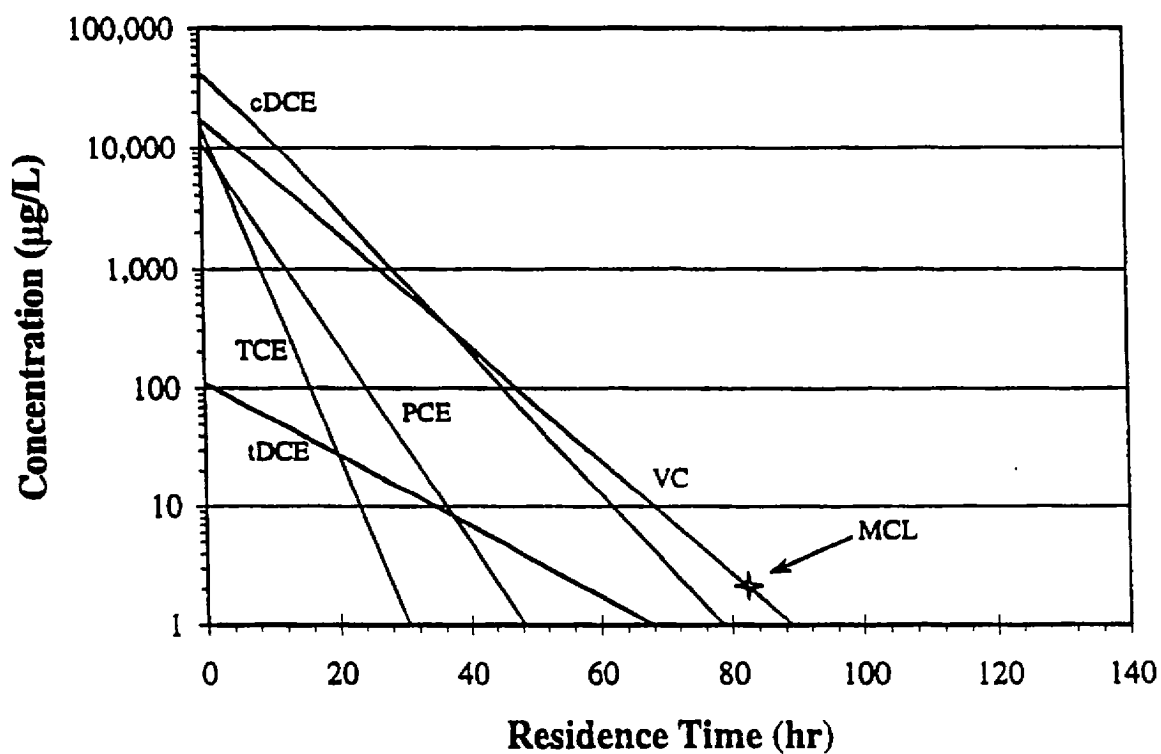


Figure 2: Degradation model results using ten times historical maximum VOC concentrations.

APPENDIX C

Draft Construction Documents

[Appendix C - Furnished Previously]

Contract Specifications

Watervliet Arsenal Permeable Reaction Wall Pilot System Construction

DRAFT FINAL

**Watervliet Arsenal
Watervliet, New York**



**US Army Corps
of Engineers**

Baltimore District

DRIVEN BY A VISION...to be the BEST

Prepared by:

Malcolm Pirnie, Inc.

15 Cornell Road

Latham, New York 12110

August 1998

(Revised to incorporate comments September 1998)

0285709

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

PERMEABLE REACTION WALL PILOT SYSTEM
CONSTRUCTION

TABLE OF CONTENTS

	<u>Page</u>
NOTICE TO BIDDERS	00100-1
INSTRUCTIONS TO BIDDERS	00200-1
BID PACKAGE	
Bid Form	00410-1
Schedule of Values	SCH-1
BIDDERS QUALIFICATION STATEMENT	00450-1
AGREEMENT	00500-1
GENERAL CONDITIONS	00700-1
SUPPLEMENTARY CONDITIONS	00800-1
 <u>DETAILED SPECIFICATIONS</u>	
Division 01000 - <u>GENERAL REQUIREMENTS</u>	
01010 Summary of Work	01010-1
01025 Measurement and Payment	01025-1
01026 Schedule of Values	01026-1
01040 Coordination	01040-1
01043 Coordination with Owner's Operations	01043-1
01050 Field Engineering and Survey Data	01050-1
01091 Reference Standards	01091-1
01092 Abbreviations and Symbols	01092-1
01210 Preconstruction Conference	01210-1
01310 Construction Schedules	01310-1
01340 Shop Drawing Procedures	01340-1
01500 Temporary Construction Facilities	01500-1
01540 Security	01540-1
01541 Protection of the Work and Property	01541-1

TABLE OF CONTENTS (Continued)

Page

DETAILED SPECIFICATIONS (Continued)

01550	Access Roads and Parking Areas	01550-1
01560	Environmental Controls	01560-1
01630	Substitutions	01630-1

Division 02000 - SITE WORK

02014	Soil Exploration and Installation of Monitoring Wells	02014-1
02052	Transport and Disposal of Excess Excavated Materials	02052-1
02223	Trench Excavation	02223-1
02230	Select Fill	02230-1
02232	Granular Iron	02232-1

Division 03000 - CONCRETE - Not Used

Division 4 - MASONRY - Not Used

Division 5 - MISCELLANEOUS METALS - Not Used

Division 6 - WOOD AND PLASTICS - Not Used

Division 7 - THERMAL AND MOISTURE PROTECTION - Not Used

Division 8 - DOORS AND WINDOWS - Not Used

Division 9 - PAINTING - Not Used

Division 10 - SPECIALTIES - Not Used

Division 11 - EQUIPMENT - Not Used

Division 12 - FURNISHINGS - Not Used

Division 13 - SPECIAL CONSTRUCTION - Not Used

Division 14 - HOISTING EQUIPMENT - Not Used

Division 15 - MECHANICAL - Not Used

TABLE OF CONTENTS (Continued)

Page

DETAILED SPECIFICATIONS (Continued)

Division 16 - ELECTRICAL - Not Used

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

PERMEABLE REACTION WALL PILOT SYSTEM
CONSTRUCTION

NOTICE TO BIDDERS

Sealed bids for **WATERVLIET ARSENAL PERMEABLE REACTION WALL PILOT SYSTEM CONSTRUCTION** will be received by the Malcolm Pirnie, Inc., 15 Cornell Road, NY 12110 until 1:00 P.M. local time on _____, 1998. Bids will be received from invited bidders only.

CONTRACTOR shall note that wage rates do not apply to this project.

Contract Documents may be examined at the office of Malcolm Pirnie, Inc., 15 Cornell Road, Latham, New York 12110.

A pre-bid conference will be held on _____. Attendance is mandatory. The time will be 10:00 A.M. prevailing local time and the location will be at the _____. The conference will be held to familiarize each prospective Bidder with the Scope of Work. The pre-bid conference will be informal only and will in no way negate the requirements associated with the interpretation of the Contract Documents stated in the subsection entitled, "Examination of Contract Documents and Site" contained in the Information to Bidders.

MALCOLM PIRNIE, INC. will not be responsible for full or partial sets of Contract Documents, including any addenda, obtained from any other source.

No Bid Bond is required.

The successful Bidder will be required to furnish performance and payment bonds in an amount equal to 100 percent of the Contract Price.

Malcolm Pirnie has the right to reject any or all Bids, as well as the right to waive all informalities in awarding a contract deemed to be in the best interest of Malcolm Pirnie, Inc.

MALCOLM PIRNIE, INC.

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

PERMEABLE REACTION WALL PILOT SYSTEM CONSTRUCTION

INSTRUCTIONS TO BIDDERS

TABLE OF ARTICLES

1. Defined Terms
2. Bids Received
3. Location and Description of Project
4. Copies of Bidding Documents
5. Qualifications of Bidders
6. Examination of Bidding Documents and Site
7. Pre-Bid Conference
8. Site and Other Areas
9. Interpretations and Addenda
10. Bid Security
11. Contract Times
12. Liquidated and Special Damages
13. Substitute and "Or Equal" Items
14. Subcontractors, Suppliers and Others
15. Preparation of Bid
16. Basis of Bids; Evaluation of Bids
17. Submittal of Bid
18. Modification or Withdrawal of Bid
19. Opening of Bids
20. Disqualification of Bidders
21. Bids to Remain Subject to Acceptance
22. Award of Contract
23. Contract Securities
24. Contractor's Insurance
25. Signing of Agreement
26. Notice to Proceed
27. Partnering
28. Sales and Use Taxes
29. Additional Requirements

ARTICLE 1 - DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof.
- 1.02 Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof.
- A. Bidder: The individual or entity who submits a Bid directly to Malcolm Pirnie, Inc. (PIRNIE).
 - B. Successful Bidder: The lowest responsible Bidder submitting a responsive Bid to whom PIRNIE (on the basis of PIRNIE's evaluation as hereinafter provided) makes an award.
 - C. Client: The U.S. Army Corps of Engineers, Baltimore District.
 - D. OWNER: The U.S. Army Industrial Operations Command.

ARTICLE 2 - BIDS RECEIVED

- 2.01 Refer to Notice to Bidders for information on receipt of Bids.

ARTICLE 3 - LOCATION AND DESCRIPTION OF PROJECT

- 3.01 Refer to Section 01010 of the General Requirements for the location and description of the Project.

ARTICLE 4 - COPIES OF BIDDING DOCUMENTS

- 4.01 Refer to Notice to Bidders for information on examination and procurement of Bidding Documents.
- 4.02 The Issuing Office is Malcolm Pirnie, Inc., 15 Cornell Road, Latham, New York 12110.
- 4.03 Complete sets of Bidding Documents must be used in preparing Bids; neither CLIENT nor PIRNIE assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

- 4.04 PIRNIE in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant permission for any other use.

ARTICLE 5 - QUALIFICATIONS OF BIDDERS

- 5.01 Bids will be received from invited bidders only.
- 5.02 To demonstrate qualifications to perform the Work, Bidder shall complete and submit with its Bid a separate Bidder Qualifications Statement which will be furnished by PIRNIE. An example of the Bidder Qualifications Statement is bound in the Project Manual. Bidders may be asked to furnish additional data to demonstrate their qualifications.
- 5.03 Bidders shall be qualified to do business in the state where the Project is located or covenant to obtain such qualification prior to signing of the Agreement.
- 5.04 Bids will be received only from contractors who are licensed or registered by the State of New York.

ARTICLE 6 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA AND SITE

- 6.01 Subsurface and Physical Conditions
- A. Information available to Bidders regarding subsurface and physical conditions is identified in the Supplementary Conditions.
- 6.02 Underground Facilities - Physical Conditions
- A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to PIRNIE by owners of such Underground Facilities, including OWNER, or others.
- 6.03 Hazardous Environmental Condition
- A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that PIRNIE has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in this paragraph 4.2 will be made available by PIRNIE to any Bidder on request. Those reports and drawings are

not part of the Contract Documents, but the “technical data” contained therein upon which Bidder is entitled to rely as provided in paragraph 4.2 of the General Conditions has been identified and established in paragraph SC- 4.2 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion drawn from any “technical data” or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

- 6.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unforeseen conditions appear in paragraphs 4.2, 4.3 and 4.4 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Bidding Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the Scope of Work appear in paragraph 4.3 of the General Conditions.
- 6.05 On request, OWNER will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests and studies as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former conditions upon completion of such explorations, investigations, tests and studies.
- 6.06 On request, OWNER will conduct a Site visit for Bidders during OWNER's normal business hours.
- 6.07 Reference is made to the Supplementary Conditions for identification of the general nature of other Work (if any) that is to be performed at the Site by OWNER or others (such as utilities and other prime contractors) that relates to the Work for which a Bid is to be submitted.
- 6.08 It is the responsibility of Bidder, before submitting a Bid to:
 - A. examine and carefully study the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;
 - B. visit the Site and become familiar with and satisfy Bidder as to the general, local and Site conditions that may affect cost, progress and performance of the Work;
 - C. become familiar with and satisfy Bidder as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work;

- D. carefully study all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.3 of the General Conditions, and to carefully study all reports and drawings of a Hazardous Environmental Condition identified at the Site, if any, which have been identified in the Supplementary Conditions as provided in paragraph 4.3 of the General Conditions;
- E. obtain and carefully study (or assume responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Bidder, including any specific means, methods, techniques, sequences and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;
- F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for the performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of work (if any) to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents;
- H. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies and data with the Bidding Documents;
- I. promptly give PIRNIE written notice of all conflicts, errors, ambiguities or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by PIRNIE is acceptable to Bidder; and
- J. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

- 6.09 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 6, that without exception the Bid is premised upon performing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences or procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given PIRNIE written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by PIRNIE are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing the Work.

ARTICLE 7 - PRE-BID CONFERENCE

- 7.01 A pre-Bid conference will be held on _____, 1998 at 10:00 a.m. at the _____. Representatives of PIRNIE will be present to discuss the Project. Bidders are required to attend and participate at the conference. PIRNIE will transmit to all prospective Bidders of record such Addenda as PIRNIE considers necessary in response to questions raised at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 8 - SITE AND OTHER AREAS

- 8.01 The Site is identified in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment, to be incorporated into the Work are to be obtained and paid for by CONTRACTOR.

ARTICLE 9 - INTERPRETATIONS AND ADDENDA

- 9.01 All questions about the meaning or intent of the Bidding Documents shall be submitted to PIRNIE in writing. In order to receive consideration, questions must be received by PIRNIE at least ten days prior to the date for the opening of Bids. Interpretations or clarifications considered necessary by PIRNIE in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by PIRNIE as having received the Bidding Documents for receipt not later than three days prior to the date for the opening of Bids. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 9.02 Addenda may also be issued to clarify, correct or change the Bidding Documents as deemed advisable by PIRNIE. Such Addenda, if any, will be issued in the manner and within the time period stated in paragraph 9.01.

ARTICLE 10 - BID SECURITY

10.01 No Bid Bond is required.

ARTICLE 11 - CONTRACT TIMES

11.01 The dates in which the Work is to be substantially completed and also completed and ready for final payment (the Contract Times) are set forth in the Agreement.

ARTICLE 12 - LIQUIDATED AND SPECIAL DAMAGES

12.01 Provisions for liquidated and special damages, if any, are set forth in the Agreement.

ARTICLE 13 - SUBSTITUTE AND "OR EQUAL" ITEMS

13.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to PIRNIE application for such acceptance will not be considered by PIRNIE until after the Effective Date of the Agreement. The procedure for submittal of any such application by CONTRACTOR and consideration by PIRNIE is set forth in the General Conditions which may be supplemented in the General Requirements.

13.02 Refer to Section 01630 of the General Requirements for the period of time after the Effective Date of the Agreement during which PIRNIE will accept applications for substitute or "or-equal" items of material or equipment.

ARTICLE 14 - SUBCONTRACTORS, SUPPLIERS AND OTHERS

14.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals or entities to be submitted to in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within seven days after Bid opening submit to PIRNIE a list of all such Subcontractors, Suppliers, other individuals or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualifications for each such Subcontractor, Supplier, individual or entity if requested by PIRNIE. If PIRNIE after due investigation, has reasonable objection to any proposed Subcontractor,

Supplier, individual or entity, PIRNIE may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in Bid price.

- 14.02 If apparent Successful Bidder declines to make any such substitution, PIRNIE may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers and other individuals or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual or entity so listed and against which PIRNIE makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to PIRNIE subject to revocation of such acceptance after the Effective Date of the Agreement as provided in paragraph 6.06 of the General Conditions.
- 14.03 CONTRACTOR shall not be required to employ any Subcontractor, Supplier, individual or entity against whom CONTRACTOR has reasonable objection.

ARTICLE 15 - PREPARATION OF BID

- 15.01 A Bid must be made on a separate Bid form furnished by PIRNIE. The Bid form shall not be altered in any way.
- 15.02 All blanks in the Bid form shall be completed by printing in black ink or by typewriter. A Bid price shall be indicated in both words and numerals for each Bid Item listed therein or the words "No Bid", or "Not Applicable" entered. Ditto marks shall not be used.
- 15.03 A Bid shall be executed as stated below.
- A. A Bid by an individual shall show the Bidder's name and official address.
 - B. A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title shall appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.
 - C. A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture shall be shown below the signature.
 - D. A Bid by a corporation shall be executed in the corporate name by an officer of the corporation and shall be accompanied by a certified copy of a resolution of the board of directors authorizing the person signing the Bid to do so on behalf of the corporation. The corporate seal shall be affixed and attested by

the secretary or an assistant secretary. The state of incorporation and the official corporate address shall be shown below the signature.

- E. A Bid by a limited liability company shall be executed in the name of the firm and signed by a member accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.
 - F. All names shall be typed or printed in black ink below the signature.
 - G. Evidence of authority to conduct business as an out-of-state corporation in the state where the Work is to be performed shall be provided, if applicable.
 - H. Contractor's license or registration number, if any, shall be entered in the space provided on the Bid form.
- 15.04 The Bid shall contain an acknowledgment of the receipt of all Addenda in the space provided on the Bid form.
- 15.05 The address and telephone number for communications regarding the Bid shall be shown.
- 15.06 In addition to the Bid form, the following listed documents, which will be furnished by PIRNIE shall be submitted with the Bid. Each document shall be executed in the manner described in paragraph 15.03 unless another manner is indicated.
- A. Bidder's Qualification Statement.
 - B. Noncollusive Bidding Certification.
 - C. Schedule of Values for Lump Sum Bids.

ARTICLE 16 - BASIS OF BIDS; EVALUATION OF BIDS

16.01 Series of Lump Sums

- A. Bidder shall submit its Bid on the basis of each lump sum item as set forth on the Bid form, and shall compute and enter the total of all lump sum items in the space provided on the Bid form.
- B. For determination of the apparent low Bidder, Bids will be evaluated on the basis of the total of all lump sum items. Malcolm Pirnie reserves the right to waive all formalities in awarding a Contract deemed to be in the best interest of Malcolm Pirnie, Inc.

- 16.02 In evaluating Bids, discrepancies between words and figures will be resolved in favor of words. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

ARTICLE 17 - SUBMITTAL OF BID

- 17.01 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Notice to Bidders.
- 17.02 Bid shall be enclosed in an opaque sealed envelope plainly marked on the outside with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) the name and address of the Bidder and its license or registration number, if applicable. Bid shall be accompanied by Bid security and other required documents.
- 17.03 If the Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "Bid Enclosed". A mailed Bid shall be addressed to:

Malcolm Pirnie, Inc.
15 Cornell Road
Latham, NY 12110

ARTICLE 18 - MODIFICATION OR WITHDRAWAL OF BID

- 18.01 Withdrawal Prior to Bid Opening:
- A. A Bid may be withdrawn by an appropriate document duly executed, in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time fixed for the opening of Bids. Upon receipt of such written notice, the unopened Bid will be returned to the Bidder.
- 18.02 Modification Prior to Bid Opening:
- A. If a Bidder wishes to modify its Bid, Bidder must withdraw its initial Bid in the manner specified in paragraph 18.01.A and submit a new Bid.

ARTICLE 19 - OPENING OF BIDS

- 19.01 Bids will be privately opened at the time and place where Bids are to be submitted.

- 19.02 Bids received by mail or otherwise after the date and time specified for the opening of Bids will not be accepted and will be returned to the Bidder unopened.

ARTICLE 20 - DISQUALIFICATION OF BIDDERS

- 20.01 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

ARTICLE 21 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 21.01 All Bids shall remain subject to acceptance for sixty days after the day of the Bid opening, but PIRNIE may, in its sole discretion, release any Bid and return the Bid security prior to that date.

ARTICLE 22 - AWARD OF CONTRACT

- 22.01 PIRNIE reserves the right to reject any or all Bids, including without limitation the right to reject any or all nonconforming, nonresponsive or conditional Bids.
- 22.02 PIRNIE reserves the right to reject any Bid not accompanied by specified documentation and Bid security.
- 22.03 PIRNIE reserves the right to reject any Bid that, in its sole discretion, is considered to be unbalanced or unreasonable as to the amount bid for any lump sum or unit price item.
- 22.04 In evaluating Bidders, PIRNIE will consider their qualifications whether or not their Bids comply with the prescribed requirements, the alternatives, if any, the lump sum and unit prices, and other data as maybe requested in the Bid Form or prior to the Notice of Award.
- 22.05 PIRNIE may consider the qualifications and experience of Subcontractors, Suppliers and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers and other individuals or entities must be submitted as provided in the Supplementary Conditions.
- 22.06 PIRNIE may conduct such investigations as PIRNIE deems necessary to establish the responsibility, qualifications and financial ability of the Bidders to perform the Work in accordance with the Contract Documents. PIRNIE reserves the right to

reject the Bid of any Bidder who does not pass any such evaluation to PIRNIE's satisfaction.

- 22.07 If a Contract is to be awarded, it will be awarded to the lowest responsive and responsible Bidder who has neither been disqualified nor rejected pursuant to Article 20 or this Article 22.

ARTICLE 23 - CONTRACT SECURITIES

- 23.01 Performance Bond shall be in the form of Engineers Joint Contract Documents Committee (EJCDC) "Construction Performance Bond", 1910-28-A. Payment Bond shall be in the form of EJCDC "Construction Payment Bond", 1910-28-B. The amounts of and other requirements for Performance and Payment Bonds are stated in paragraph 5.01 of the General Conditions. The requirements for delivery of Bonds are stated in paragraph 2.01 of the General Conditions. Additional requirements may be stated in the Supplementary Conditions.
- 23.02 Successful Bidder shall within five days from the date of the Notice of Award deliver to PIRNIE, for PIRNIE's review and approval, the Performance Bond and the Payment Bond CONTRACTOR proposes to furnish at the time of the execution of the Agreement.

ARTICLE 24 - CONTRACTOR'S INSURANCE

- 24.01 The requirements for CONTRACTOR's insurance are stated in Article 5 of the General Conditions and in the Supplementary Conditions. The requirements for delivery of certificates of insurance are stated in paragraph 2.05.C of the General Conditions.
- 24.02 Successful Bidder shall within five days from the date of the Notice of Award deliver to PIRNIE, for review and approval, the required policies of insurance. Upon approval, the policies will be returned to the Bidder and Bidder shall submit certificates of insurance to PIRNIE as stated in the General Conditions.

ARTICLE 25 - SIGNING OF AGREEMENT

- 25.01 When PIRNIE gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to

PIRNIE. Within ten days thereafter, PIRNIE will deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 26 - NOTICE TO PROCEED

26.01 Issuance of the Notice to Proceed shall be as stated in Article 2 of the General Conditions.

ARTICLE 27 - PARTNERING - NOT USED

ARTICLE 28 - SALES AND USE TAXES - Not Used

ARTICLE 29 - ADDITIONAL REQUIREMENTS - NOT USED

MALCOLM PIRNIE, INC.
15 Cornell Road
Latham, NY 12110

++ END OF INSTRUCTIONS TO BIDDERS ++

BID FORM

BID FOR:

Watervliet Arsenal
Permeable Reaction Wall Pilot System Construction

BID TO:

Malcolm Pirnie, Inc.
15 Cornell Road
Latham, NY 12110

BID FROM: _____

(Print or Type Name of Bidder)

(/A Corporation/A Partnership/An Individual/A Joint Venture/
[Bidder to strike out inapplicable terms.]

Gentlemen:

The undersigned Bidder offers and agrees, if this Bid is accepted, to enter into an Agreement with PIRNIE in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price(s) and within the Bid Times indicated in this Bid and in accordance with the Contract Documents.

Bidder declares that no person or persons other than those named herein are interested in this Bid; that this Bid is made without collusion with any other person, firm or corporation; and that no person or persons acting in any official capacity for the OWNER or PIRNIE are directly or indirectly interested in this Bid, or in any portion of the profit thereof.

In submitting this Bid, Bidder represents, as more fully set forth in the Agreement, that Bidder has examined the Instructions to Bidders, if any, all of the other Bidding Documents and all of the Contract Documents; that Bidder has examined the actual site and locality where the Work is to be performed; that Bidder has familiarized himself with the legal requirements (federal, state and local Laws and Regulations); that Bidder has carefully studied all reports of explorations and tests of subsurface conditions, and all drawings of physical conditions identified in the Supplementary Conditions and has made such independent investigations as deemed necessary; and that Bidder has satisfied himself as to all conditions affecting cost, progress or performance and furnishing of the Work.

Bidder further agrees as follows: 1) that this Bid shall remain open and may not be withdrawn for the time period set forth in the Instructions to Bidders; 2) that Bidder accepts all of the terms and conditions of the Instructions to Bidders, if any, including without limitation those dealing with the disposition of Bid security; 3) and that, upon acceptance of this Bid, Bidder will execute the Agreement and will furnish the required contract security and insurance certificates within the time period(s) set forth in the Instructions to Bidders, if any.

In accordance with the above understandings and agreements, Bidder will complete the Work for the following sums:

DESCRIPTION	ESTIMATED QUANTITIES	COMPUTED TOTALS
<p>ITEM 1. Site Preparation, the lump sum price of</p> <p>_____ Dollars</p> <p>and _____ Cents</p> <p>(\$ _____)</p>	Lump Sum	\$ _____
<p>ITEM 2. Disposal of Excess Excavated Material,</p> <p>the lump sum price of</p> <p>_____ Dollars</p> <p>and _____ Cents</p> <p>(\$ _____)</p>	Lump Sum	\$ _____
<p>ITEM 3. Permeable Reaction Wall, the lump sum price of</p> <p>_____ Dollars</p> <p>and _____ Cents</p> <p>(\$ _____)</p>	Lump Sum	\$ _____
<p>ITEM 4. Groundwater Collection, Treatment and Disposal,</p> <p>the lump sum price of</p> <p>_____ Dollars</p> <p>and _____ Cents</p> <p>(\$ _____)</p>	Lump Sum	\$ _____

DESCRIPTION	ESTIMATED QUANTITIES	COMPUTED TOTALS
ITEM 5. Additional Work for Carbon Treatment of Groundwater, the lump sum price of _____ Dollars and _____ Cents (\$ _____)	Lump Sum	\$ _____
ITEM 6. Monitoring and Observation Wells Installation, the lump sum price of _____ Dollars and _____ Cents (\$ _____)	Lump Sum	\$ _____
ITEM 7. Site Restoration, the lump sum price of _____ Dollars and _____ Cents (\$ _____)	Lump Sum	\$ _____
<u>TOTAL BID - Items 1 through 7</u>		<u>\$ _____</u>

(Amounts to be shown in both words and numerals. In case of discrepancy, amounts shown in words will govern.)

Bidder agrees that the Work will be substantially completed on or before _____ and completed by _____. Bidder accepts the provisions of the Agreement as to liquidated and special damages in the event of failure to substantially complete the Work on time.

Bidder acknowledges receipt of the Addenda listed below and further acknowledges that the provisions of each Addendum have been included in the preparation of this Bid.

<u>Addendum No.</u>	<u>Date Received</u>	<u>Addendum No.</u>	<u>Date Received</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The following documents are attached to and made a condition of this Bid.

1. Required Bidder's Qualification Statement with supporting data.
2. A tabulation of Subcontractors and other persons and organizations required to be identified in this Bid.

The terms used in this Bid, which are defined in the General and Supplementary Conditions, have the meanings assigned to them in the General and Supplementary Conditions.

Respectfully submitted on _____, 19__.

If Bidder is:

An Individual

By _____
(Individual's Signature)

(Printed or Typed Name of Individual)

Doing business as _____

License or Registration Number: _____

Business Address: _____

Phone No.: _____ FAX No.: _____

A Partnership

By _____
(Firm Name)

(General Partner's Signature)

(Printed or Typed Name of General Partner)
(Attach evidence of authority to sign.)

License or Registration Number: _____

Business Address: _____

Phone No.: _____ FAX No. _____

A Corporation

By _____
(Corporation Name)

(State of Incorporation)

By _____
(Signature of Officer Authorized to Sign)

(Printed or Typed Name and Title of Officer Authorized to Sign)
(Attach evidence of authority to sign.)

(CORPORATE
SEAL)

Attest _____
(Secretary)

License or Registration Number: _____

Business Address: _____

Phone No.: _____ FAX No. _____

Limited Liability Company

By _____
(Firm Name)

(State of Formation)

By _____
(Signature of Member/Authorized to Sign)

(Printed or Typed Name and Title of Member Authorized to Sign)
(Attach evidence of authority to sign.)

License or Registration Number: _____

Business Address: _____

Phone No.: _____ FAX No. _____

A Joint Venture

Joint Venture Name: _____

By _____
(Signature)

(Printed or Typed Name)

(Title)

(Address)

By _____
(Signature)

(Printed or Typed Name) (Title)

(Address)

Phone and FAX number and address for receipt of communications to joint venture:

(Each joint venturer must sign. The manner of signing for each individual, partnership, corporation or limited liability company that is a party to the joint venture shall be in the manner indicated above).

++ END OF BID FORM ++

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

PERMEABLE REACTION WALL PILOT SYSTEM CONSTRUCTION

SCHEDULE OF VALUES

Contractor shall complete and submit with bid the following schedule of values form. This form will be used in comparison of bids and as a basis of payment for any additional work completed by order of PIRNIE.

Payment Item	Description	Quantity	Unit	Unit Cost	Total
Item 1 - Site Preparation					
	Mobilization	1	LS	_____	_____
	Temporary Facilities	1	LS	_____	_____
	General Conditions	1	LS	_____	_____
Item 2 - Disposal of Excess Excavated Material					
	Soil Staging	_____	LS	_____	_____
	Soil Testing	_____	LS	_____	_____
	Permits/Fees	_____	LS	_____	_____
	Transportation	_____	CY	_____	_____
	Disposal	_____	Tons	_____	_____
Item 3 - Permeable Reaction Wall					
	Excavation	_____	CY	_____	_____
	Furnish Granular Iron Sand	_____	CY	_____	_____
	Furnish Concrete Sand	_____	CY	_____	_____
	Mix Materials	_____	CY	_____	_____
	Install Reaction Wall	_____	CY	_____	_____

Payment Item	Description	Quantity	Unit	Unit Cost	Total
	Backfill with Excavated Material	_____	CY	_____	_____
	Furnish and Install Se- lect Backfill	_____	CY	_____	_____
Item 4 - Groundwater Collection, Treatment and Disposal					
	Base Groundwater System	1	LS	_____	_____
	Carbon Treatment Standby	1	LS	_____	_____
Item 5 - Additional Work for Carbon Treatment of Groundwater					
	Rental of Carbon Filter, pumps, hoses, etc.	1	LS	_____	_____
	Installation and Opera- tion of carbon treatment system	1	LS	_____	_____
	Removal of System and Disposal of Carbon	1	LS	_____	_____
Item 6 - Monitoring and Observation Wells Installation					
	Install Overburden Well	_____	EA	_____	_____
	Install W. Bedrock Well	_____	EA	_____	_____
Item 7 - Site Restoration					
	Crushed Stone	_____	CY	_____	_____
	Decontamination of Equipment	1	LS	_____	_____

BIDDER'S QUALIFICATION STATEMENT

(Completion of this statement is required in advance of
consideration for award of contract.)

SUBMITTED TO:

Malcolm Pirnie, Inc.
15 Cornell Road
Latham, New York 12110

SUBMITTED FOR:

Watervliet Arsenal
Permeable Reaction Wall Pilot System Construction

SUBMITTED BY:

Name: _____
(Print or Type Name of Bidder)
(/A Corporation/A Partnership/An Individual/A Joint Venture/
[Bidder to strike out inapplicable terms.]

Address: _____

Gentlemen:

The undersigned certifies under oath the truth and correctness of all statements and of all
answers to questions made hereinafter.

(Note: Attach Separate Sheets as Required)

1.0 How many years has your organization been in business as a contractor?

2.0 How many years has your organization been in business under its present name?

3.0 If a corporation, answer the following:

3.1 Date of incorporation:

3.2 State of incorporation:

3.3 President's name:

3.4 Vice president's name(s):

3.5 Secretary's or Clerk's name:

3.6 Treasurer's name:

4.0 If individual or partnership, answer the following:

4.1 Date of organization:

4.2 Name and address of all partners. (State whether general or limited partnership.):

5.0 If other than corporation or partnership, describe organization and name principals:

6.0 Do you plan to subcontract any part of this project? _____ If so, give details.

- 7.0 Has any construction contract to which you have been a party been terminated by the owner; have you ever terminated work on a project prior to its completion for any reason; has any surety which issued a performance bond on your behalf ever completed the work in its own name or financed such completion on your behalf; has any surety expended any monies in connection with a contract for which they furnished a bond on your behalf? If the answer to any portion of this question is "yes", please furnish details of all such occurrences including name of owner, architect or engineer, and surety, and name and date of project.
- 8.0 Has any officer or partner of your organization ever been an officer or partner of another organization that had any construction contract terminated by the owner; terminated work on a project prior to its completion for any reason; had any surety which issued a performance bond complete the work in its own name or financed such completion; or had any surety expend any monies in connection with a contract for which they furnished a bond? If the answer to any portion of this question is "yes", please furnish details of all such occurrences including name of owner, architect or engineer, and surety, and name and date of project.
- 9.0 List name of project, owner, architect or engineer, contract amount, percent complete and scheduled completion of the major construction projects your organization has in process on this date.
- 10.0 List name of project, owner, architect or engineer, contract amount, date of completion and percent of work with own forces of the major projects of the same general nature as this project which your organization has completed in the past five years.

11.0 List name, address and telephone number of a reference for each project listed under Items 9.0 and 10.0, above.

12.0 List name and construction experience of the principal individuals of your organization.

13.0 List the states and categories of construction in which your organization is legally qualified to do business.

14.0 List name, address and telephone number of an individual who represents each of the following and whom OWNER may contact for a financial reference:

14.1 A surety:

14.2 A bank:

14.3 A major material supplier:

15.0 Dated at _____, this _____ day of
_____, 19__.

(Print or Type Name of Bidder)

By _____

(Title)

(Seal, if corporation)

------(Affidavit for Individual)-----

_____ being duly sworn, deposes and says that:
a) the financial statement, taken from his/her books, is a true and accurate statement of his/her financial condition as of the date thereof; and b) all of the foregoing qualification information is true, complete, and accurate.

------(Affidavit for Partnership)-----

_____ being duly sworn, deposes and says that:
a) he/she is a member of the partnership of _____;
b) he/she is familiar with the books of said partnership showing its financial condition; c) the financial statement, taken from the books of said partnership, is a true and accurate statement of the financial condition of the partnership as of the date thereof; and d) all of the foregoing qualification information is true, complete, and accurate.

------(Affidavit for Corporation)-----

_____ being duly sworn, deposes and says that: a) he/she is
_____ of _____;
(Full name of Corporation)
b) he/she is familiar with the books of said corporation showing its financial condition; c) the financial statement, taken from the books of said corporation, is a true and accurate statement of the financial condition of said corporation as of the date thereof; and d) that all of the foregoing qualification information is true, complete, and accurate.

------(Acknowledgment)-----

_____ being duly sworn, deposes and says
that he/she is _____ of _____;

(Name of Bidder)

that he/she is duly authorized to make the foregoing affidavit and that he/she makes it on
behalf of

() himself/herself; () said partnership; () said corporation.

Sworn to before me this _____ day of _____, 19__, in the County
of _____, State of _____.

(Notary Public)

My commission expires _____

(Seal)

AGREEMENT

THIS AGREEMENT is dated as of the _____ day of _____ in the year _____, by and between Malcolm Pirnie, Inc., 15 Cornell Road, Latham, NY 12110 hereinafter called PIRNIE) and _____ (hereinafter called CONTRACTOR).

WITNESSETH:

WHEREAS, PIRNIE has entered into an agreement with the U.S. Army Corps of Engineers, Baltimore District, (hereinafter called CLIENT) to provide technical, professional, and construction services for the Permeable Reaction Wall Pilot System Construction (hereinafter called Project);

WHEREAS, CONTRACTOR represents that it has the expertise, knowledge, ability and is qualified to render certain construction and related services;

WHEREAS, PIRNIE desires to employ CONTRACTOR to render certain construction and related services in connection with the Project;

WHEREAS, CONTRACTOR is willing to provide such construction and related services under the terms and conditions contained herein;

NOW, THEREFORE, in consideration of these premises and of the mutual promises, covenants and agreements hereinafter set forth, PIRNIE and CONTRACTOR agree as follows:

ARTICLE 1 - CONTRACTOR AS AN INDEPENDENT CONTRACTOR

- 1.1 CONTRACTOR shall perform the Work as an independent contractor with exclusive control of the means, methods, techniques, sequences and procedures of performing the Work, and the safety precautions and programs incident to performing the Work, all in accordance with the Contract Documents. CONTRACTOR has no authority to act or make any agreements or representations on behalf of PIRNIE or the CLIENT, and no contractual relationship exists between CONTRACTOR and the CLIENT. This Agreement is not intended to create, and shall not be construed as creating, between PIRNIE and CONTRACTOR, the relationship of principal and agent, joint venturers, co-partners or any other such relationship, the existence of which is hereby expressly denied. No employee, Subcontractor or agent engaged by CONTRACTOR shall be, or shall be deemed to be, an employee, Subcontractor or agent of PIRNIE.

ARTICLE 2 - WORK

- 2.1 CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents for the Watervliet Arsenal, Permeable Reaction Wall Pilot System Construction, General Contract in complete accordance with the Contract Documents. The Work under the Contract Documents is generally described in Section 01010 of the General Requirements.

ARTICLE 3 - CONTRACT DOCUMENTS

- 3.1 The Contract Documents are defined in the General Conditions. The Contract Documents, which comprise the entire agreement between PIRNIE and CONTRACTOR are attached to this Agreement and are made a part hereof.
- 3.2 Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon PIRNIE and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

ARTICLE 4 - ENGINEER - NOT USED

ARTICLE 5 - CONTRACT TIMES

- 5.1 The Work will be substantially completed on or before _____ and completed and ready for final payment in accordance with paragraph 14.11 of the General Conditions on or before _____.

ARTICLE 6 - LIQUIDATED AND SPECIAL DAMAGES

- 6.1 Liquidated Damages:
- A. PIRNIE and CONTRACTOR recognize that time is of the essence of this Agreement and that PIRNIE will suffer financial loss if the Work is not completed within the times specified in Article 5 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by PIRNIE if the Work is not completed on time. Accordingly, instead of requiring any such proof, PIRNIE and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay PIRNIE \$500.00 for each day that expires after the time specified in Article 5 for Substantial Completion (adjusted for any extensions thereof made in accordance with Article 12 of the General Conditions) until the Work is substantially complete.

6.2 Special Damages:

- A. In addition to the amount provided for liquidated damages, CONTRACTOR shall pay PIRNIE the actual costs reasonably incurred by PIRNIE for engineering and inspection forces employed on the Work for each day that expires after the time specified in Article 5 for Substantial Completion (adjusted for any extensions thereof made in accordance with Article 12 of the General Conditions) until the Work is substantially complete.
- B. After Substantial Completion, if CONTRACTOR shall neglect, refuse or fail to complete the remaining Work within the time specified in Article 5 for completion and readiness for final payment or any proper extension thereof granted by PIRNIE, CONTRACTOR shall pay PIRNIE the actual costs reasonably incurred by PIRNIE for engineering and inspection forces employed on the Work for each day that expires after the time specified in Article 5 for completion and readiness for final payment (adjusted for any extensions thereof made in accordance with Article 12 of the General Conditions) until the Work is completed and ready for final payment.

- 6.3 PIRNIE may deduct the amount of liquidated damages and special damages from monies due CONTRACTOR under this Agreement.

ARTICLE 7 - CONTRACT PRICE

- 7.1 PIRNIE shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents the prices stipulated in CONTRACTOR'S Bid, which Bid is attached hereto and identified as Exhibit 1 of this Agreement.
- 7.2 As provided in paragraph 11.9 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by PIRNIE as provided in paragraph 9.10 of the General Conditions. CONTRACTOR warrants that unit prices have been computed as provided in paragraph 11.9.2 of the General Conditions.

ARTICLE 8 - PAYMENT PROCEDURES

- 8.1 CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed as provided in the General Conditions.
- 8.2 Progress Payments:
 - A. PIRNIE shall make progress payments on account of the Contract Price on the basis of CONTRACTOR'S Applications for Payment and as provided in Article 14 of the General Conditions. CONTRACTOR'S Applications for Payment will be due on the

last day of the month. All progress payments will be on the basis of the progress of the Work measured by the schedule of values provided for in paragraph 2.9 of the General Conditions (and in the case of Work performed on the basis of unit prices, based on the number of units completed). A progress payment will not be made whenever the value of the Work completed since the last previous progress payment is less than \$5,000.00.

1. Prior to Substantial Completion, progress payments will be in the amount of 95 percent of the Work completed, and of the materials and equipment not incorporated into the Work but suitably stored, less the aggregate of payments previously made.
2. Prior to Substantial Completion, progress payments will be in the amount of 90 percent of the Work completed, and of materials and equipment not incorporated into the Work but suitably stored, less the aggregate of payments previously made, until 50 percent of the total value of the Work has been completed. Thereafter, progress payments will be in the amount of 95 percent of the subsequent value of the Work completed, less the aggregate of payments previously made.
3. Upon Substantial Completion, PIRNIE shall pay an amount sufficient to increase total payments to CONTRACTOR to 100 percent of the Contract Price, less such amounts as PIRNIE or CLIENT shall determine in accordance with paragraph 14.5 of the General Conditions.

8.3 Final Payment:

- A. Upon final completion and acceptance of the Work in accordance with paragraph 14.11 of the General Conditions, PIRNIE shall pay the remainder of the Contract Price as determined by PIRNIE in accordance with said paragraph 14.11.

ARTICLE 9 - INTEREST

- 9.1 Any interest received by PIRNIE from CLIENT for late progress payments or retainages will be shared with CONTRACTOR on a pro rata basis.

ARTICLE 10 - CONTRACTOR'S REPRESENTATIONS

- 10.1 As part of the inducement for PIRNIE to enter into this Agreement, CONTRACTOR makes the following representations:
 - A. CONTRACTOR has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
 - B. CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect costs, progress, performance or furnishing of the Work.

- C. CONTRACTOR is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- D. CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto. CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.
- E. CONTRACTOR is aware of the general nature of work to be performed by CLIENT or PIRNIE and others at the site that relates to the Work as indicated in the Contract Documents.
- F. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.
- G. CONTRACTOR has given PIRNIE written notice of all conflicts, errors, ambiguities or discrepancies that CONTRACTOR has discovered in the Contract Documents and written resolution thereof by PIRNIE is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 11 - DRAWINGS AND ADDENDA

- 11.1 The Drawings comprise a set entitled "Watervliet Arsenal, Permeable Reaction Wall Pilot System Construction", dated September, 1998, and include the following:

Title Sheet
Sheets 1 to 2, inclusive

11.2 Addenda consisting of Numbers ____ to ____, inclusive.

ARTICLE 12 - MISCELLANEOUS

12.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

12.2 No assignment or transfer by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned or transferred without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment or transfer, no assignment or transfer will release or discharge the assignor from any duty or responsibility under the Contract Documents.

12.3 PIRNIE and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, and its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

12.4 No waiver by either party of any default by the other party in the performance of any provision of this Agreement will operate as or be construed as a waiver of any future default whether like or different in character.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first written above.

This Agreement will be effective on _____, 19_____.

PIRNIE _____

CONTRACTOR _____

By _____

By _____

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest _____

Attest _____

Address for giving notices

Address for giving notices

License No. _____

Agent for service of process: _____

(If CONTRACTOR is a corporation,
attach evidence of authority to
sign.)

+ + END OF AGREEMENT + +

GENERAL CONDITIONS

TABLE OF ARTICLES

1. Definitions
2. Preliminary Matters
3. Contract Documents: Intent, Amending, Reuse
4. Availability of Lands; Subsurface and Physical Conditions; Reference Points
5. Bonds and Insurance
6. Contractor's Responsibilities
7. Other Work
8. Client's Responsibilities
9. PIRNIE's Responsibilities
10. Changes in the Work; Claims
11. Change of Contract Price
12. Change of Contract Times
13. Tests and Inspections; Correction, Removal or Acceptance of *Defective* Work
14. Payments to Contractor and Completion
15. Suspension of Work and Termination
16. Dispute Resolution
17. Miscellaneous

ARTICLE 1-DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Addenda—Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the Contract Documents.

Agreement—The written contract between PIRNIE and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

Application for Payment—The form accepted by PIRNIE which is to be used by CONTRACTOR in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

Asbestos—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

Bid—The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

Bidding Documents—The advertisement or invitation to Bid, instructions to bidders, the Bid form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

Bidding Requirements—The advertisement or invitation to Bid, instructions to bidders, and the Bid form.

Bonds—Performance and Payment bonds and other instruments of security.

Change Order—A document which is signed by PIRNIE and CONTRACTOR and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

CLIENT—The public body or authority, corporation, association, firm or person with whom PIRNIE has entered into an agreement for work associated with the Project.

Contract Documents—The Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders and PIRNIE's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Shop Drawing submittals approved pursuant to paragraphs 6.27 and 6.28 and the reports and drawings referred to in paragraph 4.2.1 are not Contract Documents.

Contract Price—The moneys payable by PIRNIE to CONTRACTOR for completion of the Work in accordance with the Contract Documents.

Contract Times—The numbers of days or the dates stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the Work so that it is ready for final payment as evidenced by PIRNIE's and CLIENT's written acceptance thereof.

CONTRACTOR—The person, firm or corporation with whom PIRNIE has entered into the Agreement.

Defective—An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to PIRNIE's and CLIENT's acceptance thereof.

Drawings—The drawings which show the scope, extent and character of the Work to be furnished and performed by CONTRACTOR and which have been prepared or approved by PIRNIE and are referred to in the Contract Documents.

Effective Date of the Agreement—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

Field Order—A written order issued by PIRNIE which orders minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

General Requirements—Sections of Division 1 of the Specifications.

Hazardous Waste—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

Laws and Regulations; Laws or Regulations—Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.

Liens—Liens, charges, security interests or encumbrances upon real property or personal property.

Milestone—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

Notice of Award—The written notice by PIRNIE to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, PIRNIE will sign and deliver the Agreement.

Notice to Proceed—A written notice given by PIRNIE to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR's obligations under the Contract Documents.

Partial Utilization—Use by PIRNIE or CLIENT of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

PCBs—Polychlorinated biphenyls.

Petroleum—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.

PIRNIE—The party with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

Project—The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

Radioactive Material—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

Resident Project Representative—The authorized representative of PIRNIE who may be assigned to the site or any part thereof.

Samples—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

Shop Drawings—All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

Specifications—Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

Subcontractor—An individual firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion—The Work (or a specified part thereof) has progressed to the point where, in the opinion of PIRNIE as evidenced by PIRNIE's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents so that the Work (or specified part) can be utilized for the purposes intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

Supplementary Conditions—The part of the Contract Documents which amends or supplements these General Conditions.

Supplier—A manufacturer, fabricator, supplier, distributor, materialman or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

Underground Facilities—All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television,

sewage and drainage removal, traffic or other control systems or water.

Unit Price Work—Work to be paid for on the basis of unit prices.

Work—The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

Work Change Directive—A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by PIRNIE, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed. A Work Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

Written Amendment—A written amendment of the Contract Documents, signed by PIRNIE and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

ARTICLE 2—PRELIMINARY MATTERS

Delivery of Bonds:

2.1. When CONTRACTOR delivers the executed Agreements to PIRNIE, CONTRACTOR shall also deliver such Bonds as CONTRACTOR may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

2.2. PIRNIE shall furnish to CONTRACTOR up to ten copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents as are reasonably

necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Times; Notice to Proceed:

2.3. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement. Unless otherwise agreed by PIRNIE and CONTRACTOR, the Contract Times will commence to run no later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

Starting the Work:

2.4. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run.

Before Starting Construction:

2.5. Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to PIRNIE any conflict, error, ambiguity or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from PIRNIE before proceeding with any Work affected thereby.

2.6. Within ten days after the commencement of the Contract Times, CONTRACTOR shall submit to PIRNIE for review:

2.6.1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2.6.2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;

2.6.3. a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the

Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.7. Before any Work at the site is started, CONTRACTOR shall deliver to PIRNIE, with copies to each additional insured, certificates of insurance which CONTRACTOR is required to purchase and maintain.

Preconstruction Conference:

2.8. Within twenty days after the Contract Times start to run, but before any Work at the site is started, a conference attended by CONTRACTOR, PIRNIE and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.6, procedures for handling Shop Drawings and other submittals, processing Applications for Payment and maintaining required records.

Initially Acceptable Schedules:

2.9. At least ten days before submission of the first Application for Payment, a conference attended by CONTRACTOR, PIRNIE and others as appropriate will be held to review, for acceptability to PIRNIE, the schedules submitted in accordance with paragraph 2.6. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. The progress schedule will be acceptable to PIRNIE as providing an orderly progression of the Work to completion within any specified Milestones and the Contract Times, but such acceptance will neither impose on PIRNIE responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor. CONTRACTOR's schedule of Shop Drawing and Sample submissions will be acceptable to PIRNIE as providing a workable arrangement for reviewing and processing the required submittals. CONTRACTOR's schedule of values will be acceptable to PIRNIE as to form and substance. No progress payment shall be made to CONTRACTOR until the schedules are submitted to and are acceptable to PIRNIE.

ARTICLE 3-CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

Intent:

3.1. The Contract Documents comprise the entire agreement between PIRNIE and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

3.2. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and interpretations of the Contract Documents shall be issued by PIRNIE as provided in paragraph 9.4.

3.3. Reference to Standards and Specifications of Technical Societies; Reporting and Resolving Discrepancies:

3.3.1. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

3.3.2. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier referred to in

paragraph 6.6, CONTRACTOR shall report it to PIRNIE in writing at once, and, CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as authorized by paragraph 6.24) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.5 or 3.6.

3.3.3. Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by one of the methods indicated in paragraph 3.5 or 3.6, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity or discrepancy between the provisions of the Contract Documents and:

3.3.3.1. the provisions of any such standard, specification, manual, code or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

3.3.3.2. the provisions of any such Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

No provision of any such standard, specification, manual, code or instruction shall be effective to change the duties and responsibilities of CONTRACTOR or PIRNIE, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to PIRNIE or any of PIRNIE's consultants, agents or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.4. Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgement of PIRNIE as to the Work, it is intended that such requirements, direction, review or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there

is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to PIRNIE any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.13 or any other provision of the Contract Documents.

Amending and Supplementing Contract Documents:

3.5. The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

3.5.1. a formal Written Amendment,

3.5.2. a Change Order, or

3.5.3. a Work Change Directive (pursuant to paragraph 10.1).

3.6. In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

3.6.1. a Field Order (pursuant to paragraph 9.5),

3.6.2. PIRNIE's approval of a Shop Drawing or Sample (pursuant to paragraphs 6.27 and 6.28), or

3.6.3. PIRNIE's written interpretation or clarification (pursuant to paragraph 9.4).

Reuse of Documents:

3.7. CONTRACTOR, and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with CLIENT or PIRNIE (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of PIRNIE and (ii) shall not reuse any of such Drawings, Specifications, other documents or copies on extensions of the Project or any other project without written consent of and specific written verification or adaption by PIRNIE.

ARTICLE 4-AVAILABILITY OF LANDS; SUB-SURFACE AND PHYSICAL CONDITIONS: REFERENCE POINTS

Availability of Lands:

4.1. CLIENT shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. CLIENT shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which CONTRACTOR will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by CLIENT, unless otherwise provided in the Contract Documents. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2. *Subsurface and Physical Conditions:*

4.2.1. *Reports and Drawings:* Reference is made to the Supplementary Conditions for identification of:

4.2.1.1. *Subsurface Conditions:* Those reports of explorations and tests of subsurface conditions at or contiguous to the site that have been utilized by PIRNIE in preparing the Contract Documents; and

4.2.1.2. *Physical Conditions:* Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) that have been utilized by PIRNIE in preparing the Contract Documents.

4.2.2. *Limited Reliance by CONTRACTOR Authorized; Technical Data:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data", CONTRACTOR may not rely upon or make any claim against PIRNIE or any of PIRNIE's consultants, agents or employees with respect to:

4.2.2.1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto, or

4.2.2.2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings, or

4.2.2.3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information.

4.2.3. *Notice of Differing Subsurface or Physical Conditions:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the site that is uncovered or revealed either:

4.2.3.1. is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.2.2 is materially inaccurate, or

4.2.3.2. is of such a nature as to require a change in the Contract Documents, or

4.2.3.3. differs materially from that shown or indicated in the Contract Documents, or

4.2.3.4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then

CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.24), notify PIRNIE in writing about such condition. CONTRACTOR shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

4.2.4. *PIRNIE's Review:* PIRNIE will promptly review the pertinent conditions, determine the necessity of obtaining additional exploration or tests with respect thereto and advise CONTRACTOR in writing of PIRNIE's findings and conclusions.

4.2.5. *Possible Contract Documents Change:* If PIRNIE concludes that a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in paragraph 4.2.3, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.

4.2.6. *Possible Price and Times Adjustments:* An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such uncovered or revealed condition causes an increase or decrease in CONTRACTOR's cost of, or time required for performance of, the Work; subject, however, to the following:

4.2.6.1. such condition must meet any one or more of the categories described in paragraphs 4.2.3.1 through 4.2.3.4, inclusive;

4.2.6.2. a change in the Contract Documents pursuant to paragraph 4.2.5 will not be an automatic authorization of nor a condition precedent to entitlement to any such adjustment;

4.2.6.3. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.10 and 11.9; and

4.2.6.4. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Times if;

4.2.6.4.1. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to PIRNIE in respect of Contract Times and Contract Price by the submission of a bid or becoming bound under a negotiated contract; or

4.2.6.4.2. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test or study of the site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

4.2.6.4.3. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.2.3.

CLIENT, PIRNIE and PIRNIE's consultants, and their officers, directors, employees and agents shall not be liable to CONTRACTOR for any claims, costs, losses or damages sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.3. Physical Conditions--Underground Facilities:

4.3.1. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to PIRNIE by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

4.3.1.1. PIRNIE shall not be responsible for the accuracy or completeness of any such information or data; and

4.3.1.2. The cost of all of the following will be included in the Contract Price and CONTRACTOR shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities as provided in paragraph 6.21 and repairing any damage thereto resulting from the Work.

4.3.2. *Not Shown or Indicated:* If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.24), identify the owner of such Underground Facility and give written notice to that owner and to PIRNIE. PIRNIE will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the Underground Facility. If PIRNIE concludes that a

change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document such consequences. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.21. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. PIRNIE and PIRNIE's consultants, agents or employees shall not be liable to CONTRACTOR for any claims, costs, losses or damages incurred or sustained by CONTRACTOR on or in connection with any other project or anticipated project.

Reference Points:

4.4. PIRNIE shall provide engineering surveys to establish reference points for construction which in PIRNIE's judgement are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of PIRNIE. CONTRACTOR shall report to PIRNIE whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 5--BONDS AND INSURANCE

Performance, Payment and Other Bonds:

5.1. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall furnish Performance and Payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents.

CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

5.2. If the surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1, CONTRACTOR shall within ten days thereafter substitute another Bond and surety, both of which must be acceptable to PIRNIE.

5.3. Licensed Sureties and Insurers; Certificates of Insurance:

5.3.1. All Bonds and insurance required by the Contract Documents to be purchased and maintained by CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.3.2. CONTRACTOR shall deliver to PIRNIE, with copies to each additional insured, certificates of insurance (and other evidence of insurance requested by PIRNIE) which CONTRACTOR is required to purchase and maintain in accordance with paragraph 5.4.

CONTRACTOR's Liability Insurance:

5.4. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance and furnishing of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or

indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

5.4.1. claims under workers' compensation, disability benefits and other similar employee benefit acts;

5.4.2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

5.4.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

5.4.4. claims for damages because of personal injury sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5.4.5. claims for damages, other than to the Work itself, because of injury to or destruction of property wherever located, including loss of use resulting therefrom; and

5.4.6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

The policies of insurance so required by paragraph 5.4 to be purchased and maintained shall:

5.4.7. with respect to insurance required by paragraphs 5.4.1 and 5.4.2, contain provisions to the effect that in the event of any loss the insurers will have no rights of recovery against CLIENT or PIRNIE or any other persons or entities identified in the Supplementary Conditions;

5.4.8. with respect to insurance required by paragraphs 5.4.3 through 5.4.6 inclusive, include as additional insureds CLIENT and PIRNIE and any other persons or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers and employees of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

5.4.9. include the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

5.4.10. include completed operations insurance;

5.4.11. include contractual liability insurance, covering CONTRACTOR's indemnity obligations under paragraphs 6.13, 6.17 and 6.32 through 6.34;

5.4.12. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to CLIENT and PIRNIE and to each other additional insured identified in the Supplementary Conditions (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.3.2 will so provide);

5.4.13. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing *defective* Work; and

5.4.14. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish CLIENT, PIRNIE and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to PIRNIE and CLIENT of continuation of such insurance at final payment and one year thereafter).

ARTICLE 6-CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

6.1. CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

6.2. CONTRACTOR shall keep on the Work at all times during its progress a competent resident supervisor, who shall be acceptable to PIRNIE and shall not be replaced without written consent of PIRNIE except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials and Equipment:

6.3. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without the written consent of PIRNIE.

6.4. CONTRACTOR shall not employ workers or work methods which may cause strikes, work stoppages or any disturbance by workers employed by CONTRACTOR, a Subcontractor, PIRNIE, CLIENT or by any of their contractors or subcontractors. In the event of any actual or threatened labor dispute or delay, CONTRACTOR shall immediately give PIRNIE notice thereof, and shall take such actions as reasonably may be required to avoid delays to the Work. CONTRACTOR shall comply will all Laws and Regulations regarding the employment of labor on the site and shall indemnify and hold PIRNIE harmless against any liability for its failure to so comply.

6.5. Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

6.6. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents and shall be fit, merchantable and suitable for

the purpose intended. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of PIRNIE (or to the CLIENT if directed by PIRNIE.) If required by PIRNIE, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

Progress Schedule:

6.7. CONTRACTOR shall maintain material deliveries and employ sufficient workers and equipment to adhere to the progress schedule established in accordance with paragraph 2.9 as it may be adjusted from time to time as provided below:

6.7.1. CONTRACTOR shall submit to PIRNIE on the twentieth day of each month, a summary report of the progress of the various parts of the Work, stating the existing status, rate of progress, estimated time of completion, and the cause of any existing or anticipated delay, if any.

6.7.2. If, in the opinion of PIRNIE, CONTRACTOR falls behind schedule, PIRNIE shall have the right to reasonably require CONTRACTOR to increase the work force, days of work, or the hours of work per day, or to use additional plant or equipment, or to take such other steps as may be necessary or required to ensure completion of the Work in accordance with the original schedule, all without any additional cost to PIRNIE.

6.7.3. The CONTRACTOR shall remain on such accelerated work schedule until such time as, in the opinion of PIRNIE, the degree of completion of the Work complies with the original schedule.

6.7.4. Failure to comply with such an accelerated work schedule may result in no further monthly progress payments until such time as the degree of completion of the Work complies with the original schedule or a revised schedule has been accepted by PIRNIE.

6.7.5. Notwithstanding the requirements of paragraph 6.7.1, PIRNIE shall be notified in writing of any actual or anticipated departure from the original or accepted

revised schedule within twenty-four hours from the time CONTRACTOR knows or has reason to know of such a departure.

Substitutes and "Or-Equal" Items:

6.8.1. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by PIRNIE under the following circumstances:

6.8.1.1. *"Or-Equal"*: If in PIRNIE's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by PIRNIE as an "or-equal" item, in which case review and approval of the proposed item may, in PIRNIE's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

6.8.1.2. *Substitute Items*: If in PIRNIE's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under subparagraph 6.8.1.1, it will be considered a proposed substitute item. CONTRACTOR shall submit sufficient information as provided below to allow PIRNIE to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. The procedure for review by the PIRNIE will include the following as supplemented in the General Requirements and as PIRNIE may decide is appropriate under the circumstances. Requests for review of proposed substitute items of material or equipment will not be accepted by PIRNIE from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall first make written application to PIRNIE for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified

and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with CLIENT for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by PIRNIE in evaluating the proposed substitute. PIRNIE may require CONTRACTOR to furnish additional data about the proposed substitute.

6.8.1.3. *CONTRACTOR's Expense:* All data to be provided by CONTRACTOR in support of any proposed "or-equal" or substitute item will be at CONTRACTOR's expense.

6.8.2. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to PIRNIE. CONTRACTOR shall submit sufficient information to allow PIRNIE, in PIRNIE's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by PIRNIE will be similar to that provided in subparagraph 6.8.1.2.

6.8.3. *PIRNIE's Evaluation:* PIRNIE will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.8.1.2 and 6.8.2. PIRNIE will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized without PIRNIE's prior written acceptance which

will be evidenced by either a Change Order or an approved Shop Drawing. PIRNIE may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any "or-equal" or substitute. PIRNIE will record time required by PIRNIE and PIRNIE's consultants in evaluating substitutes proposed or submitted by CONTRACTOR pursuant to paragraphs 6.8.1.2 and 6.8.2 and in making changes in the Contract Documents (or in the provisions of any other direct contract with PIRNIE for work on the Project) occasioned thereby. Whether or not PIRNIE accepts a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse PIRNIE for the charges of PIRNIE and PIRNIE's consultants for evaluating each such proposed substitute item.

Concerning Subcontractors, Suppliers and Others:

6.9.1. CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to PIRNIE as indicated in paragraph 6.9.2), whether initially or as a substitute, against whom PIRNIE may have reasonable objection.

6.9.2. If the Supplementary Conditions require the identity of Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials or equipment) to be submitted to PIRNIE in advance of the specified date prior to the Effective Date of the Agreement for acceptance by PIRNIE, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, PIRNIE's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be adjusted by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by PIRNIE of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of PIRNIE to reject *defective Work*.

6.10.1. CONTRACTOR shall be fully responsible to PIRNIE for all acts and omissions of the Subcontractors,

Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between PIRNIE and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of PIRNIE to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

6.10.2. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR. CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the PIRNIE through CONTRACTOR.

6.11. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

6.12. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of PIRNIE.

Patent Fees and Royalties:

6.13. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of PIRNIE its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to

others, the existence of such rights shall be disclosed in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless CLIENT, PIRNIE, and its officers, directors, employees, and agents from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents.

Permits:

6.14. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. CONTRACTOR shall pay all government charges and inspection fees necessary for the prosecution of the Work.

Laws and Regulations:

6.15.1. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither CLIENT nor PIRNIE shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

6.15.2. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses and damages caused by, arising out of or resulting therefrom.

Taxes:

6.16. CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

Use of Premises:

6.17. CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and

other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless CLIENT and PIRNIE and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against CLIENT, PIRNIE or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

6.18. During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials, and shall leave the site clean and ready for occupancy at Substantial Completion of the Work. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

6.19. CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Record Documents:

6.20. CONTRACTOR shall maintain at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications in good order and annotated to show all changes made during construction. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered to PIRNIE for CLIENT.

Safety and Protection:

6.21. CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.21.1. all persons on the Work site or who may be affected by the Work;

6.21.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

6.21.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.21.2 or 6.21.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of PIRNIE or PIRNIE's consultants or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and PIRNIE has issued a notice to CONTRACTOR in accordance with

paragraph 14.11 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

Safety Representative:

6.22. CONTRACTOR shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

CONTRACTOR's safety representative shall promptly report to PIRNIE in writing all accidents arising out of or in connection with the Work, whether on or adjacent to the site of the Work, which result in death, injury, or property damage, giving full details and statements of witnesses. In addition, if death or serious injury to persons or serious damage to property occurs, CONTRACTOR's safety representative shall report such event immediately to PIRNIE.

Hazard Communication Programs:

6.23. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with Laws or Regulations.

Emergencies:

6.24. In emergencies threatening the release of toxic or hazardous materials or affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from PIRNIE, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give PIRNIE immediate verbal notice of the actions taken. Said verbal notice shall be followed promptly by a written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If PIRNIE determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

6.25. Shop Drawings and Samples:

6.25.1. CONTRACTOR shall submit Shop Drawings to PIRNIE for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see paragraph 2.9). All submittals will be identified as PIRNIE may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show PIRNIE the material and equipment CONTRACTOR proposes to provide and to enable PIRNIE to review the information for the limited purposes required by paragraph 6.27.

6.25.2. CONTRACTOR shall also submit Samples to PIRNIE for review and approval in accordance with said accepted schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as PIRNIE may require to enable PIRNIE to review the submittal for the limited purposes required by paragraph 6.27. The numbers of each Sample to be submitted will be as specified in the Specifications.

6.26. Submittal Procedures:

6.26.1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

6.26.1.1. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers and similar information with respect thereto,

6.26.1.2. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and

6.26.1.3. all information relative to CONTRACTOR's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other

Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

6.26.2. Each submittal will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR'S review and approval of that submittal.

6.26.3. At the time of each submission, CONTRACTOR shall give PIRNIE specific written notice of such variations, if any that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to PIRNIE for review and approval of each such variation.

6.27. PIRNIE will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by PIRNIE as required by paragraph 2.9. PIRNIE's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. PIRNIE's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by PIRNIE, and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by PIRNIE on previous submittals.

6.28. PIRNIE's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called PIRNIE's attention to each such variation at the time of submission as required by paragraph 6.26.3 and PIRNIE's

has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by PIRNIE relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.26.1.

6.29. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions required by paragraph 2.9, any related Work performed prior to PIRNIE's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

Continuing the Work:

6.30. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with PIRNIE. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or as PIRNIE and CONTRACTOR may otherwise agree in writing.

6.31. CONTRACTOR's General Warranty and Guarantee:

6.31.1. CONTRACTOR warrants and guarantees to CLIENT and PIRNIE that all Work will be in accordance with the Contract Documents and will not be *defective*. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

6.31.1.1. abuse, modification or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors or Suppliers; or

6.31.1.2. normal wear and tear under normal usage.

6.31.2. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

6.31.2.1. observations by PIRNIE;

6.31.2.2. the making of any progress or final payment by PIRNIE;

6.31.2.3. the issuance of a certificate of Substantial Completion or the issuance of a notice of acceptability by PIRNIE pursuant to paragraph 14.11;

6.31.2.4. use or occupancy of the Work or any part thereof by PIRNIE or CLIENT;

6.31.2.5. any acceptance by PIRNIE or CLIENT or any failure to do so;

6.31.2.6. any review and approval of a Shop Drawing or Sample submittal;

6.31.2.7. any inspection, test or approval by others; or

6.31.2.8. any correction of *defective* Work by PIRNIE or CLIENT.

Indemnification:

6.32. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless CLIENT, PIRNIE, and PIRNIE's consultants and the officers, directors, employees, agents and other consultants of each and any of them as set forth in the Supplementary Conditions.

6.33. In any and all claims against CLIENT or PIRNIE or any of their respective consultants, agents, officers, directors or employees the indemnification obligation under paragraph 6.32 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.34. The indemnification obligations of CONTRACTOR under paragraph 6.32 shall not extend to the liability of PIRNIE and PIRNIE's consultants, officers, directors, employees or agents caused by their negligent preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications.

Survival of Obligations:

6.35. All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing

obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

ARTICLE 7-OTHER WORK

Related Work at Site:

7.1. CLIENT may perform other work related to the Project at the site by CLIENT's own forces or have other work performed by utility owners, or PIRNIE may perform other work related to the Project at the site by PIRNIE's own forces, or PIRNIE may let other direct contracts therefor which shall contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents, then: (i) written notice thereof will be given to CONTRACTOR prior to starting any such other work, and (ii) CONTRACTOR may make a claim therefor as provided in Articles 11 and 12 if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or requires additional time.

7.2. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and CLIENT or PIRNIE, if CLIENT or PIRNIE is performing the additional work with their employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of PIRNIE and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between CLIENT or PIRNIE and such utility owners and other contractors.

7.3. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by

others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to PIRNIE in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent or nonapparent defects and deficiencies in such other work.

Coordination:

7.4. If CLIENT or PIRNIE contracts with others for the performance of other work on the Project at the site, PIRNIE will have authority and responsibility for coordination of the activities among the various prime contractors.

ARTICLE 8-CLIENT'S RESPONSIBILITIES

8.1. CLIENT shall issue all communications to CONTRACTOR, if any, through PIRNIE.

8.2. CLIENT's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4.

8.3. The CLIENT shall not supervise, direct or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. CLIENT will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

ARTICLE 9--PIRNIE'S RESPONSIBILITIES

CLIENT'S Representative:

9.1. PIRNIE will be CLIENT's representative during the construction period. The duties and responsibilities and the limitations of authority of PIRNIE as CLIENT's representative during construction are set forth in the

Contract Documents and shall not be extended without written consent of CLIENT and PIRNIE

Visits to Site:

9.2. PIRNIE will make visits to the site at intervals appropriate to the various stages of construction as PIRNIE deems necessary in order to observe the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work, and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. During or as a result of PIRNIE's on-site visits or observations of CONTRACTOR's Work, PIRNIE will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the or Performance of the Work. PIRNIE's observations of the Work will not relieve CONTRACTOR of its obligations to conduct its own comprehensive inspections of the Work or to perform the Work in accordance with the Contract Documents.

Project Representative:

9.3. PIRNIE may furnish a Resident Project Representative to assist PIRNIE in providing more continuous observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.13, which may be supplemented in the Supplementary Conditions.

Clarifications and Interpretations:

9.4. PIRNIE will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as PIRNIE may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. Such written clarifications and interpretations will be binding on CONTRACTOR. If CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Times, CONTRACTOR may make a written claim therefor as provided in Article 11 or Article 12.

Authorized Variations in Work:

9.5. PIRNIE may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on CONTRACTOR who shall perform the Work involved promptly. If CONTRACTOR believes that a Field Order justifies an adjustment in the Contract Price or the Contract Times, CONTRACTOR may make a written claim therefor as provided in Article 11 or 12.

Rejecting Defective Work:

9.6. PIRNIE will have authority to disapprove or reject Work which PIRNIE believes to be *defective*, or that PIRNIE believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. PIRNIE will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or completed. Failure of PIRNIE to reject *defective* Work or the inclusion of payment for *defective* Work in a progress payment will not constitute acceptance of said *defective* Work.

Shop Drawings, Change Orders and Payments:

9.7. In connection with PIRNIE's authority as to Shop Drawings and Samples, see paragraphs 6.25 through 6.29 inclusive.

9.8. In connection with PIRNIE's authority as to Change Orders, see Articles 10, 11, and 12.

9.9. In connection with PIRNIE's authority as to Applications for Payment, see Article 14.

Determinations for Unit Prices:

9.10. PIRNIE will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. PIRNIE's preliminary determinations on such matters will be reviewed with CONTRACTOR before rendering a written decision thereon (by recommendation of

an Application for Payment or otherwise). PIRNIE's written decision thereon will be final and binding upon CONTRACTOR.

Decisions on Disputes:

9.11. PIRNIE will be the interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Times shall be submitted to PIRNIE in writing with a request for a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter shall be delivered to PIRNIE promptly (but in no event later than seven days) after the start of the occurrence or event giving rise thereto, and written supporting data shall be submitted to PIRNIE within seven days after the event giving rise to claim has been remedied (unless PIRNIE allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter.) PIRNIE will render a formal decision in writing within thirty days after receipt of the written supporting data. PIRNIE's written decision on such claim, dispute or other matter will be final and binding upon CONTRACTOR unless: (i) an appeal from PIRNIE's decision is taken within the time limits and in accordance with the procedures set forth in any dispute resolution agreement entered into between PIRNIE and CONTRACTOR pursuant to Article 16, or (ii) if no such dispute resolution agreement has been entered into, a written notice of intention to appeal from PIRNIE's written decision is delivered by CONTRACTOR to PIRNIE within thirty days after the date of such decision and a formal proceeding is instituted by CONTRACTOR in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty days of the date of such decision, unless otherwise agreed in writing by PIRNIE and CONTRACTOR.

9.12. The rendering of a decision by PIRNIE pursuant to paragraphs 9.10 or 9.11 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.12) will be a condition precedent to any exercise of such rights or remedies CONTRACTOR may

otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter.

9.13. *Limitations on PIRNIE's Responsibilities:*

9.13.1. Neither PIRNIE's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by PIRNIE in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by PIRNIE shall create, impose or give rise to any duty owed by PIRNIE to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them.

9.13.2. PIRNIE will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. PIRNIE will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

9.13.3. PIRNIE will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9.13.4. The limitations and responsibility set forth in this paragraph 9.13 shall also apply to the Resident Project Representative and assistants, and to PIRNIE's consultants, agents or employees.

ARTICLE 10-CHANGES IN THE WORK; CLAIMS

10.1. Authorized Changes in the Work:

10.1.1. Without invalidating the Agreement and without notice to any surety, PIRNIE may, at any time or from time to time, order additions, deletions or revisions in the Work by the issuance of a Written Amendment, a Change Order, or a Work Change Directive. Such document will specify the addition, deletion or revision, and will specify the adjustment in the Contract Price or

Contract Times, if any, or the method by which such adjustment(s) will be determined. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

10.2. Unauthorized Changes in the Work:

10.2.1. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents, except in the case of an emergency as provided in paragraph 6.24 or in the case of uncovering Work as provided in paragraph 13.9.

10.3. Claims:

10.3.1. If PIRNIE and CONTRACTOR are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Times that should be allowed as a result of a Work Change Directive, a Change Order, a Written Amendment, or any other occurrence or event, a claim may be made therefor as provided herein.

10.3.2. Claims Relating to CLIENT:

10.3.2.1. For all claims for which CLIENT is or may be liable, CONTRACTOR shall prepare such claims in the manner provided in the CLIENT's contract documents for like claims by PIRNIE upon the CLIENT.

10.3.2.2. CONTRACTOR shall provide notice of such claims to PIRNIE in sufficient time to permit PIRNIE to comply with the notice requirements of the CLIENT's contract documents.

10.3.2.3. If PIRNIE believes that a CONTRACTOR's claim is reasonable and justified, PIRNIE may prosecute such claim in the name of PIRNIE. The amount received by PIRNIE from CLIENT in settlement of such claim, if any, will after deducting PIRNIE's costs thereof, be shared with CONTRACTOR on a pro rata basis.

10.3.2.4. If PIRNIE determines that a CONTRACTOR's claim is reasonable and justified,

and elects not to prosecute such claim, PIRNIE will permit CONTRACTOR to prosecute such claim, in the name of PIRNIE, for the use and benefit of the CONTRACTOR, in the manner provided in the CLIENT's contract documents for like claims by PIRNIE upon the CLIENT.

10.3.2.5. If CLIENT's contract documents do not include provisions for the making of claims upon CLIENT, CONTRACTOR shall make such claims as provided in paragraph 10.3.3.

10.3.3. Other Claims: CONTRACTOR shall make all other claims not included in paragraph 10.3.2 in the manner provided in Article 11 or Article 12.

10.4. If notice of any change affecting the general scope of the Work or the provisions of the Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11-CHANGE OF CONTRACT PRICE

11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at CONTRACTOR's expense without change in the Contract Price.

11.2. The Contract Price may only be changed by a Change Order or by a Written Amendment. Except as provided in paragraph 10.3.2, any claim for an adjustment in the Contract Price shall be based on written notice delivered by CONTRACTOR to PIRNIE promptly (but in no event later than seven days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered to PIRNIE within seven days after the event giving rise to the claim has been remedied (unless PIRNIE allows CONTRACTOR additional time to ascertain more accurate data in support of the claim) and shall be accompanied by a written statement that the adjustment claimed covers all known amounts to

which CONTRACTOR has reason to believe it is entitled as a result of said occurrence or event. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.

11.3. The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows:

11.3.1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.9.1 through 11.9.3, inclusive);

11.3.2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.6.2);

11.3.3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 11.3.2, on the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 11.6).

Cost of the Work:

11.4. The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by PIRNIE, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:

11.4.1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by PIRNIE and CONTRACTOR. Such employees shall include without limitation superintendents, foremen and other personnel employed full-time at the site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to salaries and wages plus the cost of fringe benefits which shall include social security contributions,

unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by PIRNIE.

11.4.2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless PIRNIE deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to PIRNIE. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to PIRNIE, and CONTRACTOR shall make provisions so that they may be obtained.

11.4.3. Payments made by CONTRACTOR to the Subcontractors for Work performed or furnished by Subcontractors. If required by PIRNIE, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to PIRNIE and CONTRACTOR and shall deliver such bids to PIRNIE who will then determine which bids, if any, will be accepted. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in paragraphs 11.4, 11.5, 11.6 and 11.7. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work, when agreed to by PIRNIE prior to incurring said costs.

11.4.5. Supplemental costs including the following:

11.4.5.1. The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

11.4.5.2. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities

at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR.

11.4.5.3. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by PIRNIE and the costs of transportation, loading, unloading, installation, dismantling and removal thereof-all in accordance with the terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4. Sales, consumer, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

11.4.5.5. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by PIRNIE or CLIENT, if any, as specified in the Supplementary Conditions), provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of PIRNIE or CLIENT. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee. If however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7. The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work.

11.5. The term Cost of the Work shall not include any of the following:

11.5.1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR's principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.4.1 or specifically covered by paragraph 11.4.4—all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

11.5.2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.

11.5.3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

11.5.4. Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 11.4.5.9 above).

11.5.5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

11.5.6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

11.6. The CONTRACTOR's fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

11.6.1. a mutually acceptable fixed fee; or

11.6.2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

11.6.2.1. for costs incurred under paragraphs 11.4.1 and 11.4.2, the CONTRACTOR's fee shall be fifteen percent;

11.6.2.2. for costs incurred under paragraph 11.4.3, the CONTRACTOR's fee shall be five percent;

11.6.2.3. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraphs 11.4.1, 11.4.2, 11.4.3 and 11.6.2 is that the Subcontractor who actually performs or furnishes the Work at whatever tier, will be paid a fee of fifteen percent of the costs incurred by such Subcontractor under paragraphs 11.4.1 and 11.4.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

11.6.2.4. no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5;

11.6.2.5. the amount of credit to be allowed by CONTRACTOR to PIRNIE for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five percent of such net decrease; and

11.6.2.6. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with paragraphs 11.6.2.1 through 11.6.2.5, inclusive.

11.7. Whenever the cost of any Work is to be determined pursuant to paragraphs 11.4 and 11.5, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to PIRNIE an itemized cost breakdown together with supporting data.

Cash Allowances:

11.8. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to PIRNIE. CONTRACTOR agrees that:

11.8.1. the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and

11.8.2. CONTRACTOR's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances and no demand for additional payment on account of any of the foregoing will be valid.

Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.9. Unit Price Work:

11.9.1. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by PIRNIE in accordance with paragraph 9.10.

11.9.2. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to

cover CONTRACTOR's overhead and profit for each separately identified item.

11.9.3. PIRNIE or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if:

11.9.3.1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

11.9.3.2. there is no corresponding adjustment with respect any other item of Work; and

11.9.3.3. if CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or PIRNIE believes that PIRNIE is entitled to a decrease in Contract Price.

ARTICLE 12-CHANGE OF CONTRACT TIMES

12.1. The Contract Times (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Times (or Milestones) shall be based on written notice delivered by CONTRACTOR to PIRNIE promptly (but in no event later than seven days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim including, without limitation, the cause and an estimate of the required adjustment of the Contract Times. Notice of the extent of the claim with supporting data shall be delivered to PIRNIE within seven days after the event giving rise to the claim has been remedied (unless PIRNIE allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by a written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of said occurrence or event. No claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

12.2. All time limits stated in the Contract Documents are of the essence of the Agreement.

12.3. If CONTRACTOR is delayed at any time in the progress of WORK by any act or neglect of CLIENT or PIRNIE or of any utility owner or other contractor performing work contemplated by Article 7, or by changes in the WORK, or by labor disputes, fire, unusual delay in transportation, unusually severe weather conditions, adverse soil conditions, unavoidable casualties, delays specifically authorized by PIRNIE, or by causes beyond the CONTRACTOR's control, avoidance, or mitigation, and without the fault or negligence of the CONTRACTOR or Subcontractor or Supplier, then the Contract Times shall be extended by Change Order for such reasonable times as PIRNIE shall determine that such event has delayed the Work if CONTRACTOR complies with the notice and documentation requirements set forth in paragraph 12.1.

12.4. The extension of Contract Times provided in paragraph 12.3 shall be the CONTRACTOR's sole remedy for any and all delays. No payment or compensation of any kind will be made to the CONTRACTOR for damages because of hindrance in the orderly progress of the Work or delay from any cause in the progress of the Work, whether such hindrances or delays be avoidable or unavoidable, reasonable or unreasonable, or contemplated or not contemplated by CONTRACTOR or PIRNIE. CONTRACTOR expressly agrees not to make, and hereby waives any claim for damages on account of any delay, obstruction, or hindrance for any cause whatsoever, including but not limited to the aforesaid causes and agrees that CONTRACTOR's sole right and remedy in the case of any delay shall be an extension of the time. Without limitation, PIRNIE's exercise of its rights under Article 10, regardless of the extent or number of such changes in the Work, shall not under any circumstances be construed as compensable delays, it being acknowledged that the Contract Price includes and anticipates any and all delays whatsoever from any cause, whether such delays be avoidable or unavoidable, reasonable or unreasonable, or contemplated or not contemplated by CONTRACTOR or PIRNIE.

ARTICLE 13-TESTS AND INSPECTIONS; CORRECTIONS, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1. *Notice of Defects:* Prompt notice of all *defective* Work of which PIRNIE has actual knowledge will be given

to CONTRACTOR. All *defective* Work may be rejected, corrected or accepted as provided in this Article 13.

Access to Work:

13.2. CLIENT and PIRNIE, other representatives and personnel of CLIENT and PIRNIE, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.

Tests and Inspections:

13.3. CONTRACTOR shall give PIRNIE timely notice of readiness of the Work for all required inspections, tests or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.4. PIRNIE shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

13.4.1. for inspections, tests or approvals covered by paragraph 13.5 below;

13.4.2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.9 below shall be paid as provided in said paragraph 13.9; and

13.4.3. as otherwise specifically provided in the Contract Documents.

13.5. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish PIRNIE the required certificates of inspection, or approval. CONTRACTOR shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for PIRNIE's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to

CONTRACTOR's purchase thereof for incorporation in the Work.

13.6. If any Work (or the work of others) that is to be inspected, tested or approved is covered by CONTRACTOR without written concurrence of PIRNIE it must, if requested by PIRNIE be uncovered for observation.

13.7. Uncovering Work as provided in paragraph 13.6 shall be at CONTRACTOR's expense unless CONTRACTOR has given PIRNIE timely notice of CONTRACTOR's intention to cover the same and PIRNIE has not acted with reasonable promptness in response to such notice.

Uncovering Work:

13.8. If any Work is covered contrary to the written request of PIRNIE it must, if requested by PIRNIE, be uncovered for PIRNIE's observation and replaced at CONTRACTOR's expense.

13.9. If PIRNIE considers it necessary or advisable that covered Work be observed by PIRNIE or inspected or tested by others, CONTRACTOR, at PIRNIE's request, shall uncover, expose or otherwise make available for observation, inspection or testing as PIRNIE may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is *defective*, CONTRACTOR shall pay all claims, costs, losses, and damages caused by, arising out of, or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and PIRNIE shall be entitled to an appropriate decrease in the Contract Price. If, however, such Work is not found to be *defective*, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones) or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction.

PIRNIE May Stop the Work:

13.10. If the Work is *defective*, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, PIRNIE may order CONTRACTOR to stop the

Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of PIRNIE to stop the Work shall not give rise to any duty on the part of PIRNIE to exercise this right for the benefit of CONTRACTOR or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them, or any surety or other party.

Correction or Removal of Defective Work:

13.11. If required by PIRNIE, CONTRACTOR shall promptly, as directed either correct all *defective* Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by PIRNIE, remove it from the site and replace it with Work that is not *defective*. CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.12. Correction Period:

13.12.1. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be *defective*, CONTRACTOR shall promptly, without cost to PIRNIE and in accordance with PIRNIE's written instructions: (i) correct such *defective* Work, or, if it has been rejected by PIRNIE, remove it from the site and replace it with Work that is not *defective*, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions or in an emergency where delay would cause serious risk of loss or damage, PIRNIE may have the *defective* Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

13.12.2. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date

if so provided in the Specifications or by Written Amendment.

13.12.3. Where *defective* Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this Paragraph 13.12, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

Acceptance of Defective Work:

13.13. If, instead of requiring correction or removal and replacement of *defective* Work, PIRNIE may, at it's sole option, accept it. CONTRACTOR shall pay all claims, costs, losses and damages attributable to PIRNIE's evaluation of and determination to accept such *defective* Work. A Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and PIRNIE shall be entitled to an appropriate decrease in the Contract Price.

PIRNIE May Correct Defective Work:

13.14. If CONTRACTOR fails within a reasonable time after written notice from PIRNIE to correct *defective* Work or to remove and replace rejected Work as required by PIRNIE in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, PIRNIE may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph PIRNIE shall proceed expeditiously. In connection with such corrective and remedial action, PIRNIE may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which PIRNIE has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow PIRNIE and CLIENT, and PIRNIE's and CLIENT's representatives, agents and employees, and the other contractors and utility owners contemplated by Article 7 access to the site to enable PIRNIE to exercise the rights and remedies under this

paragraph. All claims, costs, losses and damages incurred or sustained by PIRNIE in exercising such rights and remedies will be charged against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and PIRNIE shall be entitled to an appropriate decrease in the Contract Price. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's *defective* Work. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by PIRNIE of it's rights and remedies hereunder.

ARTICLE 14-PAYMENTS TO CONTRACTOR AND COMPLETION

Schedule of Values:

14.1. The schedule of values established as provided in paragraph 2.9 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to PIRNIE. Progress payments on account of Unit Price Work will be based on the number of units completed.

Application for Progress Payment:

14.2. At least twenty days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to PIRNIE for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that CLIENT has received the materials and equipment free and clear of all liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect CLIENT's interest therein, all of which will be satisfactory to CLIENT. The amount of retainage with

respect to progress payments will be as stipulated in the Agreement.

CONTRACTOR's Warranty of Title:

14.3. CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to CLIENT no later than the time of payment free and clear of all Liens.

Review of Applications for Progress Payment:

14.4. PIRNIE will, within ten days after receipt of each Application for Payment either indicate in writing a recommendation of payment and present the Application to CLIENT, or return the Application to CONTRACTOR indicating in writing PIRNIE's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application. Ten days after receipt of payment from CLIENT, payment will be made by PIRNIE to CONTRACTOR less any amount retained by CLIENT as provided in paragraph 14.5. PIRNIE's payment obligation is contingent upon PIRNIE's receipt of payment from CLIENT.

14.5. PIRNIE may refuse to recommend the whole or any part of any payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in PIRNIE's opinion to protect CLIENT from loss because:

14.5.1. the Work is *defective* or completed Work has been damaged requiring correction or replacement,

14.5.2. the Contract Price has been reduced by Written Amendment or Change Order,

14.5.3. PIRNIE has been required to correct *defective* Work or complete Work in accordance with paragraph 13.14,

14.5.4. claims have been made against PIRNIE on account of CONTRACTOR's performance or furnishing of the Work, or

14.5.5. PIRNIE has actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.4 inclusive.

CLIENT may refuse to make payment of the full amount recommended by PIRNIE because:

14.5.6. claims have been made against CLIENT on account of CONTRACTOR's performance or furnishing of the Work,

14.5.7. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to CLIENT to secure the satisfaction and discharge of such Liens,

14.5.8. there are other items entitling CLIENT to a set-off against the amount recommended, or

14.5.9. CLIENT has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.5.1 through 14.5.3 or paragraphs 15.2.1 through 15.2.4 inclusive.

PIRNIE will request that CLIENT give PIRNIE and CONTRACTOR immediate written notice stating the reasons for such action and promptly make payment of the amount so withheld, or any adjustment thereto when CONTRACTOR corrects to CLIENT's satisfaction the reasons for such action.

Substantial Completion:

14.6. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify PIRNIE in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that PIRNIE issue a certificate of Substantial Completion. Within a reasonable time thereafter, CLIENT, CONTRACTOR and PIRNIE shall make an inspection of the Work to determine the status of completion. If PIRNIE does not consider the Work substantially complete, PIRNIE will notify CONTRACTOR in writing giving the reasons therefor. If PIRNIE considers the Work substantially complete, PIRNIE will prepare and deliver to CLIENT a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment and a request that CLIENT

immediately make written objection to PIRNIE as to any provisions of the certificate or attached list. If, after considering such objections, PIRNIE concludes that the Work is not substantially complete, PIRNIE will within fourteen days after submission of the tentative certificate to CLIENT notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of CLIENT's objections, PIRNIE considers the Work substantially complete, PIRNIE will within said fourteen days execute and deliver to CLIENT and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as PIRNIE believes justified after consideration of any objections from CLIENT. At the time of delivery of the tentative certificate of Substantial Completion, PIRNIE will deliver to CLIENT and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between CLIENT and PIRNIE with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees. Unless CLIENT and CONTRACTOR agree otherwise in writing and so inform PIRNIE in writing prior to PIRNIE's issuing the definitive certificate of Substantial Completion, PIRNIE's aforesaid recommendation will be binding on CLIENT and CONTRACTOR until final payment.

14.7. PIRNIE shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but PIRNIE shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.8. Use by CLIENT or PIRNIE at CLIENT's or PIRNIE's option of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) CLIENT, PIRNIE and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by CLIENT or PIRNIE for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.8.1. CLIENT or PIRNIE at any time may request the use of any such part of the Work which CLIENT or PIRNIE believes to be ready for its intended use and

substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to CLIENT and PIRNIE that such part of the Work is substantially complete and request PIRNIE to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify CLIENT and PIRNIE in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request PIRNIE to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, CLIENT, CONTRACTOR and PIRNIE shall make an inspection of that part of the Work to determine its status of completion. If PIRNIE does not consider that part of the Work to be substantially complete, PIRNIE will notify CLIENT and CONTRACTOR in writing giving the reasons therefor. If PIRNIE considers that part of the Work to be substantially complete, the provisions of paragraphs 14.6 and 14.7 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.8.2. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of the Contract Documents in respect of property insurance, if any.

Final Inspection:

14.9. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, PIRNIE will make a final inspection with CLIENT and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or *defective*. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

Final Application for Payment:

14.10. After CONTRACTOR has completed all such corrections to the satisfaction of PIRNIE and delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance required by Article 5, certificates of inspection, marked-up record documents (as provided in paragraph 6.20) and other documents, CONTRACTOR may make application for final

payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Article 5, (ii) consent of the surety, if any, to final payment, and (iii) complete and legally effective releases or waivers (satisfactory to PIRNIE and CLIENT) of all Liens arising out of or filed in connection with the Work. In lieu of such releases or waivers of Liens and as approved by CLIENT, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and (ii) all payrolls, material and equipment bills and other indebtedness connected with the Work for which PIRNIE or CLIENT or their property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to PIRNIE and CLIENT to indemnify PIRNIE and CLIENT against any Lien.

Final Payment and Acceptance:

14.11. If on the basis of PIRNIE's observation of the Work during construction and final inspection, and PIRNIE's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, PIRNIE is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, PIRNIE will within ten days after receipt of the final Application for Payment, indicate in writing PIRNIE's recommendation of payment and present the Application to CLIENT for payment. At the same time PIRNIE will also give written notice to CLIENT and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.12. Otherwise, PIRNIE will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. Ten days after receipt of payment from CLIENT, payment will be made by PIRNIE to CONTRACTOR. PIRNIE's payment obligation is contingent upon PIRNIE's receipt of payment from CLIENT.

Waiver of Claims:

14.12. The making and acceptance of final payment will constitute:

14.12.1. a waiver of all claims by CLIENT or PIRNIE against CONTRACTOR, except claims arising from unsettled Liens, from *defective* Work appearing after final inspection pursuant to paragraph 14.9, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

14.12.2. a waiver of all claims by CONTRACTOR against CLIENT or PIRNIE other than those previously made in writing and still unsettled.

ARTICLE 15-SUSPENSION OF WORK AND TERMINATION

PIRNIE May Suspend Work:

15.1. At any time and without cause, PIRNIE may suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an extension of the Contract Times directly attributable to any such suspension if CONTRACTOR makes an approved claim therefor as provided in Article 12.

PIRNIE May Terminate for Cause:

15.2. Upon the occurrence of any one or more of the following events:

15.2.1. if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.9 as adjusted from time to time pursuant to paragraph 6.7);

15.2.2. if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;

15.2.3. if CONTRACTOR disregards the authority of PIRNIE; or

15.2.4. if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

PIRNIE may, after giving CONTRACTOR (and the surety, if any,) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which CLIENT or PIRNIE has paid CONTRACTOR but which are stored elsewhere, and finish the Work as PIRNIE may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims costs, losses, and damages sustained by CLIENT or PIRNIE arising out of or resulting from completing the Work such excess will be paid to CONTRACTOR. If such claims, costs, losses and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to PIRNIE. Such claims, costs, losses and damages incurred by PIRNIE will be incorporated in a Change Order. When exercising any rights or remedies under this paragraph PIRNIE shall not be required to obtain the lowest price for the Work performed.

15.3. Where CONTRACTOR's services have been so terminated by PIRNIE, the termination will not affect any rights or remedies of PIRNIE against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by PIRNIE will not release CONTRACTOR from liability.

15.4. If it is subsequently determined that CONTRACTOR was not in default or should not have otherwise been terminated for cause, the rights and obligations of the parties will be the same as if the notice of termination had been issued pursuant to paragraph 15.5.

PIRNIE May Terminate for Convenience:

15.5. Upon seven days' written notice to CONTRACTOR, PIRNIE may, without cause and without

prejudice to any other right or remedy of PIRNIE, elect to terminate the Agreement. In such case, CONTRACTOR shall be paid (without duplication of any items):

15.5.1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

15.5.2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

15.5.3. for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others, however, any such settlement or termination shall be subject to the approval and ratification of PIRNIE.

15.5.4. for reasonable expenses directly attributable to termination.
CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

ARTICLE 16-DISPUTE RESOLUTION

16.1. If and to the extent that PIRNIE and CONTRACTOR have agreed on the method and procedure for resolving disputes between them that may arise under this Agreement, such dispute resolution method and procedure, if any, shall be as set forth in the Supplementary Conditions. If no such agreement on the method and procedure for resolving such disputes is set forth and subject to the provisions of paragraphs 9.10, 9.11, and 9.12 PIRNIE and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17-MISCELLANEOUS

Giving Notice:

17.1. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

Computation of Times:

17.2.1. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.2.2. A calendar day of twenty-four hours measured from midnight to the next midnight will constitute a day.

Notice of Claim:

17.3. Should PIRNIE or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 17.3 shall not be construed as a substitute for or a waiver of any other provisions of the Contract Documents or of the provisions of any applicable statute of limitations or repose.

Cumulative Remedies:

17.4. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.13, 6.17, 6.31, 6.32, 6.33, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to CLIENT and PIRNIE thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

Professional Fees and Court Costs Included:

17.5. Whenever reference is made to "claims, costs, losses and damages", it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs.

SUPPLEMENTARY CONDITIONS

(These Supplementary Conditions amend or supplement the General Conditions and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.)

TABLE OF ARTICLES

SC-1	Definitions
SC-4	Availability of Lands; Subsurface and Physical Conditions; Reference Points
SC-5	Bonds and Insurance
SC-6	Contractor's Responsibilities
SC-16	Dispute Resolution
SC-17	Miscellaneous

ARTICLE SC-1 - DEFINITIONS

SC-1.1 The terms used in these Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions. Additional terms to be added to the General Conditions are as follows:

OWNER: The U.S. Army Industrial Operations Command, which operates and maintains the Watervliet Arsenal.

ARTICLE SC-4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

SC-4.2 Physical Conditions - Investigations and Reports:

Add a new paragraph immediately after paragraph 4.2.1.2 of the General Conditions, which is to read as follows:

4.2.1.3 In the preparation of Drawings and Specifications, PIRNIE has relied upon the following report(s) of explorations and tests of subsurface conditions at the site of Work:

- a. Final RCRA Facility Investigation Report: Siberia Area, Watervliet Arsenal, Watervliet, New York, Malcolm Pirnie, Inc., December 1997.

- b. Work Plan: Permeable Reaction Wall Pilot Treatment System, Watervliet Arsenal, Siberia Area, NE Quadrant, Watervliet, New York, Malcolm Pirnie, Inc., April 1998.
- c. Information gained through miscellaneous soil borings and test pits.

ARTICLE SC-5 - BONDS AND INSURANCE

SC-5.4 CONTRACTOR'S liability Insurance:

SC-5.4.15 Limits of Liability

Add a new paragraph immediately after paragraph 5.4.14 of the General Conditions, which is to read as follows:

5.4.15 Limits of Liability: The limits of liability for the insurances required by paragraph 5.4 of the General Conditions shall provide coverage for not less than the following amounts, or greater where required by Laws or Regulations:

5.4.15.1 For Workers' Compensation, etc. under paragraphs 5.4.1 and 5.4.2 of the General Conditions:

5.4.15.1.1	Applicable Federal or State: Statutory
Maritime	Not Required
Railroad	Not Required
Employer's Liability	Required

5.4.15.2 For CONTRACTOR's Liability Insurance under paragraphs 5.4.3 through 5.4.5 of the General Conditions (including Premises-Operations, Independent Contractor's Protection, Products and Completed Operations, Broad Form Property Damage, Contractual Liability):

5.4.15.2.1 Bodily Injury:
\$1,000,000 Each Occurrence
\$2,000,000 Annual Aggregate

5.4.15.2.2 Property Damage:
\$1,000,000 Each Occurrence
\$2,000,000 Annual Aggregate
Or Combined Single Limit of \$2,000,000

5.4.15.2.3 Property Damage liability insurance shall provide Explosion, Collapse and Underground coverages.

5.4.15.3 For CONTRACTOR's Automobile Liability Insurance under paragraph 5.4.6 of the General Conditions:

5.4.15.3.1 Bodily Injury:

Combined Single Limit (Bodily Injury and Property Damage) of \$1,000,000

SC-5.5 CONTRACTOR's Pollution Liability Insurance

Add new paragraphs immediately after paragraph 5.4 of the General Conditions, which are to read as follows:

SC-5.5 CONTRACTOR's Pollution Liability Insurance

5.5.1 Definitions Applicable to This Insurance:

Pollutant - Any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals, and waste. Waste includes products or materials containing asbestos in any of its forms and materials to be recycled, reconditioned or reclaimed.

Release - Any actual or substantial threat of spilling, leaking, pumping, pouring, emitting, emptying, discharging, injection, escaping, leaching, dumping or disposing of a Pollutant into the environment.

5.5.2 CONTRACTOR shall purchase and maintain such commercial pollution liability insurance as will provide coverage for:

5.5.2.1 claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees; and

5.5.2.2 claims for damages incurred by customary personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason; and

5.5.2.3 claims for damages, other than to the Work itself, because of injury to or destruction of property wherever located, including loss of use resulting therefrom;

which may arise directly or indirectly from the Release of Pollutants resulting from CONTRACTOR's performance and furnishing of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform

or furnish any of the Work, or by anyone for whose acts any of them may be liable.

5.5.3 The policy of insurance required by this paragraph shall:

5.5.3.1 Include as additional insureds CLIENT, PIRNIE, OWNER and the officers, directors, employees, agents and other consultants of each and any of them.

The insurance afforded to these additional insureds shall provide primary coverage from all claims covered thereby.

5.5.3.2 Be written for not less than \$2,000,000 combined single limit per claim and in the aggregate, and shall have a deductible of not more than \$10,000.

5.5.3.3 Shall include blanket contractual liability coverage, completed operations coverage, and broad form property damage coverage, and there shall be no exclusion for XCU, sudden and accidental pollution or non-sudden and gradual pollution.

5.5.3.4 Shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to CLIENT and PIRNIE and to each other additional insured identified herein.

5.5.3.5 Except as noted in paragraph 5.5.3.6, shall remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective Work.

5.5.3.6 With respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish CLIENT, PIRNIE and each other additional insured evidence satisfactory to PIRNIE and CLIENT of continuation of such insurance at final payment and one year thereafter).

5.5.3.7 CONTRACTOR shall deliver to PIRNIE, with copies to each additional insured, certificates of insurance (and other evidence of insurance requested by PIRNIE) which CONTRACTOR is required to purchase and maintain in accordance with this paragraph 5.5

ARTICLE SC-6 - CONTRACTOR'S RESPONSIBILITIES

SC-6.21 Safety and Protection:

Add a new paragraph immediately after paragraph 6.21 of the General Conditions, which are to read as follows:

SC-6.21.A CONTRACTOR's Health and Safety Plan

6.21.A.1 Health and Safety Plan

6.21.A.1.1 A detailed site specific health and safety plan shall be developed by the CONTRACTOR to address potential hazards to the on-site personnel and the surrounding community. This plan shall be consistent with all applicable local, state and federal Laws and Regulations including but not limited to the OSHA Standard (29 CFR 1910.120 - Hazardous Waste Site Operation and Emergency Response) and the USEPA Remedial Investigation Guidance Document (EPA/564/6-85/002).

6.21.A.1.2 PIRNIE will provide CONTRACTOR, for informational purposes only, a copy of PIRNIE's health and safety plan governing PIRNIE's personnel on the site. PIRNIE's health and safety plan is not a part of the Contract Documents.

6.21.A.1.3 CONTRACTOR's Health and Safety Plan shall be acceptable to PIRNIE. No work shall be performed at the site until PIRNIE has indicated acceptance of CONTRACTOR's Plan. Notwithstanding any other provision of the Contract Documents, PIRNIE's acceptance of Contractor's Health and Safety Plan shall not give rise to any duty on the part of PIRNIE to CONTRACTOR or any other party and such acceptance shall not diminish CONTRACTOR's obligation with respect to the safety of persons and property under the Contract Documents.

6.21.A.1.4 As a minimum, the Health and Safety Plan shall address the following issues:

6.21.A.1.4.1 Personnel: Identification of site specific personnel responsibilities, employee training and medical monitoring.

6.21.A.1.4.2 Potential Contaminant Characteristics: Potential contaminants may be encountered during the Work. CONTRACTOR shall address the characteristics, toxicity and potential risks associated with the contaminants that may be encountered.

6.21.A.1.4.3 Air Monitoring: An air monitoring program shall be designed to detect and quantify the release or volatilization of soil contaminants associated with the excavation program. Air monitoring data shall be used to determine appropriate levels of personnel protection and need to enact emergency response plan provisions in the event of a contaminant release. The plan shall identify the type(s) and quantity of air monitoring equipment to be utilized.

6.21.A.1.4.4 Personnel Protective Equipment: CONTRACTOR shall address personnel protective equipment to be used on the site. Equipment shall be in accordance with USEPA Levels A, B, C and D for each element of the Work.

6.21.A.1.5 Work Zones: CONTRACTOR shall specify project work zones in accordance with 29 CFR 1910.120. As a minimum, the area surrounding each work area shall be divided into the following zones:

6.21.A.1.5.1 Exclusion (Hot) Zone.

6.21.A.1.5.2 Contamination Reduction (Buffer) Zone.

6.21.A.1.5.3 Support (Clean) Zone.

6.21.A.1.6 Safe Work Procedure Specifications: CONTRACTOR shall provide a general description of safe working procedures to be followed on the site.

6.21.A.1.7 Decontamination:

6.21.A.1.7.1 CONTRACTOR shall provide decontamination procedures for both equipment and personnel to ensure that any materials encountered in the exclusion zone are removed in the contamination reduction zone.

6.21.A.1.7.2 Decontamination of excavation and other equipment employed in the Work shall include, but not necessarily be limited to, the physical removal of solid materials and complete steam cleaning. All materials generated during decontamination shall be containerized. These containers shall be accumulated on the site in accordance with applicable Laws and Regulations and at a locations designated by PIRNIE.

6.21.A.1.7.3 The extent of personnel decontamination procedures to be employed will be subject to the nature of work performed. At a minimum, there shall be a segregated equipment drop and a boot and glove detergent wash water rinse. This level of decontamination will

be upgraded as required commensurate with the appropriate level of personnel protection being employed.

6.21.A.1.8 Contingency Plan: The CONTRACTOR shall develop a site specific emergency response and contingency plan. This plan shall include, but not be limited to, on-site emergency equipment; emergency response plan; site emergency warning and notification system; and personnel injury response plan. The Contingency Plan shall also specifically address procedures to be followed if air monitoring detects higher than background levels of contaminants in the breathing zone.

SC-6.32 Indemnification:

Add the following language immediately after the first sentence of paragraph 6.32 of the General Conditions: The indemnification obligation under this paragraph 6.32 shall extend to all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage is caused in whole or in part by either (1) any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder, or (2) whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.

ARTICLE SC-16 - DISPUTE RESOLUTION

Add a new paragraph immediately after paragraph 16.1 of the General Conditions, which is to read as follows:

16.2 PIRNIE and CONTRACTOR hereby agree that Article 16 of the General Conditions to the Agreement between PIRNIE and CONTRACTOR is amended to include the following agreement of the parties:

16.2.1 All claims, disputes and other matters in question between PIRNIE and CONTRACTOR arising out of or relating to the Contract Documents or the breach thereof (except for claims which have been waived by the making or acceptance of final payment as provided by paragraph 14.12) will be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then obtaining, subject to the limitations of this Article 16. This agreement so to arbitrate and any other agreement or consent to arbitrate entered into in accordance herewith as provided in this

Article 16 will be specifically enforceable under the prevailing law of any court having jurisdiction.

16.2.2 No demand for arbitration of any claim, dispute or other matter that is required to be referred to PIRNIE initially for decision in accordance with paragraph 9.11 will be made until the earlier of (a) the date on which PIRNIE has rendered a written decision or (b) the thirty-first day after the CONTRACTOR has presented its evidence to PIRNIE if a written decision has not been rendered by PIRNIE before that date. No demand for arbitration of any such claim, dispute or other matter will be made later than thirty days after the date on which PIRNIE has rendered a written decision in respect thereof in accordance with paragraph 9.11; and the failure to demand arbitration within said thirty days' period will result in PIRNIE's decision being final and binding upon CONTRACTOR. If PIRNIE renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but will not supersede the arbitration proceedings, except where the decision is acceptable to the parties concerned.

16.2.3 Notice of the demand for arbitration will be filed in writing with the other party to the Agreement and with the American Arbitration Association. The demand for arbitration will be made within the thirty-day period specified in paragraph 16.2.2 as applicable, and in all other cases within a reasonable time after the claim, dispute or other matter in question has arisen, and in no even shall any such demand be made after the date when institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

16.2.4 Except as provided in paragraph 16.2.5 below, no arbitration arising out of or relating to the Contract Documents shall include by consolidation, joinder or in any other manner any other person or entity who is not a party to this contract unless:

16.2.4.1 the inclusion of such other person or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration, and

16.2.4.2 such other person or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings, and

16.2.4.3 the written consent of the other person or entity sought to be included and of PIRNIE and CONTRACTOR has been obtained for such inclusion, which consent shall make specific reference to this paragraph; but no such consent shall constitute consent to arbitration of any dispute not

specifically described in such consent or to arbitration with any party not specifically identified in such consent.

16.2.5 Notwithstanding paragraph 16.2.4 if a claim, dispute or other matter in question between PIRNIE and CONTRACTOR involves the Work of a Subcontractor, either PIRNIE or CONTRACTOR may join such Subcontractor as a party to the arbitration between PIRNIE and CONTRACTOR hereunder. CONTRACTOR shall include in all subcontracts required by paragraph 6.12 a specific provision whereby the Subcontractor consents to being joined in an arbitration between PIRNIE and CONTRACTOR involving the Work of such Subcontractor. Nothing in this paragraph 16.2.5 nor in the provision of such subcontract consenting to joinder shall create any claim, right or cause of action in favor of Subcontractor and against PIRNIE that do not otherwise exist.

16.2.6 The award rendered by the arbitrators will be final, judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal.

16.2.7 Exceptions: This agreement to arbitrate shall not apply to any claim:

(a) of contribution or indemnity asserted by one party to this Agreement against the other party and arising out of an action brought in a state or federal court or in arbitration by a person who is under no obligation to arbitrate the subject matter of such action with either of the parties hereto; or does not consent to such arbitration; or

(b) asserted by the CONTRACTOR against PIRNIE if PIRNIE asserts said claim, either in whole or part, against the CLIENT and the contract between PIRNIE and CLIENT does not provide for binding arbitration, or does so provide but the two arbitration proceedings are not consolidated, or PIRNIE and CLIENT have not subsequently agreed to arbitrate said claim, in either case of which the parties hereto shall so notify each other either before or after demand for arbitration is made.

16.2.8 In any dispute arising over the application of this Article 16, the question of arbitrability shall be decided by the appropriate court and not by arbitration.

16.2.9 PIRNIE and CONTRACTOR agree that they shall first submit any and all unsettled claims, counterclaims, disputes and other matters in question between them arising out of or relating to the Contract Documents or the breach thereof ("disputes"), to mediation by The American Arbitration Association under the Construction Industry Mediation Rules of the American Arbitration Association prior to either of them initiating against the other a demand for arbitration pursuant to paragraphs 16.2.1 through 16.2.7 unless delay in initiating arbitration would irrevocably prejudice one of the parties. The thirty day time limit within which to file a demand for arbitration as provided in paragraphs

16.2.2 and 16.2.3 above shall be suspended with respect to a dispute submitted to mediation within that applicable time limit and shall remain suspended until ten days after the termination of the mediation. The mediator of any dispute submitted to mediation under this Agreement shall not serve as arbitrator of such dispute unless otherwise agreed.

ARTICLE SC-17 - MISCELLANEOUS

SC-17.6 Publicity

Add a new paragraph immediately after paragraph 17.5 of the General Conditions, which is to read as follows:

17.6 Publicity

CONTRACTOR shall not disclose the nature of its Work on this Project or engage in any other publicity or public media disclosures with respect to this Project without the prior written consent of PIRNIE.

ARTICLE SC-18 - STATUTORY REQUIREMENTS

SC-18.1 This Article contains portions of certain Laws and Regulations which, by provision of law, ordinance, rule or regulation, are required to be included in the Contract Documents. The material included in this Article may not be complete or current. CONTRACTOR'S obligation to comply with all Laws and Regulations applicable to the Work is set forth in paragraph 6.15.1 of the General Conditions.

+ + End of Supplementary Conditions + +

SECTION 01010

SUMMARY OF WORK

1.1 LOCATION AND DESCRIPTION OF WORK

- A. In general, the work under this contract consists of, but is not limited to, the construction of the Permeable Reaction Wall Pilot System at the Watervliet Arsenal, Watervliet, New York. Work includes, but is not limited to, the following:
 - 1. Trench excavation for installation of permeable reaction wall pilot system.
 - 2. Installation of reactive iron and sand material.
 - 3. Transportation and disposal of excavated soils.
 - 4. Installation of monitoring wells.
 - 5. Collection, treatment, and disposal of groundwater from dewatering operations.
 - 6. Site restoration.
- B. The Work shall take place at the Watervliet Arsenal, Watervliet, New York, as shown on the Contract Drawings. The Watervliet Arsenal is an active manufacturing facility. The CONTRACTOR is responsible for maintaining all access roads and all utilities at all times so that manufacturing operations are not disrupted.
- C. The summary of the Work described in this Section is an overall summary of the responsibilities of the CONTRACTOR and his relation to the PIRNIE. It does not supersede specific requirements of other Contract Documents and does not in any way limit the responsibility of the Contractor to perform all Work and furnish the required materials, equipment, labor and means as shown or required by the Contract Documents.
- D. Materials, equipment, labor, etc. obviously a part of the Work and necessary for the proper operation and installation of same, although not specifically indicated in the Contract Documents, shall be provided as if called for in detail without additional cost to the PIRNIE.

1.2 JOB CONDITIONS

- A. The CONTRACTOR assumes the risk of possible physical hazards, such as slippery conditions, etc.
- B. Information regarding site conditions is intended to assist the CONTRACTOR in preparing his bid. PIRNIE does not guarantee its accuracy or that it is necessarily indicative of conditions to be encountered. CONTRACTOR shall satisfy himself regarding all local conditions affecting his work by personal investigation and neither the information on local geology, nor that derived from maps or drawings, nor from PIRNIE, the CLIENT, OWNER or their agents or employees, shall act to relieve

CONTRACTOR of any responsibility hereunder or from fulfilling all of the terms and requirements of the Contract Specifications.

1.3 CONTRACTS

- A. On-going operation of Arsenal including materials storage adjacent to Work area.

1.4 WORK BY OTHERS

- A. Existing OWNER'S landfilling operations.

1.5 CONTRACTOR'S USE OF PREMISES

- A. CONTRACTOR'S use of the premises shall be confined to the areas shown on the Drawings.
- B. CONTRACTOR shall:
 - 1. Assume full responsibility for protection and safekeeping of products stored on or off premises.
 - 2. Move stored products that interfere with the operations of OWNER.
 - 3. Obtain and pay for all additional storage or work areas required for his operations.
- C. Limits on CONTRACTOR'S use of site are:
 - 1. Work within limits shown on Drawings.
- D. All access to the site shall be through the South Gate.
- E. The Arsenal is closed every other Friday. No Work shall be done on the project on days when the Arsenal is closed.

1.6 CODES AND STANDARDS

- A. CONTRACTOR shall conform to, comply with, and abide by any and All Applicable Law which pertain to or in any way affect the Work to be done by the CONTRACTOR. CONTRACTOR shall also comply with any and all instructions and regulations of the OWNER pertaining thereto, including any Applicable Law and instructions regarding signs, advertising, fire and/or smoke.
- B. CONTRACTOR shall at his own expense obtain all permits, certifications and licenses required of him by Applicable Law for the execution of the Work.
- C. CONTRACTOR shall comply with all Applicable Law relating to the performance of the Work.

- D. Where provisions of the pertinent codes, standards or regulations conflict with this Specification, the more stringent provision shall govern.

1.7 SAFETY REGULATIONS

- A. CONTRACTOR shall comply with the requirements and standards of all federal, state and local laws, ordinances, codes, rules and regulations governing safety and health. Protection shall be afforded to all persons having access to the site. Nothing in any paragraphs of these Contract Documents shall be construed as relieving the CONTRACTOR from full responsibility for safe work practices at all times.
- B. The CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection, training as stipulated under 29 CFR 1910.120. and equipment to prevent damage, injury or loss to:
1. All employees on the work site and other persons who may be affected thereby.
 2. All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site.
 3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- C. The CONTRACTOR shall comply with all Applicable Laws for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- D. The CONTRACTOR shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents.
- E. In emergencies affecting the safety of protection of persons or the work or property at the site or adjacent thereto , the CONTRACTOR, without special instruction or authorization from PIRNIE or OWNER, is obligated to act to prevent threatened damage, injury or loss. The CONTRACTOR shall give PIRNIE prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby as required by the Contract Documents.

+ + END OF SECTION + +

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The items listed below beginning with Article 1.4, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, plant, services, CONTRACTOR'S or PIRNIE'S field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and record drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, bonds, insurance, and all other requirements of the General Conditions, Supplementary Conditions, and the General Requirements. Compensation for all such services, things and materials shall be included in the prices stipulated for the lump sum and extra work unit price pay items listed herein.
- B. Each lump sum price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.

1.2 RELATED PROVISIONS

- A. Payments to CONTRACTOR: Refer to General Conditions and Agreement.
- B. Changes in Contract Price: General Conditions.
- C. Schedule of Values: Section 01026.

1.3 CONTRACT NO. 1 - GENERAL

- A. Item 1 - Site Preparation:
 - 1. Measurement and Payment: The lump sum bid for Item 1 shall be full compensation for furnishing tools, materials, equipment, and supervision required to mobilize and demobilize at the site; temporary facilities; general conditions including office management, bonds and insurances, etc.; and any other work shown on the drawings and specified and not specifically included for payment under the other items of the Contract.

B. Item 2 - Disposal of Excess Excavated Material:

1. Measurement and Payment: The lump sum bid for Item 2 shall be full compensation for furnishing all labor, materials, tools, equipment and supervision to dispose of contaminated soils as shown and specified. Specifically, Item 2 includes but is not limited to: staging of contaminated soils, transport and disposal of contaminated soils, and all testing, permits and fees associated with contaminated soil disposal.

C. Item 3 - Permeable Reaction Wall:

1. Measurement and Payment: The lump sum bid for Item 3 shall be full compensation for furnishing all labor, materials, tools, equipment and supervision necessary to construct the permeable reaction wall. More specifically, Item 3 includes, but is not limited to: excavation, shoring and sheeting, protection of existing utilities, furnishing granular iron material, furnishing concrete sand material, mixing of granular iron and concrete sand, installation of mixed granular iron and concrete sand mix to trench, backfilling trench above granular iron and concrete sand with excavated material and selected granular fill, and all else required to construct the permeable reaction wall as shown and specified which is not included for payment under other items of the contract.

D. Item 4 - Groundwater Collection, Treatment and Disposal:

1. Measurement and Payment: The lump sum bid for Item 4 shall be full compensation for furnishing all labor, materials, tools, equipment and supervision to collect, treat and dispose of all groundwater collected during the trench excavation and permeable reaction wall installation as specified. CONTRACTOR shall also include any cost associated with securing carbon units for use in Item 5 as required to allow the contingency use of carbon treatment with minimal delay to the project.

E. Item 5 - Additional Work for Carbon Treatment of Groundwater:

1. Measurement and Payment: The lump sum bid for Item 5 shall be full compensation for furnishing all labor, materials, tools, equipment and supervision to treat groundwater using carbon treatment and discharge treated water to existing sanitary sewer as shown and specified except that specifically included for payment under other items. More specifically, Item 6 includes but is not limited to the additional cost of furnishing, installing, operating, and demobilizing bag filters and a carbon treatment system and all piping and pumps necessary to pump through the treatment unit and discharge to the sewer rather than discharging to the infiltration trench.

F. Item 6 - Monitoring and Observation Wells Installation:

1. Measurement and Payment: The lump sum bid for Item 6 shall be full compensation for furnishing all labor, materials, tools, equipment and

supervision necessary to install and develop monitoring and observations wells as shown and specified.

G. Item 7 - Site Restoration:

1. Measurement and Payment: The lump sum bid for Item 7 shall be full compensation for furnishing all labor, materials, tools, equipment and supervision to restore the site as shown and specified except that specifically included for payment under other items. More specifically, Item 7 includes but is not limited to: furnishing and placing crushed stone over areas disturbed by the construction, removing trash, debris and other material remaining after construction, repairing or replacing and damaged signs, pavements, structures, access roads, or utilities, equipment decontamination and demobilization and all else needed to restore the site to its original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01026

SCHEDULE OF VALUES

1.1 GENERAL

- A. The Schedule of Values is an itemized list that establishes the value or cost of each part of the Work. It shall be used as the basis for preparing progress payments and may be used as a basis for negotiations concerning additional work or credits which may arise during the construction. Quantities and unit prices may be included in the schedule when approved by or required by PIRNIE.

1.2 PREPARATION

- A. Schedule shall show breakdown of labor, materials equipment and other costs used in preparation of the Bid.
- B. Costs shall be in sufficient detail to indicate separate amounts for each Section of the Specifications.
- C. CONTRACTOR may include an item for bond, insurance, temporary facilities and job mobilization. This item will be included for payment at a rate of 50 percent for the first month and 50 percent upon final completion of the Work. This item is included in Item 1 of the Measurement and Payment Specification Section 01025.
- D. Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
- E. Use Table of Contents of the Specifications as basis for Schedule format and identify each item with number and title in the Table of Contents. List sub-items of major products or systems as appropriate or when requested by PIRNIE.
- F. When requested by PIRNIE, support values with data that will substantiate their correctness.
- G. The sum of the individual values shown on the Schedule of Values must equal the total Contract Price.
- H. Each item shall include a directly proportional amount of the CONTRACTOR'S overhead and profit.
- I. Schedule shall show the purchase and delivery costs for materials and equipment that the CONTRACTOR anticipates he shall request payment for prior to their installation.

1.3 SUBMITTAL

- A. Submit two copies of Schedule to PIRNIE for approval prior to submitting first application for a progress payment. After review by PIRNIE, revise and resubmit Schedule as required until it is approved.

+ + END OF SECTION + +

SECTION 01040

COORDINATION

1.1 GENERAL

- A. As more fully set forth in Article 6 of the General Conditions, CONTRACTOR shall be solely responsible for coordination of all of the Work. He shall supervise, direct and cooperate fully with all Subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the Work within the Contract Time.
- B. As more fully set forth in Article 7 of the General Conditions, CONTRACTOR shall cooperate with and coordinate his Work with the work of any other contractor, utility service company or OWNER's employees performing additional work related to the Project at the site.
- C. CONTRACTOR shall not be responsible for damage done by contractors not under his jurisdiction. He will not be liable for any such loss or damage unless it is through the negligence of the CONTRACTOR.
- D. CONTRACTOR shall also coordinate his Work with the work of others to assure compliance with schedules.
- E. CONTRACTOR shall attend and participate in all project coordination or progress meetings and report on the progress of all Work and compliance with schedules.

+ + END OF SECTION + +

SECTION 01043

COORDINATION WITH OWNER'S OPERATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall coordinate the work with the OWNER'S operations.
- B. CONTRACTOR shall perform the work in such a manner as will not disrupt the OWNER'S present operations. When work cannot be performed without disruption to the OWNER'S operations, the CONTRACTOR shall perform the work in such a manner as will minimize disruption to the OWNER'S operations.
- C. The CONTRACTOR shall not perform any portion of the work which disrupts the OWNER'S operations without prior consent of the OWNER. Except as otherwise specified, CONTRACTOR shall inform OWNER and PIRNIE at least 48 hours prior to beginning any of the Work which may affect the OWNER'S operations.
- D. Where the work or any portion of the work disrupts the OWNER'S normal activities, the CONTRACTOR shall install all such temporary facilities and materials as are necessary for the OWNER to continue with said activities.
- E. Any measures taken or methods used by the CONTRACTOR to enable the OWNER to continue operations shall be acceptable to PIRNIE and to the OWNER.
- F. All materials, equipment and installations used by the CONTRACTOR shall meet the requirements specified in other sections and Divisions of these Contract Documents.
- G. The CONTRACTOR has full responsibility for any disruptions to the OWNER's operations which are caused by his work and which result in Federal, State, County or Municipal penalties or fines.

1.2 SUBMITTALS

- A. Submit to PIRNIE, in writing, detailed descriptions and schedules of proposed construction procedures during periods that may interfere with OWNER'S operations. The information shall be submitted to PIRNIE for approval not less than 14 days prior to the beginning of each period of interference. Information submitted to PIRNIE shall include a complete inventory of materials and equipment on hand or needed to perform the Work. No Work which interferes with OWNER'S operations will be permitted until PIRNIE has reviewed and approved, in writing, the proposed construction plans and procedures submitted by CONTRACTOR.

- B. If in the opinion of PIRNIE, CONTRACTOR does not or will not have sufficient materials and equipment on-site to complete the Work, his schedule will be rejected and he will not be allowed to perform the Work at the scheduled time. Submission and approval or rejection of detailed descriptions and schedules does not relieve CONTRACTOR of the following:
1. Completing the Contract within the time allowed in the Agreement.

++ END OF SECTION ++

SECTION 01050

FIELD ENGINEERING AND SURVEY DATA

1.1 GENERAL

- A. Two (2) temporary bench marks are available for use by the CONTRACTOR at locations shown on the Drawings.
- B. CONTRACTOR shall:
 - 1. Provide civil, structural or other professional engineering services specified, or required to execute CONTRACTOR'S construction methods.
 - 2. Develop and make all detail surveys and measurements needed for construction including slope stakes, batter boards, piling layouts and all other working lines, elevations and cut sheets and miscellaneous survey equipment, all in good working order,
 - 3. Maintain a transit and level on the site at all times and provide a skilled instrument man whenever necessary for horizontal and vertical control of the Work.
 - 4. Provide all material required for bench marks, control points, batter boards, grade stakes, and other items.
 - 5. Be solely responsible for all locations, dimensions and levels. No data other than written orders of the PIRNIE shall justify departure from the dimensions and levels required by the Drawings. Notify PIRNIE, in writing of any differences in actual and indicated measurements before commencing any of the work.
 - 6. Safeguard all points, stakes, grade marks, monuments and bench marks made or established on the Work, re-establish same if disturbed and rectify all Work improperly installed because of not maintaining, not protecting or removing without authorization such established points, stakes, marks and monuments.
 - 7. When requested by PIRNIE provide such facilities and assistance as may be necessary for PIRNIE to check line and grade points placed by CONTRACTOR. CONTRACTOR shall do no excavation or embankment work until all cross-sectioning necessary for determining pay quantities has been completed and checked by PIRNIE.

1.2 CONTRACTOR'S FIELD ENGINEER

- A. CONTRACTOR shall employ and retain at the site of the Work a field engineer capable of performing all engineering tasks required of the CONTRACTOR. Tasks included are:
 - 1. Daily reports of Project activity to be submitted to PIRNIE with all pertinent information pertaining to the Project as follows:
 - a. Numbers of employees,
 - b. Subcontractor employees,

- c. Breakdown of employees by trade,
 - d. Major equipment and materials installed,
 - e. Major construction equipment utilized,
 - f. Location of all areas in which construction was done,
 - g. Materials and equipment received.
- 2. Provide all surveying equipment required including transit, level, stakes and required surveying accessories. Provide survey grids and control information (tied into existing site grid system) on a bi-weekly basis or as directed by PIRNIE.
 - 3. Furnish all required lines and grades for construction operations. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment.
 - 4. Maintain field office files and drawings, record drawings, and coordinate engineering services with Subcontractors. Prepare layout and coordination drawings for construction operations.
 - 5. Check and coordinate Work for conflicts and interferences and immediately advise PIRNIE of all discrepancies noted.
 - 6. Cooperate with PIRNIE in field inspections as required.

1.3 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses. Notes of all measurements and calculations made while surveying and laying out the work shall be neat and legible.
- B. On completion of the project, prepare a certified survey showing all dimensions, locations, angles, elevations of construction and deviations from Contract Documents.

1.4 SUBMITTALS

- A. Submit name and address of surveyor and engineer to PIRNIE.
- B. On request of PIRNIE, submit documentation to verify accuracy of field engineering work.
- C. When requested by PIRNIE, submit certificate signed by registered engineer or surveyor certifying that elevations and locations of Work are in conformance with Contract Documents. Explain all deviations.
- D. One copy of all notes and a reproducible mylar shall be furnished to PIRNIE.
- E. CONTRACTOR shall make available to the PIRNIE any survey notes generated during the course of work.

+ + END OF SECTION + +

SECTION 01091

REFERENCE STANDARDS

1.1 GENERAL

- A. When a reference standard is specified, comply with requirements and recommendations stated in that standard, except when they are modified by the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest provisions of applicable standards shall apply to the Work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:
1. American Association of State Highway and Transportation Officials.
 2. American Concrete Institute.
 3. American Institute of Steel Construction.
 4. American Iron and Steel Institute.
 5. American National Standards Institute.
 6. American Society of Mechanical Engineers.
 7. American Society for Testing and Materials.
 8. American Water Works Association.
 9. American Welding Society.
 10. Concrete Reinforcing Steel Institute.
 11. Factory Mutual Association.
 12. Federal Specifications.
 13. Institute of Electrical and Electronics Engineers.
 14. National Electrical Manufacturer's Association.
 15. National Sanitation Foundation.
 16. New York State Department of Transportation Standard Specifications.
 17. National Fire Protection Association.
 18. Underwriters' Laboratories, Inc.
 19. Geosynthetic Research Institute
 20. United States Department of Transportation Federal Highway Administration
 21. USACE, EM 385-1-1, Safety and Health Requirements Manual.
 22. USACE, Monitoring Well Installation Manual.
 23. All other applicable standards listed in the Specifications, and the standards of utility service companies, where applicable.

+ + END OF SECTION + +

SECTION 01092

ABBREVIATIONS AND SYMBOLS

1.1 ABBREVIATIONS

A. Common abbreviations which may be found in the Specifications are:

alternating current	a-c	maximum	max
ante meridiem	a.m.	mercury	Hg
ampere	A	milligram	mg
average	avg	milligrams per liter	mg/l
		milliliter	ml
biochemical oxygen demand	BOD	millimeter	mm
brake horsepower	bhp	million gallon	mil
British thermal unit	Btu	million gallons per day	mgd
		minimum	min
Centigrade	C	net positive suction head	npsh
company	Co	number	No.
cubic inch	cu in	National Pipe Threads	NPT
cubic foot	cu ft		
cubic yard	cu yd		
cubic feet per minute	cfm		
cubic feet per second	cfs	ounce	oz
		outside diameter	OD
decibel	db	parts per million	ppm
degree Centigrade (or Celsius) (say)	20 C	plus or minus	(±)
degree Fahrenheit (say)	68 F	post meridiem	p.m.
diameter	diam	pound	lb
direct current	d-c	pounds per square foot	psf
dollars	\$	pounds per square inch	psi
each	ea	pounds per square inch absolute	psia
efficiency	eff	pounds per square inch gage	psig

Fahrenheit	F	revolutions per	rpm
feet	ft	minute	
feet per hour	fph		
feet per minute	fpm	second	sec
feet per second	fps	specific gravity	sp gr
figure	Fig.	square	sq
flange	flg	square foot	sq ft
foot-pound	ft-lb	square inch	sq in
		square yard	sq yd
gallon	gal	standard	std
gallons per minute	gpm	standard cubic feet	scfm
gallons per second	gps	per minute	
gram	g		
Hertz	Hz	total dynamic	TDH
hour	hr	head	
horsepower	hp	totally-enclosed-	tefc
		fan-cooled	
inch	in.	volt	V
inch-pound	in.-lb		
inside diameter	ID		
kilovolt-ampere	kva		
kilowatt	kw		
kilowatt-hour	kwh		
linear foot	lin ft		
liter	l		

1.2 ORGANIZATION ABBREVIATIONS

A. Abbreviations of organizations which may be used in these Specifications are:

ACI	American Concrete Institute
ACSM	American Congress on Survey and Mapping
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers

AWWA	American Water Works Association
AWS	American Welding Society
DIPRA	Ductile Iron Pipe Research Association
CRSI	Concrete Reinforcing Steel Institute
EPA	Environmental Protection Agency
FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCI	Precast Concrete Institute
SSPC	Steel Structures Painting Council
UL	Underwriters Laboratories, Inc.
USGS	United States Geological Survey
GRI	Geosynthetic Research Institute

1.3 LEGEND

- A. Legends of symbols used are shown on the Drawings, and in general, use of symbols is confined to the Drawings.

+ + END OF SECTION + +

SECTION 01210

PRECONSTRUCTION CONFERENCE

1.1 GENERAL

- A. Date, Time and Location: Conference will be held after execution of the Contract and before construction is started at the site. PIRNIE will fix the date, time and location of the meeting in accordance with requirements of the General Conditions.
- B. PIRNIE shall prepare agenda, preside at meeting, and prepare and distribute minutes of proceedings to all parties.
- C. CONTRACTOR shall provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda.

1.2 REQUIRED ATTENDANCE

- A. CONTRACTOR and major Subcontractors.
- B. OWNER'S representative.
- C. PIRNIE.
- D. Representatives of government agencies having any degree of control or responsibility, if available.

1.3 AGENDA

- A. Agenda will include, but will not necessarily be limited to, the following:
 - 1. Designation of responsible personnel.
 - 2. Subcontractors.
 - 3. Coordination with other contractors.
 - 4. Coordination with OWNER'S operations.
 - 5. Construction schedule.
 - 6. Processing of Shop Drawings.
 - 7. Processing of field decisions and Change Orders.
 - 8. Requirements for copies of Contract Documents.
 - 9. Insurance in force.
 - 10. Schedule of Values.
 - 11. Schedule of Payments.
 - 12. Use of premises.
 - 13. CONTRACTOR responsibility for safety and first aid procedures.
 - 14. Security.

15. Housekeeping.
16. Field Offices.
17. Record Drawings.
18. QA/QC issues including but not limited to:
 - a. Provide each organization with all relevant QA/QC documents and supporting information;
 - b. Discuss the construction plans, QA/QC Plan and its role relative to the design criteria, specifications and construction documentation;
 - c. Determine any changes to the QA/QC Plan that are needed to ensure that the liner system will be constructed to meet or exceed the specified design;
 - d. Review the responsibilities of each organization;
 - e. Review lines of authority and communication for each organization;
 - f. Discuss the established procedures or protocol for observations and tests, including sampling strategies;
 - g. Discuss the established procedures or protocol for handling construction deficiencies, repairs, and retesting;
 - h. Review methods for documenting and reporting inspection data;
 - i. Review methods for distributing and storing documents and reports;
 - j. Review work area security and safety protocol for specific test equipment;
 - k. Discuss procedures for the location and protection of construction materials and for the prevention of damage of the materials by inclement weather or other adverse events;
 - l. Conduct a site walk-around to review construction material and inspection equipment storage locations.

+ + END OF SECTION + +

SECTION 01310

CONSTRUCTION SCHEDULES

1.1 GENERAL

- A. To assure completion of the Work within the established time of completion, all activities of the CONTRACTOR will be scheduled and monitored by use of the critical path method or Gantt Chart, utilizing both activity diagram and computer printout.
- B. The CONTRACTOR shall prepare and submit the initial and subsequent critical path diagrams or Gantt Charts and computer printouts for the entire Project.
- C. Critical path diagrams or Gantt Charts and printouts shall be prepared by the CONTRACTOR by experts having demonstrated skill and substantial experience in scheduling and shall show all activities in detail. Computer printouts shall include for each activity its number, description, duration, early start, early finish, late start, late finish, and float time. Both the initial and subsequent submissions shall be time scaled.
- D. In the preparation of the preliminary schedule, as described hereinafter, the CONTRACTOR shall take into consideration Shop Drawing submittal and approval time, the delivery times of equipment and materials, Subcontractors' work, availability and abilities of workmen, weather conditions, any restrictions in operations at the Project site, and all other items that may affect completion of the Work within the time requirements of the Contract Documents.
- E. In the preparation of the Preliminary Schedule, the CONTRACTOR shall take into consideration the fact that no Work can be done on the site every second Friday.

1.2 REVISION OF SCHEDULE

- A. The critical path diagram or Gantt Chart shall be revised every two months during the project to reflect departures and changes from the previous schedule. If departures and changes during the previous period are of such minor nature that no useful purpose is served by revising the schedule, PIRNIE may waive this requirement.
- B. The CONTRACTOR shall furnish six (6) copies of the revised schedule and the accompanying computer printout to PIRNIE within five (5) days from the date its preparation is directed.

+ + END OF SECTION + +

SECTION 01340

SHOP DRAWING PROCEDURES

1.1 GENERAL

- A. Shop Drawing procedures shall conform to requirements of General Conditions and as described in this Section.

1.2 PROCEDURE

- A. Submit Shop Drawings to: Malcolm Pirnie, Inc., 15 Cornell Road, Latham, New York 12110.
- B. A letter of transmittal shall accompany each submittal. If data for more than one Section of the Specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section. A form shall be provided to the CONTRACTOR for all Shop Drawing submittals.
- C. At the beginning of each letter of transmittal provide a reference heading indicating the following:
1. Project Name _____
 2. Contract No. _____
 3. Transmittal No. _____
 4. Section No. _____
- D. If a Shop Drawing deviates from the requirements of the Contract Documents, CONTRACTOR shall specifically note each variation in his letter of transmittal.
- E. All Shop Drawings submitted shall bear the stamp of approval and signature of CONTRACTOR as evidence that they have been reviewed by CONTRACTOR. Submittals without this stamp of approval will not be reviewed by PIRNIE and will be returned to CONTRACTOR. CONTRACTOR'S stamp shall contain the following minimum information:
- Project Name: _____
- CONTRACTOR'S Name: _____
- Date: _____

-----Reference-----

Item: _____

Specifications:

Section: _____

Page No.: _____

Para. No.: _____

Drawing No.: _____ of _____

Location: _____

Submittal No.: _____

Approved By: _____

- F. A number shall be assigned to each submittal by CONTRACTOR starting with No. 1 and thence numbered consecutively. Resubmittals shall be identified by the original submittal number followed by the suffix "A" for the first resubmittal, the suffix "B" for the second resubmittal, etc.
- G. Shop drawing submittals shall be of a scale and size sufficient to show clearly all necessary details of construction, layout, and components. Any size, model number, etc. proposed for use shall be clearly identified on the submittal.
- H. CONTRACTOR shall initially submit to PIRNIE a minimum of 6 copies of all submittals that are on 8-1/2-inch by 11-inch or smaller sheets, and one unfolded sepia and 2 prints made from that sepia for all submittals on sheets larger than 8-1/2-inch by 11-inch. The Resident Project Representative shall receive one copy only of each submittals which will be stamped "Preliminary - Not For Construction."
- I. After PIRNIE completes their review, Shop Drawings will be marked with one of the following notations:
1. Approved
 2. Approved as Corrected
 3. Revise and Resubmit
 4. Not Approved
- J. If a submittal is acceptable, it will be marked "Approved" or "Approved as Corrected". Two (2) prints or copies of the submittal will be returned to CONTRACTOR.

- K. Upon return of a submittal marked "Approved" or "Approved as Corrected", CONTRACTOR may order, ship or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.
- L. If a Shop Drawing marked "Approved as Corrected" has extensive corrections or corrections affecting other drawings or Work, PIRNIE may require that CONTRACTOR make the corrections indicated thereon and resubmit the Shop Drawings for record purposes. Such drawings will have the notation, "Approved as Corrected - Resubmit."
- M. If a submittal is unacceptable, 2 copies will be returned to CONTRACTOR with one of the following notations:
 - 1. "Revise and Resubmit"
 - 2. "Not Approved"
- N. Upon return of a submittal marked "Revise and Resubmit", CONTRACTOR shall make the corrections indicated and repeat the initial approval procedure. The "Not Approved" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, CONTRACTOR shall repeat the initial approval procedure utilizing acceptable material or equipment.
- O. Any related Work performed or equipment installed without an "Approved" or "Approved as Corrected" Shop Drawing will be at the sole responsibility of the CONTRACTOR.
- P. Shop Drawings shall be submitted well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. CONTRACTOR shall assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of Shop Drawings. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.
- Q. PIRNIE will review and process all submittals within 10 days of receipt and return the Shop Drawings to CONTRACTOR.
- R. It is CONTRACTOR'S responsibility to review submittals made by his suppliers and Subcontractors before transmitting them to PIRNIE to assure proper coordination of the Work and to determine that each submittal is in accordance with his desires and that there is sufficient information about materials and equipment for PIRNIE to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.
- S. CONTRACTOR shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within two submittals. All

costs to PIRNIE involved with subsequent submittals of Shop Drawings, Samples or other items requiring approval, will be backcharged to CONTRACTOR, at the rate of 3.0 times direct technical labor cost, by deducting such costs from payments due CONTRACTOR for Work completed. In the event that CONTRACTOR requests a substitution for a previously approved item, all of PIRNIE'S costs in the reviewing and approval of the substitution will be backcharged to CONTRACTOR unless the need for such substitution is beyond the control of CONTRACTOR.

+ + END OF SECTION + +

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

1.1 GENERAL

- A. CONTRACTOR shall be responsible for all temporary construction facilities required for the Work. CONTRACTOR shall make all arrangements with utility service companies for temporary services and shall pay all costs associated therewith.
- B. Temporary construction facilities include:
 - 1. Water.
 - 2. Telephone.
 - 3. Weather protection for materials stored on-site.
 - 4. Sanitary and First Aid Facilities.
- C. CONTRACTOR shall abide by all rules and regulations of the utility service company or authority having jurisdiction.
- D. For work in confined areas, CONTRACTOR shall abide by applicable OSHA Regulations, 29 CFR 1910.146
- E. Suitably enclosed chemical or self-contained toilets shall be provided for the use of the men employed on the Work. Toilets shall be located near the Work site and secluded from observation insofar as possible. Toilets shall be serviced at regular intervals, kept clean and supplied throughout the course of the Work.
- F. CONTRACTOR shall furnish and maintain a safe drinking water supply readily available to all workers.
- G. CONTRACTOR shall:
 - 1. Comply with applicable requirements specified elsewhere.
 - 2. Maintain and operate systems to assure continuous service.
 - 3. Modify and extend systems as Work progress requires.
 - 4. Completely remove temporary materials and equipment when their use is no longer required.
 - 5. Clean and repair damage caused by temporary installations or use of temporary facilities.
 - 6. Restore existing facilities used for temporary services to specified or to original condition.

+ + END OF SECTION + +

SECTION 01540

SECURITY

1.1 GENERAL

- A. CONTRACTOR shall safely guard all Work, materials, equipment and property from loss, theft, damage and vandalism. CONTRACTOR'S duty to safely guard property shall include the OWNER'S property and other private property from injury or loss in connection with the performance of the Contract.
- B. He shall employ watchmen as needed to provide the required security and prevent unauthorized entry.
- C. CONTRACTOR may make no claim against PIRNIE or OWNER for damage resulting from trespass.
- D. Party responsible for security shall make good all damage to property of OWNER and others arising from failure to provide adequate security.
- E. If existing fencing or barriers are breached or removed for purposes of construction, CONTRACTOR shall provide and maintain temporary security fencing equal to the existing in a manner satisfactory to the PIRNIE and OWNER.
- F. Maintain security program throughout construction until OWNER'S acceptance and occupancy precludes need for CONTRACTOR'S security program.

+ + END OF SECTION + +

SECTION 01541

PROTECTION OF THE WORK AND PROPERTY

1.1 GENERAL

- A. CONTRACTOR shall be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private property and facilities from damage as specified in the General Conditions and herein.
- B. In order to prevent damage, injury or loss, CONTRACTOR'S actions shall include, but not be limited to, the following:
 - 1. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with the progress of the Work or the Work of any other contractor or utility service company.
 - 2. Provide suitable storage facilities for all materials which are subject to injury by exposure to weather, theft, breakage, or otherwise.
 - 3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
 - 4. Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the Work shall present a safe, orderly and workmanlike appearance.
 - 5. Provide barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways and other hazardous areas.
- C. CONTRACTOR shall not, except after written consent from proper parties, enter or occupy with men, tools, materials or equipment, privately-owned land except on easements provided herein.
- D. CONTRACTOR shall assume full responsibility for the preservation of all public and private property or facility on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect or misconduct in the execution of the Work by the CONTRACTOR, it shall be restored by the CONTRACTOR, at his expense, to a condition equal to that existing before the damage was done.
- E. CONTRACTOR shall not disturb, damage, or alter any trees, shrubs, landforms, vegetation, outside of the limit of disturbance shown on the drawings. CONTRACTOR shall erect temporary snow-fencing, (orange colored plastic type) to delineate the limit of disturbance.

1.2 BARRICADES AND WARNING SIGNALS

- A. Where Work is performed on or adjacent to any roadway, right-of-way, or public

place, CONTRACTOR shall furnish and erect barricades, fences, lights, warning signs, and danger signals, shall provide watchmen, and shall take other precautionary measures for the protection of persons or property and of the Work. Barricades shall be painted to be visible at night. From sunset to sunrise, the CONTRACTOR shall furnish and maintain at least one light at each barricade. Sufficient barricades shall be erected to keep vehicles from being driven on or into Work under construction. CONTRACTOR shall furnish watchmen in sufficient numbers to protect the Work. The CONTRACTOR'S responsibility for the maintenance of barricades, signs, lights, and for providing watchmen shall continue until the Project is accepted by OWNER.

1.3 PROTECTION OF EXISTING STRUCTURES

A. Underground Structures:

1. Underground structures are defined to include, but not be limited to, all sewer, water, gas, and other piping, and manholes, chambers, electrical conduits, tunnels and other existing subsurface work located within or adjacent to the Contract limits.
2. All underground structures except sewers, electric and telephone service connections, known to PIRNIE, are shown on the Drawings. This information is shown for the assistance of CONTRACTOR in accordance with the best information available, but is not guaranteed to be correct or complete.
3. CONTRACTOR shall explore ahead of his trenching and excavation Work and shall uncover all obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption to the services which such structures provide. If CONTRACTOR damages an underground structure, he shall restore it to original condition at his expense.
4. Necessary changes in the location of the Work may be made by PIRNIE, to avoid unanticipated underground structures.
5. If permanent relocation of an underground structure or other is required and is not otherwise provided for in the Contract Documents, PIRNIE, will direct CONTRACTOR in writing to perform the Work, which shall be paid for under the provisions of Article 11 of the General Conditions.

B. Surface Structures:

1. Surface structures are defined as all existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.

C. Protection of Underground and Surface Structures:

1. CONTRACTOR shall sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the Work area. Such sustaining and supporting shall be done carefully and as

required by the party owning or controlling such structure. Before proceeding with the work of sustaining and supporting such structure, CONTRACTOR shall satisfy the ENGINEER that the methods and procedures to be used have been approved by the party owning same.

2. CONTRACTOR shall assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the Work area. CONTRACTOR shall be responsible for all damage and expense for direct or indirect injury caused by his work to any structure. CONTRACTOR shall repair immediately all damage caused by his work, to the satisfaction of the owner of the damaged structure.

- D. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers, and curbs which are temporarily removed to facilitate installation of the Work shall be replaced and restored to their original condition at CONTRACTOR'S expense.

1.4 PROTECTION OF INSTALLED PRODUCTS AND LANDSCAPING

- A. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.
- B. Control traffic to prevent damage to equipment, materials, and surfaces.
- C. Provide coverings to protect equipment and materials from damage.
 1. Cover projections, wall corners, and jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent work.
- D. Prohibit traffic of any kind across planted lawn and landscaped areas.

+ + END OF SECTION + +

SECTION 01550

ACCESS ROADS AND PARKING AREAS

1.1 GENERAL

- A. CONTRACTOR shall provide all temporary construction roads, walks, and parking areas required during the construction and for use of emergency vehicles. Temporary roads and parking areas shall be designed and maintained by the CONTRACTOR so as to be fully usable in all weather conditions.
- B. CONTRACTOR shall prevent interference with traffic on existing roads. He shall indemnify and save harmless the OWNER from any expenses caused by CONTRACTOR'S operations over these roads.
- C. Roadways damaged by CONTRACTOR shall be restored to their original condition by the CONTRACTOR subject to approval of the OWNER or PIRNIE.
- D. Temporary roads, walks, and parking areas shall be removed by the CONTRACTOR prior to final acceptance and the ground returned to its original condition, unless otherwise required by the Contract Documents.

+ + END OF SECTION + +

SECTION 01560

ENVIRONMENTAL CONTROLS

1.1 GENERAL

- A. CONTRACTOR shall provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.
- B. CONTRACTOR shall comply with all laws, rules, regulations, ordinances and requirements of the State of New York, USEPA, NYSDEC, and other governing authorities pertaining to noise control, dust control, soil erosion and sediment control, pollution control and all other environmental controls, protection and restoration.
- C. All costs incurred in complying with the laws, rules, regulations, ordinances and requirements of the governing authorities pertaining to environmental controls, protection and restoration shall be included in the prices bid for this Contract, and at no additional cost to the OWNER.
- D. CONTRACTOR shall conform to the requirements pertaining to environmental protection, restoration and erosion and sediment control as shown on the Drawings and specified in other Divisions and Sections of these Contract Documents.

1.2 NOISE CONTROL

- A. CONTRACTOR'S vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards, other federal regulations, and state and local regulations, and in no case will noise levels be permitted which interfere with the work of the OWNER or others.
- B. All construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler.
- C. Air compressors shall be operated in accordance with the manufacturer's instructions for proper noise abatement.
- D. Air-powered equipment shall be fitted with pneumatic exhaust silencers.
- E. Stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of noise sensitive sites without temporary noise barriers placed between the equipment and the noise sensitive sites. Noise sensitive sites shall include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas. Temporary noise barriers shall be con-

structed of plywood or tongue and groove boards with a noise absorbent treatment on the interior surface (facing the equipment).

1.3 WATER CONTROL

- A. CONTRACTOR shall provide methods to control water to prevent damage to the Work, the site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct water away from excavations, pits, tunnels and other construction areas; direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.
- B. CONTRACTOR shall provide, operate and maintain equipment and facilities of adequate size to control surface water.
- C. CONTRACTOR shall dispose of drainage water in accordance with the water control treatment specification and in conformance with all environmental requirements.

1.4 POLLUTION CONTROL

- A. CONTRACTOR shall provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.
- B. CONTRACTOR shall take special measures to prevent harmful substances from entering public water.
 - 1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
 - 2. Disposal of materials in wetlands or surface waters is prohibited.
- C. All CONTRACTOR'S equipment used during construction shall conform to all current federal, state and local laws and regulations.
- D. CONTRACTOR shall dispose of all excavated refuse, leachate, and contaminated ground water in accordance with the requirements of Section 02200.

1.5 PEST AND RODENT CONTROL

- A. CONTRACTOR shall provide rodent and pest control as necessary to prevent infestation of construction and storage area.
 - 1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

1.6 EROSION CONTROL

- A. CONTRACTOR shall plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold the areas of bare soil exposed at one time to a minimum.
 - 2. Provide temporary control measures such as berms dikes and drains.
- B. CONTRACTOR shall construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. CONTRACTOR shall periodically inspect earthwork to detect any evidence of the start of erosion, and shall apply corrective measures as required to control erosion.

+ + END OF SECTION + +

SECTION 01630

SUBSTITUTIONS

1.1 GENERAL

- A. Requests for review of a substitution shall conform to the requirements of Article 6.3 of the General Conditions and shall contain complete data substantiating compliance of proposed substitution with Contract Documents.

1.2 CONTRACTOR'S OPTIONS

- A. For materials or equipment (hereinafter products) specified only by reference standard, select product meeting that standard, by any manufacturer, fabricator, supplier or distributor (hereinafter manufacturer). To the maximum extent possible, provide products of the same generic kind from a single source.
- B. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named which complies with Specifications.
- C. For products specified by naming one or more products or manufacturers and stating "or equal", submit a request for a substitution for any product or manufacturer which is not specifically named.
- D. For products specified by naming only one product or manufacturer and followed by words indicating that no substitution is permitted, there is no option and no substitution will be allowed.
- E. Where more than one choice is available as a CONTRACTOR'S option, select product which is compatible with other products already selected or specified.

1.3 SUBSTITUTIONS

- A. During a period of thirty (30) days after date of commencement of Contract Time, PIRNIE will consider written requests from CONTRACTOR for substitution of products or manufacturers, and construction methods (if specified).
 - 1. After end of specified period, requests will be considered only in case of unavailability of product or other conditions beyond control of CONTRACTOR.
- B. Submit six (6) copies of request for substitution. Submit separate request for each substitution. In addition to requirements set forth in Article 6.3 of General Conditions, include in request the following:

1. For products or manufacturers:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature with product description, performance and test data, and reference standards.
 - c. Samples, if appropriate.
 - d. Name and address of similar projects on which product was used, and date of installation.
 2. For construction methods (if specified):
 - a. Detailed description of proposed method.
 - b. Drawings illustrating method.
 3. Such other data as the PIRNIE may require to establish that the proposed substitution is equal to the product, manufacturer or method specified.
- C. In making request for substitution, CONTRACTOR represents that:
1. CONTRACTOR has investigated proposed substitution, and determined that it is equal to or superior in all respects to the product, manufacturer or method specified.
 2. CONTRACTOR will provide the same or better warranties or bonds for proposed substitution as for product, manufacturer or method specified.
 3. CONTRACTOR waives all claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.
- D. Proposed substitutions will not be accepted if:
1. Acceptance will require substantial revision of Contract Documents.
 2. They will change design concepts or Specifications.
 3. They will delay completion of the Work, or the work of other contractors.
 4. They are indicated or implied on a Shop Drawing and are not accompanied by a formal request for substitution from CONTRACTOR.
- E. If the PIRNIE determines that a proposed substitute is not equal to that specified, CONTRACTOR shall furnish the product, manufacturer or method specified at no additional cost.
- F. Approval of a substitution will not relieve CONTRACTOR from the requirement for submission of Shop Drawings as set forth in the Contract Documents.

+ + END OF SECTION + +

SECTION 02014

SOIL EXPLORATION AND INSTALLATION OF MONITORING WELLS

PART 1 - GENERAL

1.1 GENERAL

- A. Scope: CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to install monitoring wells, as shown on the Drawings.
- B. Monitoring and observation wells will be installed at the locations a shown. The construction details of the monitoring wells are as shown on the Drawings.
- C. Related Sections:
 - 1. Section 02223, Trench Excavation.

1.2 QUALITY ASSURANCE

- A. CONTRACTOR shall retain a soil exploration contractor and/or water well contractor experienced in the recovery of undisturbed soil samples and the installation of monitoring wells to perform all soil exploration and monitoring well installation. Submit name and qualifications of well driller for approval by PIRNIE.
- B. Permits and Regulations:
 - 1. CONTRACTOR shall perform soil exploration and monitoring well installation in compliance with the applicable requirements of governing authorities having jurisdiction, including but not limited to, the New York State Department of Environmental Conservation and the Occupational Safety and Health Administration.
- C. Reference Standards:
 - 1. Occupational Safety and Health Act, OSHA.
 - 2. AWWA Standard for Water Wells, AWWA A-100.
 - 3. ASTM D 422, Standard Method for Particle-Size Analysis of Soils.
 - 4. ASTM F 480, Specification for Thermoplastic Water Well Casing Pipe and Couplings made in Standard Dimension Ratios (SDR).
 - 5. ASTM D 1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils.
 - 6. ASTM D 1784, Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
 - 7. ASTM 1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 8. USACE, Monitoring Well Installation Manual.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following items:
 - 1. Soil boring and soil sample recovery method.
 - 2. Monitoring well installation method.
 - 3. Monitoring well development method.
- B. Submit samples of proposed well construction materials.

1.4 JOB CONDITIONS

- A. Subsurface Information: Data on subsurface conditions and well boring logs are available for review from PIRNIE. These data are not intended as a representation of warranty of status of the existing subsurface conditions. PIRNIE will not be responsible for interpretations or conclusions drawn therefrom by CONTRACTOR. Data are made available for the convenience of CONTRACTOR.
- B. Existing Utilities: Locate existing underground and aboveground utilities in the area of Work and provide adequate means of protection during operations.
- C. Protection of Persons and Property: Protect structures, utilities, pavements, and other facilities from damage created by soil exploration and the installation of monitoring wells. To prevent unauthorized access to an unfinished boring or monitoring well, the drill rig shall be secured over the hole or well whenever boring or well installation is not occurring. If the drill rig cannot be secured over the unfinished boring, other means suitable to PIRNIE shall be employed to prevent unauthorized access.

PART 2 - PRODUCTS

2.1 CASING MATERIALS

- A. The monitoring well casing shall be nominal or four (4) inch I.D., Type I, Grade I, Polyvinyl Chloride (PVC) pipe and shall meet ASTM F 480, ASTM D 1784 and, ASTM D 1785 specifications. The minimum wall thickness shall be Schedule 40.
- B. End fittings on the casing shall have flush screw threads and be fitted with Viton or Nitrile O-rings.
- C. The cap for the casing shall be PVC and contain a vent hole.
- D. Steel protective casing shall be at least five (5) feet in length and at least four (4) inches in I.D. and equipped with hinged or overlapped metal caps. The caps shall

be equipped with hasps and furnished with locks with at least two (2) keys each. All locks shall be keyed alike.

2.2 SCREEN MATERIALS

- A. The well screens shall be nominal four (4) inch I.D. PVC and of specified length. The well screens shall be of the continuous slot, PVC wire-wound design. They shall be fabricated by circumferentially wrapping a trapezoidal PVC wire around a circular array of PVC internal rods.
- B. The screens shall have 10 slot (0.10 inch) openings.
- C. End fittings on the screens shall have flush screw threads and be fitted with Viton or Nitrile O-rings.

2.3 FILTER PACK MATERIALS

- A. The filter pack materials shall comply with AWWA A-100 Section 6.

2.4 BENTONITE PELLET MATERIALS

- A. Bentonite pellets shall be no longer than 0.25 inches in their longest dimension and shall have a dry bulk density of at least 75 lb/cu. Ft. The bentonite pellets shall be dry prior to placement in the well annulus.

2.5 GROUT MATERIALS

- A. The annuls of monitoring wells and soil boring holes shall be filled with neat-cement grout so as to achieve a coefficient of permeability of 1×10^{-7} cm/sec. Neat-cement grout shall consist of a mixture of API spec. 10, Class G cement (or Class B similar to ASTM C 150 Type II) and water in the ratio of 0.67 cu ft (5.0 gal [19.0 L]) of water per 94 lb (42.6 kg) sack of cement weighing approximately 117 lb/cu ft (1880 kg/m³). A maximum of six percent (6%), by weight, dry bentonite and two percent (2%), by weight, calcium chloride may be added. The neat-cement grout shall be thoroughly mixed and free of lumps.

2.6 WATER

- A. All water used in soil exploration and monitoring well installation and development shall be free of contaminants and obtained from a potable water supply approved by PIRNIE.

2.7 PROTECTIVE CASING/FLUSH MOUNT WELL COVER

- A. Provide protective casing at locations shown constructed of Schedule 80 steel pipe. Casing shall have tab for securing well with lock.
- B. Provide flush mount well cover at locations shown. Flush mount cover shall be secured with three (3) bolts and shall be secured with lockable well cap.

2.8 DISPOSAL OF DRILLING SPOILS AND FLUIDS

- A. CONTRACTOR shall dispose of drilling spoils and fluids at location as designated by OWNER.

PART 3 - EXECUTION

3.1 INSPECTION

- A. PIRNIE shall be notified five (5) days prior to soil exploration and monitoring well installation and PIRNIE shall be present.

3.2 WELL INSTALLATION

- A. All well installation equipment, casing and screen materials shall be steamed-cleaned prior to use on the site. Equipment shall also be steamed-cleaned between wells.
- B. Bore holes for the monitoring well shall be installed with a six and one-quarter (6-1/4) inch inside diameter hollow-stem auger. The bore holes shall be plumb and vertical.
- C. Filter pack shall be emplaced by tremie pipe at the bottom of the boring. The screen and casing assembly shall be inserted in the bore hole. Centralizers shall be used as necessary to assure the screen and casing remain centered in the bore hole during emplacement of the filter pack, bentonite pellet seal, and grout.
- D. The filter pack shall be extended by tremie pipe to a height of one (1) foot above the top for the screen.
- E. Bentonite pellets shall be emplaced on the top of the filter pack by tremie pipe. If the pellets are above the water elevation in the bore hole, they shall be hydrated after emplacement with water introduced into the annulus. The bentonite pellets seal shall be allowed to hydrate at least one (1) hour prior to grouting.
- F. The remaining annulus shall be grouted with neat-cement grout to within two (2) feet of the ground surface. A protective strainer shall be used on the grout tank from

which the grout is pumped to retain any lumps. When grouting, the tremie pipe shall be lowered to the bottom of the zone being grouted and raised slowly as the grout is introduced. The tremie pipe shall be kept full continuously from the start to finish of the grouting procedure, and the discharge end of the tremie pipe shall be continuously submerged in the grout until the zone to be grouted is completely filled.

- G. The PVC casing shall project 2.0 to 3.0 feet above the ground surface and be surrounded by the steel protective casing set in concrete. The protective casing shall be set in at least two (2) feet of concrete which forms a pad around the base of the protective casing and slopes radically outward from the protective casing in order to divert precipitation and surface water.

3.3 WELL DEVELOPMENT

- A. All wells shall be developed by pumping or bailing within the screened interval until at least five (5) well volumes of water are removed and two (2) consecutive water samples collected at five (5) minutes intervals have a turbidity reading of 50 nephelometric turbidity units (NTU's) or less. Specific conductivity, pH and temperature shall be monitored and recorded at a minimum of five (5) minute intervals during well development.

3.4 RECORDS

- A. CONTRACTOR shall maintain complete, accurate records of the entire well installation and well development procedures to provide detailed records for possible future reference and to demonstrate to the governing state or local agency that the monitoring wells were properly installed. Information to be recorded shall include, but not necessarily be limited to the following:
 - 1. The CONTRACTOR shall maintain a detailed daily log of his operations during all drilling procedures. The log shall give a complete description of all formations encountered, footage, size of the hole drilled, depth, sizes of all casing installed, blow counts, sampling interval, fluid losses, water-level changes and depths at which they occurred, a description of cementing operations, a record of cement quantities, and other such pertinent data as may be requested by PIRNIE. The daily log shall be maintained on the site and available for inspection by PIRNIE at all times.
 - 2. Soil boring and well construction logs.
- B. CONTRACTOR shall submit three (3) copies of the soil boring and well construction logs for each boring and well to PIRNIE within fourteen (14) days from the completion of well installation.

3.5 SURVEY

- A. CONTRACTOR shall survey new and existing monitoring wells for horizontal location and vertical elevation.
- B. CONTRACTOR shall establish vertical elevation to an accuracy of ± 0.01 feet using differential levels. CONTRACTOR shall establish vertical elevations of the top of protective casing, measuring point elevation, and existing ground. Tied to permanent control established on-site.
- C. CONTRACTOR shall establish horizontal location of wells to an accuracy of ± 0.01 feet. Horizontal location shall be tied to permanent control established on-site.

3.6 CLEAN UP

- A. Upon completion of the Work, the CONTRACTOR shall remove all rigs, equipment, surplus or unused material, and debris from the site to the satisfaction of PIRNIE.

++ END OF SECTION ++

SECTION 02052

TRANSPORT AND DISPOSAL OF EXCESS EXCAVATED MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. All labor, materials, services and equipment necessary for the transport and disposal of excess excavated materials as specified herein.

B. Related Sections:

1. Section 02223, Trench Excavation.

1.2 QUALITY ASSURANCE

A. Applicable Codes, Standards, and Specifications

1. American National Standards Institute, ANSI-Z28.2 "Standard Practices for Respiratory Protection"
2. National Institute for Occupational Safety and Health, NIOSH, "Working in Confined Space"
3. Identification and Listing of Hazardous Wastes, 6NYCRR Part 366
4. New York Hazardous Waste Management Regulations, 6NYCRR, Part 365
5. New York Waste Transporter Permit Regulations, 6NYCRR Part 364
6. State of New York Fire Code
7. New York State Solid Waste Management Regulations

1.3 SUBMITTALS

- A. Copies of all necessary permits and certifications of waste haulers and disposal facilities must be submitted to PIRNIE before commencing disposal activities.
- B. Written certification of proper transport and final disposal of the contaminated soils shall be submitted to PIRNIE within ten (10) working days after disposal.
- C. Laboratory reports for all environmental testing shall be submitted to PIRNIE within three working days of receipt by CONTRACTOR.

PART 2 - PRODUCTS

(Part 2 omitted this section)

PART 3 - EXECUTION

3.1 DISPOSAL OF CONTAMINATED SOIL

- A. The CONTRACTOR shall dispose of the contaminated soil at a solid waste management facility permitted to receive wastes of this type. Transport shall be by a permitted solid waste transporter.
- B. The OWNER has pre-approved a number of landfills for the disposal of soil and debris from the Arsenal. A copy of this list is attached hereto. CONTRACTOR is advised that he may elect to utilize a landfill not on the current list, but must bear all expenses involved in obtaining approval of the landfill by the Arsenal should he elect to do so. No landfill outside of the United States shall be used for the disposal of contaminated soil.

3.2 CONTAMINATED SOIL CHARACTERIZATION

- A. CONTRACTOR shall sample staged, excavated materials for testing prior to transport to disposal facility.
- B. CONTRACTOR shall collect a minimum of one sample for each 100 cubic yards of material to be disposed of off-site or the number of samples required by the landfill selected by CONTRACTOR for the disposal of the excess excavated material, whichever results in the greater number of samples. Samples shall be analyzed for the parameters required by the landfill selected by the CONTRACTOR but, at a minimum, shall be analyzed for TCLP and for PCBs by a Corps of Engineers and NYSDEC certified laboratory.
- C. List of Approved Landfills:
 - 1. Colonie Landfill, NY.
 - 2. City of Albany Landfill, NY.
 - 3. High Acres Landfill, Fairport, NY.
 - 4. Chemical Waste Management Landfill, Model City, NY.
 - 5. CID Landfill, Buffalo, NY.
 - 6. County Landfill, Leeper, PA.
 - 7. Environmental Quality Landfills (3), Belleville, MI.
 - 8. Earthwatch Waste Systems, Buffalo, NY.

++ END OF SECTION ++

SECTION 02223

TRENCH EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to perform all excavating, backfilling, filling and grading, and disposing of earth materials as shown, specified, and required for construction of the reactive trench as shown and specified.
2. Also included is furnishing and mixing granular iron and concrete sand for construction of the reactive wall.
3. All necessary preparation of subgrade is included.
4. All temporary means needed to prevent discharge of sediment to water courses from dewatering systems or erosion are included.
5. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.
6. Treatment of water collected during the dewatering process is included.

B. Related Sections:

1. Section 02052, Transport and Disposal of Excess Excavated Materials.
2. Section 02230, Select Fill.
3. Section 02232, Granular Iron.

1.2 QUALITY ASSURANCE

A. Tests:

1. The services of a qualified testing laboratory shall be engaged by the CONTRACTOR to evaluate materials and determine acceptability of the fill as specified in Section 02230, Select Fill and Section 02232, Granular Iron. The laboratory shall be acceptable to the PIRNIE.

B. Permits and Regulations:

1. Comply with all regulations and permits for work in roads, and rights-of-way and with all permits and conditions established by local, state and federal agencies for discharging water from excavations.
2. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

- C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ASTM A 36, Specification for Structural Steel.
 2. ASTM A 328, Specification for Steel Sheet Piling.
 3. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.
 4. OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section .650 (Subpart P - Excavations).

1.3 SUBMITTALS

- A. Excavation Plan: Prior to start of excavation operations, submit written plan to demonstrate compliance with OSHA Standard 29 CFR Part 1926.650. As a minimum, excavation plan shall include:
1. Name of competent person.
 2. Excavation of method(s) or protective system(s) to be used.
 3. Copies of "manufacturer's data" or other tabulated data if protective system(s) are designed on the basis of such data.
- B. Test Reports - Borrow, Backfill, and Grading:
1. Submit copies of the following reports directly to PIRNIE from the testing services, with copy to the CONTRACTOR as required in other sections of Division 2.

1.4 JOB CONDITIONS

- A. Subsurface Information: Refer to Supplementary Conditions for Data on subsurface conditions. Data is not intended as a representation or warranty of continuity of conditions between soil borings nor of groundwater levels at dates and times other than date and time when measured. PIRNIE will not be responsible for interpretations or conclusions drawn therefrom by CONTRACTOR. Data are solely made available for the convenience of CONTRACTOR.
1. Additional test borings and other exploratory operations may be made by CONTRACTOR at no cost to PIRNIE.
- B. Existing Structures: The Drawings show certain existing facilities and surface and underground structures located on or adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of CONTRACTOR. CONTRACTOR shall explore ahead of the required excavation to determine the exact location of all structures. They shall be supported and protected from damage by CONTRACTOR. If they are broken or damaged, they shall be restored immediately by CONTRACTOR at his expense.

- C. Existing Utilities: Locate existing underground utilities in the areas of Work. If utilities are to remain in place, provide adequate means of protection during all operations.
1. Should uncharted or incorrectly charted piping or utilities be encountered during excavation, consult PIRNIE immediately for directions as to procedure. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 2. In general, service lines to individual buildings are not shown; however, CONTRACTOR shall assume that a service exists for each utility to each building.
 3. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when permitted in writing by PIRNIE and then only after acceptable temporary utility services have been provided.
 4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- D. Use of Explosives: The use of explosives is prohibited.
- E. Protection of Persons and Property: Barricade open excavations occurring as part of this Work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
 2. Consult PIRNIE and obtain his approval before removing, trimming, or disturbing trees, shrubs, plants, fences, rails, walks, structures or other facilities that are encountered on the line of the excavation.
- F. Dust Control: Conduct all operations and maintain the area of activities, including sweeping and sprinkling of roadways, to minimize creation and dispersion of dust. Calcium chloride shall be used to control serious or prolonged dust problems, subject to approval of PIRNIE.
- G. Roadways and Walks: Unless otherwise approved by PIRNIE, excavated material and materials of construction shall be so deposited, and the Work shall be so conducted, as to leave open and free for pedestrian traffic all crosswalks, and for vehicular traffic a roadway not less than 10 feet in width. All hydrants, valves, fire alarm boxes, letter boxes, and other facilities which may require access during construction shall be kept accessible for use. During the progress of the Work, CONTRACTOR shall maintain such crosswalks, sidewalks, and roadways in satisfactory condition and the Work shall at all times be so conducted as to cause a minimum of inconvenience to public travel, and to permit safe and convenient access to private and public property along the line of the Work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide PIRNIE with sufficient notice and means to examine the areas and conditions under which excavating, filling, and grading are to be performed. PIRNIE will notify CONTRACTOR if conditions are found that may be detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. The excavation of the reaction wall trench shall be accomplished by conventional excavation methods. Deep trenching machines shall not be used.

3.2 EXCAVATION

- A. Excavate all materials to the lines and grades shown. All excavated materials shall be considered contaminated soil and fill material and disposed of in accordance with Section 02052, Transport and Disposal of Excess Excavated Materials, except that portion that will be used for backfill of the trench as shown or specified elsewhere. All excavated materials will be staged for sampling and classification prior to transport and disposal.
- B. Perform all excavation required to complete the Work as shown and specified. Excavations shall include earth, sand, clay, gravel, hardpan, boulders not requiring drilling and blasting to remove decomposed rock, pavements, rubbish and all other materials within the excavation limits. Excavation shall extend to the elevations as shown on drawings and/or interface with competent rock. Excavation shall remove all weathered rock as accomplished with a Caterpillar, Model 315 or equal hydraulic excavator equipped with a trenching bucket and rock teeth.
- C. Excavations for the trench shall be open excavations but shall be properly shored or sheeted to minimize the trench width and protect workers. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown or specified otherwise, protection system(s) shall be utilized.

3.3 UNAUTHORIZED EXCAVATION

- A. All excavation outside the lines and grades shown and which is not approved by PIRNIE, together with the removal and disposal of the associated material shall be at CONTRACTOR'S expense. The unauthorized excavation shall be filled and compacted with select fill by CONTRACTOR at his expense. Claims and damages

resulting from CONTRACTOR'S unauthorized excavation will be his sole responsibility.

3.4 DRAINAGE AND DEWATERING

A. General:

1. Prevent surface and subsurface water from flowing into excavations and from flooding adjacent areas.
2. Remove water from excavations as fast as it collects.
3. Maintain the ground water level at the bottom of the excavation to provide a stable surface for construction operations, a stable subgrade for permanent work and to prevent damage to Work during all stages of construction.
4. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations. Adequate operational standby equipment shall be maintained on the site.
5. Obtain PIRNIE'S approval before shutting down dewatering system for any reason.

B. Standby Requirements for Dewatering: Provide standby equipment to insure continuity of dewatering operations.

C. Treatment and Disposal of Water Removed by Dewatering System:

1. Treat all water removed from the excavation utilizing a 18,000 gallon (minimum) frac tank equipped with a skimming mechanism to remove any petroleum products. Water collected from dewatering operation shall be pumped into frac. tank, allowing solids to settle and oil to float to surface. Periodically remove oil which is present on the surface of the tank and store in approved drums for disposal. Effluent from frac. tank will be discharged into the infiltration trench as shown on drawings. CONTRACTOR shall be responsible for all costs involved in the collection, treatment and discharge of the collected water including but not limited to:
 - a. Furnishing, installing and demobilizing frac. tank.
 - b. Furnishing and operating all pumps necessary for dewatering trench excavation and disposal of treated water.
 - c. Collection and disposal of any oil collected in the frac tank.
 - d. Excavation of infiltration trench and restoration in-kind upon completion of Work.
2. The CONTRACTOR will operate this system as specified and monitor the water surface level in the infiltration trench. If the dewatering process requires pumping at flow rates in excess of the infiltration trench's ability to handle the water, the CONTRACTOR shall notify PIRNIE, who will direct the CONTRACTOR to implement the carbon treatment of the effluent from the frac. tank, as specified and paid for under Item 5, Additional Work for Carbon Treatment of Groundwater.

D. Additional Work for Carbon Treatment of Groundwater:

1. Upon direction by PIRNIE the CONTRACTOR will implement the further treatment of the collected groundwater utilizing bag filters and liquid phase carbon treatment.
2. CONTRACTOR shall provide a system of bag filters and liquid phase carbon treatment rated for a total maximum flow of 200 gpm. Treatment may be achieved with one or more units connected in parallel. The bag filters shall provide for the removal of solids greater than 5 microns in size. The carbon filters shall contain a minimum of 5,000 pounds of granular activated carbon. The additional treatment work includes but is not limited to the following:
 - a. Furnish, operate and Demobilize bag filters and carbon treatment system.
 - b. Furnish and dispose of filter bags and spent carbon.
 - c. Furnish and operate all pumps, piping and controls necessary to pump effluent from frac. tank through the bag filters and carbon unit(s) and discharge treated water into existing storm sewer.

3.5 SHEETING, SHORING AND BRACING

A. General:

1. All municipal, county, state and federal ordinances, codes, regulations and laws shall be observed.
2. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.
3. All steel work for sheeting, shoring, bracing, cofferdams etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the AISC except that field welding will be permitted.
4. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328. Steel for soldier piles, wales and braces shall be new or used and shall conform to ASTM A 36.
5. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
6. Safe and satisfactory sheeting, shoring and bracing shall be the entire responsibility of CONTRACTOR.

- B. Removal of Sheeting and Bracing: Remove sheeting and bracing from excavation unless otherwise ordered in writing by PIRNIE. Removal shall be done so as to not cause injury to the Work.

3.6 TRENCH SHIELDS

- A. Excavation of earth material below the bottom of a shield shall not exceed the limits established by ordinances, codes, laws and regulations.

- B. When a shield is removed or moved ahead, extreme care shall be taken to prevent the disturbance of the iron sand/concrete sand mix.

3.7 GRANULAR IRON /CONCRETE SAND MIX

- A. The granular iron reactive wall shall contain sufficient iron granules to provide a 12 inch thick pure iron granules wall. For trenches wider than 12 inches, the granular iron shall be thoroughly mixed with concrete sand such that the iron content is at least equal to that of a 12 inch thick pure granular iron wall. However, in no event shall the proportion of iron be less than 25 percent, by volume of the total wall volume.
- B. CONTRACTOR shall mix the granular iron and concrete sand in an approved mixing device such as a transit concrete truck drum. Proportioning the granular iron to the concrete sand shall be by volume if accomplished in the field or by weight if done in a batch plant.
- C. The material shall be thoroughly mixed, to provide a uniform mixture, no more than 4 hours prior to placing it in the trench. The granular iron or granular iron/concrete sand mix shall be kept dry until it is placed in the trench. Any material stockpiled on the site prior to installing it in the trench shall be stockpiled on tarpaulins and covered.
- D. Place mixture of granular iron and concrete sand in the trench in a manner that avoids separating or segregating the iron from the sand. Lower the mixture to the bottom of the trench using the excavator bucket or use a tremie tube.
- E. The granular iron/concrete sand mixture shall be evenly spread within the trench and lightly compacted using the excavator bucket. Other mechanical compaction is not required or desirable.

3.8 GENERAL REQUIREMENTS FOR BACKFILL, FILL AND COMPACTION

- A. Furnish, place and compact selected granular fill to 95 percent of Standard Proctor at the surface of the trench.
- B. Backfill excavations as promptly as Work permits, but not until completion of the following:
 - 1. Acceptance by PIRNIE of all Work within the excavation.
 - 2. Inspection, testing approval, and recording of locations of underground utilities, connections, branches, structures and other facilities.

3.9 GRADING

- A. General: Uniformly grade areas within limits of grading shown or specified, including adjacent transition areas. Smooth subgrade surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

+ + END OF SECTION + +

SECTION 02230

SELECT FILL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. CONTRACTOR shall furnish all labor, materials, source evaluation testing, equipment, and incidentals required to furnish and install select fill materials as shown and specified.
 - 2. Select fill materials include:
 - a. Concrete Sand.
 - b. Select Granular Fill.
 - c. Crushed Stone.
- B. Related work specified elsewhere:
 - 1. Section 02223, Trench Excavation.
 - 2. Section 02232, Granular Iron.

1.2 QUALITY ASSURANCE

- A. Tests: The services of a qualified testing agency shall be engaged by the CONTRACTOR to conduct tests to confirm the acceptability for the fill materials specified. All test reports for all samples taken shall be delivered directly to PIRNIE with copies provided to the CONTRACTOR.
- B. Submittals:
 - 1. Submit a sample of all materials proposed for use as specified herein.
 - 2. Submit six (6) copies of all test reports as specified.

PART 2 - PRODUCTS

2.1 CONCRETE SAND

- A. Concrete Sand shall be clean well-graded, mechanically washed sand, free from: organic matter, roots, debris, vegetation, wood, sod, frozen soil lumps, and other deleterious materials, with gradation conforming to the following:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
1/4 inch	100
No. 20	50 to 80
No. 40	20 to 40
No. 100	0 to 10
No. 200	0 to 5

- B. Concrete sand shall be tested as follows on samples collected from the source at the following frequency or whenever a change in consistency occurs or as directed by the ENGINEER. ENGINEER may order additional tests as required.

<u>Test</u>	<u>Method</u>	<u>Frequency</u>
Particle Size	ASTM D422	1 per 200 c.y.
Maximum Index Density	ASTM D4253	1 per 1,000 c.y.
Minimum Index Density	ASTM D4254	1 per 1,000 c.y.

- C. If the material does not meet the criteria specified herein then the CONTRACTOR shall identify another source for the material and conduct source evaluation testing at no additional cost to the PIRNIE.

2.2 SELECT GRANULAR FILL

- A. Select granular fill shall be furnished and installed where shown or as ordered by the ENGINEER.
- B. Select granular fill shall be clean well-graded sand or bank run gravel free from: frozen lumps, wood, organic matter, roots, debris, vegetation, sod, and other deleterious material complying with the following gradation:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3 inch	100
No. 40	40 to 70
No. 200	0 to 10

- C. CONTRACTOR shall test the material at the following frequency or whenever a change in material occur.

Test	Method	Frequency
Particle Size	ASTM D422	1 per 1,000 cy
Moisture Density Relationship of Soils and Soil Aggregate Mixtures using 4.4 lb Hammer and 12-inch Drop (Standard Proctor)	ASTM D698	1 per 1,000 cy

2.3 CRUSHED STONE

- A. Crushed stone shall be clean, durable crushed stone obtained from an approved source and shall be substantially free from shale lenses, metallic ores or other deleterious materials. Crushed stone shall be furnished as an equal mixture of Number 1 and Number 2 sizes.

PART 3 - EXECUTION

3.1 MATERIAL INSTALLATION

- A. Installation of the Concrete Sand is specified in Section 02223, Trench Excavation.
- B. Installation of Select Granular Fill is specified in Section 02223, Trench Excavation.
- C. Crushed stone shall be spread, to the depth shown on the Drawings, as a surface course over all backfilled areas.

+ + END OF SECTION + +

SECTION 02232

GRANULAR IRON

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The CONTRACTOR shall provide all labor, materials, equipment, accessories, source testing necessary to furnish and install the granular iron material as shown and specified.

B. Related Work Specified Elsewhere:

1. Section 02223, Trench Excavation.
2. Section 02230, Select Fill.

1.2 REFERENCE STANDARDS

ASTM D422 Particle-Size Analysis of Soils.

1.3 QUALITY ASSURANCE

A. Testing Laboratory:

1. The services of a qualified testing laboratory, approved by PIRNIE, shall be engaged by CONTRACTOR to make tests and determine the characteristics of the granular iron material. CONTRACTOR shall be responsible for coordinating and scheduling all testing with laboratory so as not to delay completion of the Work.

B. Submittals:

1. Submit a 10 pound sample of the granular iron materials proposed for use as specified herein.
2. Submit six (6) copies of particle size analysis.
3. Submit certification by manufacturer of granular iron that it meets the specifications for specific gravity, bulk unit weight, bulk void fraction, average hydraulic conductivity and porosity as specified herein.

PART 2 - PRODUCTS

2.1 GRANULAR IRON

- A. Granular iron shall be clean, well-graded metallic iron particles free of oxidation, with the following gradations:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
No. 4	100
No. 8	95-100
No. 16	75-90
No. 30	30-50
No. 50	2-10
No. 100	0-5

- B. The granular iron shall also meet the following properties:

<u>Property</u>	<u>Value</u>
Specific Gravity, Helium Pycnometer	7.04 g/cm ³
Bulk Unit Weight	160-170 lb/ft ³ (loose) 180-200 lb/ft ³ (packed)
Bulk Void Fraction	50% Loose; 42% Packed
Average Hydraulic Conductivity	5 x 10 ⁻² cm/sec
Measured Porosity	0.4 to 0.45

- C. The granular iron shall be as manufactured by:
1. Master Builders Technologies, Cleveland, OH, Product GX-027
 2. Peerless Metal Powders and Abrasives, Detroit, MI, Product ETI 8-50
 3. Connelly - GPM, Inc., Chicago, IL, Product ETICC-1004
- D. Granular iron shall be furnished either in bulk or in bags containing an internal, plastic liner to protect the material from moisture. Granular iron shall be free of oil and chemical contaminants. Bulk shipments shall be stored under cover until used and shall be rejected if the material shows visual evidence of rust or other oxidation.

PART 3 - EXECUTION

3.1 GENERAL

- A. Material shall be mixed with concrete sand and installed as specified in Section 02223, Trench Excavation.
- B. CONTRACTOR shall protect granular iron from damage, oxidation, or contamination due to exposure to soil, dust, and rain.
- C. Granular iron shall be installed in the reaction wall trench within 4 hours of mixing with concrete sand. Do not mix and stockpile more material on-site than can be installed within 4 hours.

+ + END OF SECTION + +