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DRAFT 90% Design for Permeable Reactive Barrier Design Specifications & Drawings

Former Miller Container Plant
Volney, NY

Prepared for:

Miller Brewing Company
Milwaukee, WI

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PART 1—GENERAL

1.1 SUMMARY

A. This section lists and defines items, abbreviations, codes, terms, and symbols that may be used in the Construction Documents.

B. Abbreviations may be similar but have different meanings. If clarification is required, the Engineer shall be consulted.

1.2 DEFINITIONS

Construction Documents	Construction Documents including General Conditions, Technical Specifications and all the Construction Drawings.
Construction Drawings	Issued for construction activities and any revision thereafter.
Contractor	URS personnel that will perform the Work.
Engineer	The Design Engineer or designated representative who shall oversee the Work, any person assigned such responsibility and authority by the Design Engineer.
Iron	Zero-Valent Iron Filings used in the construction of the permeable reactive walls to remediate contaminated groundwater.
Project Owner	Miller Brewing Company or representative.
PRB	Permeable Reactive Barrier: constructed of Iron and Sand. The chosen remedy for degrading contaminants of concern in groundwater at the site.
Site	Former Miller Container Plant, Volney, NY.
State	State of New York.
Work	All construction work associated with the Former Miller Container Plant site as identified in the Construction Documents.

1.3 ACRONYMS AND ABBREVIATIONS

'	Feet
"	Inches
%	Percent
±	Plus or minus
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
bgs	Below ground surface
CP	Control Point
CQAP	Construction Quality Assurance Plan

CQCP	Construction Quality Control Plan
CFR	Code of Federal Regulations
CY	Cubic yards
ECP	Erosion Control Plan
EL. or ELEV.	Elevation
EPA or USEPA	United States Environmental Protection Agency
°F	Degrees Fahrenheit
ft	Feet
GWTS	Groundwater Treatment System
HASP	Health and Safety Plan
H:V	Horizontal to Vertical ratio
IDW	Investigation-Derived Waste
Lbs	Pounds
MAX	Maximum
MH	Manhole
MIN	Minimum
mm	Millimeter
MSL	Mean Sea Level
NEC	National Electrical Code
NYSDEC	New York State Department of Environmental Conservation
NAD	North American Datum
NFPA	National Fire Protection Association
NGVD	North American Geodetic Vertical Datum
No. or #	Number
NPDES	National Pollutant Discharge Elimination System
NTS	Not to Scale
OD	Outside diameter
OMC	Optimum moisture content
OSHA	Occupational Safety and Health Administration
PRW	Permeable Reactive Wall
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
ROD	Record of Decision
RAP	Remedial Action Plan
RI	Remedial Investigation
SCH.	Schedule
SMP	Site Management Plan
US	United States
USCS	Unified Soil Classification System
USGS	United States Geological Survey
WMP	Waste Management Plan

PART 2—PRODUCTS

Not Applicable

PART 3—EXECUTION

Not Applicable

END OF SECTION 01010

PART 1—GENERAL

1.1 SITE LOCATION AND HISTORY

A. The Former Miller Containment Plant site is located in Volney, New York, as shown on the Construction Drawings. The Former Miller Container Plant is located approximately 1200 feet south of the city of Fulton, New York. The facility is located approximately 1000 feet northeast of the Oswego River. The site address is:

Former Miller Container Plant (Active Crysteel Manufacturing facility)
1902 County Route 57
Fulton, NY 13069

B. Remedial investigations during the late 1980's and early 1990's documented groundwater with constituents of concern (COCs) at the site. The New York State Department of Environmental Conservation (NYSDEC) selected pump and treat as a final remedial alternative for the site in a record of decision dated March 20, 1995. Recent performance data from the pump and treat system indicates that removal of the COCs has reached the limit of diminishing return and may not reduce COC concentrations to less compliance levels (than 5 ppb east of Route 57 and less than the detection limit (0.5 ppb) west of Route 57). The remedial activities covered by this specification include construction of two zero-valent iron permeable reactive barrier systems (PRBs) in the Northern Operable Unit, Southern Operable Unit, and City of Fulton municipal well field property respectively. The PRB systems are designed to treat chlorinated COCs to below the required limits.

1.2 SITE INFORMATION

A. Soil and subsurface investigations, annual monitoring, and PRB treatability and pilot test results have been conducted at the site and are presented in the following documents:

1. Remedial Investigation Report, Miller Brewing Company Container Division, Fulton, New York, July 1993.

2. Annual Monitoring Report, Soil Vapor Extraction and Groundwater Recovery and Treatment System, Former Miller Brewing Company Container Plant Site, Fulton, New York (Four reports form Year 1 (1997-1998) through Year 5 (2001-2002)).

3. Zero-Valent Iron Permeable Reactive Wall Treatability Test and Design Report, Former Miller Container Plant, Town of Volney, New York, May 2001.

1.3 LIMITATIONS

A. The site conditions represented in the borings, monitoring well logs, lithologic cross sections, or other available data show the conditions that that are anticipated in conducting the Work, however there is inherently some uncertainty with regard to site conditions, and actual work conditions may vary from those represented in the available data. Changes in site conditions shall be brought to the attention of the Engineer. The information contained in the Specifications and

Construction Drawings shows conditions at the locations of the borings and wells at the time of exploration.

PART 2—PRODUCTS

Not Applicable

PART 3—EXECUTION

Not Applicable

END OF SECTION 01020

PART 1—GENERAL

1.1 SUMMARY

A. This section presents a summary of the Work for the site and other general information regarding the Work.

1.2 RELATED SECTIONS

A. Section 01020: Site Description and Background Information.

B. Section 02100: Permeable Reactive Barrier Construction.

C. Section 02340: Geotextiles.

D. Section 02370: Erosion and Sediment Control.

E. Section 02521: New Monitoring Wells.

F. Section 02700: Topsoil.

G. Section 02730: Permanent Markers.

H. Section 02740: Seeding and Soil Supplements.

1.3 GENERAL

A. The Work outlined in these specifications includes, but is not limited to:

A.1 Zero-Valent Iron PRB Construction:

1. Permitting/SubContracting/equipment & material procurement;
2. Site preparation;
3. Supply of granular iron (and other construction materials, if applicable);
4. Installation of the PRBs, Performance Monitoring Wells, Maintenance Points, and Survey Markers;
5. Management of excavated spoils and groundwater (if applicable);
6. Verification of PRB installation;
7. Site Restoration including final grading; and
8. Work incidental to the above work items.

A.2 Well Installation:

1. Installation of new monitoring wells;
2. Installation of new Maintenance Points; and
3. Site restoration.

B. If, during the Work, unanticipated, potentially hazardous conditions are encountered (e.g., evidence of chemical spills, noxious odors, etc.), the Contractor shall stop work, remove personnel from the area, and notify the Engineer immediately for direction.

1.4 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Comply with codes and standards applicable to each type of work and as listed in individual sections.

1. Where a conflict occurs between referenced documents and the Technical Specifications, the Technical Specifications govern.

2. Where a conflict occurs between different referenced documents, the document containing the more stringent requirements governs.

3. Where referenced documents are not specified by date, the applicable version of the document shall be the version current as of the date established for the Construction.

B. Any discrepancies in the Construction Documents shall be brought to the immediate attention of the Engineer for further guidance.

1.5 REFERENCE SPECIFICATIONS

A. Materials, applications, and tests specified by reference to published standards of a society, association, code, or other published standards are included in the Specifications as if written in their entirety.

B. Products and processes included in the Specifications shall conform to the manufacturer's latest published specifications, as of the date established for the Construction.

C. Provide manufacturer's certifications that materials, products, and processes delivered and used on the project meet the specified requirements.

1.6 SUBSTITUTIONS

A. Provide all equipment, materials, and services as specified or noted on the Construction Drawings, unless approval for substitution is obtained from the Engineer. The Engineer's decision regarding the acceptability of substitutions shall be final.

1.7 MEANS AND METHODS

A. Means and methods of construction of subcontracted Work shall be such as the Subcontractors may choose, subject, however, to the Engineer's right to reject means and methods proposed which:

1. Constitute a hazard to the Work, persons, or property;
2. Would not produce finished work in accordance with terms of the Construction Documents; or
3. Are contrary to specified means or methods required in the Construction Documents.

B. The right to reject means and methods of the Subcontractor shall not be construed or interpreted as acceptance or control of means or methods by the Engineer.

C. The Contractor is solely responsible for determining means and methods to satisfactorily complete the Work within guidelines established in the Construction Documents, generally accepted industry standards, and considering personnel and site safety and security.

D. Total responsibility for control of all means and methods lies with the Engineer for the Work under this Construction.

PART 2—PRODUCTS

Not Applicable

PART 3—EXECUTION

Not Applicable

END OF SECTION 01110

PART 1—GENERAL

1.1 SUMMARY

A. The work covered by this Section includes initial site grading and preparation; utility location verification, protection, and removal; permeable reactive barrier (PRB) construction using the biopolymer slurry trench method; construction of PRB funnels using a soil bentonite slurry method, backfilling; and final site grading.

B. The biopolymer slurry trench method of excavation consists of excavating a trench and simultaneously filling the trench with the biopolymer slurry. The biopolymer slurry temporarily supports the walls of the excavation. The granular iron, which may be mixed with sand, is placed into the trench through the biopolymer slurry. Excess biopolymer in the subsurface is degraded with the aid of additives leaving no long-term impairment on the hydraulic conductivity of the PRB.

C. The soil-bentonite trench method of excavation consists of excavating a trench and simultaneously filling the trench with the soil bentonite slurry. The soil-bentonite slurry temporarily supports the walls of the excavation. Sections of the soil-bentonite trench directly adjacent to (within about 8 feet of) the biopolymer slurry trench sections will be constructed of soil-bentonite-cement. This will segregate the different trench section materials.

1.2 RELATED SECTIONS

A. Section 01020: Site Description and Background Information.

B. Section 02340: Geotextiles.

C. Section 02370: Erosion and Sediment Control.

D. Section 02521: New Monitoring Wells.

E. Section 02700: Topsoil.

F. Section 02730: Permanent Markers.

G. Section 02750: Seeding and Soil Supplements.

1.3 REFERENCES

A. Construction Work Plan (Work Plan)

B. Construction Quality Control/Quality Assurance Plan (CQCP/CQAP)

C. American Society for Testing and Materials (ASTM)

1. ASTM C 143: Test Method for Slump of Concrete;
2. ASTM D-422: Method for Particle-Size Analysis of Soils;
3. ASTM D-698: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 Ft. – LBF/Ft.^{3} (600 KN-m/m^3)];

4. ASTM D-1140: Test Method for Amount of Material in Soils Finer than the No. 200 Sieve;
5. ASTM D-2216: Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock;
6. ASTM D-2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System);
7. ASTM D-2922: Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Willow Depth);
8. ASTM D-3017: Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Willow Depth);
9. ASTM D 4389: Density of Bentonite Slurries;
10. ASTM D 4381: Sand Content by Volume of Bentonite Slurries;
11. ASTM D 5084: Hydraulic Conductivity Using a Flexible Wall Permeameter.

B. American Petroleum Institute (API)

1. API 13A: Specification for Oil Well Drilling Fluid Materials.
2. API RP 13B-1: Recommended Practice Standard Procedure for Field Testing Water Based Drilling Fluids.

C. Code of Federal Regulations (CFR).

1. CFR 1926 Subpart F. Excavations.

1.4 DEFINITIONS

A. Excavation: Removal of material encountered to the limits indicated and subsequent stockpiling of materials removed as specified herein.

B. Upgradient: The direction from which groundwater flows. Typically, upgradient is northeast of the PRB location.

C. Downgradient: The direction to which groundwater flows. Typically, downgradient is southwest of the PRB location.

D. Contamination: The presence of chlorinated contaminants exceeding levels defined by the NYSDEC as the Standards, Criteria, and Guidance (SCGs) for groundwater based on the NYSDEC Ambient Water Quality Standards and Guidance Values.

E. Gap Graded: Containing obvious steps in the grain size distribution creating unacceptable voids.

F. Percent Compaction and Optimum Moisture Content: Percent compaction is a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698. Optimum moisture content (OMC) is the percentage of moisture (by weight) at which the maximum density is obtained by the test procedure presented in ASTM D-698.

G. Satisfactory Materials: Materials meeting the requirements as indicated in this specification section for required materials and free from roots, and unacceptable quantity of organic matter;

free from trash, debris, frozen materials, and stones larger than specified herein; and free from contamination.

H. Subgrade: The exposed surfaces of existing or newly placed soil, fill, or aggregate on which, or adjacent to which, soil, other fill, or geotextiles will be placed.

I. Random Fill: Backfill material that will be placed above the Iron that will be compacted, produce minimal settling and is an order of magnitude less permeable than the Iron below it.

J. Unsatisfactory Materials: Materials that do not comply with the requirements for satisfactory materials. Gap graded materials are unsatisfactory unless approved by the Engineer. Unsatisfactory materials also include man-made fills, refuse, or backfill from previous construction where these types of materials are not specifically approved for use. Excessively wet materials and frozen materials, unless approved by the Engineer, are considered unsatisfactory.

K. Iron: Iron meeting the requirements in this section for required materials and free from oil, grease, other chemical contamination, trash, debris, and other unacceptable material.

1.5 PROJECT CONDITIONS

A. Site Information: Subsurface exploratory borings have been completed to evaluate the character of materials and to evaluate hydrogeologic conditions. Boring locations and profile views of the anticipated subsurface conditions for the PRB locations, based on the borings, are summarized and shown on the Construction Drawings. Variations in the subsurface materials are to be expected, and should be monitored during construction. Changes in anticipated conditions must be brought to the attention of the Engineer as soon as they occur. Refer also to Section 01020: Site Description and Background for more information.

Boring logs are contained in Appendix A. Soil classifications shown on the boring logs are the result of field visual classifications in accordance with the Unified Soil Classifications System (USCS).

B. The Work is being conducted at an active industrial facility, Crysteel Manufacturing, Inc. Designated paths for construction access and egress to the site are shown in the Construction Drawings. Construction personnel will adhere to the general access/egress scheme at the site and otherwise maintain easy site access for Crysteel personnel. High traffic times for Crysteel personnel are typically around 8 AM and 5 PM. Periodic semi tractor trailer deliveries may be expected throughout the day. When necessary Contractor will direct traffic flow on Crysteel property to maintain easy access. In the event of conflict, Crysteel access will take precedence over construction activities. Refer to Work Plan, and Construction Drawings for locations of temporary construction roadways, and routing for site access and egress.

C. Access agreements (as necessary) will be executed for construction activities on Crysteel Manufacturing Property, Oswego County Highway Right-of-Way, Town of Volney property, and City of Fulton property well in advance of commencing any work on the respective properties.

D. Protect utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Project personnel include the URS construction personnel (Contractor), URS resident engineer (Engineer), URS Project Manager, and a Specialty Subcontractor. The Specialty Subcontractor provides the know-how necessary to complete this project.

F. The Contractor will prepare a Work Plan that details excavation and construction activities associated with PRB installation. The Contractor will also prepare a Construction Quality Control Plan (CQCP) and Construction Quality Assurance Plan (CQAP). The QA/QC testing specified in the CQCP and CQAP will ensure the materials placed and their placement meet the Specifications.

G. URS will conduct the construction as a Design/Build project, under the direction of URS's Project Manager. NYSDEC may have a Field Representative or Project Observer on-site, per TAGM 4056, during the course of construction. URS will make construction records available upon request to DEC representatives during the course of construction. At the request of NYSDEC QA/QC sample splits will also be made available, in the event NYSDEC desires to conduct further verification testing. However, NYSDEC personnel will not have the authority to direct this work. Should NYSDEC personnel identify deficiencies or have other concerns with the Work, they should bring their concerns to the attention of the Resident Engineer or URS Project Manager.

1.6 SUBMITTALS

A. Submit test reports and analysis certifying that all materials, such as the Iron used to construct the PRBs, conform to the specified requirements for all tests conducted in accordance with this specification.

B. Submit certification that all materials to be supplied for use at the Site meet the requirements of this specification and are clean and free of contaminants, as deemed necessary or appropriate by the Engineer and Project Manager. Certification will be received and approved prior to delivery of materials to the Site.

C. Submit field QC data, reports, etc., to comply with the QC requirements in this specification and in the Construction Quality Assurance Project Plan (QAPP).

D. Submit waste characterization analyses and disposal manifests.

PART 2—PRODUCTS

2.1 GENERAL

A. Fill Materials: Fill material will meet requirements and conditions of the particular fill for which it is to be used. Fill material will be free from biodegradable material, roots, frozen material, stones larger than specified herein, debris, contaminants, and any other objectionable material, unless otherwise specified. Any organic matter will be relatively evenly dispersed throughout the soil. Gap graded or segregated materials will not be permitted unless approved by the Engineer. Excessively wet or dry materials will not be permitted for placement if they appear too wet or too dry to effectively compact, as determined by the Engineer based on visual observation and any guidelines set forth herein.

B. Clearing, grubbing, debris disposal of the three trees on the City of Fulton property, shown in the Construction Drawings, will be performed by the Contractor or approved subcontractor, as necessary.

C. Pre-Construction Material Quality Testing: Each material will be subject to pre-construction testing to determine if the material is suitable. Such pre-construction testing is intended to result in approval or rejection of a material source. Contractor will schedule pre-construction testing on proposed materials. Pre-construction testing will be made available for review a period of ten (10) calendar days after Contractor's receipt of the test results. The test results will be maintained and submitted with the As-Built report.

2.2 RANDOM FILL

A. Random fill required for excavation or trenching as specified in the following:

B. Random Fill will consist of approved, well-graded materials and free from roots, organic matter, trash, debris, frozen materials, and other objectionable material. It is anticipated that all Random Fill to construct the PRBs will be obtained from an off-site source. Trench spoils will not be classified as Random Fill.

C. A list of required pre-construction material testing for Random Fill is presented in Table 1. The tests will be conducted at the frequencies designated unless otherwise directed by the Engineer.

TABLE 1
PRE-CONSTRUCTION RANDOM FILL TESTING

TEST	TEST METHOD (CURRENT VERSION)	TEST FREQUENCY[1]
Geotechnical:		
Soil Classification	ASTM D-2487	40 ft of installed length
Grain Size Analysis	ASTM D-422, D-1140	40 ft of installed length

NOTES:
[1]Testing will be conducted for volume of material calculated based on the length specified for each PRB. Minimum one per source and one per material type.
ASTM - American Society for Testing and Materials

2.3 TOPSOIL AND SEEDING

A. The topsoil to be placed over each PRB will meet the specifications in Section 02700: Topsoil. Subsequent seed application will meet the specifications of Section 02750: Seeding and Soil Supplements.

2.4 IRON

The following specifications detail the Iron that will be utilized by the Contractor.

A. Iron will consist of approved dry material free from contamination oils, greases, or other foreign organic substances. Iron will be obtained from the following source:

Peerless Metal Powders and Abrasives
124 S. Military Rd.
Detroit, MI 48209
(313) 841-5400 phone

B. The Iron will be Peerless (-8+50 mesh sieve) and Peerless (-30+70 and -30+76 mesh sieve) or equivalent type that is approved by the design Engineer.

C. The gradation of Iron will be as specified in Table 2.

TABLE 2
SCREEN SPECIFICATION FOR THE IRON

US Standard Screen Number	Sieve Size (mm)	Weight Percent Passing
#8	2.4	95 – 100
#16	1.2	75 – 90
#30	0.6	25 – 45
#50	0.3	0 – 10
#100	0.15	0 – 5

D. Manufacturing Quality Control

1. The Iron Manufacturer will perform grain size analyses at a frequency of 1 test per 50 tons of Iron delivered to the site.

2.5 SAND

The sand utilized as inert material mixed with the Iron, will meet the specifications in the following sections.

A. The sand will consist of approved dry material free from contamination or other foreign organic substances.

B. Sand will consist of USCS classifications SP or SW in accordance with ASTM D-2487. Sand will contain no more than 2 percent by weight passing the US Number 200 sieve and not less than 100 percent by weight passing the US Number 4 sieve.

C. A list of required pre-construction material testing for sand is presented in Table 3. The tests will be conducted at the frequencies designated unless otherwise directed by the Engineer.

TABLE 3
PRE-CONSTRUCTION SAND TESTING (PRB GATES ONLY)

TEST	TEST METHOD (CURRENT VERSION)	TEST FREQUENCY[1]
Soil Classification	ASTM D-2487	20 ft of installed length
Grain Size Analysis	ASTM D-422, D-1140	20 ft of installed length

NOTES:
[1]Testing will be conducted for volume of material calculated based on the length specified for each PRB. Minimum one per source and one per material type.
ASTM - American Society for Testing and Materials

2.6 BENTONITE

A. Bentonite used in preparing the soil bentonite slurry shall be pulverized (powder or granular) premium grade sodium-cation montmorillonite and shall meet the most current API Standard 13A, Section 4. The yield of the bentonite shall be ninety (90) barrels per ton or similar as approved by Engineer.

2.7 SLURRY

A. Slurry for funnel construction shall consist of a stable colloidal suspension of bentonite in water and shall be controlled in accordance with the most current API Recommended Practice 13B-1, and the following requirements:

1. At the time of introduction of the slurry into the trench, the slurry shall be a mixture of not less than five (5) percent bentonite in water. Additional bentonite or admixtures may be required depending on the hardness and temperature of the water and the quality of the bentonite. The slurry shall have a minimum apparent viscosity of forty (40) seconds reading through a Marsh Funnel Viscometer, a pH between 6 and 9 units, a minimum density of 64 pcf (1.03 gm/cc) and a filtrate loss of twenty five (25) cubic centimeters in thirty (30) minutes at 100 psi.

2. The slurry mixture in the trench shall have a unit weight of not less than sixty four (64) pcf (1.03 gm/cc), not greater than eighty five (85) pcf (1.36 gm/cc) or 15 pcf less than the backfill unit weight, or as approved by the Engineer.

2.8 BACKFILL

The material for backfilling the funnel trench shall be composed of fresh slurry, trench slurry and selected soils obtained from designated trench spoils. Trench slurry may be disallowed if not acceptable to Engineer. The soil shall be friable and free from roots, organic matter, refuse, or other deleterious materials. The backfill shall be thoroughly mixed and reasonably well graded between the following gradation limits:

TABLE 4
BACKFILL (PRB FUNNELS ONLY)

SCREEN SIZE (US STANDARD)	PERCENT PASSING (BY DRY WT.)
3-inches	100%
No. 200	>15% to <80%

ASTM - American Society for Testing and Materials

The permeability of the backfill shall be less than 5 x 10-7 cm/sec. The slump shall be at least 15 pcf greater than the slurry. (NOTE: The backfill design should accommodate, if possible, the trench spoils/soils. Dry bentonite may be added to reduce permeability, make soils more acceptable, or reduce slump of wet mixtures.)

2.9 EXCAVATION SPOILS

Excavation spoils will be generated during excavation of the PRBs. Spoils will consist of a mix of silty sand and sand and gravel soils. At PRB 1, about 300 cy of material will be generated. At PRB 2 about 800 cy of spoils will be generated.

2.10 SAMPLES

A. A representative archive sample will be collected for each of the materials sampled and tested in accordance with the specified frequencies at time of sampling. Samples will be used for comparison to the pre-construction samples, and to confirm that the field quality control testing is being conducted on a similar material to that tested prior to construction. The archived soil samples will be maintained on-site for the duration of fill placement and made available to the NYSDEC upon request.

2.11 TESTING EQUIPMENT

A. Testing equipment used by the Contractor for quality control (QC) testing will be in good working order and have current calibration certificates where required by the applicable standards. Calibration certificates will be maintained on-site and submitted with the As Built report.

PART 3—EXECUTION

3.1 GENERAL

A. Before initiating work covered by this section, the Contractor will become thoroughly familiar with all site features, site conditions, and all portions of the work in this section. Interpreted cross sections were constructed near the areas where the PRBs will be installed. These are provided in the Construction Drawings and are based on the soil borings in Appendix A, but as discussed above, may vary.

B. If, during the course of the work, unanticipated, potentially hazardous conditions or materials are encountered (e.g., evidence of chemical spills, noxious odors, etc.) the Contractor will stop work, remove personnel from the area, and notify the Engineer and URS Project Manager immediately for direction.

C. Immediately prior to conducting construction activities on Crysteel Manufacturing property, Oswego County Highway Right-of Way, Town of Volney property, and City of Fulton property, the respective party will be notified and shown areas and scope of work of specific activities on their property.

3.2 IRON AND BENTONITE TRANSPORT AND STORAGE

A. Iron and bentonite will be shipped and stored such that it is kept free of moisture, dirt, and any other foreign material. Stored Iron and Bentonite will be placed on pallets and covered with a waterproof protective tarp or liner to prevent contact with the ground surface and to protect the iron and bentonite from precipitation.

B. Protective packaging will not be removed from Iron and Bentonite until placement in each PRB. Unused portions of Iron and Bentonite will be returned to storage and protected in accordance with the above requirements.

3.3 UTILITY AND SITE IMPROVEMENT PROTECTION

A. Before performing excavation or subsurface work (including in-situ placement or installation of monitoring wells), the Contractor will verify the actual location of known underground utilities and determine the presence and location of other underground utilities not identified on the Construction Drawings that may be affected by site activities. The Contractor will contact "Dig Safely New York" in New York at (800) 962-7962. The Contractor will coordinate all utility work with the local authorities, including location and shutoffs (if necessary).

1. The utilities shown on the Construction Drawings will remain in service and will be supported in place by engineered measures, such that the utility remains in service and is undamaged.

2. If the Contractor chooses to relocate a utility, the relocation will be approved by the Project Owner and will be performed utilizing materials equivalent to the original construction.

3.4 EXCAVATION

A. Excavation activities for constructing the PRBs will meet the specifications in this Section.

B. Comply with CFR 1926, Subpart P, Excavations, OSHA Part 9 regulations and any other applicable codes, ordinances, and regulations including NYOSHA regulations. Barricade open excavations occurring as part of this work and post with warning signs.

C. Stability of all excavations will be maintained by the Contractor. Slope sides of excavations to comply with applicable codes, ordinances, and regulations. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

D. Excavate to the lines and grades shown on the Construction Drawings, or as directed by the Engineer.

E. The following tolerances shall apply to the slurry trench dimensions and construction.

1. The slurry trench shall be essentially vertical. The working platform and/or excavation equipment may be leveled to be plumb within three (3) percent of vertical.
2. The depth of the slurry trench shall be measured or surveyed to within six (6) inches of the desired elevation.
3. The excavating tool shall at least be as wide as the design width of the slurry trench.
4. The slurry trench shall follow the designed alignment within two (2) feet of the centerline. The slurry trench may vary from the designed alignment if approved by Engineer.
5. Construction will not be permitted when the air temperature is below twenty (20) degrees F or when severe weather conditions may compromise the quality of the Work or cause unsafe conditions.
6. Overlaps and changes in direction of the slurry trench shall require an over excavation of at least five (5) feet beyond the centerline of the trench. In cases where the trench must be re-excavated, the overlap into acceptable backfill shall be at least ten (10) feet.

3.5 EXCAVATION SPOILS

A. The Contractor will stockpile excavated materials in a contained area in order to prevent runoff of potentially contaminated liquids. The location and method of containment will be as detailed in the Work Plan.

B. A representative composite sample will be taken from the stockpiled area of excavated spoils from PRB 1 and PRB 2. A toxicity characteristic leaching procedure (TCLP) test will be conducted.

C. The Contractor will leave soils will on site for storage until excavation work is complete. Excavated Spoils from PRB 1 and PRB 2 will be spread upgradient of PRB 1 and PRB 2 in specified locations deemed acceptable by the Engineer. The spoils will be spread prior to site restoration. The Spoils will be covered with topsoil and seeded following Section 02750 Seeding and Soil Supplements during site restoration. Runoff from the areas of soil spreading of the Spoils will be protected with silt fences to help maintain Spoil placement and limit migration with surface water runoff.

3.6 PRB CONSTRUCTION METHODS

A. The PRBs will be constructed by excavation of "Funnels" and "Gates" as specified in the Construction Drawings. The Funnels will be constructed of a soil/bentonite slurry. In the eight (8) feet (roughly) before the Funnels intersect with the Gates, the Funnels will be constructed with soil, bentonite, and cement. The Gates will be constructed with an iron/sand mixture consisting of twenty (20) percent iron by volume. The gate excavation will be maintained using a biopolymer slurry. The construction method will be performed to allow placement of Iron Gates and Bentonite Funnels to the lines, grades, depths, and dimensions shown for each of the PRBs on the Construction Drawings. The PRB dimensions are shown in Table 4. Approvals for any

deviations are at the discretion of the Engineer and Project Manager, Project Owner, and may be subject to NYSDEC approval.

B. PRB Thickness: PRBs in Area 1 and Area 2 will be constructed to achieve a minimum pure Iron thickness of 5 inches. The PRB thickness may be greater than the required thickness by mixing in the appropriate amount of sand (per specifications on iron/sand mixtures).

C. PRB Length: The length for the PRB in Area 1 will be 130 ft as shown on the Construction Drawings. For Area 2, the PRB length will be 700 ft and include three (3) Gates 80 feet long. The length of each PRB is stationed in the increments shown on the Construction Drawings.

D. PRB Height: The vertical extent of the PRBs will vary as shown in the Construction Drawings. The iron will be placed at the minimum elevation shown on the Construction Drawings to prevent groundwater from passing under the PRBs. The top of the PRB in Area 1 and Area 2 will be about 354 feet above mean sea level (msl) and 362 feet above msl, respectively, as shown on the Construction Drawings.

TABLE 4
MINIMUM PRB DESIGN DIMENSIONS USING 100% IRON

PRB Location	PRB Width (inches)	PRB Length (ft)	PRB Top Elevation* (ft)	PRB Bottom Elevation* (ft)	Maximum PRB Height (ft)
Area 1	5	130	354	305	60
Area 2	5	700	362	286	75

* Measured above mean sea level, values vary as shown on the Construction Drawings. Dimensions may vary based on field conditions.

E. Efforts will be undertaken to minimize the impact of construction activities at each of the two PRBs.

F. Contractor will provide means to keep the slurry and runoff from moving from the work area. Adequate safe guards will be implemented, and include temporary spill prevention measures such as bales of hay or temporary soil berms constructed with excavated soil, and silt fences as shown in the Construction Drawings. If site groundwater is used to mix the biopolymer slurry, a compatibility test will be performed to ensure that mixing will be effective.

G. The construction method requires Sand to be mixed with the Iron. The sand will be mixed with the Iron per Section 3.6 (Construction Using an Iron/Sand Mixture) of this specification.

H. The construction method also requires that excavated Soil and, where specified, Cement be mixed with Bentonite. The Soils and Cement will be mixed with the Bentonite per the Work Plan.

During construction, the subsurface conditions including excavation depths will be monitored to facilitate PRB construction. The Construction Quality Assurance Plan (CQAP) and Construction Quality Control Plan (CQCP) detail activities to document monitoring of the excavation depths. Substantial changes in excavation depths or conditions will be brought to the Engineers attention

immediately. Deviations from the design required by any significant change in understanding of subsurface conditions will only be allowed if approved by the URS Project Manager.

3.7 CONSTRUCTION USING AN IRON/SAND MIXTURE

A. The iron and sand will be mixed into a uniform mixture using suitable equipment. Satisfactory means, incorporating weighing or metering, will be provided to ensure the approved ratio of sand to granular iron is maintained. It is presently anticipated that the iron and sand will be mixed off-site, with confirmation sampling to confirm mix proportions conducted real time on-site upon delivery.

B. All equipment used for mixing will be clean of foreign materials (e.g. concrete mix, soil, stones, etc.) and no water will be used during the mixing process. Addition of water will only occur after mixing.

C. The ratio of iron to sand will be dependent on the actual excavated width of the trench. For a minimum pure iron thickness of five (5) inches, Table 5 is provided as a guide. The Engineer will approve actual iron/sand ratios and trench widths. The iron sand ratio will be based on dry weights.

TABLE 5
MINIMUM IRON/SAND RATIOS FOR TRENCH WIDTHS

Trench Width	Percent Iron by Volume	Percent Iron by Mass	Percent Sand by Mass
2 ft	20%	29%	71%
2.5 ft	20%	29%	71%

Note: Based on estimated bulk densities of 160 lbs/ft^3 for the granular iron and 100 lbs/ft^3 for the sand. The actual bulk densities should be determined prior to construction and this table modified if required.

D. The iron/sand mixture will contain a minimum 20 percent iron by volume or 29 percent iron by mass dry weight. Weight percent based on trench width is preferred. This requires a determination of the expected in-place bulk density of the granular iron and sand. Methods for attaining this mixture requirement are addressed in CQAP attached to this specification.

E. The weights of sand and iron mixed in each batch will be measured with approved methods and recorded as specified.

F. The sand and iron will be combined to provide a uniform mixture. The uniformity of the mixture will be determined with a magnetic iron separation test as described in Appendix C. The results of the magnetic separation test will be plus or minus 2% of the specified ratio.

G. The off-site iron/sand-mixing vendor will be responsible for iron handling and storage issues (i.e. keeping it covered and dry). The iron/sand mixture will be stored in the same manner as the Iron as specified in this section. During the transport and handling process, care will be taken to minimize vertical drop and vibration of the finished product to prevent separation/ segregation.

H. The iron and sand mixture may be stored prior to installation based on the moisture content of the mixture as shown in Table 6.

TABLE 6
MAXIMUM STORAGE TIMES FOR IRON/SAND MIXTURES

Mixture Moisture Content (Weight Percent)	Iron/Sand Mixture Maximum Storage Times (hr)
0 to 3	72
3 to 6	48
6 to 9	24
greater than 9	8

During construction, quality control testing of the iron-sand mixture will be conducted per the CQAP to verify compliance with the specifications.

3.8 CONSTRUCTION USING A BENTONITE/SOIL OR BENTONITE/SOIL/CEMENT MIXTURE

A. The bentonite and soil (and bentonite, soil, and cement) will be combined into a uniform mixture using suitable equipment. Satisfactory means, incorporating weighing or metering, will be provided to ensure the approved ratio of sand to granular iron is maintained. Methods to mix the bentonite and soil (bentonite, soil, and cement) will be provided in the Work Plan.

B. All equipment used for mixing will be clean of foreign materials (e.g. stones, etc.) and no water will be used during the mixing process. Addition of water is permitted only after mixing.

C. The bentonite sand (bentonite, soil, and cement) ratio will be based on dry weights.

TABLE 7
MINIMUM BENTONITE/SOIL (CEMENT) RATIOS

Percent Bentonite by Mass (By Dry Wt. Soils)	Percent Soil	Percent Cement by Mass
1 to 3	100	100

Note: The actual bulk densities should be determined prior to construction and this table modified as required.

D. The bentonite/soil mixture will contain a minimum 1% percent bentonite by dry weight. This requires a determination of the expected in place bulk density of the bentonite and soil. Methods for attaining this mixture requirement are addressed in the Work Plan and the CQC/CQA Plan.

E. The weights of bentonite and soil mixed in each batch will be measured with approved methods and recorded as specified.

F. The soil and bentonite will be mixed to provide a uniform mixture. The CQC/CQA Plan will specify testing to confirm the uniformity of the mixture.

3.9 FILL PLACEMENT AND COMPACTION

A. Remove vegetation, debris, unsuitable soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Fill operations will be suspended at any time when satisfactory results cannot be obtained because of unsatisfactory conditions in the field.

C. The Contractor will maintain the stability of fill placed.

3.10 GEOTEXTILE AND RANDOM FILL

A. Following placement of Iron to the required limits, a permeable geotextile will be installed above the Iron in accordance with Section 02340: Geotextiles. Following placement of the geotextile, Random Fill will be placed above the geotextile within 3 calendar days. Following placement of the Bentonite/Soil, Random Fill will be placed.

B. Provide a minimum of two (2) feet of Random Fill over the geotextile or Bentonite/Soil material to match the existing grade. Six (6) inches of topsoil will be placed over the top of the Random Fill as specified in Section 02700: Topsoil.

C. Place Random Fill in 10-inch loose lifts. Loose lift thickness may vary slightly but will not result in a final compacted lift exceeding 8 inches.

D. Random Fill compaction effectiveness will be based on visual observation and field moisture-density testing. Random Fill will be compacted to meet density requirements, and to achieve a stable, relatively unyielding soil mass under all construction traffic. The in-place density of Random Fill will be sufficiently high to allow the effective placement and compaction of overlying materials.

E. Compact Random Fill to a minimum of 90 percent of the Standard Proctor (ASTM D-698) maximum density at a moisture content within 2% of the optimum moisture content. Random Fill under roadways, driveways, or paved areas shall be compacted to a minimum of 95 percent of the Standard Proctor maximum density at a moisture content within 2% of the optimum moisture content.

3.11 FINAL GRADING AND RECLAMATION

A. All areas disturbed by construction, including the excavation areas, stockpile areas, laydown areas, support areas, and adjacent transition areas, will be restored to pre-disturbed conditions and graded evenly to match the intent of the surrounding grade according to the specifications. Refer to Section 02370: Erosion and Sediment Control, Section 02700: Topsoil and Section 02750: Seeding and Soil Supplements.

3.12 MONITORING WELLS

A. Install new monitoring wells in accordance with Section 02521: New Monitoring Wells.

B. Protect existing monitoring wells as specified in the Work Plan.

3.13 PERMEABLE REACTIVE BARRIER SURVEY MARKERS

A. Following completion of grading, PRB survey markers will be installed as shown on the Construction Drawings. Markers will be installed on the PRB centerline, at the ends of each PRB, and at the locations indicated on the Construction Drawings.

B. The markers will consist at a minimum of rebar or pipe with a brass surveyor's cap. Markers will be clearly labeled with the survey marker number inscribed on the cap and the appropriate description.

C. The caps will have a minimum diameter of six (6) inches and be clearly labeled as follows:

1. Northwest End of Area 1 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Northwest End PRB 1";
2. Center of Area 1 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Center of Area PRB 1";
3. Southeast End of Area 1 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Southeast End PRB 1";
4. Northwest End of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, North End PRB 2";
5. Gate 1 of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Gate 1 NW End PRB 2"; and
6. Gate 1 of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Gate 1 SE PRB 2"; and
7. Gate 2 of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Gate 2 NW End PRB 2"; and
8. Gate 2 of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Gate 2 SE PRB 2"; and
9. Gate 3 of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Gate 3 NW End PRB 2"; and
10. Gate 3 of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, Gate 3 SE PRB 2"; and
11. Southeast End of Area 2 PRB Inscription: "DO NOT DISTURB - SUBSURFACE GROUNDWATER TREATMENT SYSTEM, South End Area 3 PRB".

D. A registered New York land surveyor will survey each marker. The surveyed marker locations and any related description will be recorded in the field notes. All surveying will be preformed in accordance with the Work Plan.

Markers will be mounted flush with final grade. During construction and restoration activities the Contractor will protect the markers and wells.

3.14 EROSION CONTROL AND MAINTENANCE

A. Erosion and sediment control measures will be provided in accordance with local, state, and federal regulations. Any erosion and sediment control measures that are damaged or found to be ineffective will be repaired as soon as possible. Also, see Section 02370: Erosion and Sediment

Control, and the Work Plan for periodic maintenance of the constructed erosion and sediment control features.

3.15 GRADING CONTROL AND TOLERANCE

A. Random Fill will be placed to a final compacted elevation to match the existing grade. For sloping surfaces, Random Fill thickness will be measured normal to slopes and not vertically. Random Fill thickness may deviate up to two tenths of a foot (0.2 ft) above the minimum design thickness.

B. Iron will be placed to a final compacted elevation and thickness as shown on the Construction Drawings. Iron thickness and elevation may deviate up to two tenths of a foot (0.2 ft) above the minimum thickness and elevation shown on the Construction Drawings.

3.16 CONSTRUCTABILITY ISSUES

A. Guar: The Contractor will prevent discharge of guar to the pond and drainage ditch on-site. See Section 02370: Erosion and Sediment Control

B. Area 1 Utilities: The water lines are in close proximity to the PRB location. The Contractor will protect these utilities from damage during PRB construction.

C. Area 2 Utilities: There is a storm sewer, sanitary sewer, gas line, and piping and electrical utilities that run through the PRB location as shown on the Construction Drawings. Care will be taken to maintain the integrity of these utilities. The utilities will remain in service during construction activities so as not to disturb Crysteel operations. All utility work will be coordinated with Crysteel through the Engineer and Project Manager.

3.17 QUALITY CONTROL TESTING

A. QC testing will be performed by qualified, Contractor personnel. Laboratory testing will be performed, as detailed in the Construction Quality Control Plan (CQCP), by a qualified, approved commercial testing laboratory. All QC testing will be documented on approved forms as presented in the CQCP.

B. Survey control will be established and surveys will be conducted to verify all materials have been placed to the specified limits in accordance with the Work Plan.

C. The work activity will be scheduled in accordance with material QC testing. The Engineer will observe materials delivered to the site. Haul tickets will be submitted to the Engineer. Any material that appears to be deficient or questionable can be returned at the discretion of the Engineer and re-weighed to verify correct weight.

E. In the event the analyses or visual inspection by the Engineer indicates a material may not meet Specifications or has changed significantly from material represented by pre-construction testing, additional testing will be performed to consider the changed material as a new material type. Fill material will not be permitted in the work that has not, in the Engineer's opinion, been represented by pre-construction material QC testing. Additional material samples will be collected from the on-site stockpiles as directed by the Engineer for subsequent tests to prove conformance with the Specifications. Such additional testing will be conducted in accordance with the requirements of this Specification.

F. The Contractor will accurately determine the trench volume, weight of Iron placed in the trench, and in-place bulk density of the Iron as detailed in the CQCP.

G. The Iron weight placed, PRB width, PRB bottom depth, and PRB alignment will be verified as proposed in the CQCP and CQAP. Weight tickets, calculations, reports or other appropriate information will be required to verify that adequate Iron was placed based upon methods detailed in the CQCP and CQAP. The Contractor will maintain the Iron in-place weight within 10% of the design weight for any 10-foot section, and ensure the above criteria do not deviate from the design.

H. The PRB depth will be confirmed per the CQCP and Work Plan.

END OF SECTION 02100

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the requirements for labor, materials, and equipment needed to furnish and install the PRB trench separation/stabilization geotextile, the temporary construction access road stabilization geotextile and the erosion control geotextile. The purpose of the PRB trench separation/stabilization geotextile is to prevent fill materials from mixing with the iron that will be placed below these materials. A separation/stabilization geotextile is required if the installation technique involves utilization of an open trench to place the iron. It is not required for in situ iron placement techniques. The Engineer will review and approve the proposed construction technique and make a final determination of whether a geotextile barrier must be utilized.

1.2 RELATED SECTIONS

A. Section 02100: Permeable Reactive Wall Construction.

B. Section 02370: Erosion and Sediment Control.

C. Section 02700: Topsoil.

D. Section 02750: Seeding and Soil Supplements.

1.3 SUBMITTALS

A. The Contractor will submit geotextile type and material properties to the Engineer for approval. The Contractor will provide the Engineer with written certifications and QC test results demonstrating that the PRB trench separation/stabilization geotextile, the temporary construction access road stabilization geotextile and erosion control geotextile meet or exceed the required minimum property values specified herein. Geotextile properties will be based on minimum average roll values as opposed to average values.

B. The Contractor will submit to the Engineer the manufacturers' written instructions for storage, handling, installation, and seaming of geotextiles along with the conditions of the warranties.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

A. Should any special handling be required, the manufacturer requirements will be marked on the top surface of the geotextile packing in a conspicuous location.

B. During shipment, the geotextiles will be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, and any other damaging or adverse conditions.

C. Upon delivery of the rolls of geotextiles, the Contractor will ensure that rolls are handled and stored in accordance with the manufacturer instructions so that no damage is caused to the material.

PART 2–PRODUCTS

2.1 PRB TRENCH SEPARATION/STABILIZATION GEOTEXTILE

A. The PRB trench separation/stabilization geotextile will be non-woven, needle-punched polyester or polypropylene polymer, and at least 6-ounce material shall be provided.

B. Separation/stabilization geotextile type and properties will be submitted to the Engineer for approval.

C. Separation/stabilization geotextile will be manufactured from first quality virgin materials.

D. Separation/stabilization geotextile will be manufactured from polymers formulated with hindered amine light stabilizers (HALS) to enhance the geotextiles' resistance to environmental degradation.

2.2 TEMPORARY CONSTRUCTION ACCESS ROAD STABILIZATION GEOTEXTILE

A. The access road stabilization geotextile will be a woven geotextile comprised of UV stabilized polypropylene silt film similar to Mirafi 600x.

B. Access road stabilization geotextile type and properties will be submitted to the Engineer for approval.

C. Access road stabilization geotextile shall be suitable for placement over very weak subgrades and site construction roads where very coarse, angular, and abrasive base material is required. It shall provide stabilization and reinforcement when heavy loads are expected.

2.3 EROSION CONTROL GEOTEXTILE

A. Erosion control geotextile will be an erosion control reinforcement blanket (ECRB) similar to that manufactured by North American Green, Evansville, Indiana 47711, and will demonstrate equal flow resistance and longevity characteristics as the following North American Green Style S150. The ECRB must be approved by the Engineer.

B. ECRB will consist of a biodegradable matting comprising straw, jute, coconut, excelsior, or other natural material that may be reinforced with polypropylene or other polymer netting as approved. ECRB shall maintain its integrity for a minimum of one (1) year or until an acceptable vegetation layer is established.

PART 3–EXECUTION

3.1 INSTALLATION

A. Separation/stabilization geotextile: Installation of separation/stabilization geotextile will follow the more strict requirements of those specified below and manufacturer recommendations.

1. Geotextiles will be handled to ensure geotextiles are not damaged in any way.

2. Separation/stabilization geotextile will be installed to cover the top of the Iron. The top of the Iron as required for each PRW is shown on the Construction Drawings and as described herein. The Contractor will prepare the subgrade to receive the geotextile in accordance with the applicable Specification. Work may include compaction and grading to prevent sharp objects or objectionable loose stones from protruding through the subgrade, hand removal of objectionable materials, and approved mechanical means to remove such materials and smooth the subgrade surface.

3. Unroll the geotextile loosely across the prepared subgrade in a manner that will allow the geotextile to conform to surface irregularities. The geotextile must not be stretched during placement.

4. The geotextile (including overlaps) will be secured in place using staples supplied by the manufacturer. Staple location and spacing will be such that there is no displacement of geotextile during the placement of cover materials.

5. The Contractor will take necessary precautions to prevent damage to underlying materials during placement of the geotextile. Should damage to underlying materials occur, Contractor will repair the underlying materials to the satisfaction of the Engineer.

6. During placement of geotextile, care must be taken not to entrap soil, stones or excessive moisture below the geotextile that could hamper subsequent installation or damage the geotextile.

7. Geotextile roll wrappings must not be removed more than 24 hours before placement.

8. Longitudinal geotextile overlaps will be a minimum of one (1) foot and end of roll laps shall be a minimum of two (2) feet. Seams will be oriented down slopes perpendicular to grading contours unless otherwise specified. All laps will be made with the uphill geotextile panel on top of the adjacent downhill geotextile panel.

9. The Contractor must not allow equipment to traffic directly on geotextile.

10. Separation/stabilization geotextile will be covered as soon as possible after approval by Engineer. Installed geotextile must not be exposed to sunlight for more than a total of 14 days. Material to overly the geotextile will be carefully placed to prevent wrinkling or damage to underlying geotextile.

B. Temporary Construction Access Road Stabilization Geotextile: The Contractor will install the geotextile according to the manufacturer's instruction and as shown on the Construction Drawings.

C. Erosion Control Reinforcement Blanket: The Contractor will install ECRB on all areas disturbed by construction of the treatment wall in accordance with approved manufacturer recommended procedures. ECRB will be installed in other disturbed areas where slopes exceed 2 percent to

protect adjacent waterways and to limit wind erosion at the discretion of the Engineer. The ECRB will be anchored and secured with pins, staples, stakes, or other devices as recommended by the manufacturer.

3.2 REPAIR OF DAMAGED SEPARATION/STABILIZATION GEOTEXTILE

A. Before repair, the Contractor will completely remove any soil or other material that may have penetrated a torn separation/stabilization geotextile. Tears or holes must be repaired to the satisfaction of the Engineer.

B. Should a hole or tear occur, a patch of the same separation/stabilization geotextile to be repaired will be placed over the area of repair a minimum of two (2) feet past the damage on all sides. The patch shall be secured in place with staples in a manner that will prevent dislodging of the patch during placement of overlying materials.

3.3 QUALITY CONTROL/QUALITY ASSURANCE

A. The Contractor will examine the geotextile rolls upon delivery, and any deviation from these Specifications and the submitted certifications will be reported to the Engineer. The Contractor will make necessary repairs or replace any damaged products delivered to the site, as directed by the Engineer.

END OF SECTION 02340

PART 1–GENERAL

1.1 SUMMARY

A. This section provides erosion and sediment control requirements to control erosion of the soils associated with the Work and to limit discharge of turbid water and sediment into streams and waterways in accordance with federal, state, and local laws and regulations and required permits.

1.2 RELATED SECTIONS

A. Section 02100: Permeable Reactive Wall Construction.

B. Section 02700: Topsoil.

C. Section 02750: Seeding and Soil Supplements.

1.3 REFERENCES

A. United States Environmental Protection Agency (EPA)

1. EPA-430/9-73-007-Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity.

B. Federal Regulations

1. Section 402 of the Federal Water Pollution Control Act - Amendments 1972.

2. 40 Code of Federal Regulations (CFR) 423, Subpart D, Area Runoff Subcategory.

C. State Rules and Regulations

1. Empire State Chapter, Soil & Water Conservation Society, New York Guidelines for Urban Erosion and Sediment Control, Syracuse. March 1988.

2. NYSDOT Environmental Procedures Manual, Chapter 4.3, Erosion and Sediment Control and Stormwater Management, January 1995

1.4 SUBMITTALS

A. The Contractor will prepare and submit temporary erosion and sediment control procedures in the Project Work Plan. The Contractor Erosion Control Plan will supplement the erosion control measure requirements in the Specifications, and are intended to address erosion measures directly adjacent to the area of excavation.

B. The proposed erosion and sediment control materials and procedures and materials will be submitted in the Project Work Plan. Information for proposed erosion and sediment control materials shall include catalog cuts, and specific intended uses.

PART 2–PRODUCTS

2.1 GENERAL

A. Materials and installation for erosion and sediment control measures will be in accordance with the requirements of the State of New York.

2.2 MATERIALS

A. The Contractor will provide the equipment and materials required to properly perform erosion and sediment control specified for the Work.

PART 3–EXECUTION

3.1 GENERAL

A. The Contractor will conduct erosion and sediment control operations in conformance with the Construction Documents. Erosion and sediment control procedures will comply with applicable federal, state, and local laws and regulations and required permits concerning erosion and sediment control.

B. The Contractor will furnish, install, and maintain temporary erosion and sediment control measures during construction.

C. The Contractor will furnish and install erosion and sediment control measures in accordance with the Construction Documents.

D. Temporary erosion and sediment control measures will be removed after completion of the Work and permanent erosion and sediment control measures (e.g., vegetation, erosion control geotextile) shall be constructed.

E. Special care will be taken to maintain all existing vegetation outside the existing Work area limits.

F. The Contractor will control trench spoils to prevent erosion from potentially contaminated soils.

3.2 EROSION AND SEDIMENT CONTROL REQUIREMENTS

A. The Contractor will prepare and submit erosion and sediment control procedures and any other information required by this specification in the Erosion Control Plan (ECP) portion of the Construction Drawings.

B. The ECP will include the following erosion and sediment control information:

1. Facilities, products, and procedures to meet the requirements of temporary erosion and sediment control requirements of these Specifications and required project permits.

2. Layout procedures and installation details to construct all required temporary erosion protection and sediment control measures.

3. Procedures and schedule to inspect, maintain, monitor, and repair temporary erosion and sediment control measures.

4. Procedures for limiting siltation, erosion, and sediment from entering waterways.

5. Proposed materials and product data for erosion and sediment control measures as specified in Part 2 of this Specification.

6. Procedures and schedule to remove temporary erosion and sediment control measures.

7. Erosion/dust control of stockpiled soils.

3.3 TEMPORARY EROSION AND SEDIMENT CONTROL

A. The Contractor will, furnish, install, and maintain all temporary erosion and sediment control measures during the course of construction in conformance with procedures outlined in the approved ECP. The Contractor shall make every effort to minimize erosion from site clearing, excavation, and earth fill operations at the site work areas.

B. Install erosion and sediment control measures before any intrusive construction work (clearing and grubbing, demolition, decommissioning, excavation, etc.) is started.

C. Temporary erosion and sediment control measures will be in accordance with the following:

1. The area of bare soil exposed at any given time shall be restricted to a minimum.

2. Temporary erosion and sediment control measures, such as grading, silt fences, or straw bales shall be provided and maintained until the permanent work is completed and operative.

D. All temporary erosion and sediment control measures will be removed from the site after the Work is complete, unless otherwise directed by the Engineer.

END OF SECTION 02370

PART 1–GENERAL

1.1 SUMMARY

A. This section covers material and construction requirements for new monitoring wells to be installed after all other construction is completed.

1.2 *RELATED SECTIONS*

A. Section 02100: Permeable Reactive Barrier Construction.

B. Section 02700: Topsoil.

1.3 REFERENCES

A. 6 NYCRR Part 360-2.11 Hydrogeologic report, (a)(8) Monitoring Wells and Piezometers.

B. Construction Quality Control Plan.

C. Monitoring Well Comparison Study: An Evaluation of Direct-Push Versus Conventional Monitoring Wells, conducted by BP North America and USEPA Regions 4 and 5, May 1, 2002

1.4 SYSTEM DESCRIPTION

A. Each monitoring well will be constructed to yield representative groundwater samples of the screened interval for chemical analysis, and to allow for the accurate measurement of groundwater depths relative to the top of the well casing.

1.5 SUBMITTALS

A. Contractor Qualifications: An installer experienced in the direct push method of installation will be used to perform and complete installation for direct push monitoring wells. All work will be performed under the direction of an experienced, qualified, and competent geologist or geotechnical engineer approved by the Engineer.

B. Installation Quality Control Reports: The Contractor will submit a report describing installation including boring logs and confirmatory measurements and observations during installation. The report shall include survey coordinates and elevations of completed monitoring wells.

C. Monitoring Well Construction Diagram: The Contractor will submit a monitoring well construction diagram. The diagram will include the following information: boring depth and diameter; casing type and depth; screen description (including material length, location, diameter, and slot size); filter pack gradation, placement method and depth; seal placement method including material hydration time and water content; grout mixture ratios and depth; construction details, including any difficulties setting casing and screen and sounding procedures for determining depth; manufacturer and quantities of all materials used; and hole preparation before installation.

PART 2–PRODUCTS

2.1 WELL CASING

A. Well Casing: Schedule 80 polyvinyl chloride (PVC) well casing shall be 3/4-inch diameter for all monitoring wells. All casing will be flush threaded, manufactured to applicable standards, and equipped with a locking expandable watertight cap.

B. Screen: The screen shall be commercially fabricated schedule 80 PVC, 3/4-inch diameter and of the length, and slot size shown on the Construction Drawings, flush threaded, and manufactured to applicable standards.

2.2 SAND PACK

A. Material for the sand pack around the screen and the PVC riser shall be the native silty sand formation (natural sand pack).

2.3 BENTONITE

A. Bentonite may be uncoated pellets or granular form for wells with screen seals that extend above the water table.

2.4 CEMENT-BENTONITE GROUT

A. Cement-bentonite grout, shall consist of a mixture with a ratio of five (5) pounds of bentonite powder and one (1) sack of cement (94 pounds) to eight (8) gallons of water.

2.5 WATER

A. Water shall be clean, potable water free of contaminants.

2.6 WELL COMPLETION

A. All monitoring wells will be installed flush to grade. The flush mount well covers shall be a minimum of seven (7)-inches in diameter with a watertight, traffic rated cover secured by bolts. Prior to installation, the Engineer must approve the protective cover.

PART 3 –EXECUTION

3.1 GENERAL

A. All materials entering borings shall be free of chemical contamination of any kind.

B. The Contractor will protect all structures, such as roads, pipelines, existing wells, fences, and shrubbery during the Work; will distribute at the monitoring well locations all cuttings. The drilling debris, and unused materials will be removed after completion of work, and the site

restored as nearly as possible to its original condition. Water from well development will be disposed in the on-site water treatment system or other approved method. Any other debris shall be disposed of off-site in accordance with the Project Work Plan, these Specifications, and approved by the Engineer.

C. During the Work, if unanticipated, potentially hazardous conditions or materials are encountered, (e.g., evidence of chemical spills, noxious odors, etc.) the Contractor will stop work, remove personnel from the area, and notify the Engineer immediately for direction.

D. Performance monitoring wells and piezometers will be constructed at the locations and in the manner shown on the Construction Drawings. If it is necessary to relocate a proposed location, the Contractor will notify the Engineer for approval of an alternate location. It may be necessary to obtain NYSDEC approval for any significant changes to the well locations.

E. Performance monitoring wells and piezometers shall be constructed to the dimensions, details, and depths shown on the Contract Drawings.

F. Contractor will coordinate utility location before drilling may commence in accordance will all federal, state, and local laws.

G. Groundwater monitoring wells will be installed by direct push techniques.

3.2 CAUSE FOR ABANDONMENT

A. In the event that any monitoring well requires abandonment for any cause, when directed by the Engineer, the Contractor will seal the abandoned boring or structure with bentonite. Every attempt shall be made to remove the casing. The Contractor will install another complete monitoring well adjacent to the abandoned structure at a location approved by the Engineer.

3.3 INSTALLATION

A. The following performance monitoring wells shall be installed in the corresponding areas as shown on the Contract Drawings.

PRB #1: PMW-1S, PMW-1D, PMW-2S, PMW-2D, PMW3S, PMW-3D, PMW-4S, PMW-4D,

PRB #2: PMW-5S, PMW-5D, PMW-6S, PMW-6D, PMW-7S, PMW-7D, PMW-8S, PMW8-D, PMW-9s, PMW-9D, PMW-10S, PMW-10D, PMW-11S, PMW-11D

B. Soil Sampling: At least one well at each PRB location will be continuously sampled from the surface to the total depth utilizing a split-spoon sampler or continuous core barrel. The soils will be logged by the on-site geologist and the installation depths confirmed prior to placement of any of the wells.

C. Boring: The permissible installation methods are the direct push method using a drive rod casing for monitoring wells. Lubricants on downhole tools and equipment shall not be used.

D. Drive Rod Installation:

1. A drive rod will be used to make borings for placement of screen, casing, and seal. Drive rod casing shall be visibly clean and free from contaminants to prevent introduction of foreign material into monitoring wells.

2. Drive rod casing used during installation of monitoring wells shall have sufficient thickness to retain its shape and maintain a true section throughout its depth during driving.

E. Casing and Screen Installation:

1. Assembly: All casing and screen shall be new and in good condition before installation. All joints and other accessory parts shall be securely fastened in place. Particular care shall be exercised to avoid damaging the screen and casing during installation and throughout all subsequent operations.

2. Installation of Wells Using Direct Push Method: The direct push drive rod shall be driven to depth with an expendable point. The well assembly (screen and casing) shall be placed inside the steel casing of the drive rod. The expendable point will be left in the hole and the steel casing of the drive rod shall be retracted from the hole. See the Construction Drawings for well construction details.

F. Sand Pack Placement: A natural sand pack will be used for 3/4-inch wells installed using the direct-push technique. Sand Pack will not be used for monitoring wells located within the PRBs. Instead, Iron will be backfilled around the well until the top of the PRW is reached as shown on the Construction Drawings.

G. Bentonite and Cement-Bentonite Seal: A bentonite seal shall be placed around the well casing at the depth shown on the Construction Drawings and hydrated with clean water. Cement-bentonite grout shall be tremied into borings. After the grout has set for 24 hours minimum, the protective cover can be placed in concrete.

H. Capping: At all times before monitoring well completion and acceptance, open borings shall be maintained in a manner that will not constitute a hazard to either humans or animals. Sufficient precautions shall be taken to prevent extraneous material or substances from falling into the boring or casing. A slip type cap or locking expandable cap shall be installed on the casing for this purpose.

I. Flush Mount Well Cover: Flush mount steel well covers shall be installed as shown on the Contract Drawings and shall be securely set in concrete. The vaults shall be seven (7) inches minimum in diameter and twelve (12) inches in length with a watertight, traffic rated cover secured by bolts.

J. Survey coordinates and elevations: After completion of the monitoring well, the location and elevations of the well riser pipe and ground surface shall be surveyed in accordance with the Work Plan.

K. Well Identification: Monitoring wells shall be permanently numbered on the protective casing in a manner specified in the Contractor's Work Plan and approved by the Engineer.

3.4 DEVELOPMENT AND COMPLETION

A. Monitoring wells shall be developed and completed by the Contractor according to those requirements approved by the Engineer in the Contractor's CQCP and to the satisfaction of the on-site Engineer.

B. All well development and completion wastes shall be properly disposed of according to those procedures in the WMP of the CQCP.

3.5 WELL ACCEPTANCE

A. It is the responsibility of the Contractor to properly construct, install, and develop all monitoring wells according to the requirements of this specification so that they are suitable for the intended purpose.

3.6 QUALITY CONTROL

A. The Contractor will observe, measure, and document installation of monitoring wells to assure compliance with the specified requirements. During drilling and construction, details of the installation shall be documented, including the depth of each construction material such as well screen, cement-bentonite grout, gravel pack, and final boring depth.

B. All new monitoring wells shall be protected according the Work Plan.

END OF SECTION 02521

PART 1 – GENERAL

1.1 SUMMARY

A. This section covers the topsoil placement activities involved with restoring the site after construction activities associated with PRB and well installation.

1.2 RELATED SECTIONS

A. Section 02100: Permeable Reactive Wall Construction.

B. Section 02370: Erosion and Sediment Control.

C. Section 02750: Seeding and Soil Supplements.

1.3 SUBMITTALS

A. A site plan showing the proposed equipment storage areas, lay down areas, and stockpile areas is shown in the Construction Drawings. The Contractor will ensure:

1. Materials to for use at the Site shall meet the requirements of this specification and be free of contaminants. The topsoil from the proposed construction locations will be scraped and stockpiled for replacement during site restoration. Based on known soil conditions, this soil is not contaminated because it is located away from the source area and is above the water table.
2. Imported materials, if necessary, must be approved by Engineer prior to delivery of materials to the Site. The requirements for testing of imported materials to verify that materials are free of contaminants will be determined as necessary by the Engineer.

PART 2 – PRODUCTS

2.1 GENERAL

A. The topsoil will consist of clean soil material spread to a minimum thickness of 6-inches above existing grade. The topsoil shall be capable of supporting vegetation and have a United States Department of Agriculture (USDA) classification of the following:

- Sandy Loam;
- Loam;
- Sandy Clay Loam;
- Silty Clay Loam;
- Loamy Sand; or
- Silt Loam.

B. The topsoil may not include rock fragments that are greater than 2-inches in diameter. The topsoil shall support quick germination and fast-growing vegetation capable of stabilizing the soil surface from erosion.

C. Topsoil samples shall have a minimum of 1% organic content as determined by laboratory testing.

PART 3 – EXECUTION

3.1 GENERAL

A. The topsoil shall be placed over all areas shown on the Construction Drawings including, but not limited to:

1. Temporary access roads;
2. Areas requiring repair due to site activities; and
3. To provide cover for areas where trench spoils will be left on-site.

B. Following topsoil placement, the Contractor shall apply fertilizer, seed and mulch at the application rates defined in Section 02750: Seeding and Soil Supplements.

3.2. EARTHWORK

A. An evenly finished surface shall be provided where new site elevations will blend with undisturbed, existing site elevations to maintain the general pattern of surface runoff prior to construction activities.

B. Topsoil shall not be placed in frozen or muddy conditions.

END OF SECTION 02700

PART 1 – GENERAL

1.1 SUMMARY

A. This section covers the installation of survey markers, which will serve as warnings regarding site hazards. Installation of each permanent marker will commence as part of the site restoration activities. Locations of the permanent markers are shown on the Construction Drawings and will be approved by the Engineer.

1.2 RELATED SECTIONS

A. Section 02100: Permeable Reactive Barrier Construction.

1.3 SUBMITTALS

A. The following information shall be submitted to the Engineer once installation of each marker is completed:

1. Survey data defining the location of each of the twelve (12) survey markers; and

2. An as-built drawing defining the location and construction details of each of the twelve (12) survey markers.

PART 2 – PRODUCTS

2.1 GENERAL

A. Specifications and numbering for the permanent survey markers are shown in the Construction Drawings. Additional labeling requirements are included in this Section.

PART 3 – EXECUTION

3.1 GENERAL

The locations of the permeable reactive walls (PRBs) will be marked at a minimum with rebar or pipe and a surveyor's cap a minimum of 6-inches in diameter. The markers will be installed at grade and located as shown on the Construction Drawings. Each marker will be inscribed: *"DO NOT DISTURB – SUBSURFACE GROUNDWATER TREATMENT SYSTEM, (location) PRB"*. The final wording, dimensions, and materials of construction for the markers will be submitted to the NYSDEC for approval prior to installation.

3.2 MARKER PROTECTION

A. Survey markers shall be protected in the same manner as the monitoring wells as specified in the Work Plan.

END OF SECTION 02730

PART 1 – GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all labor, equipment and materials necessary for fertilizing and seeding to complete the work as shown in the Contract Drawings and specified herein. All areas disturbed during construction activities shall be seeded, stabilized with straw mulch and tackifier, fertilized and watered to establish vegetation meeting the criteria of the Contract Documents.

1.2 RELATED SECTIONS

A. Section 02370: Erosion and Sediment Control.

B. Section 02700: Topsoil.

1.3 SUBMITTALS

A. The following information shall be submitted to the Engineer in the Contractor's Work Plan before seeding activities commence.

1. The Contractor shall submit certification of seed mixture, purity, germinating value and crop year identification; and

2. The Contractor shall submit certification that topsoil meets all the requirements of Section 02700: Topsoil.

C. The Contractor shall submit bag tags taken from the seed bags.

PART 2 – PRODUCTS

2.1 GENERAL

A. Lime and Fertilizer

1. Lime shall contain not less than 85 percent total carbonates.

2. Fertilizers shall be selected to supplement nutrient levels in the topsoil.

3. Topsoil samples shall be submitted for analysis at the approved lab to determine the necessary fertilizer and liming requirements.

C. Seed

1. The final cover seed mixture for permanent vegetation shall be clean, high in germinating value and mixed as follows:

Name	**Proportion by Weight**

Kentucky Bluegrass	80%
Perennial Ryegrass	20%

PART 3 – EXECUTION

3.1 GENERAL

A. Earthwork

1. Contractor shall complete topsoil placement per Section 02700: Topsoil.

2. The final surface shall be approved by the Engineer and the Project Owner prior to seeding. If damage occurs during seeding operations due to the Contractor's actions, the surface shall be restored to the original condition at the Contractor's expense.

B. Seed Application

1. Grass seed shall be applied by hydroseeding or other method approved by the Engineer;

2. Seed shall not be sowed during high winds or when the ground surface is too wet for working;

3. Seed shall be spread at a rate of 250 lb./acre;

4. Any portions of the seeded areas which do not produce a minimum 70 percent groundcover shall be re-fertilized, re-seeded and re-watered until vegetation is established; and

5. The Contractor shall coordinate the vegetation-watering schedule with the Engineer. The Contractor will continue watering as required to establish vegetation according to the watering schedule approved by the Engineer.

C. Mulching and Tackifier

1. Straw mulch and tackifier shall be placed within one (1) day of seeding;

2. Straw mulch shall be spread at a rate of 2 ton/acre for normal seeding and 3 ton/acre for dormant seeding; and

3. Tackifier shall be approved by the Engineer and spread according to Manufacture's instructions.

D. Guarantee

1. The Contractor shall guarantee all seeding for a period of one (1) year from the completion of the work.

E. Quality Assurance

1. The Engineer shall inspect all seed prior to commencement of seeding operations. The Engineer shall be notified at least 48 hours in advance of all planned seeding operations and specific materials and their locations shall be identified; and

2. Seeding operations shall be carried out between May 1 and October 10.

END OF SECTION 02750

END

OF

DOCUMENT