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Letter No. 12661-181-SL-IEPA-0003

April 19, 2024

Project No. File No. 12661-181

Re: Revised Technical Specifications for Bypass Basin Retrofit Project

Mr. Mark Liska

Illinois EPA, Bureau of Water

1021 North Grand Avenue East

Springfield, IL 62702

Submitted via email to Mark.Liska@Illinois.gov

Dear Mr. Liska:

On behalf of Midwest Generation, LLC (MWG), Sargent & Lundy is submitting revised technical specifications for the Bypass Basin Retrofit Project at the Powerton Generating Station ("Powerton") in Pekin, IL. These revised documents are being submitted in accordance with proposed Special Condition 12 in Draft CCR Permit No. 2024-CC-100030 for retrofitting the Bypass Basin.

The technical specifications for the Bypass Basin Retrofit Project have been revised to reflect the changes made to MWG's procurement strategy since the initial retrofit construction permit application was submitted in July 2022. As noted on the design drawings submitted on April 5, 2024 (12661-181-SL-IEPA-0002), the retrofit work will be performed as follows:

- Earthwork will be performed in accordance with Specification P-1400.
- All construction quality assurance (CQA) work will be performed in accordance with Specification P-1401.
- Composite liner and drainage geocomposite materials will be furnished and installed in accordance with Specification P-1402.

Following the Agency's review of these updated documents, we kindly request Illinois EPA (1) provide written approval of the revised technical specifications and (2) incorporate these revised documents into Special Condition 12 of the final retrofit construction permit issued by Illinois EPA for the Bypass Basin.

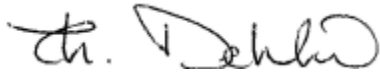
We appreciate Illinois EPA's feedback and support on the Bypass Basin Retrofit Project, and we look forward to continuing to work with the Agency on this matter.

Mr. Mark Liska
Re: Revised Technical Specifications for
Bypass Basin Retrofit Project

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April 19, 2024

Please do not hesitate to contact me directly at (312) 269-6373 or via email at tdehlin@sargentlundy.com if you have any questions on MWG's plans for retrofitting Powerton's Bypass Basin.

Best Regards,

A handwritten signature in black ink, appearing to read "Th. Dehlin".

Thomas Dehlin, P.E.
Manager / Consultant

Enclosures:

1. Specification P-1400 (Rev. 0)
2. Specification P-1401 (Rev. 0)
3. Specification P-1402 (Rev. 1)

Copies Furnished (via Email):

1. Lauren Hunt, Illinois EPA
2. Darin LeCrone, Illinois EPA
3. EPA.CCR.Part845.Coordinator@Illinois.gov
4. Sharene Shealey, MWG
5. Jill Buckley, MWG
6. Todd Mundorf, MWG



POWERTON GENERATING STATION

SPECIFICATION P-1400

EARTHWORK FOR BYPASS BASIN RETROFIT

S&L PROJECT NO.: 12661-181

REVISION 0

ISSUE PURPOSE: BIDS

ISSUE DATE: 04-19-2024





SECTION 000106

ISSUE SUMMARY AND APPROVAL PAGE

<u>Rev.</u>	<u>Purpose of Issue</u>	<u>Date</u>	<u>Sections Affected</u>
0	Bids	04-19-2024	All

This is to confirm that this Specification has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0407, Specifications and Bills of Materials, which is part of our Quality Management System.

Contributor Summary & Current Revision Signatures

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>	<u>Approved By</u>
0	<u><i>Aimee Sahlas</i></u> A. Sahlas	<u>T. Dehlin</u> T. Dehlin	<u>T. Dehlin</u> T. Dehlin



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END OF SECTION 000110



SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

101. **PROJECT INFORMATION**

- 101.1 Owner: Midwest Generation, LLC (MWG)
- 101.2 Design Engineer: Sargent & Lundy (S&L)
- 101.3 Project Name: Bypass Basin Retrofit
- 101.4 Project Location: Powerton Generating Station
13082 E. Manito Rd.
Pekin, IL 61554

102. **DESCRIPTION OF THE PROJECT AND GENERAL BACKGROUND**

- 102.1 The purpose of this project is to retrofit the Bypass Basin at Midwest Generation, LLC's Powerton Generating Station in accordance with the Illinois Pollution Control Board's Coal Combustion Residuals (CCR) Rule, 35 Ill. Adm. Code Part 845, and with the U.S. Environmental Protection Agency's (EPA) CCR Rule, 40 CFR Part 257 Subpart D.
- 102.2 The Bypass Basin will be retrofitted by removing all CCR and CCR-mixed materials stored in the basin and decontaminating the basin's existing geomembrane liner and appurtenant structures, which will remain in place. Following removal of CCR and CCR-mixed material from the basin and decontamination of the basin facilities remaining in-place, a new composite liner system and new leachate collection and removal system (LCRS) will be installed within the Bypass Basin over the basin's existing decontaminated and leak-tested geomembrane liner.

103. **SCOPE OF WORK**

- 103.1 In general, this Specification covers the technical requirements for an Earthwork Contractor to perform all earthwork and sitework required to retrofit the Bypass Basin. The Work includes the following activities:
- a. Furnishing and installing temporary sediment and erosion control best management practices (BMPs) prior to and during all phases of earth disturbance work.
 - b. Onsite unloading and storage of rolls of geosynthetic clay liner (GCL), high-density polyethylene (HDPE) geomembrane liner, and drainage geocomposite delivered to the project site by the respective manufacturers.
 - c. Retrofitting the Bypass Basin by:
 - c1. Ensuring all appropriate measures are taken to protect the Bypass Basin's existing HDPE geomembrane liner system from damage.
 - c2. Placing, compacting, and grading Structural Fill to establish the lines and grades for the basin's LCRS as specified on the Design Drawings.
 - c3. Installing a new LCRS over the new composite liner system. The LCRS consists of drainage geocomposite – an HDPE geonet core with a non-woven geotextile layer heat-laminated to each side of the geonet (to be installed by Others) – over a perforated



leachate collection pipe, a perforated sump pipe, pipe bedding material, and a solid wall riser pipe.

- c4. Installing a Sand Filter Layer above the drainage geocomposite.
- c5. Installing a Protective Warning Layer above the Sand Filter Layer on the basin floor.
- c6. Installing riprap on a gravel bedding layer above the Sand Filter Layer along the basin's side slopes to protect the Sand Filter Layer from erosion.
- d. Restoring and cleaning the project site.
- e. Earthwork Contractor shall allow access to all work areas by Owner, Design Engineer, Geosynthetics Contractor, CQA Contractor staff, and other parties as approved by Owner. Earthwork Contractor shall not install, modify, repair or work on any elements of the project that are subject to the CQA testing and inspection services without notifying the CQA firm at least 2 work days in advance. Work on weekends or holidays shall be scheduled as soon as possible with the CQA Contractor. Failure to provide CQA Contractor adequate advanced notice to staff the site shall result in a hold on work until the CQA contractor staff arrive on site.
- f. Developing fueling and maintenance facilities and practices to protect the project site from hydrocarbon spills or other environmental impacts that may impact the project site, adjacent property, or the Illinois River and connected waterways.

103.2 In addition, the Work shall include but not be limited to the following:

- a. Engineering and construction services required to perform or install the Work.
- b. Surveying to ensure the Work is located as indicated on the Design Drawings.
- c. Furnishing all installation equipment and tools including any calibrated instruments required for monitoring and testing.
- d. Maintaining the project site in a dry condition that includes dewatering of all areas that collect storm water or groundwater in the area controlled by the Earthwork Contractor, redirecting any surface water as a result of rainfall or water generated by the installation Work. Any groundwater and/or surface water which requires removal from the area of work shall be disposed of in compliance with the Powerton Generating Station's National Pollutant Discharge Elimination System (NPDES) discharge permit in effect at the time of the Work. The methods and proposed place of discharge shall be approved by the Owner prior to disposing of the water.
- e. Excess excavated material and other construction related debris shall be disposed of offsite in a permitted landfill approved by the Owner.
- f. Maintaining a record of the installation (i.e., as-built drawings) in accordance with the technical requirements of this Specification.
- g. Furnishing the services of qualified personnel at the project site to perform the Work.
- h. Progress reporting as specified in the Commercial Terms and Conditions.
- i. Daily site cleanup and disposal of waste and debris.
- j. Participation in the Owner's on-site safety program, including the Owner's CCR Safety and Health Plan Training.



- 103.3 The Work shall conform to the requirements of this Specification and shall be performed and supervised by personnel who are experienced and knowledgeable in the crafts and trades required by the Scope of Work. The Work shall be performed exclusively by the Earthwork Contractor's trained and competent personnel or, where permitted, that of its subcontractor(s); and shall comply with all applicable safety laws, regulations, programs, and practices to ensure the safety of all people located on the work site, including the Contractor's personnel (or that of its subcontractor(s)) performing the Work.
- 103.4 Performance of the Work shall include all the labor, supervision, administration, management, material procurement, tools, installation and testing equipment, miscellaneous material, and consumables to perform the Work specified herein.
- 103.5 Provide all installation equipment and all incidental items not shown or specified but reasonably implied for successful completion of the Work and in strict accordance with Design Drawings and this Specification, including inspection, testing and quality standards.
- 103.6 Provide installation quality assurance and quality control submittals where required.
- 103.7 Prepare red-lined as-built drawings for review upon completion of the Work to document any variances between the construction issue of the Design Drawings and the actual installation. Finalize as-built drawings after the Owner and the Design Engineer review.
- 103.8 All other work, as indicated on the Design Drawings, as specified herein or as required to properly complete the Work.

104. DIVISION OF RESPONSIBILITY & CONTRACTOR QUALIFICATIONS

104.1 Owner:

- a. MWG is the Owner of the facility and has the authority to accept or reject materials and workmanship of the Earthwork Contractor or reports and recommendations of the CQA Contractor.
- b. The Owner will ultimately be responsible for the retrofit construction for the Bypass Basin and for assuring the Permitting Authority that the construction meets or exceeds the requirements specified in state regulations, permits, Project Specifications, and the Design Drawings.

104.2 Design Engineer:

- a. S&L is the Design Engineer and is responsible for designing the retrofitted features for the Bypass Basin.
- b. The Design Engineer will ensure that the retrofit design meets the construction requirements of the Owner and meets or exceeds the requirements of the Permitting Authority.
- c. The Design Engineer shall resolve unexpected conditions or unanticipated problems during construction, which may require changes to the permitted design. Changes to the permitted design shall require approval of the Owner and Design Engineer to ensure that the original design objectives are still maintained. All changes shall meet state regulatory requirements and the rules promulgated thereunder and may include Permitting Authority-approved variances to the rules.



104.3 Permitting Authority:

- a. The Illinois EPA is the Permitting Authority and is responsible for reviewing the permit application for retrofitting the Bypass Basin to assure compliance with state regulations and for granting the construction permit for the project.
- b. The Permitting Authority may review any design revisions during construction and any requests for variance submitted by the Owner. The Permitting Authority has the authority to review and approve all CQA documentation and reports and to confirm the Bypass Basin was retrofitted as specified in Project Specifications and the Design Drawings.

104.4 Earthwork Contractor:

- a. The Earthwork Contractor is the contractor responsible for:
 - a1. Earthwork and sitework.
 - a2. Placement of fill material to support the basin's new composite liner system and to establish the lines and grades of the basin's new LCRS.
 - a3. Excavation and backfill of crest anchor trenches.
 - a4. Placement of bedding material around and installation of the leachate collection pipe.
 - a5. Installation of the granular materials above the basin's new LCRS.

104.5 Geosynthetics Contractor:

- a. The Geosynthetics Contractor is the contractor responsible for the installation of all geosynthetic materials for the project, including geosynthetic clay liner (GCL), high-density polyethylene (HDPE) geomembrane, drainage geocomposite, and non-woven geotextile all in accordance with the Design Drawings and Specification P-1402.

104.6 Construction Quality Assurance (CQA) Contractor:

- a. The CQA Contractor is the firm with whom the Owner establishes a contract to perform all CQA work as specified on the Design Drawings and in Specification P-1401.
- b. The CQA Contractor is independent of the GW Contractor and their subcontractors.

105. MATERIAL AND SERVICES FURNISHED BY OTHERS

105.1 The following work has been, or will be, performed and/or provided by Others:

- a. Initial dewatering of the Bypass Basin. The Earthwork Contractor shall be responsible for dewatering the basin as necessary after the Earthwork Contractor mobilizes to the site.
- b. Removing all CCR, gravel, and sand above the basin's existing geomembrane liner.
- c. Decontaminating the basin's existing geomembrane liner and appurtenant structures, including conducting and documenting visual inspections and analytical testing to demonstrate the existing liner is no longer contaminated with CCR constituents.
- d. Construction Quality Assurance services as detailed in Specification P-1401 will be procured by the Owner.
- e. GCL materials will be supplied and installed by the Geosynthetics Contractor hired by the Owner in accordance with Specification P-1402.



- f. HDPE geomembrane and drainage geocomposite materials will be supplied and installed by the Geosynthetics Contractor hired by the Owner in accordance with Specification P-1402.

106. DEFINITIONS

- 106.1 The term "Design Drawing" means the Design Engineer's drawings indicating the Work to be performed.
- 106.2 The term "Project Specifications" means the technical specifications issued by the Design Engineer that define minimum material, installation, and/or testing requirements for the Work. Project Specifications include this Specification and the CQA Specification (P-1401), and the Geosynthetic Contractor Specification (P-1402).
- 106.3 The term "Work" means the material and services furnished to retrofit the Bypass Basin as identified on the Design Drawings and as specified herein.
- 106.4 The term "Owner-approved equal" means an acceptable equivalent to a specified material that has been accepted by the Owner.

107. INTENT OF DOCUMENTS

- 107.1 The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is to include all labor, material, equipment, and transportation necessary for the proper execution of the Work.
- 107.2 Discrepancies between the Design Drawings and this Specification, or errors or omissions, ambiguities, or mis-description in either the Design Drawings or in this Specification, shall be referred to the Design Engineer for interpretation and adjustment prior to beginning the Work. Do not proceed without the Design Engineer's written acceptance.

108. PERFORMANCE OF THE WORK

- 108.1 The Earthwork Contractor shall provide materials and employ construction practices that are sustainable to the greatest extent possible, including disposal of waste.
- 108.2 The Earthwork Contractor shall provide a representative that will input and provide daily force reports and daily production reports.
- 108.3 The performance of the Work, as specified herein and as indicated on the Design Drawings, shall comply with the current safety and health standards authorized by the U.S. Department of Labor's Occupational Safety and Health Administration, as well as state and local jurisdictional requirements.
- 108.4 The Earthwork Contractor shall take all appropriate precautions to ensure the safety of all people working on site.
- 108.5 The Earthwork Contractor shall maintain the necessary skilled and qualified labor force for the Work to ensure the on-time completion of the Work.
- 108.6 The Earthwork Contractor's personnel shall be competent, capable, qualified, and able to perform the duties required to the satisfaction of the Owner. A supervisor vested with authority to make decisions binding on the Earthwork Contractor shall be assigned to the task to resolve installation problems as they arise so as not to delay completion of the Work.
- 108.7 The Earthwork Contractor shall be solely responsible for advising the Design Engineer in



writing of any conflicts between this Specification and the Design Drawings and the Earthwork Contractor's drawings, including performance and levels of quality. The Contractor agrees that its obligations, liabilities, and warranties shall not be diminished or extinguished due to its meeting the requirements of this Specification and the Design Drawings.

109. REGULATORY REQUIREMENTS

109.1 The Earthwork Contractor shall at all times be solely responsible for complying with all applicable laws, ordinances, regulations, and codes, including those relating to safety of all persons, in connection with the Work. No obligation of the Owner or Design Engineer shall impose upon them any duty to review the Earthwork Contractor's compliance with safety measures.

110. PROTECTION OF PROPERTY AND PERSONNEL SAFETY

110.1 The Earthwork Contractor shall take adequate precautions to protect existing structures, fences, pavements, aboveground utilities and underground utilities and to avoid damage thereto. The Earthwork Contractor shall, at its own expense, repair any damage caused by its operations.

110.2 The Earthwork Contractor shall conduct safety training of all its personnel (including any subcontractors) in accordance with the Owner's safety requirements, including the Owner's CCR Safety and Health Plan.

110.3 The Earthwork Contractor shall take adequate precautions to protect the Illinois River, other waterways, and adjacent properties from environmental damage.

111. CLEAN-UP AND DISPOSAL OF DEBRIS

111.1 The Contractor shall be responsible for clean-up and disposal of all debris resulting from the installation work. All excess excavated material and other construction related debris shall be properly disposed of (i.e., in an environmentally responsible way) offsite in a permitted landfill approved by the Owner.

111.2 Clean up, disposal, and site restoration, if required, shall be in compliance with the applicable requirements of all access permits. If any additional permits are required for disposal of debris, these shall be the responsibility of the Earthwork Contractor.

111.3 Work areas shall be kept clean and orderly at all times with as little disturbance as possible to existing conditions. Upon completion of work at each site, all tools, equipment, material, and debris shall be completely removed and the area left in a clean condition.

112. EXISTING SITE CONDITIONS

112.1 Prior to performing any Work in any part of the project site, the Earthwork Contractor shall make a thorough field check for the purposes of verifying existing conditions that may affect the Work. The Earthwork Contractor shall include a thorough investigation of the potential interferences and difficulties that it may encounter in the proper and complete execution of the Work, including the field location and identification of underground and overhead utilities within and adjacent to the limits of the Work. The Earthwork Contractor shall advise the Owner immediately of the discovery of any conditions, including the existence of underground and overhead utilities that may affect the timely and safe execution of the Work.



- 112.2 The Earthwork Contractor shall be responsible for location of underground utilities and obstructions prior to performance of the Work and shall promptly notify Owner of any potential interferences that may impact performance of the Work. Modifications to the design to resolve these interferences shall not be implemented until approved by the Owner.
- 112.3 The Earthwork Contractor further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface material and obstacles, including underground or embedded utilities, to be encountered insofar as this information is reasonably ascertainable from:
- a. An inspection of the site (including field location and identification of underground utilities).
 - b. Reference drawings made available by the Owner.
 - c. Drawings and specifications that are a part of the Contract.
 - d. The character and extent of existing work within or adjacent thereto.
 - e. Any other work being performed thereon at the time of the submission of bids.
- 112.4 Should the Earthwork Contractor fail to perform any of the obligations set forth above, the Earthwork Contractor's later plea of ignorance of existing or foreseeable conditions which create difficulties or hindrances in the execution of the Work will not be considered as an excuse for any failure on the part of the Earthwork Contractor to fulfill in every detail the requirements of the Contract nor will such a plea be acceptable as the basis of a claim for additional compensation or time to complete the work.
113. VERIFICATION OF DIMENSIONS ON DRAWINGS AND MEASUREMENTS AT SITE
- 113.1 The Earthwork Contractor shall make a thorough field check for the purpose of verifying existing conditions that may affect the Work, such as existing topographic data shown on the Design Drawings, difficulties that might be encountered in the execution of the Work for any reason, and dimensions and other questions relating to interconnection of the Work with the existing ash basin construction.
- 113.2 The Earthwork Contractor shall satisfy itself as to the accuracy of the dimensions of the existing ash basin construction as such dimensions relate to the dimensions given on any drawing issued by the Design Engineer. It shall be understood that neither the Design Engineer nor the Owner guarantee the exactness of such dimensions.
- 113.3 Should the Earthwork Contractor discover any variation in the dimensions of existing conditions and the dimensions given on any drawings issued by the Design Engineer, the Earthwork Contractor shall give immediate notice thereof to the Owner and the Earthwork Contractor shall not proceed with the Work until such variation is resolved.
114. SOIL DATA
- 114.1 A structural stability and factor of safety assessment for the Bypass Basin was prepared in October 2016. Site specific soil data and geotechnical recommendations are provided and referenced therein. The geotechnical information in and referenced by this assessment indicates the general character of the subsurface conditions at the site. This information is made available for the Earthwork Contractor's information and for interpretation of soil and water conditions that may be encountered at the site. The logs and test data that are provided are not to be taken as a complete description of the site soil and water information, but only display what was found in borings at the indicated



locations. The Owner and the Design Engineer take no responsibility for the accuracy of this information.

114.2 The Earthwork Contractor may obtain additional subsurface information, as it deems necessary, for installation purposes.

115. LINES AND GRADES

115.1 The Earthwork Contractor shall use the existing benchmarks established at the site, as identified on the survey drawings included in the reference documents for the project, to lay out lines and grades on the project site. The Earthwork Contractor is fully responsible for the correctness of such lines and grades and for proper execution of work to such lines and grades.

115.2 The Owner reserves the right to verify correctness of lines and grades during progress of the Work. Such verification by the Owner will not relieve the Earthwork Contractor of responsibility as herein specified.

115.3 The Earthwork Contractor shall preserve and maintain existing benchmarks and reference points established at the project site. Should the Earthwork Contractor, during execution of the Work, destroy or remove any existing benchmark or reference point, the cost to the Owner for re-establishing the benchmark or reference point will be charged to the Earthwork Contractor.

116. CONTROL AND CHARGE OF CONTRACTOR'S WORK

116.1 The Design Engineer shall have no authority to stop the Work by the Earthwork Contractor for any reason.

116.2 The Earthwork Contractor shall be responsible for the safety of its employees and subcontractors and for maintaining the safety of the job site.

116.3 The Earthwork Contractor shall be solely responsible for construction means, methods, techniques, sequences, and procedures used in the construction of the Work. The Owner, however, reserves the right to request, and the Contractor shall supply, detailed information regarding the Work such as procedures or work methods.

116.4 Only the Owner (or its authorized representative) has the authority to stop the Work (in accordance with the Commercial Terms and Conditions) if such Work is determined to be not in accordance with this Specification, the Design Drawings, or the Contract documents.

117. DESIGN DRAWINGS

117.1 The Design Drawings prepared by the Design Engineer indicate the physical dimensions of the Work to be installed as defined by the Scope of Work and form a part hereof.

117.2 Refer to Attachment 1 for a list of the applicable Design Drawings for this project.

118. REFERENCE DOCUMENTS

118.1 The reference documents assembled by the Design Engineer are for information only.

118.2 Refer to Attachments 2 and 3 for applicable reference documents for this project.

END OF SECTION 011100



SECTION 311010

TEMPORARY SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 - GENERAL

101. **EXTENT**

- 101.1 This section defines the minimum material and installation requirements for temporary sediment control throughout retrofit construction for the Bypass Basin at the Powerton Generating Station.
- 101.2 The Work shall include, but not be limited to, the following items:
- a. Furnishing all materials.
 - b. Installation of self-supporting silt fence.
 - c. Cleaning and maintenance of silt fence.
 - d. Installation of straw wattles.
 - e. Cleaning and maintenance of straw wattles.
 - f. Installation of straw bale barriers.
 - g. Cleaning and maintenance of straw bale barriers.
 - h. Final cleanup and removal of all temporary facilities.
- 101.3 Requirements for Sediment Control:
- a. The Earthwork Contractor shall be responsible for control of sediment throughout retrofit construction for the Bypass Basin.
 - b. Temporary sediment and erosion control facilities shall be installed where specified on the Design Drawings, as indicated in (and to ensure compliance with) the project's Stormwater Pollution Prevention Plan (SWPPP), where instructed by the Owner's on-site representative, and/or where needed to control sediment in accordance with federal, state, and local regulations.

102. **RELATED WORK SPECIFIED IN OTHER SECTIONS AND SPECIFICATIONS**

- 102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:
- a. Earthwork Specification (P-1400):
 - a1. Section 319005 – Earthwork.
 - b. CQA Specification (P-1401):
 - b1. Section 014362 – Quality Assurance for Fill, Liner, and Leachate Collection Materials.

103. **REFERENCE DOCUMENTS**

- 103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and



materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local agencies having jurisdiction.

- 103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.
- 103.3 Abbreviations listed indicate the form used to identify the reference documents herein.
- 103.4 FHWA – Federal Highway Administration:
 - a. FHWA Geosynthetic Design and Construction Guidelines, Report No. FHWA-HI-95-038.
- 103.5 AASHTO – American Association of State Highway and Transportation Officials:
 - a. M288 Standard Specification for Geotextile Specification for Highway Applications.

104. SUBMITTALS

- 104.1 The Earthwork Contractor shall submit the following data. The Earthwork Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Project Owners' information systems specified by the Owner.
- 104.2 Data shall be submitted a minimum of 30 days prior to installation.
- 104.3 Submittals During Construction:
 - a. Material certificate(s) signed by the manufacturer of the silt fencing stating:
 - a1. Name of manufacturer.
 - a2. Chemical composition of filaments or yarns used for the geotextile.
 - a3. Specification sheet describing the geotextile.
 - a4. Other information required to fully describe the product.
 - a5. Guarantee stating that the furnished geotextile meets the requirements specified herein and on the Design Drawings.
 - b. Material certificate signed by the manufacturer of prefabricated silt fences stating:
 - b1. Manufacturer's catalog data.
 - b2. Manufacturer's installation instructions.
 - b3. Manufacturer's preventive maintenance instructions.
 - b4. Manufacturer's inspection instructions.

105. QUALITY ASSURANCE

- 105.1 Materials and construction procedures shall be subject to inspection and testing by the CQA Contractor employed the Owner. Such inspections and tests will not relieve the Earthwork Contractor of responsibility for providing and installing materials in compliance with specified requirements.
- 105.2 The Owner reserves the right, at any time before final acceptance, to reject materials and workmanship not complying with specified requirements. The Earthwork Contractor shall



correct the deficiencies which the inspections and tests have indicated are not in compliance with specified requirements.

105.3 CQA activities shall be performed as described herein and in Specification P-1401.

PART 2 - PRODUCTS

201. MATERIALS FOR GEOTEXTILE SILT FENCES

201.1 Silt fences shall be classified as "Self-Supporting Silt Fences" pursuant to AASHTO M288 and/or the FHWA.

201.2 Additional material requirements for silt fences are provided on the Design Drawings.

201.3 The geotextile manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of this Specification and of the Design Drawings.

202. ACCEPTABLE SILT FENCE PRODUCTS

202.1 Self-Supporting Geotextile Fence Materials:

a. The following self-supporting geotextile fence materials meet the requirements of this Specification and are acceptable for use:

- a1. Typar 3301 – Woven Slit-Film Polypropylene.
- a2. Thrace-Linq GTF-180SF – Woven Slit-Film Polypropylene.
- a3. Carthage Mills FX – Woven Slit-Film Polypropylene.
- a4. Propex, Inc. Geotex 2130 – Woven Slit-Film Polypropylene.
- a5. Owner-approved equal.

202.2 Packaging, Identification Requirements, and Storage:

- a. Deliver geotextile to the project site in rolls, each wrapped securely with a heavy duty protective covering. The protective covering shall bar the entrance of water, vermin, and dirt and shall be adequate for protection against ultraviolet exposure.
- b. Attach or adhere a tag to each geotextile roll identifying the following:
 - b1. Manufacturer and product name and number.
 - b2. Date of manufacture of the geotextile.
 - b3. Roll identification number.
 - b4. Earthwork Contractor's order number (matching Bill of Lading).
- c. Verify that manufacturer includes a label on the inside of the roll core indicating the manufacturer's name, product name, and roll identification number.
- d. During periods of shipment and storage, the fabric shall be protected from temperatures greater than 140°F. To the extent possible, the fabric shall remain wrapped in the protective covering until ready for use.
- e. Stakes shall be packaged separately from geotextiles.



202.3 Silt Fence Fabrication:

- a. Silt fences shall be fabricated as specified on the Design Drawings.

202.4 Line Posts for Silt Fence:

- a. Line posts may be steel posts or wooden posts as specified on the Design Drawings.

203. MATERIALS FOR STRAW WATTLES

203.1 Straw Wattles:

- a. Straw wattles shall be tube-shaped erosion-control devices filled with straw and wrapped with biodegradable netting.
- b. Straw wattle dimensions shall be as specified on the Design Drawings.

203.2 Stakes for Straw Wattles:

- a. Wooden stakes shall be used for anchor straw wattles.
- b. Wooden stakes shall be, at a minimum 1" by 1" square and at least 1'-6" long with pointed ends.
- c. Wooden stakes shall be free from decay, splits, or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

204. MATERIALS FOR STRAW BALE BARRIERS

204.1 Straw Bales:

- a. Straw bale barriers shall be erosion-control devices made of baled straw bound with wire or nylon bands.
- b. Straw bale barriers shall be approximately 14-inches wide by 18-inches high by 36-inches long and have a minimum weight of 50 pounds.
- c. Straw bales shall be bound by steel wire, nylon, or polypropylene string placed horizontally. Jute and cotton binding shall not be used. Baling wire shall be 14 gauge minimum. Nylon or polypropylene string shall be approximately 12 gauge with a breaking strength of 80 pounds.

204.2 Stakes for Straw Bales:

- a. Stakes for anchoring straw bales shall be wooden stakes.
- b. Wooden stakes shall be commercial quality oak or other hardwood and, at a minimum, be 2" by 2" square and at least 3'-0" long with pointed ends.
- c. Wooden stakes shall be free from decay, splits, or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.



PART 3 - EXECUTION

301. GEOTEXTILE SILT FENCING

301.1 Locations:

a. The following are location guidelines for installing silt fences in addition to the locations specified on the Design Drawings:

a1. No further than 10 feet from the toes of slopes or the ends of large graded areas.

a2. At least 3 feet from the toe of a slope. Where this minimum setback distance is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and difficult to maintain.

a3. On the upstream edge of the bank of a natural drainage course traversing the property.

301.2 Silt Fence Construction:

a. Silt fences shall be installed as specified on the Design Drawings.

301.3 Silt Fence Maintenance:

a. After installation, the Earthwork Contractor shall be responsible for satisfactorily maintaining the silt fence until it is no longer required.

b. The Earthwork Contractor shall inspect the silt fence:

b1. Prior to forecasted rain.

b2. Daily during extended rain events.

b3. After every rainfall.

b4. Weekly during the rainy season.

b5. At two-week intervals during the non-rainy season.

c. The Earthwork Contractor shall be responsible for replacing portions of the silt fence that tear, start to decompose, or become ineffective in any way.

d. Repair or replace split, torn, slumping, or weathered fabric.

e. Repair or replace any missing or broken stakes immediately.

f. Silt fences that are damaged and become unsuitable for the intended purpose shall be removed from the project site, disposed of, and replaced with new silt fence barriers.

g. The Earthwork Contractor shall remove sediment deposits when the deposits reach one-third of the silt fence height or when heavy runoff or high water is expected. When removing sediment deposits, care shall be taken not to tear the fabric or to dig up the bottom of the geotextile and disturb the anchorage.

h. Silt fences shall be left in place, inspected, and maintained until the upstream area is permanently stabilized.



- i. Holes, depressions, or other ground disturbance caused by the removal of the silt fences shall be backfilled and repaired.

301.4 Removal of Silt Fencing:

- a. The Earthwork Contractor shall be responsible for removal of silt fences when they are no longer needed and for proper disposal of fencing materials.
- b. Silt fences shall not be removed until adequate vegetative growth or other means of erosion protection ensures no additional erosion of the contributing drainage area.
- c. Sediment deposits remaining in place after the silt fence is removed shall be graded to conform to the existing terrain, and the area shall be covered with topsoil and seeded or otherwise stabilized.

302. STRAW WATTLES

302.1 Locations. Straw wattles shall be installed where specified on the Design Drawings.

302.2 Installation:

- a. Excavate a 3-inch-deep trench along the contour of the slope. The trench shall be wide enough to embed the straw wattle 3 inches into the existing ground surface. Excavated soil shall be placed up-slope from the trench.
- b. Place the straw wattle in the trench so that it is embedded 3 inches into the existing ground surface and conforms to the shape of the trench. Compact soil excavated from the trench against the wattle on the up-slope side.
- c. Adjacent straw wattles shall tightly abut such that no sediment can pass between the wattles.
- d. To secure the straw wattles in-place, a wooden stake shall be driven through the wattle every 3 to 4 feet along the length of the wattle and at each end of the wattle. Wooden stakes shall be driven through the middle of the wattle, perpendicular to the slope face, leaving at least 2 to 3 inches of the stake extending above the wattle.

302.3 Maintenance:

- a. After installation, the Earthwork Contractor shall be responsible for satisfactorily maintaining the straw wattles until they are no longer required.
- b. The Earthwork Contractor shall inspect the straw wattles:
 - b1. Prior to forecasted rain.
 - b2. Daily during extended rain events.
 - b3. After every rainfall.
 - b4. Weekly during the rainy season.
 - b5. At two-week intervals during the non-rainy season.
- c. The Earthwork Contractor shall be responsible for replacing straw wattles that start to decompose or become ineffective in any way.
- d. Sediment that accumulates in or against straw wattles must be periodically removed in order to maintain the straw wattles' effectiveness. Sediment shall be removed when the



sediment accumulation reaches one-third of the barrier height or when heavy runoff or high water is expected.

302.4

Removal:

- a. The Earthwork Contractor shall be responsible for removing all straw wattles when they are no longer needed and for disposing of the straw wattles.
- b. Straw wattles shall not be removed until the contributing drainage area has been restored and/or stabilized.
- c. Sediment deposits remaining in place after the straw wattles have been removed shall be graded to conform to the existing terrain, and the area shall be covered with topsoil and seeded or otherwise stabilized.

303.

STRAW BALE BARRIERS

303.1

Locations. Straw bale barriers shall be installed where specified on the Design Drawings.

303.2

Installation:

- a. Bales shall be placed in a row with the ends lightly abutting adjacent bales.
- b. Each bale shall be embedded in soil a minimum of 4-inches deep and placed with the bindings horizontal so that bales project about 14 inches vertically above the surface. Backfill and compact excavated soil against the bales to ground level.
- c. Each bale shall be securely anchored in place with two stakes. The first stake shall be driven at an angle toward the previously-placed bale to force the bales together. The second stake shall be driven vertically. Stakes shall be driven flush with the bale.
- d. Chink (tightly wedge) straw into any gaps between bales to prevent sediment-laden water from running through the gaps. Use sand bags or gravel to seal larger gaps.

303.3

Maintenance:

- a. After installation, the Earthwork Contractor shall be responsible for satisfactorily maintaining the straw bale barriers until they are no longer required.
- b. The Earthwork Contractor shall inspect the straw bale barriers:
 - b1. Prior to forecasted rain.
 - b2. Daily during extended rain events.
 - b3. After every rainfall.
 - b4. Weekly during the rainy season.
 - b5. At two-week intervals during the non-rainy season.
- c. The Earthwork Contractor shall be responsible for replacing straw bale barriers that start to decompose or become ineffective in any way.
- d. Sediment that accumulates in or against straw bale barriers must be periodically removed in order to maintain the straw bale barriers' effectiveness. Sediment shall be removed when the sediment accumulation reaches one-third of the barrier height or when heavy runoff or high water is expected.



- 303.4 Removal:
- a. The Earthwork Contractor shall be responsible for removing all straw bale barriers when they are no longer needed and for disposing of the straw bales.
 - b. Straw bale barriers shall not be removed until the contributing drainage area has been restored and/or stabilized.
 - c. Sediment deposits remaining in place after the straw bale barriers have been removed shall be graded to conform to the existing terrain, and the area shall be covered with topsoil and seeded or otherwise stabilized.

END OF SECTION 311010



SECTION 319005

EARTHWORK

PART 1 - GENERAL

101. **EXTENT**

101.1 This section defines the material and work requirements associated with preparation for, and placement of, Structural Fill to be placed in the Bypass Basin and other tasks associated with the installation of a new composite liner system for the Bypass Basin. The Structural Fill will support the basin's new composite liner system and will establish the lines and grades for the basin's new leachate collection and removal system (LCRS). This work is further defined and depicted on the Design Drawings.

101.2 The work shall include, but not be limited to, the following items:

- a. Clearing, and grubbing, and topsoil stripping.
- b. Preparation of the on-site, outdoor storage space for the rolls of geosynthetic clay liner (GCL), high-density polyethylene (HDPE) geomembrane liner, and drainage geosynthetic delivered to the project site.
- c. Unloading of the GCL, HDPE geomembrane liner, and drainage geosynthetic rolls delivered to the project site.
- d. Placement and compaction of Structural Fill over the Bypass Basin's existing liner.
- e. Preparation of the Structural Fill surface to be lined with the Bypass Basin's new composite liner system.
- f. Preparation of concrete surfaces that will come into contact with geosynthetic materials.
- g. Excavation and backfill of crest anchor trenches for geosynthetic materials.
- h. Placement of crushed stone to re-surface existing roads on the top of the Bypass Basin's dikes.
- i. Placement of crushed rock surfacing for erosion protection along exterior slopes.
- j. Offsite disposal of excess or unsuitable excavated earthen material and debris.

101.3 Definitions. The following definitions of terms shall apply throughout this section:

- a. GCL Manufacturer: The manufacturer who is responsible for manufacture of GCL materials and for transporting the GCL materials to the site.
- b. GM/GC Manufacturer: The manufacturer who is responsible for manufacture of geomembrane and drainage geocomposite materials and for transporting geomembrane and drainage geocomposite materials to the site.

102. **RELATED WORK SPECIFIED IN OTHER SECTIONS AND SPECIFICATIONS**

102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:

- a. Earthwork Specification (P-1400):
 - a1. Section 319050 – Leachate Collection and Removal System.



- a2. Refer to Section 319050 for material and installation requirements for granular materials associated with the Bypass Basin's new LCRS.
- b. CQA Specification (P-1401):
- b1. Section 014362 – Quality Assurance for Fill, Liner, and Leachate Collection Materials.
- c. Geosynthetic Materials Specification (P-1402):
- c1. Section 319020 – High-Density Polyethylene Geomembrane Liner with Geocomposite.
- c2. Section 319025 – Geosynthetic Clay Liner.

103. REFERENCE DOCUMENTS

- 103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local agencies having jurisdiction.
- 103.2 References to these documents are to the latest issue of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of the Contract for the Work.
- 103.3 Abbreviations listed indicate the form used to identify the reference documents cited in this section.
- 103.4 ASTM – ASTM International:
 - a. C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
 - b. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - c. D2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - d. D2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
- 103.5 IDOT – Illinois Department of Transportation:
 - a. Standard Specifications for Road and Bridge Construction (Adopted January 1, 2022).
- 103.6 ITP – Illinois Test Procedure:
 - a. 27 Sieve Analysis of Fine and Coarse Aggregates
 - b. 96 Resistance by Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - c. 104 Soundness of Aggregate by Use of Sodium Sulfate
 - d. 203 Deleterious Particles in Coarse Aggregate



104. SUBMITTALS

104.1 The Earthwork Contractor shall submit drawings and data as specified. The Earthwork Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Owner's information systems specified by the Owner.

104.2 Submittals with Bid Proposal:

- a. Catalog data on all compaction equipment and proofrolling equipment the Earthwork Contractor plans to use on the project.
- b. Earthwork Contractor's plan for placing Structural Fill material to meet the requirements specified herein while preventing damage to the Bypass Basin's existing geomembrane liner.

104.3 Submittals After Award:

- a. Earthwork Equipment:
 - a1. Earthwork Contractor's demonstration that all earthwork equipment to be used to transport and place Structural Fill material will not exert a ground pressure greater than 8 psi.
- b. Structural Fill Material:
 - b1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the Structural Fill material signed by the supplier or a qualified geotechnical engineering consultant that certify the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
b1.1 Sieve Analysis	ASTM C136	Percent Passing Selected Sieves
b1.2 Classification of Material	ASTM D2487	Classification
b1.3 Organic Content	ASTM D2974	Percent of Organic Material
b1.4 Atterberg Limits ⁽²⁾	ASTM D4318	Liquid Limit and Plasticity Index

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.
- (2) Atterberg limits are only required if cohesive/fine grained materials are to be used for Structural Fill.



- c. Crushed Stone Surfacing for Roads:
 - c1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the crushed stone material to be used to re-surface the existing roads on top of the basin dikes, which shall be signed by the supplier or a qualified geotechnical engineering consultant certifying the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
c1.1 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
c1.2 Na ₂ SO ₄ Soundness 5 Cycle	ITP 104	Percent Loss Max.
c1.3 Los Angeles Abrasion	ITP 96	Percent Loss Max.

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.

- d. Crushed Rock Slope Surfacing Material:
 - d1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the crushed rock slope surfacing material signed by the supplier or a qualified geotechnical engineering consultant certifying that the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
d1.1 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
d1.2 Na ₂ SO ₄ Soundness 5 Cycle	ITP 104	Percent Loss Max.
d1.3 Los Angeles Abrasion	ITP 96	Percent Loss Max.
d1.4 Deleterious Materials	ITP 203	Shale, Percent Max. Clay Lumps, Percent Max. Soft & Unsound Fragments, Percent Max. Other Deleterious, Percent Max. Total Deleterious, Percent Max.

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.

105. QUALITY ASSURANCE

- 105.1 Material and construction procedures shall be subject to inspection and testing by the CQA Contractor hired by Owner. Such inspections and tests will not relieve the Earthwork Contractor of responsibility for providing and placing materials in compliance with specified requirements.



- 105.2 The Owner reserves the right, at any time before final acceptance, to reject material not complying with the specified requirements. The Earthwork Contractor shall correct all deficiencies which inspections, laboratory tests, or field tests have indicated are not in compliance with specified requirements. The Earthwork Contractor shall perform additional tests, at their expense, as may be necessary to reconfirm any noncompliance of the original work, and as may be necessary to show compliance of corrected work.
- 105.3 The Earthwork Contractor shall promptly correct errors or flaws in the work or material identified during construction and which prevent proper installation. The Earthwork Contractor shall make immediate substitution of the noncomplying material or shall make field changes to make the noncomplying material acceptable. The correction or substitution shall be performed at no cost to the Owner.
- 105.4 CQA activities will be performed by the CQA Contractor as described herein and in Specification P-1401.

PART 2 - PRODUCTS

201. MATERIAL FOR STRUCTURAL FILL

201.1 Definitions:

- a. Structural Fill is fill placed within the Bypass Basin to support the basin's new composite liner system as identified on the Design Drawings.

201.2 Satisfactory Material:

a. Granular Material:

- a1. Granular material for use as Structural Fill shall be rounded and not crushed, with less than two percent organic or other deleterious material, free of excess moisture, and a maximum particle size less than one inch.
- a2. Acceptable granular materials are soils which are classified as coarse-grained soils in the Unified Soil Classification System, ASTM D2487. Classifications are GW, GP, GC, SW, SP, or SC, or combinations of these such as SP-SC.
- a3. No material with a silt content of greater than 12 percent (i.e., SM or GM) shall be used for Structural Fill.

b. Cohesive Material:

- b1. Cohesive material is suitable for use as Structural Fill if it contains not more than two percent organic or other deleterious material, has a maximum particle size of one inch, has a liquid limit of less than 45, and has a plasticity index of less than 25.
- b2. Acceptable cohesive materials are soils which are classified as fine-grained soils in the Unified Soil Classification System, ASTM D2487. Classification is CL.

201.3 Unsatisfactory Material:

a. Material unsatisfactory use as Structural Fill is as follows:

- a1. Soils classified as silt, silty, or organic soils in the Unified Soil Classification System, ASTM D2487. Classifications are SM, GM, ML, MH, PT, OL and OH.
- a2. Clay soils classified as CH in the Unified Soil Classification System, ASTM D2487.



- a3. Soils classified as CL-ML (plasticity index of 4 to 7) in the Unified Soil Classification System, ASTM D2487.
- a4. Coal combustion residuals and fill containing coal combustion residuals.
- a5. Rock material without a soil matrix in which nesting of rocks could occur.
- a6. Uncontrolled fill.
- a7. Debris.
- b. Material Sources:
 - b1. Structural Fill material shall be obtained from an offsite borrow source identified by the Earthwork Contractor and approved by the Owner.

202. RESTRICTIONS ON THE USE OF MATERIAL FOR ANY PURPOSE

- 202.1 Any material which is frozen is considered unsatisfactory for use as fill.
- 202.2 Fill and backfill soils placed by previous construction shall be considered unsatisfactory for use as fill unless they meet the requirements for satisfactory material. This specifically includes using any of the existing protective layers below the Bypass Basin's new composite liner system or on roads outside of the basin.

203. CRUSHED STONE SURFACING FOR ROADS

- 203.1 Material Requirements:
 - a. Crushed stone for re-surfacing existing roads on the top of the basin dikes shall be composed of gravel, crushed gravel, or crushed stone that is processed to meet the following requirements:
 - a1. The material shall conform to Gradation CA 6 in accordance with Paragraph 1004.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
 - a2. The material quality shall be Class D or better in accordance with Paragraph 1004.01(b) of the IDOT Standard Specifications for Road and Bridge Construction.
- 203.2 Material Sources:
 - a. Crushed stone surfacing material shall be obtained from an offsite borrow source identified by the Earthwork Contractor and approved by the Owner.

204. CRUSHED ROCK SLOPE SURFACING

- 204.1 Material Requirements:
 - a. When specified on the Design Drawings, material for surfacing exterior slopes shall be crushed aggregate that is processed to meet the following requirements:
 - a1. The material shall conform to Gradation CA 7 in accordance with Paragraph 1004.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
 - a2. The material quality shall be Class B or better in accordance with Paragraph 1004.01(b) of the IDOT Standard Specifications for Road and Bridge Construction.



204.2 Material Sources:

- a. Crushed rock slope surfacing material shall be obtained from an offsite borrow source identified by the Earthwork Contractor and approved by the Owner.

PART 3 - EXECUTION

301. DEMOLITION, CLEARING, GRUBBING AND STRIPPING

301.1 General:

- a. The work required is shown on the Design Drawings. No work shall be performed outside of the designated area without prior written approval of the Owner.
- b. All work incidental to excavation or fill work will not be specifically indicated on the Design Drawings but shall be performed as part of the work.

301.2 Demolition:

a. Concrete Infills:

- a1. The Earthwork Contractor shall remove concrete infills from inlet, outlet, and emergency overflow structures as indicated on the Design Drawings.

- a2. All concrete surfaces impacted by demolition work that will also come into contact with the Bypass Basin's new composite liner system shall be ground smooth in accordance with Article 305.

- b. Demolition and removal of minor items which are incidental to the earthwork may be required. The Earthwork Contractor shall identify any such items during their pre-bid walkdown. The Earthwork Contractor shall demolish such items as required as part of the performance of the work.

- c. All waste resulting from demolition work shall be disposed of by the Earthwork Contractor in an offsite disposal area.

301.3 Clearing, Grubbing, and Topsoil Stripping:

- a. All vegetation within areas to be excavated or to receive fill shall be cleared and grubbed, stripped of topsoil and debris, and shall be inspected and approved by the Owner prior to beginning the earthwork operations.

- b. Weeds, small roots, heavy grass, and other vegetation remaining after clearing and grubbing operations shall be removed with the topsoil.

c. Disposal:

- c1. Stripped topsoil shall be placed in an onsite stockpile area as directed by Owner. Topsoil may be removed from the stockpile area at a later date and used to cover finished slopes and other designated areas.

- c2. If any material remains in the topsoil stockpile area after construction is complete, the stockpile area side slopes shall be graded to a maximum slope of 20 percent (five horizontal to one vertical), the top of the pile shall be sloped to drain properly and provided with devices to control erosion, and the stockpile shall be seeded.



302. UNLOADING AND STORAGE OF GEOSYNTHETIC MATERIALS

302.1 Storage:

- a. The Owner will provide an on-site, outdoor storage space near the Bypass Basin for the rolls of GCL, HDPE geomembrane liner, and drainage geosynthetic delivered to the project site.
- b. The Earthwork Contractor shall, in coordination with the Geosynthetics Contractor, prepare the storage space for geosynthetic materials to ensure the rolls are protected from damage, moisture, theft, and vandalism. At a minimum, the storage space for geosynthetic materials shall be prepared such that the surface is smooth and is free of rocks and standing water.
- c. GCL Rolls:
 - c1. Rolls of GCL shall be stored horizontally in their original, unopened, wrapped cover in a clean, dry area. The material shall be stored off the ground on pallets or plywood in small stacks not to exceed five rolls in height. Rolls shall be stacked in a manner recommended by the GCL Manufacturer that prevents them from sliding or rolling from the stacks.
 - c2. All GCL rolls shall be covered with a heavy, protective tarpaulin or plastic sheeting. Care shall be used to keep the GCL dry, clean, and free from debris prior to installation.
 - c3. Any GCL roll that comes into contact with moisture while in storage shall be set aside by the Earthwork Contractor to await examination by the Owner. Damaged rolls shall also be set aside and inspected to determine suitability of the material for use.
- d. HDPE Geomembrane Liner and Drainage Geocomposite Rolls:
 - d1. Rolls of HDPE geomembrane liner and drainage geocomposite shall be stored horizontally in their original, unopened, wrapped cover in a clean, dry area. The materials shall be stored in accordance with the GM/GC Manufacturer's recommendations.
 - d2. Any roll of HDPE geomembrane liner or drainage geocomposite that is damaged in storage shall be set aside and inspected to determine suitability of the material for use.

302.2 Unloading:

- a. The Earthwork Contractor shall unload all geosynthetic materials delivered to the project site by the respective manufacturers. During unloading, all rolls of geosynthetic materials shall be handled with care in a manner that prevents damage to the rolls.
- b. All rolls of GCL shall be unloaded in accordance with the GCL Manufacturer's recommendations.
- c. All rolls of HDPE geomembrane liner and drainage geocomposite shall be unloaded in accordance with the GM/GC Manufacturer's recommendations.
- d. Any roll of GCL, HDPE geomembrane, or drainage geocomposite that is damaged during unloading shall be replaced at no additional cost to the Owner.



303. PLACEMENT OF STRUCTURAL FILL

303.1 Acceptable Placement Methods:

a. Acceptable placement methods for Structural Fill include:

- a1. Using a conveyor truck to place material from outside of the basin.
- a2. Using a crane to place material from outside of the basin.
- a3. Transporting material into the basin to the point of dumping using trucks or scrapers, while complying with maximum ground pressure requirements.
- a4. Alternate placement method(s) proposed by the Earthwork Contractor and approved by the Owner.

b. Requirements for Transportation of Structural Fill Materials into Basin:

- b1. Under no circumstances shall any equipment (wheeled or tracked) traverse the Bypass Basin's existing geomembrane liner or new liner when less than 10 inches of earthen material are above the subject liner.
- b2. Equipment transporting material into the basin shall use the permanent ramp along the basin's east dike. Following removal of the existing ramp surface layer, Structural Fill shall be installed above the existing geomembrane liner along the ramp surface as detailed on the Design Drawings and as specified herein before any equipment uses the ramp to access the basin floor.
- b3. Only earthmoving equipment with low ground pressure shall be used to transport material inside of the basin. The Earthwork Contractor shall demonstrate that equipment entering the basin will not exert a ground pressure greater than 8 psi. The ground pressure is influenced by the tread pattern / tire contact area and is not the reading from a tire pressure gauge.
- b4. Equipment operating within the basin shall avoid hard braking on ramps and avoid sharp turns or quick stops that could pinch or tear the existing geomembrane liner.
- b5. Structural Fill shall be placed by the "dump and spread" method in which lightweight equipment with low ground pressure is used to spread the material.
- b6. Material placement over the geomembrane liner during periods of warm weather can cause wrinkling and damage to the geosynthetic materials. Placement of the initial lift of Structural Fill shall be halted when the air temperature is greater than 85°F or less than 40°F.
- b7. When Structural Fill is being placed, a worker shall safely walk alongside earthmoving equipment spreading the material to spot and remove rocks, stones, roots, and other debris that may be present in the Structural Fill that could cause damage to the liner.

303.2 Moisture Content of Structural Fill Material:

- a. Unless granular materials are used for Structural Fill, the moisture content of Structural Fill material shall be within ± 3 percent of optimum moisture content as determined by ASTM D1557 at the time of compaction. The moisture content of granular materials shall not be used as a criterion for acceptance of Structural Fill.
- b. Fill material containing excessive moisture shall not be compacted unless the material has dried and the moisture content is within the specified limits.



- c. Fill material that is too dry shall have moisture added and then be blended so that the moisture content is uniform prior to compaction.

303.3 Lift Thickness:

- a. Fill shall be placed in horizontal layers in thicknesses compatible with the material being placed, equipment being used and the compaction requirements.
- b. Unless otherwise approved by the Owner the loose thickness shall not exceed the following:
 - b1. 12 inches maximum loose lift thickness for the lowest lift in contact with the Bypass Basin's existing geomembrane liner.
 - b2. 8 inches maximum loose lift thickness for compaction by self-propelled equipment.
 - b3. 4 inches maximum loose lift thickness for compaction by hand-operated equipment.

303.4 Placement Structural Fill:

- a. Each layer of fill shall be evenly spread and moistened or aerated as required to achieve the required moisture content.
- b. Each lift of Structural Fill in the Bypass Basin shall be uniformly placed to cover the entire length and width of the basin prior to compaction or placement of the next lift.
- c. As allowed by the design of the LCRS, the top surface of each layer shall be approximately level but shall have sufficient crown or cross fall to provide adequate drainage of water at all times during the construction period. The crown or crossfall shall be at least 1 in 50 (2 percent) but no greater than 1 in 20 (5 percent).
- d. Fill placed on slopes steeper than 20 percent (i.e., 5 horizontal to 1 vertical) shall be overfilled a minimum of 6 inches beyond the face of the slope, measured horizontally, and then cut back and trimmed to the required line and grade to expose a smooth surface uniformly compacted to the required density. Installing the fill slope to lines and grades shown on the Design Drawings and then compacting is not acceptable on the basin side slopes.

303.5 Compacting Structural Fill:

- a. Equipment:
 - a1. Sheepfoot, modified sheepfoot, padfoot, or other non-smooth drums shall not be used to compact Structural Fill placed for this work.
 - a2. Each layer of fill shall be compacted by tamping, pneumatic-tired roller, or other mechanical means acceptable to the Owner that will produce the specified compaction.
 - a3. At locations where it would be impractical because of inaccessibility to use self-propelled compacting equipment, fill layers shall be compacted using hand directed compaction equipment.
 - a4. When soils are used that develop a densely packed surface as a result of spreading or compacting equipment, the surface of each layer of fill shall be sufficiently roughened after compaction to ensure bonding of the succeeding layer.



b. Inspection and Testing:

- b1. All work is subject to inspection and testing by the CQA Contractor. The CQA Contractor shall have access to the work at all times. Testing shall be in accordance with the Contract. Refer to Specification P-1401 for inspection and testing requirements.
- b2. Each layer of compacted fill shall be tested before proceeding with the next layer.
- b3. It is the Earthwork Contractor's responsibility to request inspection prior to proceeding with further work that would make parts of the work inaccessible for inspection.
- b4. If the fill material fails to meet the required density, the material shall be removed and replaced or reworked, altering the construction method as necessary to obtain the required density and compaction. Sufficient time shall be allotted between lifts for the necessary testing of the soils.

c. Compaction Density:

- c1. Structural Fill shall be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D1557.

303.6 Fine Grading:

- a. Structural Fill shall be fine graded using equipment with low ground pressure.

303.7 Reporting Damage:

- a. If damage occurs to the Bypass Basin's existing geomembrane liner while placing Structural Fill material, the Earthwork Contractor shall report the damage(s) to the Owner and Geosynthetics Contractor immediately so that repairs can be performed without delay.
- b. Repairs to the existing geomembrane liner shall be made by the Geosynthetics Contractor as specified in Specification P-1402, Section 319020 at no additional cost to the Owner.

304. REQUIREMENTS FOR PREPARATION AND ACCEPTANCE OF STRUCTURAL FILL SURFACE SUPPORTING COMPOSITE LINER

304.1 Intersections Between Planes:

- a. Intersections between planes shall be rounded as specified below to provide a firm bearing without abrupt change:

<u>Intersection of Slope</u>	<u>Radius of Rounding</u>
a1. Side slope and bottom plane	3 feet minimum
a2. Side slope and top of dike or grade	6 inch minimum
a3. Intersection of 2 bottom planes (planes sloped at 10% or less)	Straight line is acceptable

304.2 Responsibility:

- a. The Earthwork Contractor shall be responsible for preparing the surface of the Structural Fill beneath the composite liner system prior to placement of the liner. The subgrade is



subject to inspection and acceptance by the Owner and the Geosynthetics Contractor prior to installation of the lower component of the composite liner system.

304.3

Inspection:

- a. The Earthwork Contractor, the Owner, the Geosynthetics Contractor, and the CQA Contractor shall inspect and document the following:
 - a1. Lines, grades, and slopes are in conformance with the Design Drawings.
 - a2. Surface has been graded and rolled such that it is free of irregularities, protrusions, loose soil, and abrupt changes in grade.
 - a3. The surface is free of debris, clods, stones, roots, and organic material.
 - a4. That no settlement or erosion has occurred.
 - a5. That there are no side slope failures.
 - a6. That there are no moisture seeps, puddling or ponding.
 - a7. That there are no soft spots.

304.4

Certification:

- a. The Geosynthetics Contractor shall provide written certification that the surface is acceptable. The acceptance shall be recorded and copies of the certification given to both the Earthwork Contractor, the CQA Contractor, and the Owner.
- b. Only as much surface as will be lined the following day shall be inspected, certified, and documented as acceptable.

305.

PREPARATION OF CONCRETE SURFACES

305.1

All concrete surfaces that will come in contact with the Bypass Basin's new composite liner system shall be free of sharp edges or rough spots that can puncture or abrade the new liner materials. Where necessary, the concrete shall be ground smooth by the Earthwork Contractor.

306.

CREST ANCHOR TRENCH EXCAVATION AND BACKFILLING

306.1

Excavation and Shaping:

- a. The anchor trench for geosynthetic materials shall be excavated by the Earthwork Contractor at the top of the basin slope to the lines and widths shown on the Design Drawings prior to the Geosynthetics Contractor deploying the geosynthetic clay liner component of the Bypass Basin's new composite liner system in accordance with Specification P-1402, Section 319025.
- b. A slightly rounded corner shall be provided in the trench where the geosynthetic materials adjoin the trench to avoid sharp bends in the geosynthetic materials. The radius of rounding is shown on the Design Drawings. No loose soil shall be allowed to underlie the geosynthetic materials in the anchor trench.
- c. The anchor trench shall be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open.



- 306.2 Backfilling:
- a. The anchor trench shall be backfilled by the Earthwork Contractor after all geosynthetic materials are in place and seams are welded.
 - b. Backfilling of the anchor trench shall occur during the morning or during extended periods of overcast skies when the geosynthetic materials are at their most contracted states.
 - c. The first lift of fill above the geosynthetic materials in the anchor trench may be 12 inches in thickness.
 - d. If compacted using hand-operated equipment, backfill shall be placed in lifts not exceeding 4 inches loose thickness and shall be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D1557.
 - e. If compacted using self-propelled equipment, backfill shall be placed in lifts not exceeding 8 inches loose thickness and shall be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D1557.
307. **GRADING TOLERANCES**
- 307.1 The acceptable deviation from lines and grades indicated on the Design Drawings shall be as shown in Table 319005-1.
- 307.2 Slopes shall be finished in conformance with the lines and grades shown on the Design Drawings. When completed, the average plane of a slope shall conform to the slope indicated on the Design Drawings and no point on the completed slope shall vary from the designated plane by more than 6 inches measured at right angles to the slope.
308. **CLEAN-UP**
- 308.1 All waste, excess materials and debris shall be disposed of in an offsite disposal area approved by the Owner.

TABLE 319005-1
ACCEPTABLE DEVIATIONS FROM DESIGN LINES AND GRADES

Type of Installation (Excavation or Fill)	Maximum Acceptable Deviation from Line (feet)	Maximum Acceptable Deviation from Grade ⁽¹⁾ (feet)
General Earthwork		
Top of Structural Fill	±0.3	+0.1 to -0.0
Roads		
Road Embankment	±0.2	+0.1 to -0.0
Leachate Collection & Removal System		
Leachate Collection Pipe Trench and Sump	±0.3	+0.1 to -0.0

Note:

- (1) After initial settlement has taken place. Initial settlement is that settlement that will occur up to the time of determination and acceptance of final grade elevation as approved by the Owner.

END OF SECTION 319005



SECTION 319050

LEACHATE COLLECTION AND REMOVAL SYSTEM

PART 1 - GENERAL

101. **EXTENT**

101.1 This section defines the minimum material and installation requirements for the components of the Bypass Basin's new leachate collection and removal system (LCRS) including high-density polyethylene (HDPE) leachate collection and sideslope riser pipes, non-woven geotextiles, Coarse Aggregate Bedding Material, Sand Filter Layer material, Protective Warning Layer material, Riprap Bedding Layer material, and riprap, all in accordance with the Design Drawings and as specified herein.

101.2 The components and dimensions of the LCRS are shown on the Design Drawings. The division of work shall include, but not be limited to, the following items:

- a. The following items shall be furnished and installed by the Earthwork Contractor:
 - a1. Coarse Aggregate Bedding Material.
 - a2. Non-woven geotextile between Coarse Aggregate Bedding Material and composite liner system, as specified on the Design Drawings.
 - a3. Sand Filter Layer.
 - a4. Protective Warning Layer.
 - a5. Perforated leachate collection pipe.
 - a6. Perforated sump pipe.
 - a7. Solid sideslope riser pipe and cover.
- b. The following items shall be installed by the Geosynthetics Contractor in accordance with Specification P-1402, Sections 319020 and 319025:
 - b1. HDPE geomembrane.
 - b2. Drainage geocomposite.
 - b3. Geosynthetic clay liner (GCL).
- c. The following items will be furnished and installed by Others:
 - c1. Wheeled submersible pump with flexible hose.
 - c2. Flowmeters.
 - c3. Control station for pumps and meters.
 - c4. Electrical and instrument conduit.



101.3 Definitions:

- a. The following definitions of terms shall apply throughout this section:
- a1. Pipe Manufacturer: The manufacturer who is responsible for manufacture of LCRS pipe materials and fittings and for transporting these materials to the site.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS AND SPECIFICATIONS

102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:

- a. Earthwork Specification (P-1400):
 - a1. Section 319005 – Earthwork.
- b. CQA Specification (P-1401):
 - b1. Section 014362 – Quality Assurance for Fill, Liner, and Leachate Collection Materials.
- c. Geosynthetic Materials Specification (P-1402):
 - c1. Section 319020 – High-Density Polyethylene Geomembrane Liner with Geocomposite.
 - c2. Section 319025 – Geosynthetic Clay Liner.

103. REFERENCE DOCUMENTS

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents in addition to federal, state, or local codes having jurisdiction.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

103.3 Abbreviations listed indicate the form used to identify the reference documents cited in this section.

103.4 ASTM – ASTM International:

- a. D2434 Standard Test Method for Permeability of Granular Soils (Constant Head)
- b. D2487 Standard Practice for Classification of Soils for Engineering Purposes
- c. D2513 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
- d. D2657 Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
- e. D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- f. D6473 Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control
- g. D6825 Standard Guide for Placement of Riprap Revetments



- h. F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- 103.5 IDOT – Illinois Department of Transportation:
 - a. Standard Specifications for Road and Bridge Construction (Adopted January 1, 2022)
- 103.6 ITP – Illinois Test Procedure:
 - a. 27 Sieve Analysis of Fine and Coarse Aggregates
 - b. 96 Resistance by Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - c. 104 Soundness of Aggregate by Use of Sodium Sulfate
 - d. 203 Deleterious Particles in Coarse Aggregate
- 103.7 NSF – National Sanitation Foundation International:
 - a. NSF Listings: Plastics and Plumbing System Components
- 104. SUBMITTALS
- 104.1 The Earthwork Contractor shall submit drawings and data at least 30 days prior to use. The Earthwork Contractor’s drawings and data shall be submitted via electronic medium in a format compatible for importing into the Owner’s information systems specified by the Owner.
- 104.2 Submittals with Bid Proposal:
 - a. HDPE Pipe:
 - a1. Pipe Manufacturer’s name, address, and telephone number.
 - a2. Pipe Manufacturer’s literature providing specifications of the pipes that will be supplied for the project.
 - a3. Pipe Manufacturer’s signed certification that the pipes that will be supplied comply with the requirements of this Specification.
 - a4. Pipe Manufacturer’s signed certification that no reclaimed polymer has been added to the resin.



104.3 Submittals After Award:

a. Coarse Aggregate Bedding Material:

- a1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the Coarse Aggregate Bedding Material signed by the supplier or a qualified geotechnical engineering consultant certifying that the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
a1.1 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
a1.2 Na ₂ SO ₄ Soundness 5 Cycle	ITP 104	Percent Loss Max.
a1.3 Los Angeles Abrasion	ITP 96	Percent Loss Max.
a1.4 Deleterious Materials	ITP 203	Shale, Percent Max. Clay Lumps, Percent Max. Soft & Unsound Fragments, Percent Max. Other Deleterious, Percent Max. Total Deleterious, Percent Max.

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.

b. Sand Filter Layer Material:

- b1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the Sand Filter Layer material signed by the supplier or a qualified geotechnical engineering consultant certifying that the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
b1.1 Classification of Material	ASTM D2487	Classification
b1.2 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
b1.3 Hydraulic Conductivity	ASTM D2434	Hydraulic Conductivity

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.



c. Protective Warning Layer Material:

- c1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the Protective Warning Layer material signed by the supplier or a qualified geotechnical engineering consultant certifying that the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
c1.1 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
c1.2 Na ₂ SO ₄ Soundness 5 Cycle	ITP 104	Percent Loss Max.
c1.3 Los Angeles Abrasion	ITP 96	Percent Loss Max.

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.

d. Riprap Bedding Layer Material:

- d1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the Riprap Bedding Layer material signed by the supplier or a qualified geotechnical engineering consultant certifying that the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
d1.1 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
d1.2 Na ₂ SO ₄ Soundness 5 Cycle	ITP 104	Percent Loss Max.
d1.3 Los Angeles Abrasion	ITP 96	Percent Loss Max.
d1.4 Deleterious Materials	ITP 203	Shale, Percent Max. Clay Lumps, Percent Max. Soft & Unsound Fragments, Percent Max. Other Deleterious, Percent Max. Total Deleterious, Percent Max.

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.



- e. Riprap:
 - e1. At least 30 days prior to scheduled delivery, the Earthwork Contractor shall submit certificates for the riprap material signed by the supplier or a qualified geotechnical engineering consultant certifying that the following items comply with or exceed specifications for the material:

Property	Standard ⁽¹⁾	Data Required
e1.1 Sieve Analysis	ITP 27	Percent Passing Selected Sieves
e1.2 Na ₂ SO ₄ Soundness 5 Cycle	ITP 104	Percent Loss Max.

Note:

- (1) Test results shall be provided on two random samples taken from each borrow area. If processing of borrow area material is required to meet material specifications, the tests shall be performed on the process material.

104.4 Submittals Upon Shipment:

- a. HDPE Pipe:
 - a1. Copies of Pipe Manufacturer's QA/QC certificates on tests performed during fabrication.

104.5 Submittals After Construction is Complete:

- a. HDPE Pipe:
 - a1. Logs indicating the location of each joint that did not pass visual examination and the work done to correct improper fusion weld.

105. QUALITY ASSURANCE

105.1 Materials and construction procedures shall be subject to inspection and testing by the CQA Contractor employed by the Owner. Such inspections and tests will not relieve the Earthwork Contractor of the responsibility of providing and placing materials in compliance with specified requirements.

105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Earthwork Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance with specified requirements.

105.3 CQA activities shall be performed as described herein and in Specification P-1401.

PART 2 - PRODUCTS

201. PIPE

201.1 Pipe Materials:

- a. Perforated leachate collection pipe, perforated sump pipe, and solid wall sideslope riser pipe shall meet the general and material requirements presented in Table 319050-1.

201.2 Pipe Requirements:

- a. Leachate collection and removal system piping shall be single wall piping.

201.3 Fittings:

- a. All fittings shall be prefabricated and manufactured by the same manufacturer as the pipe.



**TABLE 319050-1
 MATERIAL REQUIREMENTS FOR LEACHATE COLLECTION AND REMOVAL SYSTEM PIPING**

General Requirements for Leachate Collection & Removal System Pipes & Fittings			
Items	Leachate Collection Pipe, Sump Pipe, and Sideslope Riser Pipe		
Service	Leachate Collection and Removal System		
Location	Leachate Collection Trench and Sump		
Material	Perforated and Solid Wall High-Density Polyethylene, Thermal Butt Fusion Welded Joints ⁽¹⁾		
Listing	NSF Listed and Approved		
Rating	Maximum Working Temperature:	Ambient	
	Maximum Working Pressure:	Atmospheric	
Material Requirements for Leachate Collection & Removal System Pipes & Fittings			
Item	ASTM Test Method	Size (in.)	Remarks
Pipe ⁽¹⁾	ASTM F714, Pipe Grade PE4710 Resin	6	SDR 11 (160 psi)
		12	SDR 17 (100 psi)
Joints	Not Applicable	All	Thermal Butt Fusion Welded
Fittings ⁽²⁾ : 30°, 45°, 60°, and 90° Bends	ASTM D2513 and ASTM D3261	6	SDR 11 (120 psi) (reduced pressure) Injection molded butt fittings from same resins as pipe.
		12	SDR 17 (75 psi) Mitered fittings fabricated from angular cut sections of pipe.
Fittings ⁽²⁾ : Tees, Wyes, and Reducers	Not Applicable	6	SDR 11 (160 psi) (reduced pressure) Mitered fittings fabricated from angular cut sections of pipe.
		12	SDR 17 (75 psi) Mitered fittings fabricated from angular cut sections of pipe.
Cleanout	Not Applicable	12	Lockable Cap



Approved Manufacturers of Leachate Collection & Removal System Pipes and Fittings		
Manufacturer	Trade Name	Size Range (in.)
Chevron Phillips Chemical Company	Performance Pipe DriscoPlex® 4100	6 to 12
KWH Pipe	Sclairpipe	6 to 12
JM Eagle	HDPE Water Sewer C906	6 to 12
Others as Approved by the Owner	--	--

Notes:

- (1) Solid or perforated pipe shall be provided as specified on the Design Drawings. Perforated pipe shall be perforated in accordance with the details shown on the Design Drawings.
- (2) Fittings are reduced pressure rating fittings.

202. COARSE AGGREGATE BEDDING MATERIAL:

- a. The bedding material for the leachate collection and removal system piping shall be washed gravel or washed crushed coarse aggregate. Crushed slag or Portland cement concrete shall not be used.
- b. The gradation for Coarse Aggregate Bedding Material shall conform to Gradation CA 7 in accordance with Paragraph 1004.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
- c. The material quality for Coarse Aggregate Bedding Material shall be Class B or better in accordance with Paragraph 1004.01(b) of the IDOT Standard Specifications for Road and Bridge Construction.

203. SAND FILTER LAYER MATERIAL:

- a. The "Sand Filter Layer" placed on top of the HDPE geonet and geotextile shall be composed of washed sand imported from an offsite borrow source, which shall be identified by the Earthwork Contractor and approved by the Owner, that is processed to meet the following requirements:
 - a1. The material shall be classified as SP, SM, or SP-SM in the Unified Soil Classification System, ASTM D2487.
 - a2. The material shall conform to Gradations FA 1 or FA 2 in accordance with Paragraph 1003.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
 - a3. The material shall have a permeability of greater than 1×10^{-5} cm/sec when tested in accordance with ASTM D2434.
 - a4. The material shall be free from all organic material and deleterious material.
 - a5. Fine aggregate produced by crushing slag or Portland cement concrete is not acceptable.



204. PROTECTIVE WARNING LAYER MATERIAL:

- a. The "Protective Warning Layer" placed on top of the Sand Filter Layer along the basin floor shall be composed of gravel, crushed gravel, or crushed stone imported from an offsite borrow source, which shall be identified by the Earthwork Contractor and approved by the Owner, that is processed to meet the following requirements:
 - a1. The material shall conform to Gradation CA 6 in accordance with Paragraph 1004.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
 - a2. The material quality for Protective Warning Layer material shall be Class D or better in accordance with Paragraph 1004.01(b) of the IDOT Standard Specifications for Road and Bridge Construction.

205. RIPRAP BEDDING LAYER MATERIAL

- a. The "Riprap Bedding Layer" placed on top of the Sand Filter Layer along the basin side slopes shall be composed of gravel, crushed gravel, or crushed stone imported from an offsite borrow source, which shall be identified by the Earthwork Contractor and approved by the Owner, that meets the following requirements:
 - a1. The material shall conform to Gradation CA 16 in accordance with Paragraph 1004.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
 - a2. The material quality for Riprap Bedding Layer material shall be Class B or better in accordance with Paragraph 1004.01(b) of the IDOT Standard Specifications for Road and Bridge Construction.

206. RIPRAP

- a. Riprap placed along the basin side slopes shall consist of quarried or crushed stone imported from an offsite borrow source, which shall be identified by the Earthwork Contractor and approved by the Owner, that meets the following requirements:
 - a1. Riprap stones shall have 100% of all faces angular or crushed and shall be free from structural defects, laminations, seams, weak cleavage planes, and undesirable effects of weathering. Stone containing shale, unsound sandstone, or any other material which will readily disintegrate under handling and placing or under weathering shall not be used. All riprap material shall be clean and free from deleterious material and impurities, including but not limited to earth, clay, and refuse.
 - a2. Riprap material shall conform to Gradation RR 2 in accordance with Paragraph 1005.01(c) of the IDOT Standard Specifications for Road and Bridge Construction.
 - a3. Riprap material shall meet Quality A requirements in accordance with Paragraph 1005.01(b) of the IDOT Standard Specifications for Road and Bridge Construction, except that the bulk specific gravity of the riprap shall not be less than 2.55 per ASTM D6473 (approximate unit weight of 160 pounds per cubic foot).
 - a4. Riprap color shall be gray unless otherwise approved by the Owner.

PART 3 - EXECUTION

301. LEACHATE COLLECTION PIPE INSTALLATION

- 301.1 The perforated leachate collection pipe shall be installed according to the elevations and locations indicated on the Design Drawings.

- 301.2 The maximum vertical variation from the correct profile and section shall not exceed ± 0.1 ft. The slope of the pipe shall not vary from the specified slopes by more than $\pm 0.1\%$. The Earthwork Contractor shall regrade any area which does not meet the specified tolerances.
- 301.3 Perforated pipe shall have two rows of 1/2-inch diameter perforations spaced 5 inches apart along the length of the pipe. The perforations shall face down in the collection trench.
- 301.4 All PE pipes shall be joined by the thermal butt-fusion process described in Article 303.
- 301.5 The Earthwork Contractor shall provide hydraulic jet cleaning of all pipelines following installation. The jet cleaning shall verify that each pipe is intact and unobstructed. Defects in any pipeline identified by the cleaning process shall be repaired by the Earthwork Contractor.
302. COLLECTION SUMP PIPE INSTALLATION
- 302.1 The collection sump shall be provided with a horizontal perforated pipe for housing the pump and a solid riser pipe for inserting and removing the pump. The size and location of the pipes and the perforation pattern for the perforated pipe shall be as shown on the Design Drawings.
- 302.2 All PE pipes shall be joined by the thermal butt-fusion process described in Article 303. The inside of the pipe shall be ground smooth so that it will not impede the sliding of pumps.
303. WELDING AND TESTING OF HDPE PIPE JOINTS
- 303.1 Joints for HDPE Pipe:
- a. HDPE pipe shall be joined together by the thermal butt fusion method in accordance with ASTM D2657 Procedure 2. Fittings shall be fabricated to provide a smooth inside surface. The hot plate butt fusion procedure shall be performed using apparatus recommended by the Pipe Manufacturer and which complies with ASTM D2657.
- 303.2 Bent Strap Test
- a. Test Requirements:
- a1. A bent strap test shall be made on each diameter of pipe prior to the start of joint welding procedures. A test joint shall be made and a specimen cut from the joint and destructively tested to confirm fusion joint integrity, operator procedure, and fusion machine settings, including temperature and pressure.
- a2. Additional bent strap tests may be required by the Owner and/or CQA Contractor during the joint welding process if it is found that the joints of unacceptable quality are being made. These tests shall be used to adjust fusion machine settings and/or operator procedures as required. Test joints shall be prepared at no additional cost to the Owner.
- b. Test Procedure:
- b1. Using waste pieces of pipe, a joint specimen shall be prepared and then butt fusion welded and allowed to cool to ambient temperature.
- b2. A test strap shall be cut from the specimen:
- b2.1 The width of the strap shall be 1-1/2 times the pipe wall thickness, but not less than one inch.

- b2.2 The length of the strap on each side of the fusion weld shall be 15 times the pipe wall thickness, but not less than six inches.
- b3. The cut shall be bent so that the ends of the strap touch. If any separation, cracks or voids are observed, the fusion is unacceptable and indicates poor fusion quality.
- b4. If failure occurs, fusion procedures and/or machine settings shall be changed, and a new trial fusion weld and new bent strap specimen shall be prepared and tested.
- b5. The CQA Contractor shall witness all bent strap tests.
- b6. Field fusion of pipe shall not proceed until a test joint has passed the bent strap test and visual inspection indicates that the fusion beads and "V" groove are the correct size.

304. VISUAL INSPECTION OF HDPE PIPE DURING INSTALLATION

304.1 General:

- a. The Earthwork Contractor shall visually inspect all pipes during installation for:
 - a1. Verification that all perforated pipe has been placed with the perforations facing down.
 - a2. Surface damage.
 - a3. Weld quality.

304.2 Surface Damage:

- a. Surface damage to a pipe that occurs during handling or installation shall be minimized. The maximum acceptable depth of damage is 10 percent of wall thickness of the pipe. If excessive damage occurs, the damaged portions of pipe shall be cut out and replaced. Deep, sharp notches may be filled with extrudite and dressed smooth.
- b. Butt fuse on misalignment shall not exceed 10 percent of the pipe wall thicknesses. Misaligned butt fusions shall be cut out and redone.

304.3 Butt-Fusion Joint Weld Quality:

- a. All butt fusion welded joints shall be visually inspected to ensure joint quality. The size and shape of the fusion beads shall be used as an indicator of joint quality. Specifically:
 - a1. The double bead width shall be 2 to 2-1/2 times the height of the bead measured from the pipe surface.
 - a2. Both beads shall be uniform in size and shape around the joint.
 - a3. The depth of the "V" between the two beads shall not be more than half the bead height.
- b. If the "V" groove is too deep a "cold" fusion may have occurred (uneven heating or insufficient heating time, or excessive pressure during heating or during joining). A non-uniform bead shape around the pipe indicates uneven heating.
- c. A joint with cold fusion or a non-uniform bead is a poor quality joint that shall be removed (i.e., cut-out) and remade.

305. INSTALLATION OF GRANULAR AND RIPRAP MATERIALS

- 305.1 "Granular Materials" in this article include Coarse Aggregate Bedding Material, Sand Filter Layer material, Protective Warning Layer material, and Riprap Bedding Layer material.

305.2 Acceptable Placement Methods:

- a. Acceptable placement methods for Granular Materials include:
 - a1. Using a conveyor truck to place material from outside of the basin.
 - a2. Using a crane to place material from outside of the basin.
 - a3. Transporting material into the basin to the point of dumping using trucks or scrapers.
 - a4. Alternate placement method(s) proposed by the Earthwork Contractor and approved by the Owner.
- b. Requirements for Transportation of Granular and Riprap Materials into Basin:
 - b1. Under no circumstances shall there be direct equipment travel over any geosynthetic material (GCL, geomembrane, geotextile, geonet, etc.).
 - b2. Equipment transporting material into the basin shall use the permanent ramp along the basin's east dike. Structural Fill shall be installed above the existing HDPE geomembrane liner along the ramp surface as detailed on the Design Drawings and as specified in Section 319005 before any equipment uses the ramp to access the basin floor.
 - b3. Only earthmoving equipment with low ground pressure shall be used to transport material inside of the basin. The Earthwork Contractor shall demonstrate that equipment entering the basin will not exert a ground pressure greater than 8 psi. The ground pressure is influenced by the tread pattern / tire contact area and is not the reading from a tire pressure gauge.
 - b4. Equipment operating within the basin shall avoid hard braking on ramps and avoid sharp turns or quick stops that could pinch or tear the geosynthetic materials.
 - b5. The Sand Filter Layer, Protective Warning Layer, and Riprap Bedding Layer Materials shall be placed by the "dump and spread" method in which appropriate lightweight equipment with low ground pressure are used to spread the material.
 - b6. No travel over piping shall be allowed without sufficient protection of the piping.
 - b7. Material placement over geosynthetic materials during periods of warm weather can cause wrinkling in the geosynthetic materials. The wrinkling effect can cause damage to the geosynthetic materials. Placement of Granular Materials shall be halted when the air temperature is greater than 85°F or less than 40°F.
 - b8. When Sand Filter Layer, Protective Warning Layer, or Riprap Bedding Layer materials are being placed, a worker shall walk alongside earthmoving equipment spreading the material to spot and remove all rocks, stones, roots, and other debris that may be remaining in the materials that could cause damage to a geosynthetic material.
 - b9. Placement of Granular Materials and riprap on the basin's side slopes shall begin at the toe of the slope and proceed up the slope.

305.3 Placement of Coarse Aggregate Bedding Material:

- a. Coarse Aggregate Bedding Material shall be placed under and around the leachate collection, sump collection, and sideslope riser pipes to the thicknesses shown on the Design Drawings.
- b. All piping shall be installed over an initial layer of Coarse Aggregate Bedding Material. After a pipe is installed, Coarse Aggregate Bedding Material shall be placed by hand beneath the

haunches and above the pipe and compacted to ensure complete and uniform support of the pipe.

305.4 Placement of Sand Filter Layer Material:

- a. Installation of the Sand Filter Layer shall not begin until Geosynthetics Contractor has finished installing the non-woven geotextile and HDPE geonet components of the LCRS, the CQA Contractor has finished inspecting those geosynthetic components of the LCRS, and the area has been released to the Earthwork Contractor in writing to proceed.
- b. Sand Filter Layer material shall be placed in a single layer to the thickness shown on the Design Drawings without compaction or working of the material that could cause intrusion through the non-woven geotextile into the underlying HDPE geonet.
- c. The Sand Filter Layer shall be fine graded using low ground pressure equipment.

305.5 Placement of Protective Warning Layer Material:

- a. Protective Warning Layer materials shall be placed to the thickness shown on the Design Drawings.
- b. Compaction:
 - b1. Protective Warning Layer materials shall be placed and maintained to a uniform thickness, free of ruts and irregularities.
 - b2. The Protective Warning Layer shall be compacted by a minimum of four passes in each direction (perpendicular to each other) by the equipment spreading the material. The upper surface shall then be compacted with a minimum of four passes each way by a vibratory drum roller with a minimum static weight of 13 tons.
 - b3. Acceptance of the fill shall be based on ruts less than 1 inch between the last successive passes. Compaction testing is not required.
- c. The Protective Warning Layer shall be fine graded using low ground pressure equipment.

305.6 Placement of Riprap Bedding Layer Material:

- a. Riprap Bedding Layer materials shall be placed to the full thickness shown on the Design Drawings in one operation using methods which will not cause segregation of particle sizes.
- b. Riprap Bedding Layer materials shall not be dropped onto the underlying Sand Filter Layer from a height exceeding 3 feet.
- c. Compaction of the Riprap Bedding Layer is not required; however, the surface shall be reasonably even and free from mounds or windrows.
- d. The Riprap Bedding Layer shall be fine graded using low ground pressure equipment.

305.7 Placement of Riprap:

- a. Riprap shall be placed in general accordance with the methods described in ASTM D6825 in designated areas to the lines, grades, and thickness specified on the Design Drawings. Riprap shall be placed to the full thickness in one operation.
- b. Riprap placement operations – including handling, stockpiling, and transporting – shall be accomplished in such a manner as to produce a reasonably well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stone and clusters of



large stones. The larger stones shall be well distributed and the entire mass of stones in their final positions shall be roughly graded to conform to the gradation specified.

- c. Riprap shall be placed by dragline, clamshell, appropriately-sized excavators, or similar equipment, which shall be operated so as to place each load of material in approximately its final position without reworking and without excessive height drop (i.e., more than 12 inches).
- d. Placing riprap in layers is not permitted.
- e. Placing stones by dumping into chutes or other methods, which cause segregation of various stone sizes, is not permitted.

305.8 Grading Tolerances:

- a. Horizontal and vertical tolerances for the Sand Filter Layer and Protective Warning Layer shall be as specified in Table 319050-2.
- b. Thickness determination of riprap and Riprap Bedding Layer materials will be made at points selected by the CQA Contractor. When the average constructed thickness is less than the thickness specified on the Design Drawings, additional material shall be added to obtain the specified thickness at no additional cost to the Owner.

305.9 Reporting Damage:

- a. If damage occurs (or is suspected to have occurred) to any portion of the LCRS, composite liner system, or existing HDPE geomembrane liner under the composite liner system while placing Granular Materials, the Earthwork Contractor shall report the damage(s) to the Owner immediately so that repairs can be performed without delay.
- b. Repairs to a geosynthetic material shall be made as specified in Specification P-1402, Section 319020 (HDPE geomembrane liner and/or drainage geosynthetic) and/or Section 319025 (GCL). The Geosynthetics Contractor shall perform all geosynthetic repair work at no additional cost to the Owner.
- c. Repairs to components of the LCRS shall be repaired as specified herein. The Earthwork Contractor shall perform all LCRS repair work at no additional cost to the Owner.

TABLE 319050-2
ACCEPTABLE DEVIATIONS FROM DESIGN LINES AND GRADES

Type of Installation (Excavation or Fill)	Maximum Acceptable Deviation from Line (feet)	Maximum Acceptable Deviation from Grade ⁽¹⁾ (feet)
Granular Materials		
Top of Sand Filter Layer	±0.3	+0.1 to -0.0
Top of Protective Warning Layer		
Top of Riprap Bedding Layer		

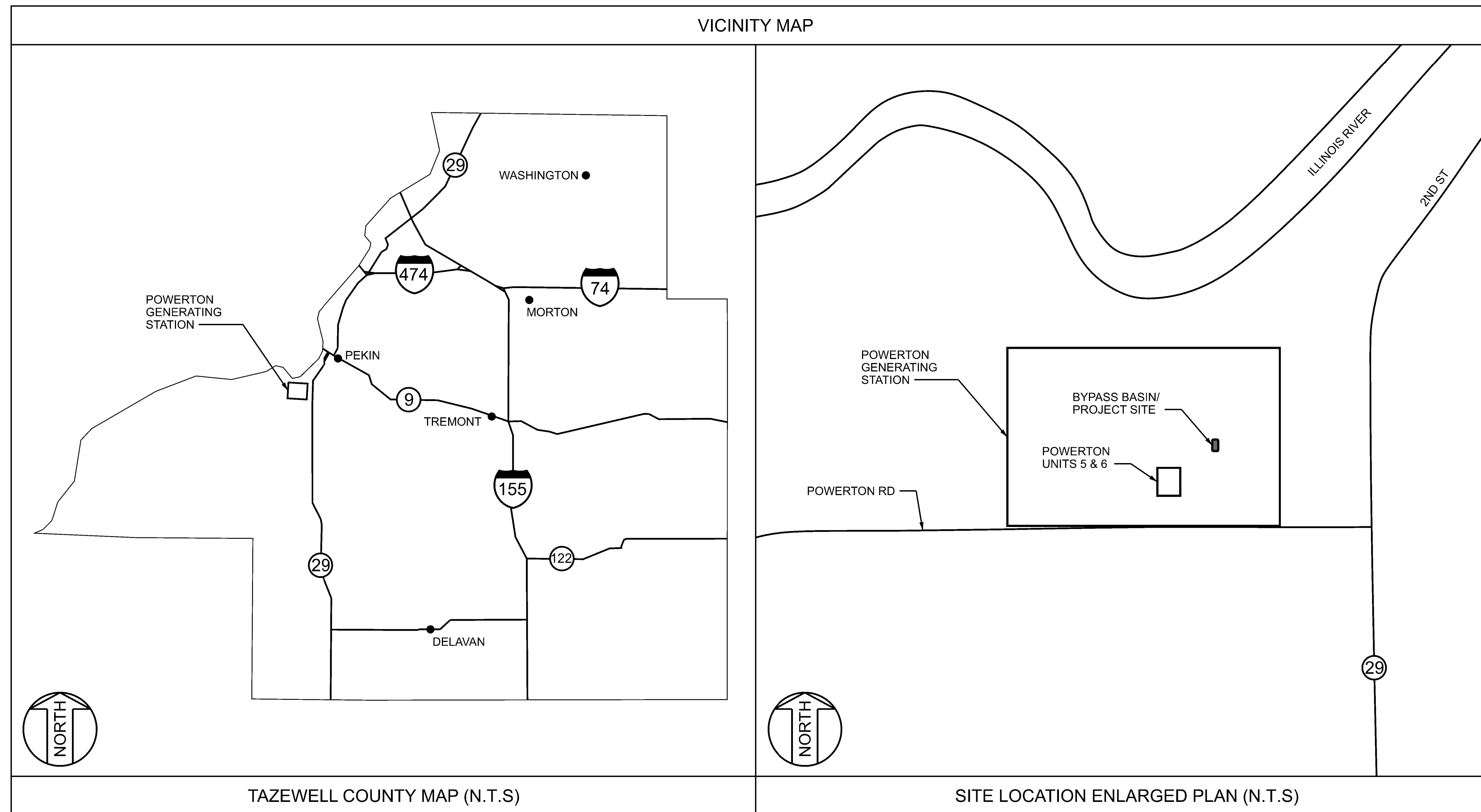
END OF SECTION 319050



ATTACHMENT 1
DESIGN DRAWINGS

DWG NO.	REV.	TITLE
POW-BBR-CSK-001	1	COVER SHEET
POW-BBR-CSK-002	1	GENERAL NOTES
POW-BBR-CSK-003	1	POST-EXCAVATION CONDITIONS
POW-BBR-CSK-004	0	TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
POW-BBR-CSK-005	0	TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS
POW-BBR-CSK-006	1	STRUCTURAL FILL GRADING PLAN
POW-BBR-CSK-007	1	COMPOSITE LINER & LEACHATE COLLECTION SYSTEM PLAN
POW-BBR-CSK-008	1	COMPOSITE LINER & LEACHATE COLLECTION SYSTEM SECTIONS & DETAILS
POW-BBR-CSK-009	1	INLET & OUTLET STRUCTURE DETAILS SHEET 1
POW-BBR-CSK-010	1	INLET & OUTLET STRUCTURE DETAILS SHEET 2

MIDWEST GENERATION, LLC POWERTON GENERATING STATION BYPASS BASIN RETROFIT PROJECT



PREPARED FOR:
MIDWEST GENERATION, LLC
POWERTON GENERATING STATION
13082 E. MANITO RD.
PEKIN, IL 61554

PREPARED BY:
SARGENT & LUNDY
55 E. MONROE ST.
CHICAGO, IL 60603

HOLD INFORMATION	
NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE: BIDS
SPECIFICATION: P-1400, P-1401 & P-1402
PROJECT NO.: 12661-181

CAD FILE NAME: POW-BBR-CSK-001.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN
APPROVED BY: --

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.



PROJECT
**POWERTON
GENERATING STATION
BYPASS BASIN RETROFIT**

DRAWING TITLE
COVER SHEET

DRAWING NUMBER	REVISION
POW-BBR-CSK-001	1

SHEET 1 OF 1

POWERTON BYPASS BASIN RETROFIT PROJECT DRAWING LIST	
DWG NO.	DRAWING TITLE
POW-BBR-CSK-001	COVER SHEET
POW-BBR-CSK-002	GENERAL NOTES
POW-BBR-CSK-003	POST-EXCAVATION CONDITIONS
POW-BBR-CSK-004	TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
POW-BBR-CSK-005	TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS
POW-BBR-CSK-006	STRUCTURAL FILL GRADING PLAN
POW-BBR-CSK-007	COMPOSITE LINER & LEACHATE COLLECTION SYSTEM PLAN
POW-BBR-CSK-008	COMPOSITE LINER & LEACHATE COLLECTION SYSTEM SECTIONS & DETAILS
POW-BBR-CSK-009	INLET & OUTLET STRUCTURE DETAILS SHEET 1
POW-BBR-CSK-010	INLET & OUTLET STRUCTURE DETAILS SHEET 2

PRELIMINARY
NOT FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED. REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK. THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

PL127830M168Z\Sheriff\INFO CENTER\DISCIPLINE REF MATERIAL\CIVIL\DESIGN\2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-001.dgn
 Form: GDC-CAD1-1-01-06_ANSI (Imperial) Microstation Border - Size E - 34 x 44
 Revision: 11A, Revision Date: 04-30-2010

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7

GENERAL NOTES

- ALL WORK SHALL BE PERFORMED ACCORDING TO THE REQUIREMENTS OF SPECIFICATIONS P-1400, P-1401, AND P-1402, AS NOTED ON THE DESIGN DRAWINGS.
- THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR AND HAVE CONTROL AND CHARGE OF CONSTRUCTION MEANS, METHODS, TECHNIQUES, WORK SEQUENCING, AND PROCEDURES IN CONNECTION WITH THE WORK. THE CONTRACTOR SHALL CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, COMPOSED OF THE DESIGN DRAWINGS AND SPECIFICATIONS.
- ALL WORK DONE BY CONTRACTOR/INSTALLER PURSUANT TO THESE DRAWINGS SHALL: (A) CONFORM TO THE GOVERNING CONTRACT DOCUMENTS; (B) BE PERFORMED EXCLUSIVELY BY ITS TRAINED, COMPETENT PERSONNEL OR, WHERE PERMITTED, THAT OF ITS SUBCONTRACTOR(S); AND (C) COMPLY WITH ALL APPLICABLE SAFETY LAWS, REGULATIONS, PROGRAMS AND PRACTICES TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING THE CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.
- THE CONTRACTOR SHALL PERFORM INSTALLATION AND REMOVAL WORK IN A NEAT AND SKILLFUL MANNER, CAREFULLY TERMINATING WORK NEAR MATERIAL TO REMAIN IN PLACE. PRECAUTIONS SHALL BE TAKEN NOT TO DAMAGE OR DEFACE WORK, EXISTING FACILITIES, AND/OR MATERIAL TO REMAIN IN PLACE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY SUCH DAMAGE OR REPAIR THEREOF.
- ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF FEDERAL STATE OR LOCAL CODES, STANDARDS AND SPECIFICATIONS.
- ANY WORK FOUND DEFECTIVE OR NOT IN COMPLIANCE WITH THE REQUIREMENTS OF THE PROJECT SPECIFICATIONS OR THE DESIGN DRAWINGS SHALL BE REPLACED/FIXED AT NO ADDITIONAL COST TO THE OWNER.
- EARTHWORK AND COMPACTION:**
SEE SPECIFICATION P-1400 FOR EARTHWORK AND COMPACTION REQUIREMENTS UNLESS OTHERWISE NOTED.
- SOIL EROSION AND SEDIMENTATION CONTROL:**
PROPER SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED TO MEET THE APPLICABLE REGULATORY CODES AND THE PERMIT REQUIREMENTS.
- CONSTRUCTION QUALITY ASSURANCE:**
A. MATERIALS AND CONSTRUCTION PROCEDURES WILL BE SUBJECT TO INSPECTION AND TESTING BY A CONSTRUCTION QUALITY ASSURANCE (CQA) CONTRACTOR EMPLOYED BY THE OWNER. SUCH INSPECTIONS AND TESTS WILL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY FOR PROVIDING MATERIALS AND INSTALLATION IN COMPLIANCE WITH SPECIFIED REQUIREMENTS.
B. THE OWNER RESERVES THE RIGHT, AT ANY TIME BEFORE FINAL ACCEPTANCE, TO REJECT MATERIALS OR WORKMANSHIP NOT COMPLYING WITH SPECIFIED REQUIREMENTS. THE CONTRACTOR SHALL CORRECT THE DEFICIENCIES WHICH THE INSPECTIONS AND TESTS HAVE INDICATED ARE NOT IN COMPLIANCE WITH SPECIFIED REQUIREMENTS.
C. CQA ACTIVITIES WILL BE PERFORMED AS DESCRIBED ON THE DESIGN DRAWINGS AND IN SPECIFICATION P-1401.
- TOPOGRAPHIC MAP & COORDINATES:**
A. EXISTING TOPOGRAPHY FOR THE PROJECT SITE SHOWN ON THE DESIGN DRAWINGS WAS PREPARED IN 2022 BY RUETTIGER, TONELLI & ASSOCIATES, INC.
B. THE PLANT COORDINATE SYSTEM SHOWN ON THE DESIGN DRAWINGS IS BASED ON THE ILLINOIS STATE PLANE, WEST ZONE, NORTH AMERICAN DATUM OF 1983 (2011) (NAD 83/2011), U.S. SURVEY FEET.
- HORIZONTAL AND VERTICAL CONTROL:**
A. THE BASIS FOR HORIZONTAL CONTROL IS AS DESCRIBED IN NOTE 10.
B. THE BASIS FOR VERTICAL CONTROL IS THE LOCAL PLANT DATUM.
C. THE FOLLOWING PERMANENT BENCHMARKS FOR HORIZONTAL AND VERTICAL CONTROL HAVE BEEN ESTABLISHED AT THE PROJECT SITE. THE CONTRACTOR SHALL NOTIFY THE OWNER OF ANY DISCREPANCIES IN EXISTING BENCHMARK LOCATIONS AND/OR ELEVATIONS.

ID #	NORTHING	EASTING	ELEVATION
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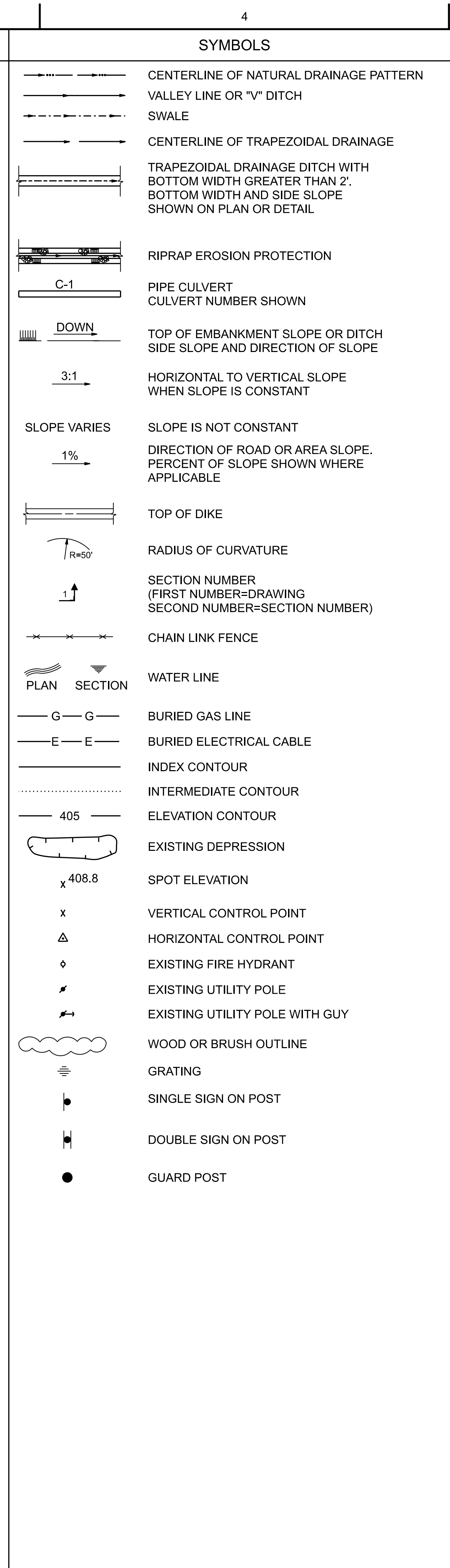
D. CONTRACTOR IS RESPONSIBLE FOR SETTING ADDITIONAL MONUMENTS AND CONTROL POINTS THAT THEY DEEM NECESSARY FOR COMPLETION OF THE WORK.
- GEOTECHNICAL WORK:**
A STRUCTURAL STABILITY AND FACTOR OF SAFETY ASSESSMENT FOR THE ASH SURGE AND BYPASS BASINS WAS PREPARED BY GEOSYNTEC CONSULTANTS IN OCTOBER 2016. SITE SPECIFIC SOIL DATA AND GEOTECHNICAL RECOMMENDATIONS ARE PROVIDED AND REFERENCED THEREIN.
- EXISTING CONDITIONS:**
A. DIMENSIONS OF EXISTING WORK SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO THE START OF WORK IN ACCORDANCE WITH THE SPECIFICATION AS FIELD CONDITIONS MAY VARY FROM INFORMATION SHOWN ON THE DESIGN DRAWINGS. DIMENSIONS NOTED FOR REFERENCE (REF) INDICATE NOMINAL DIMENSIONS FOR THE EXISTING STRUCTURE, UTILITY, ETC. NEW WORK SHALL NOT BE LOCATED BASED ON THE REFERENCE DIMENSIONS.
B. PRIOR TO COMMENCING THE WORK, THE CONTRACTOR SHALL EXAMINE THE AREAS AND CONDITIONS UNDER WHICH THE RETROFIT WORK IS TO TAKE PLACE, AND NOTIFY THE OWNER IN WRITING OF CONDITIONS WHICH MAY IMPACT THE PROPER AND TIMELY COMPLETION OF THE WORK.
C. UNDERGROUND OR EMBEDDED UTILITIES MAY EXIST WITHIN THE AREA OF AND ADJACENT TO THE LIMITS OF THE WORK. THE LOCATION OR IDENTIFICATION OF SUCH UTILITIES HAS NOT BEEN VERIFIED BY THE OWNER OR BY S&L. CONTRACTOR/INSTALLER IS RESPONSIBLE FOR FIELD LOCATING AND IDENTIFYING UNDERGROUND OR EMBEDDED UTILITIES AND ANY OTHER UNDERGROUND OR EMBEDDED UTILITY DIMENSIONS.
D. REFERENCES USED HAVE BEEN IDENTIFIED ON EXCAVATION/FOUNDATION/DEMOLITION DRAWINGS AND HAVE BEEN PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING EXISTING UTILITIES AND OTHER POTENTIAL UNDERGROUND OR EMBEDDED INTERFERENCES. THESE REFERENCES ONLY SHOW THE APPROXIMATE LOCATION OF POTENTIAL UNDERGROUND OR EMBEDDED UTILITIES AND MAY NOT INDICATE OR REFLECT ALL EXISTING UNDERGROUND OR EMBEDDED UTILITIES OR THEIR ACTUAL LOCATIONS.
E. REFERENCES IDENTIFIED SHALL NOT SUBSTITUTE FOR THE CONTRACTOR'S/INSTALLER'S OBLIGATION TO FIELD LOCATE ANY UNDERGROUND OR EMBEDDED UTILITIES OR INTERFERENCES THAT MAY AFFECT THE WORK.
F. DUE CAUTION SHALL BE TAKEN DURING ANY EXCAVATION/FOUNDATION/DEMOLITION WORK WITHIN THE AREA OF, AND ADJACENT TO THE LIMITS OF THE WORK DUE TO POSSIBLE INTERFERENCES THAT MAY NOT BE REFLECTED ON THE REFERENCES IDENTIFIED.
G. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PRESERVATION AND RESTORATION OF THE EXISTING UTILITIES IF DAMAGED DURING CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER.

6

ABBREVIATIONS

ROAD AND GRADING

TR/D	TOP OF ROAD ELEVATION
EL OR ELEV	GRADE ELEVATION
INV	INVERT ELEVATION
HP	HIGH POINT
LP	LOW POINT
HPFS	HIGH POINT FINISH SURFACING
BC	BEGINNING OF CURVE (HORIZONTAL CURVE)
EC	END OF CURVE (HORIZONTAL CURVE)
PI	POINT OF INTERSECTION (HORIZONTAL CURVE)
PT	POINT OF TANGENT
PC	POINT OF CURVE
STA	STATION
VC	VERTICAL CURVE
BVC	BEGINNING OF VERTICAL CURVE
EVC	END OF VERTICAL CURVE
PIVC	POINT OF INTERSECTION OF VERT. CURVE
PRC	POINT OF REVERSE CURVE
PCC	POINT OF COMPOUND CURVE
R	RADIUS
T	TANGENT
L	LENGTH OF CURVE
D	DEGREE OF CURVE
I	INTERIOR/DEFLECTION ANGLE OF CURVE
UN	UNLESS NOTED
ROW	RIGHT OF WAY
OHL	OVERHEAD LINE
OC	ON CENTER
WL	WATER LEVEL
HWL	HIGH WATER LEVEL
YR	YEAR
DS	DOWNSTREAM
US	UPSTREAM
CL	CENTERLINE
AC	ACRE
N.T.S.	NOT TO SCALE
LWL	LOW WATER LEVEL



3

SYMBOLS & ABBREVIATIONS

EROSION CONTROL SYMBOLS

S	SILT FENCE
IP	INLET PROTECTION
— ■ ■ ■ —	ROCK CHECK

SEWERS AND UNDERGROUND PIPE

CB	CATCH BASIN
CO	CLEANOUT
MH	MANHOLE
RE	RIM ELEVATION
CL	CENTERLINE
S	SLOPE
BOP	BOTTOM OF PIPE
PVC	POLY VINYL CHLORIDE PIPE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
RCP	REINFORCED CONCRETE PIPE
CMP	CORRUGATED METAL PIPE
CHDPE	CORRUGATED HIGH DENSITY POLYETHYLENE PIPE
CISP	CAST IRON SOIL PIPE
DIWP	DUCTILE IRON WATER PIPE
STL	CARBON STEEL PIPE
IP	IN PLACE
SWS	STORM WATER SEWER
OWS	OILY WATER SEWER
SAN	SANITARY SEWER
PWS	PROCESS WASTE SEWER
C.S.	CARBON STEEL

ROAD, PAVEMENT AND SURFACING SYMBOLS

ASPHALT OR CONCRETE PAVED ROAD, OUTER LINES SHOW OVERALL WIDTH, INTERIOR LINES SHOW EDGES OF PAVEMENT.
ROCK SURFACED ROAD
ISOLATION JOINT
THICKENED EDGE ISOLATION JOINT
THICKENED EDGE EXPANSION JOINT
PAVEMENT THICKENED EDGE
CONTRACTION JOINT
CONCRETE PAVING
CRUSHED ROCK SURFACING
ASPHALT PAVEMENT
6" THICK CRUSHED STONE GROUND COVER SURFACING
4" THICK SEEDED TOPSOIL

2

HOLD INFORMATION

NO.	DESCRIPTION

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RELEASE INFORMATION

REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE: BIDS
SPECIFICATION: P-1400, P-1401 & P-1402
PROJECT NO.: 12661-181

CAD FILE NAME: POW-BBR-CSK-002.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN
APPROVED BY: —

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

Sargent & Lundy LLC
SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

1

PROJECT

POWERTON GENERATING STATION BYPASS BASIN RETROFIT

DRAWING TITLE

GENERAL NOTES

DRAWING NUMBER	REVISION
POW-BBR-CSK-002	1

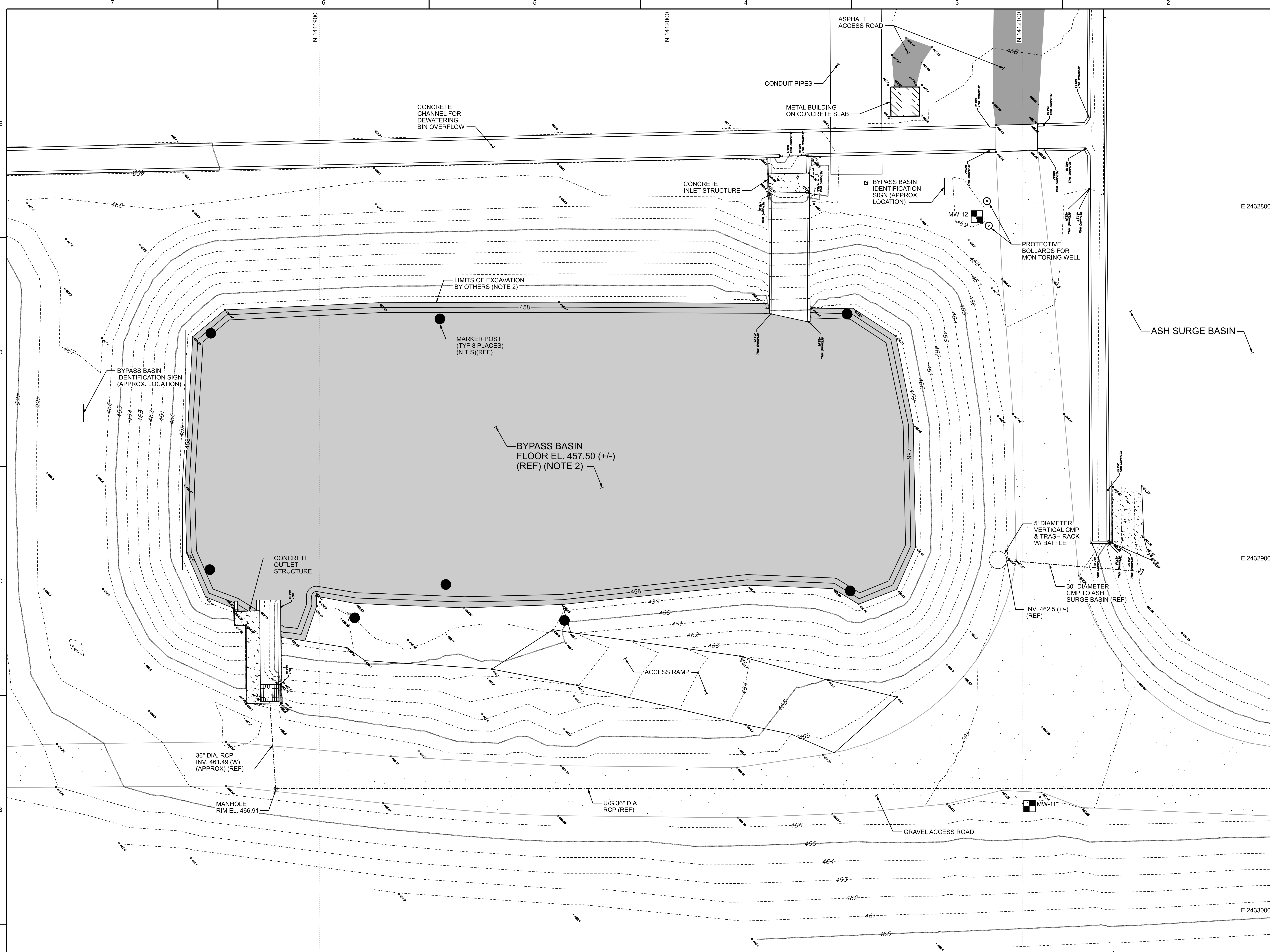
SHEET 1 OF 1

PRELIMINARY
NOT FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED. REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK. THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

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Revision 11A, Revision Date: 04-30-2010

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HOLD INFORMATION	
NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE: BIDS
 SPECIFICATION: P-1400, P-1401 & P-1402
 PROJECT NO.: 12661-181

CAD FILE NAME: POW-BBR-CSK-003.DGN
 PREPARED BY: J. CHAVEZ
 REVIEWED BY: T. DEHLIN
 APPROVED BY: -

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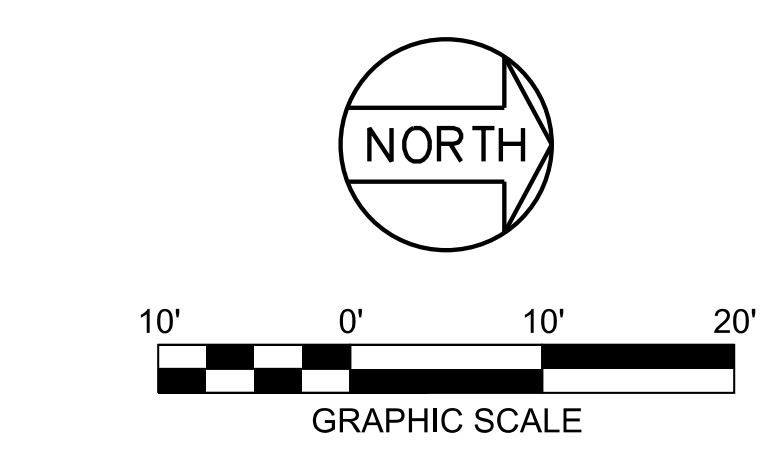


PROJECT
 POWERTON GENERATING STATION BYPASS BASIN RETROFIT

DRAWING TITLE	
POST-EXCAVATION CONDITIONS	
DRAWING NUMBER	REVISION
POW-BBR-CSK-003	1
SHEET	OF
1	1

- NOTES**
- FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - EXCAVATION / REMOVAL OF BYPASS BASIN'S GRANULAR PROTECTIVE LAYER MATERIALS AND UPPER NON-WOVEN GEOTEXTILE WILL BE PERFORMED BY OTHERS. MATERIAL WILL BE REMOVED TO TOP OF BASIN'S EXISTING GEOMEMBRANE LINER. LIMITS OF EXCAVATION / REMOVAL AND CONTOURS WITHIN LIMITS OF EXCAVATION / REMOVAL ARE APPROXIMATE.

LEGEND	
	MONITORING WELL
	MAJOR CONTOUR (POST-EXCAVATION)
	MINOR CONTOUR (POST-EXCAVATION)
REFERENCE DRAWINGS	
D1965C030-02	NATURAL RESOURCE TECHNOLOGY BYPASS BASIN LINER REPLACEMENT WARNING LAYER PLAN
5925-C-5001	ASH SURGE BASIN BY PASS PLAN AND PROFILE
5925-C-5003	ASH SURGE BASIN BY PASS MISCELLANEOUS DETAILS

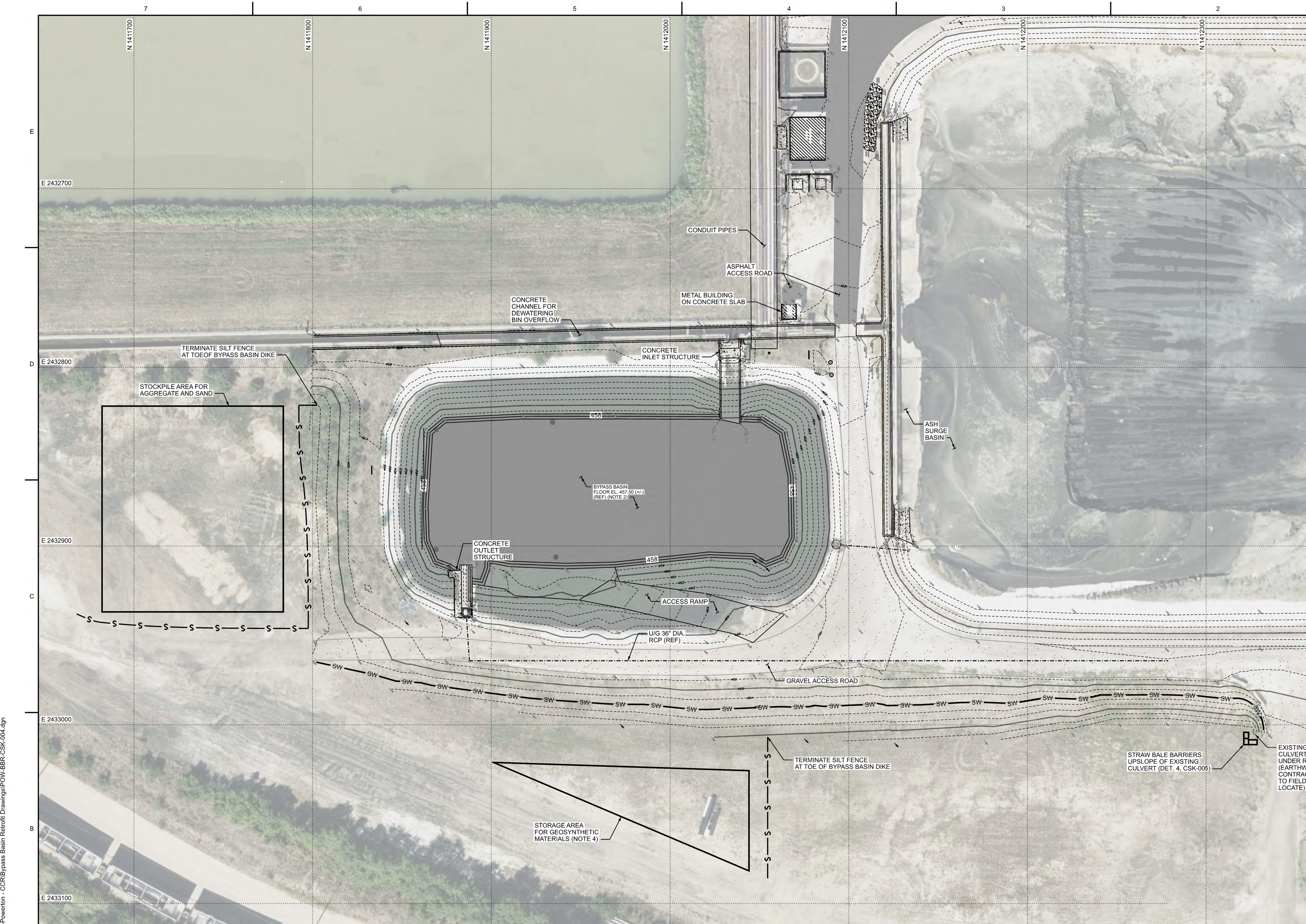


PRELIMINARY
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PL1279300168472\Sheriff\INFO CENTER\DISCIPLINE REF MATERIAL\LIC\DESIGN2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-003.dgn
 Form: GDC-CAD-1-01-06, ANSI (Imperial) Microstation border - Size: E - 34 x 44
 Revision: 11A, Revision Date: 04-30-2010

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 ...POW-BBR-CSK-003.dgn



HOLD INFORMATION	
NO.	DESCRIPTION

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RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE:	BIDS
SPECIFICATION:	P-1400
PROJECT NO.:	12661-181

CAD FILE NAME:	POW-BBR-CSK-004.DGN
PREPARED BY:	J. CHAVEZ
REVIEWED BY:	T. DEHLIN
APPROVED BY:	--

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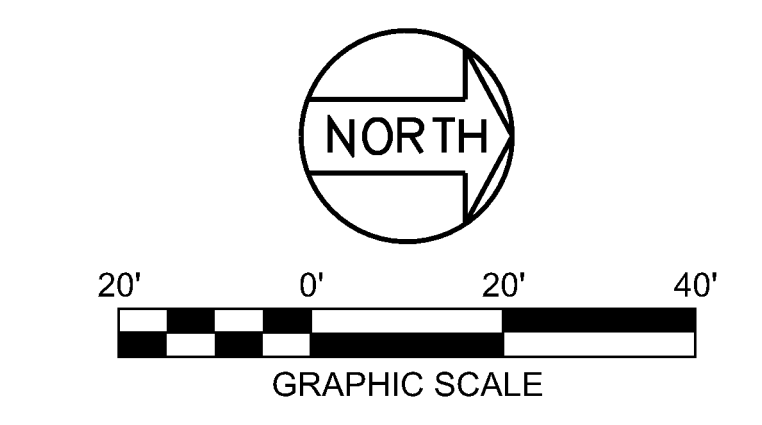


PROJECT	POWERTON GENERATING STATION BYPASS BASIN RETROFIT
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DRAWING TITLE	TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
DRAWING NUMBER	POW-BBR-CSK-004
REVISION	0
SHEET	1 OF 1

- NOTES**
- ALL WORK SHALL BE FURNISHED AND INSTALLED PER SPECIFICATION P-1400 UNLESS NOTED OTHERWISE.
 - FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - FOR TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS AND NOTES, SEE DRAWING POW-BBR-CSK-005.
 - EARTHWORK CONTRACTOR SHALL INSTALL SILT FENCE DOWNSLOPE OF GEOSYNTHETIC MATERIAL STORAGE AREA BEFORE PREPARING / IMPROVING STORAGE AREA IN ACCORDANCE WITH SPECIFICATION P-1400, SECTION 319005.

LEGEND	
— S — S —	SILT FENCE (DET. 1, CSK-005)
— SW —	STRAW WATTLE (DET. 3, CSK-005)
REFERENCE DRAWINGS	
CSK-005	SARGENT & LUNDY TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS



PRELIMINARY
NOT FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED. REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK. THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

PL1276301068Z\Sshare\INFO CENTER\DESIGN\REF MATERIAL\CVL\DESIGN\2-Power\refn - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-004.dgn
 Form: GDC-CAD17-1-10-ANSI (Imperial) Microstation Border - Size: E - 34 x 44
 Revision: 1/14, Revision Date: 04-30-2010

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 ...POW-BBR-CSK-004.dgn

SEDIMENT AND EROSION CONTROL MEASURES DURING CONSTRUCTION:
 THE EARTHWORK CONTRACTOR IS REQUIRED TO FOLLOW BEST MANAGEMENT PRACTICES (BMPs) ACCORDING TO THE PROJECT STORMWATER POLLUTION PREVENTION PLAN (SWPPP), THE DESIGN DRAWINGS, AND PROJECT SPECIFICATIONS. THESE BMPs INCLUDE, BUT ARE NOT LIMITED TO:

1. PROVIDING TEMPORARY CRUSHED STONE CONSTRUCTION ENTRANCES. MINIMUM WIDTH SHALL BE AS SHOWN IN DETAIL 2, INCREASED AS NECESSARY TO ACCOMMODATE LARGER VEHICLES.
2. PROVIDING SILT FENCES, STRAW WATTLES, AND STRAW BALE BARRIERS UNTIL FINAL SITE STABILIZATION IS ACHIEVED.
3. ENCLOSING MATERIAL STOCKPILE, STORAGE, AND LAYDOWN AREAS WITH SILT FENCES AS SHOWN ON DRAWING POW-BBR-CSK-004.
4. PERIODICALLY INSPECTING SILT FENCES, STRAW WATTLES, STRAW BALE BARRIERS, FOR ACCUMULATED SEDIMENT AND REMOVING BUILT UP SEDIMENT WHEN IT HAS REACHED THE LESSER OF ONE-THIRD OF THE HEIGHT OF THE BARRIER OR SIX INCHES. ALL INSPECTIONS SHALL BE PERFORMED AT A MINIMUM OF ONCE EVERY SEVEN CALENDAR DAYS OR WITHIN 24 HOURS OF THE END OF A STORM EVENT THAT PRODUCES 0.5 INCH OR MORE OF PRECIPITATION.
5. PERIODICALLY INSPECTING SILT FENCES FOR DEPTH OF SEDIMENT, TEARS IN THE FABRIC, AND FABRIC ATTACHMENT TO POSTS. INSPECTING POSTS TO ENSURE THEY ARE FIRMLY ANCHORED IN THE GROUND.
6. IN ADDITION TO THE SITE PERIMETER CONTROLS SHOWN AND GENERAL MEASURES, PERFORM WORK ACCORDING TO BEST MANAGEMENT PRACTICES TO MINIMIZE SOIL EROSION AND CONTROL SEDIMENT MIGRATION.
7. THE EARTHWORK CONTRACTOR SHALL EMPLOY CONSTRUCTION METHODS AND MEANS THAT KEEP FUGITIVE DUST TO A MINIMUM AND SHALL NOT DISCHARGE INTO THE ATMOSPHERE OF SUCH QUANTITY, CHARACTER OR DURATION THAT IT INTERFERES WITH THE COMFORTABLE ENJOYMENT OF LIFE AND PROPERTY OR IS HARMFUL TO PLANTS OR ANIMALS. THE EARTHWORK CONTRACTOR SHALL PROVIDE SUFFICIENT WATER AND MEANS OF STORING, SPREADING AND SPRAYING AT ALL TIMES DURING CONSTRUCTION TO CONTROL FLYING DUST AS NECESSITATED BY WEATHER CONDITIONS AND CONSTRUCTION ACTIVITIES.

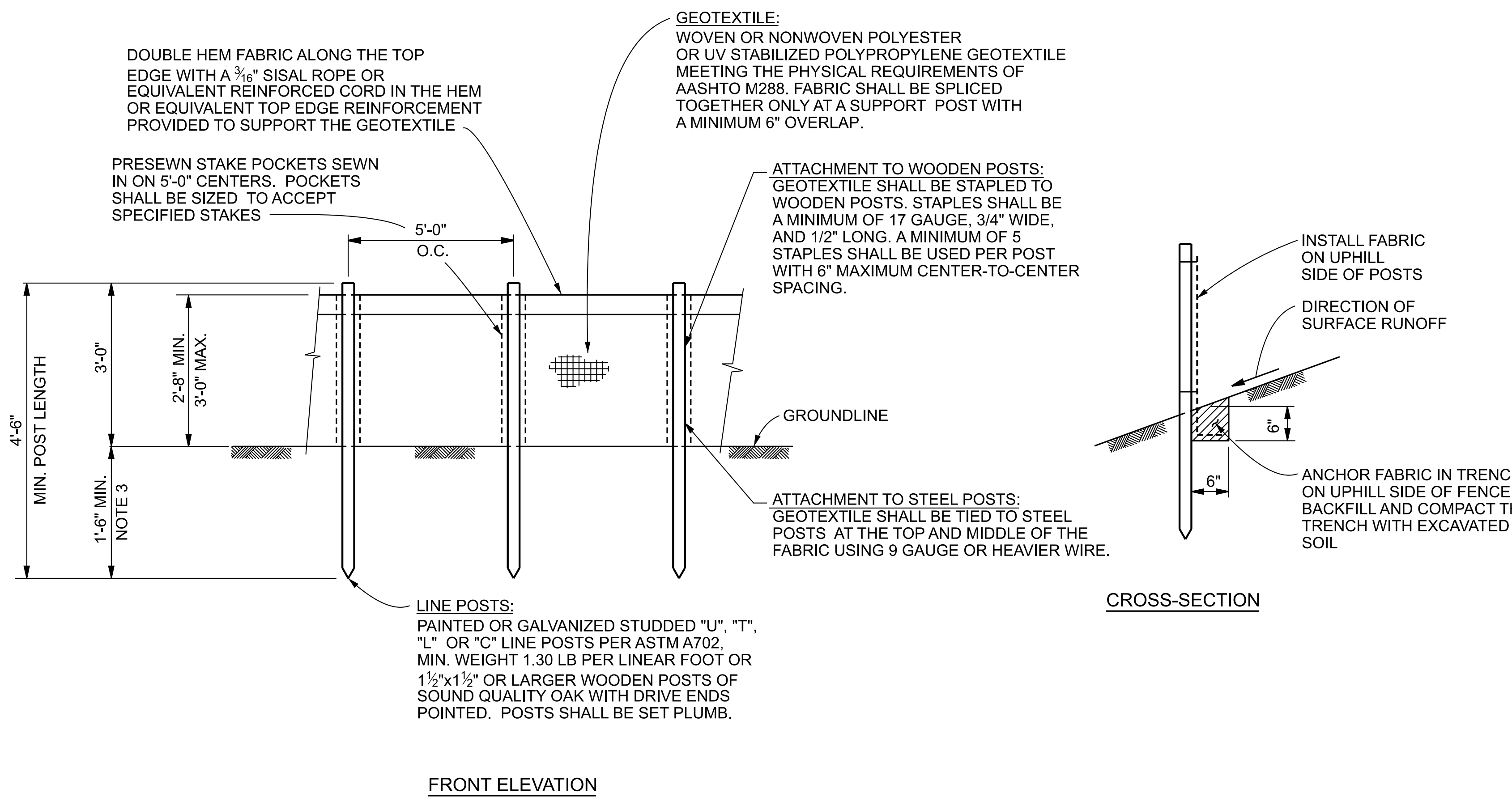
MAINTENANCE:

THE EARTHWORK CONTRACTOR SHALL PROVIDE, INSPECT, AND MAINTAIN ALL SOIL EROSION AND SEDIMENT CONTROL MEASURES THROUGHOUT CONSTRUCTION.

ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO THE ROADWAY AND PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY.

THE CONTRACTOR SHALL WORK IN SEQUENCE AS STATED BELOW:

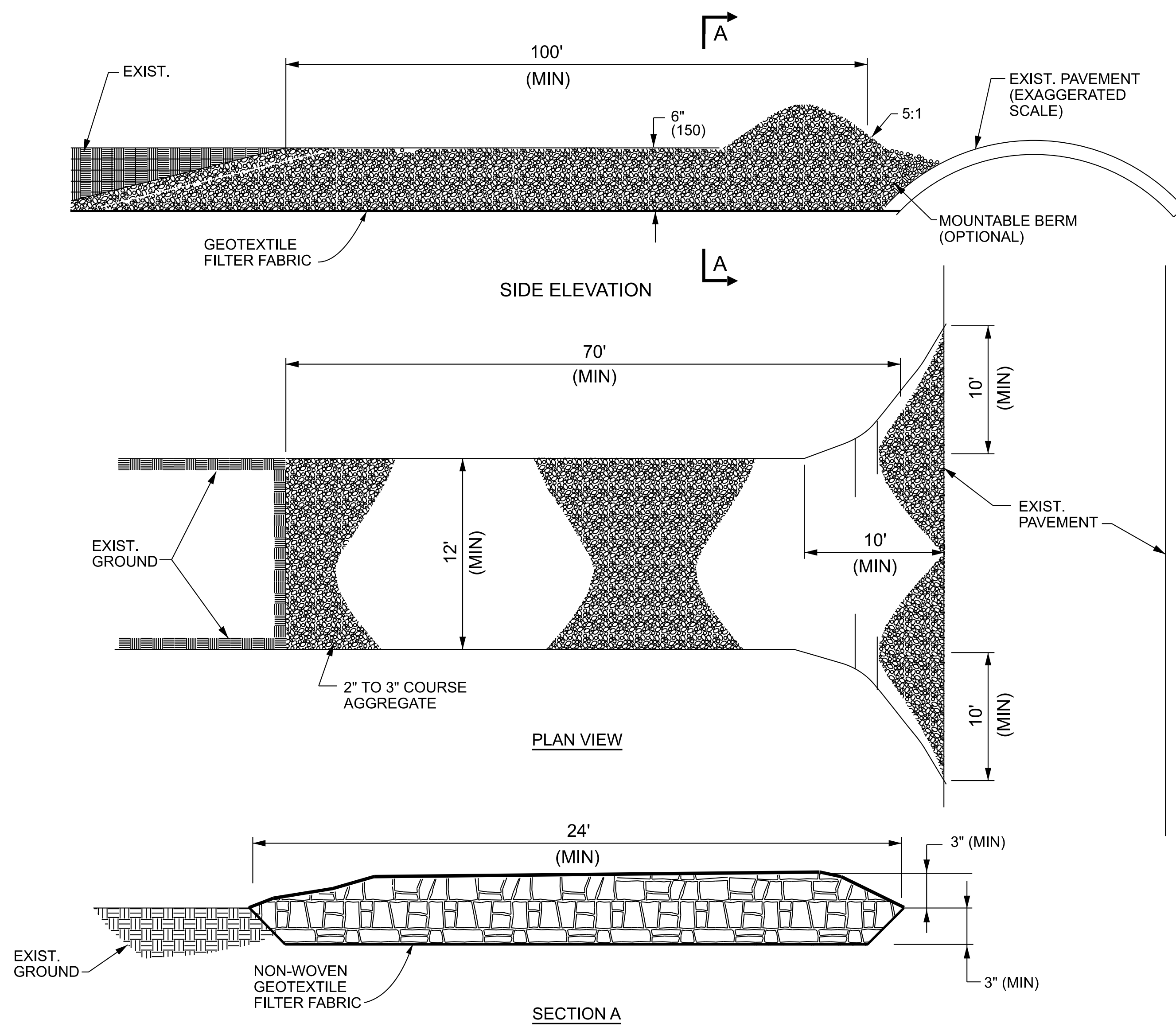
1. INSTALL STABILIZED CONSTRUCTION ENTRANCE.
2. INSTALL PERIMETER EROSION AND SEDIMENT CONTROL (SILT FENCE, STRAW WATTLES, STRAW BALE BARRIERS, AND CONSTRUCTION ENTRANCE) PRIOR TO ANY LAND DISTURBING ACTIVITIES AS SHOWN ON THE DESIGN DRAWINGS AND AS REQUIRED TO CONTROL EROSION.
3. INSTALL SILT FENCING AROUND EQUIPMENT AND MATERIAL STORAGE / STAGING AREAS.
4. INSTALL SILT FENCING AND STRAW WATTLES DOWNGRADEMENT OF PROPOSED CONSTRUCTION AREAS AS REQUIRED.
5. INSTALL STRAW BALE BARRIERS UPSTREAM OF EXISTING CULVERT AS SHOWN ON DRAWING POW-BBR-CSK-004.
6. PERIODICALLY INSPECT EROSION AND SEDIMENT CONTROLS THROUGHOUT CONSTRUCTION. REMOVE SEDIMENT AND REPAIR CONTROLS AS REQUIRED.



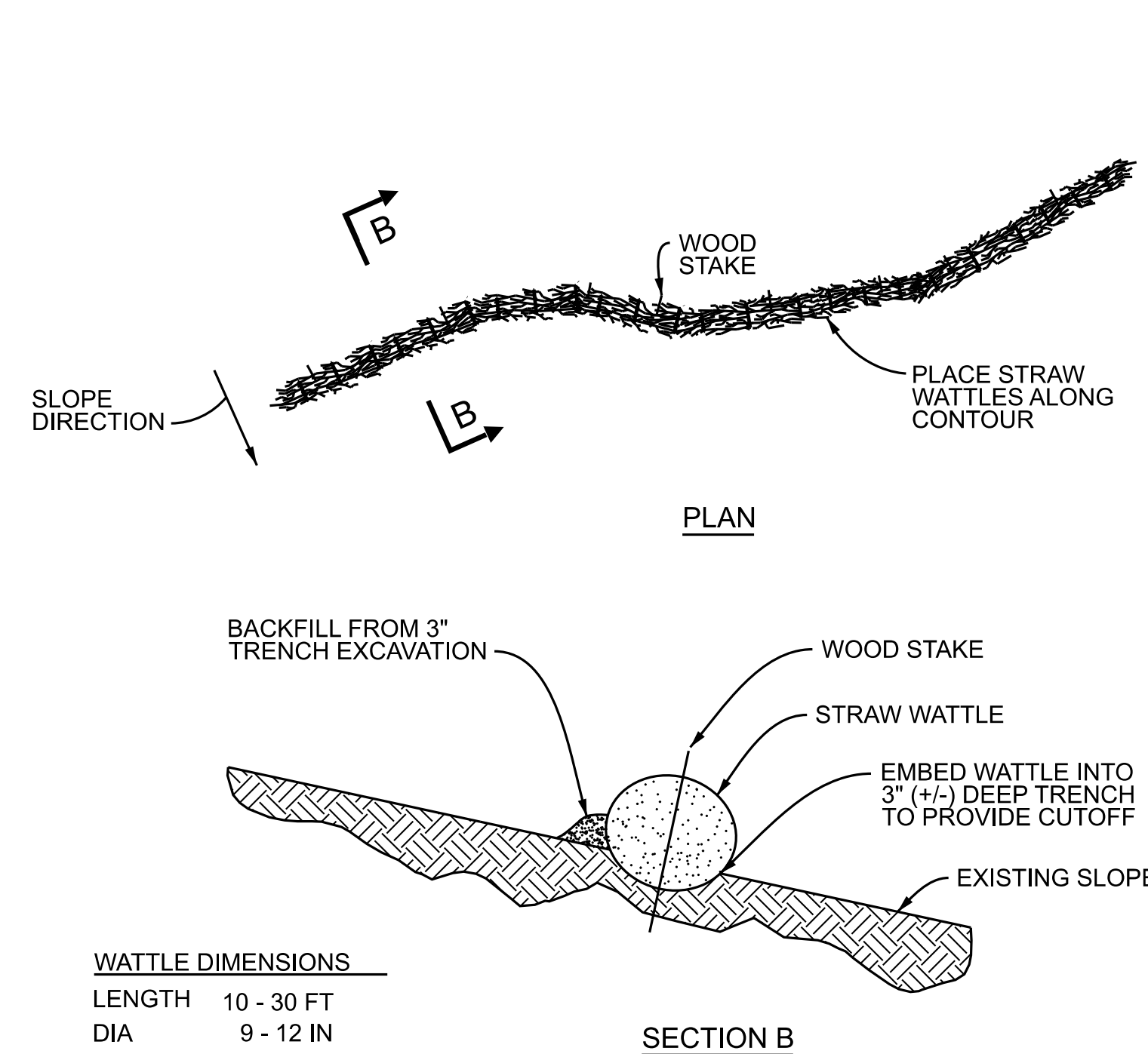
NOTES:

1. AFTER INSTALLATION, THE EARTHWORK CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFACTORILY MAINTAINING THE FENCE. THE EARTHWORK CONTRACTOR SHALL INSPECT FENCES AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. THE EARTHWORK CONTRACTOR IS RESPONSIBLE FOR REMOVING AND REPLACING SILT FENCING NOT FUNCTIONING DUE TO CLOGGING, DAMAGE OR DETERIORATION.
2. THE EARTHWORK CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND DISPOSAL OF FENCING WHEN, AS DETERMINED BY THE PROJECT MANAGERS, THE FENCING IS NO LONGER NEEDED.
3. WHERE 18\"/>

**TYPICAL DETAIL
 SELF-SUPPORTING SILT FENCE
 DETAIL 1
 N.T.S.**

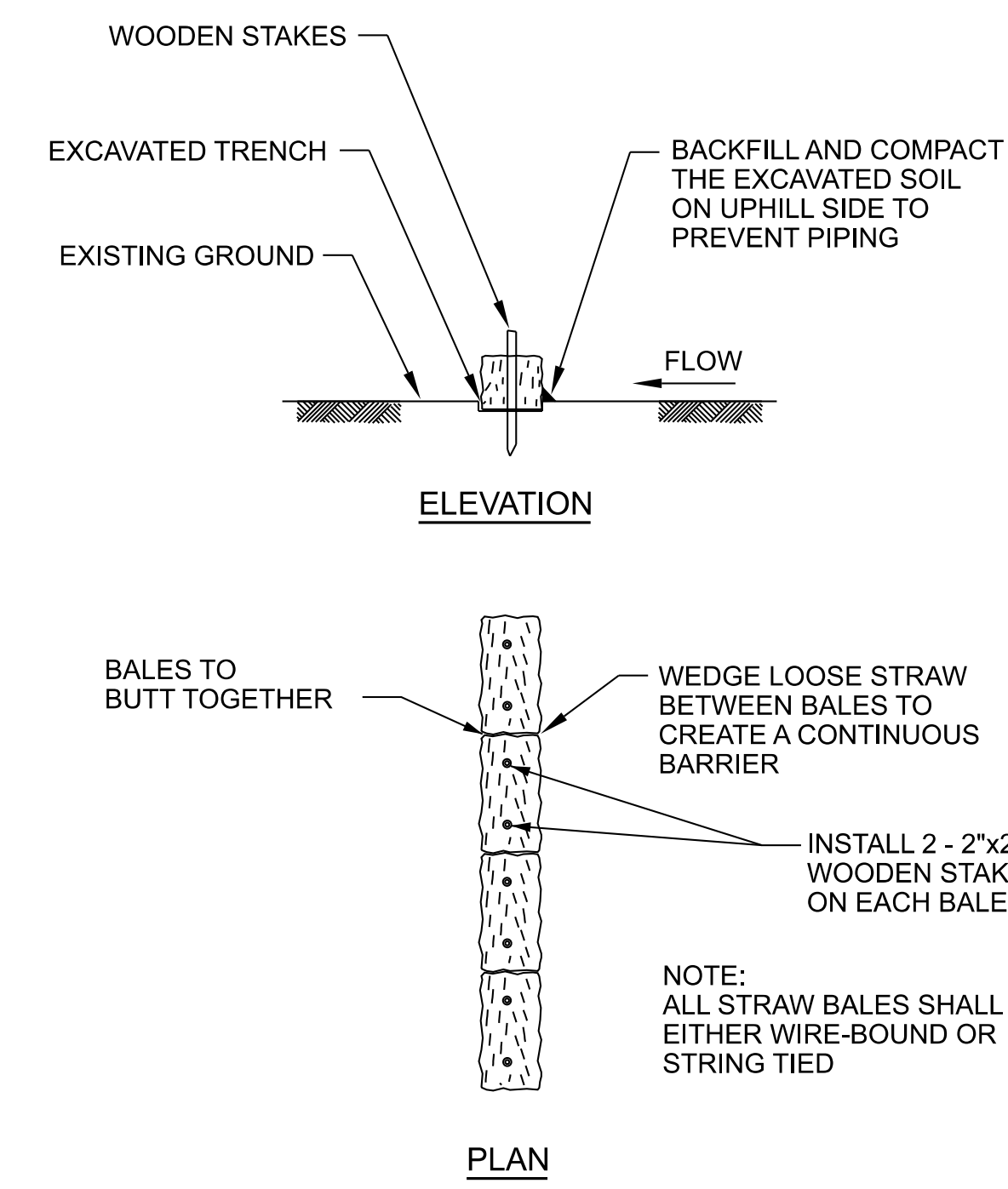


**TYPICAL DETAIL
 STONE CONSTRUCTION ENTRANCE
 DETAIL 2
 N.T.S.**



WATTLE DIMENSIONS
 LENGTH 10 - 30 FT
 DIA 9 - 12 IN

**CONTOUR STRAW WATTLES
 DETAIL 3
 N.T.S.**



**STRAW BALE BARRIERS
 DETAIL 4
 N.T.S.**

NOTES	
1.	ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1400 UNLESS NOTED OTHERWISE.
2.	FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.

REFERENCE DRAWINGS	
CSK-004	SARGENT & LUNDY TEMPORARY EROSION AND SEDIMENT CONTROL PLAN

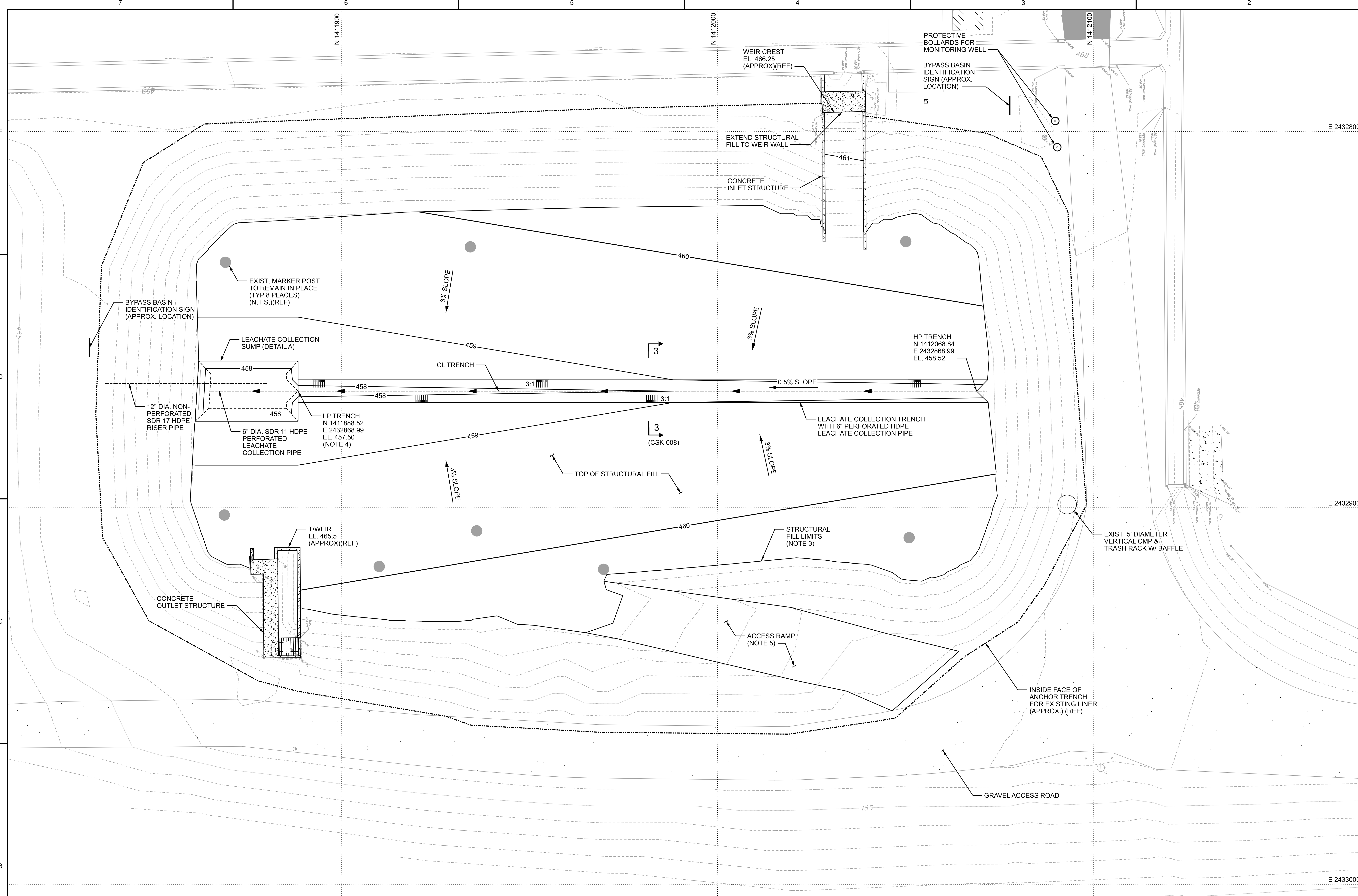
UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED. REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK. THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

**PRELIMINARY
 NOT FOR CONSTRUCTION**

HOLD INFORMATION		
NO.	DESCRIPTION	
CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.		
RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-19-2024	FOR BIDS SPEC P-1400
ISSUE PURPOSE: BIDS		
SPECIFICATION: P-1400		
PROJECT NO.: 12661-181		
CAD FILE NAME: POW-BBR-CSK-005.DGN		
PREPARED BY: J. CHAVEZ		
REVIEWED BY: T. DEHLIN		
APPROVED BY: -		
ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.		
 SARGENT & LUNDY ^{LLC} 55 EAST MONROE STREET CHICAGO, ILLINOIS 60603-5780		
 MWG Midwest Generation, LLC		
PROJECT		
POWERTON GENERATING STATION BYPASS BASIN RETROFIT		
DRAWING TITLE		
TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS		
DRAWING NUMBER		REVISION
POW-BBR-CSK-005		0
SHEET	1 OF 1	

PL127930M1684Z\Sheriff\INFO CENTER\DISCIB\INE REF MATERIAL\LIC\LIC\DESIGN\2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-005.dgn
 Form: G:\CADD\1-10-ANSI (Imperial)\Microstation Border - Size E - 34 x 44
 Revision: 11A, Revision Date: 04-30-2010

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HOLD INFORMATION	
NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION

REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE: BIDS
 SPECIFICATION: P-1400, P-1401 & P-1402
 PROJECT NO.: 12661-181

CAD FILE NAME: POW-BBR-CSK-006.DGN
 PREPARED BY: J. CHAVEZ
 REVIEWED BY: T. DEHLIN
 APPROVED BY: -

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.



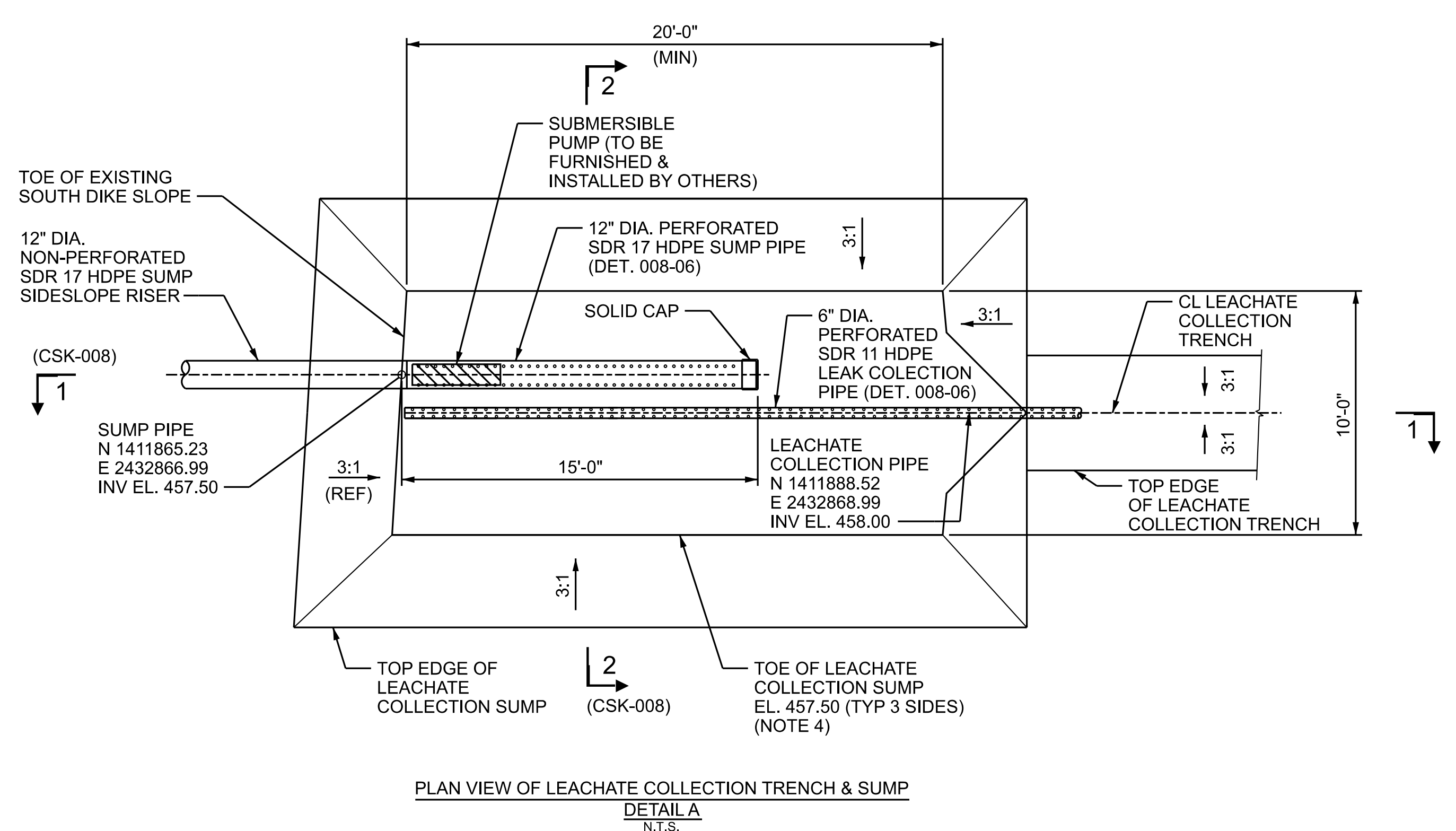
PROJECT
POWERTON
 GENERATING STATION
 BYPASS BASIN RETROFIT

DRAWING TITLE	
STRUCTURAL FILL GRADING PLAN	
DRAWING NUMBER	REVISION
POW-BBR-CSK-006	1
SHEET 1 OF 1	1

LEGEND	
—465—	MAJOR CONTOUR
—464—	MINOR CONTOUR

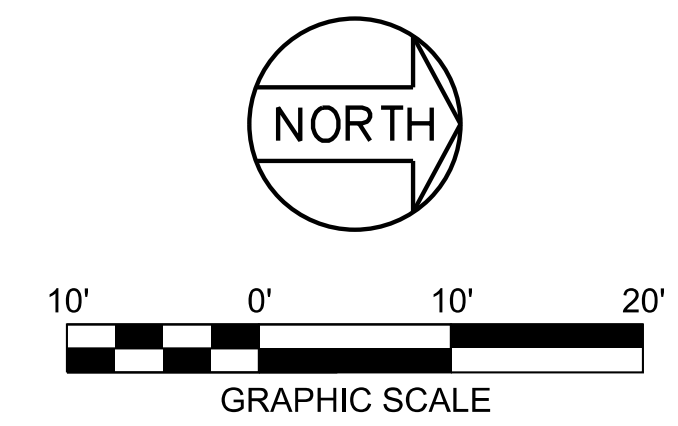
- NOTES**
- ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1400 UNLESS NOTED OTHERWISE.
 - FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - STRUCTURAL FILL SHALL EXTEND TO BYPASS BASIN'S EXISTING GEOMEMBRANE LINER.
 - AT LOW POINTS, LEACHATE COLLECTION TRENCH AND SUMP ELEVATIONS SHALL MATCH EXISTING GEOMEMBRANE LINER ELEVATION.
 - SEE SECTION 8 ON DRAWING POW-BBR-CSK-010 FOR STRUCTURAL FILL REQUIREMENTS ALONG ACCESS RAMP.

REFERENCE DRAWINGS	
CSK-008	SARGENT & LUNDY COMPOSITE LINER & LEACHATE COLLECTION SYSTEM SECTIONS & DETAILS
CSK-010	INLET & OUTLET STRUCTURE DETAILS SHEET 2
5295-C-5501	NUS CORPORATION ASH SURGE BASIN BY PASS, BASIN INLET STRUCTURE
5295-C-5502	NUS CORPORATION ASH SURGE BASIN BY PASS, BASIN OUTLET STRUCTURE
D1965C020-02	NATURAL RESOURCE TECHNOLOGY LINER SUBGRADE PREPARATION
D1965C031-02	DETAILS AND SECTIONS



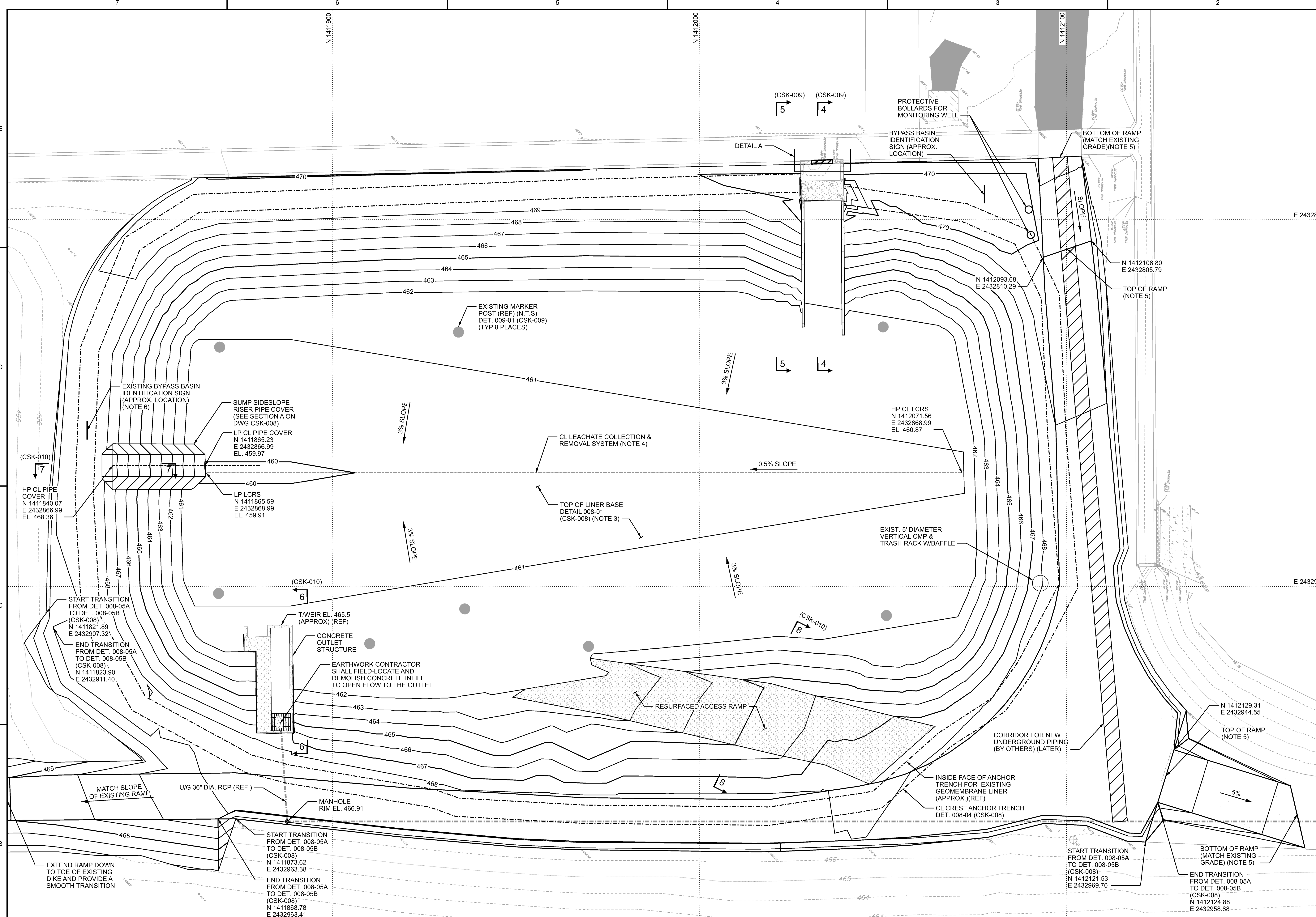
PRELIMINARY
 NOT FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED. REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK. THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.



PL127930106472\Sheriff\INFO CENTER\DISC\REF MATERIAL\LIC\DESIGN2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-006.dgn
 Form: GDC-CAD-1-01-06, ANSI (Imperial) Microstation border - Size: E - 34 x 44
 Revision: 11A, Revision Date: 04-30-2010

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HOLD INFORMATION	
NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE: BIDS
 SPECIFICATION: P-1400, P-1401 & P-1402
 PROJECT NO.: 12661-181

CAD FILE NAME: POW-BBR-CSK-007.DGN
 PREPARED BY: J. CHAVEZ
 REVIEWED BY: T. DEHLIN
 APPROVED BY: -

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

SARGENT & LUNDY^{LLC}
 55 EAST MONROE STREET
 CHICAGO, ILLINOIS 60603-5780

MWG
 Midwest Generation, LLC

PROJECT
**POWERTON
 GENERATING STATION
 BYPASS BASIN RETROFIT**

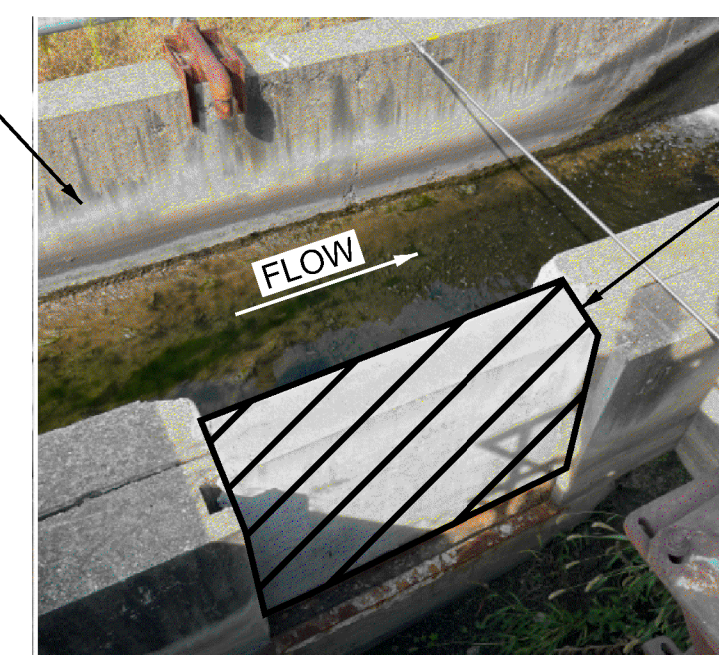
DRAWING TITLE
**COMPOSITE LINER & LEACHATE
 COLLECTION SYSTEM PLAN**

DRAWING NUMBER	REVISION
POW-BBR-CSK-007	1
SHEET 1 OF 1	1

LEGEND	
— 465 —	MAJOR CONTOUR
— 464 —	MINOR CONTOUR

- NOTES**
- ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1400 UNLESS NOTED OTHERWISE.
 - FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - GCL, HDPE GEOMEMBRANE, AND DRAINAGE GEOCOMPOSITE SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1402.
 - FOR LEACHATE COLLECTION TRENCH AND SUMP PLANS, SEE DRAWING POW-BBR-CSK-006. FOR LEACHATE COLLECTION TRENCH AND SUMP DETAILS, SEE DRAWING POW-BBR-CSK-008.
 - PROVIDE SMOOTH TRANSITIONS AT TOPS AND BOTTOMS OF RAMPS.
 - EARTHWORK CONTRACTOR (SPEC. P-1400) SHALL COORDINATE WITH OWNER TO RELOCATE EXISTING IDENTIFICATION SIGN AT SOUTHERN END OF BASIN OUTSIDE OF NEW LINER AREA.

REFERENCE DRAWINGS	
CSK-008	SARGENT & LUNDY COMPOSITE LINER & LEACHATE COLLECTION SYSTEM SECTIONS & DETAILS
CSK-009	INLET & OUTLET STRUCTURE DETAILS - SHEET 1
CSK-010	INLET & OUTLET STRUCTURE DETAILS - SHEET 2
5925-C-5001	NUS CORPORATION ASH SURGE BASIN BY PASS PLAN AND PROFILE



DETAIL A
 N.T.S.
 DEMOLITION OF CONCRETE INFILL
 AT BYPASS BASIN INLET STRUCTURE
 (LOOKING NORTHWEST)

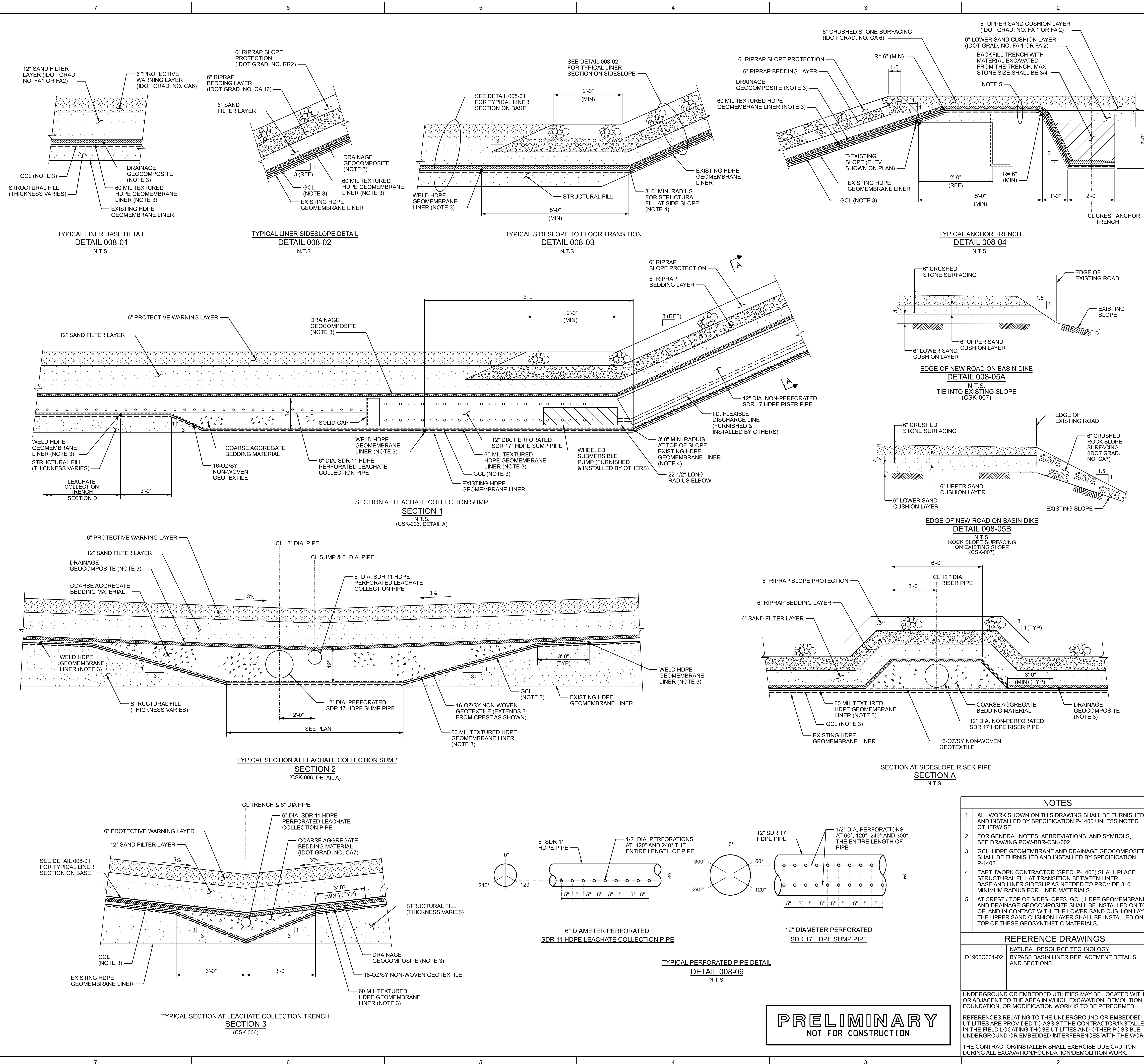
EARTHWORK CONTRACTOR SHALL DEMOLISH CONCRETE INFILL TO OPEN FLOW TO THE BYPASS BASIN'S INLET STRUCTURE

PRELIMINARY
 NOT TO BE USED FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED. REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK. THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

PL12793010M1684Z\Sheriff\INFO CENTER\DISCIPLINE REF MATERIAL\CVL\DESIGN\2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-007.dgn
 Form: G:\CADD\1-10-06_ANSI (Imperial)\MicroStation Border - Size E - 34 x 44
 Revision 11A, Revision Date: 04-30-2010

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HOLD INFORMATION	
NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400

ISSUE PURPOSE: BIDS
 SPECIFICATION: P-1400, P-1401 & P-1402
 PROJECT NO.: 12661-181

CAD FILE NAME: POW-BBR-CSK-008.DGN
 PREPARED BY: J. CHAVEZ
 REVIEWED BY: T. DEHLIN
 APPROVED BY: -

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.



MWG

Midwest Generation, LLC

PROJECT

**POWERTON
GENERATING STATION
BYPASS BASIN RETROFIT**

DRAWING TITLE

**COMPOSITE LINER &
LEACHATE COLLECTION SYSTEM
SECTIONS & DETAILS**

DRAWING NUMBER	REVISION
POW-BBR-CSK-008	1

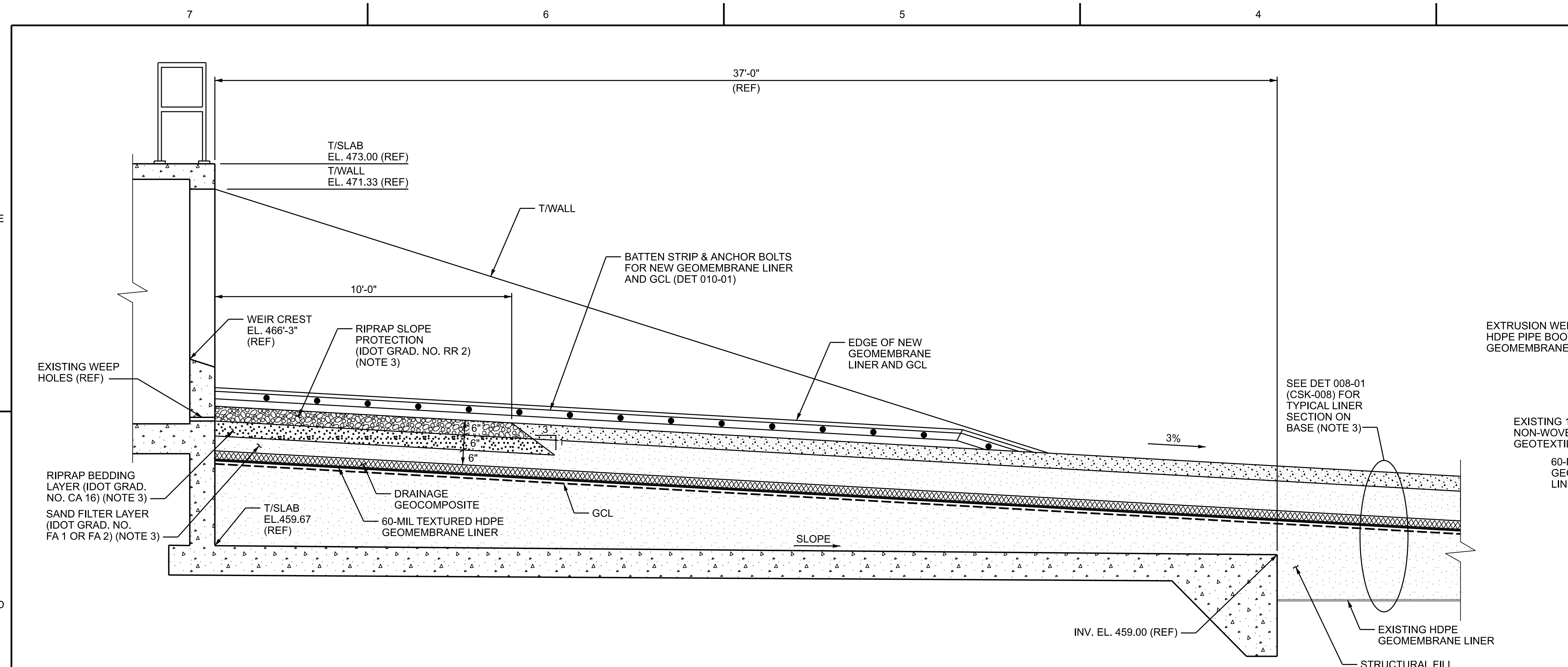
SHEET	REVISION
1 OF 1	1

- NOTES**
- ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1400 UNLESS NOTED OTHERWISE.
 - FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - GCL, HDPE GEOMEMBRANE AND DRAINAGE GEOCOMPOSITE SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1402.
 - EARTHWORK CONTRACTOR (SPEC. P-1400) SHALL PLACE STRUCTURAL FILL AT TRANSITION BETWEEN LINER BASE AND LINER SIDESLIP AS NEEDED TO PROVIDE 3'-0" MINIMUM RADIUS FOR LINER MATERIALS.
 - AT CREST / TOP OF SIDESLOPES, GCL, HDPE GEOMEMBRANE, AND DRAINAGE GEOCOMPOSITE SHALL BE INSTALLED ON TOP OF, AND IN CONTACT WITH, THE LOWER SAND CUSHION LAYER. THE UPPER SAND CUSHION LAYER SHALL BE INSTALLED ON TOP OF THESE GEOSYNTHETIC MATERIALS.
- REFERENCE DRAWINGS**
- D1965C031-02 NATURAL RESOURCE TECHNOLOGY, BYPASS BASIN LINER REPLACEMENT DETAILS AND SECTIONS
- UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.
- REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.
- THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

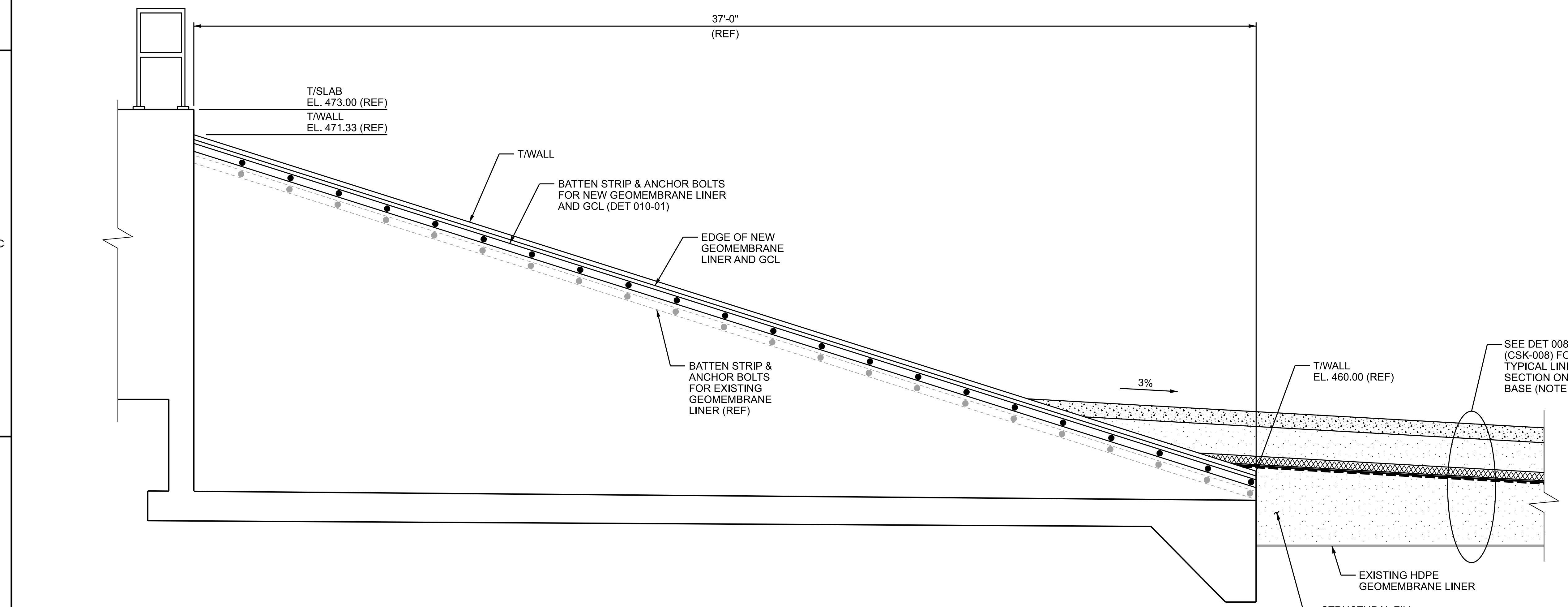
**PRELIMINARY
NOT FOR CONSTRUCTION**

PL127930M1664Z\Sheriff\INFO CENTER\DISC\B IN REF MATERIAL\LIC\DESIGN\2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-008.dgn
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 Revision: 11A, Revision Date: 04-30-2010

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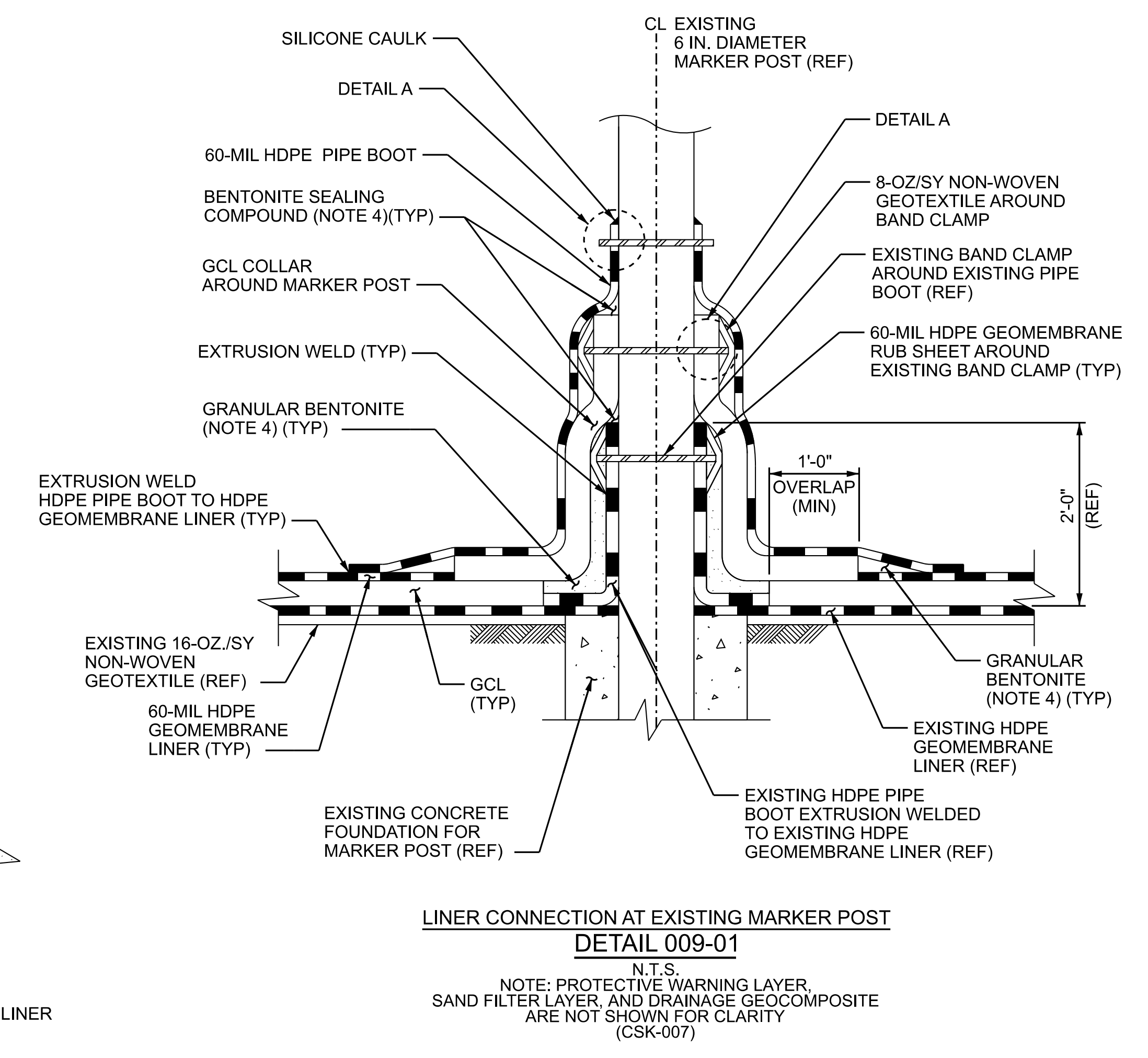


INTERIOR OF CONCRETE INLET STRUCTURE
SECTION 4
N.T.S.
(CSK-007)

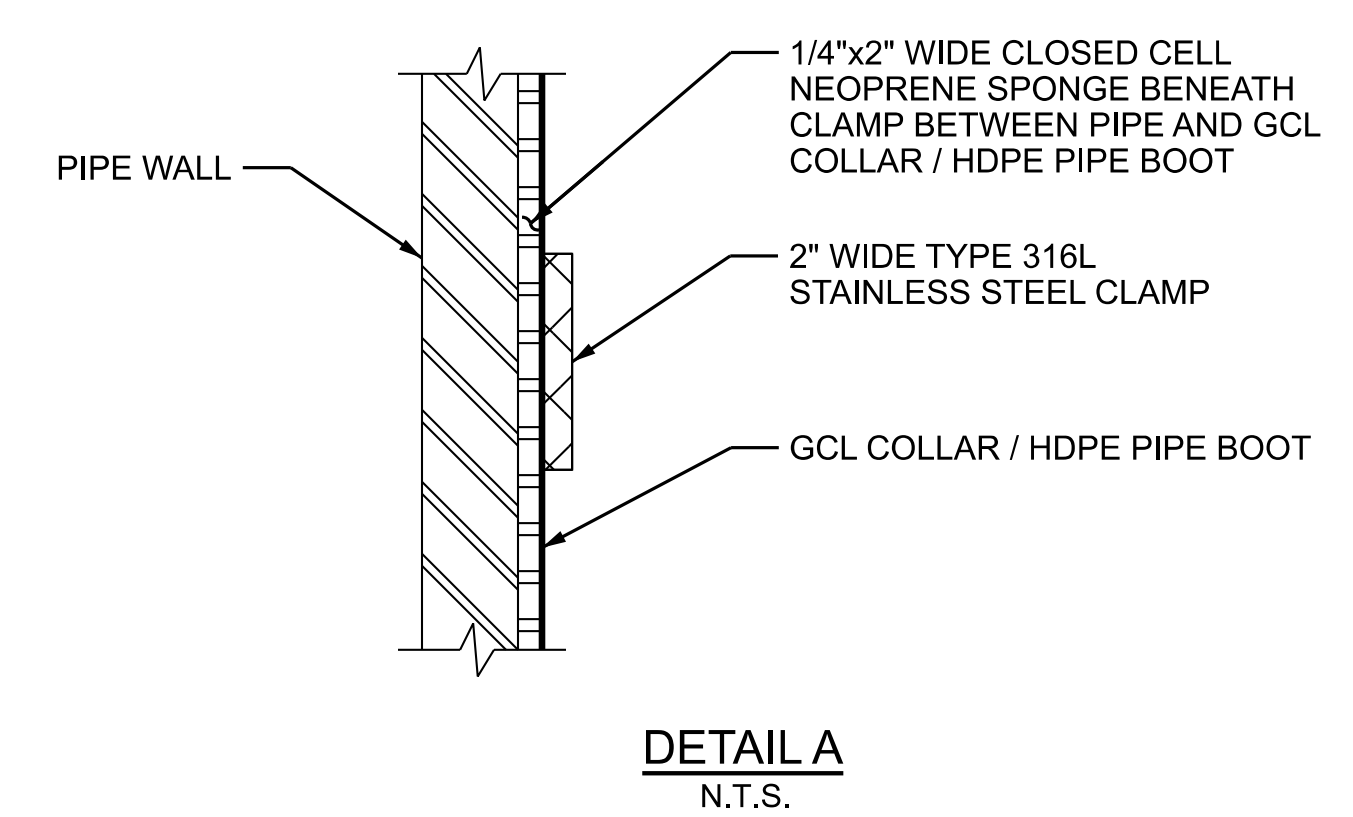


EXTERIOR OF CONCRETE INLET STRUCTURE
SECTION 5
N.T.S.
(CSK-007)

PRELIMINARY
NOT FOR CONSTRUCTION



LINER CONNECTION AT EXISTING MARKER POST
DETAIL 009-01
N.T.S.



DETAIL A
N.T.S.

- NOTES**
- ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1402 UNLESS NOTED OTHERWISE.
 - FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - FILL MATERIALS SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1400.
 - GEOSYNTHETICS CONTRACTOR (SPEC. P-1402) SHALL APPLY GRANULAR BENTONITE AND BENTONITE SEALING COMPOUND IN BETWEEN EXISTING HDPE GEOMEMBRANE LINER AND GCL AS SPECIFIED AT A MINIMUM RATE OF 1 LB PER LINEAR FOOT.

REFERENCE DRAWINGS

CSK-007	SARGENT & LUNDY COMPOSITE LINER & LEACHATE COLLECTION SYSTEM PLAN
D1965C032-02	NATURAL RESOURCE TECHNOLOGY BYPASS BASIN LINER REPLACEMENT DETAILS AND SECTIONS
5295-C-5501	NUS CORPORATION ASH SURGE BASIN BYPASS BASIN INLET STRUCTURE

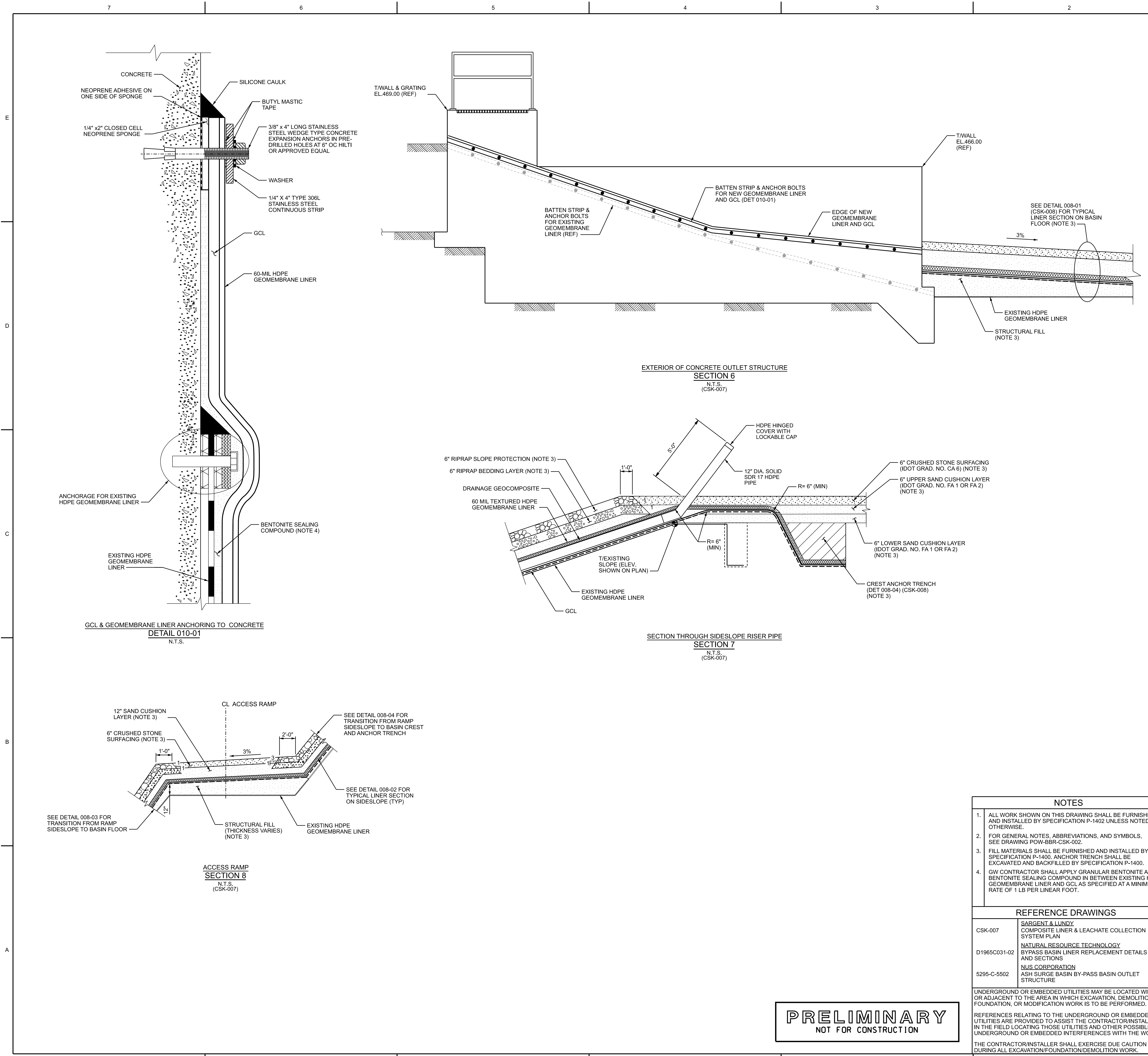
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HOLD INFORMATION		
NO.	DESCRIPTION	
CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.		
RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400
ISSUE PURPOSE: BIDS		
SPECIFICATION: P-1400, P-1401 & P-1402		
PROJECT NO.: 12661-181		
CAD FILE NAME: POW-BBR-CSK-009.DGN		
PREPARED BY: J. CHAVEZ		
REVIEWED BY: T. DEHLIN		
APPROVED BY: T. DEHLIN		
ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.		
 SARGENT & LUNDY ^{LLC} 55 EAST MONROE STREET CHICAGO, ILLINOIS 60603-5780		
PROJECT		
POWERTON GENERATING STATION BYPASS BASIN RETROFIT		
DRAWING TITLE		
INLET & OUTLET STRUCTURE DETAILS SHEET 1		
DRAWING NUMBER		REVISION
POW-BBR-CSK-009		1
SHEET	1 OF 1	1

PL12783001064723Share\INFO CENTER\DISCIPLINE REF MATERIAL\LIC\DESIGN\2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-009.dgn
 Form: GDC-CAD-101-006_ANSI (Imperial) Microstation border - Size E - 34 x 44
 Revision: 11A, Revision Date: 04-30-2010

4/19/2024 11:43:43 AM
 ...POW-BBR-CSK-009.dgn

PL127830101684Z\Sheriff\INFO CENTER\DISC\IN LINE REF MATERIAL\LIC\LIC\DESIGN\2-Powerton - CCR\Bypass Basin Retrofit Drawings\POW-BBR-CSK-010.dgn
 Form: G:\CADD\1-1-106_ANSI (Imperial) Microstation Border - Size E - 34 x 44
 Revision: 11A, Revision Date: 04-30-2010



HOLD INFORMATION		
NO.	DESCRIPTION	
CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.		
RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	04-04-2024	FOR MATERIAL ORDER SPEC P-1402
1	04-19-2024	FOR BIDS SPEC P-1400
ISSUE PURPOSE: BIDS		
SPECIFICATION: P-1400, P-1401 & P-1402		
PROJECT NO.: 12661-181		
<p>CAD FILE NAME: POW-BBR-CSK-010.DGN</p> <p>PREPARED BY: J. CHAVEZ</p> <p>REVIEWED BY: T. DEHLIN</p> <p>APPROVED BY: T. DEHLIN</p> <p>ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.</p>		
 SARGENT & LUNDY ^{LLC} 55 EAST MONROE STREET CHICAGO, ILLINOIS 60603-5780		
 MWG Midwest Generation, LLC		
PROJECT		
POWERTON GENERATING STATION BYPASS BASIN RETROFIT		
DRAWING TITLE		
INLET & OUTLET STRUCTURE DETAILS SHEET 2		
DRAWING NUMBER		REVISION
POW-BBR-CSK-010		1
SHEET	1 OF 1	

- NOTES**
- ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1402 UNLESS NOTED OTHERWISE.
 - FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING POW-BBR-CSK-002.
 - FILL MATERIALS SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION P-1400. ANCHOR TRENCH SHALL BE EXCAVATED AND BACKFILLED BY SPECIFICATION P-1400.
 - GW CONTRACTOR SHALL APPLY GRANULAR BENTONITE AND BENTONITE SEALING COMPOUND IN BETWEEN EXISTING HDPE GEOMEMBRANE LINER AND GCL AS SPECIFIED AT A MINIMUM RATE OF 1 LB PER LINEAR FOOT.
- REFERENCE DRAWINGS**
- | | |
|--------------|--|
| CSK-007 | SARGENT & LUNDY
COMPOSITE LINER & LEACHATE COLLECTION SYSTEM PLAN |
| D1965C031-02 | NATURAL RESOURCE TECHNOLOGY
BYPASS BASIN LINER REPLACEMENT DETAILS AND SECTIONS |
| 5295-C-5502 | NUS CORPORATION
ASH SURGE BASIN BY-PASS BASIN OUTLET STRUCTURE |
- UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.
- REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.
- THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

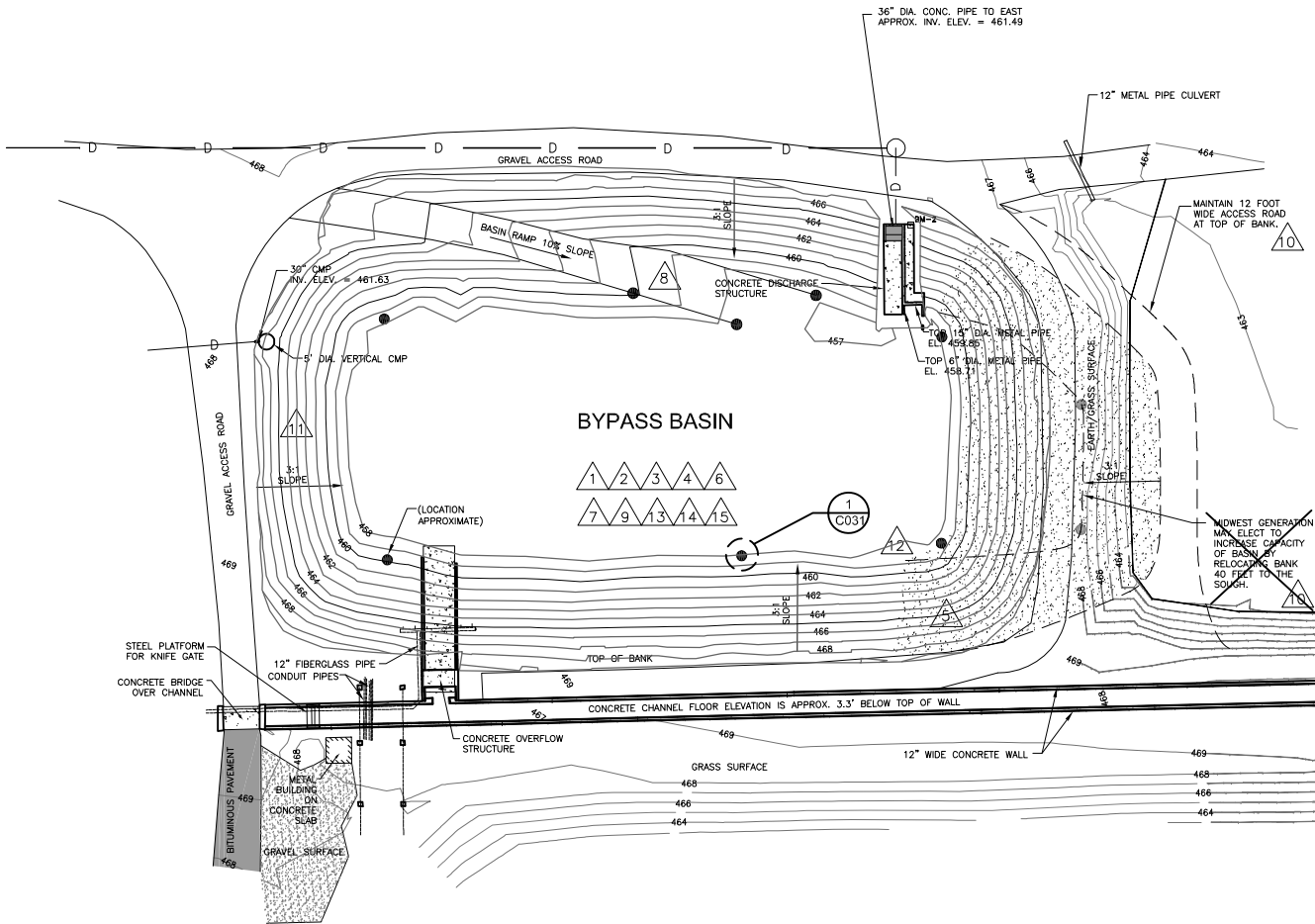
PRELIMINARY
 NOT FOR CONSTRUCTION

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 ...POW-BBR-CSK-010.dgn



ATTACHMENT 2
REFERENCE DRAWINGS

DWG NO.	TITLE	DATE
D1965C020-02	BYPASS BASIN LINER REPLACEMENT, LINER SUBGRADE PREPARATION, REV. 2	06-08-2011
D1965C030-02	BYPASS BASIN LINER REPLACEMENT, WARNING LAYER PLAN, REV. 2	06-08-2011
D1965C031-02	BYPASS BASIN LINER REPLACEMENT, DETAILS AND SECTIONS, REV. 2	06-16-2011
D1965C032-02	BYPASS BASIN LINER REPLACEMENT, DETAILS AND SECTIONS, REV. 2	06-16-2011
5925-C-5001	ASH SURGE BASIN BY PASS PLAN AND PROFILE, REV. 2	06-26-1980
5925-C-5003	ASH SURGE BASIN BY PASS MISCELLANEOUS DETAILS, REV. 2	06-26-1980
5295-C-5501	ASH SURGE BASIN BY PASS, BASIN INLET STRUCTURE, REV. 1	02-08-1980
5295-C-5502	ASH SURGE BASIN BY PASS, BASIN OUTLET STRUCTURE, REV. 1	02-08-1980



LEGEND

- UNDERGROUND DISCHARGE PIPE
- ABOVEGROUND INTAKE PIPE
- PREPARED SUBGRADE SURFACE CONTOUR
- 12 OZ. NON-WOVEN GEOTEXTILE
- MARKER POST LOCATION
- ADDITIONAL MARKER POST LOCATION IF BANK IS RELOCATED.
- BANK/AREA FOR POSSIBLE RELOCATION
- BENCHMARK 2

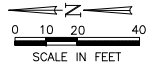
- CONTRACTOR NOTES:**
1. CONTRACTOR SHALL FIELD VERIFY LOCATION OF UNDERGROUND PIPES WITH ASSISTANCE OF OWNER'S UTILITY LOCATOR.
 2. CONTRACTOR SHALL FIELD VERIFY LOCATION OF CONCRETE STRUCTURES AND ABOVE GROUND PIPING.
 3. CONTRACTOR SHALL STORE ALL GEOSYNTHETICS AND SUBGRADE MATERIALS IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
 4. CONTRACTOR SHALL STORE AND STAGE EQUIPMENT AT LOCATION APPROVED BY OWNER.
 5. CLEAR AND GRUB ALL BRUSH ALONG TOP OF SLOPE OF BASIN.
 6. PROTECT ALL CONCRETE AND UTILITY STRUCTURES THROUGHOUT PROJECT DURATION.
 7. CONTRACTOR SHALL REMOVE ALL VEGETATION, ROCKS, AND OTHER DEBRIS FROM EXISTING LINER AND DISPOSE OF IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
 8. CONTRACTOR SHALL CLEAN OFF THE RAMP SURFACE TO THE EXTENT PRACTICAL TO REMOVE ROCKS THAT MAY POSE A HAZARD TO GEOMEMBRANE, AS APPROVED BY GEOMEMBRANE INSTALLER, ENGINEER AND/OR OWNER.
 9. CONTRACTOR SHALL REMOVE 12-INCH LAYER OF POZ-O-PAC AND 6-INCHES OF POZ-O-PAC SUBGRADE FROM THE BASE OF BASIN.
 10. CONTRACTOR SHALL RELOCATE SOUTHERN BANK 40 FEET TO THE SOUTH AS DIRECTED BY OWNER. SEGREGATE GRAVEL ACCESS ROAD MATERIAL TO BE REUSED AS BASE COURSE MATERIAL. MATERIAL REMOVED FROM THE EXISTING BANK MAY BE USED TO RECONSTRUCT NEW SOUTHERN BANK IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
 11. CONTRACTOR SHALL REMOVE "SOFT" SUBGRADE MATERIAL BENEATH EXISTING HYPALON LINER, AS DIRECTED BY OWNER AND/OR ENGINEER. BACK FILL AREAS WITH FILL IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS. CUT HYPALON AS NEEDED TO REPAIR THE "SOFT" SUBGRADE AREAS.
 12. CONTRACTOR SHALL INSTALL MARKER POSTS ALONG THE TOE OF SLOPE AS SHOWN AND IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS AND DETAIL 1 ON SHEET C031.
 13. CONTRACTOR SHALL PLACE 16 OZ. NONWOVEN GEOTEXTILE AT BASE OF BASIN AND WHERE HYPALON LINER DOES NOT EXIST OR WAS REMOVED OF THE PREPARED SUBGRADE IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
 14. SUBGRADE SHALL BE APPROVED BY OWNER AND/OR ENGINEER PRIOR TO INSTALLATION OF GEOMEMBRANE.
 15. CONTRACTOR SHALL PROVIDE MEANS TO PROTECT SUBGRADE FROM EROSION, STORM WATER, AND HEAVY EQUIPMENT TRAFFIC. DAMAGE TO SUBGRADE SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.

HORIZONTAL DATUM:
ILLINOIS STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83.

VERTICAL DATUM:
LOCAL PLANT DATUM

BENCHMARK 2:
NORTHEAST CORNER OF CONCRETE DISCHARGE STRUCTURE. CHISELED "+" IN CONCRETE ELEVATION 468.75 FT.

SOURCE NOTES:
THIS DRAWING WAS DEVELOPED FROM A SURVEY MAURER STUTZ, INC. DATED SEPTEMBER 7, 2010, DRAWING NO. 23210023.
LOCATION OF BASIN AND ACCESS RAMP TAKEN FROM MIDWEST GENERATION DRAWING NO. 5295 C5001-2, DATED 6-26-1989.
BASIN SUBGRADE AND SITE IMPROVEMENTS FROM A SURVEY PROVIDED BY MILLENNIA PROFESSIONAL SERVICES, MARCH 2011.



6.			
5.			
4.			
3.			
2.	RECORD DOCUMENTATION	06/08/11	HMS
1.	ISSUED FOR BID	10/06/10	HMS
0.	ISSUED FOR PERMIT	06/30/10	HMS
REVISION:		DATE:	APP'D BY:










PROJECT NO.	1965/5.4
DRAWN BY:	KNW 06/30/10
CHECKED BY:	RJC 06/30/10
APPROVED BY:	HMS 06/30/10

LINER SUBGRADE PREPARATION
BYPASS BASIN LINER REPLACEMENT
MIDWEST GENERATION
POWER/ POWER STATION
PEKIN, ILLINOIS

DRAWING NO:	D1965C020-02	SHEET NO.	C020
REFERENCE:			


LEGEND

-  D UNDERGROUND DISCHARGE PIPE
-  ABOVEGROUND INTAKE PIPE
-  ANCHOR TRENCH
-  X 459.11 TOP OF WARNING LAYER (ELEVATION, FT.)
-  ● MARKER POST LOCATION
-  BM-2 BENCHMARK 2
-  HDPE GEOMEMBRANE

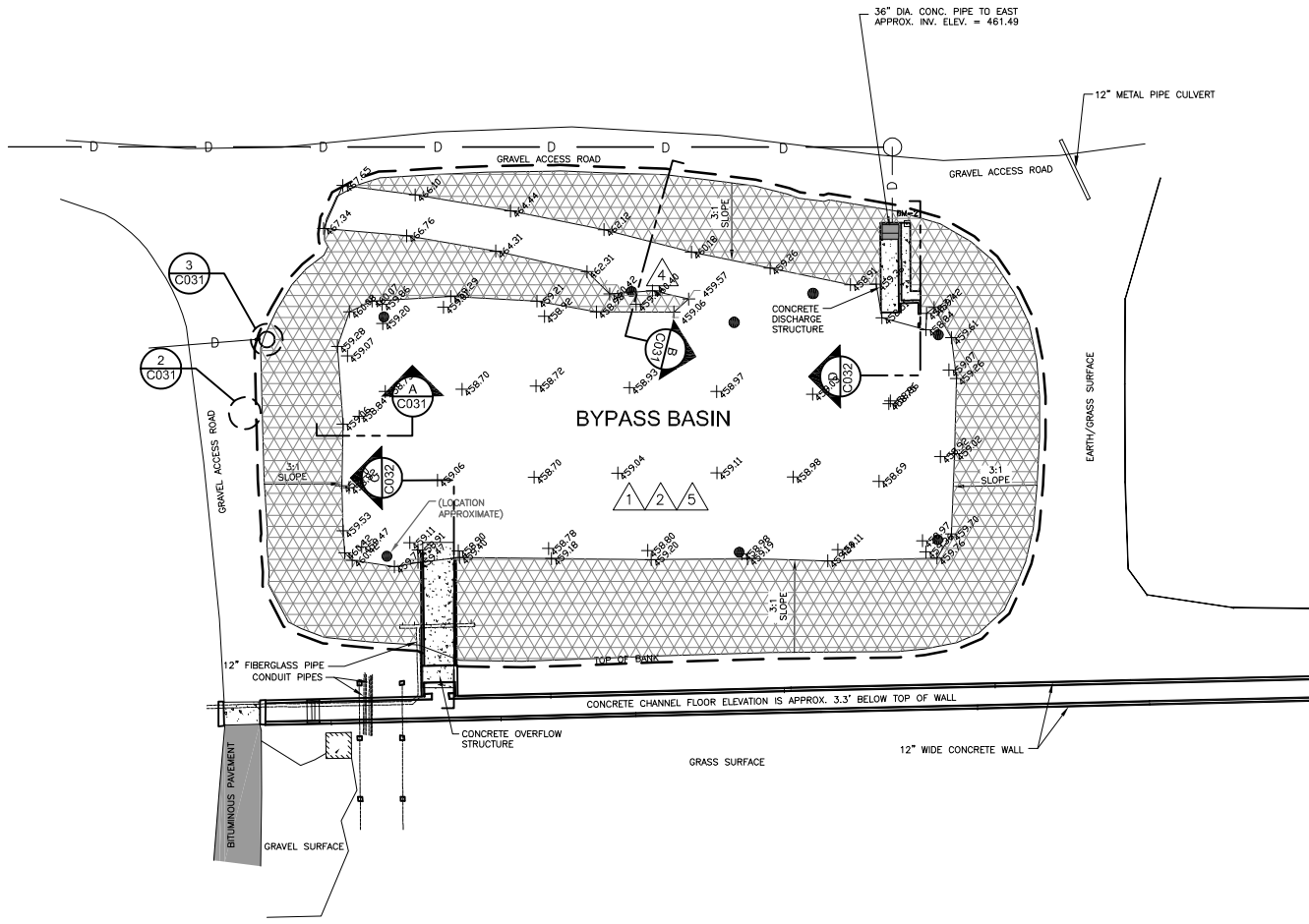
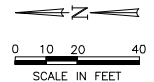
HORIZONTAL DATUM:
ILLINOIS STATE PLANE COORDINATE SYSTEM,
WEST ZONE, NAD83.

VERTICAL DATUM:
LOCAL PLANT DATUM

BENCHMARK 2:
NORTHEAST CORNER OF CONCRETE DISCHARGE
STRUCTURE, CHISELED "+." IN CONCRETE
ELEVATION 468.75 FT.

- CONTRACTOR NOTES: 
1. CONTRACTOR SHALL INSTALL 60 MIL HDPE, WHITE, TEXTURED GEOMEMBRANE IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION PRIOR TO PLACEMENT OF THE WARNING LAYER. CONTRACTOR SHALL PROVIDE AND FOLLOW AN APPROVED GEOMEMBRANE LAYOUT PLAN.
 2. GEOMEMBRANE SHALL BE ANCHORED INTO 2.5 FEET DEEP TRENCHES ALONG TOP OF BASIN BANK, AS SHOWN ON SHEET C031. CONTRACTOR SHALL ADVISE OWNER AND/OR ENGINEER IF PROPOSED LOCATION FOR ANCHOR TRENCH IS NOT POSSIBLE.
 3. CONTRACTOR SHALL PLACE 12-0Z, NON-WOVEN GEOTEXTILE, CUSHION MATERIAL AND WARNING LAYER MATERIAL OVER THE GEOMEMBRANE AT BASE AND 4 FEET ON SIDE SLOPES FOLLOWING ENGINEER APPROVAL AND PASSING QUALITY CONTROL RESULTS IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS (SEE SHEET C031).
 4. CONTRACTOR SHALL PLACE 2 LAYERS OF 12-0Z, NONWOVEN GEOTEXTILE, CUSHION AND WARNING LAYER MATERIALS OVER THE GEOMEMBRANE ON THE RAMP, AS SHOWN ON SHEET C031.
 5. RESTORE AREAS DISTURBED BY EQUIPMENT AND MATERIAL LAYDOWN.
 6. CONTRACTOR SHALL PROVIDE SURVEY DOCUMENTATION OF THE ITEMS LISTED IN THE TECHNICAL SPECIFICATIONS.
 7. CONTRACTOR SHALL PERFORM A LEAK LOCATION SURVEY IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.

SOURCE NOTES:
THIS DRAWING WAS DEVELOPED FROM A SURVEY MAURER STUTZ, INC. DATED SEPTEMBER 7, 2010, DRAWING NO. 23210023.
LOCATION OF BASIN AND ACCESS RAMP TAKEN FROM MIDWEST GENERATION DRAWING NO. 5295 C5001-2, DATED 6-26-1980.
BASIN SUBGRADE AND SITE IMPROVEMENTS FROM A SURVEY PROVIDED BY MILLENNIA PROFESSIONAL SERVICE, MARCH 2011.

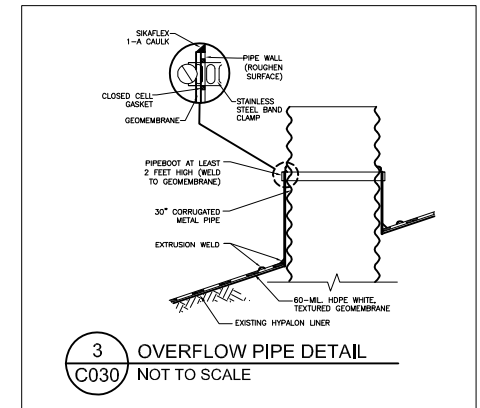
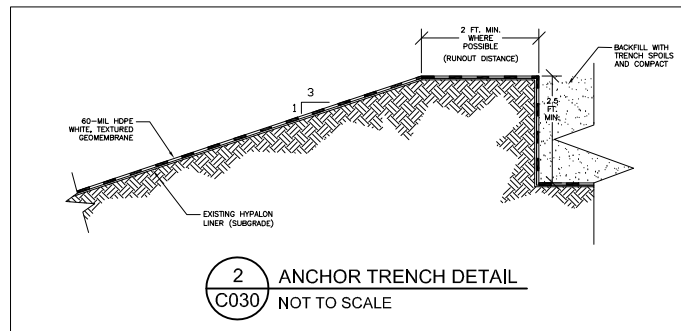
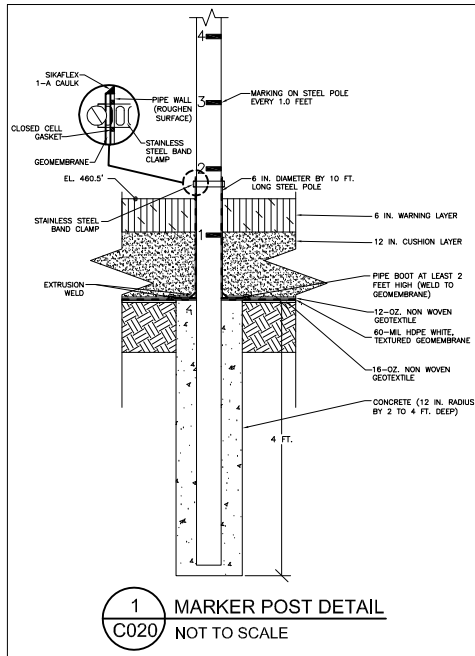
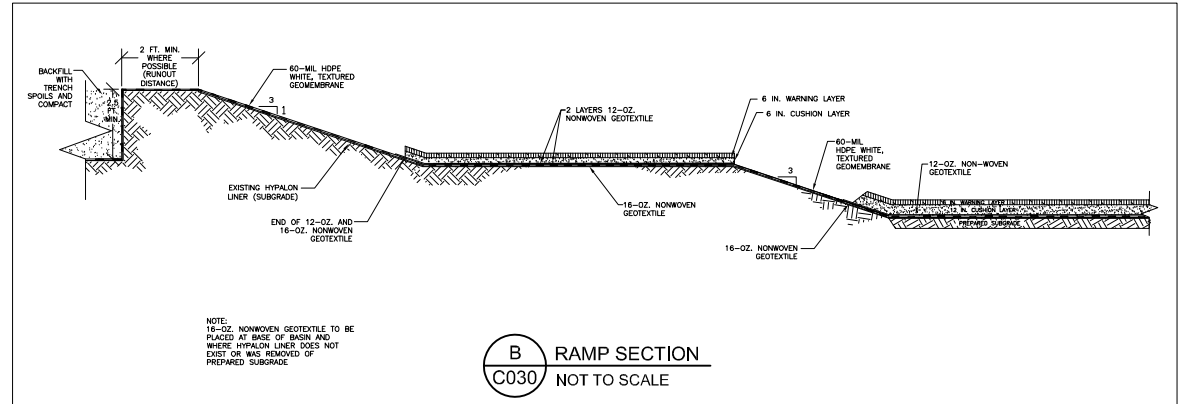
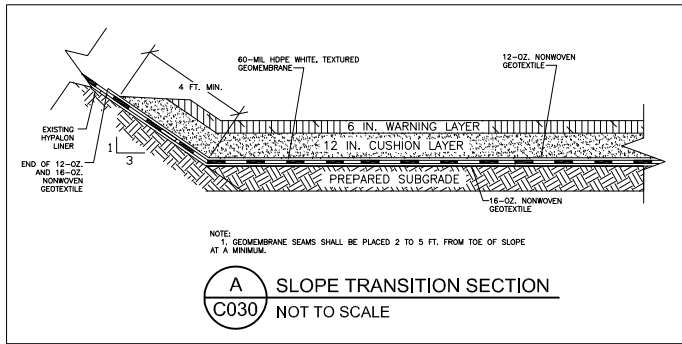


6.			
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4.			
3.			
2.	RECORD DOCUMENTATION	06/08/11	HMS
1.	ISSUED FOR BID	10/06/10	HMS
0.	ISSUED FOR PERMIT	06/30/10	HMS
REVISION:		DATE:	APP'D BY:



PROJECT NO.	1965.5/5.4
DRAWN BY:	KNW 06/30/10
CHECKED BY:	RJC 06/30/10
APPROVED BY:	HMS 06/30/10

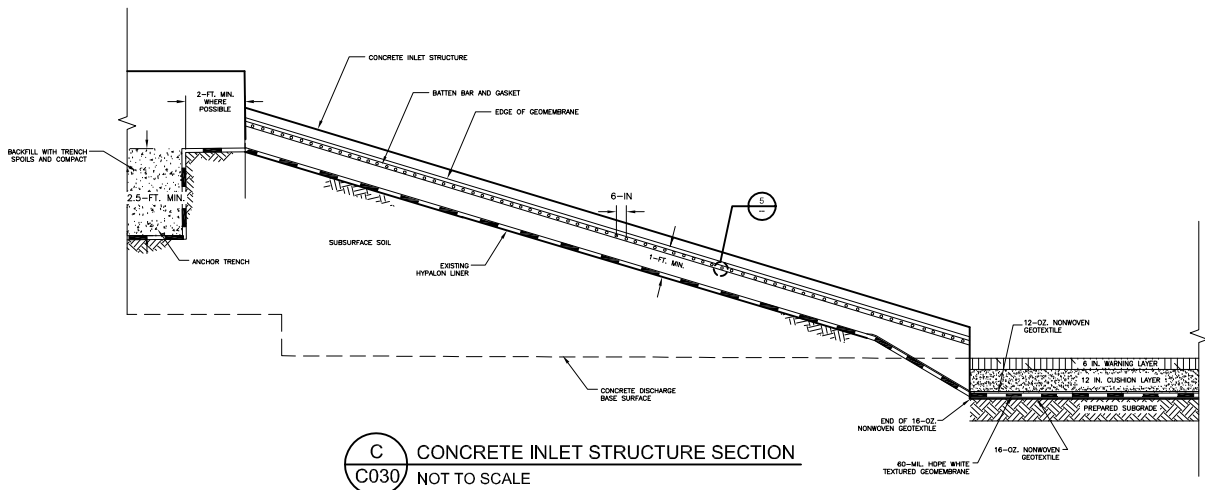
WARNING LAYER PLAN	
BYPASS BASIN LINER REPLACEMENT MIDWEST GENERATION POWER/POWER STATION PEKIN, ILLINOIS	
DRAWING NO: 01965C030-02	SHEET NO. C030



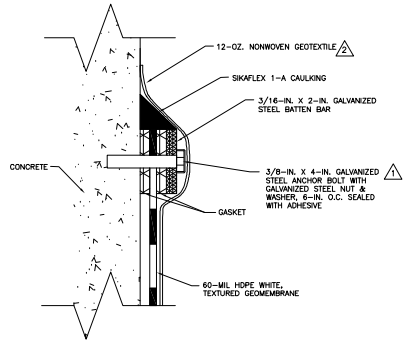
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2.	RECORD DOCUMENTATION	06/16/11	HMS
1.	ISSUED FOR BID	10/06/10	HMS
0.	ISSUED FOR PERMIT	06/30/10	HMS
REVISION:		DATE:	APP'D BY:



PROJECT NO. 1965/5.4	NOT FOR CONSTRUCTION DETAILS AND SECTIONS BYPASS BASIN LINER REPLACEMENT MIDWEST GENERATION POWER TOWER STATION PEKIN, ILLINOIS	SHEET NO. C031
DRAWN BY: KNW 06/30/10		
CHECKED BY: RJC 06/30/10	DRAWING NO: 01965C031-02	REFERENCE:
APPROVED BY: HMS 06/30/10		

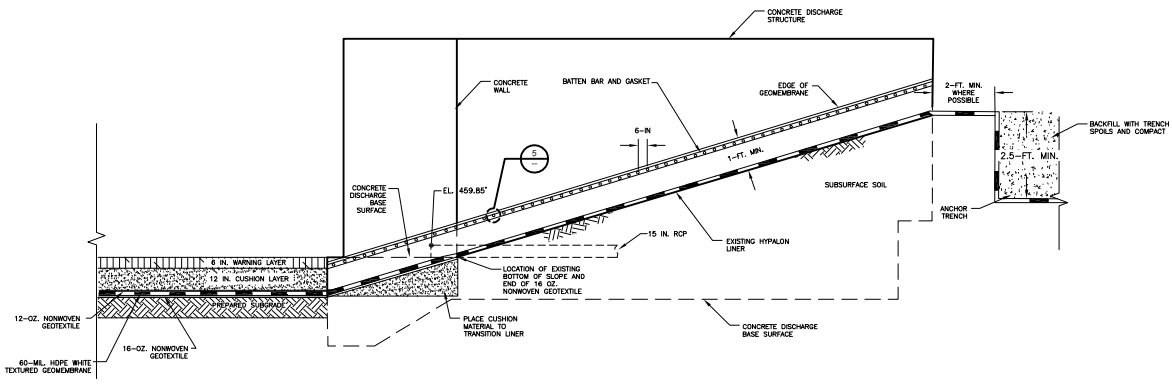


C CONCRETE INLET STRUCTURE SECTION
C030 NOT TO SCALE



NOTE: Δ
 1. ANCHOR BOLTS 6 IN. ON CENTER.
 2. 12-OZ. NONWOVEN GEOTEXTILE TO BE USED TO PROTECT GEOMEMBRANE BELOW CUSHION/WARNING LAYERS.

5 BATTEN BAR ATTACHMENT
-- NOT TO SCALE



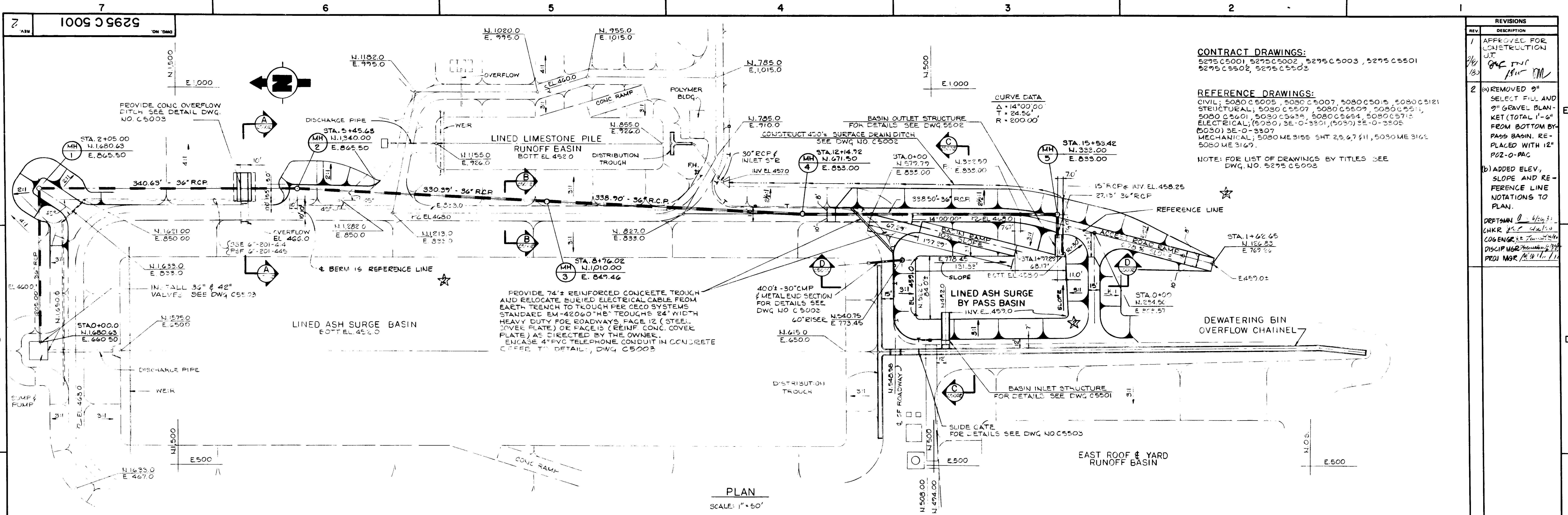
D CONCRETE DISCHARGE STRUCTURE SECTION
- NOT TO SCALE

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2.	RECORD DOCUMENTATION	06/16/11	HMS
1.	ISSUED FOR BID	10/06/10	HMS
0.	ISSUED FOR PERMIT	06/30/10	HMS
REVISION:		DATE:	APP'D BY:

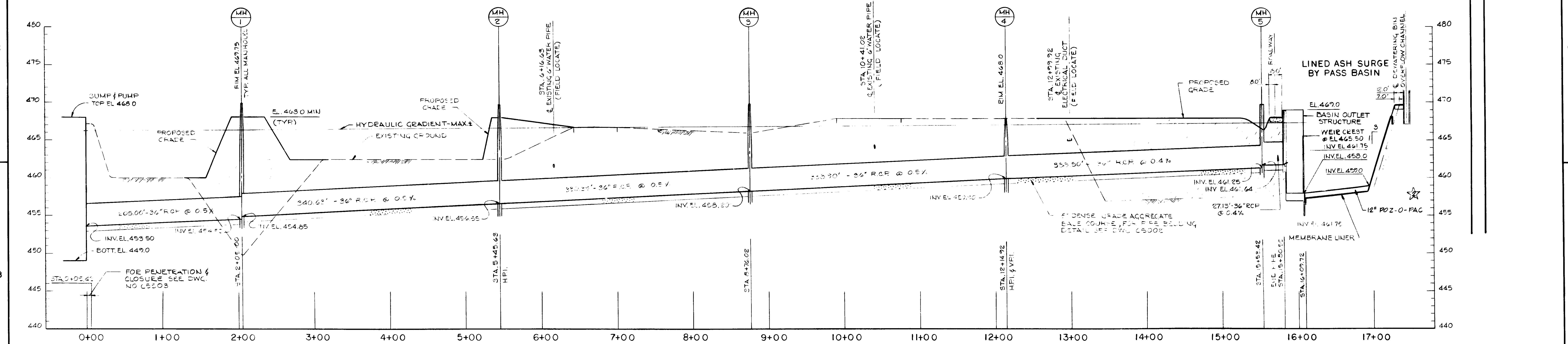


PROJECT NO.	1965/5.4
DRAWN BY:	KNW 06/30/10
CHECKED BY:	RJC 06/30/10
APPROVED BY:	HMS 06/30/10

NOT FOR CONSTRUCTION	
DETAILS AND SECTIONS	
BYPASS BASIN LINER REPLACEMENT MIDWEST GENERATION POWERTRON POWER STATION PEKIN, ILLINOIS	
DRAWING NO:	01965C032-02
REFERENCE:	
SHEET NO.	C032



PLAN
SCALE: 1" = 50'



PROFILE
SCALE: HOR. 1" = 50'
VERT. 1" = 5'

SPECIFICATION:

1. ALL PIPE SHALL CONFORM TO THE REQUIREMENTS OF REINFORCED CONCRETE PIPE (RCP) AS SPECIFIED IN THE CONTRACT DRAWINGS. THE PIPE SHALL BE MANUFACTURED BY A QUALIFIED MANUFACTURER AND SHALL BE TESTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS. THE PIPE SHALL BE TESTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS. THE PIPE SHALL BE TESTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS.

3. MANHOLES

MANHOLES SHALL BE THE SIZE AND AT THE LOCATIONS AND GRADES SHOWN ON THE CONTRACT DRAWINGS. MATERIAL FOR THE WALL SHALL BE EITHER CAST-IN-PLACE REINFORCED CONCRETE OR PRECAST REINFORCED CONCRETE SECTIONS. MANHOLES SHALL BE MANUFACTURED TO THE REQUIREMENTS OF ANSI/ASTM A475-79. A STANDARD SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLES, SECTION 05100.00, SHALL BE USED. ALL MANHOLES SHALL BE CONSTRUCTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS. THE MANHOLES SHALL BE CONSTRUCTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS.

4. MEMBRANE LINER SPECIFICATION (SEE DWG. NO. C5002)

MEMBRANE LINER SHALL CONFORM TO THE REQUIREMENTS OF REINFORCED CONCRETE PIPE (RCP) AS SPECIFIED IN THE CONTRACT DRAWINGS. THE LINER SHALL BE TESTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS. THE LINER SHALL BE TESTED TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS.

MANHOLE SCHEDULE

MH NO.	BY PASS STATION	ELTOP CONE	EL. 36" IN PIPE	MH DEPTH (MIN.)	NOTES
-	0+00	-	454.50	-	EXISTING SLUMP
1	2+05	469.0	454.85	14.4'	HPI 4' x 90"
2	5+45.63	469.0	456.51	12.47'	HPI 4' x 90" x 27"
3	8+76.02	469.0	458.22	10.82'	STRAIGHT RUN
4	12+14.92	467.25	459.92	7.37'	HPI 4' x 90" x 27" USE SCALE ENGINEERED
5	15+53.42	469.0	461.64	7.75'	HPI 4' x 90"
-	15+80.55	-	461.75	-	OUTLET STRUCTURE

NOTE: MAX. HYDRAULIC GRADIENT EL. 467.25 ±

CONTRACT DRAWINGS:
5295 C 5001, 5295 C 5002, 5295 C 5003, 5295 C 5004, 5295 C 5005, 5295 C 5006, 5295 C 5007

REFERENCE DRAWINGS:
CIVIL: 5080 C 5005, 5080 C 5007, 5080 C 5015, 5080 C 5121, 5080 C 5122, 5080 C 5123, 5080 C 5124, 5080 C 5125, 5080 C 5126, 5080 C 5127, 5080 C 5128, 5080 C 5129, 5080 C 5130, 5080 C 5131, 5080 C 5132, 5080 C 5133, 5080 C 5134, 5080 C 5135, 5080 C 5136, 5080 C 5137, 5080 C 5138, 5080 C 5139, 5080 C 5140, 5080 C 5141, 5080 C 5142, 5080 C 5143, 5080 C 5144, 5080 C 5145, 5080 C 5146, 5080 C 5147, 5080 C 5148, 5080 C 5149, 5080 C 5150, 5080 C 5151, 5080 C 5152, 5080 C 5153, 5080 C 5154, 5080 C 5155, 5080 C 5156, 5080 C 5157, 5080 C 5158, 5080 C 5159, 5080 C 5160, 5080 C 5161, 5080 C 5162, 5080 C 5163, 5080 C 5164, 5080 C 5165, 5080 C 5166, 5080 C 5167, 5080 C 5168, 5080 C 5169, 5080 C 5170, 5080 C 5171, 5080 C 5172, 5080 C 5173, 5080 C 5174, 5080 C 5175, 5080 C 5176, 5080 C 5177, 5080 C 5178, 5080 C 5179, 5080 C 5180, 5080 C 5181, 5080 C 5182, 5080 C 5183, 5080 C 5184, 5080 C 5185, 5080 C 5186, 5080 C 5187, 5080 C 5188, 5080 C 5189, 5080 C 5190, 5080 C 5191, 5080 C 5192, 5080 C 5193, 5080 C 5194, 5080 C 5195, 5080 C 5196, 5080 C 5197, 5080 C 5198, 5080 C 5199, 5080 C 5200

NOTE: FOR LIST OF DRAWINGS BY TITLES SEE DWG. NO. 5295 C 5002

REV.	DESCRIPTION
1	APPROVED FOR CONSTRUCTION
2	REMOVED 9" SELECT FILL AND 9" GRAVEL BLANKET (TOTAL 1'-6" FROM BOTTOM BY-PASS BASIN. RE-PLACED WITH 12" P2-Z-0-PAC
	ADDED ELEV., SLOPE AND REFERENCE LINE NOTATIONS TO PLAN.

APPROVED FOR CONSTRUCTION

DATE: 6/26/90

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
POWERTON

ASH SURGE BASIN BY PASS
PLAN AND PROFILE

CECO CONTRACT: B02566 CECO DWG. NO. 5295 C 5001

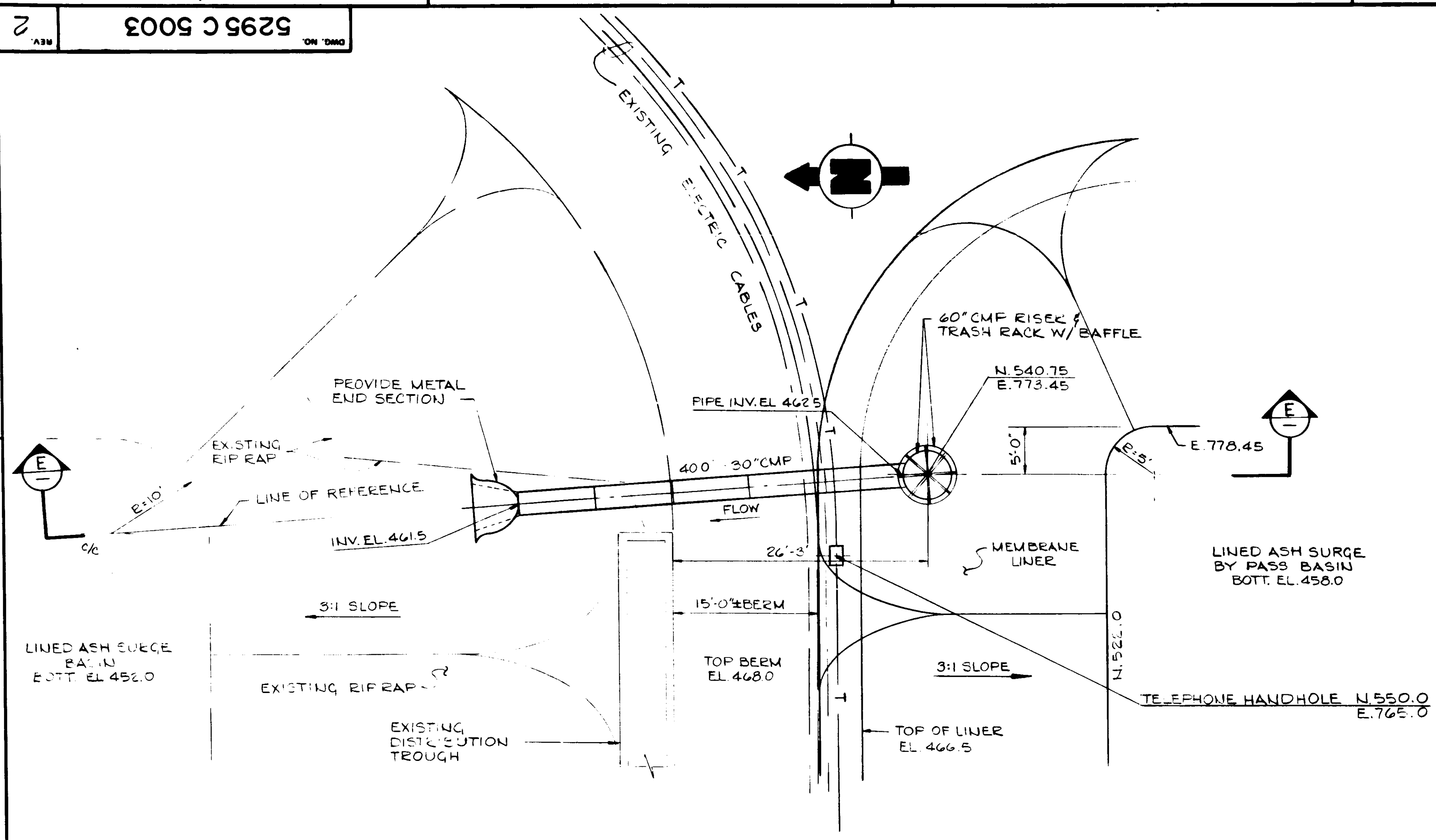
NUS CORPORATION
ROCKVILLE, MD.

SCALE: AS SHOWN SHEET 1 OF 1

LIST OF DRAWINGS

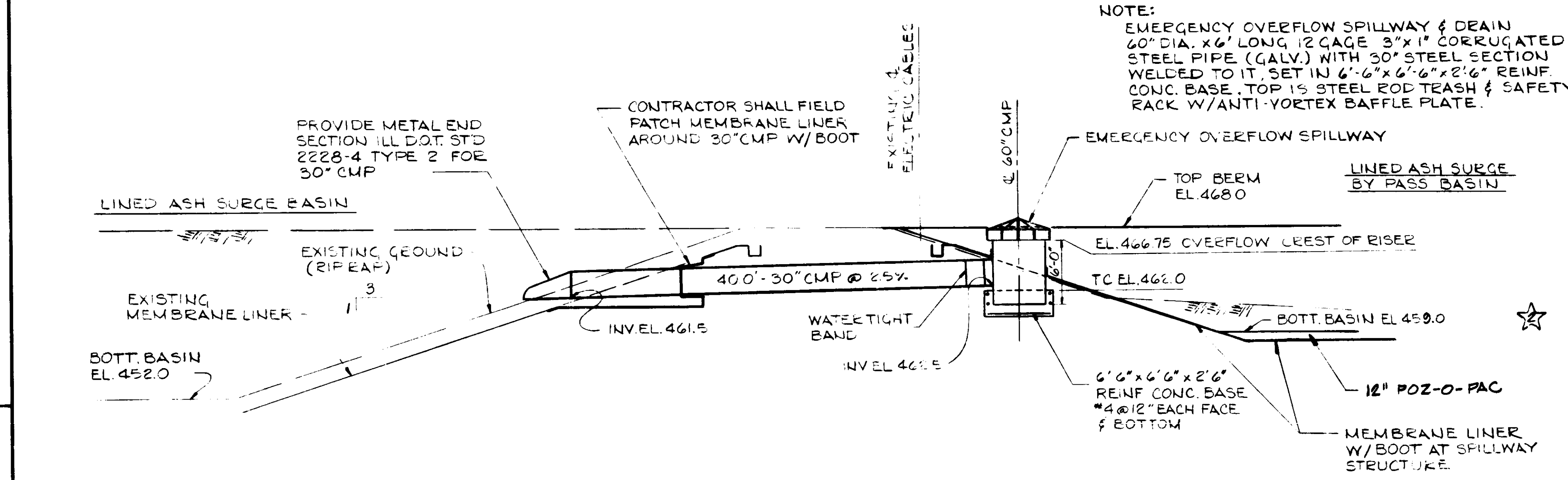
CONTRACT DRAWINGS		
DRAWING NO.	REV.	DRAWING TITLES
5295 C 5001	1	PLAN & PROFILE
5295 C 5002	1	DETAILS & SECTIONS
5295 C 5003	1	MISCELLANEOUS DETAILS
5295 C 5501	1	INLET STRUCTURE
5295 C 5502	1	CUTLET STRUCTURE
5295 C 5503	1	MISCELLANEOUS GATES
REFERENCE DRAWINGS		
5080 C 5005	2	DETAIL PLAN - EAST ROOF & YARD RUNOFF BASIN
5080 C 5007	2	DETAIL PLAN ASH SURGE BASIN
5080 C 5015	2	MISCELLANEOUS SECTIONS AND DETAILS, SHTS 1 & 2
5080 C 5121	1	BASIN END SECTION
5080 C 5507	1	RAMPS & ASH SURGE BASIN OVERFLOW STRUCTURE
5080 C 5509	1	ASH SURGE BASIN & LIMESTONE BASIN DISTRIBUTION TROUGH SECTION & DETAILS
5080 C 5511	2	DEWATERING BIN OVERFLOW CHANNEL SECTIONS & DETAILS
5080 C 5601	2	STANDARD DETAILS
5080 C 5638	2	ASH SURGE BASIN SUMP - CLARIFIER OVERFLOW SUMP
5080 C 5654	1	PIPE SUPPORTS FEAMING PLAN & SECTIONS COL. NO. 74 TO 131
5080 C 5713	1	ASH SURGE BASIN SUMP PLAT FORM SECTIONS & DETAILS
(5080) 3E-0-3301	2	ELECTRICAL AREA LAYOUT EAST RUNOFF BASIN - NORTH
(5080) 3E-0-3305	3	ELECTRICAL AREA LAYOUT LIMESTONE PILE RUNOFF BASIN
(5080) 3E-0-3307	2	ELECTRICAL AREA LAYOUT ASH SURGE BASIN AREA
5080 ME 3155 SHT. 2	4	PIPING ARRANGEMENT, YARD AREA
SHT. 5	3	
SHT. 6	3	
SHT. 7	3	
SHT. 11	3	
5080 ME 3162 SHT. 1	3	PIPING ARRANGEMENT YARD DETAIL EAST ROOF & YARD RUNOFF BASIN
5080 ME 3169 SHT. 1	1	PIPING ARRANGEMENT YARD DETAIL LIMESTONE PILE RUNOFF BASIN AND ASH SURGE BASIN SUMPS

REV.	DESCRIPTION
1	APPROVED FOR CONSTRUCTION
2	REMOVED COMBINED SELECT AND GRAVEL BLANKET FROM BOTTOM OF BASIN AND ADDED 12" POZ-O-PAC, SEC. E
	CHANGED BOTTOM EL. 458.0 TO 459.0
	DRAFTSMAN: [Signature]
	CHKR: [Signature]
	COG ENGR: [Signature]
	PROJ. MGR: [Signature]



PLAN

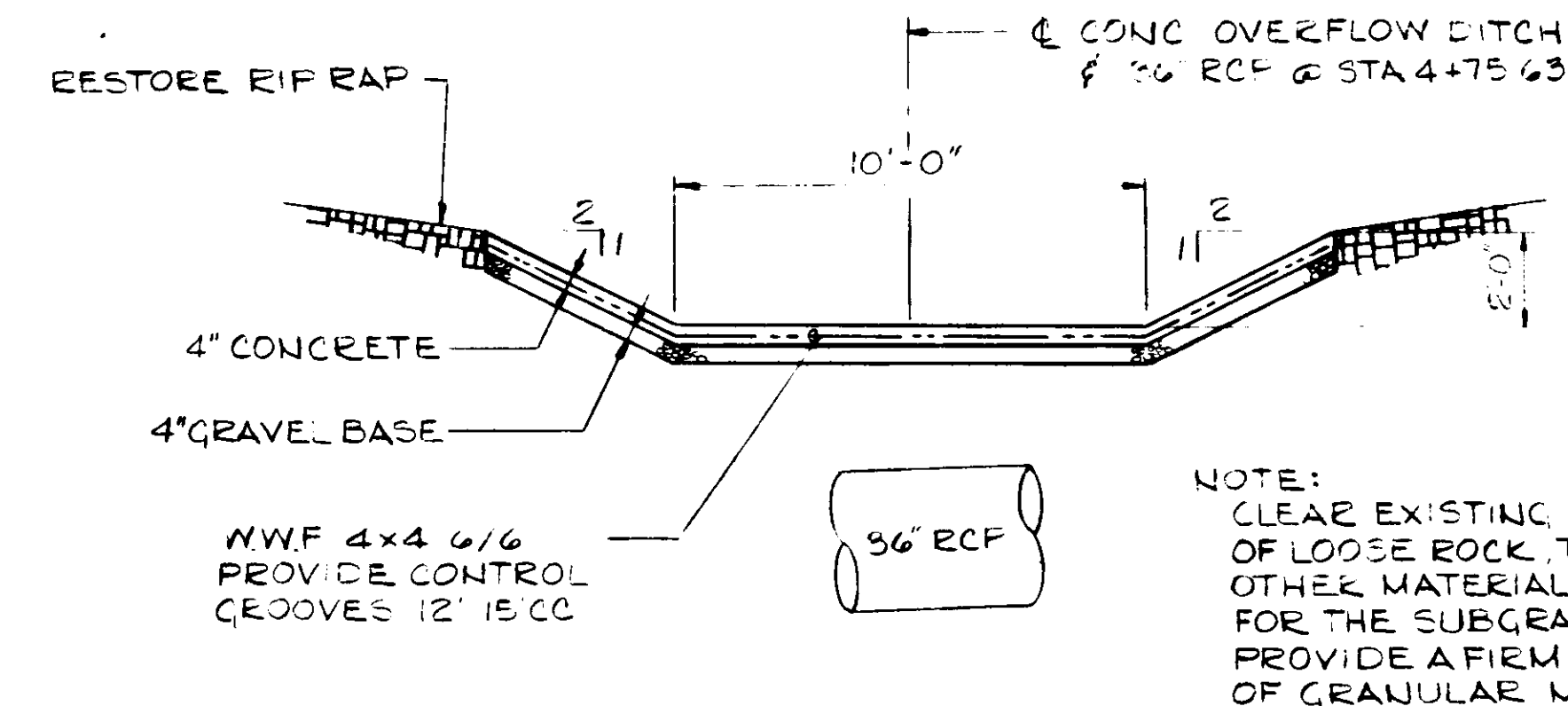
NOTE:
FOR ELECTRICAL CABLE TROUGH SEE CECO SYSTEMS STANDARD EM-42060 "HB" TROUGHS 24" WIDTH HEAVY DUTY FOR ROADWAYS PAGE 12 (STEEL COVER PLATE) OR PAGE 13 (REINFORCED CONCRETE COVER PLATE).



SECTION E

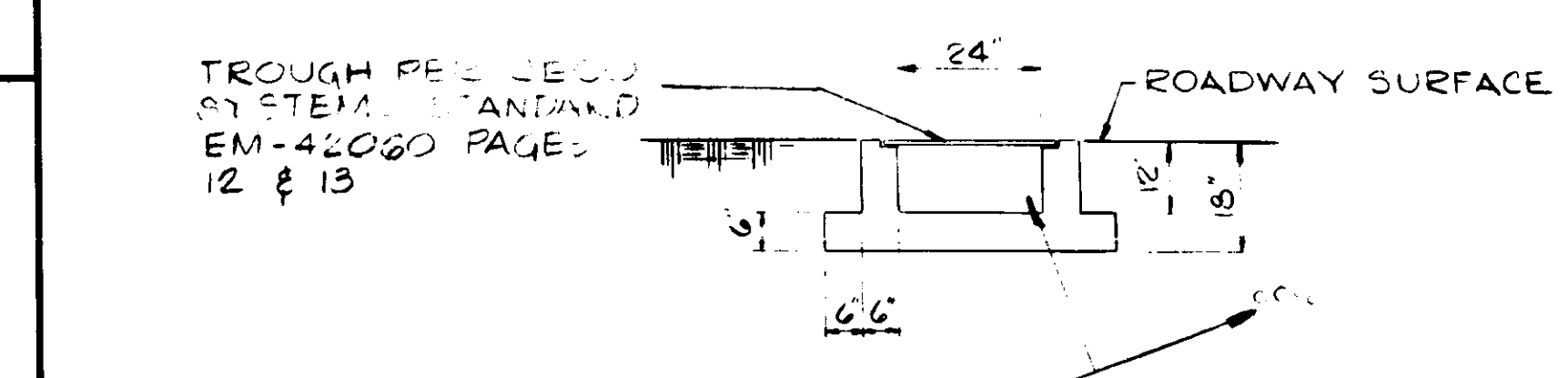
EMERGENCY OVERFLOW SPILLWAY

SCALE: 1/8" = 1'-0"



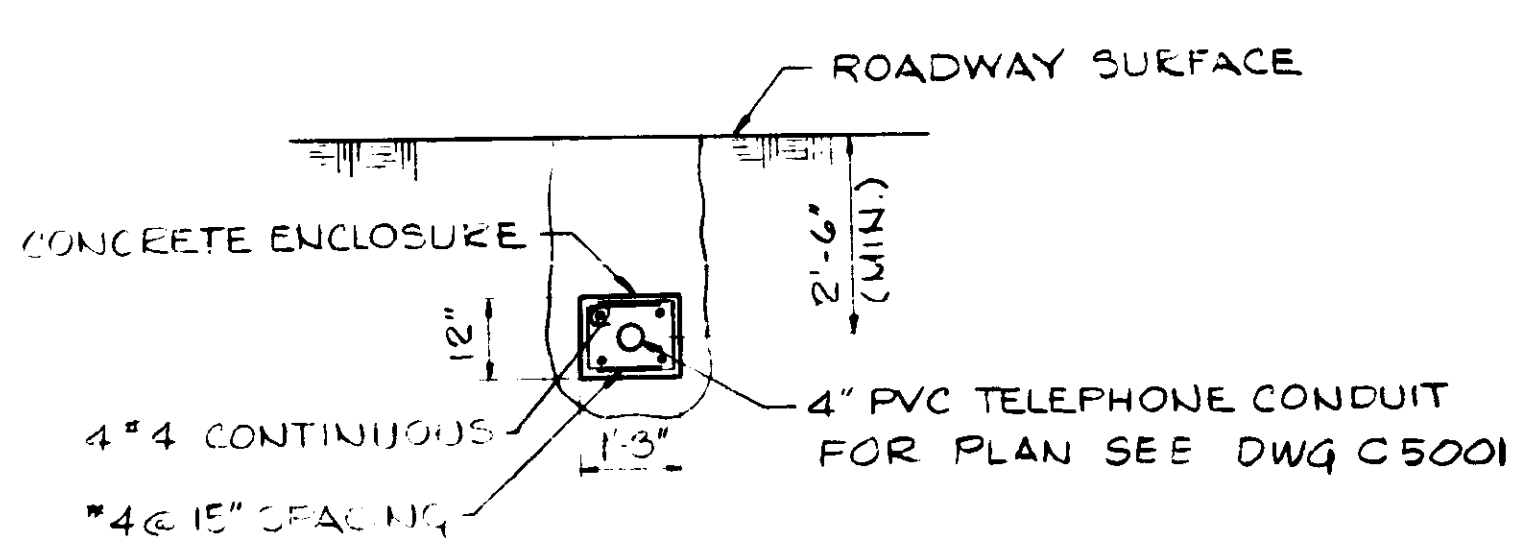
TYPICAL DETAIL CONCRETE OVERFLOW DITCH

SCALE: 1/4" = 1'-0"



DETAIL ELECTRICAL CABLE TROUGH

SCALE: 3/8" = 1'-0"



DETAIL CONCRETE ENCLOSURE FOR TELEPHONE CONDUIT

SCALE: 3/8" = 1'-0"

APPROVED FOR CONSTRUCTION

DATE: 6/24/83

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
POWERTON

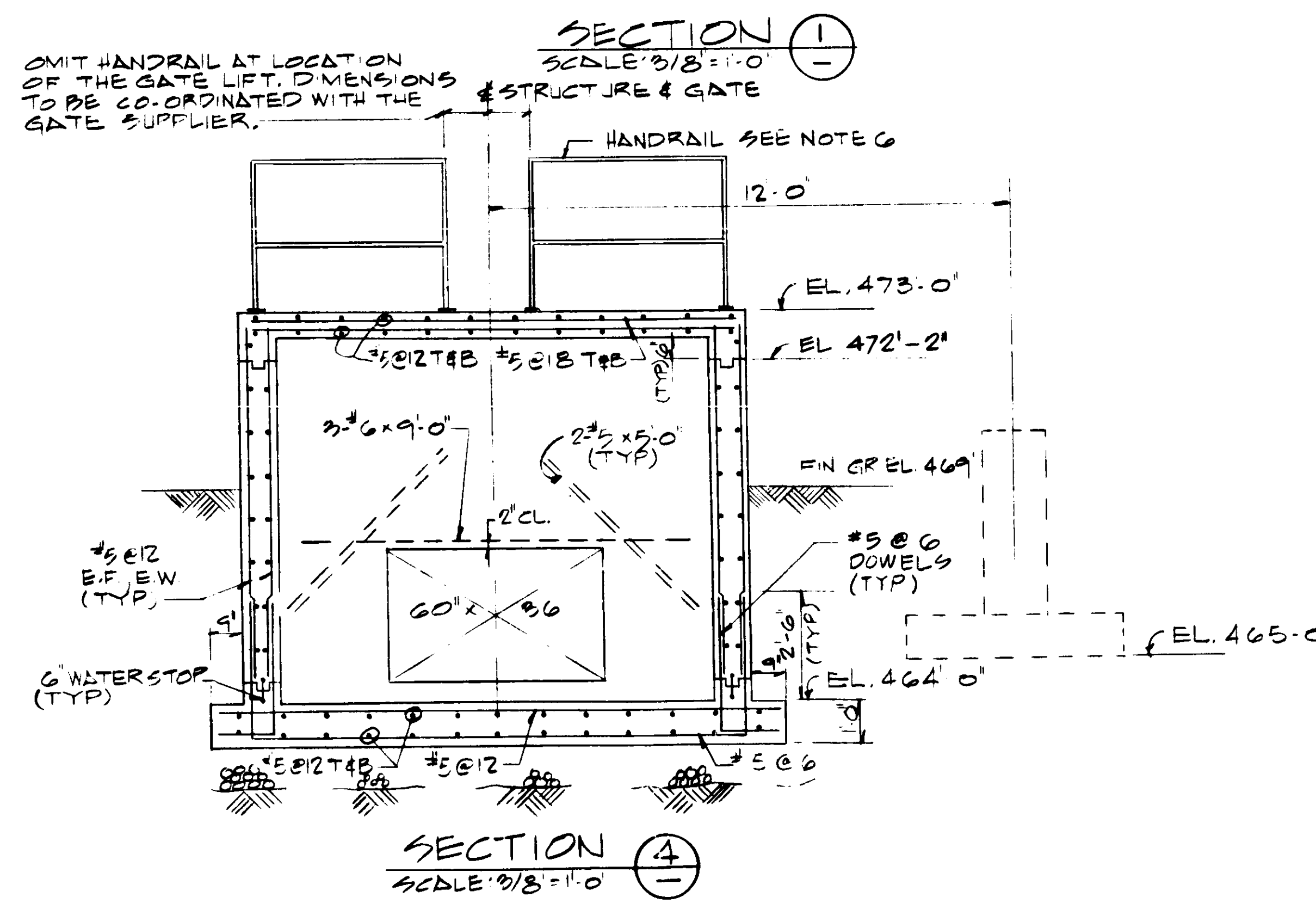
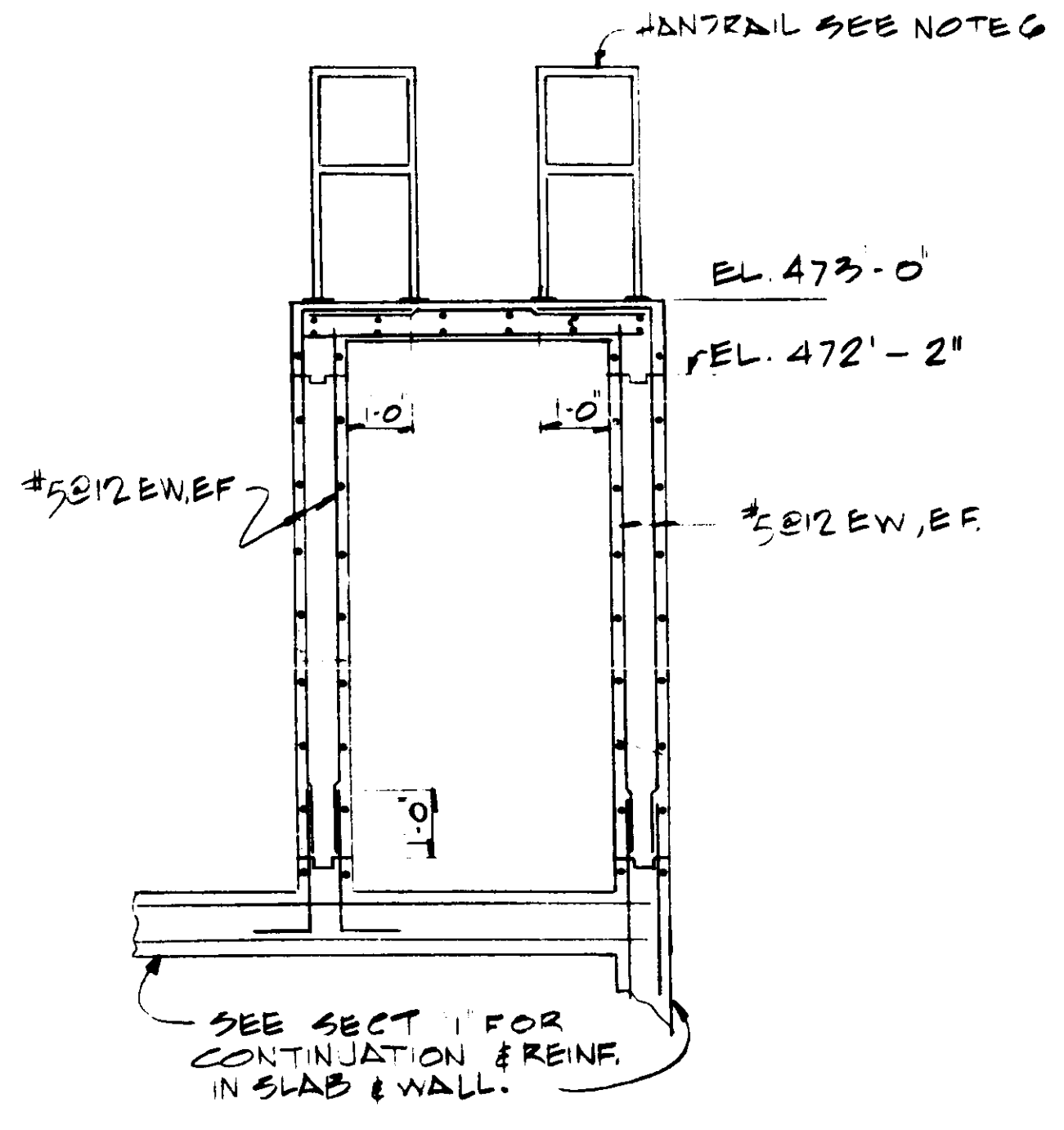
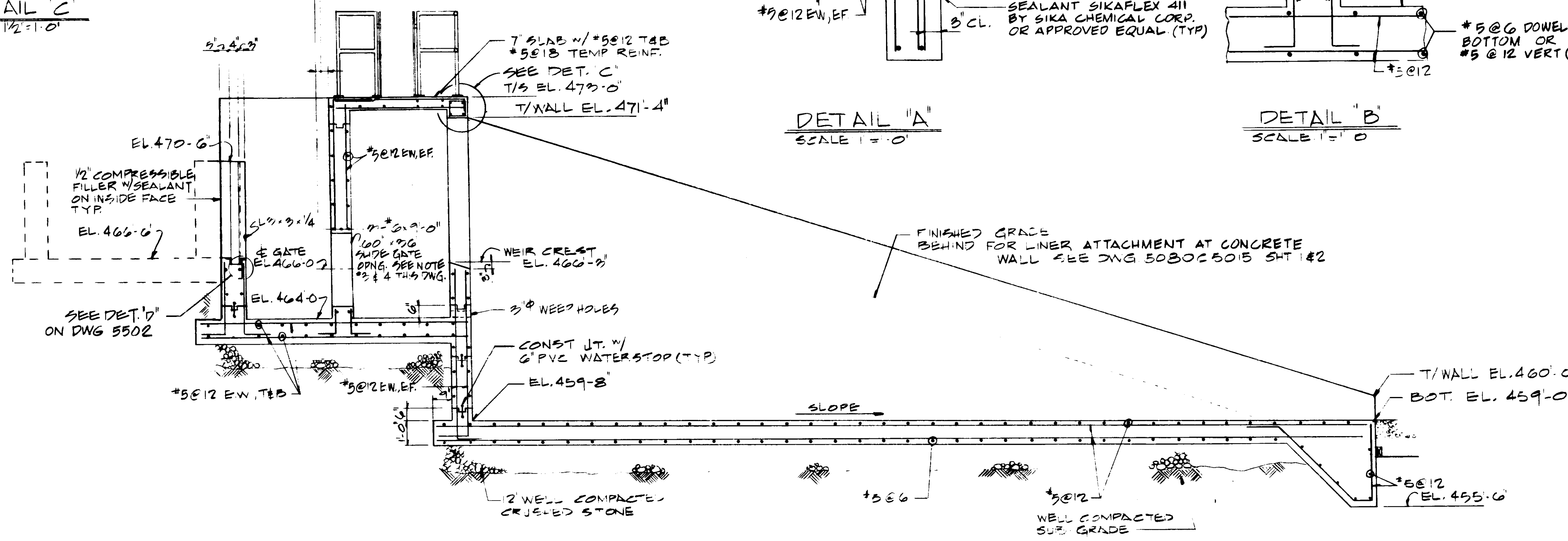
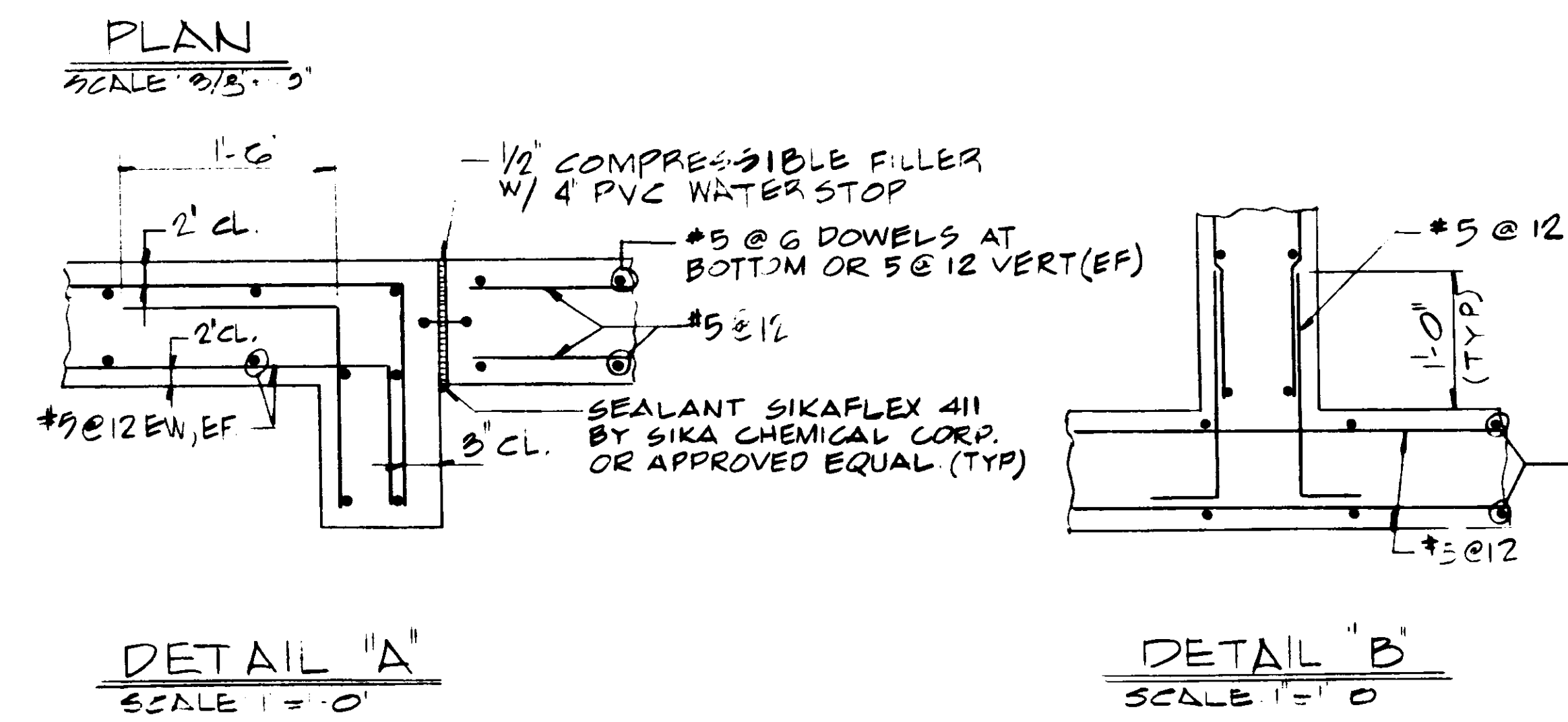
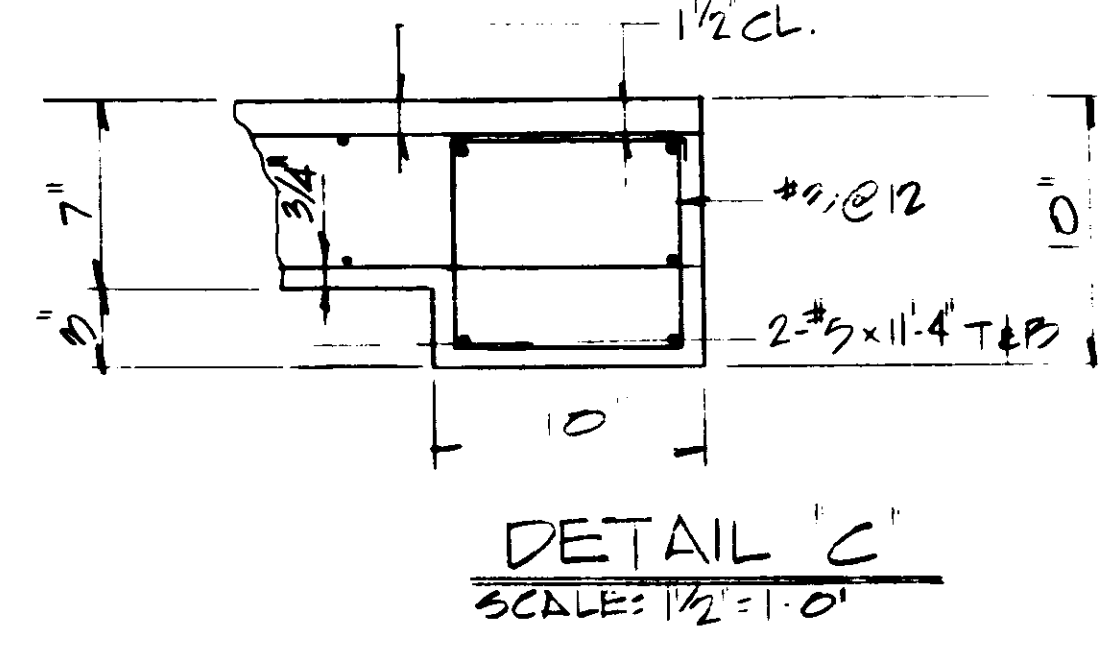
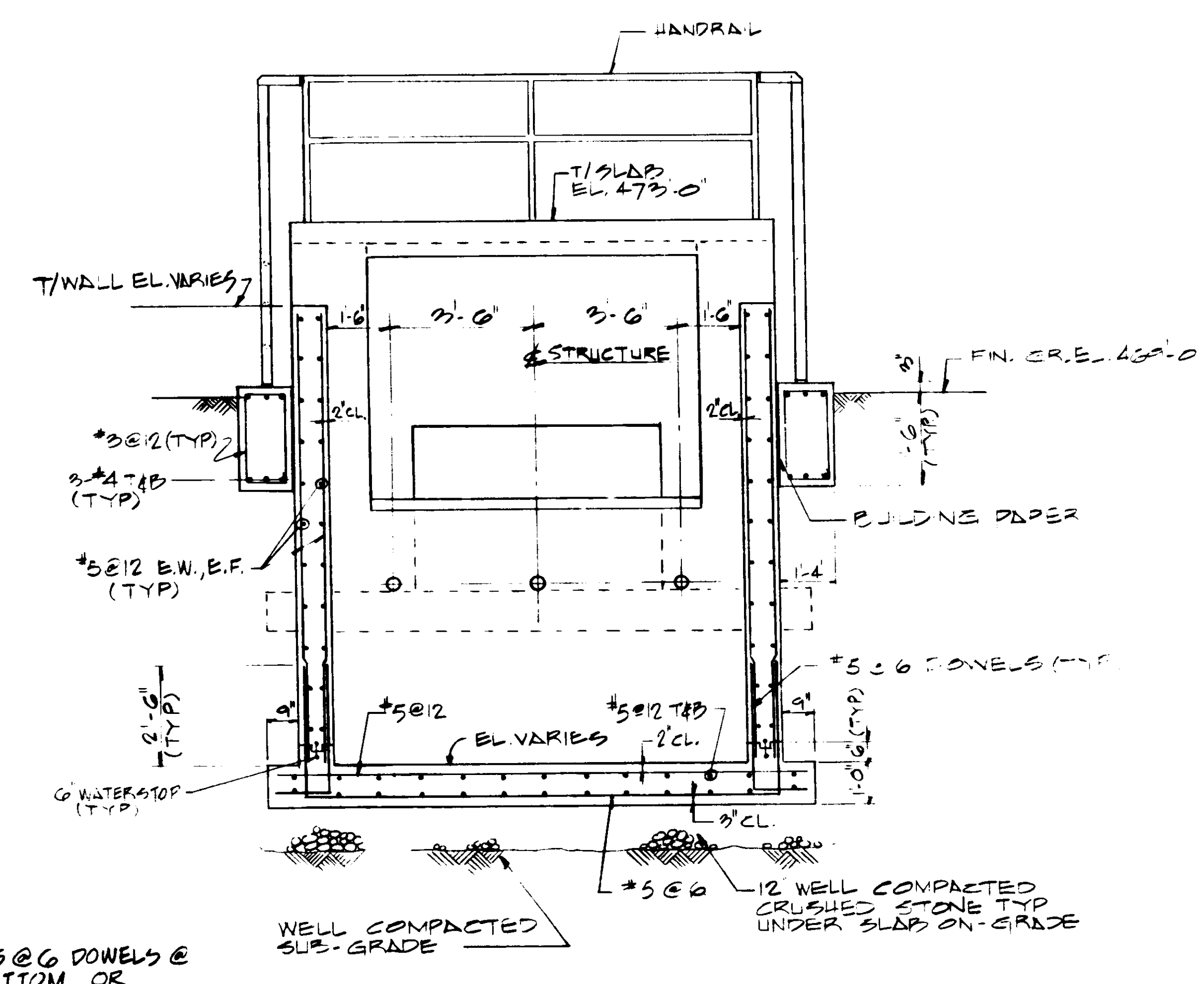
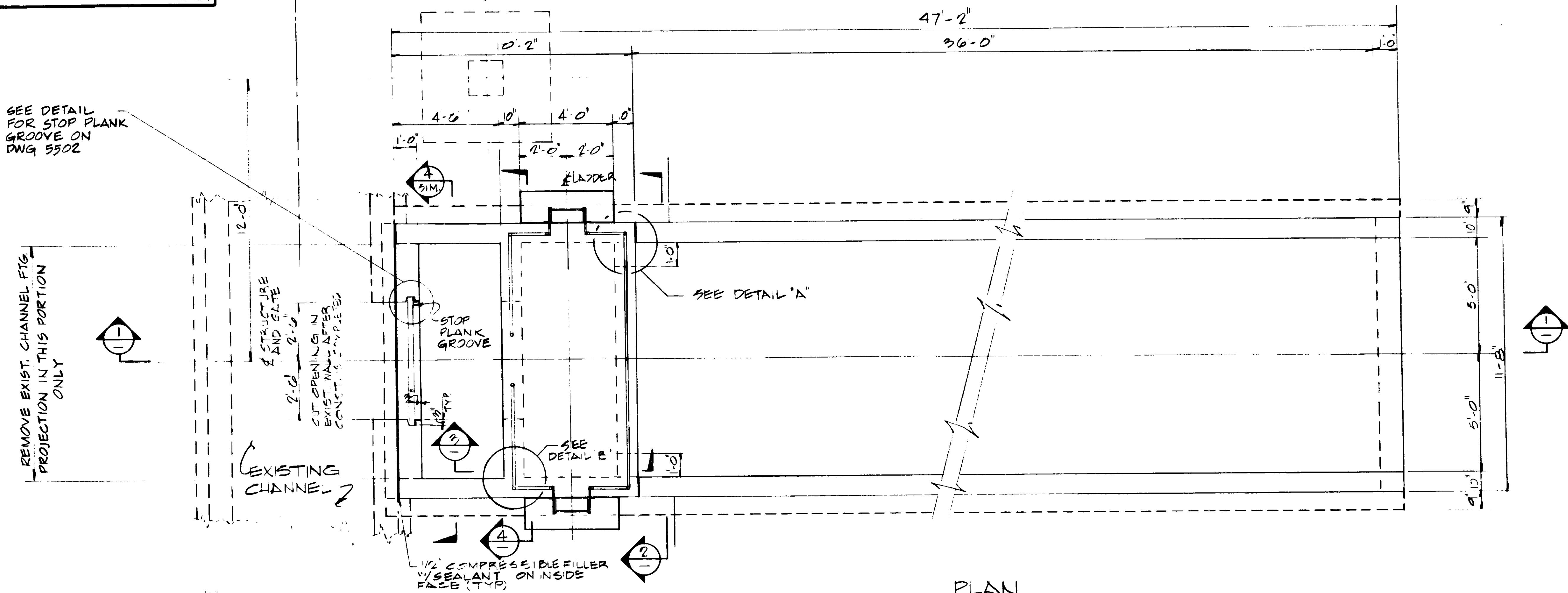
ASH SURGE BASIN BY PASS
MISCELLANEOUS DETAILS

CECO CONTRACT: 802668 CECO DWG. NO. 5295 C 5003

NUS CORPORATION
ROCKVILLE, MD.

SCALE: AS SHOWN SHEET 2 OF 2

REV	DESCRIPTION
1	APPROVED FOR CONSTRUCTION
2	
3	



- NOTES:**
1. CONCRETE: $f_c = 3000$ PSI AT 28 DAYS
 2. REINFORCING = ASTM A 615, GRADE 60
 3. CONTRACTOR SHALL FURNISH AND INSTALL FAB STEEL GATE AND ACCESSORIES AS MANUFACTURED BY ARMCO STEEL CORP. CONFORMING TO THE FOLLOWING SPECS. OR APPROVED EQUAL.
 - a. GATE MODEL 10-00
 - QUANTITY REQUIRED = 1
 - OPENING SIZE = 60' x 36'
 - FRAME TYPE = FLAT BACK STD. BOTTOM
 - MATERIAL COMBINATION = #2
 - STEM DIA. = 1 1/2"
 4. ACCESSORIES
 - a. TYPE OF LIFT = CPE 2
 - LIFT SUPPORT = WALL BRACKET TO MATCH CPE 2
 - STEM SUPPORT = ADJUSTABLE STEM GUIDES AT SPACING RECOMMENDED BY MANUFACTURER
 4. CONTRACTOR SHALL COORDINATE WITH THE GATE SUPPLIER FOR THE NUMBER, SIZE AND LOCATION OF ANCHOR BOLTS REQUIRED TO ATTACH THE GATE WALL BRACKET AND STEM GUIDES TO THE SUPPORTING WALL.
 5. WORK THIS DWG. WITH CIVIL DWGS. 5295 C 5001 AND 5002.
 6. FOR HANDRAIL & LADDER DETAILS SEE REF DWG. 5080 C 5001
 7. FOR STOP PLANKS SEE DWG. 5295 C 5502 NOTE 4

CONTRACT DRAWINGS:
5295 C 5001, 5002, 5003, 5501, 5502, 5503.

REFERENCE DRAWINGS:
CIVIL: 5080 C 5005, 5007, 5015, 5121
STRUCTURAL: 5080 C 5507, 5509, 5511, 5601, 5638, 5654, 5713
ELECTRICAL: (5080) 3E-0-3301, 3305, 3307
MECHANICAL: 5080 ME 3155 SHT 2, 5, 6, 7 & 11, 3162, 3169

NOTE: FOR LIST OF DRAWINGS BY TITLES SEE DWG. NO. 5295 C 5003

APPROVED FOR CONSTRUCTION

DATE: 2/1/80

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
POWERTON

ASH SURGE BASIN BY PASS
BASIN INLET STRUCTURE

SCALE: AS SHOWN SHEET 1 OF 1

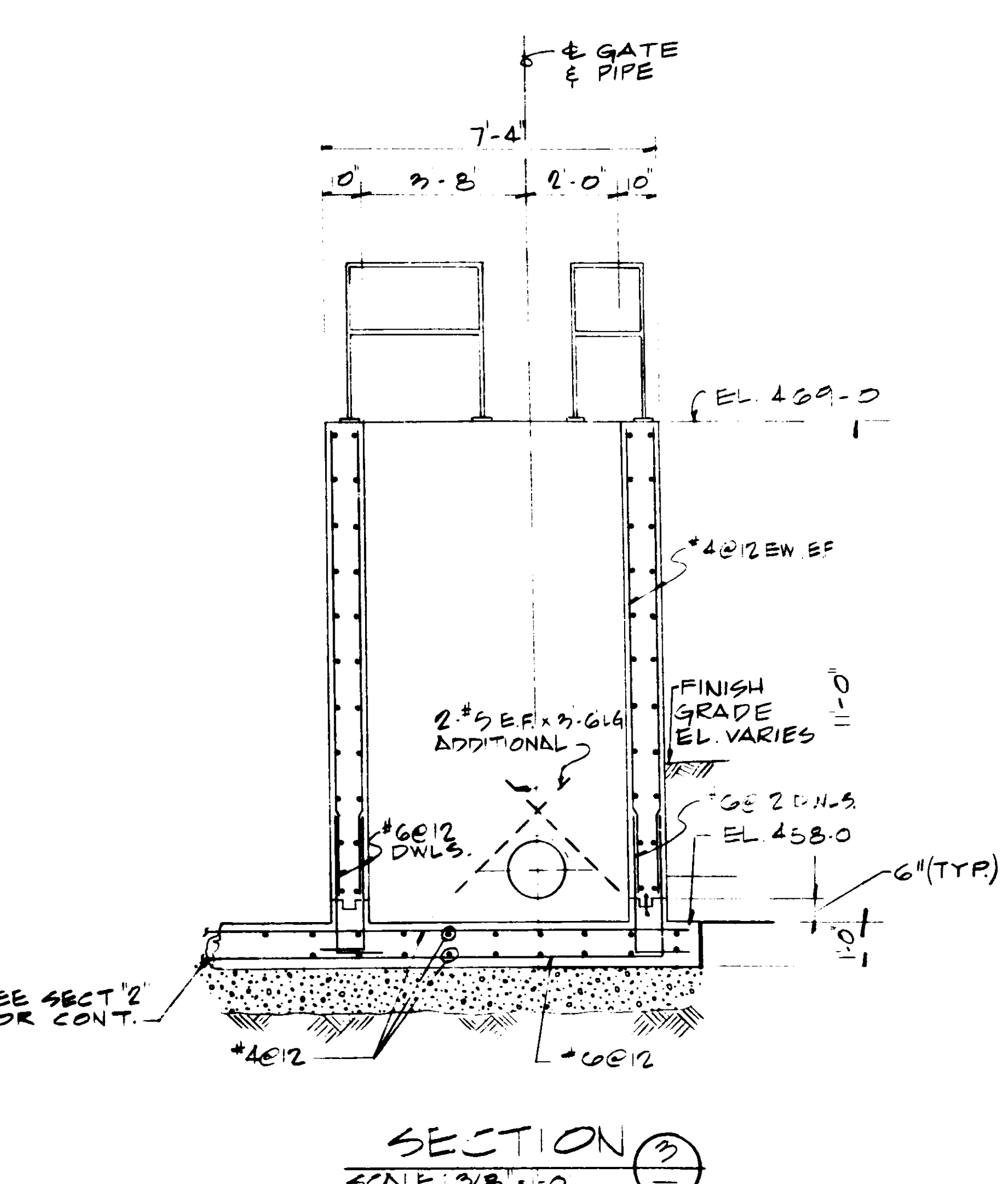
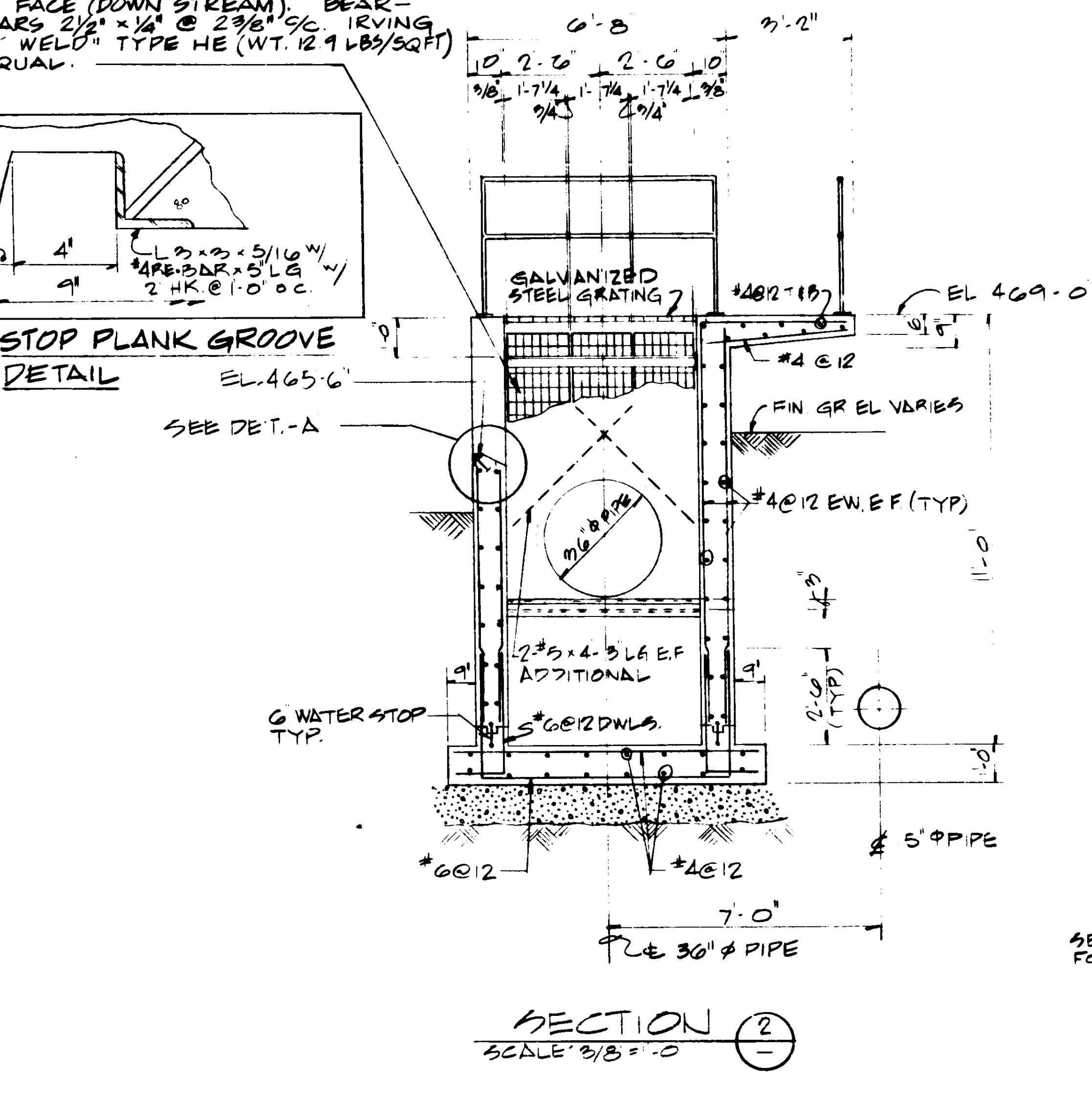
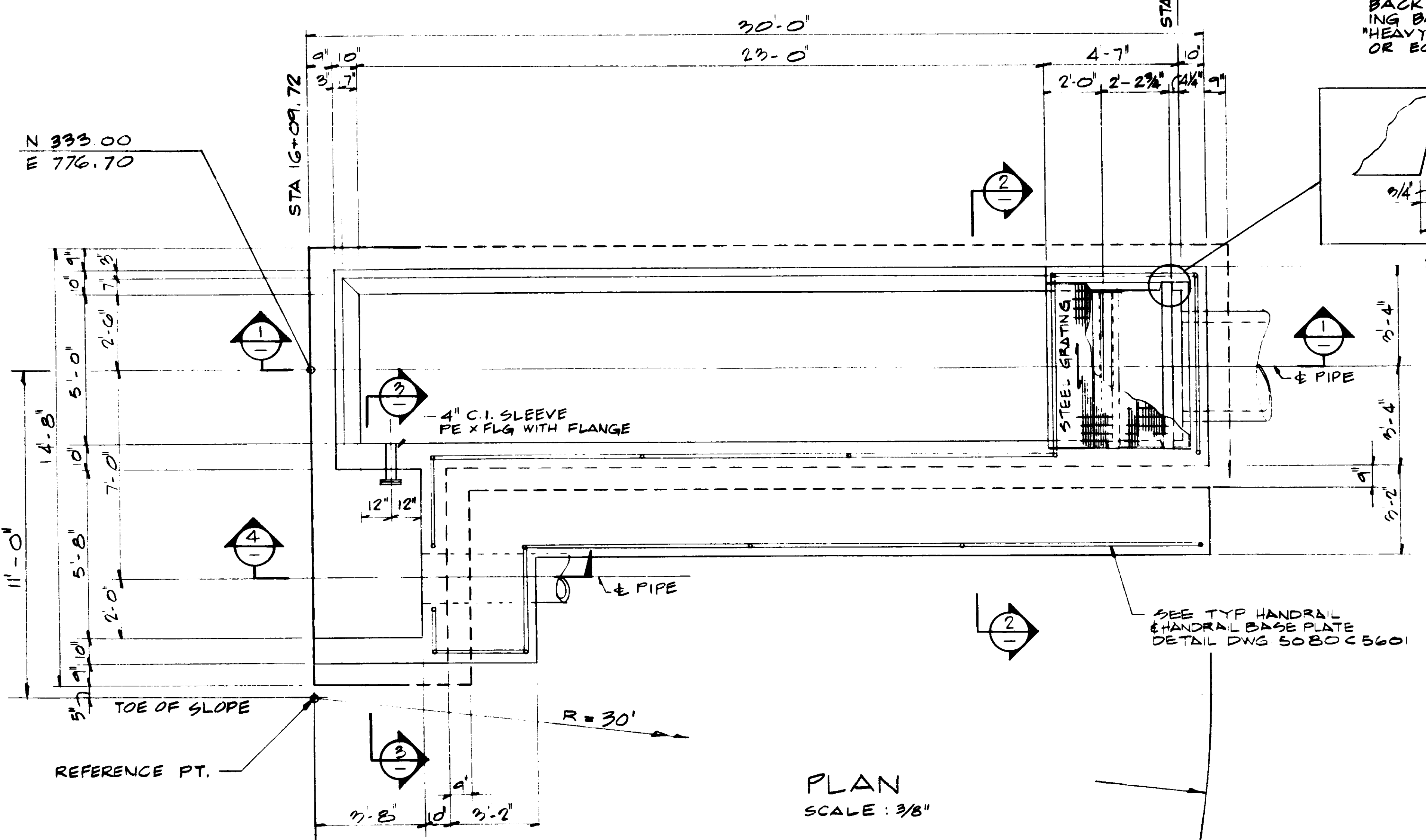
DRAWING NO. 5295 C 5501

REVISIONS:

DATE	BY	DESCRIPTION
2/1/80	Kenneth Long	APPROVED FOR CONSTRUCTION

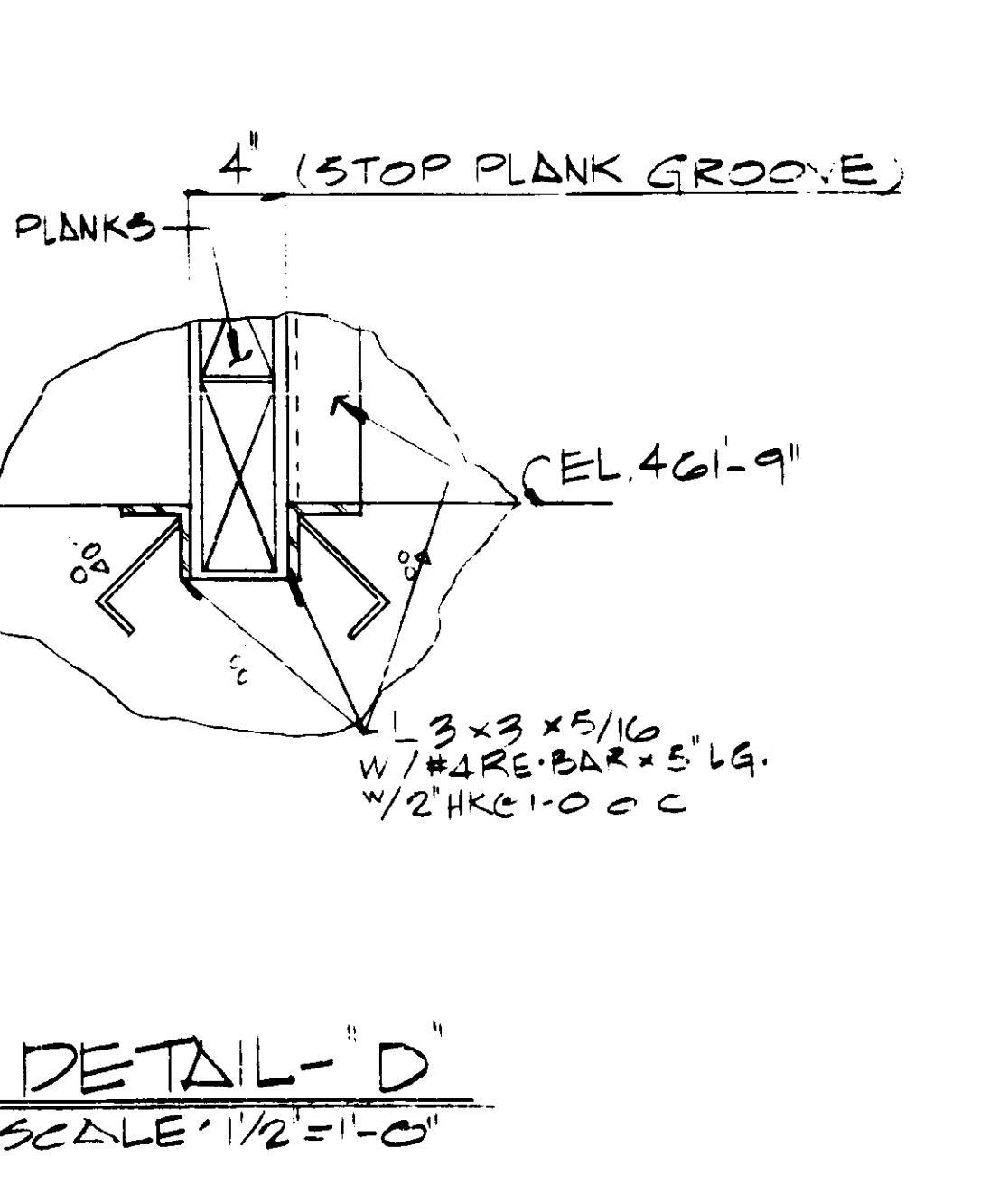
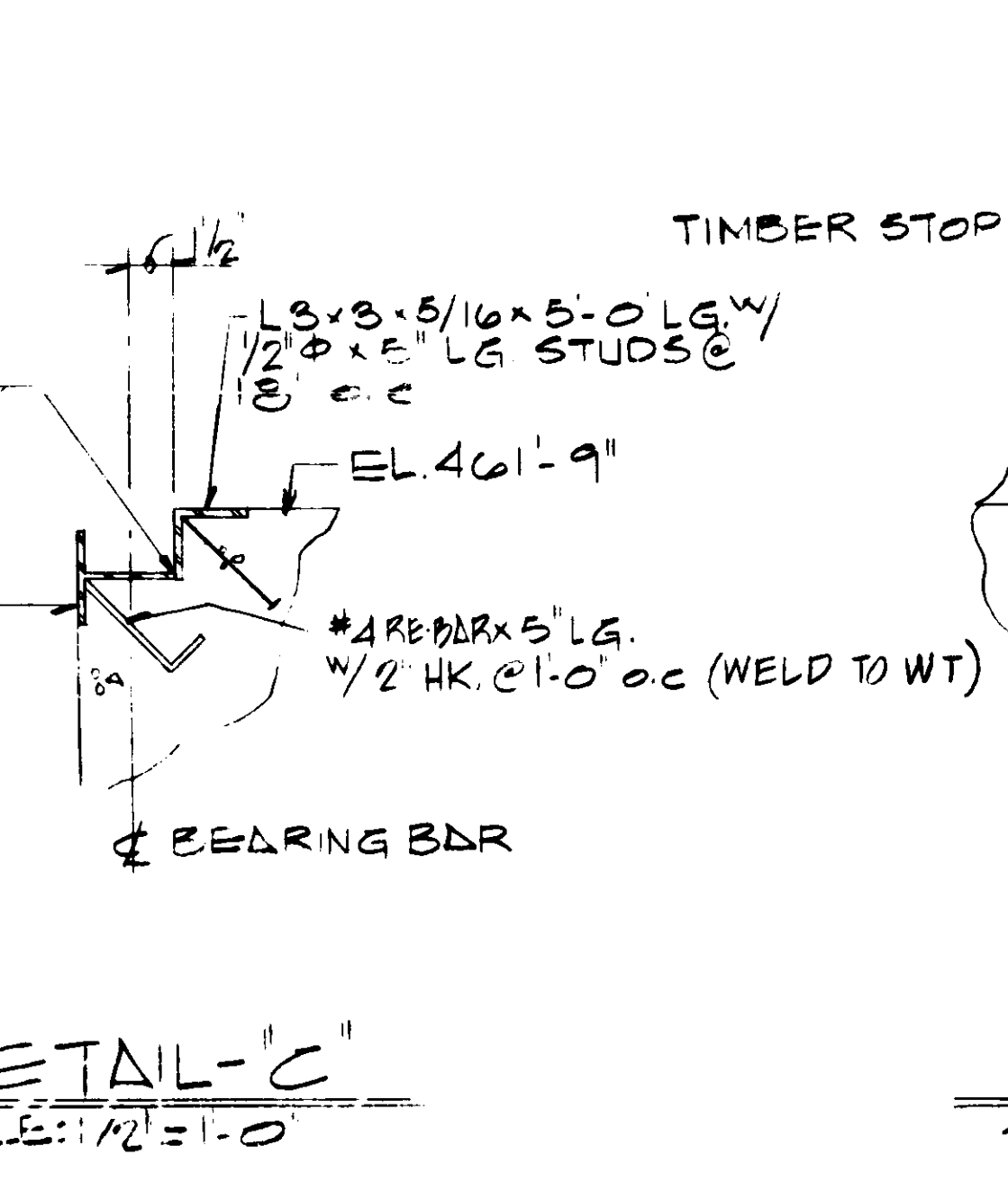
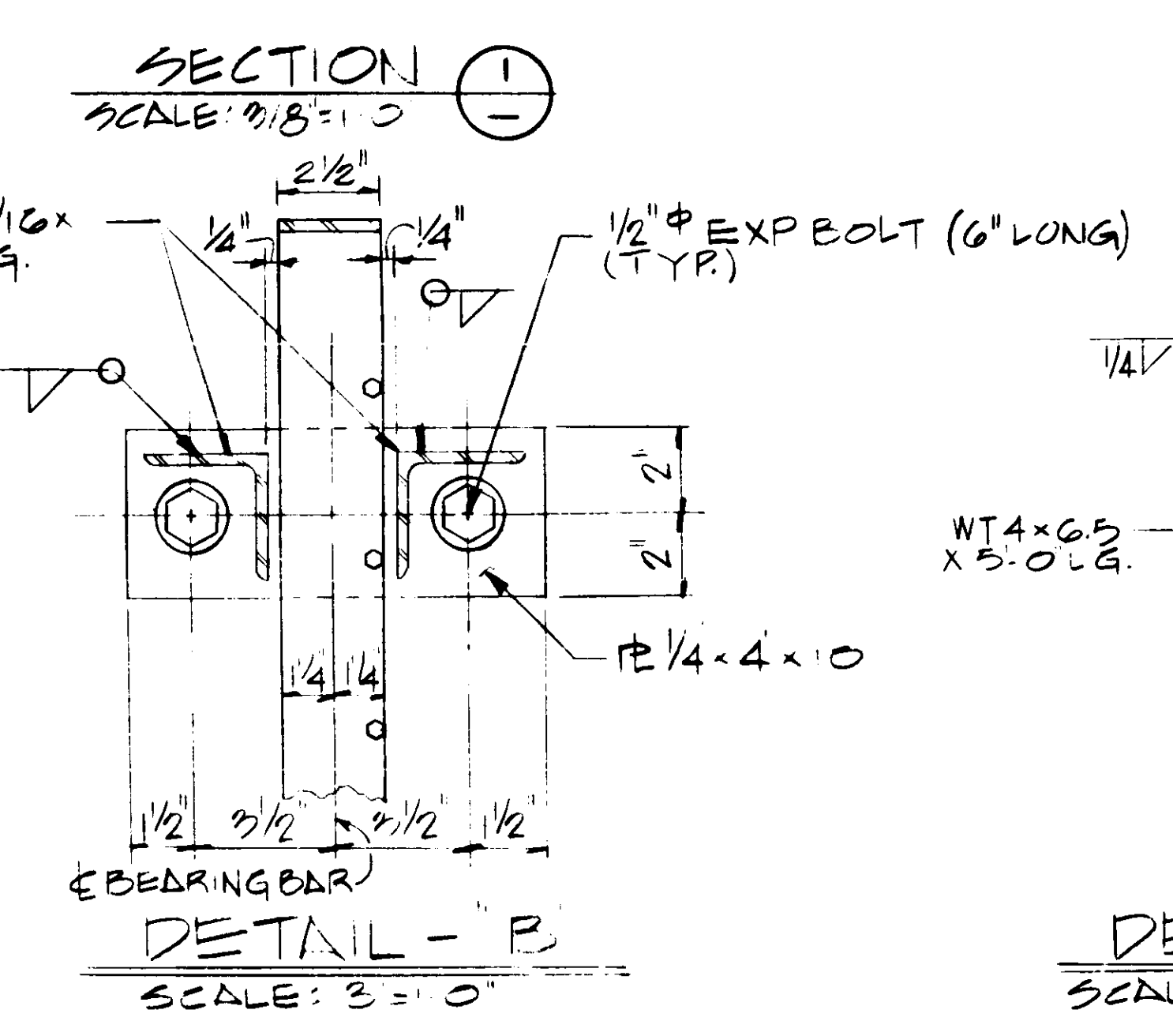
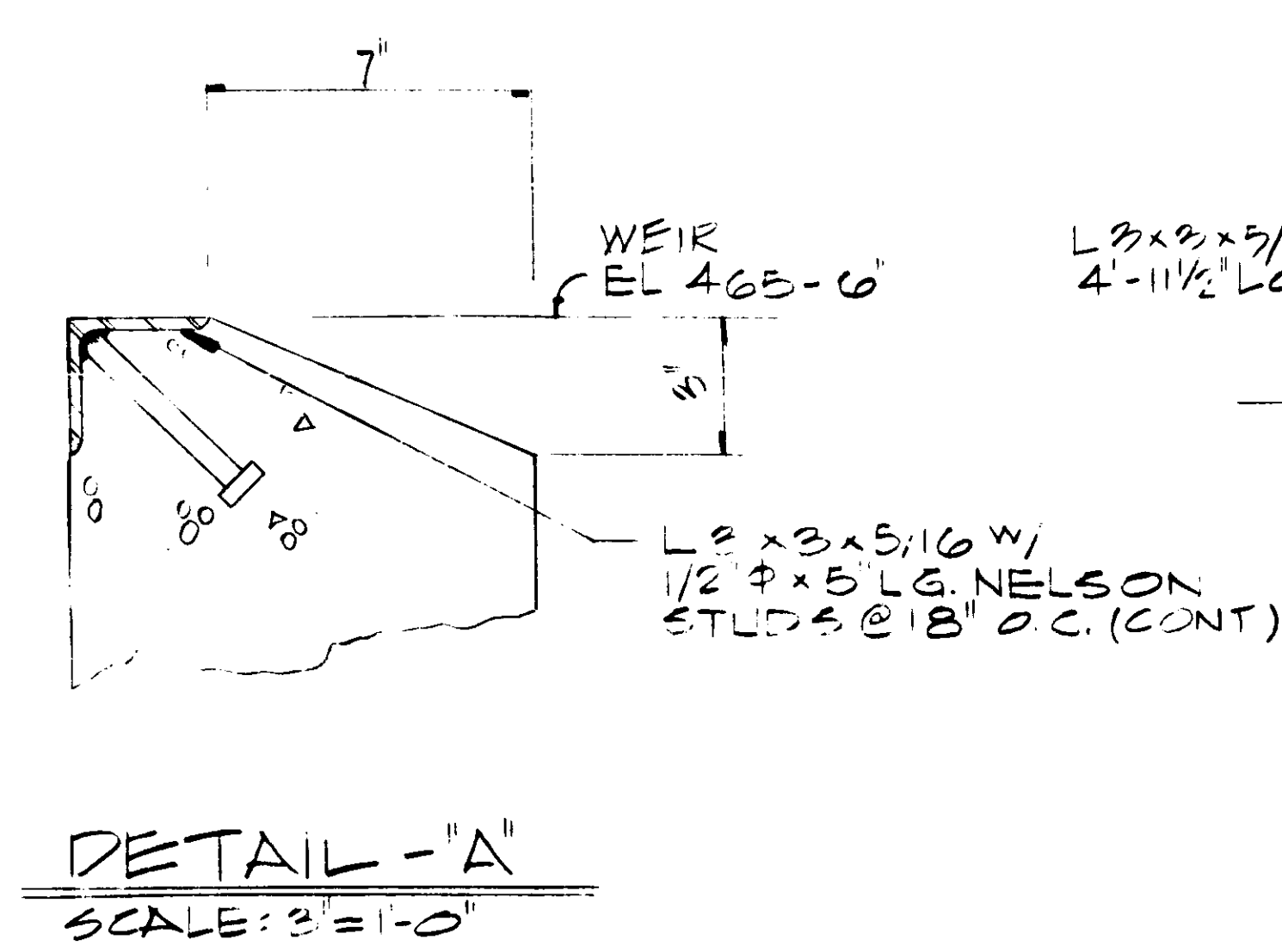
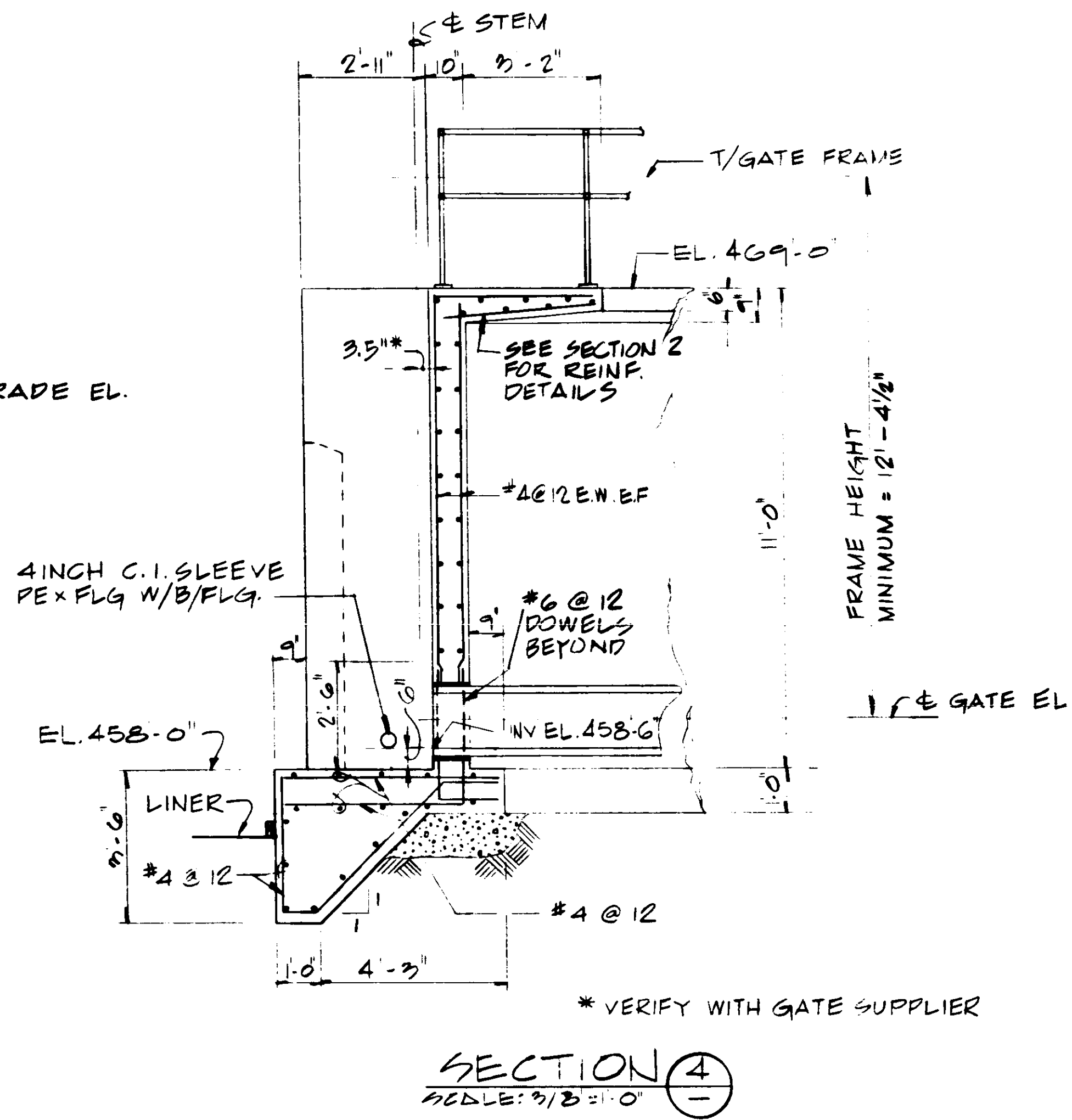
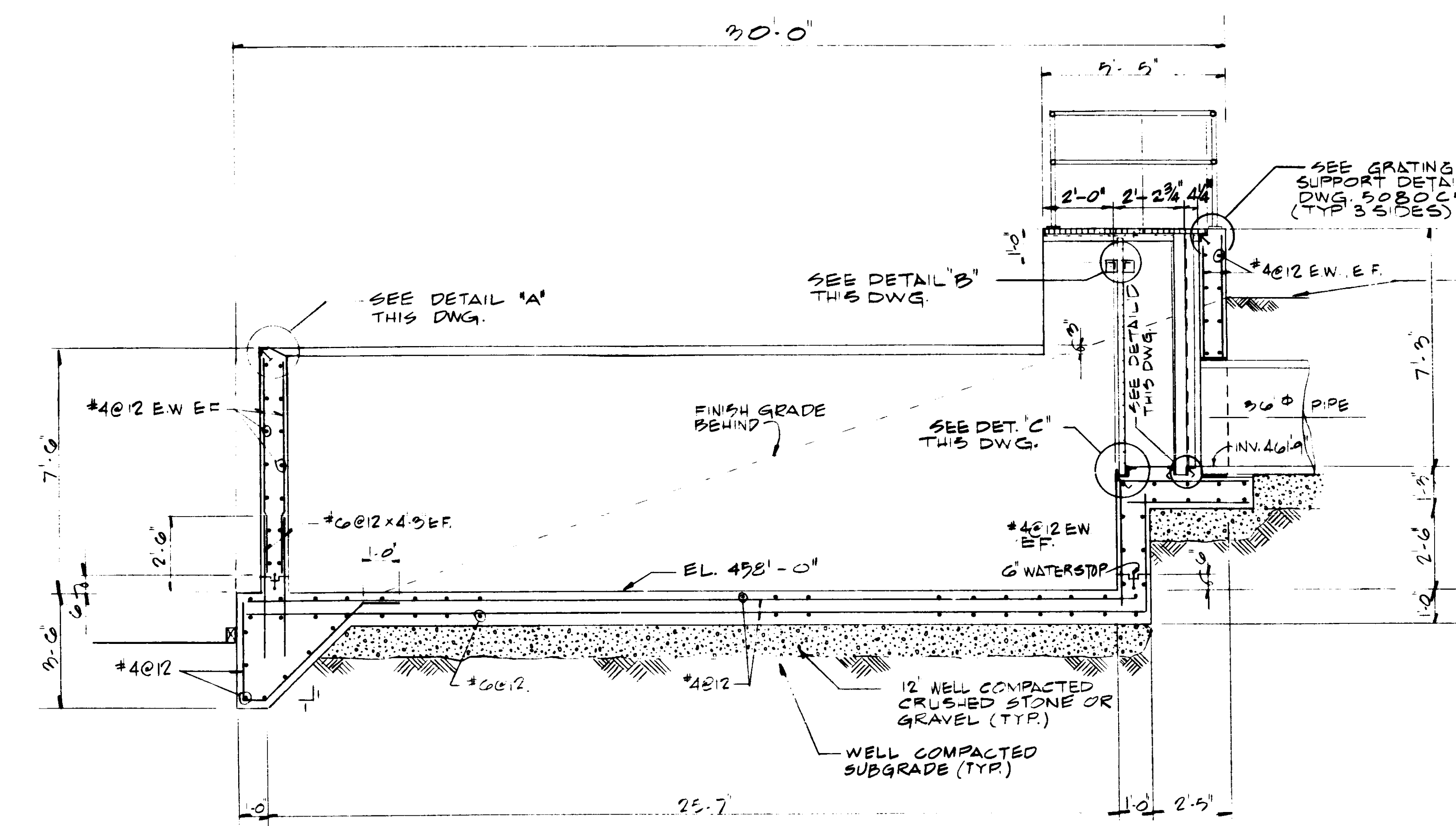
DATE: 2/1/80

REVISIONS	
REV	DESCRIPTION
1	APPROVED FOR CONSTRUCTION
2	NEW
3	NEW



NOTE 3:

- SEE NOTE NOS. 1, 2, 4, 5 AND 6 ON DWG 5501.
- CONTRACTOR SHALL FURNISH & INSTALL MEDIUM DUTY SLUICE GATE & ACCESSORIES AS MANUFACTURED BY ARNCO STEEL CORP. OR APPROVED EQUAL, CONFORMING TO FOLLOWING SPECS:
 - GATE**
MODEL 20-10C
QUANTITY REQD = 1
OPENING SIZE = 15" DIA.
FRAME TYPE = FLAT BACK
MATERIAL COMBINATION = #2
STEM DIA. = 7/8"
 - ACCESSORIES**
TYPE OF LIFT = H1-10
FRAME HT = 12'-4 1/2" MINIMUM.
- STEEL GRATING TO BE IRVING WELDED RECTANGULAR DESIGN TYPE 1HB-2 WITH 1 1/4" x 1/4" MAIN BARS, AS MANUFACTURED BY IKG INDUSTRIES OR APPROVED EQUAL (GALVANIZED)
- STOP PLANKS TO BE DOUGLAS FIR COMMERCIAL GRADE NO. 2 (WEST COAST)
PROVIDE ONE SET OF 7 PLANKS 4" x 8" x 5'-5" LONG (DRESSED SIZE 3 1/2" x 7 1/4" x 5'-5")
STOP PLANKS ARE INTERCHANGEABLE AT THREE LOCATIONS — SEE ALSO DWGS C5501 & C5503 (ONLY ONE SET REQUIRED UNLESS DIRECTED OTHERWISE BY OWNER)



CONTRACT DRAWINGS:
5295 C 5001, 5002, 5003, 5501, 5502, 5503.

REFERENCE DRAWINGS:
CIVIL: 5080 C 5005, 5007, 5015, 5121.
STRUCTURAL: 5080 C 5507, 5509, 5511, 5601, 5635, 5654, 5713.
ELECTRICAL: (Engr) 3E-0-3301, 3305, 3307
MECHANICAL: E-80 ME 3155 SHT 2, 5, 6, 7 & 11, 3-62, 3169

NOTE: FOR LIST OF DRAWINGS BY TITLES SEE D. & NO. 5295 C 5003.

APPROVED FOR CONSTRUCTION

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
POWERTRON
ASH SURGE BASIN BY PASS
BASIN OUTLET STRUCTURE

NUS CORPORATION
ROCKVILLE, MD

DRAWING NO. **5295 C 5502**

SCALE: AS SHOWN SHEET 1 OF 1

Midwest Generation, LLC
Powerton Generating Station
Project No. 12661-181
Attachment 3 – 2016 Structural Stability
& Safety Factor Assessment



Specification P-1400
Rev. 0
Issue: Bids
Date: 04-19-2024

ATTACHMENT 3

2016 STRUCTURAL STABILITY AND SAFETY FACTOR ASSESSMENT

**STRUCTURAL STABILITY AND FACTOR OF SAFETY ASSESSMENT
ASH SURGE BASIN AND BYPASS BASIN
POWERTON STATION
OCTOBER 2016**

This report presents documentation of the initial periodic structural stability and initial safety factor assessments for the Ash Surge Basin and Bypass Basins (the Basins) at the Powerton Station (Site) in Pekin, Illinois (Figure 1). This report addresses the initial structural stability and safety factor assessment requirements of the Coal Combustion Residuals (CCR) regulations, Code of Federal Regulations Title 40, Part 257, Subpart D (referred to as the CCR Rule). These regulations were published in the Federal Register on 17 April 2015 and became effective on 19 October 2015. The Powerton Station is owned and operated by Midwest Generation, LLC (Midwest Generation). Based on the results provided in this report, the Ash Surge Basin and Bypass Basin meet the requirements of §257.73(d) and §257.73(e) of the CCR Rule.

The work presented in this report was performed under the direction of Ms. Jane Soule, P.E., of Geosyntec Consultants Inc. (Geosyntec) in accordance with §257.73(d) and §257.73(e). Mr. Robert White reviewed this report in accordance with Geosyntec's senior review policy.

1. Regulation Requirements - §257.73

Structural integrity criteria for existing CCR impoundments is described in §257.73 and includes structural stability and factor of safety assessments. The Ash Surge Basin and Bypass Basin meet the minimum size and capacity criteria under §257.73(b) and are subject to the structural stability and safety factor assessments required.

2. Site Conditions

The Ash Surge Basin is located east of the Main Wastewater Building, the cylindrical concrete clarifier and thickener structures, and the Metal Cleaning Basin, west of the inactive Limestone Basin, north of the Bypass Basin and East Roof and Yard Runoff (ERYR) Basin. The Ash Surge Basin is approximately 1,050 feet by 335 feet in plan dimensions (total plan area of approximately 8.1 acres). The surface impoundment is surrounded by a paved and a gravel perimeter access road around the western and eastern half of the impoundment, respectively.

The Bypass Basin is located east of the ERYR Basin and south of the southeast corner of the Ash Surge Basin. The Bypass Basin is approximately 160 feet by 255 feet in plan dimensions (total plan area of approximately 0.9 acres). A gravel perimeter access road is located along the northern and eastern boundaries of the Bypass Basin. A concrete-lined dewatering bin overflow

channel is located along the crest of the berm between the Bypass Basin and the ERYR Basin. A temporary construction staging area is located south of the surface impoundment.

The Ash Surge Basin and the Bypass Basin are both lined with a 60-mil high density polyethylene (HDPE) geomembrane.

Based on available documentation and discussions with site personnel, the Basins, in their current configuration, were constructed in the late 1970s and early 1980s. A history of construction for the basins was prepared in accordance with §257.73(c) and describes the design of the basins and their construction (Geosyntec, 2016a).

3. Structural Stability Assessment

The following subsections address the components of §257.73(d)(1).

3.1 Foundations and Abutments – §257.73(d)(1)(i)

The Ash Surge Basin and the Bypass Basin consist of embankments on all sides. Because no formational materials provide lateral structural support for the embankments, the Basins do not include abutments. The remainder of this section addresses the foundation materials for the Basins.

Previous subsurface investigations performed at the Site indicate foundation materials underlying the embankments for the Ash Surge Basin and Bypass Basin generally consists of approximately 17 to 28 feet of fat and lean clay overlying approximately 35 to 40 feet of loose to very dense poorly graded sand and silty sand with some gravel associated with the Henry Formation (Geosyntec, 2016b).

Elastic settlement of the clay and sand layers underlying the embankments likely occurred very soon after construction in the late 1970s and early 1980s. Because of the age of the embankments (approximately 35 years old), the majority of consolidation and secondary compression settlement of the clay layer has likely already occurred. The initial annual inspection performed for the Basins in accordance with §257.83(b) did not identify any adverse effects on the Basins or their appurtenant structures resulting from settlement that may have occurred since construction (Geosyntec, 2016c). There are no proposed changes in operation which would increase loading conditions on the foundation materials; therefore, no significant settlement of the foundation materials underlying the embankments is anticipated to occur in the future. Further, the embankments of the Basins were not constructed with abutments or separate engineered zones that would be most susceptible to the adverse effects of differential settlement. Therefore, potential settlement of the foundation is not anticipated to impact the integrity of the impoundment embankments.

A factor of safety against the triggering of liquefaction was calculated for saturated foundation materials underlying the Ash Surge Basin and Bypass Basin embankments. The factor of safety was calculated based methods outlined in Idriss and Boulanger (2008) using information obtained from field explorations, including borings, Cone Penetration Test (CPT) soundings, laboratory data (Geosyntec, 2016b) and seismic data (Geosyntec, 2016g). Overall, the foundation materials underlying the Ash Surge Basin and Bypass Basin have a low susceptibility to liquefaction and liquefaction-induced strength loss (Geosyntec, 2016d).

3.2 Upstream Slope Protection – §257.73(d)(1)(ii)

The Ash Surge Basin and Bypass Basin are lined with a 60-mil HDPE geomembrane that protects the interior basin slopes from erosion, the effects of wave action, and mitigates potential effects of rapid drawdown.

3.3 Dike Compaction – §257.73(d)(1)(iii)

Documentation of as-built construction conditions for the Ash Surge Basin and Bypass Basin embankments was not available at the time of this report. Samples of embankment fill materials obtained during Geosyntec’s geotechnical investigations at the Site indicate that the Ash Surge Basin embankments are compacted to relative densities on the order of 95 percent based on Standard Proctor testing (Geosyntec, 2016b). No quantitative evaluation of the degree of compaction of the embankments for the Bypass Basin was performed for the embankments in their current state. Slope stability analyses show that the embankments for the Ash Surge Basin and Bypass Basin are sufficient to withstand the range of loading conditions in the CCR units (Geosyntec, 2016e).

3.4 Downstream Slope Vegetation – §257.73(d)(1)(iv)

Downstream slopes of the Ash Surge Basin and Bypass Basin have erosion protection from either vegetation or geomembrane liners located on the interior slopes of adjacent basins.

3.5 Spillway – §257.73(d)(1)(v)

The Ash Surge Basin and the Bypass Basin both contain emergency spillway structures. A description of these structures and the design storm event identified for the Basins is included in the Inflow Design Flood Control System Plan (IDFCSP) prepared for the site in accordance with §257.82(c) (Geosyntec, 2016f). The IDFCSP identifies the design event for the Site as the 1,000 year flood. Because the Ash Surge Basin and Bypass Basin do not impound water from a natural stream and do not impound stormwater flows, except for direct precipitation that falls on the embankment crest or within the Basins, the IDFCSP identifies the design event as the 24-hour, 1,000-year precipitation event. When the operating freeboard for the Basins is taken

into account, the water levels in the Basins estimated after the design precipitation event are estimated to be lower than the invert elevations of the emergency spillways and no discharge from the Basins is anticipated (Geosyntec, 2016f). Therefore, the hydraulic capacity of the spillways was not calculated.

3.6 Structural Integrity of Hydraulic Structures – §257.73(d)(1)(vi)

Hydraulic structures passing through or beneath the embankments of the Bypass Basin and Ash Surge Basin consist of several pipes and conveyance structures associated with the inlet and outlet structures of the Basins. These structures and pipes were inspected periodically between 10 May 2016 and 24 May 2016 by a company specializing in video camera pipe inspections. The inspected structures and pipes related to the Basins included are presented on Figure 2. The video inspections did not identify significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris that would negatively affect operation of the pipes was observed.

3.7 Downstream Slopes Adjacent to Water Bodies – §257.73(d)(1)(vii)

Ponds or water bodies near downstream slopes of the Ash Surge Basin and Bypass Basin are identified on Figure 3 and include:

- The Metal Cleaning Basin located west of the Ash Surge Basin. This basin is lined with an HDPE geomembrane.
- The ERYR Basin located west of the Bypass Basin and south of the Ash Surge Basin;
- The inactive Limestone Basin located east of the Ash Surge Basin; and
- The FAB located northeast of the Ash Surge Basin.

For stability analyses performed, a “low pool” condition where the modeled groundwater depth is lowered so there is little or no stabilizing force present on the downstream slope of the Ash Surge Basin or Bypass Basin embankments was evaluated for the water bodies presented above (Geosyntec, 2016e).

Stability during rapid drawdown was also evaluated for the embankments affected by the ERYR Basin and the FAB. Rapid drawdown was not evaluated for the embankments affected by the Metal Cleaning Basin because its HDPE geomembrane minimizes potential inundation of the slopes and mitigates effects of rapid drawdown. Similarly, embankments affected by the inactive Limestone Basin were not evaluated for rapid drawdown because the volume of water in this basin is anticipated to be minimal (inflow is limited to direct precipitation) and there is no outlet structure associated with this basin that could create a rapid drawdown condition for the adjacent Ash Surge Basin embankment.

Slope stability analyses show that the embankments are designed and constructed to maintain structural stability during “low pool” and rapid drawdown conditions (Geosyntec, 2016e).

3.8 Structural Stability Assessment Deficiencies - §257.73(d)(2)

No structural stability deficiencies associated with the Ash Surge Basin and Bypass Basin were identified in this initial structural stability assessment and no corrective measures are required.

3.9 Annual Inspection Requirement - §257.83(b)(4)(ii)

In accordance with §257.83(b)(4)(ii), submittal of this structural stability assessment precludes the requirement of an annual inspection under §257.83(b) for the Ash Surge Basin and Bypass Basin during the 2016 calendar year. One deficiency identified in the initial annual inspection (Geosyntec, 2016c) for the Bypass Basin was corrected as documented in the Notice of Remedy prepared in response to the initial annual inspection.

4. Safety Factor Assessment

This section describes the initial safety factor assessment for the Ash Surge Basin and Bypass Basin and the methodology used to perform the assessment in accordance with §257.73(e)(1). This assessment includes slope stability analyses of the critical embankment cross-section for each basin, shown in Figure 3.

4.1 Slope Stability Methodology

Limit equilibrium slope stability analyses were performed to evaluate the stability of the embankments for the Ash Surge Basin and Bypass Basin. The process involved performing two-dimensional analyses on the critical cross-section for each basin using Spencer’s Method as coded in the computer program SLOPE/W (Version 8.15.4.11512, www.geoslope.com) which satisfies vertical and horizontal force equilibrium and moment equilibrium. For each cross section analyzed, the program searches for the sliding surface that produces the lowest factor of safety (FS). Factor of safety is defined as the ratio of the shear forces/moments resisting movement along a sliding surface to the forces/moments driving the instability.

Subsurface stratigraphy, groundwater conditions, and engineering parameters for the embankment and foundation materials were developed based on previous subsurface investigations performed at the Site (Geosyntec, 2016b and Geosyntec, 2016e).

4.2 Slope Stability Analyses

Four cases were analyzed to satisfy the safety factor assessment requirements in §257.73(e) (Geosyntec, 2016e).

4.2.1 Static, Long-Term Maximum Storage Pool Loading – §257.73(e)(1)(i)

Pursuant to §257.73(e)(1)(i) a static, long-term condition with the maximum operating pool loading on the embankments was evaluated. For the Ash Surge Basin and Bypass Basin, this condition included a pool elevation at 465 feet MSL¹ for the Ash Surge Basin and 465.5 feet MSL for the Bypass Basin, and a groundwater elevation of 451.8 feet MSL (Geosyntec, 2016e).

4.2.2 Static, Maximum Storage Pool Loading – §257.73(e)(1)(ii)

The conditions for §257.73(e)(1)(ii) are identical to §257.73(e)(1)(i) with the exception of the pool elevation, which is set at the lowest points of the embankment crest (Geosyntec, 2016e).

4.2.3 Seismic – §257.73(e)(1)(iii)

Pursuant to §257.73(e)(1)(iii), a seismic condition for Ash Surge Basin and Bypass Basin was also analyzed. Seismic stability was evaluated with a pseudostatic analysis that uses constant horizontal accelerations to represent the effects of earthquake shaking. The horizontal accelerations are represented in SLOPE/W by a horizontal seismic coefficient. The horizontal seismic coefficient used for analysis was based on a peak ground acceleration with a 2 percent probability of exceedance in 50 years (Geosyntec, 2016g).

4.2.4 Liquefaction – §257.73(e)(1)(iv)

The majority of the embankment soils for the Ash Surge Basin and Bypass Basin are not considered susceptible to liquefaction because saturation of the embankment soils is unlikely based on the presence of a geomembrane liner system. Based on the design phreatic surface discussed in Geosyntec (2016b), a limited portion of the bottom of the embankments may become saturated from groundwater. Liquefaction triggering analyses of these saturated embankment soils show that liquefaction and associated post-liquefaction shear strength loss is unlikely for the seismic design event (Geosyntec, 2016d). Because the likelihood of liquefaction and associated shear strength loss of the embankment soils is very low, post-liquefaction conditions are represented by the static factor of safety analyses.

4.3 Results

The results of the slope stability analysis for the critical cross sections of the Ash Surge Basin and Bypass Basin embankments are summarized in Table 1 below and presented in Figures 4 through 9 (Geosyntec 2016e).

¹ Mean Sea Level based on local plant vertical datum.

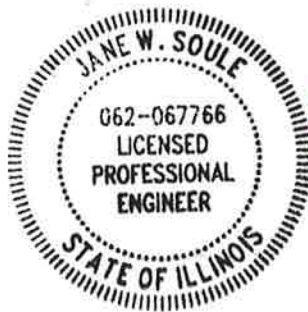
Table 1: Safety Factor Results

Section	Safety Factor			
	257.73(e)(1)(i)	257.73(e)(1)(ii)	257.73(e)(1)(iii)	257.73(e)(1)(iv)
1	≥1.50	≥1.40	≥1.00	≥1.20
2	≥1.50	≥1.40	≥1.00	≥1.20

These results meet the factor of safety requirements presented in §257.73(e)(1)(i) through §257.73(e)(1)(iv).

5. Limitations and Certification

This initial periodic structural stability and safety factor assessment meets the requirements of §257.73(d) and §257.73(e) of the Code of Federal Regulations Title 40, Part 257, Subpart D, and was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.



Jane W. Soule

Jane W. Soule, P.E.
 Illinois Professional Engineer No. 062-067766
 Expiration Date: 11/30/2017

6. References

Das, 2007. "Principles of Foundation Engineering," Sixth edition. Thomson Canada Limited.

Geosyntec, 2016a. History of Construction Report, Ash Surge Basin and Bypass Basin, Powerton Station, October.

Geosyntec, 2016b. Ash Surge Basin and Bypass Basin – Soil Properties Calculation, Powerton Station, October.

Geosyntec, 2016c. Annual Inspection Report, Ash Surge Basin and Bypass Basin, Powerton Station, 18 January 2016.

Geosyntec, 2016d. Ash Surge Basin and Bypass Basin – Liquefaction Calculations, Powerton Station, October.

Geosyntec, 2016e. Ash Surge Basin and Bypass Basin – Slope Stability Calculations, Powerton Station, October.

Geosyntec, 2016f. Inflow Design Flood Control System Plan, Ash Surge Basin and Bypass Basin, Powerton Generating Station, October.

Geosyntec, 2016g. Ash Surge Basin and Bypass Basin – Seismic Coefficient Calculations, Powerton Station, October.

Idriss and Boulanger, 2008. "Soil Liquefaction During Earthquakes". Earthquake Engineering Research Institute, MNO-12.

Attachments

Figure 1 – Site Location

Figure 2 – Hydraulic Structure Locations

Figure 3 – Stability Sections

Figure 4 – Slope Stability Output, Section 1 - 257.73(e)(1)(i)

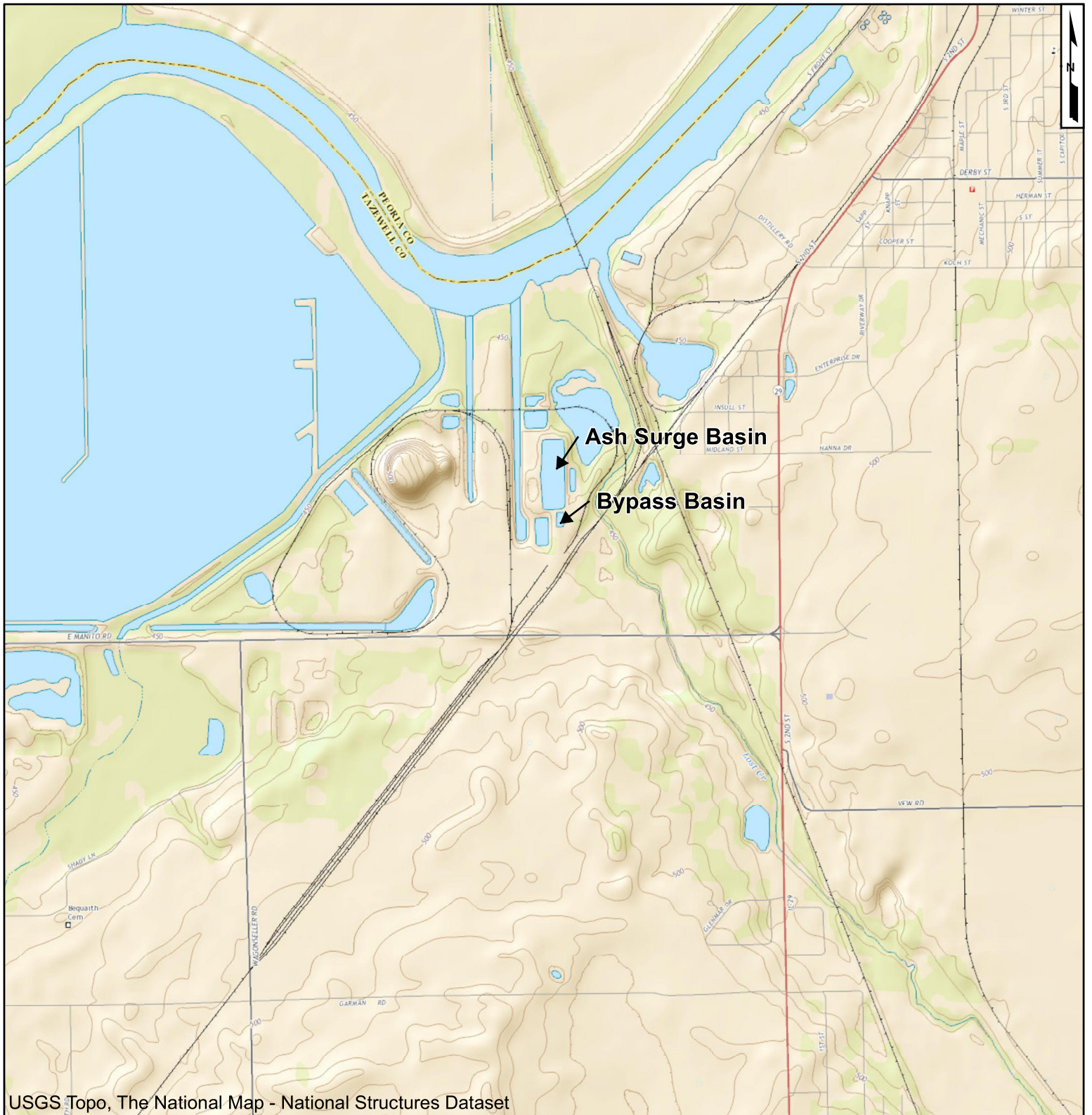
Figure 5 – Slope Stability Output, Section 1 - 257.73(e)(1)(ii)

Figure 6 – Slope Stability Output, Section 1 - 257.73(e)(1)(iii)

Figure 7 – Slope Stability Output, Section 2 - 257.73(e)(1)(i)

Figure 8 – Slope Stability Output, Section 2 - 257.73(e)(1)(ii)

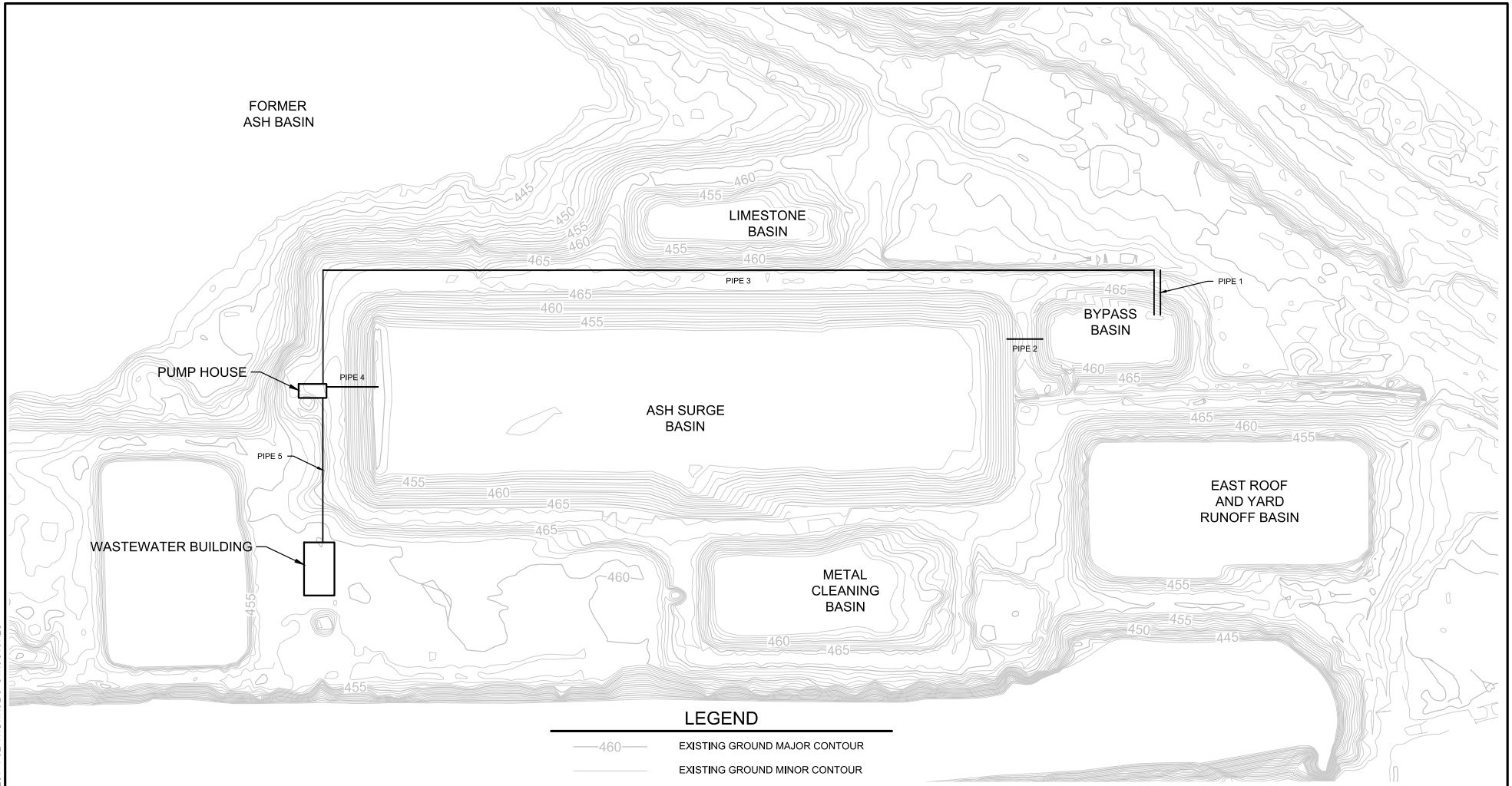
Figure 9 – Slope Stability Output, Section 2 - 257.73(e)(1)(iii)



2,000 1,000 0 2,000 Feet 	
Site Location Ash Surge and Bypass Basins Powerton Station Pekin, Illinois	
San Diego	October 2016
Figure 1	

K:\GIS\Powerton\SiteLocation.mxd Name

Z:\CADD\FIGURES\POWERTON\SW0251-F02 HYDRAULIC STRUCTURES



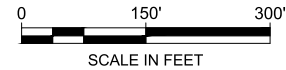
LEGEND

- 460 EXISTING GROUND MAJOR CONTOUR
- EXISTING GROUND MINOR CONTOUR
- PIPE LOCATION

SOURCE OF SURVEY:
 TOPOGRAPHY WITHIN THE ASH SURGE AND BYPASS BASINS IS BASED ON TOP OF LINER TOPOGRAPHY FOR LINER REPLACEMENT PROJECTS (NRT, 2011 AND 2013). TOPOGRAPHY OUTSIDE THE LINER LIMIT OF THE BASINS IS AEROMETRIC, INC. PROJECT NUMBER 1080611, DATED 6-19-2008.

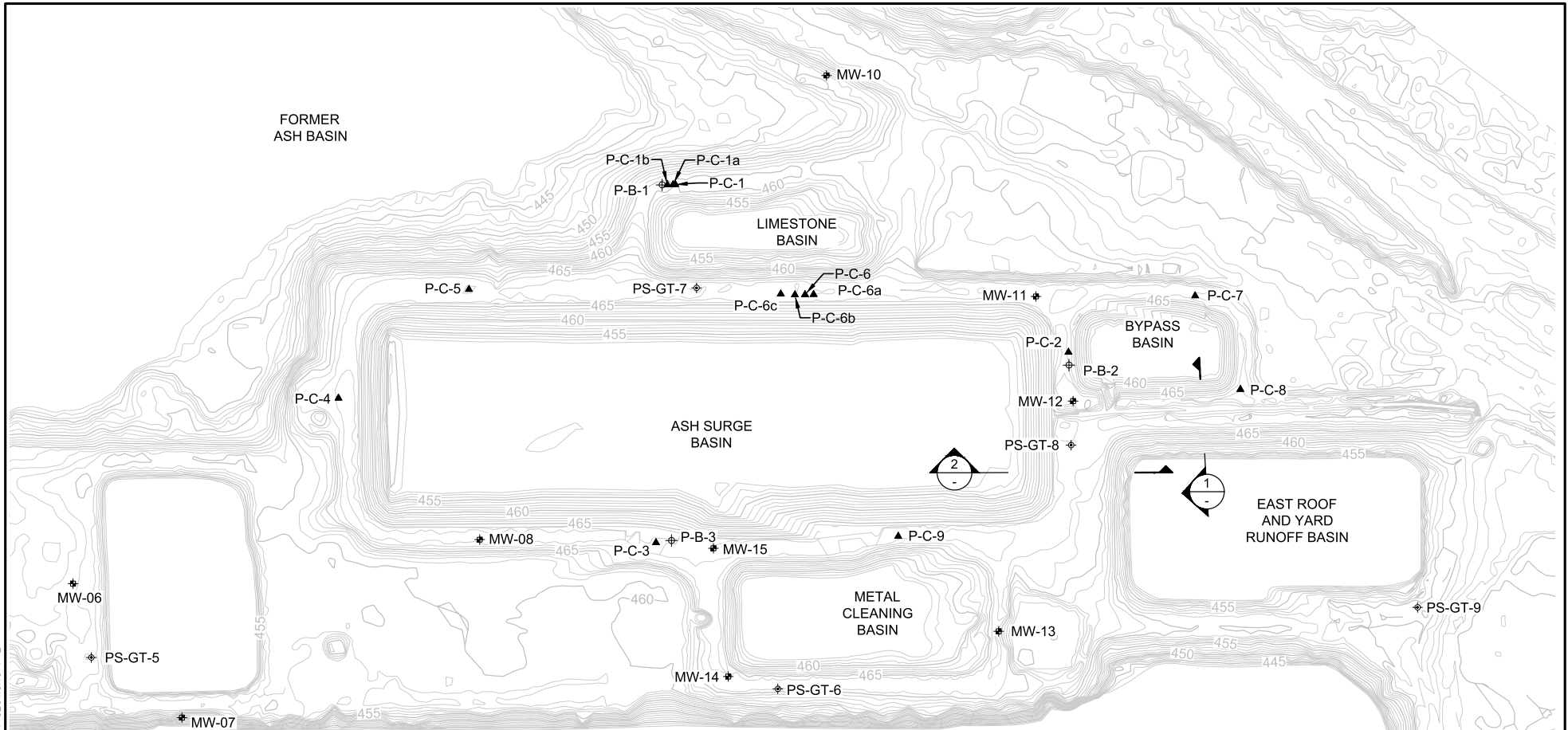
HORIZONTAL DATUM: NAD83 IL SPC WEST
 VERTICAL DATUM: LOCAL PLANT DATUM

NOTES:
 1. ALL PIPE LOCATIONS ARE APPROXIMATE.



HYDRAULIC STRUCTURE LOCATIONS ASH SURGE AND BYPASS BASINS POWERTON STATION PEKIN, ILLINOIS	
	FIGURE 2
PROJECT NO: SW0251-07	OCTOBER 2016

Z:\CADD\FIGURES\POWERTON\SW0251-F01 STABILITY SECTIONS 1-2



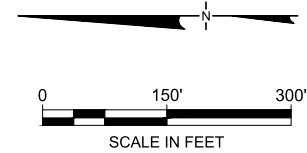
SOURCE OF SURVEY:
 TOPOGRAPHY WITHIN THE ASH SURGE AND BYPASS BASINS IS BASED ON TOP OF LINER TOPOGRAPHY FOR LINER REPLACEMENT PROJECTS (NRT, 2011 AND 2013). TOPOGRAPHY OUTSIDE THE LINER LIMIT OF THE BASINS IS AEROMETRIC, INC. PROJECT NUMBER 1080611, DATED 6-19-2008.

HORIZONTAL DATUM: NAD83 IL SPC WEST
 VERTICAL DATUM: LOCAL PLANT DATUM

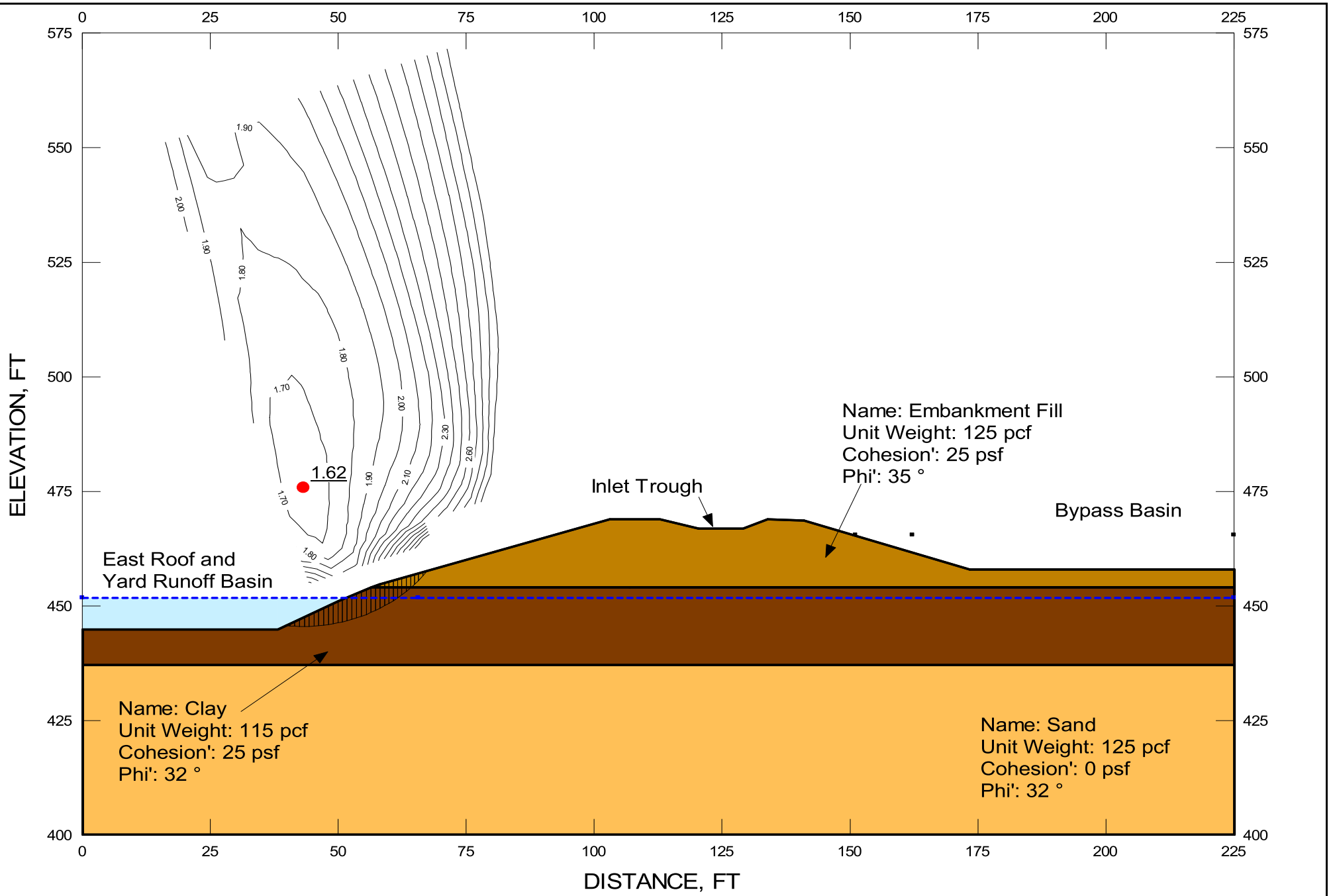
LEGEND

- 460 — EXISTING GROUND MAJOR CONTOUR
- — — EXISTING GROUND MINOR CONTOUR
- ⊕ MW-03 MONITORING WELL (PATRICK, 2011)
- ⊗ P-B-1 BORING (GEOSYNTEC, 2016)
- ▲ P-C-1 CPT SOUNDING (GEOSYNTEC, 2016)
- ⊕ PS-GT-5 BORING (KPRG, 2005)
- ⊕ CROSS SECTION LOCATION

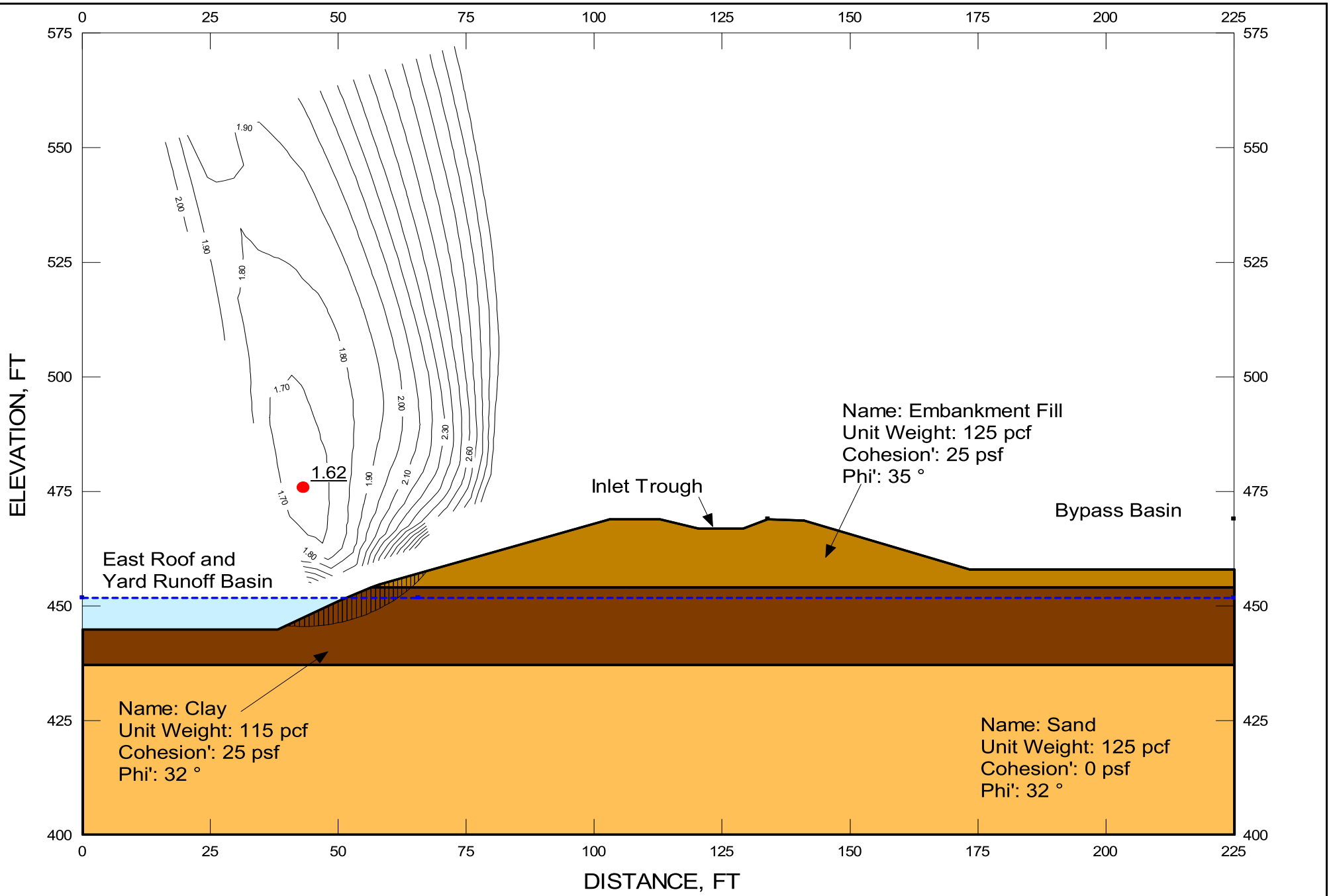
NOTES:
 1. ALL EXPLORATION LOCATIONS ARE APPROXIMATE.



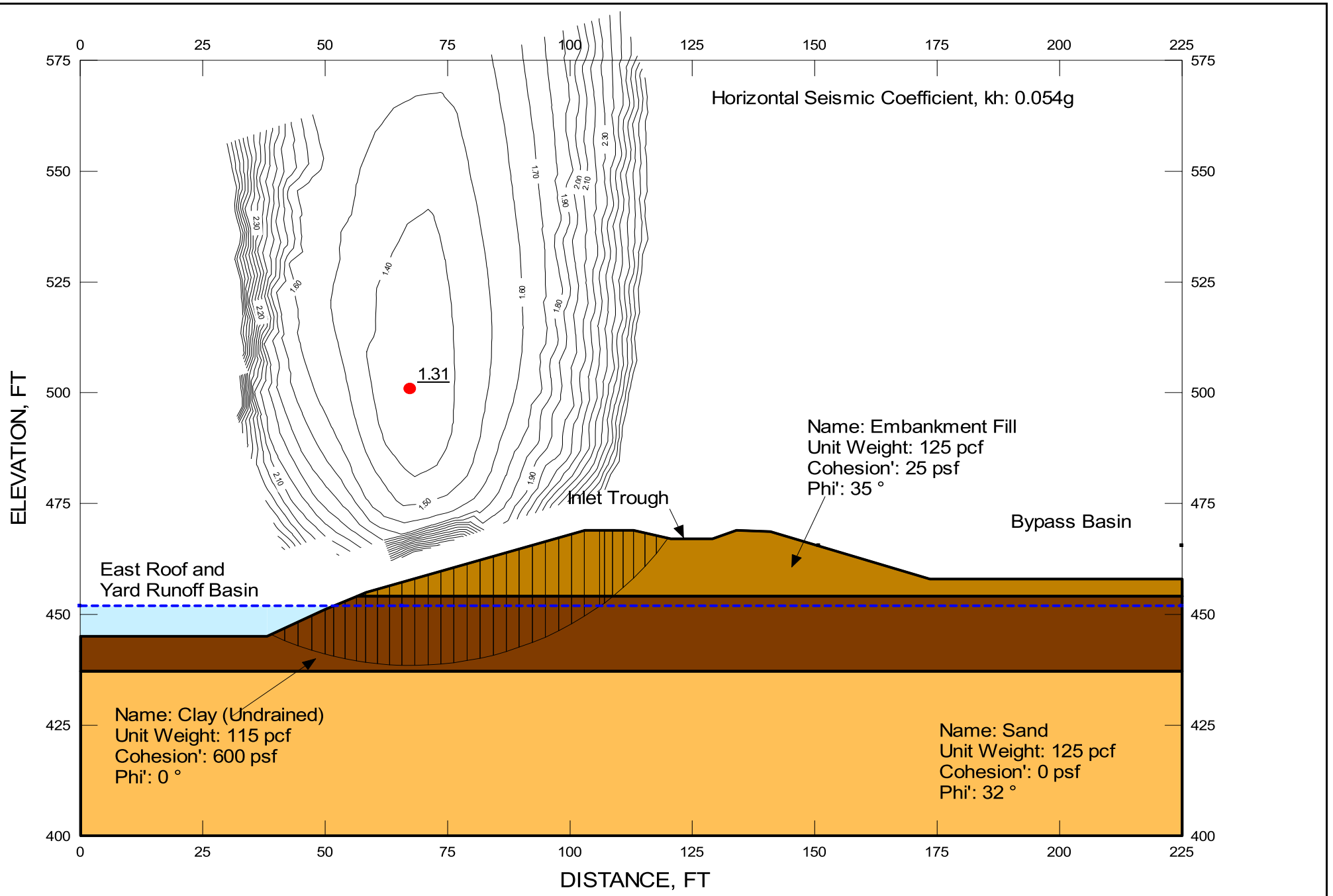
STABILITY SECTIONS ASH SURGE AND BYPASS BASINS POWERTON STATION PEKIN, ILLINOIS	
PROJECT NO: SW0251-07	OCTOBER 2016
FIGURE 3	

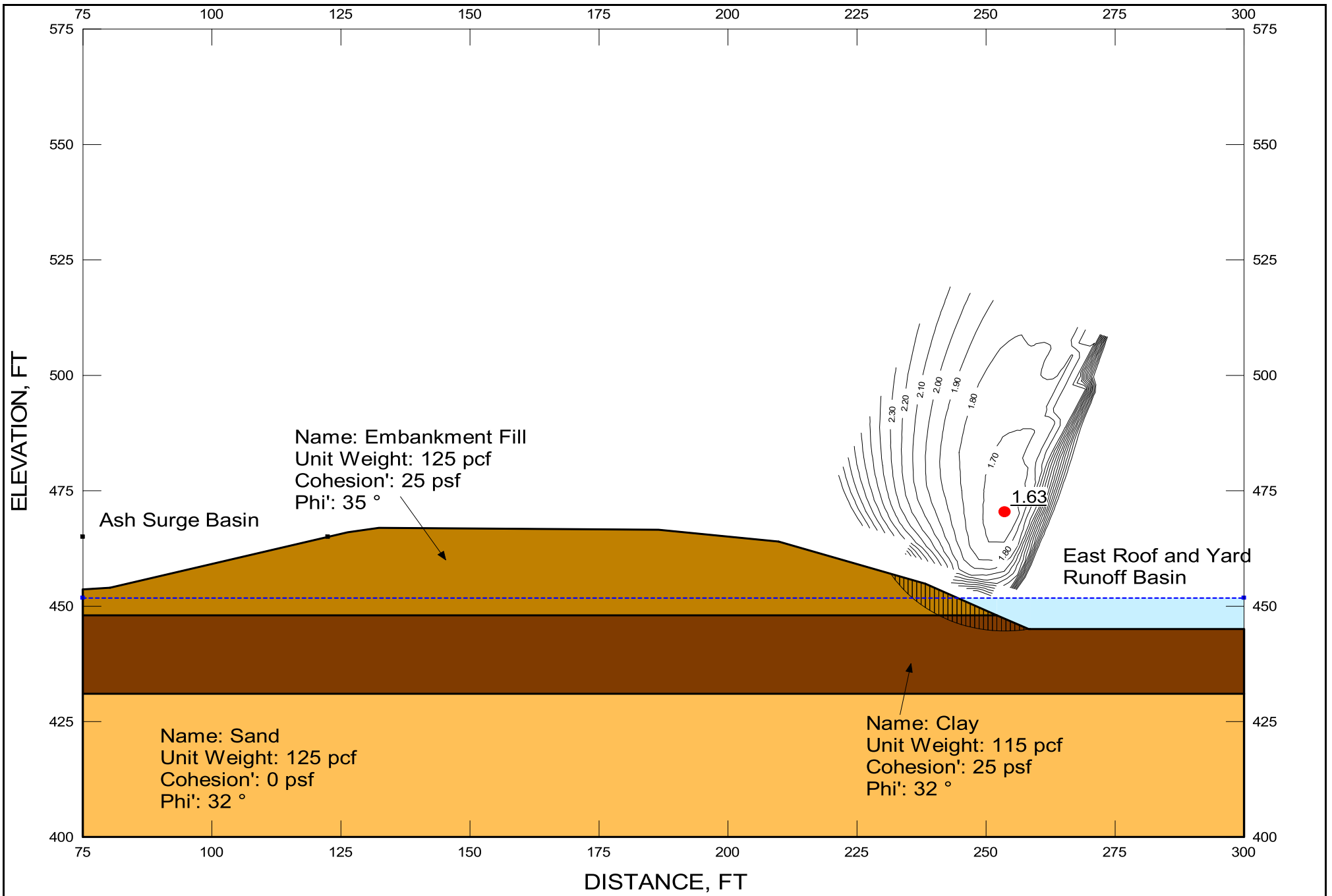


Analysis	Section 1 - §257.73(e)(1)(i): Long Term, Maximum Storage Pool Loading	
Project	Powerton Ash Surge and Bypass Basins	Analysis By Cory Russell
File Name	Powerton Section 1.gsz	Date October 2016

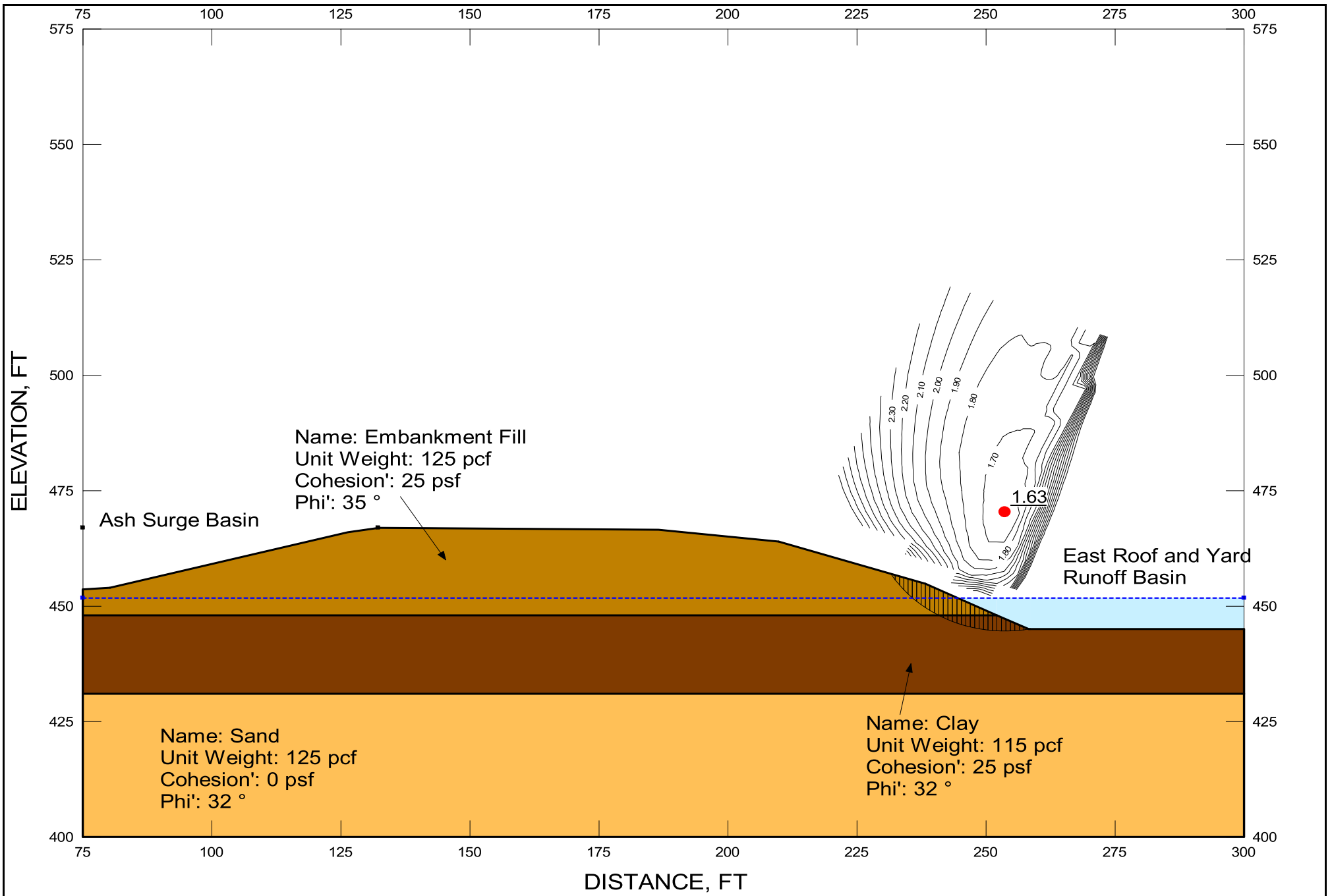


Analysis	Section 1 - §257.73(e)(1)(ii): Maximum Surcharge Pool Loading	
Project	Powerton Ash Surge and Bypass Basins	Analysis By Cory Russell
File Name	Powerton Section 1.gsz	Date October 2016

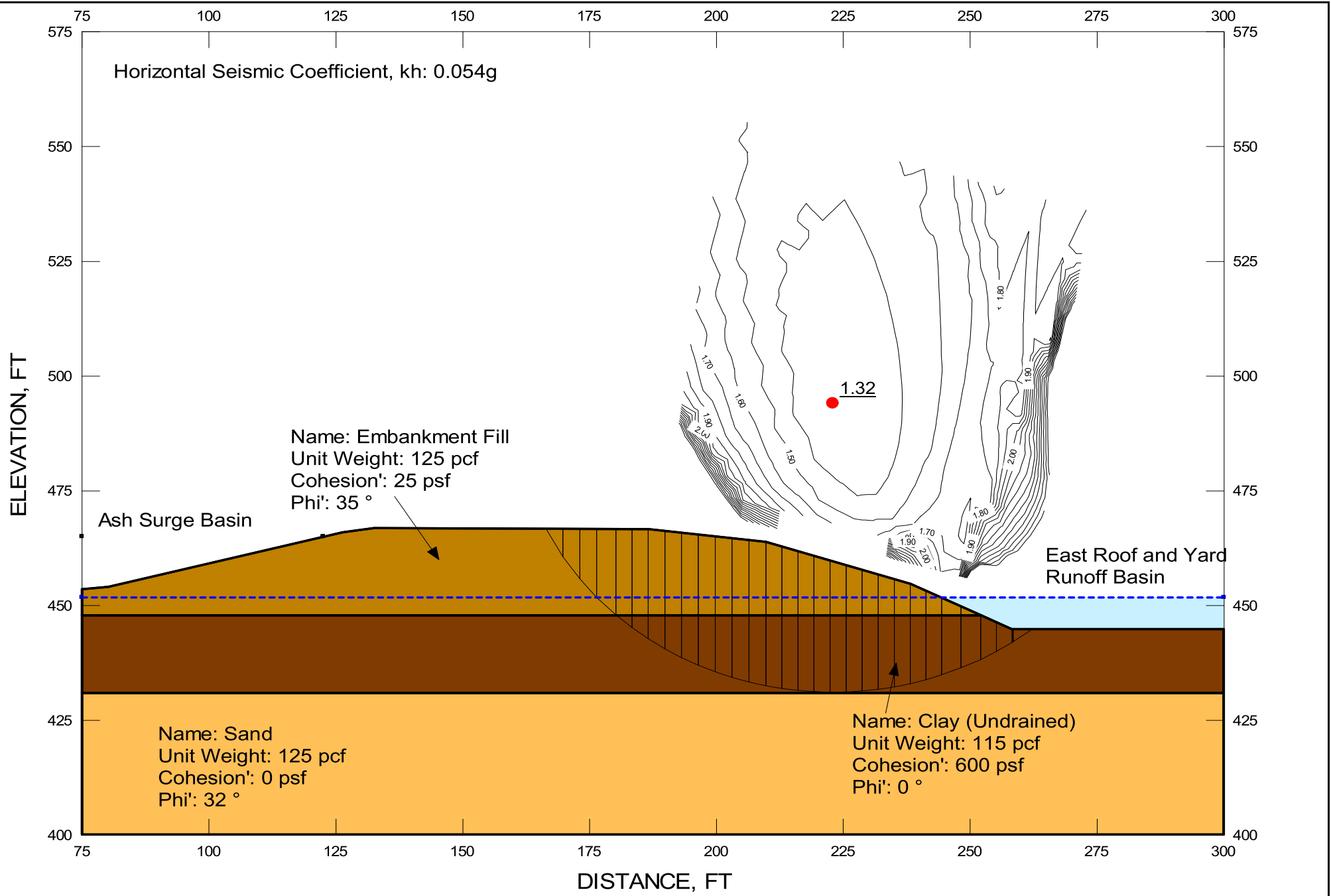




Analysis	Section 2 - §257.73(e)(1)(i): Long Term, Maximum Storage Pool Loading	
Project	Powerton Ash Surge and Bypass Basins	Analysis By Cory Russell
File Name	Powerton Section 2.gsz	Date October 2016



Analysis	Section 2 - §257.73(e)(1)(ii): Maximum Surcharge Pool Loading	
Project	Powerton Ash Surge and Bypass Basins	Analysis By Cory Russell
File Name	Powerton Section 2.gsz	Date October 2016



MWVG

Midwest Generation, LLC

POWERTON GENERATING STATION

SPECIFICATION P-1401

**CONSTRUCTION QUALITY ASSURANCE
FOR
BYPASS BASIN RETROFIT**

S&L PROJECT NO.: 12661-181

REVISION 0

ISSUE PURPOSE: BIDS

ISSUE DATE: 04-19-2024






SECTION 000106

ISSUE SUMMARY AND APPROVAL PAGE

<u>Rev.</u>	<u>Purpose of Issue</u>	<u>Date</u>	<u>Sections Affected</u>
0	Bids	04-19-2024	All

This is to confirm that this Specification has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0407, Specifications and Bills of Materials, which is part of our Quality Management System.

Contributor Summary & Current Revision Signatures

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>	<u>Approved By</u>
0	 A. Sahlas	_____ T. Dehlin	_____ T. Dehlin



SECTION 000107
CERTIFICATION PAGE

Sargent & Lundy (S&L) is registered in the State of Illinois to practice engineering. S&L's Illinois Department of Financial and Professional Regulation registration number is 184-000106.

I certify that this Specification was prepared by me or under my direct supervision and that I am a registered professional engineer under the laws of the State of Illinois.

Certified By: _____ Thomas J. Dehlin _____ Date: _____ April 19, 2024 _____

Seal:





SECTION 000110
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DIVISION 00 – PROCUREMENT AND CONTRACTING

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DIVISION 01 – GENERAL REQUIREMENTS

Section 011100 Summary of Work
Section 014362 Construction Quality Assurance for Fill, Liner, and Leachate Collection
Materials

END OF SECTION 000110



SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

101. **PROJECT INFORMATION**

- 101.1 Owner: Midwest Generation, LLC (MWG)
- 101.2 Design Engineer: Sargent & Lundy (S&L)
- 101.3 Project Name: Bypass Basin Retrofit
- 101.4 Project Location: Powerton Generating Station
13082 E. Manito Rd.
Pekin, IL 61554

102. **DESCRIPTION OF THE PROJECT AND GENERAL BACKGROUND**

- 102.1 The purpose of this project is to retrofit the Bypass Basin at Midwest Generation, LLC's Powerton Generating Station in accordance with the Illinois Pollution Control Board's Coal Combustion Residuals (CCR) Rule, 35 Ill. Adm. Code Part 845, and with the U.S. Environmental Protection Agency's (EPA) CCR Rule, 40 CFR Part 257 Subpart D.
- 102.2 The Bypass Basin will be retrofitted by removing all CCR and CCR-mixed materials stored in the basin and decontaminating the basin's existing geomembrane liner and appurtenant structures, which will remain in place. Following removal of CCR and CCR-mixed material from the basin and decontamination of the basin facilities remaining in-place, a new composite liner system and new leachate collection and removal system (LCRS) will be installed within the Bypass Basin over the basin's existing decontaminated and leak-tested geomembrane liner.

103. **SCOPE OF WORK**

- 103.1 In general, this Specification covers the field and laboratory activities for a Construction Quality Assurance (CQA) Contractor to provide assurance and documentation that the Bypass Basin at the Powerton Generating Station is retrofitted in accordance with the Earthwork Specification (P-1400), the Geosynthetic Materials Specification (P-1402), the Design Drawings, and permit requirements.
- 103.2 The CQA Work shall include but not be limited to the following:
- a. Prepare a CQA Plan that provides a detailed description of the activities that will be performed by the CQA Contractor in accordance with the Design Drawings and this Specification.
 - b. Verify and document that all appropriate measures are taken by the Earthwork Contractor and the Geosynthetics Contractor to protect the Bypass Basin's existing geomembrane liner from damage throughout the project.
 - c. Perform earthwork inspection and testing work specified in Section 014362 to:
 - c1. Verify compliance of materials with Project Specifications and Design Drawings.
 - c2. Perform specified field material and installation tests.



- c3. Obtain samples and perform laboratory tests and/or contract to have laboratory tests performed and audit laboratory test results.
- c4. Perform inspections during construction as specified.
- d. Perform geosynthetics inspection and testing work specified in Section 014362 to:
 - d1. Verify compliance of materials with the Project Specifications and Design Drawings.
 - d2. Perform field material and installation tests.
 - d3. Obtain samples and perform laboratory tests and/or contract to have laboratory tests performed and audit laboratory test results.
 - d4. Witness field testing and audit field test results as specified.
 - d5. Perform inspections during construction.
- e. Identify non-conforming work.
- f. Meetings, Documentation, and Reports:
 - f1. Participate in project meetings.
 - f2. Prepare CQA records and documents.
 - f3. Prepare CQA reports, including:
 - f3.1 Preparing an Index Report listing all CQA reports prepared throughout the project.
 - f3.2 Preparing and certifying Weekly Summary Reports until the end of the project.
 - f3.3 Preparing and certifying a Final Report at the end of the project.
- 103.3 The CQA Work shall conform to the requirements of this Specification and shall be performed and supervised by personnel who are experienced and knowledgeable in the crafts and trades required by the Scope of Work. The CQA Work shall be performed exclusively by the CQA Contractor's trained and competent personnel or, where permitted, that of its subcontractor(s); and shall comply with all applicable safety laws, regulations, programs, and practices to ensure the safety of those located on the work site and associated laboratories, including the CQA Contractor's personnel (or that of its subcontractor(s)) performing the CQA Work.
- 103.4 Performance of the CQA Work shall include all the labor, supervision, administration, management, tools, testing equipment, and consumables to execute the CQA Work identified herein.
- 103.5 Inspection and tests specified in this Specification shall be performed by personnel qualified to perform such inspections and tests.
- 104. RESPONSIBILITY AND AUTHORITY
- 104.1 The responsibilities and authority are described below for the organizations that will be involved in the design, permitting, and construction activities associated with the project.



- a. Permitting Authority:
 - a1. The Illinois EPA is the Permitting Authority and is responsible for reviewing the permit application for retrofitting the Bypass Basin to assure compliance with state regulations and for granting the construction permit for the project.
 - a2. The Permitting Authority may review any design revisions during construction and any requests for variance submitted by the Owner. The Permitting Authority has the authority to review and approve all CQA documentation and reports and to confirm the Bypass Basin was retrofitted as specified in Project Specifications and the Design Drawings.
- b. Owner:
 - b1. MWG is the Owner of the facility and has the authority to accept or reject materials and workmanship of the Earthwork Contractor or the Geosynthetics Contractor, or reports and recommendations of the CQA Contractor.
 - b2. The Owner will ultimately be responsible for the retrofit construction for the Bypass Basin and for assuring the Permitting Authority that the construction meets or exceeds the requirements specified in state regulations, permits, Project Specifications, and the Design Drawings. The Owner will accomplish this by retaining a CQA Contractor for the project.
- c. Design Engineer:
 - c1. S&L is the Design Engineer and is responsible for designing the retrofitted features for the Bypass Basin.
 - c2. The Design Engineer will ensure that the retrofit design meets the construction requirements of the Owner and meets or exceeds the requirements of the Permitting Authority.
 - c3. The Design Engineer will resolve unexpected conditions or unanticipated problems during construction, which may require changes to the permitted design. Changes to the permitted design shall require approval of the Owner and Design Engineer to ensure that the original design objectives are still maintained. All changes shall meet state regulatory requirements and the rules promulgated thereunder and may include Permitting Authority-approved variances to the rules.
- d. Earthwork Contractor. The Earthwork Contractor is the firm with whom the Owner establishes a contract to perform all earthwork and sitework required to retrofit the Bypass Basin, as specified on the Design Drawings and in Specification P-1400.
- e. Geosynthetics Contractor. The Geosynthetics Contractor is the firm with whom the Owner establishes a contract to procure and install the geosynthetic clay liner, high-density polyethylene geomembrane liner, and drainage geocomposite for the retrofitted Bypass Basin, as specified on the Design Drawings and in Specification P-1402.
- f. CQA Contractor:
 - f1. The CQA Contractor shall be the company employed by the Owner who is responsible for performing the CQA Work. The CQA Contractor shall be objective, competent, and independent from the Earthwork and Geosynthetics Contractors, whose work is being inspected. The CQA Contractor shall remain independent throughout the duration of the project.



- f2. The CQA Contractor's team shall include the CQA Officer and two or more CQA Inspectors.
- g. CQA Officer:
 - g1. The CQA Officer shall be a professional engineer licensed in the State of Illinois who shall be responsible for implementation of the CQA Work. The CQA Officer shall be responsible to the Owner.
 - g2. The CQA Officer shall be responsible for the performance of activities specified herein such as auditing, inspecting, sampling, testing, documenting, and for preparing and certifying the Final Report. In addition, the CQA Officer and/or its inspectors shall have the responsibility of daily coordination with CQA Inspectors, the Earthwork Contractor and its subcontractors, the Geosynthetics Contractor and its subcontractors, and the Owner to discuss daily progress, review completed work, plan for upcoming work, perform visual inspections, review test results, and discuss and assist in resolving any current or potential construction problems.
 - g3. Except as provided by Paragraph 104.1g4, the CQA Officer shall be present to provide supervision and assume responsibility for performing all inspections of the following activities, when applicable:
 - g3.1 Compaction of subgrade materials.
 - g3.2 Installation of the new composite liner system.
 - g4. If the CQA Officer is unable to be present as required by Paragraph 104.1g4, the CQA Officer shall provide the following in writing:
 - g4.1 The reasons for the CQA Officer's absence.
 - g4.2 A designation of a person who must exercise professional judgment in carrying out the duties of the CQA Officer-in-Absentia.
 - g4.3 A signed statement that the CQA Officer assumes full responsibility for all inspections performed and reports prepared by the designated CQA Officer-in-Absentia during the absence of the CQA Officer.
- h. CQA Inspectors:
 - h1. The CQA Inspectors shall be responsible for performing visual examinations and for performing or obtaining field and laboratory tests. The CQA Inspectors shall be under the direct supervision of the CQA Officer.
 - h2. The CQA Inspectors shall be responsible for reporting to the CQA Officer and the Owner's representative the results of any inspections or tests indicating materials or installed work are of unacceptable quality or do not meet specified design requirements.
 - h3. The work shall be divided so that two or more CQA Inspectors, each with specialized knowledge and training, will be involved in inspection work.
- 105. QUALIFICATIONS
 - 105.1 CQA Officer:
 - a. The CQA Officer shall be a registered professional engineer in the State of Illinois with at least 10 years of experience in design/construction/permitting/licensing, at least 5 years



of which is CQA experience as a certifying engineer on landfills or ponds with geomembrane liner systems.

- b. The CQA Officer shall be qualified by education, technical knowledge, and experience to complete the technical certifications required by this Specification.

105.2 CQA Inspectors:

- a. The CQA Inspectors shall have adequate formal academic training and sufficient practical and technical experience needed to execute and record auditing and inspection activities conducted at the site and perform all required laboratory and field testing. This includes a demonstrated knowledge of the various aspects of the type of work being conducted.

- b. As required, different CQA Inspectors, each with specialized knowledge and experience, shall be employed for different portions of the work.

- c. CQA Earthwork Inspectors:

- c1. The lead CQA field inspector for earthwork (Lead CQA Earthwork Inspector) shall have at least 5 years of experience as an earthwork inspector.

- c2. All CQA Earthwork Inspectors shall be knowledgeable in:

- c2.1 Field practices relating to construction techniques used for the type of earthwork being performed.

- c2.2 Construction and compaction equipment.

- c2.3 All codes and regulations concerning material installation.

- c2.4 Observation procedures for earthwork construction.

- c2.5 Sampling and earthwork testing procedures.

- c2.6 Testing equipment.

- c2.7 Documentation procedures.

- c2.8 Site safety.

- d. CQA Geosynthetics Inspectors:

- d1. The lead CQA field inspector for geosynthetics (Lead CQA Geosynthetics Inspector) shall have at least 5 years of CQA experience as a field inspector on projects with a geomembrane lining system including two years as a CQA inspector.

- d2. All CQA Geosynthetics Inspectors shall be knowledgeable in:

- d2.1 Field practice relating to techniques used for the installation of geosynthetic clay liners (GCLs), high-density polyethylene (HDPE) geomembranes, pipes, HDPE geonets, and non-woven geotextiles.

- d2.2 Correct procedures for seaming GCL.

- d2.3 HDPE geomembrane welding equipment and the correct operating procedures for seaming HDPE geomembranes, including but not limited to:

- d2.3.1 Non-destructive seam testing procedures and failure criteria.



- d2.3.2 Sampling for destructive testing of samples of seams and laboratory testing procedures.
- d2.3.3 Laboratory testing equipment.
- d2.4 Geotextile seaming equipment and the correct procedures for splicing geotextiles and joining HDPE geonets.
- d2.5 All codes and regulations concerning material installation.
- d2.6 Documentation procedures for field and laboratory tests.
- d2.7 Site safety.

106. DEFINITIONS

- 106.1 The term "Design Drawing" means the Design Engineer's drawings indicating the Work to be performed.
- 106.2 The term "Project Specifications" means the technical specifications issued by the Design Engineer that define minimum material, installation, and/or testing requirements for the Work. Project Specifications include this Specification, the Earthwork Specification (P-1400), and the Geosynthetic Materials Specification (P-1402).
- 106.3 The term "Work" means the services furnished to complete the CQA activities specified herein.
- 106.4 The term "Owner-approved equal" means an acceptable equivalent to a specified material or equipment that has been accepted by the Owner.

107. PROJECT MEETINGS

- 107.1 Project meetings will be held on a periodic basis during the lifetime of the project. The meetings will include:
 - a. A preconstruction meeting.
 - b. Progress meetings.
 - c. Additional meetings as required to discuss problems or work deficiencies.
- 107.2 Preconstruction Meeting:
 - a. The preconstruction meeting will be organized by the Owner. In addition to the Owner, the Design Engineer, the Earthwork Contractor, the Geosynthetics Contractor, the CQA Officer (or CQA Officer-in-Absentia), the Lead CQA Inspectors, and any other interested party designated by the Owner shall attend the preconstruction meeting.
 - b. The preconstruction meeting shall be used to discuss:
 - b1. Site specific safety requirements.
 - b2. Requirements of the Design Drawings and the Project Specifications.
 - b3. The CQA Contractor's CQA Plan and the responsibilities of each party.
 - b4. The lines of authority and communication.
 - b5. Procedure for submittal of manufacturer QA/QC documents for audit.



- b6. Procedures for examination of materials delivered to the site.
 - b7. Location of material storage area(s).
 - b8. Field and laboratory test requirements and sample sizes.
 - b9. Procedures for observance of field tests.
 - b10. Coordination between each contractor and the Lead CQA Inspectors to obtain timely field samples and tests.
 - b11. Procedure for handling construction deficiencies, repairs, and retesting.
 - b12. Work area security and safety protocol.
 - b13. Work days and work hours.
 - b14. Coordination with other contractors or trades.
 - b15. Site visits.
- 107.3 Weekly Progress Meetings:
- a. Weekly progress meetings will be scheduled by the Owner. In addition to the Owner, the meetings shall be attended by the Design Engineer, the Earthwork Contractor, the Geosynthetics Contractor, the CQA Officer (or CQA Officer-in-Absentia), and the Lead CQA Inspectors.
 - b. If needed, daily meetings shall be held each day to review the work schedule, work completed, results of tests, and to discuss potential construction problems.
 - c. The Owner or its designee will document each meeting and distribute copies of meeting minutes to all responsible parties.
- 107.4 Additional Meetings:
- a. Additional meetings between one or more contractors, the Lead CQA Inspector(s), and the CQA Officer (or the CQA Officer-in-Absentia) shall be held immediately after a work deficiency is identified or a problem arises. These meetings shall be used to define and resolve the problem.
 - b. Any supervisor/superintendent can request such a meeting through their line of authority.
 - c. Possible solutions to the problem shall be discussed, and an acceptable solution shall be selected. This solution shall be implemented provided it does not conflict with or require a change to the Design Drawings, in which case the solution shall be submitted to the Design Engineer for review.
 - d. The Design Engineer will resolve unexpected conditions or unanticipated problems during construction, which may require changes to the permitted design. Changes from the permitted design shall require approval by the Owner and Design Engineer to ensure that the original design objectives are maintained. All changes shall meet the requirements of the Permitting Authority and may include regulations approved by the Permitting Authority.
 - e. The CQA Contractor shall document each special meeting and distribute copies of minutes to all responsible parties.



108. PERFORMANCE AUDITS AND CQA DOCUMENTATION

- 108.1 As a minimum, the CQA Officer shall conduct the following reviews and performance audits:
- a. Full review and audit of results of preconstruction testing or Earthwork Contractor's material certificates used to qualify earthwork materials for construction use.
 - b. Full review and audit of manufacturer certificates that qualify geosynthetic materials for use in the composite liner system and leachate collection and removal system.
 - c. Weekly audit of reports and test data sheets during and after construction of the earthwork until completion of work.
 - d. Weekly audit of reports and test data sheets during and after installation of composite liner system materials until completion of the work.
 - e. Weekly audit of reports and test data sheets during and after installation of leachate collection and removal system materials until completion of the work.
- 108.2 When auditing documentation produced by material suppliers and third-party testing laboratories, the CQA Contractor shall, at a minimum:
- a. Verify that material samples tested are representative of the material(s) to be used in this project.
 - b. Verify that material samples were tested in accordance with the specified tests and at the specified frequencies.
 - c. Verify that all tests performed meet the applicable testing standards and parameters specified (e.g., met specified ASTM method).
 - d. Verify that all test records include the information specified in the Project Specifications, Design Drawings, and/or the specified test standard (e.g., includes all reporting data required by the specified ASTM method).
- 108.3 CQA documentation shall be well-documented and include at least the following:
- a. Daily records, which shall include:
 - a1. Inspection data sheets.
 - a2. Data sheets listing the number and types of construction equipment used by the Earthwork Contractor and/or Geosynthetics Contractor, including applicable construction equipment data.
 - a3. Problem identification reports and corrective action reports. Problem identification reports and corrective action reports shall include detailed descriptions of materials and/or workmanship that do not meet a specified design and shall be cross-referenced to specific inspection data sheets where the problem was identified and corrected.
 - b. Testing records, which shall include:
 - b1. Material shipping and manufacturer QA/QC data sheets.
 - b2. Data sheets describing field samples taken.
 - b3. Laboratory data sheets.



- b4. Field test data sheets.
- b5. Notes, charts, drawings, or sketches identifying the location and elevation of field tests, location of failures and repairs or retests, and where samples were obtained.
- b6. Non-destructive test reports including location of failures, records of repairs, and results of retests.
- c. Photographic records, which shall include:
 - c1. Digital photographs, each with a unique identifying number.
 - c2. Figure indicating the location from which each photograph was taken.
 - c3. Summary list giving the date and time of each photograph.
- 108.4 All records shall, at a minimum, bear the following:
 - a. Unique identifying sheet number.
 - b. The date.
 - c. Project name, project number, and location.
 - d. Descriptive remarks.
 - e. Data sheets for tests.
 - f. Written text descriptions for visual observations
 - g. Signature of the preparer of designated authority.

END OF SECTION 011100



SECTION 014362

QUALITY ASSURANCE FOR FILL, LINER, AND LEACHATE COLLECTION MATERIALS

PART 1 – GENERAL

101. EXTENT

101.1 This section defines the requirements for Construction Quality Assurance (CQA) activities to ensure that the quality of materials and installation procedures used to retrofit the Bypass Basin are in accordance with the Earthwork Specification (P-1400), Geosynthetic Materials Specification (P-1402), Design Drawings, permit requirements, and as specified herein.

101.2 The Work specified within this section is the responsibility of the CQA Contractor and shall include, but not be limited to, the following items:

- a. Attend project meetings and site visits for coordination between the Owner, the Earthwork Contractor, the Geosynthetics Contractor, subcontractors, and the CQA Contractor.
- b. Perform pre-construction material certification activities to ensure materials meet or exceed specified requirements, including, but not limited to:
 - b1. Testing for suitability of material prior to use.
 - b2. Performing pre-construction audits of material certifications prior to material use.
- c. Perform CQA activities during construction to ensure materials meet or exceed specified requirements, including, but not limited to:
 - c1. Audits of material certifications.
 - c2. Perform field observations, inspections, and tests.
 - c3. Perform laboratory tests and reviews of test results.
 - c4. Material sampling.
- d. Documentation of all observations, findings, and testing, and of conformance of work to the Project Specifications, the Design Drawings, and permit requirements, which will be submitted by the Owner to the Permitting Authority.
- e. Preparation of an Index Report, an Acceptance Report, Weekly Summary Reports, and a Retrofit Completion Report.
- f. Submit a draft version of the Retrofit Completion Report to the Owner and Design Engineer for their review and comment. Upon resolution of all comments, submit a final version of the Retrofit Completion Report, sealed and certified by the CQA Officer, to the Owner and Design Engineer.

101.3 Definitions:

- a. The following definitions of terms shall apply throughout this section:
 - a1. GCL Manufacturer: The manufacturer who is, pursuant to Specification P-1402, responsible for manufacturing GCL materials and for transporting GCL materials to the site.



- a2. GM/GC Manufacturer: The manufacturer who is, pursuant to Specification P-1402, responsible for manufacturing HDPE geomembrane and drainage geocomposite materials and for transporting HDPE geomembrane and drainage geocomposite materials to the site.
- a3. Pipe Manufacturer: The manufacturer who is, pursuant to Specification P-1400, responsible for manufacturing LCRS pipe materials and fittings and for transporting these materials to the site.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS AND SPECIFICATIONS

102.1 CQA Specification (P-1401):

- a. Section 011100 – Summary of Work.

102.2 Earthwork Specification (P-1400):

- a. Section 319005 – Earthwork.
- b. Section 319050 – Leachate Collection and Removal System.
- c. Geosynthetic Materials Specification (P-1402):
- d. Section 319025 – Geosynthetic Clay Liner.
- e. Section 319020 – High-Density Polyethylene Geomembrane Liner with Geocomposite.

103. REFERENCE DOCUMENTS

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

103.3 Abbreviations listed indicate the form used to identify the reference documents cited in this section.

103.4 ASTM – ASTM International:

- a. D422 Standard Test Method for Particle-Size Analysis of Soils.
- b. D1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- c. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- d. D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- e. D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
- f. D2434 Standard Test Method for Permeability of Granular Soils (Constant Head).
- g. D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).



- h. D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).
 - i. D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - j. D4643 Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating.
 - k. D4959 Standard Test Method for Determination of Water Content of Soil By Direct Heating.
 - l. D5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 - m. D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
 - n. D5887 Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
 - o. D5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.
 - p. D5891 Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.
 - q. D5993 Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners.
 - r. D6243 Standard Test Method for Determining the Internal and Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method.
 - s. D6496 Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.
 - t. D6768 Standard Test Method for Tensile Strength of Geosynthetic Clay Liners.
 - u. D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- 103.5 ITP – Illinois Test Procedure:
- a. 27 Sieve Analysis of Fine and Coarse Aggregates
104. SUBMITTALS
- 104.1 Submittals with Bid Proposal:
- a. Documentation to substantiate that the CQA Contractor's and its laboratory's Accreditation Certifications are current.
 - b. Detailed resumes on all CQA laboratory and field personnel proposed for the Work, including:
 - b1. A complete description of their qualifications and previous experience in the same type of work.
 - b2. Documentation of certification to perform required testing.



- 104.2 Submittals During the Course of the Work:
- a. Certifications and submittals as specified herein.
 - b. An Index Report, an Acceptance Report, Weekly Summary Reports, and a Retrofit Completion Report as described below shall be prepared.
 - b1. Index Report:
 - b1.1 An Index Report shall be prepared listing all records and reports.
 - b1.2 The Index Report shall be assembled in chronological framework for recording and identifying all reports.
 - b2. Weekly Summary Reports:
 - b2.1 At the end of each week of construction, until construction is complete, a Weekly Summary Report must be prepared by either the CQA Officer or under the supervision of the CQA Officer and submitted to the Owner and the Design Engineer. The CQA Officer must review and approve each Weekly Summary Report.
 - b2.2 The Weekly Summary Report shall contain descriptions of the weather, locations where construction occurred during the previous week, materials used, results of testing, inspection reports, and procedures used to perform inspections.
 - b3. Retrofit Completion Report:
 - b3.1 After the Earthwork Contractor and Geosynthetics Contractor have completed retrofit construction activities, the CQA Officer shall prepare a Retrofit Completion Report that demonstrates the Bypass Basin was retrofitted in conformance with Project Specifications, the Design Drawings, and permit requirements. At a minimum, this report shall include:
 - b3.1.1 All data sheets, testing records, manufacturer data sheets, and reports concerning items that were installed and tested.
 - b3.1.2 Photographs of the liner system and leachate collection system and any other photographs relied upon to document construction activities. All photographs shall include time, date, and location information.
 - b3.1.3 Any designations of CQA officers-in-absentia in accordance with Section 011100, Paragraph 104.1g4.
 - b3.1.4 Certification that the Earthwork Contractor's work and the Geosynthetic Contractor's work are in compliance with Project Specifications, the Design Drawings, and permit requirements.
 - b3.1.5 Certifications that:
 - b.3.1.5.1 Pipe bedding material contains no undesirable objects.
 - b.3.1.5.2 The anchor trench and backfill are constructed to prevent damage to a geosynthetic membrane.
 - b.3.1.5.3 All tears, rips, punctures, and other damage to geosynthetic materials are repaired.
 - b.3.1.5.4 All geomembrane seams are properly constructed and tested in accordance with the manufacturer's specifications.



- b.3.1.5.5 Proper filter material consisting of uniform granular fill, to avoid clogging, is used in construction.
- b.3.1.5.6 The filter material, as placed, possesses structural strength adequate to support the maximum loads imposed by the overlying materials and equipment used at the facility.
- b3.2 The first draft version of the Retrofit Completion Report shall be submitted within 1 week after completion of CQA Work to the Owner and Design Engineer for their review and comment.
- b3.3 Within 1 week of resolving all comments, the final version of the Retrofit Completion Report shall be sealed and certified by the CQA Officer and submitted to the Owner and Design Engineer.

105. CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS

105.1 Organizations Involved:

- a. The organizations involved in the design, permitting, and construction activities associated with the Work are defined in Section 011100.
- b. The responsibilities and authorities of the organizations and personnel associated with the Work are described in Section 011100.

105.2 Qualifications:

- a. The qualifications of the CQA Contractor personnel are described in Section 011100.

105.3 Project Meetings:

- a. The requirements for project meetings and audits are described in Section 011100.

105.4 Performance Audits, CQA Documentation, and CQA Reports:

- a. The requirements for performance audits and CQA documentation are described in Section 011100.
- b. The requirements for CQA reports are described in Paragraph 104.2 of this section.



PART 2 – PRODUCTS

201. PRODUCTS

- 201.1 The requirements for the various products used for retrofitting the Bypass Basin are specified in their respective technical specification sections in the Project Specifications.
- 201.2 All HDPE geomembrane liner, drainage geocomposite, and GCL for the basin's new composite liner and leachate collection and removal system will be supplied by the Geosynthetics Contractor in accordance with Specification P-1402. All other permanent materials to be used in the Work will be supplied by the Earthwork Contractor in accordance with Specification P-1400.
- a. The CQA Contractor shall coordinate with the Geosynthetics Contractor to obtain material certifications and third-party laboratory test reports required for performing the audits on GCL, HDPE geomembrane, and drainage geocomposite materials required by this Specification.
 - b. The CQA Contractor shall coordinate with the Earthwork Contractor to obtain material certifications and samples required for performing the audits and tests on all other permanent materials required by this Specification.

PART 3 – EXECUTION

301. GENERAL CQA TESTING AND INSPECTION REQUIREMENTS

- 301.1 Record daily weather conditions.
- 301.2 Field tests shall document the elevation and coordinate location for each test. The locations may be determined by survey, taping, or pacing off distances unless otherwise noted.
- 301.3 Material Source Testing: Material source testing activities include visual observations and laboratory and field testing at the material source to control material quality and material preparation prior to transport of the material to the project site.

302. CQA TESTING AND INSPECTION REQUIREMENTS FOR EXISTING LINER DECONTAMINATION AND INTEGRITY VERIFICATION

- 302.1 The CQA Contractor shall coordinate with the Geosynthetics Contractor to assemble, document the receipt of, and audit the report prepared by the Geosynthetics Contractor in accordance with Specification P-1402, Section 011100 containing the following:
- a. Visual inspection notes and digital photographs.
 - b. Electrical leak location survey results.
 - c. Documentation of any repairs made to the existing liner.
- 302.2 The CQA Contractor shall coordinate with the Owner to assemble, document the receipt of, and audit the following documents related to the decontamination of the Bypass Basin's existing HDPE geomembrane liner and approval for re-using the existing liner:
- a. Laboratory test results on samples of the existing liner demonstrating that the liner is no longer contaminated with CCR constituents.
 - b. Illinois EPA's written approval for re-using the existing liner as a supplemental liner in the retrofitted Bypass Basin.



302.3 The CQA Contractor shall include the documents listed in Paragraphs 302.1 and 302.2 in the Retrofit Completion Report.

303. CQA TESTING AND INSPECTION REQUIREMENTS FOR STRUCTURAL FILL MATERIAL

303.1 Initial Material Certification:

- a. Prior to shipment of any Structural Fill material, the CQA Contractor shall assemble, document the receipt of, and audit the material supplier's test results and certifications that the properties of the material meet Specification P-1400 requirements.

303.2 Inspections and Testing During Construction:

- a. CQA activities during placement of Structural Fill shall include visual observations and laboratory and field testing to ensure that Structural Fill is installed in accordance with Specification P-1400 requirements. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-1 and the following paragraphs.
 - b. Visual Observation of the Material Source for Structural Fill Material During Construction:
 - b1. Inspect materials to ensure that they are uniform.
 - b2. Visually inspect the material in accordance with ASTM D2488.
 - b3. Inspect to ensure that only suitable material is transported to the site, observe segregation operations if unsuitable materials are present, and observe (if necessary) the removal of organic soils, roots, stumps, and stones.
 - b4. Observe changes in color or texture that can be indicative of a change in material type or moisture content.
 - b5. Observe moisture conditioning activities to ensure that any required substantial changes in moisture content are made at the source.
 - c. Visual Observation of Fill Placement:
 - c1. Record the placement method(s) the Earthwork Contractor is utilizing for installing the Structural Fill.
 - c2. In instances where the Earthwork Contractor is transporting material into the basin, the CQA Contractor shall:
 - c2.1 Verify no equipment (wheeled or tracked) is traversing the Bypass Basin area when less than 10 inches of earthen material are above the basin's existing geomembrane liner.
 - c2.2 Verify Structural Fill has been installed above the existing geomembrane liner along the basin's ramp as detailed on the Design Drawings before the Earthwork Contractor's equipment uses the ramp to transport fill material into the basin.
 - c2.3 Document the receipt of and audit the Earthwork Contractor's demonstration(s) that equipment entering the basin will not exert a ground pressure greater than 8 psi.
 - c2.4 Verify equipment operating within the basin does not hard brake on the ramp, make sharp turns, nor make quick stops that could pinch or tear the Bypass Basin's existing geomembrane liner.



- c3. Record type and size of compaction equipment in use:
 - c3.1 For rubber-tired rollers, record the tire inflation pressure, spacing of tires, and empty and ballasted wheel loads.
 - c3.2 For hand tampers, record make, model number, size and compactive effort.
 - c3.3 Observe and record compactive effort, uniformity of compaction and scarification and connection between compacted lifts. Record number of passes of a roller by type, size, and weight of roller.
 - c3.4 For proofrolling, record the type, size, and weight of compaction equipment or other vehicles used for proofrolling.
- c4. Observe removal of roots, rocks, rubbish, or out-of-specification soil from the borrow material.
- c5. Observe and record changes in soil characteristics necessitating a change in construction procedures.
- c6. Observe fill placement and procedures for proper lift thickness.
- c7. Observe procedures to be followed to adjust the soil moisture content to obtain uniform moisture content.
- c8. Observe and record final finishing procedures.
- c9. Observe and record that final grade is consistent with the design grade specified on the Design Drawings.
- d. Laboratory and Field Tests:
 - d1. Laboratory and field testing shall be performed in accordance with the requirements specified in Table 014362-1.
- e. Test Acceptance Criteria:
 - e1. Acceptance criteria shall be as specified in Specification P-1400 Section 319005.
- 304. CQA TESTING AND INSPECTION REQUIREMENTS FOR GEOSYNTHETIC CLAY LINER COMPONENT OF COMPOSITE LINER SYSTEM
 - 304.1 Initial Material Certification:
 - a. The CQA Contractor shall assemble, document the receipt of, and audit the GCL Manufacturer's submittals listed below for conformance with Specification P-1402, Section 319025.
 - a1. Certificates describing the origin and identification of the raw materials.
 - a2. Copy of the GCL Manufacturer's QA/QC certificates on tests performed on the material and a summary of results of the tests.
 - a3. Certification and guarantee by the GCL Manufacturer that the properties of the manufactured material meet the requirements of Specification P-1402, Section 319025.

- a4. Certification that the GCL was continuously inspected during the manufacturing process for, as a minimum, the following:
 - a4.1 Lack of uniformity.
 - a4.2 Damage.
 - a4.3 Imperfections.
 - a4.4 Holes.
 - a4.5 Tears.
 - a4.6 Thin spots.
 - a4.7 Foreign materials.
- b. GCL Panel Layout:
 - b1. Document receipt of the GCL Manufacturer's proposed GCL panel layout.
- c. Third-Party Quality Assurance Conformance Testing:
 - c1. Document receipt of copies of test reports prepared by the third-party, independent testing laboratory that performed conformance tests on representative samples provided by the GCL Manufacturer in accordance with Specification P-1402, Section 319025.
 - c2. Audit test reports to verify the third-party quality assurance conformance tests and test results meet the requirements of Specification P-1402, Section 319025.
- 304.2 Transportation, Handling, and Storage:
 - a. Documentation of Delivery:
 - a1. Document rolls of GCL delivered to the site.
 - a2. Document that each roll is labeled and that each label identifies the following information:
 - a2.1 Name of GCL Manufacturer.
 - a2.2 Product identification (brand name, product code).
 - a2.3 Order number.
 - a2.4 Date of manufacture.
 - a2.5 Manufacturing lot number.
 - a2.6 GCL thickness.
 - a2.7 Roll identification number.
 - a2.8 Roll dimensions (i.e., length and width) and weight.
 - a2.9 Panel number, which shall be referenced to the proposed GCL panel layout drawing prepared by the GCL Manufacturer.
 - a3. Check the QA/QC certificates on each roll to verify that the rolls received onsite meet the requirements of Specification P-1402, Section 319025. Take the identifying labels from each roll or pallet and save them for future reference.



- a4. Recommend rejection of rolls which do not have the required documentation and ensure that the rolls are removed from the site.
- b. Inspection of Manufactured Rolls:
 - b1. Inspect all manufactured rolls at the site.
 - b2. Ensure that packaging is secure and that no damage has occurred.
 - b3. If damage to packaging has occurred, inspect exposed roll surfaces, and note and identify any damage or repairable flaws. Note: This visual observation shall be conducted without unrolling rolls unless the extent of surface damage indicates that internal damage may be present.
 - b4. If damage to just the packaging has occurred, document repair of the packaging.
 - b5. If damage to the product has occurred, document that the damage or flaws are repaired or that the damaged material is wasted and removed from the site.
 - b6. Report all damage to the Owner.
- c. Handling:
 - c1. Inspect the onsite handling equipment used to move materials to ensure that it is adequate to minimize the risk of damage to materials.
 - c2. Inspect the handling of materials by installing personnel to ensure that care is used.
- d. Storage:
 - d1. Inspect the storage facility.
 - d2. Inspect the ground surface to ensure that it is dry, relatively level, smooth and free of rocks, holes, and debris.
 - d3. Document unsafe or improper storage conditions, and report conditions to the Owner.
- 304.3 Inspections During Construction:
 - a. CQA activities during placement of the GCL component of the Bypass Basin's new composite liner system shall include visual observations and field testing to ensure that the GCL is installed in accordance with the requirements of Specification P-1402, Section 319025. Field observations and tests shall be performed in accordance with the requirements specified in the following paragraphs.
 - b. Weather Conditions for Placement:
 - b1. Observe and document the weather conditions (i.e., temperature, humidity, precipitation, and wind) to ensure that they are appropriate for GCL placement. Specification P-1402, Section 319025 describes acceptable weather conditions.
 - b2. If the weather becomes unacceptable for installation of GCL, recommend stopping the installation until conditions again become favorable, thus minimizing the potential for unacceptable installation.



- c. GCL Placement:
 - c1. Supporting Surface:
 - c1.1 Prior to placement of the GCL, visually inspect the Structural Fill surface to ensure that it meets the requirements of Specification P-1400, Section 319005. Confirm that it is compacted and is free from clods of soil, rocks larger than specified, roots, sudden or sharp changes in grade, and standing water. Field observations shall be performed in accordance with the requirements specified in Table 014362-3.
 - c1.2 Provide documentation of daily inspection of the Structural Fill surface for the area of GCL to be placed that day.
 - c2. Panel Deployment, Seams, and Repairs:
 - c2.1 As each panel is unrolled, visually inspect the GCL to ensure there are no flaws or damage. The CQA Geosynthetics Inspector shall traverse the panels in such a way that the entire surface is inspected. Any defects shall be documented on a drawing and marked on the GCL for repair.
 - c2.2 Document that the location of the seams meet the general requirements for seaming contained in Specification P-1402 Section 319025.
 - c2.3 At the time of placement, make measurements to confirm that required overlap of adjacent GCL panels has been achieved, that proper temporary anchorage is being used (e.g., sand bags or tires), and that the GCL is being placed in a relaxed (nonstressed) state.
 - c2.4 Document any liner damage from adverse weather conditions, equipment, inadequate temporary anchoring, or rough handling. Any damage shall be documented on a drawing and marked on the GCL for repair.
 - c2.5 Document improper GCL panel placement and, as a result, inadequate coverage with the available materials or an excess number of field seams.
 - c2.6 Document inadequate sheet overlap resulting in poor quality seams.
 - c2.7 Document unseamed or cut panels.
 - c2.8 Document repair of damage. Documentation shall include location, type, and method of repair.
- 305. CQA TESTING AND INSPECTION REQUIREMENTS FOR GEOMEMBRANE COMPONENT OF COMPOSITE LINER SYSTEM
 - 305.1 Initial Material Certification and Inspection of Installation Plans:
 - a. The CQA Contractor shall assemble, document the receipt of, and audit the GM/GC Manufacturer's submittals listed below for conformance with Specification P-1402, Section 319020.
 - a1. Geomembrane Resin:
 - a1.1 Certificate that the resin meets requirements of Specification P-1402, Section 319020.
 - a1.2 Certificate of the origin of the resin and that all resin is from the same supplier (including resin supplier's name and contact information and identification brand name).

- a1.3 Copies of the GM/GC Manufacturer's and resin supplier's QA/QC certificates. Certificates shall include a summary report of test results conducted to verify the quality of the resin used in each batch to manufacture geomembrane for this project. As a minimum, the report shall include tests on specific gravity, melt flow index, and percent carbon black.
- a2. Geomembrane Sheeting:
 - a2.1 Certification that the properties of the manufactured sheeting meet the requirements of Specification P-1402, Section 319020, and are guaranteed by the GM/GC Manufacturer.
 - a2.2 Certification stating that no post-consumer resin (PCR) has been added to the formulation.
 - a2.3 Certification stating that the manufactured sheeting is free of per- and polyfluoroalkyl substances (PFAS).
 - a2.4 Copies of all of the GM/GC Manufacturer's QA/QC certificates for the geomembrane sheeting. The certificates shall include test results.
- a3. Extrudate Resins or Rod for Seaming Geomembrane:
 - a3.1 Certification from the GM/GC Manufacturer that all extrudate is the same resin type as the geomembrane and was obtained from the same resin supplier as the resin used to manufacture the geomembrane.
- b. Review of Geosynthetics Contractor's Installation Plans:
 - b1. Geomembrane Field Installation Quality Assurance Plan:
 - b1.1 Document receipt of the Geosynthetics Contractor's QA plan for installing geomembrane.
 - b1.2 Review the plan for compliance with Specification P-1402, Section 319020, and document where the plan is not in compliance.
 - b2. Geomembrane Panel Layout:
 - b2.1 Document receipt of the GM/GC Manufacturer's proposed geomembrane panel layout.
- c. Third-Party Quality Assurance Conformance Testing:
 - c1. Document receipt of copies of test reports prepared by the third-party, independent testing laboratory that performed conformance tests on representative samples provided by the GM/GC Manufacturer in accordance with Specification P-1402, Section 319020.
 - c2. Audit test reports to verify the third-party quality assurance conformance tests and test results meet the requirements of Specification P-1402, Section 319020.
- 305.2 Transportation, Handling, and Storage:
 - a. Documentation of Delivery:
 - a1. Document rolls of geomembrane delivered to the site.
 - a2. Document that each roll is labeled and that each label identifies the following information:
 - a2.1 Name of GM/GC Manufacturer.



- a2.2 Product identification (e.g., brand name, product code), which can be traced back to the origin of the base material (resin supplier's name, resin production plant, resin brand name type, and production date of the resin).
- a2.3 Order number.
- a2.4 Date of manufacture.
- a2.5 Manufacturing lot number.
- a2.6 Geomembrane thickness and type.
- a2.7 Roll identification number.
- a2.8 Roll dimensions (i.e., length and width) and weight.
- a2.9 Panel number.
- a3. Check the QA/QC certificates on each roll to verify that the rolls received onsite meet the requirements of Specification P-1402, Section 319020. Take the identifying labels from each roll or pallet and save them for future reference.
- a4. Recommend rejection of rolls which do not have the required documentation and ensure that the rolls are removed from the site.
- b. Inspection of Manufactured Rolls:
 - b1. Inspect all manufactured rolls at the site.
 - b2. Ensure that packaging is secure and that no damage has occurred.
 - b3. If damage to packaging has occurred, inspect exposed roll surfaces, and note and identify any damage or repairable flaws. Note: This visual observation shall be conducted without unrolling rolls unless the extent of surface damage indicates that internal damage may be present.
 - b4. If damage to just the packaging has occurred, document repair of the packaging.
 - b5. If damage to the product has occurred, document that the damage or flaws are repaired or that the damaged material is wasted and removed from the site.
 - b6. Report all damage to the Owner.
- c. Handling:
 - c1. Inspect the onsite handling equipment being used to move materials to ensure that it is adequate to minimize the risk of damage to materials.
 - c2. Inspect the handling of materials by installing personnel to ensure that care is used.
- d. Storage:
 - d1. Inspect the storage facility.
 - d2. Inspect the ground surface to ensure that it is dry, relatively level, smooth, and free of rocks, holes, and debris.
 - d3. Document unsafe or improper storage conditions, and report conditions to the Owner.

305.3 Inspections and Testing During Construction:

- a. CQA activities during placement of the geomembrane component of the Bypass Basin's new composite liner system shall include visual observations and field testing to ensure that the geomembrane is installed in accordance with the requirements of Specification P-1402, Section 319020. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-5 and the following paragraphs.
- b. Weather Conditions for Placement:
 - b1. Observe and document the weather conditions (i.e., temperature, humidity, precipitation, and wind) to ensure that they are acceptable for geomembrane placement and seaming. Specification P-1402, Section 319020, describes acceptable weather conditions.
 - b2. If the weather becomes unacceptable for installation of the geomembrane liner, recommend stopping the installation until conditions again become favorable, thus minimizing the potential for unacceptable installation.
- c. Geomembrane Placement:
 - c1. Prior to placement of the geomembrane liner, the GCL component of the composite liner system in the area to be lined shall have been installed, seamed, and inspected and all necessary repairs made in accordance with Specification P-1402 Section 319025.
 - c2. Observe and document that the Geosynthetics Contractor's geomembrane placement plan is being followed. Note where the plan is not being followed and document the Geosynthetics Contractor's reasons for not following the plan. As each panel is placed, visually inspect the geomembrane for tears, punctures, and thin spots. The CQA Geosynthetics Inspector shall traverse the panels in such a way that the entire surface is inspected. Any defects shall be documented on a drawing and marked on the geomembrane for repair.
 - c3. Document that the location of the seams meet the general requirements for seaming specified in Specification P-1402 Section 319020.
 - c4. At the time of placement, make measurements to confirm that required overlap of adjacent geomembrane sheets has been achieved, that proper temporary anchorage is being used (e.g., sand bags or tires), and that the geomembrane is being placed in a relaxed (nonstressed) state.
 - c5. Document any liner damage from adverse weather conditions, equipment, inadequate temporary anchoring, or rough handling. Mark the location of damage on the geomembrane for repair and on a drawing.
 - c6. Document improper liner placement (if the Geosynthetics Contractor's geomembrane placement plan is not followed) and, as a result, inadequate coverage with the available materials or an excess number of field seams.
 - c7. Document inadequate sheet overlap resulting in poor quality seams.
 - c8. Document nonwelded or cut panels.
 - c9. Document repair of damage. Documentation shall include location, type, and method of repair.

- d. Geomembrane Seaming and Seam Repair:
 - d1. Trial Welds Prior to Beginning Seaming:
 - d1.1 Observe that trial welds are being made at the frequency specified in Specification P-1402 Section 319020.
 - d1.2 Observe fabrication of test strips and note that test strips are fabricated correctly.
 - d1.3 Specify where samples are to be cut from the test strips and witness all destructive tests.
 - d1.4 Observe documentation of results of the destructive tests by the Geosynthetics Contractor.
 - d1.5 Audit documentation of each trial weld received from the Geosynthetics Contractor.
 - d2. Seaming and Seam Repair – Activities that shall be documented during field seaming operations include:
 - d2.1 Observe that the geomembrane is free from dirt, dust, and moisture.
 - d2.2 Observe that the seaming materials and seam welding equipment are as specified.
 - d2.3 Observe that a firm surface is available for seaming.
 - d2.4 Observe that geomembrane overlap and panel adjustment are correct prior to seaming.
 - d2.5 For extrusion welding, observe that the geomembrane is pre-beveled and the geomembrane is properly abraded and that the panels are temporarily bonded.
 - d2.6 Observe that grind marks are covered with extrudite.
 - d2.7 Observe weather conditions (e.g., temperature, humidity, wind) to ensure that they are acceptable for seaming.
 - d2.8 Measurements of temperatures, pressures, and speed of seaming to ensure that they are as specified. Gages and dials on seaming equipment shall be checked and readings recorded.
 - d2.9 Observe that the geomembrane is not damaged by equipment or personnel during the seaming process.
 - d2.10 Observe that no solvents or adhesives are used.
- e. Anchorage at Existing Penetrations and Concrete Structures:
 - e1. Where shown on the Design Drawings, CQA Geosynthetics Inspector shall ensure that the seals around existing penetrations and the anchorage to existing concrete structures are of sufficient strength and are impermeable.
 - e2. Specific inspections that shall be made on all seals and anchors include:
 - e2.1 Observations and tests to ensure that the sealing systems (i.e., pipe boots) have been installed as specified (are leak free) and in the proper location(s).
 - e2.2 Observations to ensure that all objects that are placed adjacent to the geomembrane (i.e., batten bars) are smooth and free of objects or conditions that may damage the geomembrane.



- e2.3 Observations to ensure that all seals and anchors are complete:
 - e2.3.1 Batten bars of the specified material, width, and thickness and prepunched at the specified spacing.
 - e2.3.2 Anchor bolts of the specified size and material.
 - e2.3.3 Anchor bolts spaced as specified.
- e2.4 Observations to confirm that all geomembrane liner penetrations and connections are installed as specified. Liner penetrations shall be verified for appropriate clamp and caulking use, for appropriate material, for good seaming, and for good housekeeping practices. No sharp bends on concrete surfaces shall be allowed.
- f. Geomembrane Production Seam Testing:
 - f1. Non-Destructive: Activities to be observed and documented include the following:
 - f1.1 Observe that 100 percent of the seam lengths are tested using non-destructive procedures.
 - f1.2 Observe that testing is performed as seaming progresses.
 - f1.3 Observe that the correct procedures are used for testing each type of seam.
 - f1.4 Observe all non-destructive test procedures.
 - f1.5 For air pressure testing, observe that the equipment, procedures, and air pressure meet specified requirements. Observe that all testing is properly documented.
 - f1.6 For vacuum box testing, observe that testing is being performed correctly.
 - f1.7 For inaccessible seams, observe that a procedure acceptable to the Owner is used to test the seams.
 - f1.8 Observe that all leaks are marked, recorded as to location, and repaired.
 - f1.9 Observe that repairs are made in accordance with approved techniques.
 - f1.10 Observe that all repairs are re-tested and that no leakage is present.
 - f1.11 Review leakage data for possible patterns. Make suggestions to the Geosynthetics Contractor if data shows a consistent pattern of failure of a particular machine or crew.
 - f1.12 Audit documentation of testing prepared by the Geosynthetics Contractor to make sure that the location of leaks is identified on the drawings.
 - f2. Destructive:
 - f2.1 Destructive seam testing shall be performed at the frequencies specified in Specification P-1402 Section 319020.
 - f2.2 The CQA Geosynthetics Inspector shall specify the location where each sample shall be taken and record data for each sample.
 - f2.3 The CQA Geosynthetics Inspector shall designate any additional test locations that may be necessary. These locations may be based on the suspicion of contamination by dirt or moisture, change in seaming materials, increase in failed nondestructive tests, and other causes that could result in unacceptable seams.

- f2.4 Laboratory testing shall be performed in accordance with Specification P-1402 Section 319020. Predetermined pass/fail values are specified in that section.
- f2.5 Audit and document the results of laboratory testing on seam samples. Note any sample that does not pass and identify the location on the geomembrane liner for repair in the field and on the drawings.
- f3. Repair of Failed Seams:
 - f3.1 For field seams that fail, the seam can either be reconstructed between the failed and any previous passed seam location, or the installer can go on either side of the failed seam location (10-foot minimum), take another sample, and test it. If that sample passes, reconstruct the seam between the two locations. If it fails, the process shall be continued. In all cases, acceptable seams must be bounded by two passed test locations. The CQA Geosynthetics Inspector shall document the procedure used and results of tests.
 - f3.2 Document that repairs are made. Documentation shall include location, type, and method of repair.
- 306. CQA TESTING AND INSPECTION REQUIREMENTS FOR DRAINAGE GEOCOMPOSITE OF LEACHATE COLLECTION AND REMOVAL SYSTEM
- 306.1 Initial Material Certification:
 - a. The CQA Contractor shall assemble, document the receipt of, and audit the GM/GC Manufacturer's submittals listed below for conformance with Specification P-1402, Section 319020.
 - a1. Copies of the raw material producers' certificates describing the origin and identification of the raw materials.
 - a2. Copies of the raw material producers' QA/QC certificates.
 - a3. Certification stating that the manufactured drainage geocomposite is free of per- and polyfluoroalkyl substances (PFAS).
 - a4. Copies of the GM/GC Manufacturer's QA/QC certificates on tests performed on the geonet core, geotextile cap and carrier, and double-sided laminated geocomposite as specified in Specification P-1402 Table 319020-2 and a summary of the results of the tests.
 - a5. Certification that the properties of the manufactured drainage geocomposite material meets the requirements of Specification P-1402 and are guaranteed by the GM/GC Manufacturer.
 - b. Third-Party Quality Assurance Conformance Testing:
 - b1. Document receipt of copies of test reports prepared by the third-party, independent testing laboratory that performed conformance tests on representative samples provided by the GM/GC Manufacturer in accordance with Specification P-1402.
 - b2. Audit test reports to verify the third-party quality assurance conformance tests and test results meet the requirements of Specification P-1402.



- 306.2 Transportation, Handling, and Storage:
- a. Documentation of Delivery:
 - a1. Document rolls of drainage geocomposite delivered to the site.
 - a2. Document that each roll is labeled and that each label identifies the following information:
 - a2.1 Name of GM/GC Manufacturer.
 - a2.2 Product identification (e.g., brand name, product code).
 - a2.3 Order number.
 - a2.4 Date of manufacture.
 - a2.5 Manufacturing lot number.
 - a2.6 Drainage geocomposite thickness and type.
 - a2.7 Roll identification number.
 - a2.8 Roll dimensions (i.e., length and width) and weight.
 - a3. Check the QA/QC certificates on each roll to verify that the rolls received onsite meet the requirements of Specification P-1402. Take the identifying labels from each roll or pallet and save them for future reference.
 - a4. Recommend rejection of rolls which do not have the required documentation and ensure that those rolls are removed from the site.
 - b. Inspection of Manufactured Rolls:
 - b1. Inspect all manufactured rolls at the site.
 - b2. Ensure that packaging is secure and that no damage has occurred.
 - b3. If damage to packaging has occurred, inspect exposed roll surfaces, and note and identify any damage or repairable flaws. Note: This visual observation shall be conducted without unrolling rolls unless the extent of surface damage indicates that internal damage may be present.
 - b4. If damage to just the packaging has occurred, document repair of the packaging.
 - b5. If damage to the product has occurred, document that the damage or flaws are repaired or that the damaged material is wasted and removed from the site.
 - b6. Report all damage to the Owner.
 - c. Handling:
 - c1. Inspect the onsite handling equipment being used to move materials to ensure that it is adequate to minimize the risk of damage to materials.
 - c2. Inspect the handling of materials by installing personnel to ensure that care is used.
 - d. Storage:
 - d1. Inspect the storage facility.



d2. Inspect the ground surface to ensure that it is dry, relatively level, smooth, and free of rocks, holes, and debris.

d3. Document unsafe or improper storage conditions, and report conditions to the Owner.

306.3 Inspections During Construction:

a. CQA activities during placement of the drainage geocomposite component of the Bypass Basin's new LCRS shall include visual observations and field testing to ensure that the drainage geocomposite is installed in accordance with the requirements of Specification P-1402. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-6 and the following paragraphs.

b. Weather Conditions for Placement:

b1. Observe and document the weather conditions (i.e., temperature, precipitation, and wind) to ensure they are acceptable for placement. Specification P-1402 describes correct weather conditions.

b2. If the weather becomes unacceptable for installation of the drainage geocomposite, recommend stopping the installation until conditions again become favorable, thus minimizing the potential for unacceptable installation.

c. Drainage Geocomposite Placement:

c1. Prior to placement of the drainage geocomposite, the HDPE geomembrane component of the composite liner system in the area to be lined shall have been installed, seamed, and inspected and all necessary repairs made in accordance with Specification P-1402 Section 319020.

c2. Inspect all materials as they are unrolled to ensure that there are no flaws or damage.

c3. Observe and document that drainage geocomposite coverage is as specified on the Design Drawings, that joining of the geonet cores is as specified in Specification P-1402 Section 319020, and sewing of the geotextile caps is as specified in Specification P-1402 Section 319020.

c4. Make measurements to ensure that the specified material overlap is achieved.

c5. Observe and document that all materials are free from wrinkles and folds.

c6. Observe and document that the material is not damaged during the installation process.

c7. Document any material damage from adverse weather conditions, equipment, inadequate temporary anchoring, or rough handling. Mark the location of damage on the drainage geocomposite for repair and on a drawing.

c8. Document repair of damage. Documentation shall include location, type, and method of repair.

307. CQA TESTING AND INSPECTION REQUIREMENTS FOR COARSE AGGREGATE BEDDING, SAND FILTER LAYER, PROTECTIVE WARNING LAYER, RIPRAP BEDDING LAYER, AND RIPRAP MATERIALS

307.1 Initial Material Certification:

a. Prior to shipment of any Coarse Aggregate Bedding, Sand Filter Layer, Protective Warning Layer, Riprap Bedding Layer, or riprap materials, the CQA Contractor shall



assemble, document the receipt of, and audit the material suppliers' test results and certifications that the properties of the materials meet the requirements of Specification P-1400 Section 319050.

307.2 Inspections and Testing During Construction:

- a. CQA activities during the placement of Coarse Aggregate Bedding, Sand Filter Layer, Protective Warning Layer, Riprap Bedding Layer, and riprap materials shall include visual observations and laboratory and field testing to ensure that the materials are installed in accordance with the requirements of Specification P-1400 Section 319050. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-2 and the following paragraphs.
- b. Visual Observations of Material Placement:
 - b1. Upon delivery of the material to the site, inspect the material to ensure that it has not been contaminated during transportation and handling. Observe and document rejection of contaminated materials and replacement of suitable materials.
 - b2. Record the placement method(s) the Earthwork Contractor is utilizing for installing the material.
 - b3. In instances where the Earthwork Contractor is transporting material into the basin, then the CQA Contractor shall:
 - b3.1 Verify no equipment (wheeled or tracked) is traversing the Bypass Basin area when less than 10 inches of earthen material are above geosynthetic materials (i.e., drainage geocomposite, geomembrane liner, GCL).
 - b3.2 Verify the Protective Warning and Sand Filter Layers have been installed along the basin's ramp as detailed on the Design Drawings before the Earthwork Contractor's equipment uses the ramp to transport fill material into the basin.
 - b3.3 Document the receipt of and audit the Earthwork Contractor's demonstration(s) that equipment entering the basin will not exert a ground pressure greater than 8 psi.
 - b3.4 Verify equipment operating within the basin does not hard brake on the ramp, make sharp turns, nor make quick stops that could pinch or tear geosynthetic materials.
 - b4. Observe placement procedures to provide proper thickness.
 - b5. Observe placement procedures to prevent segregation and degradation of material.
 - b6. Observe placement procedures to:
 - b6.1 Ensure pipes and underlying geosynthetic materials are not damaged during the installation process (Note: Side slope cover installation must be observed at all times to assure appropriate placement technique and equipment are used and to detect any damage to geosynthetic materials).
 - b6.2 Ensure that placement of the Coarse Aggregate Bedding material did not damage or displace the leachate collection pipe.
- c. With the use of the Earthwork Contractor's surveyor, make thickness measurements not more than 50 feet on a grid pattern to ensure that the thickness and coverage of each material is in compliance with the Design Drawings.



- d. Audit surveys of each completed layer to ensure that specified slopes and elevations specified on the Design Drawings are obtained.
 - e. Laboratory and Field Tests:
 - e1. Laboratory and field testing shall be performed in accordance with the requirements specified in Table 014362-2.
 - f. Test Acceptance Criteria:
 - f1. Acceptance criteria shall be as specified in Specification P-1400 Section 319050.
308. CQA TESTING AND INSPECTION REQUIREMENTS FOR LEACHATE COLLECTION PIPING AND SIDESLOPE RISERS
- 308.1 Initial Material Certification:
- a. Prior to shipment of any HDPE piping, the CQA Contractor shall assemble, document the receipt of, and audit the Pipe Manufacturer's submittals listed below for conformance with Specification P-1400 Section 319050:
 - a1. Certification that the manufactured pipe meets the requirements of Specification P-1400 Section 319050.
 - a2. Statement that no reclaimed polymer has been added to the resin.
 - a3. Copies of the Pipe Manufacturer's QA/QC certificates on tests performed during fabrication.
- 308.2 Transportation, Handling, and Storage:
- a. Documentation of Delivery and Inspection of HDPE Pipe:
 - a1. Document the arrival of pipe.
 - a2. Check the Quality Control certificates and marking on each pipe to verify that the pipe received meets the requirements of Specification P-1400 Section 319050.
 - a3. Document that each length of pipe is marked with the following information:
 - a3.1 Name of Pipe Manufacturer.
 - a3.2 Pipe type (ASTM designation).
 - a3.3 Pipe size (diameter).
 - a3.4 Standard Dimension Ratio (SDR).
 - a4. Document that all fittings are fabricated and manufactured by the same manufacturer.
 - a5. Measure and document the spacing and diameter of perforations for perforated pipe and that perforations are predrilled prior to shipment.
 - a6. Recommended rejection of pipe that does not have the required documentation; that is of the incorrect size, type, or strength; or that is incorrectly fabricated. Ensure that this pipe is removed from the site.



- b. Handling:
 - b1. Inspect the onsite handling equipment being used to move materials to ensure that it is adequate to minimize the risk of damage to materials.
 - b2. Inspect the handling of materials by installing personnel to ensure that care is used.
- c. Storage:
 - c1. Inspect the storage facility.
 - c2. Inspect the ground surface to ensure that it is dry, relatively level, smooth, and free of rocks, holes, and debris.
 - c3. Document unsafe or improper storage conditions, and report conditions to the Owner.
- 308.3 Preconstruction Testing:
 - a. Observe and document that the pipes are of the specified size and strength and are constructed of the specified material.
 - b. Observe and document that pipe perforations for perforated pipe are as specified.
 - c. Observe and document that the material is not damaged during the installation process and that underlying geosynthetic materials are not damaged.
- 308.4 Inspections and Testing During Construction:
 - a. Inspection activities that shall be performed during pipe placement and joining include:
 - a1. Location:
 - a1.1 Observations and measurements to ensure that the specified pipe sizes are placed at the specified locations.
 - a1.2 Observations to ensure that perforated pipe is placed correctly.
 - a1.3 Measurements to ensure that the horizontal and vertical position and slope are within tolerances required by Specification P-1400 Section 391050.
 - a1.4 Document the as-built locations of all pipes.
 - a2. Pipe Joining:
 - a2.1 Observations to ensure that the pipe is joined by using the hot plate thermal butt fusion method as required by Specification P-1400 Section 319050 and that the equipment used for welding is as recommended by the Pipe Manufacturer.
 - a2.2 Observations to ensure that the joining method described in Specification P-1400 Section 319050 is followed.
 - a3. Joint Quality Control:
 - a3.1 Observations and documentation that the test joints required by Specification P-1400 Section 319050 are made.
 - a3.2 Observations and documentation that the quality of the test joints meet the requirements of Specification P-1400 Section 319050.



a4. Miscellaneous:

- a4.1 Observations to ensure that cleanouts are installed as specified.
- a4.2 Observations to ensure that the placement of the Coarse Aggregate Bedding material under, around, and over the pipe is as specified on the Design Drawings.
- a4.3 Observations to ensure that the pipe network is not damaged during backfilling.

a5. Cleaning:

- a5.1 Observe that all the pipes are cleaned by jet cleaning after installation is complete and document that all pipes are intact and not obstructed.
- a5.2 Document the location of defective or clogged pipe.
- a5.3 Document repair by the Earthwork Contractor and re-cleaning.

a6. Testing:

- a6.1 Observe and document that visual observations on pipe joints have been performed and the results of observations documented.
- a6.2 Document the location of failed joints.
- a6.3 Document the repair and retesting of failed joints by the Earthwork Contractor and the results of testing.

309. CQA TESTING AND INSPECTION REQUIREMENTS FOR CREST ANCHOR TRENCH

309.1 Inspections and Testing During Construction:

- a. CQA activities during excavation, formation, and backfilling of the crest anchor trench for the retrofitted Bypass Basin's geosynthetic materials shall include visual observations and field testing to ensure that the crest anchor trench is constructed in accordance with the requirements of Specification P-1400 Section 319005. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-4 and the following paragraphs.
- b. Measurements:
 - b1. Perform measurements of the crest anchor trench to ensure that the trench width, depth, and location is as specified on the Design Drawings.
- c. Observations:
 - c1. Observe that the trench corners are rounded as specified.
 - c2. Observe that good housekeeping practices are followed in the trenching operation by not allowing soil to fall back into the trench or down the slope and not allowing water to pond in the trench.
 - c3. Observe that the trench is backfilled as soon as possible and compacted such that the geosynthetic materials are not damaged.

310. SAMPLING PATTERN

- 310.1 The CQA Officer shall establish a completely random sampling pattern for determining the choice of sampling points for field tests. Each block of work shall be subdivided into a



sampling grid with at least 10 times as many grids as samples or tests to be taken or as directed by the Owner. The grid shall have a numeric identification system devised to distinguish each set of tests for a specific area from all other sets of tests. Each lift shall have a separate grid.

310.2 Sampling points shall be chosen by a random number generator or other acceptable method to obtain uniform coverage. Tests shall be numbered beginning with test number one (1) and no numbers shall be skipped. In areas where a test of any type fails to meet specification criteria and a retest is performed, the retest shall have the same test number as the original test except that an "R" shall follow the test designation.

311. VERIFICATION AND CALIBRATION

311.1 Verification of Selected Field Tests:

a. The following tests shall be verified at the following frequency:

<u>Test Requiring Verification</u>	<u>Frequency of Verification Test</u>
Nuclear In-Place Density and Nuclear In-Place Moisture Content, ASTM D6938	Note 1
"Quick" Moisture Content Test Using Microwave, (ASTM D4643) or Gas Stove, Frying Pan, or Infrared Oven, (ASTM D4959), etc.	One standard oven-dry moisture content (ASTM D2216) test per 20 quick tests.
Lift Thickness Measured Using a Shaft or Shovel	One lift thickness verified by measurement every two acre-lifts.

Notes:

1 – A standard block test as required by ASTM D6938 shall be performed at the start of each day on each Nuclear apparatus that will be used that day. At the start of earthwork construction, a series of five Nuclear tests and five sand cone or rubber balloon tests shall be performed in the borrow area, or area to be excavated, on a compacted test strip to calibrate the Nuclear apparatus. During construction, one of the last Nuclear readings performed at the end of each day shall be verified using a sand cone (ASTM D1556) or rubber balloon (ASTM D2167) density and moisture content test for each apparatus used that day. The average wet density and moisture content for each apparatus shall be computed for every ten tests. If variations greater than those permitted by the ASTMs occur, corrections shall be applied to all future tests for the apparatus until the next set of 10 tests is performed.

311.2 Calibration. Procedures for calibration of field and laboratory testing equipment shall be submitted by the CQA Contractor prior to the start of testing. These procedures shall meet ASTM requirements.



312. CORRECTIVE ACTION PROCEDURES

- 312.1 Failure of Material Quality Tests. The Earthwork Contractor and the Owner shall be notified immediately if gradation or Atterberg limits tests do not meet Specification P-1400 acceptance criteria. Failure to meet acceptance criteria of one or more of these groups of tests may indicate problems with the quality of soil materials. The Earthwork Contractor shall cease all construction activities until the source of the problem or “out-of-specification” materials is identified. Construction shall not begin again until materials and installation procedures meeting Specification P-1400 acceptance criteria are identified for use.
- 312.2 Failure of Field Density or Moisture Content Tests. If the results of field density or moisture content tests fail to meet Earthwork Specification acceptance criteria, those tests shall be re-run after recompaction. Judgment shall be used to select re-test locations suspected of having lower than specified density or moisture content. If the results of the re-test meet Specification P-1400 requirements, the compaction can be considered acceptable. If the results of the re-tests show out-of-specification densities or moisture contents, the CQA Officer shall immediately inform the Owner of the extent of the defective area. The defective area shall be removed and reconstructed or recompacted by the Earthwork Contractor.



TABLE 014362-1
CQA FOR STRUCTURAL FILL MATERIAL

No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
1	In-Situ Moisture Content	Laboratory Moisture Content	ASTM D2216	One per 500 cubic yards, and for each moisture density curve sample.
2	Moisture Density Curve	Proctor	ASTM D1557	One per 500 cubic yards, and for all changes in material.
3	Soil Index Properties	Atterberg Limits	ASTM D4318	One per 500 cubic yards, and for each moisture density curve sample.
4	Soil Index Properties	Grain Size	ASTM D422	One per 500 cubic yards, and for each moisture density curve sample.
5	Soil Classification	Unified Soil Classification System	ASTM D2487	One per 500 cubic yards, and for each moisture density curve sample.
6	Field Density / Soil Compaction	Nuclear Density Gauge, Sand Cone or Rubber Balloon Method	ASTM D6938 ⁽¹⁾ , ASTM D2167, or ASTM D1556	Four per lift. One per 500 cubic yards.
7	Field Moisture Content	Nuclear Density Gauge or Direct Heat Method	ASTM D6938 ⁽¹⁾ or ASTM D4959	At each field density test location.
8	Uncompacted and Compacted Thickness of Each Lift	Direct Measurement		Four per acre per lift.
9	Surface Lines and Grades	Surveying		One per 50-foot grid and at grade breaks (i.e., toe and top of slopes).

Notes:

(1) ASTM D6938 Procedure B (backscatter) shall be used to measure the as-compacted density of Structural Fill material.



TABLE 014362-2

CQA FOR COARSE AGGREGATE BEDDING, SAND FILTER LAYER, PROTECTIVE WARNING LAYER, RIPRAP BEDDING, AND RIPRAP MATERIALS

No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
Coarse Aggregate Bedding, Protective Warning Layer, Road Surfacing, Riprap Bedding, and Riprap Materials				
1	Soil Index Properties	Grain Size	ITP 27	One per 500 cubic yards.
2	Uncompacted and Compacted Thickness of Each Lift	Direct Measurement		Four per lift. One per 250 linear feet of road for material to be used as road surfacing.
3	Certification of Final Thickness and Grade	Surveying		One per 50-foot grid spacing.
Sand Filter Layer Material				
1	Hydraulic Conductivity	Hydraulic Conductivity	ASTM D2434	One per 500 cubic yards.
2	Soil Index Properties	Grain Size	ITP 27	One per 500 cubic yards.
3	Uncompacted and Compacted Thickness of Each Lift	Direct Measurement		Four per lift. One per 250 linear feet of road for material to be used as road subgrade.
4	Certification of Final Thickness and Grade	Surveying		One per 50-foot grid spacing.



TABLE 014362-3
CQA FOR AREAS TO RECEIVE GEOSYNTHETIC MATERIALS

No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
1	Certification of Surface Elevation Prior to Geomembrane	Surveying		One per 50-foot grid and at grade breaks (toe and top of slopes).
2	Subgrade Firm and Unyielding	Observe and Document Proofroll		Continuous on Structural Fill surface.
3	Subgrade Free of Deleterious Conditions	Observe and document exposed subgrade is free from <ul style="list-style-type: none"> • Irregularities • Protrusions • Loose soil or soft spots • Abrupt changes in grade • Debris • Clods • Stones • Roots • Organic material • Moisture seeps, puddling, or ponding • Frozen material 		Continuous



TABLE 014362-4
CQA FOR ANCHOR TRENCHES

No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
1	Trench Geometry	Measurement		1 location per 100 ft of trench
2	Trench Condition	Observe and Document <ul style="list-style-type: none"> • Trench free of sloughed material • Trench free from ponded water • Absence of loose material below geosynthetics 		Continuous
3	Trench Backfill	Observe and document prompt backfill of trenches		Continuous
4	Field Density / Soil Compaction	Nuclear Density Gauge, Sand Cone or Rubber Balloon Method	ASTM D6938, ASTM D2167, or ASTM D1556	One per 200 ft of trench per lift



TABLE 014362-5
CQA FOR HDPE GEOMEMBRANE

No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
1	Documentation of Delivery	Observe and document: <ul style="list-style-type: none"> • Name of GM/GC Manufacturer • Product identification • Date of manufacture of the geomembrane • Roll identification number • Geomembrane thickness and type • Physical dimensions (length, width) • Manufacturing lot number • Panel number and weight • Order number 	Visual	Each Roll
2	Inspection of Rolls	Lack of uniformity	Visual	Each Roll
		Damage, Tears, Punctures	Visual	Each Roll
		Imperfections, Blisters, Excessive Folding	Visual	Each Roll
3	Weather and Site Conditions at Time of HDPE Geomembrane Deployment and Seaming	Observe and document weather and site conditions		Continuous



No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
4	Panel Deployment	Observe and document: <ul style="list-style-type: none"> • Relaxed deployment • Damage prevention • Wrinkles minimized • Temporary anchorage • Protected from damage • Proper overlap • Seam location 	Visual	Continuous
5	Trial Welds	Observe and document Geosynthetics Contractor staff performing and testing trial welds		<ul style="list-style-type: none"> • Prior to each seaming period. • Every 4 hours of continuous seaming. • Whenever personnel or equipment are changed. • When climatic conditions result in wide changes in geomembrane temperature. • When requested by the CQA Geosynthetics Inspector(s) for any seaming crew or piece of welding equipment if problems are suspected.
6	Preparation for Seaming	Observe and document: <ul style="list-style-type: none"> • HDPE geomembrane is clean • Minimum wrinkles and fish mouths • Fish mouths cut as necessary to lay flat • Film surface for seaming 	Visual	Continuous



No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
7	Seaming	Observe and document: <ul style="list-style-type: none"> • Materials • Equipment • Staff • Acceptable procedures • Weather • Pressure • Speed • Damage • Absence of solvents 	Visual	Continuous
8	Non-Destructive Seam Tests	Observe and document: <ul style="list-style-type: none"> • Equipment • Methods • Pressures • Leaks marked • Repairs made • Repairs retested 	Various as applicable to seam type	100 percent of seam lengths shall be tested.
9	Destructive Seam Samples and Testing	Observe and document <ul style="list-style-type: none"> • Removal of all destructive test samples • Repair of sampled areas • Testing of repairs Label all samples Ship all samples to CQA Contractor's testing laboratory	Shear strength and peel adhesion	<ul style="list-style-type: none"> • One test per every 500 linear feet of seam length if the seam is welded with a fusion weld. • One test per every 400 linear feet of seam length if the seam is welded with an extrusion weld. • One test for each seaming machine



TABLE 014362-6
CQA FOR DRAINAGE GEOCOMPOSITE

No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
1	Documentation of Delivery	Observe and document: <ul style="list-style-type: none"> • Name of GM/GC Manufacturer • Product identification • Roll identification number • Product thickness or composition • Manufacturing batch code or lot code • Date of manufacture • Order number • Roll dimensions (i.e., length, width, and total weight) 	Visual	Each Roll
2	Inspection of Rolls	Lack of uniformity	Visual	Each Roll
		Damage, Tears, Punctures	Visual	Each Roll
		Imperfections,	Visual	Each Roll
3	Weather and Site Conditions at Time of Deployment and Seaming	Observe and document weather and site conditions.		Continuous
4	Panel Deployment	Observe and document: <ul style="list-style-type: none"> • No debris or rocks below geotextile or geonet • Anchorage • Cutting • Damage prevention • Proper overlap and seaming 	Visual	Continuous



No.	Characteristic to be Monitored	Test		
		Monitoring / Testing Method	Test Method Reference	Minimum Test Frequency
5	Seaming	Observe and document: <ul style="list-style-type: none"> • Seam orientation • Seaming method • Thread material • Stitching type • Stitch length • Sweep for broken needles 	Visual	Continuous
6	Repair Areas	Identify areas to be patched Document patching method and location	Visual	Continuous

END OF SECTION 014362

MWVG

Midwest Generation, LLC

POWERTON GENERATING STATION

SPECIFICATION P-1402

GEOSYNTHETIC MATERIALS FOR BYPASS BASIN RETROFIT

S&L PROJECT NO.: 12661-181

REVISION 1

ISSUE PURPOSE: MATERIAL ORDER

ISSUE DATE: 04-04-2024





SECTION 000106

ISSUE SUMMARY AND APPROVAL PAGE

<u>Rev.</u>	<u>Purpose of Issue</u>	<u>Date</u>	<u>Sections Affected</u>
0	For Proposal	03-15-2024	All
1	Material Order	04-04-2024	All

This is to confirm that this Specification has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0407, Specifications and Bills of Materials, which is part of our Quality Management System.

Contributor Summary & Current Revision Signatures

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>	<u>Approved By</u>
0	A. Sahlas	T. Dehlin	T. Dehlin
1	<i>Aimee Sahlas</i> A. Sahlas	T. Dehlin	T. Dehlin



SECTION 000107
CERTIFICATION PAGE

Sargent & Lundy (S&L) is registered in the State of Illinois to practice engineering. S&L's Illinois Department of Financial and Professional Regulation registration number is 184-000106.

I certify that this Specification was prepared by me or under my direct supervision and that I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin Date: April 4, 2024

Seal:





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ATTACHMENTS

Attachment 1	Design Drawings
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END OF SECTION 000110



SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

101. **PROJECT INFORMATION**

- 101.1 Owner: Midwest Generation, LLC (MWG)
- 101.2 Design Engineer: Sargent & Lundy (S&L)
- 101.3 Project Name: Bypass Basin Retrofit
- 101.4 Project Location: Powerton Generating Station
13082 E. Manito Rd.
Pekin, IL 61554

102. **DESCRIPTION OF THE PROJECT AND GENERAL BACKGROUND**

- 102.1 The purpose of this project is to retrofit the Bypass Basin at Midwest Generation, LLC's Powerton Generating Station in accordance with the Illinois Pollution Control Board's Coal Combustion Residuals (CCR) Rule, 35 Ill. Adm. Code Part 845, and with the U.S. Environmental Protection Agency's (EPA) CCR Rule, 40 CFR Part 257 Subpart D.
- 102.2 The Bypass Basin will be retrofitted by removing all CCR and CCR-mixed materials stored in the basin and decontaminating the basin's existing geomembrane liner and appurtenant structures, which will remain in place. Following removal of CCR and CCR-mixed material from the basin and decontamination of the basin facilities remaining in place, a new composite liner system and new leachate collection and removal system (LCRS) will be installed within the Bypass Basin over the basin's existing decontaminated and leak-tested geomembrane liner.

103. **SCOPE OF WORK**

- 103.1 In general, this Specification covers the technical requirements for a Geosynthetics Contractor to verify the integrity of the Bypass Basin's existing geomembrane liner, to install the new composite liner system over the existing geomembrane liner, and to install the drainage geocomposite component of the LCRS. The Work includes the following activities:
- a. Ensuring all appropriate measures are taken to protect the Bypass Basin's existing HDPE geomembrane liner system from damage throughout all phases of the Work.
 - b. Verifying the integrity of the Bypass Basin's existing, decontaminated geomembrane liner by:
 - b1. Conducting a visual inspection of the entire lined area. Observations made during the visual inspection shall be supported by digital photographs, which shall include time, date, and location information.
 - b2. Performing an electrical leak location survey over the entire lined area in accordance with ASTM D7953, "Standard Practice for Electrical Leak Location on Exposed Geomembranes Using the Arc Testing Method," or an equivalent leak location survey method approved by the Owner.



- b3. Repairing all holes, punctures, tears, defects, etc. identified by the electrical leak location survey, if any, in accordance with Section 319020. All repairs shall be documented with digital photographs, which shall include time, date, and location information.
 - b4. Preparing a report documenting the results of the visual inspection and electrical leak location survey. The report shall include, at a minimum, all field notes, digital photographs, field test data sheets, and repair information (if any).
 - c. Furnishing and installing a new composite liner system over the existing, decontaminated geomembrane liner and Structural Fill placed within the basin (by Others). The composite liner system consists of an HDPE geomembrane liner over a geosynthetic clay liner (GCL).
 - d. Furnishing and installing the drainage geocomposite component of the basin's new leachate collection and removal system (LCRS). The drainage geocomposite is an HDPE geonet core with a non-woven geotextile layer heat-laminated to each side of the geonet.
 - e. Performing specified quality assurance tests to verify the manufactured geosynthetic materials consistently meet or exceed the requirements of this Specification.
 - f. Restoring and cleaning the project site.
 - g. Developing fueling and maintenance facilities and practices to protect the project site from hydrocarbon spills or other environmental impacts that may impact the project site, adjacent property, or the Illinois River and connected waterways.
- 103.2 In addition, the Work shall include but not be limited to the following:
- a. Engineering and construction services required to perform or install the Work.
 - b. Surveying to ensure the Work is located as indicated on the Design Drawings.
 - c. Furnishing all installation equipment and tools including any calibrated instruments required for monitoring and testing.
 - d. Disposing of construction-related debris offsite in a permitted landfill approved by the Owner.
 - e. Maintaining a record of the installation (i.e., as-built drawings) in accordance with the technical requirements of this Specification.
 - f. Furnishing the services of qualified personnel at the project site to perform the Work.
 - g. Progress reporting as specified in the Commercial Terms and Conditions.
 - h. Daily site cleanup and disposal of waste and debris.
 - i. Participation in the Owner's on-site safety program, including the Owner's CCR Safety and Health Plan Training.
- 103.3 The Work shall conform to the requirements of this Specification and shall be performed and supervised by personnel who are experienced and knowledgeable in the crafts and trades required by the Scope of Work. The Work shall be performed exclusively by the Geosynthetics Contractor's trained and competent personnel or, where permitted, that of its subcontractor(s); and shall comply with all applicable safety laws, regulations, programs, and practices to ensure the safety of all people located on the work site, including the Geosynthetics Contractor's personnel (or that of its subcontractor(s)) performing the Work.



- 103.4 Performance of the Work shall include all the labor, supervision, administration, management, material procurement, tools, installation and testing equipment, miscellaneous material, and consumables to perform the Work specified herein.
- 103.5 Provide all installation equipment and all incidental items not shown or specified but reasonably implied for successful completion of the Work and in strict accordance with Design Drawings and this Specification, including inspection, testing and quality standards.
- 103.6 Provide installation quality assurance and quality control submittals where required.
- 103.7 Prepare red-lined as-built drawings for review upon completion of the Work to document any variances between the construction issue of the Design Drawings and the actual installation. Finalize as-built drawings after the Owner and the Design Engineer review.
- 103.8 All other work, as indicated on the Design Drawings, as specified herein or as required to properly complete the Work.
104. DIVISION OF RESPONSIBILITY & CONTRACTOR QUALIFICATIONS
- 104.1 Owner:
- a. MWG is the Owner of the facility and has the authority to accept or reject materials and workmanship of the Geosynthetics Contractor or the Earthwork Contractor, or reports and recommendations of the CQA Contractor.
 - b. The Owner will ultimately be responsible for the retrofit construction for the Bypass Basin and for assuring the Permitting Authority that the construction meets or exceeds the requirements specified in state regulations, permits, Project Specifications, and the Design Drawings.
- 104.2 Design Engineer:
- a. S&L is the Design Engineer and is responsible for designing the retrofitted features for the Bypass Basin.
 - b. The Design Engineer will ensure that the retrofit design meets the construction requirements of the Owner and meets or exceeds the requirements of the Permitting Authority.
 - c. The Design Engineer will resolve unexpected conditions or unanticipated problems during construction, which may require changes to the permitted design. Changes to the permitted design shall require approval of the Owner and Design Engineer to ensure that the original design objectives are still maintained. All changes shall meet state regulatory requirements and the rules promulgated thereunder and may include Permitting Authority-approved variances to the rules.
- 104.3 Permitting Authority:
- a. The Illinois EPA is the Permitting Authority and is responsible for reviewing the permit application for retrofitting the Bypass Basin to assure compliance with state regulations and for granting the construction permit for the project.
 - b. The Permitting Authority may review any design revisions during construction and any requests for variance submitted by the Owner. The Permitting Authority has the authority to review and approve all CQA documentation and reports and to confirm the Bypass Basin was retrofitted as specified in Project Specifications and the Design Drawings.



104.4 Geosynthetics Contractor:

- a. The Geosynthetics Contractor is the firm with whom the Owner establishes a contract for the satisfactory performance of the Scope of Work covered by this Specification.
- b. The Geosynthetics Contractor is responsible for the work, quality, and safety of their staff and all subcontractors and suppliers.
- c. The Geosynthetics Contractor shall have a minimum 10-year history of successfully performing similar work.

104.5 Earthwork Contractor. The Earthwork Contractor is the firm with whom the Owner establishes a contract to perform all earthwork and sitework required to retrofit the Bypass Basin, as specified on the Design Drawings and in Specification P-1400.

104.6 Construction Quality Assurance (CQA) Contractor:

- a. The CQA Contractor is the firm with whom the Owner establishes a contract to perform all CQA work as specified on the Design Drawings and in Specification P-1401.
- b. The CQA Contractor is independent of the Earthwork Contractor, Geosynthetics Contractor, and their subcontractors.

105. MATERIAL AND SERVICES FURNISHED BY OTHERS

105.1 The following work has been, or will be, performed and/or provided by Others:

- a. Initial dewatering of the Bypass Basin. The Geosynthetics Contractor shall be responsible for dewatering the basin as necessary for proper installation of geosynthetics materials.
- b. Removing all CCR, gravel, and sand above the basin's existing geomembrane liner.
- c. Decontaminating the basin's existing geomembrane liner and appurtenant structures for re-use, including conducting and documenting visual inspections and analytical testing to demonstrate the existing liner is no longer contaminated with CCR constituents.
- d. Earthwork services as detailed in Specification P-1400 will be procured by the Owner.
- e. Third-party CQA services as detailed in Specification P-1401 will be procured by the Owner.

106. DEFINITIONS

106.1 The term "Design Drawing" means the Design Engineer's drawings indicating the Work to be performed.

106.2 The term "Project Specifications" means the technical specifications issued by the Design Engineer that define minimum material, installation, and/or testing requirements for the Work. Project Specifications include this Specification, the Earthwork Specification (P-1400) and the CQA Specification (P-1401).

106.3 The term "Work" means the material and services furnished to retrofit the Bypass Basin as identified on the Design Drawings and as specified herein.

106.4 The term "Owner-approved equal" means an acceptable equivalent to a specified material that has been accepted by the Owner.



107. INTENT OF DOCUMENTS

- 107.1 The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is to include all labor, material, equipment, and transportation necessary for the proper execution of the Work.
- 107.2 Discrepancies between the Design Drawings and this Specification, or errors or omissions, ambiguities, or mis-description in either the Design Drawings or in this Specification, shall be referred to the Design Engineer for interpretation and adjustment prior to beginning the Work. Do not proceed without the Design Engineer's written acceptance.

108. PERFORMANCE OF THE WORK

- 108.1 The Geosynthetics Contractor shall provide materials and employ construction practices that are sustainable to the greatest extent possible, including disposal of waste.
- 108.2 The performance of the Work, as specified herein and as indicated on the Design Drawings, shall comply with the current safety and health standards authorized by the U.S. Department of Labor's Occupational Safety and Health Administration, as well as state and local jurisdictional requirements.
- 108.3 The Geosynthetics Contractor shall take all appropriate precautions to ensure the safety of all of their personnel (and of their subcontractor's personnel) working on site.
- 108.4 The Geosynthetics Contractor shall maintain the necessary skilled and qualified labor force for the Work to ensure the on-time completion of the Work.
- 108.5 The Geosynthetics Contractor's personnel shall be competent, capable, qualified, and able to perform the duties required to the satisfaction of the Owner. A supervisor vested with authority to make decisions binding on the Geosynthetics Contractor shall be assigned to the task to resolve installation problems as they arise so as not to delay completion of the Work.
- 108.6 The Geosynthetics Contractor shall be solely responsible for advising the Design Engineer in writing of any conflicts between this Specification and the Design Drawings and the Geosynthetics Contractor's drawings, including performance and levels of quality. The Geosynthetics Contractor agrees that its obligations, liabilities, and warranties shall not be diminished or extinguished due to its meeting the requirements of this Specification and the Design Drawings.

109. REGULATORY REQUIREMENTS

- 109.1 The Geosynthetics Contractor shall at all times be solely responsible for complying with all applicable laws, ordinances, regulations, and codes, including those relating to safety of all persons, in connection with the Work. No obligation of the Owner or Design Engineer shall impose upon them any duty to review the Geosynthetics Contractor's compliance with safety measures.

110. PROTECTION OF PROPERTY AND PERSONNEL SAFETY

- 110.1 The Geosynthetics Contractor shall conduct safety training of all its personnel (including any subcontractors) in accordance with the Owner's safety requirements, including the Owner's CCR Safety and Health Plan.



111. CLEAN-UP AND DISPOSAL OF DEBRIS

- 111.1 The Geosynthetics Contractor shall be responsible for clean-up and disposal of all debris resulting from the geosynthetic installation work. All construction related debris shall be properly disposed of (i.e., in an environmentally responsible way) offsite in a permitted landfill approved by the Owner.
- 111.2 Work areas shall be kept clean and orderly at all times with as little disturbance as possible to existing conditions. Upon completion of work at each site, all tools, equipment, material, and debris shall be completely removed and the area left in a clean condition.

112. EXISTING SITE CONDITIONS

- 112.1 Prior to performing any Work in any part of the project site, the Geosynthetics Contractor shall make a thorough field check for the purposes of verifying existing conditions that may affect the Work. The Geosynthetics Contractor shall include a thorough investigation of the potential interferences and difficulties that it may encounter in the proper and complete execution of the Work. The Geosynthetics Contractor shall advise the Owner immediately of the discovery of any conditions.
- 112.2 The Geosynthetics Contractor shall be responsible for location of underground utilities and obstructions prior to performance of the Work and shall promptly notify Owner of any potential interferences that may impact performance of the Work. Modifications to the design to resolve these interferences shall not be implemented until approved by the Owner.
- 112.3 The Geosynthetics Contractor further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface material and obstacles, including underground or embedded utilities, to be encountered insofar as this information is reasonably ascertainable from:
- a. An inspection of the site (including field location and identification of underground utilities).
 - b. Reference drawings made available by the Owner.
 - c. Drawings and specifications that are a part of the Contract.
 - d. The character and extent of existing work within or adjacent thereto.
 - e. Any other work being performed thereon at the time of the submission of bids.
- 112.4 Should the Geosynthetics Contractor fail to perform any of the obligations set forth above, the Geosynthetics Contractor's later plea of ignorance of existing or foreseeable conditions which create difficulties or hindrances in the execution of the Work will not be considered as an excuse for any failure on the part of the Geosynthetics Contractor to fulfill in every detail the requirements of the Contract nor will such a plea be acceptable as the basis of a claim for additional compensation or time to complete the work.

113. VERIFICATION OF DIMENSIONS ON DRAWINGS AND MEASUREMENTS AT SITE

- 113.1 The Geosynthetics Contractor shall make a thorough field check for the purpose of verifying existing conditions that may affect the Work, such as existing topographic data shown on the Design Drawings, difficulties that might be encountered in the execution of the Work for any reason, and dimensions and other questions relating to interconnection of the Work with the existing ash basin construction.



- 113.2 The Geosynthetics Contractor shall satisfy itself as to the accuracy of the dimensions of the existing ash basin construction as such dimensions relate to the dimensions given on any drawing issued by the Design Engineer. It shall be understood that neither the Design Engineer nor the Owner guarantee the exactness of such dimensions.
- 113.3 Should the Geosynthetics Contractor discover any variation in the dimensions of existing conditions and the dimensions given on any drawings issued by the Design Engineer, the Geosynthetics Contractor shall give immediate notice thereof to the Owner and the Geosynthetics Contractor shall not proceed with the Work until such variation is resolved.
114. CONTROL AND CHARGE OF CONTRACTOR'S WORK
- 114.1 The Design Engineer shall have no authority to stop the Work by the Geosynthetics Contractor for any reason.
- 114.2 The Geosynthetics Contractor shall be responsible for the safety of its employees and subcontractors and for maintaining the safety of the job site.
- 114.3 The Geosynthetics Contractor shall be solely responsible for construction means, methods, techniques, sequences, and procedures used in the construction of the Work. The Owner, however, reserves the right to request, and the Contractor shall supply, detailed information regarding the Work such as procedures or work methods.
- 114.4 Only the Owner (or its authorized representative) has the authority to stop the Work (in accordance with the Commercial Terms and Conditions) if such Work is determined to be not in accordance with this Specification, the Design Drawings, or the Contract documents.
115. DESIGN DRAWINGS
- a. The Design Drawings prepared by the Design Engineer indicate the physical dimensions of the geosynthetic material to be manufactured and installed as defined by the Scope of Work and form a part hereof.
- b. Refer to Attachment 1 of this Specification for the applicable Design Drawings for this project.
116. REFERENCE DOCUMENTS
- 116.1 Applicable reference documents for the Scope of Work are provided in Attachment 2 of this Specification.
- 116.2 The reference documents assembled by the Design Engineer are for information only.
- a. The as-built panel layout drawing for the Bypass Basin's existing HDPE geomembrane liner, which was installed in 2010 by Clean Air and Water Systems, LLC, is included in Attachment 2.
- b. The 2010 as-built geomembrane panel layout drawing in Attachment 2 is for information only and shall not be used to determine material quantities or the physical dimensions for the Scope of Work.

END OF SECTION 011100



SECTION 319020

HIGH-DENSITY POLYETHYLENE GEOMEMBRANE LINER WITH GEOCOMPOSITE

PART 1 - GENERAL

101. EXTENT

- 101.1 This section defines the minimum requirements for furnishing and installing the following materials, all in accordance with the Design Drawings and as specified herein:
- a. High-density polyethylene (HDPE) geomembrane liner to be used as the upper component of the retrofitted Bypass Basin's new composite liner system.
 - b. Drainage geocomposite to be used in the retrofitted Bypass Basin's new leachate collection and removal system (LCRS).
- 101.2 The Work shall include, but not be limited to, the following items:
- a. Manufacturing and shipping the HDPE geomembrane liner and drainage geocomposite materials.
 - b. Performing specified quality assurance tests to verify the manufactured HDPE geomembrane liner and drainage geocomposite materials consistently meet or exceed the requirements of this Specification.
 - c. Contracting an independent, third-party Quality Assurance (QA) Testing Laboratory to perform the specified quality assurance conformance tests to verify the manufactured HDPE geomembrane liner and drainage geocomposite materials consistently meet or exceed the requirements of this Specification.
 - d. Preparation and inspection of surfaces to be lined.
 - e. Placement and seaming of geomembrane.
 - f. Placement and joining drainage geocomposite.
 - g. Crest anchorage of geomembrane and drainage geocomposite.
 - h. Attachment of the geomembrane to concrete structures, existing marker posts, and an existing corrugated metal pipe (CMP) riser.
 - i. Non-destructive field testing of 100% of geomembrane seams.
 - j. Removal of samples of geomembrane seams and transportation to an independent third-party laboratory for destructive testing.
 - k. Repair of defective geomembrane seams.
 - l. Repair of defects in the geomembrane and at locations where samples were taken.
 - m. Visual inspection of the completed geomembrane liner.



101.3 Definitions:

- a. The following definitions of terms shall apply throughout this section:
- a1. GM/GC Manufacturer: The manufacturer who is responsible for manufacture of geomembrane and drainage geocomposite materials and for transporting geomembrane and drainage geocomposite materials to the site.
- a2. QA Testing Laboratory: The company employed by the GM/GC Manufacturer who is responsible for performing the specified quality assurance conformance tests. The QA Testing Laboratory shall be objective, competent, and independent from the GM/GC Manufacturer whose products are being tested. The QA Testing Laboratory shall remain independent throughout the duration of the project.
- a3. CQA Geosynthetics Inspector: An inspector who works for the CQA Contractor and is responsible for inspection of the Geosynthetics Contractor's work.

101.4 Qualifications:

- a. GM/GC Manufacturer:
 - a1. The GM/GC Manufacturer shall be approved by the Owner. Owner's considerations when approving the GM/GC Manufacturer may include, but are not limited to, financial, safety, and prior performance aspects of the manufacturer.
 - a2. The GM/GC Manufacturer shall have an internal QA/QC program to ensure and to verify the manufactured products consistently meet or exceed the requirements of this section.
 - a3. The GM/GC Manufacturer shall have at least 10 years of experience manufacturing products similar to those required for this Work.
- b. QA Testing Laboratory:
 - b1. The QA Testing Laboratory shall be approved by the Owner. Owner's considerations when approving the QA Testing Laboratory may include, but are not limited to, financial, safety, and prior performance aspects of the company.
 - b2. The QA Testing Laboratory shall have an internal QA/QC program to ensure and to verify the specified tests are performed correctly.
 - b3. The QA Testing Laboratory shall have at least 10 years of experience testing manufactured products similar to those required for this Work.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS AND SPECIFICATIONS

- 102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:
- a. Earthwork Specification (P-1400):
 - a1. Section 319005 – Earthwork.
 - b. CQA Specification (P-1401):
 - b1. Section 014362 – Quality Assurance for Fill, Liner, and Leachate Collection Materials.
 - c. Geosynthetic Materials Specification (P-1402):
 - c1. Section 319025 – Geosynthetic Clay Liner.



103. REFERENCE DOCUMENTS

- 103.1 Standards, specifications, manuals, codes, and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local agencies having jurisdiction.
- 103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.
- 103.3 Abbreviations listed indicate the form used to identify the reference documents cited in this section.
- 103.4 ASTM — ASTM International:
- a. A276 Specification for Stainless and Heat Resisting Steel Bars and Shapes.
 - b. B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - c. D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - d. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - e. D1505 Test Method for Density of Plastics by the Density-Gradient Technique.
 - f. D1603 Standard Test Method for Carbon Black Content in Olefin Plastics.
 - g. D4218 Standard Test Method for Determination of Carbon Black Content of Polyethylene Compounds by the Muffle-Furnace Technique.
 - h. D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.
 - i. D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - j. D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - k. D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - l. D4716 Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - m. D4751 Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
 - n. D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - o. D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
 - p. D5261 Test Method for Measuring Mass per Unit Area of Geotextiles.
 - q. D5397 Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
 - r. D5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.

- s. D5641 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
 - t. D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
 - u. D5820 Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
 - v. D5885 Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Colorimetry.
 - w. D5994 Test Method for Measuring Core Thickness of Textured Geotextile.
 - x. D6241 Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50-mm Probe.
 - y. D6364 Standard Test Method for Determining Short-Term Compression Behavior of Geosynthetics.
 - z. D6392 Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-fusion Methods.
 - aa. D7005 Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.
 - bb. D7179 Standard Test Method for Determining Geonet Breaking Force.
 - cc. D7466 Standard Test Method for Measuring Asperity Height of Textured Geomembranes.
 - dd. D8117 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by Differential Scanning Calorimetry.
- 103.5 Geosynthetic Research Institute (GRI):
- a. GM6 Standard Practice for Pressurized Air Channel Test for Dual Seamed Geomembrane.
 - b. GM9 Cold Weather Seaming of Geomembranes.
 - c. GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet.
 - d. GM13 Standard Specification for Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
 - e. GM14 Standard Guide for Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes.
 - f. GM19a Standard Specification for Seam Strength and Related Properties of Thermally Bonded Homogenous Polyolefin Geomembranes/Barriers.
- 103.6 Industrial Fabrics Association International (IFAI):
- a. Field Sewing of Geotextiles by V. Diaz and B. Myles, 1989.



104. SUBMITTALS

104.1 The Geosynthetics Contractor shall submit the following drawings and data as specified. The Geosynthetics Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Owner's information systems (as specified by the Owner).

104.2 Submittals with Bid Proposal:

- a. Copies of the GM/GC Manufacturer's catalog data describing the HDPE geomembrane liner and drainage geocomposite materials proposed for use on this project.
- b. Copies of the GM/GC Manufacturer's Quality Control and Quality Assurance Policies and Procedures for the HDPE geomembrane and drainage geocomposite materials proposed for use on this project.
- c. Warranty:
 - c1. Written warranties from the GM/GC Manufacturer and Geosynthetics Contractor covering the quality of the material and workmanship as applicable.
 - c2. The minimum period of warranty for materials shall be 20 years from the date of shipment.
 - c3. The minimum period of warranty for installation shall be 2 years.

104.3 Submittals After Material Order:

- a. Geomembrane Resin:
 - a1. Certification signed by the GM/GC Manufacturer's authorized representative stating that the resin meets the requirements of this Specification.
 - a2. Certification signed by the GM/GC Manufacturer's authorized representative stating the origin of the resin used and that all resin is from the same supplier. This certification shall include, at a minimum, the resin supplier's name and contact information and the resin identification brand name.
 - a3. Copies of the GM/GC Manufacturer's and the resin supplier's QA/QC certificates. Certificates shall include a summary report of test results conducted to verify the quality of the resin used in each batch used to manufacture geomembrane for this project. As a minimum, the summary report shall include tests on specific gravity, melt flow index, and percent carbon black.
- b. Geomembrane Sheeting:
 - b1. HDPE geomembrane manufacturing lot and roll numbers with corresponding shipping information.
 - b2. The following certifications shall be submitted to the Owner and signed by an authorized representative of the GM/GC Manufacturer:
 - b2.1 Certification stating that the geomembrane liner material manufactured for this project meets the requirements of this Specification and that those requirements are guaranteed by the GM/GC Manufacturer.
 - b2.2 Certification stating that no post-consumer resin (PCR) has been added to the formulation.



- b2.3 Certification stating that the manufactured geomembrane sheeting is free of per- and polyfluoroalkyl substances (PFAS).
- b3. Copies of all of the GM/GC Manufacturer's QA/QC certificates on tests performed on the geomembrane liner material as specified in Table 319020-1 and a summary report of the test results.
- b4. Copies of all the third-party, independent QA Testing Laboratory test reports documenting the results of the conformance tests specified in Table 319020-3, as performed by the laboratory on the representative samples provided by the GM/GC Manufacturer.
- c. Drainage Geocomposite:
 - c1. Drainage geocomposite manufacturing lot and roll numbers with corresponding shipping information.
 - c2. Copies of the raw material producers' certificates describing the origin and identification of the raw materials.
 - c3. Copies of the raw material producers' QA/QC certificates.
 - c4. Certification stating that the drainage geocomposite material manufactured for this project meets the requirements of this Specification and that those requirements are guaranteed by the GM/GC Manufacturer.
 - c5. Certification stating that the manufactured drainage geocomposite is free of per- and polyfluoroalkyl substances (PFAS).
 - c6. Copies of all of the GM/GC Manufacturer's QA/QC certificates on tests performed on the geonet core, geotextile cap and carrier, and double-sided laminated geocomposite as specified in Table 319020-2 and a summary of the results of the tests.
 - c7. Copies of all the third-party, independent QA Testing Laboratory test reports document the results of the conformance tests specified in Table 319020-4, as performed by the laboratory on the representative samples provided by the GM/GC Manufacturer.
- d. Extrudate Resins or Rods for Seaming Geomembranes. Certification that all extrudate is the same resin type as the geomembrane and was obtained from the same resin supplier as the resin used to manufacture the geomembrane liner materials.
- e. Installation Data:
 - e1. GM/GC Manufacturer's proposed geomembrane panel layout for the retrofitted Bypass Basin.
 - e2. GM/GC Manufacturer's recommended procedures for making and testing seams if different from those specified herein.
 - e3. GM/GC Manufacturer's recommended procedures for repairing damaged geomembrane and drainage geocomposite material sections and seams if different from those specified herein.
 - e4. GM/GC Manufacturer's details of geomembrane liner anchorage and attachment to structures and penetrations if different from those specified herein and from the details shown on the Design Drawings.

- 104.4 Submittals After Construction is Complete:
- a. As-built panel layout.
 - b. Plan drawing showing locations of repairs and types of repairs made.
 - c. Locations of destructive tests.
 - d. Results of destructive tests.
 - e. Results of non-destructive tests.

105. QUALITY ASSURANCE

- 105.1 Materials and construction procedures shall be subject to inspection and testing by the CQA Contractor employed by the Owner. Such inspections and tests will not relieve the Geosynthetics Contractor of the responsibility for providing and installing materials in compliance with specified requirements.
- 105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Geosynthetics Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance with specified requirements.
- 105.3 CQA activities will be performed by the CQA Contractor as described herein and in Specification P-1401.

PART 2 – MATERIALS

201. HIGH-DENSITY POLYETHYLENE GEOMEMBRANE LINER

- 201.1 General Requirements:
- a. All HDPE geomembrane shall be textured on both sides and meet the requirements of Table 319020-1.
 - b. Textured surfaces shall be manufactured using a co-extrusion process, have a uniform texturing appearance, and be free from agglomerated texturing material and such defects that would affect the specified properties of the HDPE geomembrane.
 - c. Each roll of geomembrane shall have 6-inch wide (minimum) smooth edges to provide suitable seaming surfaces. Textured HDPE geomembrane without smooth edges may be provided if approved by the Owner.
 - d. HDPE geomembrane shall be manufactured from first quality, virgin resin. Blending of resins shall not be allowed. No recycled or reworked geomembrane may be used except edge trim generated during the manufacturing process, which shall be limited to at most 10%. No post-consumer resin (PCR) of any type shall be added to the formulation.
 - e. The resin used to produce the HDPE geomembrane shall be formulated to be resistant to chemical and ultraviolet degradation.
 - f. The HDPE geomembrane shall be free of plasticizers, leachable additives, and per- and polyfluoroalkyl substances (PFAS).
 - g. During manufacture, each roll of HDPE geomembrane shall be continuously monitored across the width to assure uniformity of thickness. Thickness measurements shall meet the requirements of Table 319020-1.



- h. The HDPE geomembrane shall be free of factory seams.
- i. The HDPE geomembrane shall be free from dirt, oil, foreign matter, scratches, cracks, creases, bubbles, blisters, pits, tears, holes, pores, pinholes, voids, undispersed raw material, any sign of contamination, or other defects that may affect serviceability, and shall be uniform in color, thickness, and surface texture.
- j. Panels of HDPE geomembrane shall be capable of being seamed in the field to yield seams that are as resistant to waste liquids as the sheets.
- k. The HDPE geomembrane shall be manufactured in the United States or Canada.

201.2 Panel Layout:

- a. Prior to manufacturing the HDPE geomembrane liner for the retrofitted Bypass Basin, the GM/GC Manufacturer shall make a panel layout of the surface to be lined. Each panel to be used for the installation shall be given a numeric or alphanumeric identification number.
- b. Each panel identification number shall be related in writing to the manufacturing roll number that identifies the resin type, batch number, and date of manufacture.
- c. The panel layout shall be made considering the following requirements:
 - c1. Panel lengths shall include slope gain and anchorage.
 - c2. Perpendicular tie-ins shall be made a minimum of 5 feet beyond the toe of the slope.
 - c3. A minimum 6-inch-wide overlap shall be allowed at double fusion welded seams.
 - c4. All field seams on slopes shall be oriented parallel to the slope (oriented along, not across the slope).
 - c5. The number of seams in corners or odd-shaped geometric locations shall be minimized.



TABLE 319020-1
TEXTURED HIGH-DENSITY POLYETHYLENE GEOMEMBRANE REQUIREMENTS⁽¹⁾

Property	ASTM Test Method	Polyethylene Base Compound	Geomembrane	Testing Frequency
Nominal Thickness (mil)	--	--	60	--
Resin Properties				
Density of Base Resin, g/cc (min.)	D1505 / D792	0.932		5,000 lbs. of Resin
Oxidative Induction Time (OIT) (min. ave.)				
a. Standard OIT (minutes)	D8117	100	--	5,000 lbs. of Resin
– or –				
b. High Pressure OIT (minutes)	D5885	400	--	5,000 lbs. of Resin
Oven Aging at 85°C	D5721	--	--	
a. Standard OIT (min. ave.), % retained after 90 days	D8117	55	--	One per Formulation
– or –				
b. High Pressure OIT (min. ave.), % retained after 90 days	D5885	80	--	One per Formulation
UV Resistance				
High Pressure OIT (min. ave.), % retained after 1600 hrs.	D5885	50	--	One per Formulation
Analytical Properties				
Formulated Density, g/cc (min.)	D1505 / D792	--	0.940	5,000 lbs. of Resin
Carbon Black Content, % (range)	D4218	2.0 – 3.0	--	5,000 lbs. of Resin
Carbon Black Dispersion for 10 Different Views	D5596	Note (2)	--	5,000 lbs. of Resin
Mechanical Properties				
Thickness, mils	D5994	--	--	One per Roll
Minimum Average			57	
Lowest Individual for 8 out of 10 Values			54	
Lowest Individual for 10 out of 10 Values			51	
Asperity Height, mils (min. ave.)	D7466	--	16	Every Second Roll ⁽³⁾
Tensile Properties in Each Direction (min. ave.)	D6693 (Type IV Specimen at 2 ipm)			5,000 lbs. of Resin
Tensile Stress at Yield, ppi (min.)		--	126	
Elongation at Yield, % (min.)		--	12	
Tensile Stress at Break, ppi (min.)		--	90	
Elongation at Break, % (min. 2" gage length)		--	100	
Tear Resistance, lbs. (min. ave.)	D1004		42	5,000 lbs. of Resin
Puncture Resistance, lbs. (min. ave.)	D4833		90	5,000 lbs. of Resin
Environmental Aging Effect on Properties				
Stress Crack Resistance, hours (min.)	D5397	--	500	Per GRI GM10

Notes:

- (1) Requirements shown in this table meet the minimum requirements of GRI Standard GM13, Revision 17 (July 17, 2023).
- (2) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.
- (3) Alternate measurement side for double-sided textured sheet.



202. DRAINAGE GEOCOMPOSITE

202.1 General Requirements:

- a. The drainage geocomposite shall consist of a HDPE geonet core with a non-woven geotextile layer heat-laminated to each side of the geonet.
- b. HDPE Geonet:
 - b1. The geonet shall be a profiled geonet manufactured by extruding two sets of polyethylene strands to form a three-dimensional structure in a diamond shape to provide planar water flow.
 - b2. The HDPE geonet formulation shall consist of a minimum of 97 percent of polyethylene resin, with the balance being carbon black and antioxidants for protection during extrusion and long-term service performance. No fillers, extenders, or other materials shall be mixed into the formulation.
 - b3. Regrind or reworked polymer which is previously processed HDPE geonet in chip form is acceptable if:
 - b3.1 It is the same formulation as the geonet being produced.
 - b3.2 No more than 25% rework material is used in the formulation.
 - b4. No PCR of any type shall be added to the formulation.
- c. Non-Woven Geotextiles:
 - c1. The geotextiles shall be non-woven, spun bonded fabric manufactured from long chain polymeric filaments, yarns, staple fibers, or other structural components of polyester or polypropylene formed into a stable network (mesh).
 - c2. The nominal weight of each geotextile shall be 8 oz/sy.



202.2 Material Requirements. The drainage geocomposite shall meet the requirements of Table 319020-2.

TABLE 319020-2
DRAINAGE GEOCOMPOSITE MATERIAL REQUIREMENTS

Property	Value	ASTM Test Method	Test Frequency
Geonet Core (Before Lamination)			
Thickness ⁽¹⁾	300 mil (min. ave.)	D5199	Per 5,000 lb.
Density of Formulated Material ⁽²⁾	0.95 g/cm ³ (min. ave.)	D1505 / D792	Per 5,000 lb.
Carbon Black Content	1.5% to 3.0%	D1603 / D4218	Per 5,000 lb.
Tensile Strength	75 lb/in. (min. ave.) ⁽³⁾	D7179	Per 5,000 lb.
Compressive Strength	120 psi (min. ave.)	D6364 ⁽⁴⁾	Per 5,000 lb.
Geotextile Cap and Carrier (Before Lamination)			
Mass per Unit Area	8 oz/sy (Min. ARV)	D5261	Varies ⁽⁵⁾
Grab Strength	200 lb (Min. ARV)	D4632	
Grab Elongation	50% (Min. ARV)	D4632	
Tear Strength	80 lb (Min. ARV)	D4533	
Puncture Strength	430 lb (Min. ARV)	D6241	
Permittivity	0.2 sec ⁻¹ (Min. ARV)	D4491	
AOS	0.25 (Max. ARV)	D4751	
UV Stability	50% Retained (500 hr)	D4355	
Double-Sided Laminated Composite			
Flow Rate / Width	0.42 gpm / ft (min. ave.)	D4716 ⁽⁶⁾	Per 5,000 lb.
Hydraulic Gradient	0.03		
Pressure	1,260 psf		
Seating Dwell Time	15 min.		
Ply Adhesion	1.0 lb/in. (min. ave.) ⁽⁷⁾	D7005	Per 5,000 lb.

Notes:

- (1) The diameter of the presser foot shall be 2.22 in. and the pressure shall be 2.9 psi.
- (2) The density of the base resin will be slightly lower than the density of the formulated material.
- (3) This is the average peak value for five equally spaced machine direction tests across the roll width.
- (4) Test shall be conducted using ASTM D6364 Section 6.3, the movable plate method.
- (5) Because the specified geotextile properties are based on average roll values (ARV), the statistics needed to obtain such values will dictate the frequency of testing.
- (6) Geocomposite shall be tested for ASTM D4716 flow rate per unit width between rigid end plates. Test values are for machine direction only.
- (7) This is the average of five equally spaced machine direction tests across the roll width. Both sides of the geocomposite shall be tested for ply adhesion.

202.3 Panel Layouts:

- a. Prior to manufacturing the drainage geocomposite for the retrofitted Bypass Basin, the GM/GC Manufacturer shall make a panel layout of the surface to be lined. Each panel to be used for the installation shall be given a numeric or alphanumeric identification number.
- b. Each panel identification number shall be related in writing to the manufacturing roll number that identifies the manufacturing lot number and date of manufacture.
- c. The panel layout shall be made considering the following requirements:
 - c1. Panel lengths shall include slope gain and anchorage.
 - c2. Perpendicular tie-ins shall be made a minimum of 5 feet beyond the toe of the slope.
 - c3. The drainage geocomposite shall be positioned on both the slopes and the bottom so that the geonet core overlaps by a minimum of 4 inches.
 - c4. All field seams on slopes shall be oriented parallel to the slope (oriented along, not across the slope).
 - c5. The number of seams in corners or odd-shaped geometric locations shall be minimized.

203. MATERIALS FOR ATTACHMENT OF GEOMEMBRANE TO CONCRETE

203.1 Batten Strip:

- a. Batten strip material shall be hot rolled, annealed, and pickled Type 316L stainless steel in accordance with ASTM A276.
- b. Strips shall be ¼ inch thick by 2 inches wide. Random lengths are acceptable.

203.2 Expansion Anchors:

- a. Expansion anchors shall be stud type with a single piece three section wedge and zinc plated in accordance with ASTM B633. Wedges shall be manufactured from ANSI Type 304 stainless steel. Hilti Kwik Bolt 3 Expansion Anchors, or equal, are acceptable.
- b. Wedge-type anchors shall have a minimum yield strength of 60,000 psi. Stud-type anchors shall have a minimum tensile strength of 65,000 psi.
- c. Anchors shall be 3/8-inch diameter by 3 ½-inches long.
- d. Washers for anchors shall be Type 18-8 stainless steel flat washers for 3/8-inch diameter bolt size.

203.3 Neoprene Gaskets for Batten Strips:

- a. Neoprene gaskets shall be ¼-inch thick by 2-inches wide, closed cell neoprene sponge sealing strips. Operating temperature range of neoprene shall be -40°F to +220°F.
- b. Neoprene gaskets placed against concrete shall have a pressure sensitive adhesive on the side of the gasket placed against the concrete.

PART 3 – EXECUTION

301. THIRD-PARTY QUALITY ASSURANCE CONFORMANCE TESTING

301.1 Prior to material shipment to the site, the GM/GC Manufacturer shall submit to the QA Testing Laboratory representative samples of the HDPE geomembrane and drainage geocomposite materials to be shipped to the project site. Samples sent to the QA Testing Laboratory shall be accompanied by a chain of custody and a certification that the samples submitted are from the geomembrane materials to be delivered to the project site.

301.2 HDPE Geomembrane:

- a. The QA Testing Laboratory shall perform conformance testing of the received geomembrane samples in accordance with Table 319020-3. The laboratory tests shall be performed at least at the corresponding minimum frequencies specified in Table 319020-3.
- b. Conformance test acceptance criteria shall be as specified in Table 319020-1.
- c. The QA Testing Laboratory shall prepare a test report documenting the results of all tests performed on each sample. The QA Testing Laboratory shall submit each test report to the GM/GC Manufacturer within 24 hours of completing the tests.
- d. If the results from any of the tests in Table 319020-3 do not meet the respective pass/fail thresholds, then the geomembrane materials from the resin batch(es) corresponding to the failed test(s) are to be considered rejected and shall not be shipped to the project site.

301.3 Drainage Geocomposite:

- a. The QA Testing Laboratory shall perform conformance testing of the received drainage geocomposite samples in accordance with Table 319020-4. The laboratory tests shall be performed at least at the corresponding minimum frequencies specified in Table 319020-4.
- b. Conformance test acceptance criteria shall be as specified in Table 319020-2.
- c. The QA Testing Laboratory shall prepare a test report documenting the results of all tests performed on each sample. The QA Testing Laboratory shall submit each test report to the GM/GC Manufacturer within 24 hours of completing the tests.
- d. If the results from any of the tests in Table 319020-4 do not meet the respective pass/fail thresholds, then the drainage geocomposite materials from the resin batch(es) corresponding to the failed test(s) are to be considered rejected and shall not be shipped to the project site.



TABLE 319020-3
THIRD-PARTY QUALITY ASSURANCE TESTING REQUIREMENTS
FOR HDPE GEOMEMBRANE LINER

Property	ASTM Test Method	Min. Testing Frequency
Thickness	D5994	Five per roll at locations evenly distributed throughout the roll
Density	D1505 / D792	Per resin batch, but not less than once per 20,000 SF
Tensile Properties: (1) Strength at Yield (2) Elongation at Yield (3) Strength at Break (4) Elongation at Break	D6693	
Tear Resistance	D1004	
Puncture Resistance	D4833	
Carbon Black Content	D4218	
Carbon Black Dispersion	D5596	

TABLE 319020-4
THIRD-PARTY QUALITY ASSURANCE TESTING REQUIREMENTS
FOR DRAINAGE GEOCOMPOSITE

Property	ASTM Test Method	Min. Testing Frequency
Flow Rate per Width	D4716	Once per 20,000 SF
Ply Adhesion	D7005	

302. **SHIPPING**

302.1 All geomembrane liner and drainage geocomposite materials shall be shipped to the project site in rolls. No geomembrane liner or drainage geocomposite materials shall be folded.

302.2 Transportation of all geomembrane liner and drainage geocomposite materials to the project site shall be the responsibility of the GM/GC Manufacturer.

303. **PACKAGING**

303.1 Packaging of all geomembrane liner and drainage geocomposite materials shall be the responsibility of the GM/GC Manufacturer. All rolls of geomembrane and drainage geocomposite shall be completely wrapped / covered in order to provide protection from ultraviolet degradation and damage during shipping and storage.

303.2 A label shall be attached or adhered to each roll of geomembrane. The label shall identify the following:

- a. Name of GM/GC Manufacturer.



- b. Product identification (e.g., brand name, product code), which can be traced back to the origin of the base material (resin supplier's name, resin production plant, resin brand name type, and production date of the resin).
 - c. Order number.
 - d. Date of manufacture.
 - e. Manufacturing lot number.
 - f. Geomembrane thickness and type.
 - g. Roll identification number.
 - h. Roll dimensions (i.e., length and width) and weight.
 - i. Panel number, which shall be referenced to the proposed HDPE geomembrane panel layout drawing prepared by the GM/GC Manufacturer.
- 303.3 A label shall be attached or adhered to each roll of drainage geocomposite. The label shall identify the following:
- a. Name of GM/GC Manufacturer.
 - b. Product identification (e.g., brand name, product code).
 - c. Order number.
 - d. Date of manufacture.
 - e. Manufacturing lot number.
 - f. Drainage geocomposite thickness and type.
 - g. Roll identification number.
 - h. Roll dimensions (i.e., length and width) and weight.
 - i. Panel number, which shall be referenced to proposed drainage geocomposite panel layout drawing prepared by the GM/GC Manufacturer.
304. ONSITE UNLOADING, INSPECTION, AND STORAGE
- 304.1 Unloading:
- a. Handling and unloading will be the responsibility of the Earthwork Contractor.
 - b. Upon arrival at the site, HDPE geomembrane rolls and drainage geocomposite rolls will be carefully unloaded by the Earthwork Contractor.
- 304.2 Inspection:
- a. Upon delivery of the material to the project site, the Geosynthetics Contractor shall visually inspect all of the rolls of HDPE geomembrane and drainage geocomposite for damage or rips or tears. This inspection shall be done without unrolling any rolls unless damage to the inside of a roll is found or suspected.
 - b. Any damage or defects shall be noted and immediately reported to the Owner, the GM/GC Manufacturer, and the carrier that transported the material. Any HDPE

geomembrane or drainage geocomposite roll or portion thereof, which, in the judgement of the Owner, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to the Owner.

304.3 Storage:

- a. The Owner will provide on-site, outdoor storage space for the HDPE geomembrane and drainage geocomposite materials. The Earthwork Contractor will prepare the space as necessary to provide a smooth surface free of rocks and standing water. The Earthwork Contractor will be responsible for protecting the geomembrane liner and drainage geocomposite rolls from damage, moisture, theft, and vandalism.
- b. All HDPE geomembrane and drainage geocomposite materials will be placed in the allocated storage space horizontally in their original, unopened, wrapped cover.
- c. Rolls will be placed into the allocated storage space in a manner that prevents them from sliding or rolling.

305. PREPARATION OF SURFACES TO BE LINED

305.1 Preparation of Concrete Surfaces:

- a. All concrete surfaces that will come in contact with a geomembrane shall be free of sharp edges or rough spots that can puncture or abrade the geomembrane. Where necessary, the concrete will be ground smooth by the Earthwork Contractor as specified in Specification P-1400, Section 319005.
- b. Where specified on the Design Drawings, one or more layers of geomembrane scuff strips shall be placed between the concrete and the geomembrane liner to act as a protective layer for the geomembrane liner.

305.2 Geosynthetic Clay Liner:

- a. See Section 319025 regarding installation, inspection, and acceptance of the geosynthetic clay liner (GCL) underlying the HDPE geomembrane liner.

306. INSTALLATION OF HDPE GEOMEMBRANE LINER

306.1 Weather:

- a. Geomembrane shall not be placed when the air temperature is above 104°F or below 41°F unless it can be demonstrated to the approval of the Owner by trial welds that acceptable welds can be made at the prevailing temperature. Under no circumstances shall geomembrane be placed when the air temperature is below 5°F.
 - a1. If the air temperature is above 32°F, trial welds shall be as described in Paragraph 306.7c.
 - a2. If the air temperature is at or below 32°F, trial welds and field seaming shall be as described in GRI Test Method GM9.
- b. Geomembrane shall not be deployed or placed in any of the following conditions:
 - b1. During any rainfall or snowfall.
 - b2. In the presence of excessive moisture due to fog or dew.
 - b3. In ponded water.



- b4. On frozen subgrade.
- b5. During high winds.
- 306.2 Precautions to Prevent Wind Damage:
 - a. If possible, work shall be oriented in the direction of the prevailing wind.
 - b. Provide adequate temporary loading and/or anchoring of the geomembrane by the use of sandbags, tires or other means which will not damage the geomembrane, to prevent uplift of the geomembrane by wind.
- 306.3 Other Precautions to Prevent Damage:
 - a. Protection of the geomembrane from damage due to foot traffic on the slopes shall be provided.
 - b. Provisions of facilities for safe entrance and egress of employees from sloped depressions is required.
- 306.4 Panel Layout:
 - a. The panels shall be placed in accordance with the GM/GC Manufacturer's panel layout drawing to ensure that they are placed in the proper direction for seaming.
 - b. If panels are installed in a location other than indicated on the panel layout drawing, the revised location shall be indicated on an "as-built" layout drawing prepared by the Geosynthetics Contractor. The "as-built" record drawing shall be submitted to the Owner and the CQA Contractor at the completion of the project.
- 306.5 Panel Deployment:
 - a. Only the panels that can be anchored and seamed together in one shift shall be unrolled.
 - b. Unroll and layout panels in as close to the final position as possible. Pulling geomembrane panels should be minimized to reduce the chance of permanent tension.
 - c. The methods and equipment used to deploy the panels shall not damage the geomembrane or the supporting surface.
 - d. Wrinkles and folds shall be minimized. However, enough slack shall be provided in both directions so that there will be no tension in the geomembrane at the lowest expected operating temperature.
- 306.6 Replacement of Damaged Geomembrane:
 - a. Any area of a panel, which, in the judgement of the Owner and/or the CQA Contractor, becomes seriously damaged (torn, twisted, or crimped permanently) shall be replaced at no additional cost to the Owner.
- 306.7 Field Seaming:
 - a. Method of Seaming:
 - a1. The primary welding procedure for seams shall be double wedge fusion welding.
 - a2. Extrusion welding shall be used only for repairs, detail work, and for seaming where double wedge fusion welding is not possible.

- a3. The rods used for extrusion welding shall be the same type of resin as the geomembrane, unless otherwise approved by the Owner.
- a4. The use of solvents or adhesives is not permitted.
- b. General Requirements for Seaming:
 - b1. On slopes steeper than 10 horizontal to 1 vertical, seams shall be oriented parallel to the line of maximum slope (oriented up and down, not across the slope) when possible. No seams oriented across the slope shall be used unless approved by the Owner.
 - b2. Seams parallel to the toe of the slope shall be located a minimum of 5 feet from the toe.
 - b3. Seams parallel to the crest of the slope shall be located a minimum of 2 feet from the crest.
 - b4. Seams at the bottom of a slope shall be overlapped so that the upslope sheet is positioned above the downslope sheet.
 - b5. Seaming shall extend to the outside edge of panels to be placed in the anchor trench. Seams at sheet corners of three or four sheets shall be completed with a patch having a minimum dimension of 24 inches, extrusion welded to the parent sheets.
 - b6. All cross seams between the two rows of seamed panels shall be welded during the coolest time of the day to allow for contraction of geomembrane.
- c. Trial Welds Prior to Beginning Seaming:
 - c1. Trial welds are required for pre-qualification of personnel, equipment, and procedures for making seams on identical geomembrane material under the same climatic conditions as the actual field production seams will be made.
 - c2. Trial welds shall be made as follows:
 - c2.1 Prior to each seaming period.
 - c2.2 Every 4 to 5 hours (i.e., at the beginning of the work shift and after the lunch break).
 - c2.3 Whenever personnel or equipment are changed.
 - c2.4 When climatic conditions result in wide changes in geomembrane temperature.
 - c2.5 When requested by CQA Geosynthetics Inspector for any seaming crew or piece of welding equipment if problems are suspected.
 - c3. Once qualified by passing a trial weld, welding technicians shall not change parameters without performing another trial weld.
 - c4. Trial welds shall be made on both double wedge fusion welds and on extrusion welds.
 - c5. A test strip shall be prepared by joining two pieces of geomembrane; each piece shall be at least 6 inches wide. The length of double wedge fusion welded seams shall be a minimum of 10 feet long. The length of an extrusion welded seam shall be a minimum of 4 feet long. The CQA Geosynthetics Inspector shall witness the fabrication of each test strip.
 - c6. All test welds shall be tested by destructive testing. Testing can be done as soon as the seam cools.



- c7. A minimum of three (3) one (1) inch wide sample strips shall be cut from each test strip, one from each end and one from the middle. The location of each sample shall be selected by the CQA Geosynthetics Inspector. The test strips shall be tested in peel at 2 inches per minute using a field tensiometer. The CQA Geosynthetics Inspector shall witness all tests.
- c8. If any of the test specimens fail, a new test strip shall be fabricated and the tests repeated for the new strip. If additional specimens fail, the seaming apparatus and the seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and successful trial welds have been achieved.
- c9. The trial weld is considered acceptable if, when tested for peel adhesion using the field tensiometer, all three specimens meet the criteria specified in Paragraph 306.7c or the three specimens exhibit Film Tear Bond (FTB) (yielding of the parent material before seam failure). In the case of a double wedge fusion welded seam, both welds must pass in order to be considered acceptable.
- c10. If the specimens pass the tests, production seaming operations can begin.
- c11. The Geosynthetics Contractor shall document all data on each trial weld, including:
 - c11.1 Date.
 - c11.2 Time.
 - c11.3 Operator.
 - c11.4 Machine number.
 - c11.5 Ambient temperature.
 - c11.6 Operating temperature.
 - c11.7 Speed setting.
 - c11.8 Pass/Fail designation.
- d. Preparation for Seaming:
 - d1. Prior to seaming, the surface of the geomembrane shall be wiped with a clean cloth to ensure that it is clean and free from moisture, grease, dust, dirt, and debris of any kind before seam welding is started.
 - d2. The panels shall be adjusted so that the seams are aligned to eliminate wrinkles and fish mouths. Where necessary, fish mouths and wrinkles shall be cut to achieve flat overlap.
- e. Seaming:
 - e1. Seaming shall be performed in accordance with the GM/GC Manufacturer's accepted procedure.
 - e2. Double Wedge Fusion Welds:
 - e2.1 The panels shall be overlapped a minimum of 4 inches prior to welding.
 - e2.2 A vehicle-mounted automated hot wedge welding apparatus shall be used to make each seam.

- e3. Extrusion Fillet Welding:
 - e3.1 Geomembrane overlap shall be a minimum of 3 inches for extrusion welding.
 - e3.2 Geomembrane panels shall be temporarily bonded using a hot air device prior to extrusion welding.
 - e3.3 The edge of the geomembrane to be fillet welded shall be pre-beveled before heat-tacking the seam in place.
 - e3.4 The seam overlap shall be ground (abraded) no more than one hour prior to welding.
 - e3.5 Grinding shall be performed in accordance with the GM/GC Manufacturer's instructions in a manner that does not damage the geomembrane.
 - e3.6 Grinding shall not extend more than 1/4 inch past the area to be covered with extrudate during welding.
 - e3.7 All grind marks shall be covered with extrudate.
- 306.8 Non-Destructive Field Testing:
 - a. General:
 - a1. All non-destructive field testing shall be performed and documented by the Geosynthetics Contractor.
 - a2. The CQA Geosynthetics Inspector shall observe all non-destructive test procedures.
 - a3. One hundred (100) percent of the seam length shall be tested using non-destructive procedures to check the continuity of the field seams. Non-destructive testing is not meant to qualify seam strength.
 - a4. Air pressure testing shall be performed in accordance with ASTM D5820 and GRI GM6.
 - a5. Vacuum box testing shall be performed in accordance with ASTM D5641 and as specified herein.
 - a6. Continuity testing shall be performed as seaming progresses or as soon as a suitable length of seam is available, not at the completion of all field seaming.
 - b. Double Wedge Fusion Welded Seams:
 - b1. Double wedge fusion welded seams shall be tested using air pressure testing.
 - b2. The procedure for testing shall be as specified in GRI GM6 for the type and thickness of geomembrane in use.
 - b3. The following pressures are applicable to all HDPE geomembrane. After an initial 2-minute pressure stabilization period, the pressure shall be maintained between 27 and 30 psi for 60 mil HDPE geomembrane. The pressure shall be sustained for a minimum of 5 minutes. The loss of pressure shall not exceed a maximum of 3 psi in 5 minutes. If the pressure does not stabilize in the first two minutes or the pressure loss exceeds the loss specified, the seam test shall be considered a failure.
 - b4. For every seam that fails a seam test:
 - b4.1 The leak or suspected leak shall be located and repaired.



- b4.2 The repaired seam shall be re-tested as required until all leaks are identified, and repaired, and the seam passes a subsequent air pressure test.
- b5. When the geometry of a double wedge fusion weld makes air testing impossible or impractical, vacuum testing may be used to test the seam.
- c. Extrusion Welded Seams:
 - c1. Extrusion welded seams shall be tested using vacuum chamber testing in accordance with ASTM D5641.
 - c2. The completed seam shall exhibit no leakage when tested between 4 and 8 psi minimum vacuum for approximately 10 seconds.
 - c3. If leaks are discovered during vacuum box testing, they shall be located, marked, and repaired.
 - c4. The repaired area shall be re-tested and exhibit no leakage.
- d. Inaccessible Seams:
 - d1. Where extrusion welded seam locations make use of vacuum box testing impractical, then the electric wire method of testing shall be used or the seam shall be cap stripped as approved by the Owner.
 - d2. If cap stripping is approved by the Owner, the seams shall be cap stripped as described in Paragraph 306.11d with strips of the same type and thickness of geomembrane being installed. The cap stripping shall be performed in the presence of the CQA Geosynthetics Inspector and the Owner's representative.
 - d3. The electric wire test method shall consist of placing a 24-gauge copper wire 1/8 inch beneath the top sheet overlap of the two sheets prior to welding with the extruder. The wire shall be embedded in the seam. After welding, a holiday spark detector, operating at 20,000 volts, shall be connected to one end of the wire, and slowly moved over the length of the seam. A seam defect between the probe and the embedded wire shall result in an audible alarm indicating where the defect is located.
- e. Test Reports:
 - e1. Test reports for all air pressure tests shall contain all data specified in ASTM D5820 and GRI GM6.
 - e2. Test reports for vacuum box testing shall contain all of the data specified in ASTM D5641.
 - e3. Test report for other types of non-destructive tests shall contain the following data for each test as a minimum:
 - e3.1 Location.
 - e3.2 Type of test.
 - e3.3 Test parameters.
 - e3.4 Test data.
 - e3.5 Test number.



- e3.6 Name of tester.
- e3.7 Outcome of the test.
- 306.9 Destructive Testing
 - a. Testing:
 - a1. Destructive testing shall be performed by an independent third-party laboratory employed by the CQA Contractor on samples cut from production welds in the field by the Geosynthetics Contractor.
 - a2. Samples shall be taken by the CQA Geosynthetics Inspector to the third-party laboratory and tested for shear strength and peel adhesion. For double wedge seam samples, both welds shall be tested for peel adhesion.
 - b. Location and Frequency:
 - b1. Test locations shall be determined after seaming. The location where the test samples shall be taken shall be marked by the CQA Geosynthetics Inspector. Locations may be prompted by the appearance of excessive heating, contaminations, offset welds, or a suspected defect. Destructive test samples shall be taken at a minimum average frequency of one per every 500 linear feet of seam length.
 - b2. The Method of Attributes described in GRI GM14 may be exercised to minimize the number of test samples taken if more than 100 destructive seam samples will be required based on the sampling strategy given in Paragraph 306.9b1.
 - b3. Each sample location shall be numbered and marked with permanent identification and the location of the sample and these locations shall be indicated on a plan drawing prepared and maintained by the Geosynthetics Contractor. The following shall be recorded for each sample:
 - b3.1 Date and time.
 - b3.2 Ambient temperature.
 - b3.3 Seam number and location.
 - b3.4 Welding apparatus used.
 - b3.5 Name of Master Geomembrane Seamer.
 - b3.6 Reason for taking the sample.
 - b3.7 Size of sample.
 - b3.8 Test results.
 - b3.9 Name of tester.
 - b4. Samples shall be cut by the Geosynthetics Contractor. The CQA Geosynthetics Inspector shall witness test sample cutting.
 - b5. Test samples shall be cut every shift and taken by the CQA Geosynthetics Inspector to the third-party laboratory the same day that the sample is prepared.



- c. Sample Size:
 - c1. The minimum sample size shall be 12-inches wide with a seam 16-inches long centered length wise in the sample.
 - c2. As agreed to with Owner, a sample may be increased in size to accommodate the requirements of the testing laboratory.
- d. Field Testing:
 - d1. A one-inch wide specimen shall be cut from each end of each sample for field testing.
 - d2. Each one-inch wide specimen shall be tested with a field tensiometer for peel adhesion.
 - d3. The Geosynthetics Contractor shall perform each field test in the presence of the CQA Geosynthetics Inspector.
 - d4. A test is considered acceptable if a specimen meets the criteria specified in Paragraph 306.9f for both peel and shear under Bonded Seam Strength, or exhibits Film Tear Bond (FTB). For double wedge fusion welds, both welds must pass the test. If either sample fails the field test, it shall be assumed that the seam will not pass the specified laboratory testing, and the sample shall be given a fail designation.
- e. Laboratory Testing:
 - e1. Full size (12-inch minimum length) samples shall be given to the CQA Geosynthetics Inspector for transportation to the independent third-party laboratory for testing.
 - e2. Destructive laboratory testing of all field seam samples will be performed in accordance with CQA Specification P-1401. All samples shall meet minimum requirements for shear strength and peel adhesion given in Paragraph 306.9f.
- f. Bonded Seam Strength Requirements. Geomembrane seams shall meet the following minimum strengths as specified by GRI GM19a:
 - f1. Shear strength: 120 ppi.
 - f2. Peel adhesion (hot wedge): 91 ppi.
 - f3. Peel adhesion (extrusion fillet): 78 ppi.
- g. Test Results:
 - g1. Written test results shall be given to the CQA Geosynthetics Contractor at the conclusion of each field test.
 - g2. In accordance with CQA Specification P-1401, verbal laboratory test results will be given by the CQA Contractor to the Geosynthetics Contractor within 24 hours of receipt of the samples. Written results will follow within one week.
 - g3. All test locations shall be marked with a pass/fail designation on the liner and on the drawings maintained by the Geosynthetics Contractor for submittal to the Owner after construction is complete.
- h. Re-Testing if Failure Occurs:
 - h1. If a seam fails testing, one additional sample shall be taken 10 feet on each side of the location of the failed test. Additional samples shall continue to be taken at 10-foot



intervals until tests show that seam strength is adequate and the zone in which the seam requires reconstruction is identified. Additional field and laboratory tests required to determine failed seams and any necessary patching and rework shall be performed at no additional cost to the Owner.

- h2. All passing seams shall be bounded by two locations from which samples passing laboratory destructive tests have been taken.
- h3. The entire seam length failing strength tests shall be reconstructed at no additional cost to the Owner.
- h4. If the length of reconstructed seam exceeds 150 feet, a sample shall be taken of the reconstructed seam every 150 feet and shall pass destructive testing.

306.10 Inspection:

- a. After seaming is complete, the Geosynthetics Contractor and the CQA Geosynthetics Inspector shall conduct a detailed walk-down to visually check all seamed and non-seamed areas of the HDPE geomembrane liner.
- b. All defects, holes, blisters, tears, signs of damage during installation, areas of undispersed carbon, and holes from destructive or non-destructive testing shall be marked and repaired.

306.11 Repair of Defects and Seams

a. Patching:

- a1. Patching shall be used to repair large holes, tears, and destructive sample locations.
- a2. All patches shall be round or oval, or shall have rounded corners.
- a3. All patches shall be made of the base HDPE geomembrane material and shall extend a minimum of 3 inches beyond the edges of the defect.
- a4. Patches shall be extrusion welded to the base sheet.

b. Grinding and Welding:

- b1. Grinding and welding shall be used to repair sections of extruded fillet seams with small defects.

c. Spot Welding:

- c1. Spot welding shall be used to repair small tears, pinholes, or other minor localized flaws.

d. Capping:

- d1. Capping shall be used to repair lengths of extrusion welded seams with large defects and to repair double wedge fusion welded seams.
- d2. Cap strips shall be made with strips of the same type and thickness of geomembrane being installed. Strips shall extend a minimum of 6 inches beyond the weld and shall have rounded corners.
- d3. Cap strips shall be extrusion welded to the base sheet.



- e. Cut Out and Replacement:
 - e1. When approved by the Owner, a length of defective seam may be cut out and replaced with a strip of new material seamed into place.
- f. Verification of Repairs:
 - f1. All repairs shall be non-destructive tested using one of the procedures described in Paragraph 306.8.
 - f2. Repairs passing non-destructive testing shall be deemed acceptable.
 - f3. Repairs of a seam in excess of 150 feet in length shall have one destructive seam test per 150 feet in length.

307. INSTALLATION OF DRAINAGE GECOMPOSITE

307.1 General Requirements:

- a. In the presence of wind, all drainage geocomposite shall be weighted with sand bags or the equivalent. Weights shall be installed during deployment and shall remain in place until deployment of the cover material.
- b. The drainage geocomposite shall not be welded to the geomembrane liner.
- c. All necessary precautions shall be taken to prevent damage to underlying geomembrane during placement of the drainage geocomposite.
- d. During placement of the drainage geocomposite, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the drainage geocomposite, it shall be cleaned and all dirt removed prior to placement of the cover material. Care shall be taken in the handling of sand bags to prevent rupture or damage of the sand bag.

307.2 Placement of Drainage Geocomposite:

- a. On slopes, the drainage geocomposite shall be secured in the anchor trench and then rolled down the slope in such a manner as to continuously keep the net in tension. If necessary, the net shall be positioned by hand after unrolling to minimize wrinkles.
- b. The drainage geocomposite shall be placed on side slopes with no horizontal seams along the slope and so that the long dimension is parallel to the slope.
- c. No horizontal seam shall be located within 5 feet of the toe of a slope.
- d. The drainage geocomposite shall be positioned on both the slopes and the bottom so that the geonet core overlaps by a minimum of 4 inches.
- e. Drainage geocomposite placed in the corners of the side slope shall be cut to eliminate excessive overlap of material.
 - e1. The drainage geocomposite shall only be cut using scissors or other cutting tools approved by the GM/GC Manufacturer that will not damage the underlying geomembrane.
 - e2. Care shall be taken not to leave tools in the drainage geocomposite.



- 307.3 Joining Geonet Cores:
- a. The geonet cores between adjacent drainage geocomposite panels shall be joined using white or yellow self-locking straps. Metal fastening devices are not permitted and shall not be used.
 - b. Adjacent panels on slopes shall be joined on 5-foot centers.
 - c. Adjacent panels on the basin floor shall be joined on 10-foot centers.
 - d. End seams on the basin floor shall be joined on 12-inch centers.
 - e. Horizontal and end seams in anchor trenches shall be joined on 12-inch centers.
- 307.4 Joining Geotextile Caps:
- a. Sewing on Basin Floor:
 - a1. On the basin floor and interior slopes flatter than 10H:1V (i.e., 10%), the geotextile caps between adjacent drainage geocomposite panels shall be continuously sewn or continuously heat bonded in accordance with the GM/GC Manufacturer's recommendations.
 - a2. Spot seaming is not allowed.
 - b. Sewing on Basin Slopes:
 - b1. On basin slopes greater than 10H:1V (i.e., 10%), the geotextile caps between adjacent drainage geocomposite panels shall be continuously sewn. All seams shall be vertical (i.e., parallel with the slope). No horizontal seams (i.e., across the slope) shall be permitted on basin slopes greater than 10H:1V (i.e., 10%).
 - b2. Spot seaming and heat bonding are not allowed.
 - c. Sewing Requirements:
 - c1. Sewing shall be done using polyester or heat-set UV stabilized polypropylene sewing thread with chemical and ultraviolet light resistance properties such that at least 50% of the thread's design strength is retained after 500 hours of exposure under ASTM D4355 test conditions. The thread color shall contrast with the color of the geotextile cap to assist in inspection of the seam. Tex size or denier number of the thread shall be specified by the Geosynthetics Contractor.
 - c2. Seams shall be "prayer" or "flat" seams. Seams shall be formed by mating the edge of the geotextile caps and sewing the caps together with continuous stitches located a minimum of four inches from the mated edges.
 - c3. Sewing procedures shall conform to the latest procedures recommended by the GM/GC Manufacturer.
 - c4. Stitching:
 - c4.1 For drainage geocomposites placed on the interior slopes of the basin, stitching shall be two rows (SSa-2) of stitching using a 01 two-thread locking chain stitch as described in the IFAI with 6 to 10 stitches per inch. Thread strength shall be such field seam strength will be a minimum of 90 percent of the tensile strength of the geotextile cap.



- c4.2 For drainage geocomposites used elsewhere in the basin, stitching shall be one row (SSa-1) of stitching using a Type 401 two-thread locking chain stitch as described in the IFAI with a minimum of 5 stitches per inch, or the seam shall be heat bonded. Thread strength shall be selected by the Geosynthetics Contractor.
- c5. Seam Inspections:
 - c5.1 Visual examinations shall be conducted to ensure that 100 percent of the seams are sewn or heat bonded as required.
 - c5.2 Seam sampling and testing are not required.
- 307.5 Protection of HDPE Geomembrane:
 - a. The Geosynthetics Contractor shall be responsible for protection of the HDPE geomembrane liner during installation of the drainage geocomposite and shall be responsible for repair of any damage caused to the liner by installation of the drainage geocomposite.
- 307.6 Repair of Holes or Tears:
 - a. All holes or tears in the drainage geocomposite shall be repaired by placing a patch of drainage geocomposite over the hole or tear. The patch shall extend 2 feet beyond the edges of the hole or tear. If the hole or tear width across the role is more than 50% of the width of the roll, the damaged drainage geocomposite shall be removed and replaced.
 - b. A patch's geonet core shall be secured to the original geonet core by tying every 12 inches.
 - c. A patch's geotextile cap shall be sewn into place by hand or machine so as the patch will not accidentally shift out of position or be moved when it is covered. The thread shall be the same as specified for sewing seams.
- 308. CREST ANCHORAGE
- 308.1 The HDPE geomembrane liner and the drainage geocomposite shall be anchored in an anchor trench at the top of the slope.
- 308.2 Prior to the placement of the geosynthetic clay liner (GCL) underlying the HDPE geomembrane liner in accordance with Section 319025, the Earthwork Contractor shall excavate the crest anchor trench to the lines and widths shown on the Design Drawings and in accordance with the excavation and shaping requirements specified in Specification P-1400, Section 319005.
- 308.3 After placement of the drainage geocomposite, the Earthwork Contractor will backfill the crest anchor trench in accordance with the backfilling requirements specified in Specification P-1400, Section 319005 and on the Design Drawings.
- 309. ATTACHMENT TO CONCRETE
- 309.1 Geomembrane shall be attached to concrete using batten strips in accordance with the details shown on the Design Drawings.
- 310. ATTACHMENT TO PIPE PENETRATIONS
- 310.1 Geomembrane shall be attached to pipe penetrations through the lining in accordance with the details shown on the Design Drawings.

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Geomembrane Liner with Geocomposite



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310.2 Prefabricated or field fabricated HDPE sleeves (pipe boots) used for attaching the geomembrane to the pipe shall be supplied by the GM/GC Manufacturer.

END OF SECTION 319020



SECTION 319025
GEOSYNTHETIC CLAY LINER

PART 1 – GENERAL

101. EXTENT

101.1 This section defines the minimum requirements for furnishing and installing the geosynthetic clay liner (GCL) to be used as the lower component of the retrofitted Bypass Basin's new composite liner system, all in accordance with the Design Drawings and as specified herein.

101.2 The Work shall include, but not be limited to, the following items:

- a. Manufacturing and shipping of the GCL.
- b. Performing specified quality assurance tests to verify the manufactured GCL consistently meets or exceeds the requirements of this Specification.
- c. Contracting an independent, third-party Quality Assurance (QA) Testing Laboratory to perform the specified quality assurance conformance tests to verify the manufactured GCL consistently meets or exceeds the requirements of this Specification.
- d. Preparation and inspection of surfaces to be lined.
- e. Placement and seaming of GCL.
- f. Crest anchorage of GCL.
- g. Sealing GCL around existing marker posts and an existing corrugated metal pipe (CMP) riser.
- h. Sealing GCL at vertical walls of existing inlet and outlet structures and existing marker posts within the basin.
- i. Visual inspection of the completed GCL.
- j. Patching and repairs.

101.3 Definitions:

- a. The following definitions of terms shall apply throughout this section:
 - a1. GCL Manufacturer: The manufacturer who is responsible for manufacture of GCL materials and for transporting GCL materials to the site.
 - a2. QA Testing Laboratory: The company employed by the GCL Manufacturer who is responsible for performing the specified quality assurance conformance tests. The QA Testing Laboratory shall be objective, competent, and independent from the GCL Manufacturer whose products are being tested. The QA Testing Laboratory shall remain independent throughout the duration of the project.
 - a3. CQA Geosynthetics Inspector: An inspector who works for the CQA Contractor and is responsible for inspection of the Geosynthetics Contractor's work.



- 101.4 Qualifications:
- a. GCL Manufacturer:
 - a1. The GCL Manufacturer shall be approved by the Owner. Owner's considerations when approving the GCL Manufacturer may include, but are not limited to, financial, safety, and prior performance aspects of the manufacturer.
 - a2. The GCL Manufacturer shall have an internal QA/QC program to ensure and to verify the manufactured products consistently meet or exceed the requirements of this section.
 - a3. The GCL Manufacturer shall have at least 10 years of experience manufacturing products similar to those required for this Work.
 - b. QA Testing Laboratory:
 - b1. The QA Testing Laboratory shall be approved by the Owner. Owner's considerations when approving the QA Testing Laboratory may include, but are not limited to, financial, safety, and prior performance aspects of the company.
 - b2. The QA Testing Laboratory shall have an internal QA/QC program to ensure and to verify the specified tests are performed correctly.
 - b3. The QA Testing Laboratory shall have at least 10 years of experience testing manufactured products similar to those required for this Work.
102. RELATED WORK SPECIFIED IN OTHER SECTIONS AND SPECIFICATIONS
- 102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:
- a. Earthwork Specification (P-1400):
 - a1. Section 319005 – Earthwork.
 - b. CQA Specification (P-1401):
 - b1. Section 014362 – Quality Assurance for Fill, Liner, and Leachate Collection Materials.
 - c. Geosynthetic Materials Specification (P-1402):
 - c1. Section 319020 – High-Density Polyethylene Geomembrane Liner with Drainage Geocomposite.
103. REFERENCE DOCUMENTS
- 103.1 Standards, specifications, manuals, codes, and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local agencies having jurisdiction.
- 103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.
- 103.3 Abbreviations listed indicate the form used to identify the reference documents cited in this Specification.



- 103.4 ASTM – ASTM International:
- a. D4643 Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.
 - b. D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
 - c. D5887 Standard Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Specimens using a Flexible Wall Permeameter.
 - d. D5889 Standard Practice for Quality Control of Geosynthetic Clay Liners.
 - e. D5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.
 - f. D5891 Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.
 - g. D5993 Standard Test Method for Measuring Mass per Unit of Geosynthetic Clay Liners.
 - h. D6243 Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by Direct Shear Method.
 - i. D6496 Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.
 - j. D6768 Standard Test Method for Tensile Strength of Geosynthetic Clay Liners.
104. SUBMITTALS
- 104.1 The Geosynthetics Contractor shall submit the following drawings and data as specified. The Geosynthetics Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Owner's information systems (as specified by the Owner).
- 104.2 Submittals After Material Order:
- a. Copies of the GCL Manufacturer's catalog data describing the GCL material proposed for use on this project.
 - b. Copies of GCL Manufacturer's quality assurance and quality control (QA/QC) certificates on tests performed on the material and a summary of the test results.
 - c. Certification of Compliance from the GCL Manufacturer, signed by its authorized representative, stating that the GCL material meets the requirements of this Specification and that those requirements are guaranteed by the GCL Manufacturer.
 - d. A copy of the GCL Manufacturer's Quality Control and Quality Assurance Policies and Procedures.
 - e. Warranty:
 - e1. Written warranty from the GCL Manufacturer covering the quality of the material and the installation and workmanship as applicable.
 - e2. The minimum period of warranty for materials shall be 5 years from the date of shipment.
 - e3. The minimum period of warranty for installation shall be 2 years.



- f. GCL Manufacturer's proposed GCL panel layout drawing for the Bypass Basin.
 - g. GCL Manufacturer's recommended procedures for making seams if different from those specified herein.
 - h. GCL Manufacturer's recommended procedures for repairing damaged GCL sections and seams if different from those specified herein.
 - i. GCL Manufacturer's details of GCL anchorage and attachment to structures and penetrations if different from those specified herein and from the details shown on the Design Drawings.
- 104.3 Submittals Upon Shipment:
- a. GCL Manufacturer's QA/QC certificates with each shipment of GCL. The QA/QC certificates shall include:
 - a1. GCL lot and roll numbers with corresponding shipping information.
 - a2. GCL Manufacturer's test data for the geotextile materials used in GCL production including, at a minimum, mass per unit area data and tensile test data.
 - a3. Certificates of analyses for the bentonite clay used in GCL production including, at a minimum, test data for the properties shown in Table 319025-1.
 - a4. GCL Manufacturer's test data for the finished GCL product including, at a minimum, test data for the properties shown in Table 319025-2.
 - b. Copies of all the third-party, independent QA Testing Laboratory test reports documenting the results of the conformance tests specified in Table 319025-3, as performed by the laboratory on the representative samples provided by the GCL Manufacturer.
- 104.4 Submittals After Installation:
- a. As-built panel layout.
 - b. Plan drawing showing locations of repairs and types of repairs made.
105. QUALITY ASSURANCE
- 105.1 Materials and construction procedures shall be subject to inspection and testing by the CQA Contractor employed by the Owner. Such inspections and tests will not relieve the Geosynthetics Contractor of the responsibility for providing and installing materials in compliance with specified requirements.
- 105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Geosynthetics Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance with specified requirements.
- 105.3 CQA activities will be performed by the CQA Contractor as described herein and in Specification P-1401.



PART 2 - MATERIALS

201. **GENERAL REQUIREMENTS:**

- 201.1 The GCL shall be a needle-punched GCL. The GCL shall be manufactured by placing a uniform layer of high-swell sodium bentonite encapsulated between two geotextiles and then needle punching through both layers of the geotextile and the bentonite to push fibers from the non-woven geotextile cap through the bentonite layer and embed them in the geotextile carrier on the other side.
- 201.2 The upper and lower support materials shall protect the bentonite but shall be sufficiently porous to allow bentonite flow-through to create a positive bentonite-to-bentonite seal at the seams.
- 201.3 The support materials used in the manufacturing shall not interfere with the swelling, self-healing, or low permeability characteristics of the GCL.
- 201.4 The GCL shall be fabricated such that bentonite will not be displaced when the liner is cut.
- 201.5 Six-inch and nine- or twelve-inch overlap marks shall be marked longitudinally on both edges of the geotextile cap by the GCL Manufacturer to assist in obtaining the proper overlap. The lines shall be printed in easily visible, non-toxic ink.

202. **GCL MATERIAL SPECIFICATIONS**

- 202.1 Sodium Bentonite. The bentonite utilized in the manufacture of the GCL, as well as any accessory bentonite provided for seaming and detail work, shall be Wyoming-grade sodium bentonite with the properties listed in Table 319025-1.

TABLE 319025-1
PROPERTIES OF BASE BENTONITE IN GCL MATERIALS

Property ⁽¹⁾	ASTM Test Method	Value	Min. Testing Frequency ⁽²⁾
Free Swell	D5890	24 mL / 2g min.	1/100,000 lb
Fluid Loss	D5891	18 mL max.	1/100,000 lb
Moisture Content	D4643	12% max.	1/100,000 lb

Notes:

- (1) Properties of the base bentonite prior to incorporation into the finished GCL product.
- (2) Minimum testing frequencies are per ASTM D5889. One test per 45 tonnes is also acceptable.



202.2 Geosynthetic Clay Liner. The finished GCL shall have the properties listed in Table 319025-2.

**TABLE 319025-2
 PROPERTIES OF FINISHED GCL MATERIALS**

Property	ASTM Test Method	Value	Min Testing Frequency ⁽¹⁾
Geotextile Properties			
Non-Woven Cap	D5261	6.0 oz/yd ² min.	1/20,000 SF
Non-Woven Carrier	D5261	6.0 oz/yd ² min.	1/20,000 SF
Finished GCL Properties			
Bentonite Mass/Area	D5993	0.75 lb/ft ² min. at 0% moisture content	1/20,000 SF
Moisture Content	D5993	35% max.	1/20,000 SF
Hydrated Internal Shear Strength	D6243	500 psf min. ⁽²⁾	1/20,000 SF
Tensile Strength ⁽³⁾	D6768	45 lb/in. min.	1/20,000 SF
Peel Strength	D6496	3.5 lb/in. min.	1/20,000 SF
Index Flux ⁽⁴⁾	D5887	2x10 ⁻⁹ m ³ /m ² /sec max.	1/20,000 SF
Hydraulic Conductivity ⁽⁴⁾⁽⁵⁾	D5887	1x10 ⁻⁹ cm/sec max.	1/20,000 SF

Notes:

- (1) Minimum testing frequencies listed are in accordance with ASTM D5889.
- (2) Typical peak value for specimen sheared under a 200 psf normal stress.
- (3) Machine (warp) direction of primary backing.
- (4) Index flux and hydraulic conductivity measured at 5 psi effective confining stress and 2 psi head.
- (5) Hydraulic conductivity based on a 7-mm-thick bentonite layer.

202.3 Panel Layout:

- a. Prior to manufacturing the GCL for the Bypass Basin, the GCL Manufacturer shall make a panel layout of the surface to be lined. Each panel to be used for the installation shall be given a numeric or alphanumeric identification number.
- b. Each panel identification number shall be related in writing to the manufacturing roll number that identifies the manufacturing lot number and the date of manufacture.
- c. The panel layout shall be made considering the following requirements:
 - c1. Panel lengths shall include slope gain and anchorage.
 - c2. Perpendicular tie-ins shall be made a minimum of 5 feet beyond the toe of the slope.
 - c3. A minimum 6-inch-wide overlap shall be allowed at longitudinal seams and a 24 inch-wide overlap at end seams. The GCL Manufacturer shall document the seam widths used to develop the panel layout on the plan drawing.
 - c4. All field seams on slopes shall be oriented parallel to the slope (oriented along, not across the slope).
 - c5. The number of seams in corners or odd-shaped geometric locations shall be minimized.



- 203. BENTONITE SEALING COMPOUND (BSC) AND GRANULAR BENTONITE (GB)
- 203.1 The BSC and GB shall be supplied by the GCL Manufacturer and shall be comprised of the same bentonite used in the manufacturing of the GCL.
- 203.2 The BSC shall be a mixture of non-aqueous liquid suspension agents which creates a paste-like texture. The suspension agents shall be non-toxic and water-soluble and shall not restrict the bentonite's ability to swell and absorb water upon hydration.

PART 3 - EXECUTION

- 301. THIRD-PARTY QUALITY ASSURANCE CONFORMANCE TESTING
- 301.1 Prior to material shipment to the site, the GCL Manufacturer shall submit to the QA Testing Laboratory representative samples of the GCL material to be shipped to the project site. Samples sent to the QA Testing Laboratory shall be accompanied by a chain of custody and a certification that the samples submitted are from the GCL materials to be delivered to the project site.
- 301.2 The QA Testing Laboratory shall perform conformance testing of the received GCL samples in accordance with Table 319025-3. The laboratory tests shall be performed at least at the corresponding minimum frequencies specified in Table 319025-3.
- 301.3 Conformance test acceptance criteria shall be as specified in Table 319025-1 and Table 319025-2.
- 301.4 The QA Testing Laboratory shall prepare a test report documenting the results of all tests performed on each sample. The QA Testing Laboratory shall submit each test report to the GCL Manufacturer within 24 hours of completing the tests.
- 301.5 If the results from any of the tests in Table 319025-3 do not meet the respective pass/fail thresholds, then the GCL material(s) represented by the failed test(s) shall be considered rejected and shall not be shipped to the project site.

TABLE 319025-3
THIRD-PARTY QUALITY ASSURANCE TESTING REQUIREMENTS

Property	ASTM Test Method	Min. Testing Frequency
Swell Potential	D5890	One test per material, and one test per 20,000 SF
Fluid Loss Properties	D5891	
Moisture Content	D4643	
Bentonite Mass / Area	D5993	
Peel Strength	D6496	
Hydrated Internal Shear Strength	D6243	
Tensile Strength	D6768	
Nonwoven Cap and Nonwoven Carrier Mass / Area	D5261	
Index Flux	D5887	
Hydraulic Conductivity	D5887	



302. SHIPPING

302.1 All GCL material shall be shipped to the project site in rolls. No GCL material shall be folded.

302.2 Transportation of the GCL material to the project site shall be the responsibility of the GCL Manufacturer.

303. PACKAGING

303.1 The finished GCL shall be completely wrapped and adequately secured with a durable polyethylene protective cover in order to provide protection from ultraviolet degradation of the Primary Backing Material (PBM) and excessive loss of moisture during shipping and storage.

303.2 A label shall be attached or adhered to each roll of the GCL. The label shall identify the following:

- a. Name of GCL Manufacturer.
- b. Product identification (e.g., brand name, product code).
- c. Order number.
- d. Date of manufacture.
- e. Manufacturing lot number.
- f. GCL thickness.
- g. Roll identification number.
- h. Roll dimensions (i.e., length and width) and weight.
- i. Panel number, which shall be referenced to the proposed GCL panel layout drawing prepared by the GCL Manufacturer.

303.3 The GCL shall be stenciled throughout each roll with the product name and name of the GCL Manufacturer, which can be cross-referenced to the roll number marked on the label and to the production and quality control data sheets.

304. ONSITE UNLOADING, INSPECTION, AND STORAGE

304.1 Unloading:

- a. Handling and unloading will be the responsibility of the Earthwork Contractor.
- b. Upon arrival at the site, the rolls of the GCL will be carefully unloaded by the Earthwork Contractor in accordance with the GCL Manufacturer's recommendations.

304.2 Inspection:

- a. Upon delivery of the material to the project site, the Geosynthetics Contractor shall conduct a visual inspection of the polyethylene sleeves of all rolls of GCL for damage or rips or tears. Sleeve damage shall be repaired immediately with tape or additional plastic sheeting and immediately reported to the Owner.
- b. Any damage shall be noted and immediately reported to the Owner, the GCL Manufacturer, and to the carrier that transported the material. Any GCL roll or portion



thereof, which, in the judgement of the Owner, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to the Owner.

304.3 Storage:

- a. The Owner will provide on-site, outdoor storage space for the GCL in a location near the area to be lined. The Earthwork Contractor will be responsible for protection of materials from damage, moisture, theft, and vandalism.
- b. All GCL rolls will be placed in the allocated storage space horizontally in their original, unopened, wrapped cover. The rolls will be stored off the ground on pallets or plywood in small stacks not to exceed five rolls in height. The rolls will be covered with a heavy protective tarpaulin or plastic sheeting. Care will be used to keep the GCL clean and free from debris prior to installation.
- c. Rolls will be stacked in a manner recommended by the GCL Manufacturer that prevents them from sliding or rolling from the stacks.
- d. Any rolls that come in contact with moisture while in storage will be set aside by the Earthwork Contractor to await examination by the Owner. Damaged rolls shall also be set aside and inspected to determine suitability of the material for use.

305. PREPARATION OF SURFACE TO BE LINED

305.1 The Earthwork Contractor will be responsible for the initial preparation and maintenance of the surfaces to be lined as specified in Specification P-1400, Section 319005 prior to placement of the GCL.

305.2 The Geosynthetics Contractor shall provide written certification to both the Earthwork Contractor and the Owner that the surface on which the GCL is to be installed is acceptable. The surface then becomes the responsibility of the Geosynthetics Contractor.

305.3 The surface upon which the GCL is to be placed shall be free of standing water and maintained in a firm, clean and smooth condition during liner installation.

306. GENERAL INSTALLATION REQUIREMENTS

306.1 Weather:

- a. GCL shall not be deployed or placed in any of the following conditions:
 - a1. During any rainfall or snowfall.
 - a2. In ponded water.
 - a3. During high winds.
 - a4. In the presence of excessive moisture due to fog or dew.
 - a5. On frozen subgrade.
- b. GCL shall not be deployed when the air temperature is above 104°F or below 41°F unless it can be demonstrated to the approval of the Owner by trial welds the overlying HDPE geomembrane liner sheets can be welded at the prevailing temperature in accordance with the field seaming requirements specified in Section 319020. Under no circumstances shall GCL be deployed when the air temperature is below 5°F.



- 306.2 Precautions to Prevent Wind Damage
- a. When possible, work shall be oriented in the direction of the prevailing wind.
 - b. To prevent uplift of GCL by wind, the Geosynthetics Contractor shall provide adequate temporary anchoring of the edges of the exposed sheets using sandbags, tires, or other means which will not damage the GCL.
- 306.3 Other Precautions to Prevent Damage
- a. Protection of the GCL from damage due to foot traffic on the slopes shall be provided.
 - b. Provisions of facilities for safe entrance and egress of employees from sloped depressions shall be provided.
- 306.4 Panel Layout:
- a. Horizontal panel seams are not allowed on slopes, except as required at the intersection of two slopes (valley). All panel seams on slopes shall be parallel to the flow line down the slope.
 - b. The panels shall be placed in accordance with the GCL Manufacturer's panel layout drawing to ensure that they are placed in the proper direction for overlapping.
 - c. If panels are installed in a location other than indicated on the panel layout drawing, the revised location shall be indicated on an "as-built" layout drawing prepared by the Geosynthetics Contractor. The as-built record drawing of the panel layout shall be submitted to the Owner and the CQA Contractor at the completion of the project.
307. PANEL DEPLOYMENT
- 307.1 The rolls of GCL shall be brought to the area to be lined with a front-end loader and support pipes set up such that the GCL roll is fully supported across its length and freely suspended so that it can unroll freely. The core bar and spreader bar shall not flex or bend excessively when a full roll is lifted.
- 307.2 Any rutting of the subgrade (i.e., Structural Fill) shall be smoothed and leveled prior to covering that area with GCL.
- 307.3 Deploy only as much GCL as can be covered with the HDPE geomembrane liner (in accordance with Section 319020) by the end of the day or in a reasonably short time in the event of precipitation.
- 307.4 Prior to the placement of the GCL, the Earthwork Contractor will excavate the anchor trench for the area to be lined in accordance with Article 312.
- 307.5 The cap material (non-woven geotextile) shall face upwards, toward the installer. The GCL shall be placed over the prepared surface in such a manner as to assure minimum handling.
- 307.6 Installation shall begin at a high elevation and proceed to a low elevation.
- 307.7 Pulling GCL panels shall be minimized to reduce the chance of permanent tension.
- 307.8 Wrinkles and folds shall be minimized. However, enough slack shall be provided in both directions so that there will be no tension in the GCL at the lowest expected operating temperature.



308. FIELD SEAMING

308.1 General Requirements for Seaming:

- a. Horizontal seams shall be located not less than five (5) feet from the toe of the slope.
- b. On slopes, all runs shall be continuous with the long dimension of all panels oriented parallel to the slope.
- c. Panels placed on the basin floor require no particular orientation.
- d. Once the first run has been laid, adjoining runs shall be laid with a six (6) inch minimum overlap on the longitudinal seams and twenty-four (24) inch minimum overlap on end seams. If the GCL Manufacturer recommends larger overlap seams, then the GCL Manufacturer's recommendations shall be followed.
- e. The edges of GCL panels shall be adjusted to smooth out wrinkles, creases, or "fishmouths" in order to maximize contact with the underlying panel.
- f. If the air temperature is higher than 85°F and the humidity is low, contraction may occur soon after placement when no confining stress has been placed over the GCL. To allow for the possibility of contraction under these conditions, the minimum seam overlap shall be increased to a minimum of twelve (12) inches on longitudinal seams and thirty-six (36) inches on end seams, or to 4% of the distance to the next parallel seams, whichever is greater.

308.2 Seaming:

- a. Seaming shall be performed in accordance with the GCL Manufacturer's accepted procedure (to be provided by the Owner).
- b. All seams shall be formed by executing a bentonite-enhanced overlap to ensure that a continuous seal is achieved.
- c. The side of the overlying panel shall be pulled back to expose and examine the overlap areas. Seam overlap areas shall be clean and free from moisture, free from dust and debris of any kind before seaming is started. Any contamination shall be removed.
- d. A fillet of dry granular bentonite shall be poured in a continuous manner along the overlap zone (between the edge of the panel and the six-inch line) at a rate of at least one-quarter pound per linear foot. All dry granular bentonite used shall be that provided by the GCL Manufacturer.
- e. Seam overlap on the bottom shall be placed such that the direction of flow is from the top sheet to the bottom sheet to form a shingle effect and prevent flow into the seam.

309. SEALING AROUND AND AGAINST EXISTING STRUCTURES

309.1 The GCL shall be sealed to the existing structures within the Bypass Basin.

309.2 A wedge of granular bentonite shall be installed at the point of intersection of an existing structure and the basin floor or sideslope. This granular bentonite wedge shall be placed between the existing liner and the new GCL and shall be at least 1.0 lbs per foot.

309.3 At the intersection of the GCL and an existing structure, the GCL shall extend higher on the structure than the termination point for the existing geomembrane liner.



- 309.4 If the attachment hardware for the existing geomembrane liner are sharp or protrude to the extent that they could damage the GCL, a supplement HDPE geomembrane rub sheet shall be installed between the GCL and existing attachment hardware.
- 309.5 Vertical GCL shall be anchored to an existing structure at an elevation higher than the existing HDPE geomembrane liner and lower than the new HDPE geomembrane liner as shown on the Design Drawings. As an alternate, the Geosynthetics Contractor may propose a self-adhering GCL product that demonstrates similar properties to the base GCL in accordance with GCL Manufacturer's written recommendations.
310. INSPECTION
- 310.1 After seaming is complete, the Geosynthetics Contractor and the CQA Contractor shall conduct a detailed walkdown to visually check all seamed and non-seamed areas of the GCL.
- 310.2 All defects, holes, blisters, tears, and signs of damage during installation shall be marked for repair.
311. PATCHING AND REPAIRS
- 311.1 Patching shall be used to repair small defects, blisters, holes, and tears.
- 311.2 All dirt and debris present in the patched area shall be removed.
- 311.3 All patches shall be round or oval or shall have rounded corners.
- 311.4 All patches shall be made of the base GCL and shall extend a minimum of twelve (12) inches beyond the edges of the defect. Accessory bentonite shall be placed around the perimeter of the affected area at a rate of one-quarter pound per lineal foot prior to placing the patch. Adhesive, such as wood glue, may be used if necessary to secure the patch.
312. CREST ANCHORAGE
- 312.1 The GCL shall be anchored in an anchor trench at the top of the slope.
- 312.2 Prior to the placement of the GCL, the Earthwork Contractor will excavate the crest anchor trench in accordance with the excavation and shaping requirements specified in Specification P-1400, Section 319005 and on the Design Drawings.
- 312.3 After installation of the drainage geocomposite in accordance with Section 319020, the Earthwork Contractor will backfill the anchor trench in accordance with the backfilling requirements specified in Specification P-1400, Section 319005 and on the Design Drawings.
313. PROTECTIVE COVER
- 313.1 The GCL shall be covered the same day with the HDPE geomembrane liner as shown on the Design Drawings in accordance with Section 319020. Precautions shall be taken to prevent damage to the GCL by restricting heavy equipment traffic.
- 313.2 To prevent premature contraction or hydration, only the amount of GCL that can be installed, inspected, repaired, and covered in the same day shall be installed.
- 313.3 Any leading edge or panels of GCL left unprotected shall be covered with a heavy, waterproofing tarp which is adequately secured and protected with sand bags or other ballast.



314. CORRECTIVE MEASURES FOR PREMATURE HYDRATION OF GCL

- 314.1 If the GCL is prematurely hydrated, becomes saturated, etc., then the following corrective action program shall be implemented:
- a. The affected panels shall be identified, documented, and exposed so that they can dry. Traffic over the impacted area shall be kept to a minimum during the drying process.
 - b. Once the affected panels have had enough time to dry, the Geosynthetics Contractor, the CQA Geosynthetics Inspector, and the Owner shall evaluate the impacted area for damage.
 - c. Following evaluation of the impacted area, the Geosynthetics Contractor shall recommend to either leave the GCL in place or to replace the GCL. The Geosynthetics Contractor's recommendation shall be made in writing, submitted with photographs documenting the evaluated area, and based on the extent of damage (or lack thereof).
 - c1. If the Geosynthetics Contractor's recommendation is to replace the affected GCL panels, then they shall be replaced at no additional cost to the Owner.
 - c2. If the Geosynthetics Contractor's recommendation is to leave the affected GCL panels in-place, and if either the Owner or CQA Geosynthetics Inspector disagree with that recommendation, then the Owner will contact the GCL Manufacturer for their recommendation.
 - c2.1 If the GCL Manufacturer's recommendation is to replace the affected GCL panels, then they shall be replaced at no additional cost to the Owner.
 - c2.2 If the GCL Manufacturer's recommendation is to leave the affected GCL panels in-place, and if either the Owner or CQA Geosynthetics Inspector disagree with that recommendation, then the GCL panels shall be removed in accordance with a negotiated agreement between the Owner and the Geosynthetics Contractor.

END OF SECTION 319025