

TECHNICAL SPECIFICATIONS

TIPPECANOE LAKE OUTLET STRUCTURE REPLACEMENT

KOSCIUSKO COUNTY, INDIANA

PUBLIC WORKS PROJECT NO. E060069



Prepared for:
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Public Works Division
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SECTION 01 00 00
GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project description.
- B. Specification Conventions.
- C. Codes and Regulations.
- D. Remediation Allowance
- E. Working Hours
- F. Construction and Storage Area
- G. Historical Artifacts
- H. Salvage Rights
- I. Permits
- J. Construction Surveying

1.2 PROJECT DESCRIPTION

- A. The purpose of the project is to replace the outlet structure that regulates the lake level of three interconnected lakes: Tippecanoe Lake, Oswego Lake, and James Lake. The existing outlet structure was built in 1964 and is comprised of 10 manually-operated gates and overflow weirs on a concrete foundation. The two-foot deep foundation rests on sand and has no cutoff to prevent movement. As a result, the structure incurred damage in the early 1990s due to undermining of the foundation. Riprap was placed in the scour hole as a temporary repair. In addition to concerns regarding the structure's foundation, the steel gates are weathered, some gates are no operational during winter months, and the overflow weirs are not appropriately sized. The gates and appurtenances will be removed and a new outlet structure constructed upstream of the existing structure. The Contract Documents were prepared for the Project by Christopher B. Burke Engineering, LLC, 115 W. Washington Street, Suite 1368 South, Indianapolis, IN 46204.
- B. The Work for the Tippecanoe Lake Outlet Structure Replacement includes the following general components:
 - 1. Removing the existing outlet structure including the gates and catwalk
Remove the 10 manually-operated gates, beams, platform, and other appurtenances. The existing concrete foundation and abutments are to remain.

2. Construct New Ogee Weir with Pneumatically-Operated Gate
Construct a new reinforced concrete ogee weir upstream of the existing structure with a pneumatically-operated gate and associated controls. Install a small-craft intrusion barrier upstream of the new weir.
3. Erosion and Sediment Control
Install and maintain erosion and sediment control measures throughout the duration of the project.
4. Cabin Removal (Alternate)
Remove existing cabin(s) on the south bank of Tippecanoe River downstream of the control structure.

1.3 SPECIFICATION CONVENTIONS

- A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the CONTRACTOR unless specifically noted otherwise. Incomplete sentences shall be completed by inserting “shall”, “CONTRACTOR shall”, and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. Except as worded contrary, the CONTRACTOR shall fulfill (perform) indicated requirement whether stated imperatively or otherwise.

1.4 CODES AND REGULATIONS

- A. If CONTRACTOR undertakes additional work due to the enactment of new or the amendment of existing statutes, ordinances, and regulations dealing with the performance of the successful bid, OWNER will issue a Work Directive Change requesting CONTRACTOR to prepare a Change Order and setting forth the additional work to be undertaken.

1.5 REMEDIATION ALLOWANCE

- A. CONTRACTOR shall include an allowance of \$10,000 in the base bid for OWNER-directed remediation of unforeseen constraints. The amount of any such allowances must be added to the CONTRACTOR's determined cost for performing the work, and included in the bid price for the project. **If any portion of the allowance is not used during the project, that portion shall revert to the OWNER and shall not be included in the CONTRACTOR's final payment.**
- B. Unforeseen constraints may include, but are not necessarily limited to, unforeseen subsurface conditions, improperly recorded or unrecorded physical properties or conditions at the site, uncommon adverse weather or site conditions, and conflicts within or omission from the Contract Documents.
- C. All remediation work shall be proposed to, and authorized by, the Director of Public Works Division prior to execution, jointly documented by CONTRACTOR and OWNER or designated representative, and recorded in CONTRACTOR's as-builts and OWNER or designated representative's project record documents. Proposed work must be accompanied with full documentation, and if authorized, shall be billed against, and paid under, the Remediation Allowance line item on the Schedule of Values.

1.6 WORKING HOURS

- A. CONTRACTOR shall perform all construction activity Monday through Friday, excluding State of Indiana holidays, between the hours of 7:00 AM and 7:00 PM unless previous arrangements are made with OWNER.

1.7 CONSTRUCTION AND STORAGE AREA

- A. CONTRACTOR shall confine the construction operations and storage of materials and equipment within the area shown on the Drawings or as otherwise approved by OWNER.

1.8 HISTORICAL ARTIFACTS

- A. Immediately notify OWNER and stop work if any objects are uncovered during construction which could possibly be of archaeological or historical importance. Work shall not resume until without OWNER'S permission.

1.9 SALVAGE RIGHTS

- A. Unless stated otherwise, all materials removed and not being reused shall become CONTRACTOR'S property and removed from the site.

1.10 PERMITS

- A. OWNER has obtained or will obtain the following permits for this project:
 - 1. Indiana Department of Natural Resources (IDNR) Construction in a Floodway Permit
 - 2. Indiana Department of Environmental Management (IDEM) Section 401 Water Quality Certification
 - 3. United States Army Corps of Engineers (USACE) Section 404 Permit
- B. CONTRACTOR is responsible for obtaining all other permits and/or licenses as required by law, ordinance, or regulation and paying any associated fees. Copies of any permits obtained by CONTRACTOR shall be provided to OWNER and ENGINEER.
- C. Copies of all permits obtained by OWNER will be provided to CONTRACTOR.
- D. CONTRACTOR is responsible for compliance with permit conditions and requirements.

1.11 CONSTRUCTION SURVEYING

- A. Employ a registered professional surveyor to perform surveying and staking required for construction and preparation of record drawings.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 BID ITEMS

- A. CONTRACTOR's schedule of values shall include the bid items described in this section.
- B. Take measurements and compute quantities for partial payments. ENGINEER will verify measurements and quantities.
- C. Basis for Partial Payments: As described for each individual bid item.
- D. DESCRIPTION OF BID ITEMS

1. ITEM 1 –OUTLET STRUCTURE PARTIAL REMOVAL

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Removing existing outlet structure including gates, controls, catwalk, handrails, and weir.
 - 2) Protecting existing abutments, outlet structure foundation, seawall, and placards.
 - 3) Removing existing cable buoy line.
 - 4) Other appurtenant and incidental Work.
 - 5) General requirements of sections listed.
- b. Do not include the cost of:
 - 1) Work included in other Bid Items.
- c. Basis for Payment:
 - 1) Outlet Structure Partial Removal shall be paid for as a percentage of the lump sum (LS) price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed to by ENGINEER and CONTRACTOR.
 - 2) Partial Completion percentages shall be based on the percentage of Outlet Structure Partial Removal completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for Work described herein:
 - 1) Section 02 41 16 – Demolition
 - 2) Section 31 23 19 – Dewatering

2. ITEM 2 – SITE DEMOLITION

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Removing chain link fence.

- 2) Removing and replacing dock as required.
 - 3) Removing trees.
 - 4) Protecting trees to remain.
 - 5) Removing and relocating utility poles as required including any panels or meters.
 - 6) Protecting existing utilities to remain as required.
 - 7) Other appurtenant and incidental Work.
 - 8) General requirements of sections listed.
- b. Do not include the cost of:
- 1) Removing existing outlet structure.
 - 2) Work included in other Bid Items.
- c. Basis for Payment:
- 1) Site Demolition shall be paid for as a percentage of the lump sum (LS) price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed to by ENGINEER and CONTRACTOR.
 - 2) Partial Completion percentages shall be based on the percentage of Site Demolition completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for Work described herein:
- 1) Section 02 41 16 – Demolition
 - 2) Section 31 10 00 – Site Clearing
3. ITEM 3 - DEWATERING
- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
- 1) Preparing and submitting Water Management Plan.
 - 2) Controlling ground and surface water necessary to complete Work.
 - 3) Constructing, maintaining, and removing cofferdams as required to complete Work.
 - 4) Installing, maintaining, and removing appropriate erosion and sediment control measures for dewatering.
 - 5) Other appurtenant and incidental Work.
 - 6) General requirements of sections listed.
- b. Do not include the cost of:
- 1) Work included in other Bid Items.
- c. Basis for Payment:
- 1) Dewatering shall be paid for as a percentage of the lump sum (LS) price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed to by ENGINEER and CONTRACTOR.
 - 2) Partial Completion percentages shall be based on the percentage of Dewatering completed, calculated based on what is shown on the Drawings.

- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for Work described herein:
 - 1) Section 31 23 19 – Dewatering

4. ITEM 4 – EXCAVATION

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Excavating for construction of new outlet control structure and disposing material offsite.
 - 2) Excavating and disposing unusable unsuitable material as required.
 - 3) Other appurtenant and incidental Work.
 - 4) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items
- c. Basis for Payment:
 - 1) Excavation shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Excavation completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 31 20 00 – Earthwork
 - 2) Section 31 23 19 – Dewatering

5. ITEM 5 – STONE BASE

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Placing and compacting stone base for outlet structure as required by the Work and Drawings.
 - 2) Other appurtenant and incidental Work.
 - 3) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Excavation required for stone installation.
 - 2) Work included in other bid items.
- c. Basis for Payment:
 - 1) Stone Base shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the tonnage of stone installed, calculated based on what is shown on the Drawings.

- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 31 05 16 – Aggregates for Earthwork
6. ITEM 6 – CONCRETE FOR FOUNDATIONS
- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) All concrete, form material, reinforcing steel, and accessories for concrete foundations.
 - 2) Installing foundation formwork, reinforcing steel, and accessory components.
 - 3) Placing and finishing all concrete material.
 - 4) Removing concrete formwork, and disposal if necessary.
 - 5) Concrete curing and protection of concrete from weather and other physical disturbances.
 - 6) Removing and disposing excess materials resulting from installation.
 - 7) Other appurtenant and incidental Work.
 - 8) General requirements of sections listed.
 - b. Do not include cost of:
 - 1) Excavation required for foundation installation.
 - 2) Stone base.
 - 3) Sheet piling.
 - 4) Pneumatically-operated gate and associated controls.
 - 5) Low-Flow Piping.
 - 6) Concrete for ogee weir, wiper walls, and abutment extensions.
 - 7) Work included in other bid items.
 - c. Basis for Payment:
 - 1) Concrete for Foundations shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the cubic yardage of concrete installed, calculated based on what is shown on the Drawings.
 - d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 03 10 00 – Concrete Formwork
 - 2) Section 03 20 00 – Concrete Reinforcement
 - 3) Section 03 25 00 – Concrete Accessories
 - 4) Section 03 30 00 – Cast-in-Place Concrete

7. ITEM 7– CONCRETE FOR OGEE WEIR

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) All concrete, form material, reinforcing steel, and accessories for concrete ogee weir including gate wiper walls.
 - 2) Installing foundation formwork, reinforcing steel, and accessory components.
 - 3) Placing and finishing all concrete material.
 - 4) Removing concrete formwork, and disposal if necessary.
 - 5) Concrete curing and protection of concrete from weather and other physical disturbances.
 - 6) Removing and disposing excess materials resulting from installation.
 - 7) Other appurtenant and incidental Work.
 - 8) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Excavation required for foundation installation.
 - 2) Stone base.
 - 3) Sheet piling.
 - 4) Pneumatically-operated gate and associated controls.
 - 5) Low-Flow Piping.
 - 6) Concrete for foundations or abutment extensions.
 - 7) Work included in other bid items.
- c. Basis for Payment:
 - 1) Concrete for Ogee Weir shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the cubic yardage of concrete installed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 03 10 00 – Concrete Formwork
 - 2) Section 03 20 00 – Concrete Reinforcement
 - 3) Section 03 25 00 – Concrete Accessories
 - 4) Section 03 30 00 – Cast-in-Place Concrete

8. ITEM 8– CONCRETE FOR ABUTMENT EXTENSIONS

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) All concrete, form material, reinforcing steel, and accessories for concrete abutment extensions.
 - 2) Installing foundation formwork, reinforcing steel, and accessory components.
 - 3) Placing and finishing all concrete material.
 - 4) Removing concrete formwork, and disposal if necessary.
 - 5) Concrete curing and protection of concrete from weather and other physical disturbances.

- 6) Removing and disposing excess materials resulting from installation.
 - 7) Other appurtenant and incidental Work.
 - 8) General requirements of sections listed.
- b. Do not include cost of:
- 1) Excavation required for foundation installation.
 - 2) Stone base.
 - 3) Sheet piling.
 - 4) Pneumatically-operated gate and associated controls.
 - 5) Low-Flow Piping.
 - 6) Concrete for foundations, ogee weir, and wiper walls.
 - 7) Work included in other bid items.
- c. Basis for Payment:
- 1) Concrete for Abutment Extensions shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the cubic yardage of concrete installed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
- 1) Section 03 10 00 – Concrete Formwork
 - 2) Section 03 20 00 – Concrete Reinforcement
 - 3) Section 03 25 00 – Concrete Accessories
 - 4) Section 03 30 00 – Cast-in-Place Concrete
9. ITEM 9 – SHEET PILING
- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
- 1) Driving a sheet pile wall cut-off as shown on the Drawings.
 - 2) Protecting and monitoring existing structures as required.
 - 3) Other appurtenant and incidental Work.
 - 4) General requirements of sections listed.
- b. Do not include cost of:
- 1) Work included in other bid items.
- c. Basis for Payment:
- 1) Sheet piling shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the square footage of sheet pile installed, calculated based on what is shown on the Drawings.

- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 31 41 16 – Sheet Piling

10. ITEM 10 – PNEUMATICALLY-OPERATED GATE

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Installing pneumatically-operated gate and associated controls.
 - 2) Coordination with gate manufacturer as required.
 - 3) Other appurtenant and incidental Work.
 - 4) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items.
- c. Basis for Payment:
 - 1) Pneumatically-Operated Gate shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Pneumatically-Operated Gate completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Drawings
 - 2) Assembly and installation in accordance with manufacturer's recommended procedures and recommendations

11. ITEM 11 – LOW-FLOW PIPING

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Installing low-flow pipes.
 - 2) Other appurtenant and incidental Work.
 - 3) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items.
- c. Basis for Payment:
 - 1) Low-Flow Piping shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Low-Flow Piping completed, calculated based on what is shown on the Drawings.

- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 33 11 10 – Mechanical Components

12. ITEM 12 – SMALL CRAFT INTRUSION BARRIER

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Installing small craft intrusion barrier and associated anchors.
 - 2) Coordination with small-craft intrusion barrier manufacturer as required.
 - 3) Other appurtenant and incidental Work.
 - 4) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items.
- c. Basis for Payment:
 - 1) Small Craft Intrusion Barrier shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Small Craft Intrusion Barrier completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Drawings
 - 2) Assembly and installation in accordance with manufacturer's recommended procedures and instructions

13. ITEM 13 – SIGNAGE

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Installing safety signs including posts and foundation.
 - 2) Installing regulatory buoys.
 - 3) Installing staff gage.
 - 4) Coordinating with OWNER to determine locations of signs.
 - 5) Other appurtenant and incidental Work.
 - 6) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items.
- c. Basis for Payment:
 - 1) Signage shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Signage completed, calculated based on what is shown on the Drawings.

- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 10 14 00 – Signage

14. ITEM 14 – LAKE MONUMENT

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Mounting existing lake placard as shown on the Drawings.
 - 2) Other appurtenant and incidental Work.
 - 3) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items.
- c. Basis for Payment:
 - 1) Lake Monument shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Lake Monument completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 03 10 00 – Concrete Formwork
 - 2) Section 03 20 00 – Concrete Reinforcement
 - 3) Section 03 25 00 – Concrete Accessories
 - 4) Section 03 30 00 – Cast-in-Place Concrete

15. ITEM 15 – RIPRAP

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Excavation and off-site removal of existing soils for riprap installation.
 - 2) Installation of geotextile fabric prior to installation of riprap.
 - 3) Placement of riprap to lines and grades shown on the Drawings.
 - 4) Other appurtenant and incidental Work.
 - 5) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items
- c. Basis for Payment:
 - 1) Riprap shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the tonnage of riprap installed, calculated based on what is shown on the Drawings.

- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 31 35 00 – Geotextiles
 - 2) Section 31 37 00 – Riprap

16. ITEM 16 – SEEDING

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Preparation of soil surface for seeding.
 - 2) Removal and disposal of any deleterious materials from topsoil, prior to seeding.
 - 3) Placing and securing erosion control blankets where indicated on the Drawings.
 - 4) Placing and securing mulch where erosion control blankets are not shown on the Drawings.
 - 5) Other appurtenant and incidental Work.
 - 6) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items
- c. Basis for Payment:
 - 1) Seeding shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the square yardage of seeding completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 31 20 00 – Earthwork
 - 2) Section 31 25 13 – Erosion Controls
 - 3) Section 32 92 19 – Seeding

17. ITEM 17 – EROSION AND SEDIMENT CONTROL

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Installation and maintenance of silt fence, concrete washout, construction entrance, and other erosion and sediment control measures that may be required.
 - 2) Dust control
 - 3) Removal and disposal of built-up silt during and after completion of Work.
 - 4) Removal and disposal silt fence upon approval of vegetation.
 - 5) Other appurtenant and incidental Work.
 - 6) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items

- c. Basis for Payment:
 - 1) Erosion and Sediment Control shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Erosion and Sediment Control completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 31 25 13 – Erosion Controls

18. ITEM 18 – CONSTRUCTION SURVEYING

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Surveying required for staking of construction limits.
 - 2) Surveying required for development of as-built drawings.
 - 3) Surveying required for construction of new control structure and appurtenances.
 - 4) Other appurtenant and incidental Work.
 - 5) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items
- c. Basis for Payment:
 - 1) Construction Surveying shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Construction Surveying completed, calculated based on what is shown on the Drawings.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 01 00 00 – General Requirements

19. ITEM 19 – TEMPORARY TRAFFIC CONTROL

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Installing, maintaining, and removing temporary traffic control devices.
 - 2) Coordinating with OWNER and authorities having jurisdiction to determine temporary traffic control requirements.
 - 3) Other appurtenant and incidental Work.
 - 4) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items

- c. Basis for Payment:
 - 1) Temporary Traffic Control shall be paid for as a percentage of the lump sum (LS) contract price as shown in the Bidder's Itemized Proposal at the estimated completion percentage at each Progress Payment agreed upon by ENGINEER and CONTRACTOR.
 - 2) Partial completion percentages shall be based on the percentage of Temporary Traffic Control completed, calculated based on what is required by OWNER.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 01 50 00 – Temporary Controls

20. ITEM 20 – MOBILIZATION/DEMobilIZATION AND PROJECT ADMINISTRATION

- a. Include cost of material, labor, equipment, and subcontracts for the following Work:
 - 1) Project management and administration.
 - 2) Bonds and insurance.
 - 3) Escrow of Bid Documents.
 - 4) Submittals.
 - 5) Coordination of subcontractors and utilities.
 - 6) Warranties and guarantees.
 - 7) All safety-related costs for Work activities.
 - 8) Project closeout.
 - 9) Other appurtenant and incidental Work.
 - 10) General requirements of sections listed.
- b. Do not include cost of:
 - 1) Work included in other bid items
- c. Basis for Payment:
 - 1) Monthly payments will be made in accordance with following formula.
 - a) First month payment = 0.20 x contract lump sum price
 - b) Last month payment = 0.10 x contract lump sum price
 - c) Intervening month payment = $\frac{0.7 \times \text{contract lump sum price}}{\text{No. of months of construction}}$
 - d) Bid item may not exceed 5% of Project total.
- d. The primary specifications related to this Contract Item are listed below, and contain references to other related specifications with additional requirements for the Work described herein:
 - 1) Section 01 00 00 – General Requirements
 - 2) Section 01 33 00 – Submittal Procedures
 - 3) Section 01 40 00 – Quality Requirements
 - 4) Section 01 50 00 – Temporary Construction Facilities

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Definitions.
- B. Submittal procedures.
- C. Product data.
- D. Shop drawings.
- E. Samples.
- F. Design data.
- G. Test reports.
- H. Certificates.
- I. Manufacturer's instructions.
- J. Construction photographs.

1.2 DEFINITIONS

- A. Submittal for Review:
 - 1. Submittal for ENGINEER's review in accordance with Contract Documents.
- B. Submittal for Record:
 - 1. Submittal for inclusion into OWNER's records prior to Substantial Completion. Submittal will not be reviewed by the ENGINEER.

1.3 SUBMITTAL PROCEDURES

- A. Transmit each submittal with an appropriate cover sheet or transmittal form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify project name, contractor name, subcontractor and supplier, pertinent drawing and detail number, and specification section number appropriate to submittal.
- D. Apply CONTRACTOR'S stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

- E. Schedule submittals to expedite Project, and deliver to ENGINEER electronically in Portable Document Format (.pdf) or by mail to:
Christopher B. Burke Engineering, LLC
PNC Center
115 West Washington Street, Suite 1368 South
Indianapolis, IN 46204
- F. Deliver one copy of technical submittals to OWNER electronically in Portable Document Format (.pdf) or by mail to:
Indiana Department of Natural Resources
Division of Water
402 W. Washington Street W264
Indianapolis, IN 46204
- G. For each submittal for review, allow ten (10) days excluding delivery time to and from Contractor.
- H. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- I. Allow space on submittals for CONTRACTOR and ENGINEER review stamps.
- J. When revised for resubmission, identify changes made since previous submission.
- K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- L. Submittals not requested will not be recognized or processed.

1.4 PRODUCT DATA

- A. Product Data: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. After review, produce copies and distribute to appropriate parties.

1.5 SHOP DRAWINGS

- A. Shop Drawings: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.

- C. Submit electronically in Portable Document Format (.pdf) or by mail.
- D. After review, produce copies and distribute to appropriate parties.

1.6 SAMPLES

- A. Samples: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples for Selection as Specified in Product Sections:
 - 1. Submit to ENGINEER for aesthetic, color, or finish selection.
 - 2. Submit samples of finishes from full range of manufacturers' standard colors, in custom colors selected, textures, and patterns for OWNER selection.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- F. Samples will not be used for testing purposes unless specifically stated in specification section.
- G. After review, produce copies and distribute to appropriate parties.

1.7 DESIGN DATA

- A. Submit for ENGINEER'S knowledge as contract administrator or for OWNER.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 TEST REPORTS

- A. Submit for ENGINEER'S knowledge as contract administrator or for OWNER.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or CONTRACTOR to ENGINEER, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to ENGINEER.

1.10 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, and finishing, to ENGINEER for delivery to OWNER in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.11 CONSTRUCTION PHOTOGRAPHS

- A. Take photographs of existing site and structure conditions prior to commencing work. Provide to ENGINEER electronically a maximum 3 days prior to start of Work.
- B. Provide photographs of site and construction throughout progress of Work, acceptable to ENGINEER.
- C. Submit photographs with each Application for Payment.
- D. Take site photographs from differing directions indicating relative progress of the Work 3 days maximum prior to submitting.
- E. Photographs shall be submitted electronically to ENGINEER in JPEG format.
- F. Identify each photograph along with the date and time the photo was taken.
- G. Deliver electronic image files to OWNER with project record documents. Catalog and index image files in chronological sequence.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Tolerances.
- C. References.
- D. Labeling.
- E. Testing and inspection services.
- F. Manufacturer's field services.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from ENGINEER before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.

- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from ENGINEER before proceeding.
- E. Neither contractual relationships, duties, nor responsibilities of parties in Contract, nor those of ENGINEER shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 LABELING

- A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.

1.6 TESTING AND INSPECTION SERVICES

- A. Employ and pay for services of a third-party independent testing agency or laboratory acceptable to OWNER to perform specified testing.
 - 1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full-time registered Engineer and responsible officer.
- B. The independent firm will perform tests, inspections, and other services specified in individual specification sections and as required by OWNER and/or ENGINEER.
 - 1. Laboratory: Authorized to operate in the State of Indiana.
 - 2. Laboratory Staff: Maintain full-time registered Engineer on staff to review services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections, and source quality control may occur on or off project site. Perform off-site testing as required by ENGINEER or OWNER.

- D. Reports indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents will be submitted by independent firm to OWNER, ENGINEER, and CONTRACTOR.
 - 1. Submit final report indicating correction of Work previously reported as non-compliant.
- E. Cooperate with independent firm and furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify ENGINEER and independent firm 24 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR's use.
- F. Testing and employment of testing agency or laboratory shall not relieve CONTRACTOR of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection required due to non-conformance to specified requirements shall be performed by same independent firm on instructions by ENGINEER. Payment for re-testing or re-inspection will be paid by CONTRACTOR.
- H. Independent Testing Agency Responsibilities:
 - 1. Test samples of mixes submitted by CONTRACTOR.
 - 2. Provide qualified personnel at site. Cooperate with ENGINEER and CONTRACTOR in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify ENGINEER and CONTRACTOR of observed irregularities or non-conformance of Work or products.
 - 6. Perform additional tests required by ENGINEER or OWNER.
 - 7. Attend pre-construction meetings, progress meetings, and pre-installation meetings if requested.
- I. Independent Testing Agency Reports: After each test, promptly submit report electronically to OWNER, ENGINEER, and CONTRACTOR. When requested by ENGINEER or OWNER, provide interpretation of test results. Include the following:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and specifications section.
 - 6. Location in Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.
- J. Limits on Testing Authority:
 - 1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency or laboratory may not approve or accept any portion of the Work.

3. Agency or laboratory may not assume duties of CONTRACTOR.
4. Agency or laboratory has no authority to stop the Work.

1.7 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing, adjustment and balancing of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to ENGINEER 10 days in advance of required observations. Observer is subject to approval of OWNER and ENGINEER.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary water service.
 - 4. Temporary sanitary facilities.

- B. Construction Facilities:
 - 1. Field offices and sheds.
 - 2. Vehicular access.
 - 3. Parking.
 - 4. Progress cleaning and waste removal.
 - 5. Traffic regulation.
 - 6. Fire prevention facilities.

- C. Temporary Controls:
 - 1. Barriers.
 - 2. Enclosures and fencing.
 - 3. Security.
 - 4. Water control.
 - 5. Dust control.
 - 6. Erosion and sediment control.
 - 7. Noise control.
 - 8. Pollution control.

- D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

- A. Provide, maintain, and pay for power service as needed by CONTRACTOR for construction operation.

- B. Complement existing power service capacity and characteristics as required for construction operations.

- C. Facilities exposed to weather shall be weatherproof.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting as required for construction operations and to maintain a safe and secure site.

- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.
- C. Coordinate lighting with OWNER.
- D. Maintain lighting and provide routine repairs.

1.4 TEMPORARY WATER SERVICE

- A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations. Water supply may be transportable containers.
- B. Pay all costs for installation, maintenance, and removal, and service charges for all water used. Service shall be metered separately to CONTRACTOR if public water supply is used.

1.5 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures in conformance with state and local health and sanitation regulations and in sufficient number for use by CONTRACTOR'S employees.
- B. Maintain facilities daily in clean and sanitary condition.
- C. Remove temporary sanitary facilities from the site at the completion of construction.

1.6 FIELD OFFICES AND SHEDS

- A. All field offices, if necessary, shall be approved by OWNER.
- B. Locate in accordance with OWNER's requirements and in a location that will not interfere with construction activity or access to the site or adjacent sites.
- C. Storage Areas and Sheds: Size storage areas and sheds for storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products.

1.7 VEHICULAR ACCESS

- A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
- B. Perpetuate existing drainage patterns.
- C. Extend and relocate vehicular access as Work progress requires, and provide detours as necessary for unimpeded traffic flow.
- D. Location as indicated on Drawings or as approved by OWNER and ENGINEER.
- E. Provide unimpeded access for emergency vehicles.

- F. Provide and maintain access to fire hydrants and control valves free of obstructions.
- G. Provide means of removing mud from vehicle wheels before entering streets.
- H. Use designated existing on-site roads for construction traffic.

1.8 PARKING

- A. Utilize existing gravel lot for parking.
- B. When site space is not adequate, provide additional off-site parking.
- C. Parking on public streets is not permitted. Tracked vehicles shall not be allowed on paved areas.
- D. Do not allow vehicle parking on existing pavement unless approved by OWNER and applicable permits (if any) have been obtained.
- E. Maintenance
 - 1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
 - 2. Maintain existing and permanent paved areas used for construction. Promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.
- F. Repair
 - 1. Repair existing or permanent facilities damaged by use to original or specified condition.

1.9 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.10 TRAFFIC REGULATION

- A. Coordinate traffic control requirements with OWNER and authorities having jurisdiction.
- B. Signs, Signals, And Devices:
 - 1. Traffic Cones and Drums: As approved by authority having jurisdiction.
 - 2. Flagperson Equipment: As required by authority having jurisdiction.
- C. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- D. Haul Routes:
 - 1. Consult with OWNER and authorities having jurisdiction to establish public thoroughfares to be used for haul routes and site access.

2. Confine construction traffic to designated haul routes.
3. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

E. Traffic Signs and Signals:

1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
2. Relocate as Work progresses to maintain effective traffic control.

F. Removal:

1. Remove equipment and devices when no longer required.
2. Repair damage caused by installation.
3. Remove post settings to depth of 2 feet.

1.11 FIRE PREVENTION FACILITIES

- A. Prohibit smoking within buildings. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.
- B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Provide and maintain in working order portable fire extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.

1.12 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades as required by authorities having jurisdiction for public rights-of-way.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.13 ENCLOSURES AND FENCING

- A. CONTRACTOR shall construct temporary perimeter fencing as needed for safety and security. OWNER must approve the type and location of fencing prior to installation.
- B. Provide gates with locks as required to maintain access.

1.14 SECURITY

A. Security Program:

1. Protect Work and existing premises from theft, vandalism, and unauthorized entry.
2. Initiate program at project mobilization.

3. Maintain program throughout construction period until directed by OWNER or ENGINEER.

B. Entry Control:

1. Restrict entrance of persons and vehicles into Project site and existing facilities.
2. Allow entrance only to authorized persons with proper identification.
3. Maintain log of workers and visitors; make available to OWNER on request.

1.15 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping and dewatering equipment.
- B. Protect site from puddling or running water.

1.16 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.17 EROSION AND SEDIMENT CONTROL

- A. Install and maintain erosion control measures as indicated on the Drawings and in the Specifications and in accordance with local, state, and federal regulations.
- B. Minimize surface area of bare soil exposed at one time.
- C. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- D. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.18 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by construction operations.
- B. Coordinate noise control requirements with OWNER.

1.19 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.20 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.

- B. Remove underground installations and grade site as indicated on Drawings.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 02 41 16

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolishing designated structures.
 - 2. Protecting items designated to remain.
 - 3. Removing demolished materials.
- B. Related Sections:
 - 1. Section 31 05 16 - Aggregates for Earthwork
 - 2. Section 31 20 00 - Earthwork
 - 3. Section 31 10 00 - Site Clearing

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Photographs and/or videotape, sufficiently detailed, of existing conditions prior to demolition including all areas within and adjacent to the demolition limits.
- C. Submit copy of permits required by regulatory agencies for demolition.

1.3 RECORD DOCUMENTS

- A. Project Record Documents: Accurately record actual locations of capped utilities, subsurface obstructions, and other related items demolished during the construction process.

1.4 QUALITY ASSURANCE

- A. Conform to requirements of regulatory agencies and utility companies.
- B. Perform work in accordance with local, state, and federal laws for worker safety.

1.5 PROJECT CONDITIONS

- A. OWNER assumes no responsibility for actual condition of structures to be demolished.
- B. Notify OWNER and ENGINEER upon discovery of hazardous materials.
- C. Demolished materials shall be removed from the site unless otherwise noted.
- D. Maintain access to the site at all times.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Fill Material: As specified in Section 31 20 00

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine existing structures indicated to be demolished before demolition.
- B. Determine where removals may result in structural deficiency or unplanned collapse during demolition. Coordinate demolition sequence and procedures to prevent structures from becoming unstable.
- C. Determine where demolition may affect structural integrity or weather resistance of adjacent structures indicated to remain.
 - 1. Identify measures required to protect structures from damage.
 - 2. Identify remedial work including patching, repairing, bracing, and other work required to ensure the structural integrity and condition of structures indicated to remain.

3.2 PREPARATION

- A. Notify affected utility companies before starting work and comply with utility company requirements.
- B. Erect and maintain temporary barriers and security devices as required by OWNER or ENGINEER or as otherwise warranted to maintain a safe project site.
- C. Protect existing vegetation, structures, utilities, or other items indicated to remain.
- D. Protect existing utilities as required to prevent damage. All utilities must be fully operational and accessible throughout the duration of the project unless otherwise coordinated with and approved by OWNER, ENGINEER, and utility company at least two days in advance of the proposed interruption.
- E. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as required or indicated on the Drawings.
- F. Protect and maintain survey benchmarks and control points from disturbance.

3.3 DEMOLITION REQUIREMENTS

- A. Use of explosives is not permitted.
- B. Conduct demolition to minimize interference with adjacent structures or property.

- C. Cease operations immediately when adjacent structures appear to be in danger. Notify OWNER and ENGINEER immediately. Do not resume operations until directed.
- D. Conduct operations with minimum interference to public or private accesses to occupied adjacent structures. Maintain access and egress from adjacent structures at all times.
- E. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property.
- F. Sprinkle Work with water as warranted to minimize dust. Provide hoses and water connections required for this purpose.

3.4 LAKE OUTLET STRUCTURE DEMOLITION

- A. Remove existing lake outlet structure to the extent indicated on the Drawings.
- B. Protect existing foundation and abutments to remain as required.
- C. Repair any damage to the existing concrete foundation and abutments as a result of demolition.
- D. Continuously clean-up and remove demolished materials from site. Do not allow materials to accumulate on site.

3.5 CABIN DEMOLITION

- A. Remove cabins where specified on the Drawings including foundation.
- B. Backfill with approved material as required to raise excavations to existing grade and provide positive drainage.
- C. Repair any damage to adjacent structures or utilities as a result of demolition.
- D. Continuously clean-up and remove demolished materials from site. Do not allow materials to accumulate on site.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. General formwork.
 - 2. Form ties and accessories.

- B. Related Sections:
 - 1. Section 03 20 00 – Concrete Reinforcement
 - 2. Section 03 25 00 – Concrete Accessories
 - 3. Section 03 30 00 – Cast-in-Place Concrete

1.2 RESPONSIBILITY

- A. CONTRACTOR shall be solely responsible for the ability of formwork to produce members of the size, shape, and exterior finish required, for the structural adequacy of the forms to carry construction loads without excessive deflection, and for the safe use of forms in connection with completion of the concrete work. CONTRACTOR shall be responsible for any injury or damage arising from inadequate forms or from premature removal of formwork.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Forming System Data: Submit the forming system(s) to be used for each type of concrete placement. Forming system information should include information on form material, form ties, and structural bracing components.

- C. Placement Schedule: CONTRACTOR shall submit a concrete placement schedule showing the pouring sequence and desired location of construction, expansion/contraction, and control joints.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record locations of installed construction, expansion/contraction, and control joints as well as location of installed waterstops.

1.5 REFERENCE STANDARDS

- A. Formwork design, construction, and removal shall conform to ACI 301, Standard Specifications for Structural Concrete.

PART 2 PRODUCTS

2.1 FORMWORK

- A. Form Ties: Form ties shall be a watersealing snap-in type or tapered thru bolt type. The large end of tapered thru bolt ties shall be on the liquid side of the wall.
- B. Plywood Forms and Liners: Plywood forms and liners shall be minimum grade B-B High Density Overlay Concrete Form Panels, Class I.
- C. Lumber: Formwork lumber shall be straight and clean. All nails shall be withdrawn, and surfaces in contact with concrete shall be thoroughly cleaned before reuse.
- D. Metal Forms: Metal forms shall be fabricated from carbon steel sheets conforming to ASTM A569.

2.2 FORM RELEASE

- A. Form release agent shall be FORM-EZE NATURAL by Euclid Chemical Company, or approved equal.
- B. Form release agent shall be water-based or an emulsion of natural, biodegradable oils that will not discolor or stain concrete surfaces.

PART 3 EXECUTION

3.1 PREPARATION

- A. Fastening Devices for Other Work: Coordinate with other trades and properly place and locate in position all necessary dowels, bolts, anchors, anchor slots, inserts, sleeves, openings, hangers, metal ties and other fastening devices required for attachment and support of adjacent work. Securely anchor all embedded items.

3.2 FORMWORK REQUIREMENTS

- A. General:
 - 1. Formwork shall comply with ACI 347 and to shape, lines, and dimensions of the members as indicated on the Drawings. Joints in forms shall be horizontal or vertical. Forms shall be properly braced or tied to maintain position and shape under all dead and live loads and to prevent leakage. Forms shall be assembled so their removal will not damage the concrete. Tolerances for formed surfaces shall be in compliance with ACI 301.
 - 2. Lumber formwork may be used for surfaces which will not be exposed to view. Use plywood or metal forms for exposed surfaces.
 - 3. Provide temporary openings at the base of forms greater than 4 feet high, if necessary, to facilitate cleaning and inspection immediately before depositing concrete.
 - 4. All external corners of concrete exposed to view shall be chamfered by using 3/4 inch by 3/4 inch by 45 degree wood stripping, except as otherwise indicated on the Drawings.

- B. Grade A Forms
 1. Unless otherwise indicated, Grade A forms shall be used for all exposed concrete.
 2. Grade A forms shall consist of steel forms lined with 3/16-inch-thick tempered hardboard or 1/4-inch-thick plywood, or by using plywood forms.
 3. Full sized sheets shall be used wherever possible. The edges of all sheets shall be straightened for tight, close fitting joints. Bulges or depressions more than 1/8 inch in 4 feet will not be permitted. Open joints which would permit leakage shall be sufficient cause for rejection of forms. Other tolerances shall be as allowed by ACI 347.

- C. Grade B Forms
 1. Use lumber, plywood, or metal forms. All joints shall be solidly backed, aligned, and made leakproof.
 2. Unless otherwise indicated, Grade B Forms are intended for use where concrete will not be exposed to view, such as below grade, below normal liquid levels in water-retaining structures, or inside manholes, boxes, vaults, etc.

- D. Surface Treatment of Formwork: The inside surface of lumber forms shall be coated with a form release agent prior to placing concrete. Form release shall be applied by hand sprayer or roller. Excess form release shall be wiped off the form material exposed to the concrete.

- E. Inspection of Formwork: Concrete shall not be placed until the forms are in conformance with the Drawings and Specifications.

- F. Removal of Forms: Forms shall be removed in accordance with requirements of ACI 318, without damaging the concrete. Leave shoring in place until concrete will safely support its own weight plus any live loads that may be placed upon it.

- G. Cleaning of Formwork: Concrete forms which are reused shall have all laitance and other material removed from the face of the form immediately following removal of forms from the previous concrete placement and prior to installation of the formwork for the subsequent placement. Buildup of any kind accumulating on the form face is unacceptable and shall be grounds for rejection of formwork.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Provisions for steel reinforcement bars.
 - 2. Provisions for welded wire reinforcement.
- B. Related Sections:
 - 1. Section 03 10 00 – Concrete Formwork
 - 2. Section 03 25 00 – Concrete Accessories
 - 3. Section 03 30 00 – Cast-in-Place Concrete

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Shop drawings shall be prepared in accordance with ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures. Drawings shall indicate bending diagrams, shapes, dimensions, clearances, splicing and lap lengths, accessories, and installation notes.
- C. Product Data: Submit product data on all steel reinforcement coupling/splicing materials.
- D. Certifications: Certifications for reinforcement shall be submitted in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record all variations from the Drawings.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcement Bars: Reinforcement bars shall be ASTM A706, Grade 60 deformed bars, except as otherwise indicated.
- B. Smooth Dowels: Smooth dowels shall be ASTM A615, Grade 60 plain bars.
- C. Threaded Dowels: Threaded dowels shall be ASTM A36.

- D. Welded Wire Fabric: Welded wire fabric shall conform to ASTM A185. Where welded wire fabric is shown but not sized on Drawings, use 6" x 6" x W2.9 x W2.9 WWF.
- E. Accessories: Accessories for proper installation of reinforcement shall conform to CRSI "Manual of Standard Practice for Reinforced Concrete Construction". All bar supports at exposed surfaces shall be Class 1- Plastic Protected.
- F. Reinforcement Fabrication: Reinforcement fabrication shall conform to ACI 315, ACI 318, and approved shop drawings.
- G. Mechanical Splices: Mechanical splices of reinforcing bars shall be CADWELD or equal. Splices shall develop 125% of the specified yield strength of the reinforcing bar.

PART 3 EXECUTION

3.1 PREPARATION

- A. Fastening Devices for Other Work: Coordinate with other trades and properly place and locate in position all necessary reinforcement, dowels, bolts, anchors, anchor slots, inserts, hangers, metal ties, and other fastening devices required for attachment and support to adjacent work. Securely anchor all fixtures and embedded items.

3.2 REINFORCEMENT

- A. General:
 - 1. The placement of reinforcing steel shall conform to "Placing Reinforcing Bars", as published by the Concrete Reinforcing Steel Institute except as noted.
 - 2. Reinforcement shall be inspected and approved by ENGINEER before enclosing forms are erected and shall be rechecked immediately prior to depositing concrete.
- B. Splices, Laps, and Dowels:
 - 1. Provide continuous reinforcement or dowels through construction joints. The use of inserts in lieu of dowels shall be subject to ENGINEER'S approval. One half of reinforcement shall be discontinued across control joints unless otherwise indicated.
 - 2. Splice laps shall be as indicated on the Drawings. Dowels shall be of the same size as the largest bar to which they lap, unless otherwise indicated.
 - 3. Splices for horizontal wall reinforcement of walls circular in shape shall be staggered so that no more than each fifth bar in each face is spliced within any two feet of wall perimeter. The minimum length of staggered lap splices in circular structure shall be as indicated on the Drawings.
 - 4. Clean all concrete, dirt, and foreign substances from reinforcing bars by sand blasting or by other methods approved by ENGINEER prior to making a mechanical (CADWELD) splice. Manufacturer's representative shall provide on-site instruction to CONTRACTOR's personnel and OWNER's representative on proper installation procedures. Manufacturer's representative shall observe initial splices made by CONTRACTOR for proper technique and performance of the product. Manufacturer's representative shall make additional visits to the site as may be requested by OWNER/ENGINEER to inspect completed work.

CONTRACTOR shall only use personnel who have received instructions from manufacturer's representative to perform the work.

C. Reinforcement for Formed Concrete

1. Secure steel reinforcement to maintain proper position during concrete placement. Concrete protection for reinforcement shall conform to ACI 318, except as otherwise indicated on the Drawings.
2. CONTRACTOR is responsible for supporting reinforcement to maintain proper position during concrete placement.

END OF SECTION

SECTION 03 25 00

CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Construction joints.
 - 2. Waterstop.
- B. Related Sections:
 - 1. Section 03 10 00 – Concrete Formwork
 - 2. Section 03 20 00 – Concrete Reinforcement
 - 3. Section 03 30 00 – Cast-in-Place Concrete

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit product data for all materials specified in this section.
- C. Samples: Provide one (1), six-inch long sample for each type of waterstop submitted.
- D. Manufacturer’s Certificate: Provide manufacturer’s certificate stating that the submitted product meets or exceeds the requirements of this section.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of installed construction joints and waterstop locations.

1.4 TYPES OF JOINTS IN CONCRETE

- A. Construction Joint: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint also referred to as a “cold joint.” Construction joints, unlike expansion and contraction joints, are not intended to allow for movement of concrete members. Unless otherwise indicated, joints in water bearing members shall be provided with a waterstop of the shape/type indicated in the Drawings and Section 2.1. Reinforcing bars, if required, shall be continuous through the joint, as detailed on the Drawings. A bonding agent shall be applied to the hardened concrete surface of the joint prior to placing the fresh concrete.
- B. Contraction Joint: Contraction joints are also formed when fresh concrete is placed against a hardened concrete surface except the fresh concrete shall not be permitted to bond with the hardened surface of the earlier pour. A bond breaker shall be applied to the hardened concrete surface of the joint prior to placing the fresh concrete. The slab reinforcement shall be stopped 4-

1/2 inches from the joint, which is provided with a sleeve type dowel, to allow shrinkage of the concrete of the later pour. Waterstop shall also be provided when indicated.

PART 2 PRODUCTS

2.1 WATERSTOP

- A. Waterstop shall be virgin polyvinyl chloride (PVC) and shall be dense, homogeneous, and uniform. Holes and imperfections shall be cause for rejection.
- B. Waterstops for construction joints shall be 6-inch by 1/4-inch minimum split waterstop or 6-inch by 1/4-inch minimum dumbbell type with hollow center bulb. Multiple rib type of waterstop is required. Where size and type of waterstop are not indicated, 6-inch by 1/4-inch minimum with hollow center bulb shall be used. T-shaped retrofit waterstops may be required at existing to new concrete joints.
- C. Provide prefabricated tees, crosses, and other configurations as required for all intersections of waterstop.
- D. Bentonite Waterproofing Strip: A 1" x 3/4" strip of Waterstop RX as manufactured by Colloid Environmental Technologies Company, or equal.
- E. Bentonite waterproofing may serve as an acceptable alternative when PVC waterstop cannot be installed properly. CONTRACTOR must provide sufficient evidence for the need to use bentonite waterproofing.

PART 3 EXECUTION

3.1 PREPARATION

- A. Examine all existing concrete surfaces exposed to new concrete for irregularities and deficiencies. Remove all debris and foreign matter from concrete surfaces.
- B. Provide roughened surface where indicated on the Drawings prior to cleaning of surfaces.
- C. Surfaces to receive bond-breaking or other compounds shall be thoroughly cleaned prior to application of any treatment.

3.2 CONSTRUCTION JOINTS

- A. General:
 - 1. Arrange construction joint bulkheads to allow concrete to be placed between construction joints in one continuous operation.
 - 2. Provide construction joints with shear transfer keyways and waterstops as indicated. Unless otherwise indicated on the Drawings, spacing of construction joints for walls shall not exceed 40 feet.

3. Erect bulkheads where shown on the Drawings. Bulkheads shall be at right angles to the main reinforcement and shall produce a tongue and grooved joint of the configuration indicated on the Drawings. Install waterstop as indicated.
 4. Obtain ENGINEER'S approval if it becomes necessary to eliminate or relocate construction joints shown on the Drawings.
 5. Tops of edge forms, bulkheads, and screeds shall be set to the finished elevations and to provide uniform pitch to drains as indicated on Drawings.
- B. Horizontal Joints: Provide methods of achieving a leakproof joint. No horizontal construction joints will be permitted in slabs, beams, or girders.
- C. Vertical Joints: Joints in reinforced walls, slabs, beams, and girders shall be perpendicular to the axis or plane of the members joined.
- D. Exposed edges of construction joints shall have a 3/4" chamfer.

3.3 WATERSTOPS

- A. Provide continuous waterstops. Embed approximately half of the waterstop on each side of the joint. Field splice and join PVC waterstop with heat sealing butt joints.
- B. All splices and joints shall be in accordance with the manufacturer's recommendations to produce a water-tight joint. Lap splices will not be permitted. Support and protect the waterstop during construction. Repair or replace all damaged waterstop.
- C. Waterstops shall terminate 2 inches below the finished top of all walls. Waterstops extending through one or more concrete sections shall be of sufficient length to allow for proper continuation of the waterstop into the following pour(s).
- D. Bentonite waterproofing shall only be used in horizontal joints in locations where concrete is a minimum of 12 inches in thickness.
- E. Bentonite waterproofing that has been exposed to water prior to concrete placement, to any degree, shall be removed and replaced according to the manufacturer's recommendation. CONTRACTOR shall be responsible for all costs associated with replacement of fouled waterproofing.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete mixtures.
 - 2. Mixing.
 - 3. Transporting.
 - 4. Placement schedule.
 - 5. Depositing and consolidating.
 - 6. Slab finishing.
 - 7. Curing.
 - 8. Formed surface finishing.

- B. Related Sections:
 - 1. Section 03 10 00 – Concrete Formwork
 - 2. Section 03 20 00 – Concrete Reinforcement
 - 3. Section 03 25 00 – Concrete Accessories

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Samples and Certifications: Samples and certifications shall be submitted in accordance with Section 01 33 00. Unless otherwise indicated, submit certifications for all products and samples as may be specifically requested by ENGINEER.

- C. Product Data: Submit manufacturer's literature for all admixtures proposed for the work.

- D. Delivery Tickets: Submit delivery tickets in accordance with ASTM C94 for each batch of ready-mixed concrete. Information on the ticket shall include class of concrete, water content, time of loading, truck number, admixtures, and quantity

- E. Mix Design:
 - 1. At least 35 days prior to placing of concrete, CONTRACTOR shall perform laboratory testing on the proposed mix proportions and samples of proposed materials in accordance with Section 01 40 00 – Quality Requirements. The laboratory will prepare a detailed report of the 7-day and 28-day compressive strength, slump, and air-entrainment of the concrete mix submitted. The strength determination for each class of concrete will be based on not less than three concrete specimens of each age.
 - 2. The laboratory will employ techniques to adjust for mechanical vibrators and any special devices or equipment to be used for the work. CONTRACTOR shall inform OWNER and the Testing Laboratory of proposed techniques and devices.

3. As an alternate to items 1 and 2 above, the mix design may be based upon field experience. CONTRACTOR shall submit all data and calculations necessary to show compliance with Section 5.3 of ACI 318

1.3 QUALITY CONTROL

- A. Materials and Methods: Materials and methods of mixing and placing concrete shall conform to ACI 318, Building Code Requirements for Reinforced Concrete.
- B. Laboratory Tests:
 1. CONTRACTOR will retain the services of testing laboratory in accordance with Section 01 40 00 – Quality Requirements and submit reports in accordance with Section 01 33 00 – Submittal Procedures. All additional tests required because concrete fails to meet Specifications will be deducted from payments due to CONTRACTOR.
 2. CONTRACTOR shall provide all necessary labor and devices to obtain samples and provide field curing.
 3. As directed by the ENGINEER, the testing laboratory will provide for inspection of the concrete batch plant to see that the concrete is properly mixed and that the consistency of mix is being controlled.
 4. The laboratory will immediately submit two copies of laboratory reports on all strength tests to the ENGINEER, OWNER, CONTRACTOR, and the supplier. Reports will be made on a form acceptable to the ENGINEER and will indicate delivery ticket numbers, strength, slump, air entrainment, admixtures, concrete temperature, pour location, date, age, and remarks on properties changes.
- C. Compressive Strength Tests: Sample specimens for strength tests of Class A concrete shall be taken not less than once a day, nor less than once for each 50 cubic yards of concrete placed, nor less than once for each 5,000 square feet of surface area for slabs and/or walls. Five specimens shall be secured in accordance with ASTM C172. Three specimens will be laboratory-cured in accordance with ASTM C31. The other two shall be cured entirely under field conditions. Compressive strength tests will be made at the age of 7 days on one field-cured and one laboratory-cured specimen. Compressive strength tests will be made at the age of 28 days on one field-cured and two laboratory-cured specimens. All tests will be in compliance with ASTM C39.
- D. Enforcement of Strength Requirements:
 1. For Class A Concrete, the average of any five consecutive compressive strength test results on laboratory-cured specimens shall be greater than the specified strength. Not more than one of the five test results shall be less than the specified strength. No individual laboratory cured strength test result shall fall below the specified strength by more than 400 psi. Each strength test result will be the average of two laboratory cured cylinders from the same sample test at 28 days.
 2. If more than one of the laboratory-cured specimens is below the specified strength, or if the strengths of field-cured specimens are more than 10% below the strength of the corresponding laboratory-cured specimens, the ENGINEER will determine the appropriate corrective measures to be provided at CONTRACTOR's expense.
- E. Slump Tests: Tests for slump will be made when directed by the ENGINEER in accordance with ASTM C143. Excessive slump is cause for rejection of concrete prior to placement.

- F. Air Entrainment Tests: At least two air content tests will be made each day and when change in consistency of the concrete mix is noted. The air content tests will be made in accordance with ASTM C138, C173, C231, or AASHTO T152.
- G. Adverse Weather Conditions:
1. Comply with ACI 305 or 306 for hot or cold weather concreting.
 2. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing without approval of the ENGINEER. Maintain the temperature of concrete above 50 degrees F for 5 days after placement. When high early strength portland cement concrete is used, the temperature shall not be less than 70 degrees F for 2 days or 50 degrees F for 3 days. Transition the concrete to the outside temperature at a rate of 1 degree F each hour for the first 24 hours and 2 degrees F each hour thereafter.
 3. In no case shall the temperature of concrete exceed 90 degrees F at the time of placement. If insulated forms are used, the temperature of the concrete mixture shall not exceed 80°F at time of placement.
 4. If the ENGINEER determines that heat of hydration may cause excessive concrete temperatures and subsequent detrimental effects, the concrete mixture shall not exceed 60°F at time of placement for critical pours.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Water: Water shall be clean and potable.
- B. Cement: Portland cement shall be ASTM C150 Type I.
- C. Pozzolon: Pozzolons shall conform to ASTM C618 and shall have a loss of ignition less than three percent.
- D. Aggregate:
1. Fine and coarse aggregate shall be clean, hard, natural, or manufactured material conforming to ASTM C33.
 2. The nominal maximum size of the aggregate shall not be larger than one-fifth of the narrowest dimension between forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars or pretensioning tendons. Coordinate with maximum aggregate sizes specified hereafter for classes of concrete. These limitations may be waived if, in the judgement of the ENGINEER, workability and methods of consolidation are such that the concrete can be placed without honeycomb or void.
- E. Admixtures:
1. Admixtures shall conform to ASTM C260 (air entrainment) or C494 (chemical admixtures) and shall be products of one of the following manufacturers, or equivalent:
 - a. W. R. Grace and Co.
 - b. Euclid Chemical Co.
 - c. Master Builders Solutions
 - d. Sika Chemical Corp.

2.2 MISCELLANEOUS MATERIALS

- A. Curing and Sealing Compound: Curing compound shall be a colorless liquid acrylic formulated to comply with ASTM C309, Type 1, Class B.
- B. Membrane Curing Compound: Membrane curing compound shall conform to ASTM C309, Type 1 or Type 1-D. Type 1-D compound shall only be used for P.C.C. pavement.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- D. Moisture Retaining Cover: One of the following, complying with ASTM C171:
 - 1. Waterproof paper
 - 2. Polyethylene film
 - 3. Polyethylene-coated burlap
- E. Silicon Water Repellent: Silicon water repellent shall be a 5% Silicon Solution complying with Fed. Spec. SS-W-110 and manufactured by W. R. Grace, W. R. Meadows, Euclid Chemical Co., or equivalent.
- F. Hardener: Hardener shall be a colorless fluosilicate-base solution of chemically active hardening agents.

2.3 BONDING COMPOUND, GROUT, AND MORTAR MIXTURES

- A. Epoxy Bonding Compound: Epoxy bonding compound for joining new to existing concrete shall be Sikadur Hi-Mod by Sika Chemical Co., Thiopoxy by W. R. Grace and Co., Euco Epoxy 452 or 620 by Euclid Chemical Co., or equivalent.
- B. Non-Epoxy Bonding Compound: Non-epoxy bonding compound for joining new to existing concrete where bonding compound cannot be placed immediately prior to pouring of new concrete shall be Weld-Crete by Larsen Products Corp., Euco Weld by Euclid Chemical Co., or equal. Rewettable bonding compound shall be protected from all sources of moisture prior to pouring new concrete.
- C. Epoxy Grout:
 - 1. The two components of epoxy bonding compound shall be mixed in compliance with the manufacturer's instructions. If permitted by the manufacturer, the epoxy bonding compound may be combined with approximately 1-1/2 parts of oven-dry sand to 1 part of the bonding compound, by volume. Mixing of trial batches may be necessary to determine the best proportions.
 - 2. The sand for epoxy grout shall meet the following gradation and shall be oven-dry:

<u>Sieve Size</u>	<u>Percentage Passing (by mass)</u>
#8	100
#50	45
#100	10

D. Patching Mortar:

1. Mix 1 part portland cement to 3 parts fine aggregate. Add white cement to match color of adjacent surface. Provide test patch for approval by OWNER prior to patching on exposed concrete. Mix with minimum amount of water necessary.

2.4 CONCRETE MIXTURES

A. General:

1. Concrete not indicated otherwise shall be Class A concrete.
2. The proportions of cement, aggregate, and water shall be selected by CONTRACTOR in accordance with ACI 318 to provide a plastic and workable mix. Coarse aggregate shall be limited to prevent harshness and honeycombing. Coarse aggregate size shall not be greater than the maxima listed for the various classes of concrete and as previously specified under aggregate.

- B. Class A Concrete: Class A structural concrete shall have a 28-day strength of 4,000 psi, shall contain not less than 564 pounds cementitious material per cubic yard, shall have a water-cement plus pozzolon ratio of not more than 0.45, and shall contain 4 percent to 7 percent entrained air, by volume. If a pozzolon is used, it shall not exceed 140 pounds per cubic yard of concrete. In addition, Class A concrete shall contain a water-reducing, densifying admixture and have a maximum slump of 4 inches. The maximum aggregate size for concrete for columns, beams, and formed slabs shall be 1 inch. The maximum aggregate size for other concrete construction shall be 1-1/2 inches.

C. Admixtures:

1. Water-reducing densifying admixture added to Class A concrete shall reduce the water-cement ratio while maintaining slump and compressive strength. Use as manufacturer recommends.
2. Other admixtures may be proposed by CONTRACTOR or requested by the ENGINEER and shall be provided at no additional cost to OWNER. Subject to approval, admixtures may be used for the following:
 - a. To increase slump up to 50% while maintaining compressive strength and water-cement ratio.
 - b. To retard set during hot weather.
 - c. To retard set at the surface to expose aggregate.

- D. Calcium chloride, admixtures containing calcium chloride, or admixtures not approved in writing by the ENGINEER are prohibited.

PART 3 EXECUTION

3.1 PREPARATION

- A. Subgrade Preparation: The subgrade and/or bedding shall be compacted and free of frost. If placement is allowed at temperatures below freezing, provide temporary heat and protection as required to remove all frost. Saturate the subgrade approximately 8 hours before placement and sprinkle ahead of the placement of concrete in areas where vapor barrier is not used. Remove all

standing water, ice, mud, and foreign matter before concrete is deposited. Mud slabs shall be provided where necessary to obtain a dry and stable working platform for placement of slabs.

B. Batching:

1. Materials for concrete shall be proportioned according to the approved design mix and batched using either automatic or manually operated batching equipment. If manual operation is employed, fine and coarse aggregates and bulk cement shall be measured separately by weight. Proportioning aggregates for fractional bags of cement will not be permitted unless the cement is weighed for each batch. Weighing equipment shall be arranged to permit compensation for changes in weight of moisture contained in the aggregate and shall be accurate to within 1 percent of the net load being weighed. The scale beam shall indicate at least the last 100 pounds of each aggregate required for the batch.
2. Water shall be measured to within 1 pint of the total amount required per batch. Admixtures shall be measured by weight or volume to an accuracy of 3 percent.

C. Mixing and Transporting Concrete:

1. Concrete shall be ready-mixed or job-mixed at CONTRACTOR's option. Ready-mixed concrete shall be mixed and delivered to the project in accordance with ASTM C94. Job-mixed concrete shall be in accordance with the requirements of ACI 318.
2. Concrete shall be in its final position within one hour after the water and aggregate have been added to the cement, except that in cool weather (50°F or less), the ENGINEER may authorize a lapsed time of up to one and one half hours.
3. Concrete shall be transported from the mixer to place of final deposit in such manner to prevent separation or loss of ingredients.
4. General Concrete and Grout Placement Schedule:

All structural concrete	Class A Concrete
Post and anchors installation	Epoxy Grout

3.2 DEPOSITING CONCRETE

A. General:

1. Concrete shall be placed in accordance with the requirements of ACI 318 and within 10 feet of its final position. Place concrete only during normal working hours unless the ENGINEER is notified at least 24 hours in advance. Concrete shall not be placed until the ENGINEER has approved the formwork, reinforcement, and embedded items and debris have been removed.
2. Whenever new concrete is to be placed against existing surfaces, roughen and clean the surface to improve bond and apply bonding compound in accordance with the manufacturer's recommendations.
3. Maximum height of free-fall during placement of concrete shall not exceed 4 feet. Where free-fall would exceed allowed maximum height, use "elephant trunks", tremies, chutes, belt conveyors, or similar aids to place concrete.

B. Depositing Formed Concrete

1. Except for beams, columns, or other deep structural monolithic members, place concrete in level layers no more than 24 inches deep. To prevent cold joints between layers, each

- successive layer shall be placed and consolidated before the preceding layer has taken its initial set. Place concrete in a continuous operation until the section is complete.
2. Concrete shall be directly placed in its final position, shall not be spaded, moved with vibrators, or permitted to fall over rods, spacers, reinforcement, or other embedded items. Any mortar coating which is more than two hours old shall be removed from items to be embedded. Hoppers with trunks, tremies, and/or other means of placement shall be used as necessary.
- C. Stopping and Resuming Concrete Placement
1. Whenever a wall pour is stopped at an intermediate height, the exposed surfaces of the joint shall be made straight and level.
 2. Before depositing new concrete against concrete that has hardened, retighten forms and remove foreign matter and laitance. Previously cast surfaces shall be coated with bonding compound.
- D. Depositing Slabs and Flatwork
1. Provide runways and chutes to discharge concrete close to final position to minimize spreading and segregation.
 2. Place slabs-on-grade for tanks using formed construction joints. Maximum size of pour shall be 40 feet each way for slabs with wire mesh reinforcement and 40 feet each way for slabs with bar reinforcement. Allow 24 hours between pours of adjacent slabs. Provide joints as specified or shown.
 3. Structural concrete slabs shall be of one course monolithic construction.
- E. Consolidating Formed Concrete
1. Thoroughly compact all concrete with internal vibrators having a minimum frequency of 8,000 vibrations per minute and sufficient amplitude and/or hand spading or rodding immediately after depositing, taking care to prevent any movement of the forms or reinforcement. Vibrate adjacent to waterstops and bulkheads to obtain a continuous bond and eliminate surface defects.
 2. Vertically insert and withdraw vibrators to consolidate each lift, partially penetrating the previous lift. Do not drag the vibrator nor allow it to come in contact with reinforcement or formwork. Do not attempt to laterally move concrete with the vibrators.

3.3 FINISHING SLABS AND FLATWORK

- A. Finish Schedule
1. Unless otherwise indicated, provide the following slab finishes:
- B. Concrete Tolerances
1. Concrete shall be within 1/4-inch of a 10-foot straightedge in all directions except where slabs are dished for drains. Deviations from the elevation indicated shall not exceed 1/4-inch.
 2. Slabs sloped for drainage shall not have depressions which retain water.
- C. Screeding
1. Immediately after placement, screed concrete with straightedges or power strikeoffs. Do not use roller screeds or vibrating screeds.

2. Stakes for wet screeds shall be driven down flush with subgrade or pulled out as work progresses to avoid disturbing screeded concrete.
 3. For drains in level slabs, form a 5-foot diameter depression approximately 1/2-inch below the adjacent slab surface.
 4. Unless otherwise indicated on the Drawings, slabs sloped for drainage shall be uniformly pitched toward the drains at 1/8-inch per foot. Form a dished depression at drains unless otherwise indicated.
- D. Darbying: Immediately after screeding, darby surface with wood or magnesium darby to eliminate ridges and to fill in voids left by screeding.
- E. Float Finish
1. Float concrete using magnesium or aluminum hand floats or power floats after the concrete has stiffened to a point where only a 1/4-inch indentation can be imparted by normal foot pressure.
 2. Float finish shall result in a uniform, smooth, granular texture. After floating, check slab tolerances with 10-foot straightedge. Fill low spots with fresh concrete; do not sprinkle with dry cement.
- F. Trowel Finish
1. Where scheduled, or indicated, trowel with steel trowels after floating.
 2. Initial troweling shall be done either by power or by hand with the trowel blade kept as flat as possible against concrete surface to prevent washboard or chatter effect.
 3. Second troweling may be done by power if three trowelings are scheduled. If two trowelings are specified, second troweling shall be done by hand.
 4. Third troweling shall be done by hand and shall continue until the concrete is consolidated to a uniform, smooth, dense surface free of trowel marks and irregularities.
 5. Allow sufficient time between successive trowelings to allow the concrete to become harder. Each successive troweling shall be done with trowels that are progressively smaller and are tipped more to increase compaction of the concrete surface.
- G. Non-Slip Finish: Incorporate non-slip aggregate in the surface of flatwork in accordance with the manufacturer's directions and at a uniform rate of not less than 50 pounds per 100 square feet. Aggregate shall be applied immediately after floating the surface and embedded flush with the surface. The surface shall be given at least two trowelings.

3.4 PROTECTION AND CURING

- A. General: Comply with ACI 305 and 306 for protecting and curing concrete in hot and cold weather. Fresh concrete shall be protected from rain. Cure all concrete for a minimum period of 7 days (3 days for high early strength concrete) after placing. Provide coverings or curing compound for conventional concrete that is less than 7 days old when forms are removed.
- B. Flatwork
1. Immediately after finishing, begin curing by covering with constantly saturated moisture retaining fabrics, impervious sheeting, or membrane curing compounds. Surfaces shall be thoroughly wetted with a fine spray before they are covered with sheeting.
 2. Sheeting shall provide complete surface coverage with all joints lapped at least 4 inches, and shall be placed and secured in a manner that will not mar or damage the concrete surface.

C. Membrane Curing Compounds

1. Apply compound in accordance with manufacturer's recommendations. Apply by spraying in a two-coat continuous operation. Apply the coats at right angles to each other with coverage of 200 square feet per gallon per coat. Begin application not later than 4 hours after finishing of the surface. The application shall result in an uninterrupted adherent film free of defects.
2. On surfaces scheduled to receive sealants, paint, seamless flooring, or other adhesive bonded finishes, either the membrane curing compound shall be compatible with the bonding agent or the curing compound shall be removed by sandblasting, acid etching, or grinding to the satisfaction of the installer of the finish surfacing. Bonded surfaces that fail to adhere to the concrete shall be removed and replaced at no additional cost to OWNER.

3.5 DEFECTIVE CONCRETE

- A. All concrete not formed as indicated on the Drawings within tolerances specified in ACI 347 shall be removed and replaced.
- B. Concrete requiring structural repairs shall either be replaced or, with prior written approval of the ENGINEER regarding materials, methods, and procedures, may be repaired with epoxy grout.
- C. Concrete that has a defective surface shall be patched or replaced. If patching does not restore the quality and appearance of the surface, the defective concrete shall be replaced.
- D. Temperature and shrinkage cracks which develop prior to final acceptance of the work shall be repaired. CONTRACTOR shall propose repair methods to be approved by ENGINEER.

3.6 FINISHING FORMED CONCRETE

- A. Patching
 1. After inspection by OWNER, patch tie holes and defective areas. Where necessary, chip out defective areas to a minimum depth of 1 inch. Wet the area to be patched and the surrounding 6 inches to prevent absorption of water from the patching mortar and/or apply a brush coat of bonding compound or cement grout immediately prior to patching with mortar.
 2. Thoroughly compact patching mortar into place and screed, leaving the patch slightly higher than the surrounding surface. For holes passing entirely through the wall, use a plunger grout gun to force the mortar through the wall, starting at the back face. Leave undisturbed for a period of one to two hours to permit initial shrinkage before final finishing. The patch shall be finished to match the texture and appearance of the adjoining surface.
 3. If form ties are removed completely from wall, place rubber seal in center at wall and epoxy grout under pressure from both sides. All patching shall be cured for three days and then inspected for shrinkage cracks. Excessive cracking shall warrant complete removal and replacement of the patch
- B. Ordinary Finish: The finish resulting directly from formwork shall be used for all surfaces which will be hidden from view by earth, submergence in water, or hidden by subsequent construction or coatings, except as otherwise indicated. Patch as specified.

C. Smooth Finish

1. Unless otherwise indicated on the Drawings, smooth finish shall be provided for all interior and exterior cast-in-place concrete surfaces permanently exposed to view. Smooth finish shall be produced by using Grade A formwork and the following finish operations.
2. After patching as specified, grind joint marks and fins smooth using a fine carborundum or abrasive stone with clean water. Remove all oil stains by scrubbing the surface with stiff bristle brushes and a 5 to 10 percent muriatic acid solution. After the stains are removed, rinse the surface thoroughly with clean water.

D. Rubbed Finish

1. Where specifically indicated on the Drawings, produce a rubbed finish on exterior and interior cast-in-place concrete surfaces permanently exposed to view. Do not provide rubbed finish where waterproofing coating is required.
2. Rubbed finish shall be produced by using Grade A formwork and the following finishing operations. As soon as possible after casting and immediately after patching, wet surfaces and grind with a No. 16 carborundum stone or a mechanical finisher to produce a smooth dense surface free from stains, pits, fins, and irregularities. After grinding, dampen the concrete and paint the entire surface with cement grout. Vigorously work the cement grout into the surface with a cork float or other suitable float. When the grout has set to the point that it will not be pulled out of holes or depressions, the entire surface shall be finished with a sponge rubber float to remove all excess grout.
3. After thorough drying, remove all loose grout by scrubbing the surface with a dry burlap or carpet float. Complete the entire rubbed finish for any one area the day it is started. The rubbing operation for any one area shall proceed continuously in an irregular patchwork fashion to eliminate linear horizontal or vertical overlaps.
4. After all rubbed areas are finished once, allow at least 24 hours for the grout to set and perform the rubbing operation, without grinding, a second time.

E. Silicone Water Repellent

1. Silicone water repellent shall be provided on all permanently exposed concrete surfaces of water retaining structures and where indicated elsewhere. Do not provide silicone water repellent where waterproofing coating is required.
2. Clean all surfaces as required to remove all dirt or stains before applying the water repellent. Apply by spray at the rate of not less than 1 gallon per 125 square feet per coat and in accordance with the manufacturer's recommendations. Apply only to dry surfaces and at temperatures above 40 degrees F. Protect adjacent work from spatter by masking or other suitable methods. Immediately remove any misplaced material from glass and other work using cloths and the proper solvent.

3.7 MISCELLANEOUS CONCRETE WORK

- A. Equipment Pads and Supports: Provide concrete equipment pads and supports as indicated and conforming to approved shop drawings. Fastening devices and accessories shall be located by templates or setting diagrams furnished by the manufacturer. Use Class A concrete with rubbed finish on exposed vertical surfaces.
- B. Correcting Slab Tolerances: Slabs exceeding specified tolerances shall have high spots ground down and low spots filled with epoxy resin floor leveler. Epoxy resin shall be applied in strict accordance with the manufacturer's printed instruction.

3.8 CLEAN-UP

- A. Clean all surfaces affected by the Concrete Work. No extraneous concrete or discoloration shall be left on any construction.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pedestrian Drowning Zone Warning Signs
 - 2. Hazard Area Warning Signs
 - 3. Regulatory Buoys
 - 4. Staff Gage

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 - 1. Shop drawings for signage including colors and dimensions.
 - 2. Shop drawings for regulatory buoys including installation details.
 - 3. Shop drawings for staff gage including installation details.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Pedestrian Drowning Zone Warning Signs and Hazard Area Warning Signs
 - 1. Reflective aluminum sign with fonts and dimensions as shown on the Drawings.
- B. Sign Posts
 - 1. As shown on the Drawings and in accordance with Indiana Department of Transportation Standard Specifications, latest edition.
- C. Regulatory Buoys
 - 1. Rolyan Model B961R with "Dam Danger" message and restricted area symbol or approved equal.
- D. Staff Gage
 - 1. WaterMark Style "C" by Forestry Suppliers, Inc. or approved equivalent.
 - 2. Gradations to be determined by OWNER and ENGINEER specific to project site.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Pedestrian Drowning Zone Warning Signs
 1. Coordinate with OWNER and ENGINEER to determine exact location for installation. Signs must be installed downstream of the boil line.
 2. Install so that the bottom of the sign is above the base flood elevation.
 3. Text shall face direction at which persons on foot could access the site.

- B. Hazard Area Warning Signs
 1. Coordinate with OWNER and ENGINEER to determine exact location for installation. Signs must be installed downstream of the boil line.
 2. For signs downstream of the dam, align sign at a 45-degree angle facing downstream.
 3. Install so that the bottom of the sign is above the base flood elevation.

- C. Regulatory Buoys
 1. Install at third points along the small craft intrusion barrier or in locations otherwise approved by OWNER and ENGINEER.
 2. Text shall face the upstream direction.
 3. Anchor in accordance with manufacturer's recommendations.

- D. Staff Gage
 1. Coordinate with OWNER and ENGINEER to determine exact location for installation.
 2. Anchor in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Coarse aggregate materials.
 - 2. Fine aggregate materials.

- B. Related Sections:
 - 1. Section 31 20 00 – Earthwork
 - 2. Section 31 35 00 – Geotextiles
 - 3. Section 31 37 00 – Riprap

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 4. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Materials Source: Submit name and location of the material suppliers.

- C. Manufacturer's Certificate: CONTRACTOR shall provide documentation that the aggregate supplier is an Indiana Department of Transportation (INDOT) Certified Aggregate Producer.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from a single source throughout the Work.

- B. Aggregate material shall be in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Course aggregate shall be as specified on the Drawings in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications.
- B. Coarse aggregate material shall be free of organic or other deleterious material.
- C. Aggregate material shall contain no ice, snow, or frozen material.

2.2 FINE AGGREGATE MATERIALS

- A. Fine aggregate shall be as indicated on the Drawings in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications.
- B. Fine aggregate free of organic or other deleterious material.
- C. Aggregate material shall contain no ice, snow, or frozen material.

2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place aggregate only when underlying excavations, foundations, and geotextile installations are completed and inspected by ENGINEER, OWNER, or CQA firm.
- B. Ensure that segregation of aggregate material is minimized during transportation and placement.
- C. Do not damage underlying geotextile fabric. Any geotextile fabric damaged during aggregate placement shall be replaced.
- D. Install aggregate to the thickness indicated on the Drawings.
- E. Compact as indicated on the Drawings.

3.2 STOCKPILING

- A. Stockpile materials on-site at locations indicated on the Drawings or where otherwise approved by OWNER and ENGINEER.
- B. The stockpile(s) shall be located in an area that will not interfere with construction activities or block drainage. The area shall be free of debris and other impediments.
- C. Stockpile in sufficient quantities to meet Project schedule and requirements.
- D. Install silt fence around the perimeter of all stockpiles. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- F. Cover with a tarp to prevent contamination or if otherwise directed by OWNER or ENGINEER.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile and leave area in clean and neat condition. Grade site surface to prevent free standing surface water.
- B. Stabilize grassed areas with permanent seeding. Install erosion control blanket if warranted or indicated on the Drawings. Restore gravel areas to pre-construction conditions.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris.
 - 2. Removing designated trees, shrubs, and other plant life.
 - 3. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
- B. Related Sections:
 - 1. Section 02 41 16 – Structure Demolition
 - 2. Section 31 20 00 – Earthwork

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. CONTRACTOR shall provide photographs or videotape, sufficiently detailed, of the existing site and adjacent areas prior to site clearing.

1.3 QUALITY ASSURANCE

- A. Conform to applicable code for environmental requirements, disposal of debris, and use of herbicides. CONTRACTOR shall attend a pre-construction meeting at the project site.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing plant life designated to remain is delineated, tagged, or otherwise identified.
- B. Identify waste area for placing removed materials. Waste area shall not restrict access to the site or adjacent sites, interfere with utilities, or block drainage. The location of the waste area shall be approved by OWNER or ENGINEER.

3.2 PREPARATION

- A. Install all temporary erosion control devices as indicated on the Drawings prior to commencement of land-disturbing activities. Inspect and maintain temporary erosion control measures in accordance with the Drawings and Specifications.

- B. CONTRACTOR shall conform to permanent and temporary construction easement requirements as applicable.

3.3 PROTECTION

- A. Locate, identify, and protect from damage all utilities and other existing site features indicated to remain.
- B. Utilities must remain operational and accessible throughout the duration of the project unless otherwise coordinated with and approved by OWNER, ENGINEER, and utility company at least two days in advance of the proposed interruption.
- C. Protect trees, plant growth, and features designated to remain with temporary fencing prior to site clearing. Remove fencing when construction is complete.
 - 1. Storage of construction materials, debris, or excavated material shall not be permitted within fenced areas.
 - 2. Vehicles, equipment, and foot traffic shall not be permitted within fenced areas.
 - 3. Keep fenced areas free from weeds and trash.
- D. Protect survey benchmarks and control points from disturbance during construction. CONTRACTOR shall repair or replace in kind any trees, vegetation, structures, or other features to remain, if damaged.
- E. Do not cut any trees suitable for Indiana Bat roosting (greater than 3 inches diameter at breast height, living or dead, with loose hanging bark) from April 1 through September 30.

3.4 CLEARING AND GRUBBING

- A. Remove all brush, shrubs, trees, and other unwanted surface objects in the areas indicated on the Drawings.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Use only hand methods for grubbing within tree protection zones.
 - 4. Remove tree branches and legally dispose of them off of OWNER's property.
- B. Remove trees and shrubs in areas indicated on Drawings. Remove or grind stumps.
- C. Fill depressions caused by clearing and grubbing operations with approved soil material unless further excavation or earthwork is indicated.
- D. During clearing and grubbing, CONTRACTOR shall ensure positive drainage is maintained on the exposed soils to prevent excess absorption of rainfall. Ruts, holes, and other depressed areas should be filled immediately to prevent ponding.

3.5 REMOVAL

- A. Except for stripped topsoil or other materials indicated to remain on OWNER'S property, all cleared materials shall become CONTRACTOR's property and shall be removed from the site and disposed of in a safe manner in accordance with all local, state, and federal regulations.
- B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on-site.
- C. Items noted or otherwise identified to be salvaged shall be returned to OWNER in their original condition.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Site grading
2. Excavation of topsoil and subsoil
3. Stockpiling
4. Trenching
5. Backfilling

B. Related Sections

1. Section 31 05 16 – Aggregates for Earthwork
2. Section 31 23 19 – Dewatering

1.2 REFERENCES

A. ASTM INTERNATIONAL

1. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
2. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
3. ASTM D6938 – Standard Test Methods for Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

B. OSHA Safety and Health Standard (29 CFR 1910)

C. OSHA General Construction Standards (29 CFR 1926)

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Topsoil: Pervious, friable loam free of hard lumps, debris, stone, large forms of vegetation, subsoil, and other deleterious material and shall be suitable for supporting vegetative growth.

1. Topsoil shall be taken from on-site sources within the construction limits.
2. If additional topsoil is needed, CONTRACTOR shall amend available soil to produce a suitable growth medium or obtain topsoil from an offsite source. CONTRACTOR shall provide certificates or testing information for imported topsoil to confirm its suitability for each borrow site.

- B. Subsoil: Existing material not fitting the description of topsoil.
- C. Rock: Solid mineral material of size that cannot be removed by standard means with an excavator.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Notify ENGINEER of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- C. Maintain and protect existing utilities, structures, vegetation, survey benchmarks and other items to remain.
- D. Clear and grub as indicated on the Drawings. Remove unsuitable material.
- E. CONTRACTOR shall deploy suitable equipment for the excavation, stockpiling, compaction, and grading of soil and shall exercise caution to avoid pumping and general deterioration of shallow soils by heavy construction traffic. Excavation and grading shall be performed during dry conditions to the extent possible.

3.2 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.
- B. Grade excavation top perimeter to prevent surface water run-off into excavation or to adjacent properties.

3.3 TOPSOIL EXCAVATING

- A. Clear and grub area and remove sod and grass before stripping topsoil.
- B. Strip topsoil to full depth in all areas to be excavated, filled, or re-graded or otherwise noted on the Drawings and in a manner to prevent mixing with subsoil or other waste materials.
- C. Do not excavate wet topsoil.
- D. Remove subsoil, trash, debris, weeds, roots, and other deleterious material from topsoil.
- E. Do not mix topsoil with other materials.
- F. Stockpile topsoil for reuse in accordance with this section.

3.4 SUBSOIL EXCAVATING

- A. Do not remove wet subsoil unless instructed by ENGINEER

- B. Remove groundwater in accordance with the approved water management plan.
- C. Provide dewatering as necessary to keep excavation free of standing water.
- D. Excavate within the project limits to the lines and grades shown on the Drawings.
- E. Over-excavate for placement of subgrade material and to remove unsuitable material.
- F. Slope banks in accordance with OSHA excavation regulations.
- G. Provide sheeting, shoring, bracing, or other protection as required to maintain a safe excavation and to adhere to all applicable safety requirements.
- H. Sheeting, shoring, and other protective measures shall be removed at the completion of excavation work.
- I. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- J. Remove lumped subsoil, rocks, and other unsuitable material encountered during the excavation.
- K. Notify ENGINEER immediately of any unexpected subsurface conditions.
- L. During/after compaction of fill, remove material which is soft, wet and/or pumping and replace with suitable backfill material and compact uniformly to 95 percent of the Standard Proctor maximum density (ASTM D-698).
- M. Correct unauthorized excavation at no cost to OWNER.
- N. Stockpile subsoil in area designated on site.
- O. Remove unsuitable material from the site and dispose of in accordance with all local, state, and federal regulations.
- P. Repair or replace items indicated to remain that are damaged by excavation.
- Q. Sloping or benching for excavations greater than twenty (20) feet shall be designed by a registered professional engineer.

3.5 STOCKPILING

- A. Stockpile materials at the location(s) indicated on the Drawings or as directed by OWNER or ENGINEER.
- B. The stockpile(s) shall be located in an area that will not interfere with construction activities or block drainage. The area shall be free of stumps, rock, and debris.
- C. If an insufficient area is available for stockpiling within the construction limits, CONTRACTOR shall store materials at an off-site location, at no additional expense to OWNER. The storage site shall be properly zoned for the intended use. CONTRACTOR shall be responsible for acquiring all permits and adherence to all applicable regulations.

- D. Stockpile in sufficient quantities to meet Project schedule and requirements.
- E. Separate differing materials with dividers or stockpile apart to prevent mixing.
- F. Stockpiles shall have a maximum height of eight (8) feet.
- G. Prevent intermixing of soil types or contamination.
- H. Install silt fence around stockpiles and temporarily seed or cover with a tarp if necessary to prevent contamination or erosion or if directed by OWNER or ENGINEER.
- I. Direct surface water away from stockpile site(s) to prevent erosion or deterioration of materials.

3.6 TRENCHING

- A. Adhere to OSHA requirements for trench safety.
- B. Refer to Drawings for trench configuration.
- C. Provide sheeting, shoring, bracing, or other protection to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- D. Remove any undesirable material such as lumped subsoil, large rocks, weak or deleterious material, trash, or organic material.
- E. Remove and replace or compact natural soils or compact fills softened by frost, flooding, or weather.
- F. Hand trim excavation and leave free of loose matter.
- G. Support pipe during placement and compaction of bedding fill.
- H. Backfill trenches to required contours and elevations in accordance with the Drawings.
- I. Sloping or benching for excavations greater than twenty (20) feet shall be designed by a registered professional engineer.

3.7 SITE GRADING

- A. Uniformly grade areas to create a smooth surface to the cross-sections, lines, and elevations indicated on the Drawings.
- B. Provide a smooth transition between existing adjacent grades and new grades.
- C. Fill settled areas that were excavated and backfilled and ruts or holes made by construction traffic. Compact to 95% of the Standard Proctor maximum dry density.

3.8 PLACING TOPSOIL

- A. Place topsoil in areas where seeding is scheduled.

- B. Place topsoil only after underlying compacted soil construction is completed and accepted by OWNER and ENGINEER.
- C. Topsoil shall be placed in a single loose lift with a minimum depth of 6 inches. Place such that a distinct joint between the new and existing soil will not be created.
- D. Remove large stone, roots, grass, weeds, debris, and foreign material while spreading.
- E. Do not place topsoil in frozen or muddy conditions.
- F. Fine grade topsoil, eliminating rough or low areas.
- G. The final surface shall be graded smooth to final design grades. All significant surface variations, including vehicle tire or equipment ruts, shall be smoothed with a grader box or other method.
- H. Final grading performed by dozers shall be done in a manner such that the track cleats are oriented parallel to the contours to minimize runoff velocity down the slope and to help maintain moisture in the topsoil to promote vegetative growth.
- I. Lightly compact or roll placed topsoil.
- J. Leave stockpile area and site clean and raked, ready to receive seed.

3.9 FIELD QUALITY CONTROL

- A. A minimum of one (1) field density test shall be taken for each lift to assure that adequate moisture conditioning and compaction is achieved.
- B. CONTRACTOR shall perform additional soil density testing on the compacted fill material as needed to confirm the density as required by ENGINEER or OWNER.
- C. Perform laboratory material tests in accordance with ASTM D698.
- D. Perform in place compaction tests in accordance with ASTM D6938.

3.10 TOLERANCES

- A. Top Surface of Exposed Subgrade: Plus or minus 0.2 foot.
- B. Top of Topsoil: Plus or minus 0.1 foot.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Groundwater control system.
 - 2. Surface water control system.
 - 3. System operation and maintenance.
 - 4. Water disposal.

- B. Related Sections:
 - 1. Section 00 31 00 - Available Project Information: Geotechnical Engineering Reports.
 - 2. Section 31 20 00 - Earthwork
 - 3. Section 31 25 13 - Erosion Controls

1.2 DEFINITIONS

- A. Groundwater control:
 - 1. Use of pumps and/or subsurface drains to establish a sufficiently lowered groundwater elevation and to collect groundwater seepage that would otherwise enter open excavations.
 - 2. Reduction of piezometric pressure within subsurface strata to prevent failure or heaving of excavations.
 - 3. Proper disposal of removed groundwater.

- B. Surface water control:
 - 1. Diversion of surface waters to prevent runoff from entering open excavations.
 - 2. Removal and proper disposal of surface water within open excavations.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide groundwater and surface water level control systems to permit Work to be completed on dry and stable subgrade.
 - 1. CONTRACTOR shall provide sufficient dewatering equipment and make satisfactory arrangements for the disposal of water collected or removed during construction without undue interference with other work or damage to surrounding property.
 - 2. Furnish standby equipment stored at Project site and ready for immediate use in the event of failure of dewatering equipment.

- B. Design groundwater and surface water control systems to:
 - 1. Lower and maintain water table within areas of excavation to a minimum of 2 feet below the deepest excavation to permit Work to be completed on dry and stable subgrade or as otherwise approved by OWNER and ENGINEER if a minimum of 2 feet cannot be reasonably obtained.

2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
3. Prevent surface water runoff from entering excavations.
4. Collect and remove surface water entering excavations.
5. Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.
6. Prevent loss of fine-grained soils, development of quick condition, or softening of foundation subgrade.
7. Maintain stability of sides and bottoms of excavations.
8. Control and prevent erosion and sedimentation. Incorporate filters or bypasses into dewatering pumps to avoid impacts to fish and aquatic organisms. Dewatering directly into the stream is prohibited.
9. Adhere to additional requirements noted on the Drawings or part of permit conditions.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Water Management Plan:
CONTRACTOR shall submit a water management plan for groundwater and surface water level control. The water management plan shall have the following components, in addition to any other requirements that may be noted on the Drawings or part of permit conditions:
 1. Shop Drawings:
 - a. Number and location of all dewatering components and features.
 - b. Location(s) for the discharge of water and measures to be taken to prevent erosion and sedimentation.
 - c. Schematic plan demonstrating layout and sequencing of dewatering activities.
- C. Field Reports: Test and monitoring reports as specified in Field Quality Control article.

1.5 QUALITY ASSURANCE

- A. Comply with all local, state, and federal regulations pertaining to water discharge and disposal from dewatering operations. Adhere to the approved water management plan and permit conditions.

1.6 SEQUENCING AND COORDINATION

- A. Sequence work as appropriate to avoid unsafe conditions, damage to property, or project delays.

PART 2 PRODUCTS

2.1 DEWATERING EQUIPMENT

- A. Select suitable dewatering equipment to meet specified performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification existing conditions before starting work.

3.2 PREPARATION

- A. Protect existing adjacent buildings, structures, and improvements from damage caused by dewatering operations.
- B. Install erosion control measures where called for by the water management plan.

3.3 GROUNDWATER AND SURFACE WATER CONTROL SYSTEM

- A. Install groundwater and surface water control system in accordance with the reviewed water management plan.
- B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way and adjacent buildings, structures, and improvements.
- C. Remove all surface water and groundwater seepage within excavation in accordance with the reviewed water management plan.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements
- B. After groundwater control system is installed, perform pumping test to determine when selected pumping rate lowers water level in well/sump below pump intake. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.
- C. Monitor the groundwater discharge for sand content and contamination. Notify ENGINEER immediately of high sand content or potential contaminants. Monitor the discharge location(s) and areas immediately downstream for erosion and sedimentation and take corrective action if needed.

3.5 SYSTEM OPERATION AND MAINTENANCE

- A. CONTRACTOR shall bear all responsibility for safely operating groundwater and surface water level control systems for the duration of the Work.
- B. Operate groundwater and surface water control systems continuously until backfilling is complete. The lake water level shall be managed throughout the duration of the project.
- C. Conduct and record daily observations of dewatering systems. Make required repairs and perform scheduled maintenance.

- D. When groundwater and surface water control systems cannot control water within excavation, immediately notify the ENGINEER and stop excavation work.
 - 1. Supplement or modify dewatering systems and provide other remedial measures to control water within excavation.
 - 2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.
- E. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.
- F. Correct unanticipated pressure conditions affecting dewatering system performance.
- G. Do not discontinue dewatering operations without the OWNER'S or ENGINEER'S approval.

3.6 WATER DISPOSAL

- A. Discharge water as indicted on the approved water management plan or as otherwise directed by OWNER or ENGINEER in accordance with the Drawings and permit conditions.

3.7 SYSTEM REMOVAL

- A. Remove dewatering systems after dewatering operations are discontinued.
- B. Repair damage caused by dewatering systems or resulting from failure of systems to protect property.

END OF SECTION

SECTION 31 25 13
EROSION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silt Fence
 - 2. Erosion Control Blanket
 - 3. Stabilized Construction Entrance
 - 4. Concrete Washout

- B. Related Sections:
 - 1. Section 31 10 00 – Site Clearing
 - 2. Section 31 20 00 – Earthwork
 - 3. Section 31 35 00 – Geotextiles
 - 4. Section 31 37 00 – Riprap
 - 5. Section 32 92 19 – Seeding

1.2 REFERENCES

- A. IDEM Indiana Stormwater Quality Manual (latest revision).
- B. Indiana Administrative Code 327 IAC 15-5.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's product data for all erosion control products.

PART 2 PRODUCTS

2.1 GEOTEXTILES

- A. Geotextile Fabric: As specified on the Drawings.

2.2 AGGREGATE AND SOIL MATERIALS

- A. Coarse Aggregate: Gradation shall be as shown on the Drawings and in accordance with Section 31 05 16 – Aggregates for Earthwork.
- B. Soil Backfill: As specified in Section 31 20 00 – Earthwork.

2.3 PLANTING MATERIALS

- A. Seeding and Soil Supplements: As specified on the Drawings.
- B. Mulch: In accordance with Indiana Department of Transportation Standard Specification 914.05, latest edition.

2.4 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Inspect all erosion control measures as indicated on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 SILT FENCE

- A. Place in locations noted on the Drawings.
- B. Install and maintain per instructions on the Drawings.
- C. Silt fence shall be a woven or non-woven geotextile fabric meeting the following minimum requirements:

Physical Property	Woven Geotextile Fabric	Non-Woven Geotextile Fabric
Filtering Efficiency	85%	85%
Textile Strength at 20% Elongation – Standard Strength	30 lbs. per linear inch	50 lbs. per linear inch
Textile Strength at 20% Elongation – Extra Strength	50 lbs. per linear inch	70 lbs. per linear inch
Slurry Flow Rate	0.3 gal/min/square feet	4.5 gal/min/square feet
Water Flow Rate	15 gal/min/square feet	220 gal/min/square feet
UV Resistance	70%	85%
Post Spacing	7 feet	5 feet

- D. Fence posts shall be 2" x 2" hardwood posts or steel posts with projections for fastening fabric.

3.3 EROSION CONTROL BLANKET

- A. Utilize product specified on the Drawings or an approved equal.
- B. Place in locations noted on the Drawings.
- C. Install and maintain per instructions on the Drawings and as recommended by manufacturer.

3.4 STABILIZED CONSTRUCTION ENTRANCE

- A. Place in location noted on the Drawings.
- B. Install and maintain per instructions on the Drawings.

3.5 CONCRETE WASHOUT

- A. Install and maintain per instructions on the Drawings.

3.6 SITE STABILIZATION

- A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
- B. Construct, stabilize, and activate temporary erosion controls before commencement of land-disturbing activities.
- C. Stabilize all disturbed areas of the project that are completed, as work proceeds, with temporary or permanent seeding, mulch, erosion control blankets, and/or riprap as described on the Drawings.
- D. Any disturbed areas that are unvegetated and are scheduled or likely to be left inactive for fifteen (15) days or more shall be temporarily or permanently stabilized with measures appropriate for the season as indicated on the Drawings.
- E. Stabilize channels, embankments, berms, and stockpiles immediately.
- F. Remove temporary erosion control measures only after approval of the established vegetation by OWNER and ENGINEER. Temporary erosion control measures shall remain in place at least until land-disturbing activities are complete and a uniform perennial vegetative cover with a density of 70% (by area) has been established.

3.7 FIELD QUALITY CONTROL

- A. Inspect erosion control devices after each storm event and as indicated on the Drawings. Make necessary repairs to ensure erosion and sediment controls are in good working order.

3.8 CLEANING

- A. Remove and dispose of sediment as indicated on the Drawings.
- B. Dispose of sediment or waste material appropriately in accordance with all local, state, and federal regulations. Sediment and waste material shall be removed by CONTRACTOR at no additional cost to OWNER.
- C. Do not damage erosion control devices during cleaning operations. Repair or replace damaged devices.
- D. Do not permit sediment to erode into construction or site areas or natural waterways.

END OF SECTION

SECTION 31 35 00

GEOTEXTILES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Woven geotextile.
 - 2. Securing geotextiles.

- B. Related Sections:
 - 1. Section 31 05 16 – Aggregates for Earthwork
 - 2. Section 31 20 00 – Earthwork
 - 3. Section 31 25 13 – Erosion Controls
 - 4. Section 31 37 00 – Riprap

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit product data for all materials specified in this section.

- C. Shop Drawings:
 - 1. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.
 - 2. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.

- D. Manufacturer's Certificate: Provide manufacturer's certificate stating that the submitted product meets or exceeds the requirements of this section.

PART 2 PRODUCTS

2.1 WOVEN GEOTEXTILE

- A. Woven geotextile shall be Mirafi FW402, or approved equal.

PART 3 EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver each roll with sufficient information attached to identify manufacturer and product name or number.

- B. Handle products in manner that maintains undamaged condition.
- C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in a way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

3.2 LAYING GEOTEXTILE

- A. Notify ENGINEER prior to placement whenever geotextiles are to be placed. Do not place geotextile prior to obtaining ENGINEER's approval of underlying materials.
- B. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.

3.3 JOINTS

- A. Unseamed Joints:
 - 1. Unseamed joints shall be overlapped to the following dimensions unless otherwise indicated:
 - a. Foundation/Subgrade Stabilization: Minimum 18-inches.
 - b. Riprap: Minimum 18 inches.
 - c. Drain Trenches: Minimum 18 inches, except overlap shall equal trench width if trench width is less than 18 inches.
 - d. Other Applications: Minimum 12 inches.
- B. Sewn seams shall be used wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by ENGINEER, may also be used instead of overlap at joints for applications that do not require stress transfer.
 - 1. Seam efficiency shall be minimum 70 percent, verified by preparing and testing minimum of one set of nondestructive samples per acre of each type and weight of geotextile provided. Test according to ASTM D 4884.
 - 2. Type: "J" type seams are preferred, but flat or butterfly seams are acceptable.
 - 3. Stitch Count: Minimum 3 to maximum 7 stitches per inch.
 - 4. Stitch Type: Double-thread chainstitch, Type 401, Federal Standard No. 751a.
 - 5. Stitch Location: Two inches from geotextile sheet edges, or more if necessary to develop required seam strength.
 - 6. Sewing Machine: Capable of penetrating 4 layers of geotextile.

3.4 SECURING GEOTEXTILE

- A. Secure geotextile during installation as necessary with sand bags or other means approved by ENGINEER.

3.5 PLACING PRODUCTS OVER GEOTEXTILE

- A. Notify ENGINEER before placing material over geotextile. Do not cover installed geotextile prior to receiving authorization from ENGINEER to proceed.
- B. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as indicated by this section.

3.6 RIPRAP APPLICATIONS

- A. Overlap geotextile at each joint with upstream sheet of geotextile overlapping downstream sheet.
- B. Sew joints where wave run-up may occur.

3.7 REPAIRING GEOTEXTILE

- A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile. Repair damaged geotextile by placing patch of undamaged geotextile over damaged area plus at least 18 inches in all directions beyond damaged area. Remove interfering material as necessary to expose damaged geotextile for repair. Sew patches or secure them as approved by ENGINEER.

3.8 REPLACING CONTAMINATED GEOTEXTILE

- A. Protect geotextile from contamination that would interfere, in the opinion of ENGINEER, with its intended function. Remove and replace contaminated geotextile with clean geotextile.

END OF SECTION

SECTION 31 37 00

RIPRAP

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Riprap placed loosely.
- B. Related Sections:
 - 1. Section 31 20 00 – Earthwork
 - 2. Section 31 35 00 – Geotextiles

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit product data for riprap (including source of material).
- C. Manufacturer's Certificate: CONTRACTOR shall provide documentation that the riprap supplier is an Indiana Department of Transportation (INDOT) Certified Aggregate Producer.

1.3 QUALITY ASSURANCE

- A. Furnish each riprap material from single source throughout the Work unless approved by ENGINEER.
- B. ENGINEER shall visually inspect riprap prior to placement.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Riprap shall be in accordance with the Indiana Department of Transportation Standard Specifications.
- B. The gradation of riprap shall be as specified on the Drawings.
- C. Riprap shall not contain zebra mussels or other foreign material.
- D. Geotextile Fabric: As specified on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.

3.2 PLACEMENT

- A. Areas on which geotextile fabric and riprap are to be placed shall be cleared of any brush, trees, stumps, debris, or other unsuitable material and graded to the lines and grades shown on the Drawings. Allow for thickness of the riprap. Compact any fill material and smooth the graded foundation.
- B. Install riprap to the lines and grades shown on the Drawings immediately after installing the geotextile fabric.
- C. Install riprap to at least the minimum depth as indicated on the Drawings. The installation depth shall be measured perpendicular to the existing grade. Finished grades shown on the Drawings are top of riprap elevations.
- D. Install using a method that will prevent segregation of stone sizes and damage to the geotextile fabric.
- E. Riprap shall be well-distributed and free from pockets of small stones and clusters of large stones. Fill holes or open spots as necessary.

3.3 SCHEDULES

- A. Place riprap according to the construction sequence provided in the Drawings or as directed by ENGINEER.

END OF SECTION

SECTION 31 41 16

SHEET PILING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel sheet piling
- B. Related Sections:
 - 1. Section 31 20 00 - Excavation: Excavating to working level.

1.2 DEFINITIONS

- A. Hot Rolled (HR) - Sections are produced by traditional hot-mill procedure with rough shape reduced during series of stages to final form. Interlocks are formed by flow of metal.
- B. Z-Type - (Designation Z): Conforms to letter Z shape and is applicable for medium to deep walls.

1.3 DESIGN REQUIREMENTS

- A. Sheet piling section specified and shown on Drawings establishes design and functional requirements for sheet piling installation.
- B. Alternate Designs: CONTRACTOR may propose alternate sheet piling design for consideration by ENGINEER.
 - 1. Design sheet piling to provide structural capacity equal to or greater than capacity of specified piling system.
 - 2. Design sheet piling configuration using standard published manufacturer's properties.
 - 3. Furnish required submittals signed and sealed by a registered professional engineer.
 - 4. Design sheet piling as permanent structure to be left in place in completed construction.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings:
 - 1. Include complete dimensions and details of sheet piling sections.
 - 2. Include sequence of driving and detailed drawings of templates or other temporary guide structures.
 - 3. Submit list and size of proposed equipment including cranes, driving equipment, extractors, protection caps, and other installation accessories.
 - 4. Submit detailed procedures and features for protection of existing structures or other installations.
 - 5. Include details of storage and handling procedures.

- C. Product Data:
 - 1. Submit material certification, details of sheet piling, mill test reports, piling driving equipment certification and interlocking joint strength test procedure.
 - 2. Include data for joint sealants.
 - 3. Include manufacturer's data sheets on cranes and driving equipment.
- D. Design Data: Signed and sealed by professional engineer.
 - 1. Submit calculations to support Contractor's sheet piling design.
- E. Test Reports: Indicate interlock tensile strength on hot steel sheet piling.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 - 1. Record actual locations of sheet piling and top and bottom elevations.
 - 2. Provide driving records with hammer blows for final 12 inches of driving.

1.6 QUALITY ASSURANCE

- A. Perform welding in accordance with AWS D1.1 and AWS D1.5.
- B. Furnish each type sheet piling from a single source.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience.
- C. Welders and Welding Procedures: AWS D1.1 or AWS D1.5 qualified within previous 12 months.
- D. Design alternate sheet piling systems under direct supervision of professional engineer experienced in design of this Work and licensed in the State of Indiana.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet piling with manufacturer's logo and mill identification mark on each sheet piling.
- B. Handle using handling holes or lifting devices to prevent damage. Lift sheet piling to prevent permanent deformation.
- C. Support on level racks spaced not more than 10 feet apart or more than 2 feet from ends. Arrange supports for multiple lifts aligned vertically.
- D. Protect sheet piling to prevent damage to coatings.

1.9 SCHEDULING

- A. Schedule sheet piling submittals sufficiently in advance of pre-installation meeting to ensure ENGINEER's review is complete.

PART 2 PRODUCTS

2.1 STEEL SHEET PILING - Z SHAPE, HOT ROLLED, JOINT BS (BALL & SOCKET)

- A. Manufacturers: As approved by the ENGINEER.
- B. Sheet Piling: ASTM A572, Grade 50.
- C. Section Modulus: Minimum 18.1 in³/ft (PZ 22 section)
- D. Interlock Strength: 16kips/inch.
- E. Interlock Swing Allowable: 10 degrees.

2.2 COMPONENTS

- A. Splices and Other Fabrication Appurtenances: Structural Steel ASTM A36/A36M.
- B. Bolts, Nuts, Washers and Shear Studs: ASTM A153/A153M; hot dipped galvanized.
 - 1. Bolts: ASTM A307; Grade A or B.
 - 2. High Strength Bolts: ASTM A325; Type 1.
 - 3. Nuts: ASTM A563 heavy hex type.
 - 4. Washers: ASTM F436; Type 1.
 - 5. Shear Studs: AASHTO M 169 Cold drawn bars; Grade 1015, 1018 or 1020 either semi- or fully-killed.
- C. Finish: Unfinished.
- D. Welding Materials: AWS D1.1; type required for materials being welded.

2.3 FABRICATION

- A. Fabricate sheet piling to full length and as indicated on Drawings.
- B. Fabricate tees, wyes, corners and cross pieces to match sheet piling sections, with 1/2-inch minimum web thickness.
- C. Fabricate sheet piling with standard pulling holes.
- D. Fabricate components indicated to receive galvanized coating in accordance with ASTM A385 to achieve high quality galvanized coating.

- E. Clean interlock joint surfaces. Mix and install joint sealant in accordance with manufacturer's instruction in female side of interlock joint.

2.4 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Interlock Tension Strength Test: Conform to piling manufacturer's standard test. Include testing at least two 3-inch-long coupons taken randomly from different as-produced pilings of each heat.
- C. Allow witnessing of factory inspections and test at manufacturer's test facility. Notify OWNER at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify of existing conditions before starting work.

3.2 TEMPLATES

- A. Provide template or driving frame suitable for aligning, supporting, and maintaining sheet piling in correct position during setting and driving:
 - 1. Structural frame sufficiently rigid to resist lateral driving forces.
 - 2. Provide at least two levels of support.
 - 3. Provide wood blocking to bear against webs of alternate sheet piling.
 - 4. Provide outer restraints to prevent sheets from warping or wandering.
 - 5. Provide visible markings on templates to verify correct sheet piling location and direction.

3.3 PREPARATION

- A. Verify equipment on site conforms to approved submittal.
- B. Utilize vibratory hammer for driving unless otherwise approved by OWNER and ENGINEER.
- C. Notify adjacent and affected land owners and building occupants minimum five (5) days before proceeding with the Work.
- D. Verify cranes will not impact overhead utilities and vegetation.
- E. Protect structures, including overhead and buried utilities near the Work, from damage.
- F. Prepare to place sheet piling from existing site elevations.
- G. Leave permanent sheet piling in place as part of completed Work.
- H. Remove temporary sheet piling when no longer required and remove from site.

3.4 PILING HAMMER

- A. Use piling hammer complying with requirements indicated on Drawings and approved submittals.
- B. Keep hammer in good mechanical condition.
- C. Operate hammer at speed and pressure recommended by manufacturer.
- D. During piling driving operations, ENGINEER may make occasional measurements of velocity of hammer ram.
- E. When energy per blow is less than 80 percent of rated energy per blow as specified by manufacturer of piling hammer, make necessary repairs to improve energy output to value of at least 80 percent of rated energy per blow, or replace piling hammer.
- F. Use protective cap during driving to prevent damage to top of sheet piling.

3.5 INSTALLATION

- A. Drive sheet piling only in presence of ENGINEER or OWNER.
- B. Align top of sheet piling normal to driving force of piling, hammer, and leads to minimize bowing of piling during impact of hammer ram.
- C. Maintain sheet piling vertical during driving.
 - 1. Drive Z piling with male interlock forward or leading.
 - 2. Drive Z piling in pairs.
 - 3. Incrementally drive sheets or pairs of sheets so tip of any sheet or pair is not more than 4 ft. below adjacent sheet or pair.
 - 4. For circular or other closed cofferdams set all sheets in place before driving begins.
- D. Jetting or pre-drilling of sheet piling is not permitted.
- E. Drive sheet piling to minimum tip penetration and to driving resistance indicated on Drawings.
 - 1. Take corrective action, when required, to prevent observable impact bowing of piling at final driving resistance.
- F. When driving is interrupted before refusal, drive additional 12 inches before resuming recording of performance data.
- G. Do not damage sheet piling during driving operations.
- H. Cut off tops of sheet piling to elevations indicated and prepare piling top to receive top finish construction indicated on Drawings.

3.6 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation from Vertical for Plumb Sheet Piling: 1:48.
- C. Maximum Variation from Sheet Piling Cut-Off Elevation: 4 inches.
- D. Maximum Out-of-Position: 2 inches.

3.7 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 - Quality Requirements.
- B. Inspect for imperfections in joint interlock capable of impeding installation.
- C. Inspect for damage to shop coatings before installation.
- D. Reject damaged sheet piling sections or repair as required prior to installing.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fertilizing.
 - 2. Seeding.
 - 3. Mulching.
 - 4. Maintenance.

- B. Related Sections:
 - 1. Section 31 20 00 – Earthwork
 - 2. Section 31 25 13 – Erosion Controls

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.3 DEFINITIONS

- A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include maintenance instructions, cutting method, and maximum grass height. The types, application frequency, and recommended coverage of fertilizer should be included.

1.6 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

1.7 QUALIFICATIONS

- A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.
- B. Installer: Company well-qualified in performing work of this section with a minimum of three (3) years documented experience or approved by the manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

- A. CONTRACTOR shall perform post-construction maintenance on the new vegetation for a period of one (1) year from substantial completion.

PART 2 PRODUCTS

2.1 SEED MIXTURE

- A. Seed Mixture: As specified on the Drawings or otherwise approved by OWNER and ENGINEER.

2.2 ACCESSORIES

- A. Mulching Material: In accordance with Indiana Department of Transportation Standard Specification 914.05, latest edition.
- B. Fertilizer: As recommended by soil testing or 400-600 lbs/acre of 12-12-12 analysis (or equivalent) fertilizer.
- C. Lime: As recommended by soil testing.
- D. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.
- E. Erosion Control Blanket: As specified on the Drawings.
- F. Stakes: Softwood lumber, chisel pointed.
- G. String: Inorganic fiber.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify prepared soil base is ready to receive the Work of this section.
- C. Test soil to determine pH and nutrient levels as indicated on the Drawings.

3.2 FERTILIZING

- A. Perform in accordance with the Drawings.

3.3 SEEDING

- A. Perform in accordance with the Drawings.

3.4 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 24 inches. Space stakes at 72 inches.
- B. Apply erosion control blanket in areas noted on the Drawings.

3.5 MAINTENANCE

- A. Mow grass at regular intervals to maintain at maximum height of 6 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove minor depressions or irregularities.
- F. Control growth of weeds. Do not apply herbicides unless approved by OWNER.
- G. Immediately reseed areas showing bare spots.
- H. Repair washouts or gullies.
- I. Protect seeded areas with warning signs during maintenance period as required.
- J. CONTRACTOR shall maintain final grades and vegetation until vegetation is established and accepted by OWNER. CONTRACTOR shall repair erosion damage to finished surfaces and vegetation at no cost to OWNER.

- K. Leave temporary erosion control measures in place until after vegetation is established and approved by ENGINEER.

END OF SECTION

SECTION 33 11 10

MECHANICAL COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductile iron pipe and fittings

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
- B. American Water Works Association:
 - 1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - 2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

1.3 SUBMITTAL PROCEDURES

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.
- C. Shop Drawings: Submit dimensioned shop drawing of piping which includes all connection types, necessary fittings, alignment, and thrust restraint systems.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of piping, valves, connections, thrust restraints, invert elevations, and structure locations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.1 Ductile Iron Pipe (DIP)

- A. DIP shall be centrifugally cast in metal or sand-lined molds and shall conform to ANSI A21.51/AWWA C 151.
- B. Minimum thickness class shall be Class 52 for all sizes unless otherwise shown on the Drawings.
- C. Pipe joints shall be push-on type and conform to ANSI A21.11/AWWA C 111 unless otherwise shown or noted on the Drawings.
- D. Each length of pipe shall be marked to show manufacturer's name or trade mark, pipe class, year of manufacture conforming to ANSI A 21.51/AWWA C 151.

2.2 Fittings

- A. Fittings shall be mechanical joint and iron or ductile iron conforming to ANSI A 21.53/AWWA C 153 and ANSI A21.4/AWWA C 104.
- B. Restrained joints may be used instead of mechanical joints. Thrust blocking shall be provided for all fittings.
- C. Fittings not covered under AWWA C153 shall comply with AWWA C110.
- D. Fittings shall have the same linings and coatings as the pipe.

2.3 Flanged Piping and Joints

- A. Flanged piping and joints where required on the Drawings shall comply with AWWA C115 and AWWA C110, respectively.
- B. Flanges shall conform to ANSI B16.1.
- C. Flange assembly bolts shall be standard hexagonal head carbon steel machine bolts with heavy, hot pressed, hexagon nuts, ANSI B18.2. Threads shall conform to ANSI B1.1, coarse thread series, Class 2 fit. Bolt length shall be such that after joints are made up the bolts shall protrude through the nut, but not more than 2-inch.

2.4 Coatings & Linings

- A. All iron or ductile iron pipe and fittings shall have a standard thickness cement mortar lining as specified in ANSI A 21.4/AWWA C 104 and an outside coating (for direct buried pipe) as specified in ANSI A 21.51/AWWA C 151.

PART 3 EXECUTION

3.1 General

- A. CONTRACTOR shall provide all tools, labor and equipment necessary for the safe and expeditious installation of all lines and appurtenances as shown on the Drawings and specified herein.
- B. CONTRACTOR shall inspect pipe and appurtenances prior to installation and promptly remove damaged or unsuitable materials and provide with new and unused materials.

3.2 Size, Location and Alignment

- A. CONTRACTOR shall be responsible for all checking and conforming to size, location, alignment, and for flange drilling of all existing piping and equipment as required for making proper piping connections.
- B. All piping shall be arranged and aligned as far as practicable, in accordance with the Drawings.
- C. Piping shall not interfere with access to valves or equipment and shall not obstruct passageways. Piping shall be installed to provide working clearance for operation and maintenance.
- D. Modifications to arrangement of piping systems may be required, subject to the review of OWNER's Representative, to suit field conditions or to avoid interference with existing or new work of other trades.
- E. Fittings shown on the Drawings may not be all inclusive of the fittings required to meet the intended alignments and configuration of the design. CONTRACTOR shall furnish all offsets, additional fittings, etc, as required to meet all requirements of installation conditions to meet the intent of the design.

3.3 Piping Workmanship

- A. Pipe shall be cut accurately by CONTRACTOR to dimensions established at the site and shall be worked into place without springing or forcing.
- B. Cut sections of pipe shall be cut square and true by common construction methods where field cutting cannot be avoided. Cut sections shall be free from burrs, deformities, and other irregularities created during performance of the Work.
- C. Where location is not exactly shown by detailed dimensions, pipe shall be installed so as to occupy minimum space.

END OF SECTION

APPENDIX A – GEOTECHNICAL ENGINEERING REPORT

CTL Engineering, Inc.

1310 S. Franklin Road
Indianapolis, Indiana 46239

Phone: (317) 295-8650 • Fax: (317) 295-8395

www.ctleng.com



Consulting Engineers – Testing – Inspection Services – Analytical Laboratories

November 19, 2017

Christopher B. Burke Engineering, LLC
115 West Washington Street, Suite 1368 South
Indianapolis, IN 46204

Attention: Mr. Aaron J. Fricke, PE

Reference: Geotechnical Engineering Investigation
Tippecanoe Lake Outlet Structure Replacement
Kosciusko County, IN
CTL Project No.: 17050037IND

Dear Mr. Fricke,

CTL Engineering, Inc. has completed the geotechnical investigation on the above referenced site. Enclosed is an electronic copy of the report.

Thank you for the opportunity to be of service to you on this project. If you have any questions or need further information, please contact us at (317) 295-8650.

Sincerely,

CTL ENGINEERING, INC.

A handwritten signature in blue ink that reads "Shawn M. Marcum". The signature is written in a cursive style and is positioned above a horizontal line.

Shawn M. Marcum, PE
Senior Project Engineer

GEOTECHNICAL INVESTIGATION

**GEOTECHNICAL ENGINEERING INVESTIGATION
TIPPECANOE LAKE OUTLET STRUCTURE REPLACEMENT
KOSCIUSKO COUNTY, IN
CTL PROJECT NO.: 17050037IND**

PREPARED FOR:

**CHRISTOPHER B. BURKE ENGINEERING, LLC
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PREPARED BY:

**CTL ENGINEERING, INC.
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NOVEMBER 19, 2017



CTL Engineering, Inc.
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Consulting Engineers – Testing – Inspection Services – Analytical Laboratories

November 19, 2017

Christopher B. Burke Engineering, LLC
115 West Washington Street, Suite 1368 South
Indianapolis, IN 46204

Attention: Mr. Aaron J. Fricke, PE

Reference: Geotechnical Engineering Investigation
Tippecanoe Lake Outlet Structure Replacement
Kosciusko County, IN
CTL Project No.: 17050037IND

Dear Mr. Fricke:

In accordance with your authorization, CTL Engineering, Inc. has completed the geotechnical investigation on the above referenced site. The attached report includes the results of the field and laboratory testing, and recommendations for the proposed replacement structure and earth related phases of the project.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 295-8650.

Sincerely,

CTL ENGINEERING, INC.

A handwritten signature in blue ink that reads "Shawn M. Marcum". The signature is written in a cursive style and is positioned above a horizontal line.

Shawn M. Marcum, PE
Senior Project Engineer

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I. PROJECT LOCATION AND DESCRIPTION

The project involves the design and construction of a replacement outlet structure for Tippecanoe Lake in Kosciusko County, Indiana. The replacement structure is a reinforced concrete ogee weir that will be supported on a reinforced concrete foundation. It is estimated that the foundation for the replacement structure will bear below approximately El 830. The replacement structure will be constructed immediately upstream of the existing outlet structure with the existing structure foundation being left in place. A steel sheet pile cutoff will be installed prior to constructing the replacement structure foundation.

II. SUBSURFACE INVESTIGATION

Two test borings, designated as B-1 and B-2, were drilled on the bank north and south of the existing outlet structure. The test borings were drilled at the approximate locations as shown on the attached Site Plan in Appendix A. The Test Boring Records are included in Appendix B.

The test borings were advanced with an ATV mounted drilling rig utilizing hollow stem augers (HSA) on June 22, 2017. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field by the drilling crew and in the laboratory by a geotechnical engineer. Representative soil samples were tested for Natural Moisture Content, pH, Atterberg Limits and Grain Size Distribution.

Drilling, soil sampling and laboratory testing were performed following standard geotechnical engineering practices and current ASTM procedures. Results from field tests are shown on the enclosed Test Boring Records in Appendix B and laboratory test sheets in Appendix C.

III. FINDINGS

A. Subsurface Conditions

Test borings B-1 and B-2 were drilled on the bank north and south of the existing outlet structure, respectively. Below a 7 inch thick surficial topsoil layer, Boring B-1 encountered very loose clayey sand (SC) fill overlying very loose to medium dense sand (SP) with varying amounts of silt and gravel and loose sand and gravel

to a depth of 17.5 feet. The boring then encountered silty clayey sand with gravel (SC-SM) glacial till to a depth of 28.0 feet. The glacial till is underlain by loose to dense sand and gravel (SP) and sand (SP) to the boring termination depth of 40.0 feet below the existing ground surface.

During the initial drilling of boring B-2, an unknown obstruction was encountered at a depth of approximately 3 feet. The boring location was offset 5 feet south and redrilled.

Below a 6 inch thick surficial topsoil layer, Boring B-2 encountered 6 inches of crushed stone fill. The boring then encountered loose to medium dense clayey sand and silty sand to a depth of 19.5 feet. The boring then encountered silty clayey sand with gravel (SC-SM) glacial till to a depth of 27.0 feet. The glacial till is underlain by loose to dense clayey sand, silty sand and sand to the boring termination depth of 40.0 feet below the existing ground surface. Cobbles were noted during drilling from approximately 34.0 to 35.5 feet below the existing ground surface.

B. Groundwater

Groundwater levels were recorded during drilling operations as shown on the attached Test Boring Records in Appendix B and summarized below in Table 1. It should be noted that groundwater levels recorded during this subsurface investigation borings are generally not a reliable indication of longterm groundwater levels. Fluctuations in the groundwater level can occur with seasonal and weather conditions and the flow level in the outlet channel.

Table 1 – Groundwater Depth

Boring No.	Ground Surface Elevation ¹ , feet	Groundwater Readings		Cave-in Depth, feet
		During Drilling, feet	At Completion, feet	
B-1	838	5.0	3.5	17.0
B-2	837	3.5	2.5	4.5

¹ Ground surface elevation estimated from provided site plans.

IV. DISCUSSIONS AND RECOMMENDATIONS

The project site is located within the existing Tippecanoe Lake outlet channel and will require excavating below the normal flow elevation of the channel. Based on the preliminary design plans, the excavations for the proposed structure will be up to approximately 6 feet below the bottom of the existing channel.

Based upon the preceding discussion as well as the subsurface information obtained from the field and laboratory testing, the following recommendations are provided.

A. Excavations

Preliminary design plans indicate that the base of the proposed outlet structure will be about 6 feet (El 827) below the base of the outlet channel. A temporary earth retention system will be required during the construction of the proposed structure to support the surrounding ground surface. It has been assumed that the earth retention system within the channel may consist of a cofferdam constructed of driven sheet piling to limit the channel flow from entering the excavation.

Soil parameters for use in design of the shoring are provided in Table 2 below. These parameters may be used in the design of temporary earth retention structures for this project along the recommendations provided in the following paragraphs.

Table 2 – Soil Parameters for Earth Retention

Parameters	Material Type		
	Loose Sand	Medium Dense Sand	Silty, Clayey Sand
Total Unit Weight, pcf	120	125	125
Angle of Internal Friction, Degrees	30	32	30
At Rest Pressure Coefficient, K_o	0.50	0.47	0.50
Active Pressure Coefficient, K_a	0.33	0.31	0.33
Passive Pressure Coefficient, K_p	3.00	3.25	3.00

1. Care should be taken while excavating adjacent to existing utilities or other structures so as not to undermine the existing support. The effect of the excavation on the adjacent structures should be considered. Depending upon the type of foundation system of nearby structures, underpinning may be required.

Temporary shoring systems, where required, should be designed by a Licensed Engineer familiar with the design of earth retention systems. The design of the shoring system should also take into account loading adjacent to the excavation such as soil stockpiles.

2. Cobbles and boulders are likely to be present within the subsurface soils at these sites which could make installation of sheet piling difficult. Sheet piling may need to be relocated and re-driven if large cobbles or boulders are encountered.

B. Groundwater Control

The project site is located within the existing outlet channel and will require excavations to extend below the normal flow elevation in the channel. It is recommended that the groundwater level be maintained at least 4 feet below the deepest anticipated excavation at the structure. The ground water level should be maintained at this level until the structure is complete and the backfill is placed around the structure. Several deep wells installed around the perimeter of the proposed excavation will most likely be required to lower the ground water level within the excavation. Sumps pumps located inside the excavation may also be necessary to control seepage water.

The design of a dewatering system or systems for this project is beyond the scope of this investigation. An experienced Dewatering Contractor familiar with projects of similar scope and size should design, install and monitor the dewatering system for any proposed excavation where water will likely be encountered. The dewatering system should be carefully designed so that adjacent structures are not adversely affected by the operation. The pumping rate should be calculated and screen sizes determined so as to prevent removal of fine-grained soils, which could result in settlement of adjacent structures, or the collapse of excavation sidewalls.

C. Structure Support

The proposed outlet structure will be a reinforced concrete structure supported on the existing loose to medium dense granular soils. It is recommended that a crushed stone base be installed at the base of the excavation to maintain a suitable construction platform. A sheetpile cut-off wall should be installed at the proposed outlet structure extending to at least 4 feet into the silty, clayey sand glacial till encountered at elevations varying from approximately El 820.5 to El 817.5. Therefore, it is recommended that the sheetpile wall be driven to a minimum elevation of 813.5.

1. The foundation for the proposed outlet structure may be designed using a net allowable soil bearing capacity of 2,000 pounds per square foot (psf). The foundations may also be designed using a modulus of subgrade reaction of 80 pounds per cubic inch (pci).
2. Settlement of the proposed structure may vary across the site due to variations in soil composition, void ratio and loading. However, it is estimated that total and differential settlements will be less than 1 inch and 1/2 inch, respectively.
3. An ultimate coefficient of friction between the cast-in-place concrete structure foundation and the underlying granular soils of 0.57 may be used when calculating sliding resistance along the base of the structure. A factor of safety against sliding of at least 1.5 is recommended for standard operating conditions.

The proposed structure will also need to be able to resist forces due to the flow of the water acting on the structure. Flowing water can exert large forces acting on the upstream side of the outlet structure, especially under flooding conditions.

4. Foundations should be at least 30 inches below the surrounding exposed grade to provide protection against frost.
5. The foundation soils supporting the outlet structure must be protected against scour due to flow of the water in the outlet channel.

D. Seismic Considerations

The soils encountered in this area are generally medium dense to dense granular soils. Based on test borings drilled for the project and Table 1615.1.1 of the 2012 International Building Code, the soil profile at this site is likely to be a Site Class D. Therefore, it is recommended that the earthquake loads be calculated using Site Class D.

E. Site Preparation and Earthwork

1. All surface objects, trees including stumps, grass, vegetation, topsoil and roots, shall be removed from within the construction limits. Topsoil can be stockpiled separately and reused for landscaping purposes.
2. During earthwork operations, care should be taken to provide adequate drainage on the exposed soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening of these soils, hence, severely weakening the strength of the subgrade soils.
3. On-site excavated soils, except topsoil, are considered suitable for use for backfill and embankment fill provided proper moisture content is maintained during placement. A portion of the excavated soils may exhibit natural moisture content above the optimum moisture. Such soils may require air-drying and/or chemical modification prior to placement.
4. Borrow material required for the project should consist of INDOT B borrow, silt-clay soil and/or sand and gravel material. Topsoil, organically contaminated material, soils with more than 50 percent silt and/or soils with Liquid Limit of more than 50 percent are not suitable for use as fill. All fill material should be inspected and approved by the Engineer.
5. Backfill around the proposed structure should be placed and compacted as outlined in Section H. Fill supporting the structure should be compacted to 100 percent of the maximum dry density (MDD) as determined by ASTM D 698. A reduced percentage of compaction can be used in lawn or grass areas. The engineered fill should not be placed in a frozen condition or over a frozen subgrade.
6. New embankment fills placed on existing and/or against already built embankments should be benched into the existing slope. A minimum bench width of 6 ft is recommended. Soft soils and/or loose soils if encountered at or below the proposed new fill, should be removed and replaced with compacted engineered fill.

7. Embankment side slopes constructed at a rate no steeper than 2.5:1 (Horizontal to Vertical) are considered safe against deep-seated failure. All slopes should be seeded and growth of vegetation permitted to limit soil erosion and sloughing.

V. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this preliminary report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

VI. TESTING AND OBSERVATION

During the design process, it is recommended that CTL work with the project designers to confirm that these geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing. CTL is not responsible for independent conclusions, opinions and recommendations made by others based on the data and the recommendations provided in this report.

VII. CLOSING

The preliminary report was prepared by CTL Engineering, Inc. (Consultant) solely for the use of the Client in accordance with an executed contract. The Client's use of or reliance on this preliminary report is limited by the terms and conditions of the contract and by the qualifications and limitations stated in the report. It is also acknowledged that the Client's use of and reliance of this report is limited for reasons which include actual site conditions that may change with time; hidden conditions, not discoverable within the scope of the assessment, may exist at the site; and the scope of the investigation may have been limited by time, budget and other constraints imposed by the Client.

Neither the report, nor its contents, conclusions or preliminary recommendations are intended for the use of any party other than the Client. Consultant and the Client assume no liability for any reliance placed on this report by such party. The rights of the Client

under contract may not be assigned to any person or entity, without the consent of the Consultant which consent shall not be unreasonably withheld.

This preliminary geotechnical report does not address the environmental conditions of the site. The Consultant is not responsible for consequences or conditions arising from facts that were concealed, withheld, or not fully disclosed at the time the assessment was conducted.

To the fullest extent permitted by law, the Consultant and Client agree to indemnify and hold each other, and their officers and employees harmless from and against claims, damages, losses and expenses arising out of unknown or concealed conditions. Furthermore, neither the Consultant nor its employees shall be liable to the Owner in an amount in excess of the available professional liability insurance coverage of the Consultant. In addition, Client and Consultant agree neither shall be liable for any special, indirect or consequential damages of any kind or nature.

The Consultant's services have been provided consistent with its professional standard of care. No other warranties are made, either expressed or implied.

Sincerely,

CTL ENGINEERING, INC.

Shawn M, Marcum, P.E.
Senior Project Engineer

Sulaiman Dawood, EI
Project Engineer

APPENDIX A
BORING LOCATION PLAN

IMPROVEMENT LEGEND

-  CONCRETE WALK
-  NEW SMALL CRAFT INTRUSION BARRIER



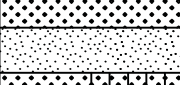


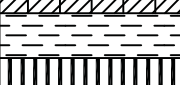
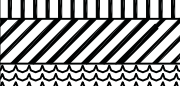

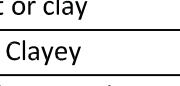
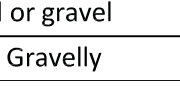




		SITE PLAN		PROJECT NO. 161R160544.00000	
		TIPPECANOE LAKE OUTLET STRUCTURE REPLACEMENT		SHEET # OF 7 DRAWING NO.	
PROJECT C-CHRISTOPHER B. BURKE ENGINEERING LLC. PKC Center, Suite 1388 South 11.5 West Wharfedon Street Indianapolis, Indiana 46204 (317) 266-8000 FAX: (317) 632-3306		KOSCIUSKO COUNTY INDIANA		TEL	
DESIGN DWG: [] CADD: [] SCALE: [] DATE: []		AUP DWG: [] CADD: [] SCALE: [] DATE: []		161R160544	

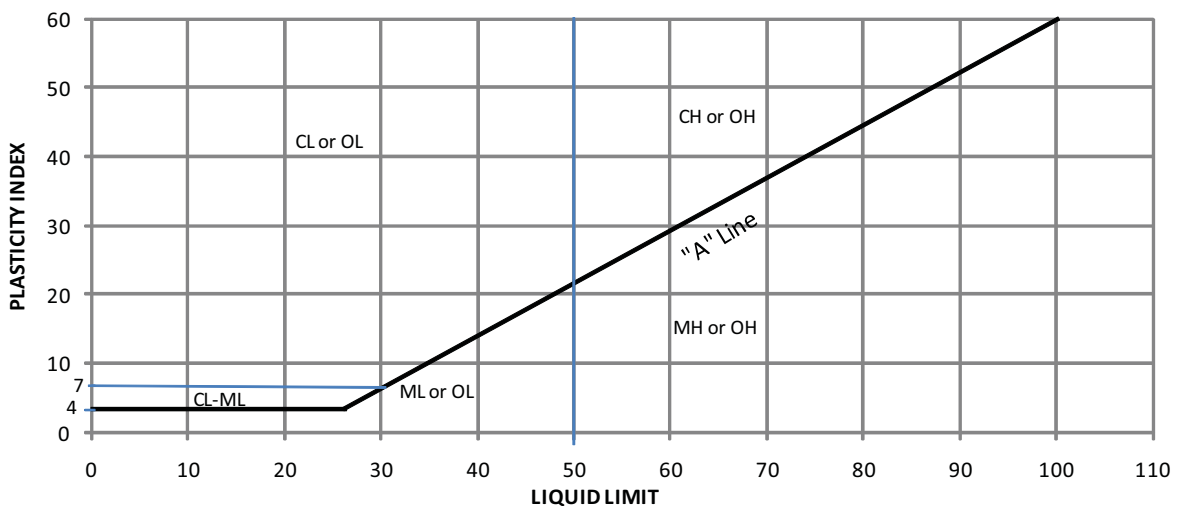
APPENDIX B
TEST BORING RECORDS

SOIL DESCRIPTIONS BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM

ASTM D 2487 and D 2488

Major Division		Group Symbol	Letter Symbol	Group Name*	
Coarse Grained Soils Less Than 50 Percent Passing the # 200 Sieve	Gravel - Percent GRAVEL > percent SAND	Gravel with < 5% Fines		GW	Well Graded GRAVEL
		Gravel with Between 5 and 15% Fines		GP	Poorly Graded GRAVEL
		Gravel with ≥ 15% Fines	GW-GM	Well Graded GRAVEL with silt	
			GW-GC	Well Graded Gravel with clay	
			GP-GM	Poorly Graded GRAVEL with silt	
			GP-GC	Poorly Graded GRAVEL with clay	
	Sand - Percent SAND ≥ percent GRAVEL	Sand with < 5% Fines		SW	Well Graded SAND
		Sand with Between 5 and 15% Fines		SP	Poorly Graded SAND
		Sand with ≥ 15% Fines	SW-SM	Well Graded SAND with silt	
			SW-SC	Well Graded SAND with clay	
			SP-SM	Poorly Graded SAND with silt	
			SP-SC	Poorly Graded SAND with clay	
		SM	Silty SAND		
		SC	Clayey SAND		
Fine Grained Soils 50 percent or more Passing the # 200 Sieve	SILT and CLAY	Liquid Limit Less Than 50		ML	SILT
		Liquid Limit 50 or Greater		CL	Lean CLAY
				CL-ML	SILTY CLAY
				OL	Organic SILT, CLAY, or SILTY CLAY
			MH	Elastic SILT	
			CH	Fat CLAY	
			OH	Organic SILT or CLAY	
Highly Organic Soils			PT	Peat	
* Additional Modifiers	Coarse Grained Soils	with silt or clay	5 to 12 % Silt or Clay by weight		
		Silty or Clayey	more than 12 % Silt or Clay by weight		
	Fine Grained Soils	with sand or gravel	15 to 29 % Sand or Gravel by weight		
		Sandy or Gravelly	30 % or more Sand or Gravel by weight		

"A" LINE GRAPH



SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION

STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)

Very Loose	0 - 4
Loose	5 - 10
Medium Dense.....	11 - 30
Dense	31 - 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION

STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)

Very Soft	0 - 1
Soft	2 - 4
Medium Stiff	5 - 8
Stiff	9 - 15
Very Stiff.....	16 - 30
Hard	Over 30

GRADATION COMPONENT

SIZE

Boulders.....	Larger than 8"
Cobbles.....	8" - 3"
Gravel	Passing 3" Retained on #4
Sand	Passing #4 Retained on #200
Silt	0.075 mm to 0.005 mm
Clay	Smaller than 0.005 mm

COMPONENT MODIFIERS

SIZE

Traces	0 - 10%
Little	11 - 20%
Some	21 - 35%
And	36 - 50%

MOISTURE TERMS

DESCRIPTION

Dry	Powdery
Damp	Below Plastic
Moist	Above Plastic Limit & Below Liquid Limit
Wet	Above Liquid Limit

TEST BORING RECORD

CLIENT : Christopher B. Burke Engineering, LLC
 PROJECT : Proposed Tippecanoe Lake Outlet Structure
 LOCATION : Kosciusko County, Indiana
 PROJECT NO. : 17050037IND


BORING NO.: **B-1**
 SHEET 1 OF 2
 DATE STARTED : 06-22-17
 DATE COMPLETED : 06-22-17

Boring Elevation: 838 Feet	Boring Depth : 40.0 Feet	Boring Method : HSA	Hammer : 140
Northing : 2,211,937	Station: ---	Rig Type : ATV	Hammer Efficiency: 80%
Easting : 294,421	Offset : ---	Casing Diameter : 3.25	Driller : D&T
Datum : NAD83, Indiana East	Line : ---	Core Size : ---	Temperature : 80° F
			Weather : Cloudy

GROUNDWATER: ▼ Encountered at 5.0' ▼ At completion 3.5' ☒ Caved in at 17.0'

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT per 6"	SPT per 12" (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (pcf)	Unconfined Compression (ksf)	Atterberg Limits				
											LL	PL	PI		
837.4		TOPSOIL (Visual) (7")	0.6		2										
		Brown and Dark Brown, Moist, Very Loose, CLAYEY SAND with Traces of Gravel (FILL) (Visual)		SS-1	1	3	29	16							
835.0		Dark Brown, Moist, Very Loose, SILTY SAND with Some Organic Matter (Visual)	3.0	SS-2	1	2	75	148							
833.0	5	Testing on SS-2 LOI = 17.2%	5.0	SS-3	3	6	50	20							
		Brown and Gray, Wet, Loose, Fine to Medium SAND with Little Silt (Visual)			7										
831.0			7.0	SS-4	4	11	50	23							
	10	Gray, Wet, Medium Dense to Very Loose, POORLY GRADED SAND (SP) with Traces of Silt and Gravel Lab 1		SS-5	2	6	100	23				NP	NP	NP	
					4										
826.2			11.8	SS-6	1	4	100	23				NP	NP	NP	
					3										
	15	Gray, Wet, Medium Dense, Medium SAND with Traces of Gravel (Visual)		SS-7	7	16	100	11							
822.3					9										
					14										
					3										
820.5		Gray, Wet, Loose, SAND and GRAVEL with Traces of Silt (Visual)	15.7	SS-8	7	16	100	14							
					9										
					8										
					3										
					3	8	100	10							
					5										
					6										
					2										
	20	2 feet heave in augers. Gray, Moist, Loose to Medium Dense, SILTY, CLAYEY SAND with GRAVEL (SC-SM) (TILL) Lab 2	17.5	SS-9	4	8	33	10				15	11	4	
					4										
					4										
					3										
					3	6	100								
					3										

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 CTL Engineering, Inc. Phone: 317-295-8650	BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
	HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling HA - Hand Auger	SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample AC - Auger Cuttings	* - Hand Penetrometer LL - Liquid Limit PL - Plastic Limit PI - Plasticity Index SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : Christopher B. Burke Engineering, LLC

BORING NO.: **B-1**

PROJECT : Proposed Tippecanoe Lake Outlet Structure

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT per 6"	SPT per 12" (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (pcf)	Unconfined Compression (ksf)	Atterberg Limits		
											LL	PL	PI
810.0	25	Gray, Moist, Loose to Medium Dense, SILTY, CLAYEY SAND with GRAVEL (SC-SM) (TILL) Lab 2	28.0	SS-12	2 3 4	7	78	9					
				SS-13	7 9 14	23	6						
800.0	30	3.5 feet heave in augers. Gray, Wet, Loose to Dense, SAND and GRAVEL with Till Seams (Visual)	38.0	SS-14	3 4 5	9	78	11					
				SS-15	6 18 20	38	33	13					
				SS-16	5 8 8	16	39	13					
798.0	40	Gray, Wet, Medium Dense, Medium to Coarse SAND (Visual)	40.0	SS-17	10 7 9	16	0						
		Bottom of Boring at 40 Feet.		SS-18	4 14 12	26	78	16					
		Boring backfilled according to aquifer protection guidelines.											
	45												
	50												



CTL Engineering, Inc.
Phone: 317-295-8650

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Christopher B. Burke Engineering, LLC
 PROJECT : Proposed Tippecanoe Lake Outlet Structure
 LOCATION : Kosciusko County, Indiana
 PROJECT NO. : 17050037IND


BORING NO.: **B-2**
 SHEET 1 OF 2
 DATE STARTED : 06-22-17
 DATE COMPLETED : 06-22-17

Boring Elevation: 837 Feet	Boring Depth : 40.0 Feet	Boring Method : HSA
Northing : 2,211,840	Station: ---	Rig Type : ATV
Easting : 294,382	Offset : ---	Casing Diameter : 3.25
Datum : NAD83, Indiana East	Line : ---	Core Size : ---
		Hammer : 140
		Hammer Efficiency: 80%
		Driller : D&T
		Temperature : 80° F
		Weather : Cloudy

GROUNDWATER: ▼ Encountered at 3.5' ▼ At completion 2.0' ☒ Caved in at 4.5'

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT per 6"	SPT per 12" (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (pcf)	Unconfined Compression (ksf)	Atterberg Limits				
											LL	PL	PI		
836.5		TOPSOIL (Visual) (6")	0.5		3										
836.0		CRUSHED STONE (FILL) (Visual) (6")	1.0		4	10	25	38							
		Dark Brown, Very Moist, Medium Dense, CLAYEY Fine to Medium SAND with Traces of Tree Roots (Visual)		SS-1	6										
				SS-2	6	15	33	48							
833.0			4.0		7										
		Gray, Wet, Medium Dense, SILTY Fine SAND (Visual)		SS-3	1	11	25	19							
831.0	5		6.0		2										
				SS-4	9	8	100	24							
				SS-5	1										
				SS-6	3	5	100	25							
	10			SS-7	5	12	100								
		Gray, Wet, Loose to Medium Dense, SILTY SAND (SM) Lab 3		SS-8	7	7	100								
		2 feet of heave.		SS-9	8	8	0								
	15			SS-10	3	8									
		1 feet of heave.		SS-11	5	23	100	18							
					8										
					15										
					15										
817.5	20	Gray, Moist, Medium Dense to Loose, SILTY, CLAYEY SAND (SC-SM) with Traces of Gravel (TILL) Lab 4	19.5	SS-10	1	13	50	13							
				SS-11	4	8	44	13				20	13	7	
					4										

Continued on next page

 CTL Engineering, Inc. Phone: 317-295-8650	BORING METHOD HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling HA - Hand Auger	SAMPLING METHOD SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample AC - Auger Cuttings	ABBREVIATIONS * - Hand Penetrometer LL - Liquid Limit PL - Plastic Limit PI - Plasticity Index SPT - Standard Penetration Test
--	---	---	--

TEST BORING RECORD

CLIENT : Christopher B. Burke Engineering, LLC

BORING NO.: **B-2**

PROJECT : Proposed Tippecanoe Lake Outlet Structure

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT per 6"	SPT per 12" (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (pcf)	Unconfined Compression (ksf)	Atterberg Limits			
											LL	PL	PI	
810.0	25	Gray, Moist, Medium Dense to Loose, SILTY, CLAYEY SAND (SC-SM) with Traces of Gravel (TILL) Lab 4	27.0	SS-12	3 5 8	13	78							
809.0		Gray, Wet, Loose, SILTY Fine SAND (Visual)	28.0	SS-13	3 3 5	8	100	12						
806.0	30	Gray, Wet, Loose, CLAYEY Fine to Medium SAND (Visual)	31.0	SS-14	4 3 4	7	100	15						
802.5		Gray, Wet, Medium Dense, SILTY Fine SAND (Visual)		SS-15	5 8 10	18	100	14						
		Cobbles noted from 34.0 to 35.5 feet	34.5	SS-16	6 6 5	11	100	12						
	35	Gray, Wet, Medium Dense, Fine to Coarse SAND with Traces of Silt		SS-17	2 6 10	16	100	14						
797.0	40	Bottom of Boring at 40 Feet. Boring backfilled according to aquifer protection guidelines.	40.0	SS-18	2 4 10	14	17	12						
	45													
	50													



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Phone: 317-295-8650

BORING METHOD

- HSA - Hollow Stem Auger
- SFA - Solid Flight Auger
- RC - Rock Coring
- MD - Mud Drilling
- WD - Wash Drilling
- HA - Hand Auger

SAMPLING METHOD

- SS - Split Spoon Sample
- ST - Shelby Tube Sample
- CR - Rock Core Sample
- BS - Bag Sample
- AC - Auger Cuttings

ABBREVIATIONS

- * - Hand Penetrometer
- LL - Liquid Limit
- PL - Plastic Limit
- PI - Plasticity Index
- SPT - Standard Penetration Test

APPENDIX C

LABORATORY TESTING

Summary of Classification Test Results
Grain Size Distribution Curves
Summary of Special Laboratory Test Results

Lab No.	Boring No.	Northing	Easting	Sample No.	Depth	Soil Classification	ASTM Group	Grain Size Distribution (%)			WC	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture Content (%)	CBR (%)	
								Gravel	Sand	Silt / Clay							90%	100%
Lab 1	B-1	2211937	294421	SS-5	8.0-10.0	POORLY GRADED SAND	SP	4.6	91.8	3.6	23	NP	NP					
Lab 2	B-1	2211937	294421	SS-10	18.0-20.0	SILTY, CLAYEY SAND with GRAVEL	SC-SM	17.1	46.5	26.4	10	15	11	4				
Lab 3	B-1	2211937	294421	SS-6	10.0-12.0	SILTY SAND	SM	2.0	85.9	12.1	23	NP	NP	NP				
Lab 4	B-2	2211840	294382	SS-11	21.0-22.5	SILTY, CLAYEY SAND	SC-SM	11.8	47.2	29.4	13	20	13	7				

SUMMARY OF CLASSIFICATION TEST RESULTS

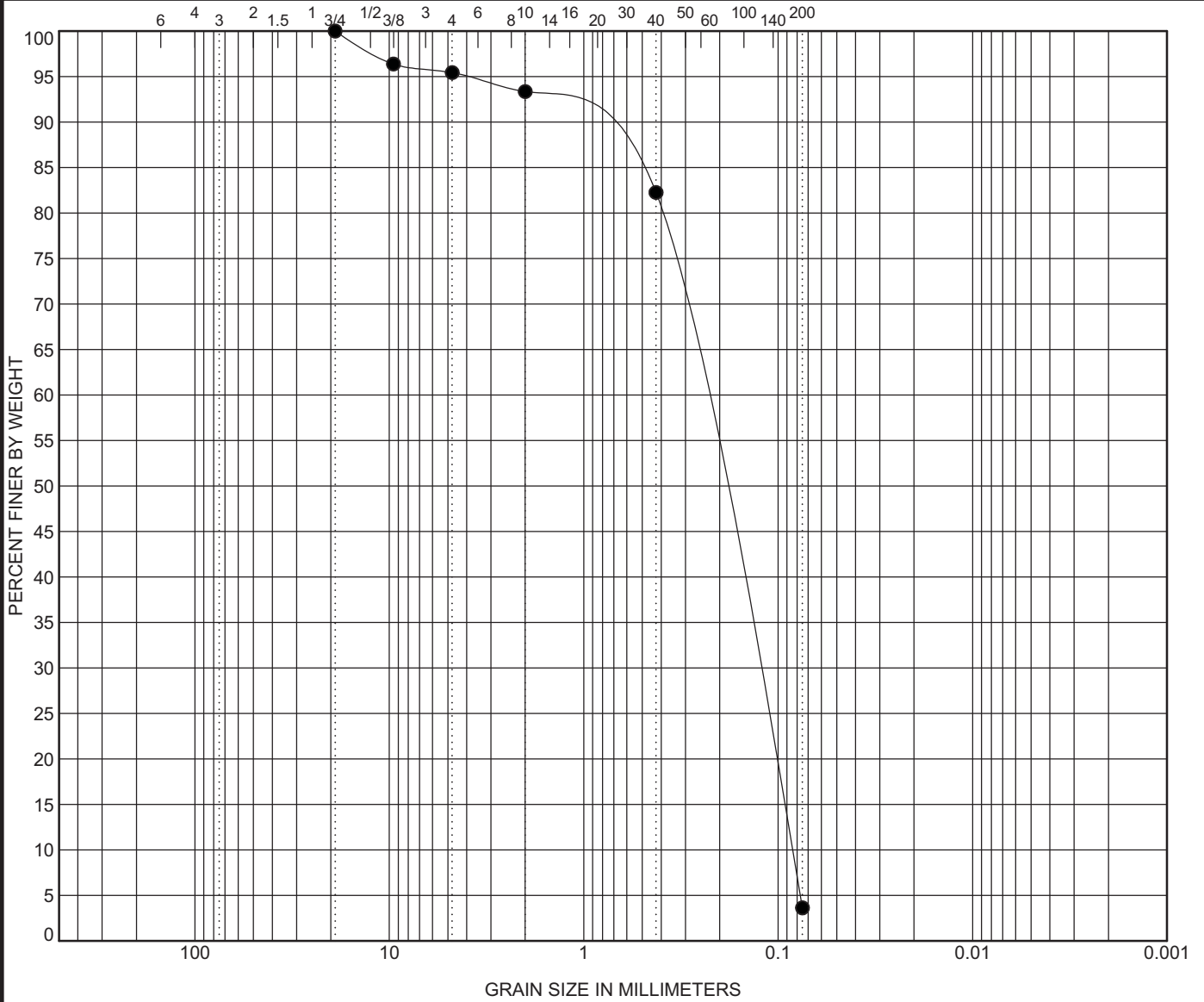
Project: Proposed Tippecanoe Lake Outlet Structure
 Location: Kosciusko County, Indiana
 Project No.: 17050037IND



U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Boring No.	B-1	Classification					MC	LL	PL	PI	Cc	Cu
Sample	SS-5	POORLY GRADED SAND					23.0	NP	NP	NP	0.80	3.01
Depth	8.0-10.0	SP										
Station	---	Lab 1										
Offset	---											
Line	---											
Fine material soaking time	Minutes	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay		
		19	0.26	0.209	0.134	0.086	4.6	91.8	3.6			
Remarks												



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Phone: 317-295-8650

GRAIN SIZE DISTRIBUTION

Project: Proposed Tippecanoe Lake Outlet Structure

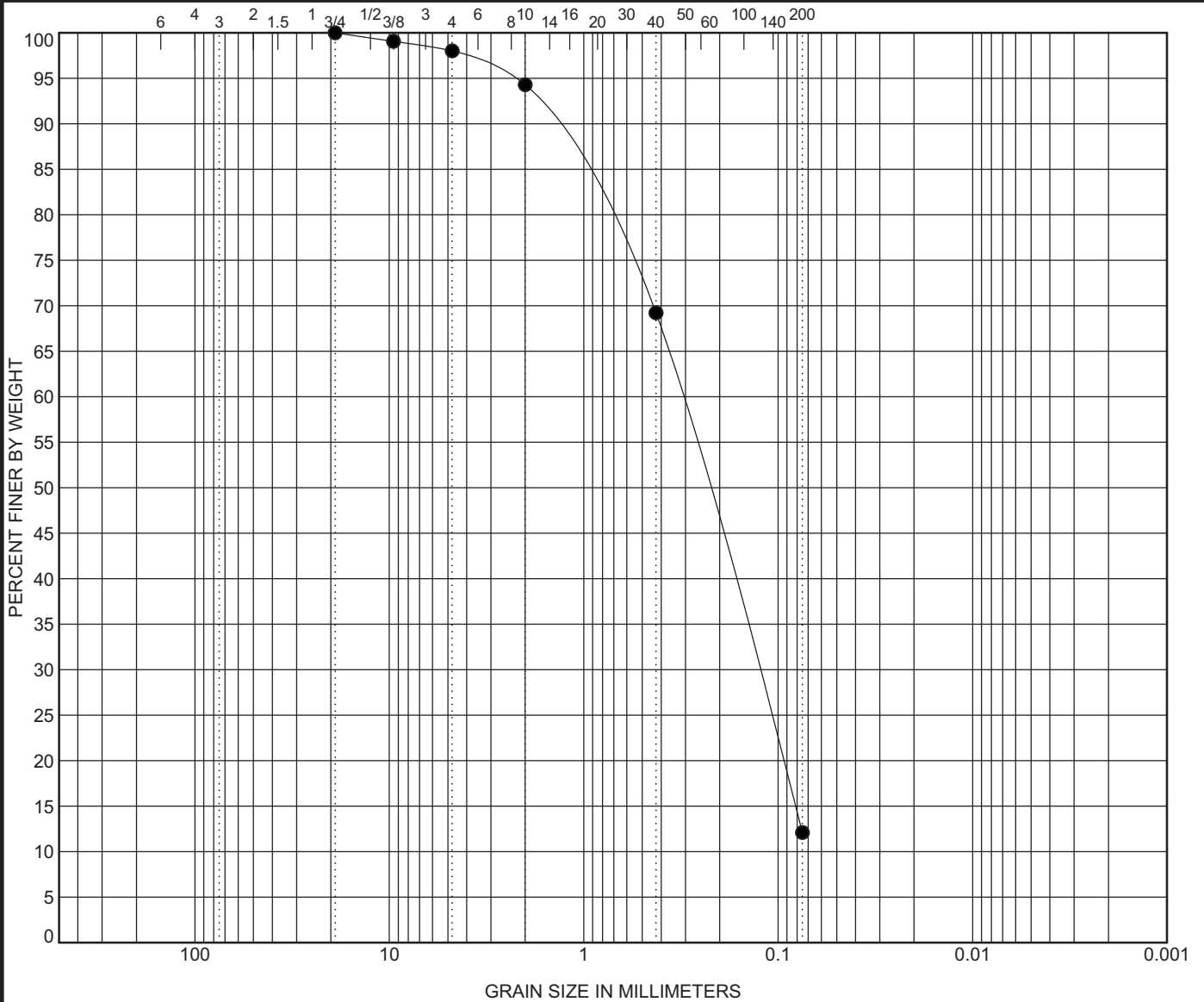
Location: Kosciusko County, Indiana

CTL Project No.: 17050037IND

U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Boring No.	B-1	Classification					MC	LL	PL	PI	Cc	Cu
Sample	SS-6	SILTY SAND					23.0	NP	NP	NP	0.74	4.56
Depth	10.0-12.0	SM										
Station	---	Lab 3										
Offset	---											
Line	---											
Fine material soaking time	Minutes	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay		
		19	0.321	0.237	0.129		2.0	85.9	12.1			
Remarks												



CTL Engineering, Inc.
Phone: 317-295-8650

GRAIN SIZE DISTRIBUTION

Project: Proposed Tippecanoe Lake Outlet Structure

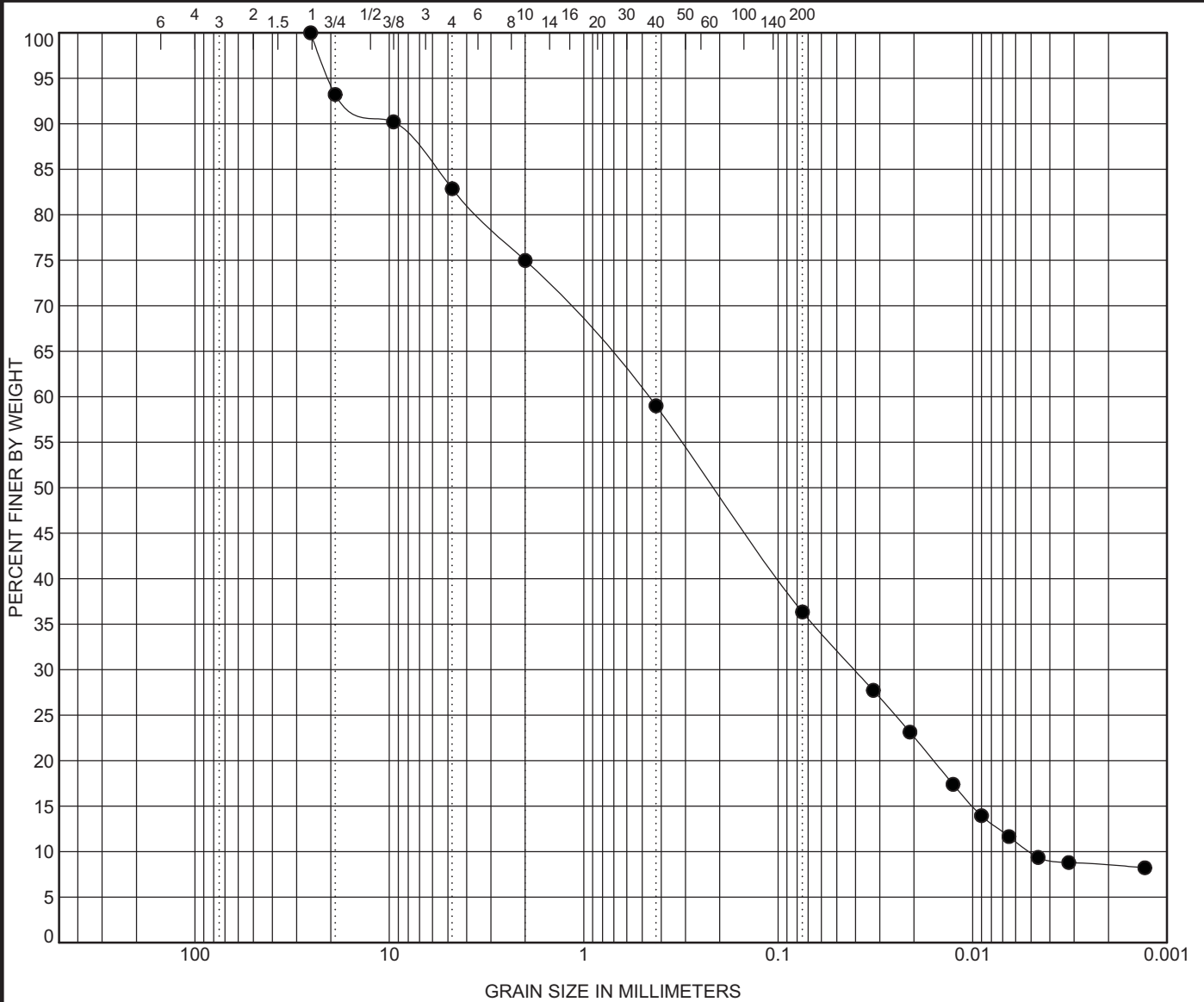
Location: Kosciusko County, Indiana

CTL Project No.: 17050037IND

U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Boring No.	B-1	Classification					MC	LL	PL	PI	Cc	Cu
Sample	SS-10	SILTY, CLAYEY SAND with GRAVEL					9.6	15	11	4	0.69	92.45
Depth	18.0-20.0	SC-SM										
Station	---	Lab 2										
Offset	---											
Line	---											
Fine material soaking time	Minutes	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay		
		25.4	0.468	0.213	0.04	0.005	17.1	46.5	26.5	9.9		
Remarks												



CTL Engineering, Inc.
Phone: 317-295-8650

GRAIN SIZE DISTRIBUTION

Project: Proposed Tippecanoe Lake Outlet Structure

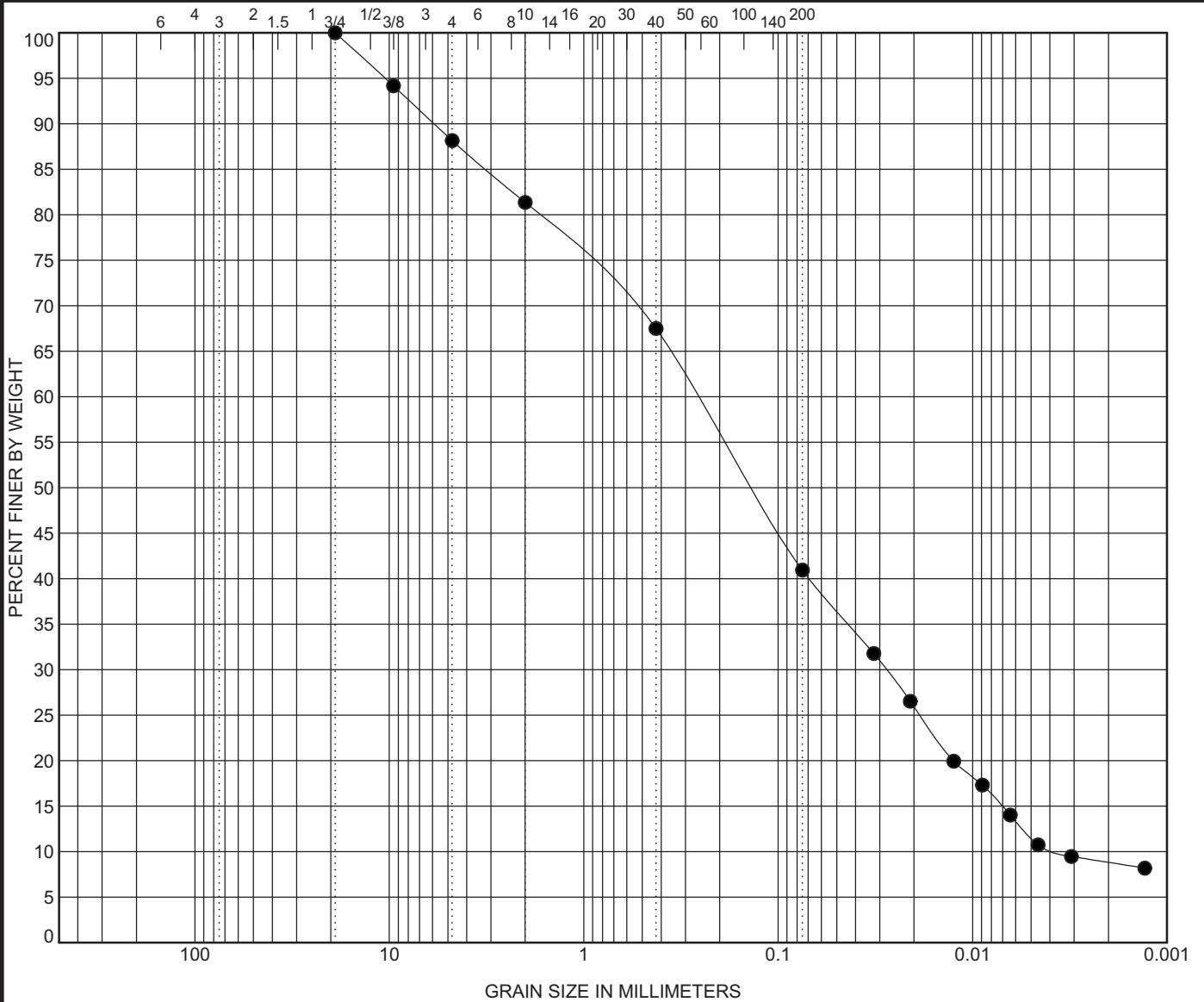
Location: Kosciusko County, Indiana

CTL Project No.: 17050037IND

U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Boring No.	B-2	Classification					MC	LL	PL	PI	Cc	Cu
Sample	SS-11	SILTY, CLAYEY SAND					13.3	20	13	7	0.81	71.18
Depth	21.0-22.5	SC-SM										
Station	---	Lab 4										
Offset	---											
Line	---											
Fine material soaking time	Minutes	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay		
		19	0.26	0.136	0.028	0.004	11.8	47.2	29.4	11.6		
Remarks												



CTL Engineering, Inc.
Phone: 317-295-8650

GRAIN SIZE DISTRIBUTION


Project: Proposed Tippecanoe Lake Outlet Structure

Location: Kosciusko County, Indiana

CTL Project No.: 17050037IND

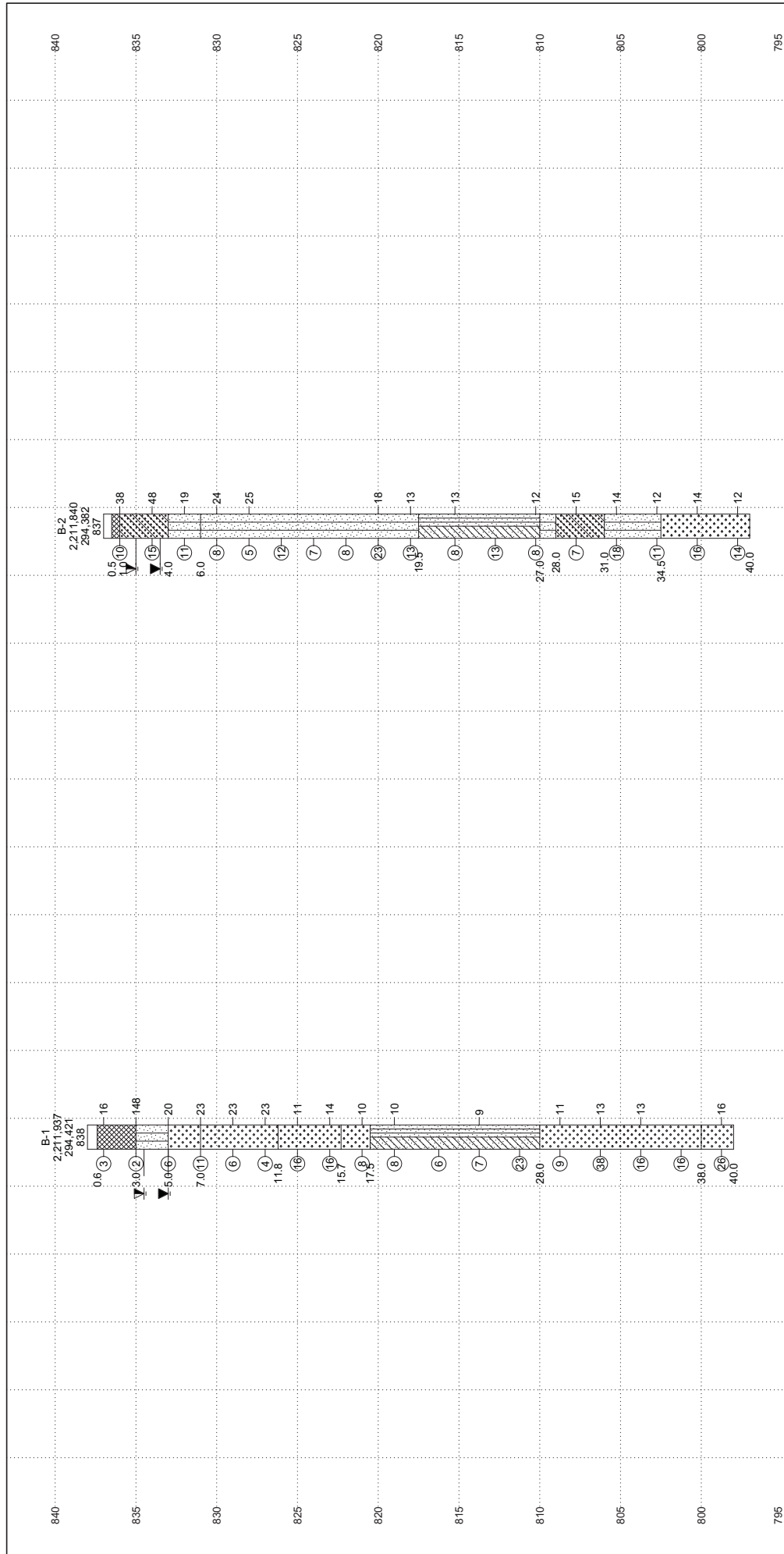
Boring No.	Northing	Easting	Sample No.	Depth	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	Calcium Carbonate (%)	pH
B-1	2211937	294421	SS-1	0.0-2.0	16.4							
B-1	2211937	294421	SS-2	2.0-4.0	147.7					17.2		
B-1	2211937	294421	SS-3	4.0-6.0	20.2							
B-1	2211937	294421	SS-4	6.0-8.0	23.0							
B-1	2211937	294421	SS-5	8.0-10.0	23.0							8.8
B-1	2211937	294421	SS-6	10.0-12.0	23.0							8.7
B-1	2211937	294421	SS-7	12.0-14.0	11.1							
B-1	2211937	294421	SS-8	14.0-16.0	14.3							
B-1	2211937	294421	SS-9	16.0-18.0	9.6							
B-1	2211937	294421	SS-10	18.0-20.0	9.6							8.6
B-1	2211937	294421	SS-12	23.5-25.0	8.9							
B-1	2211937	294421	SS-14	28.5-30.0	10.6							
B-1	2211937	294421	SS-15	31.0-32.5	12.6							
B-1	2211937	294421	SS-16	33.5-35.0	13.2							
B-1	2211937	294421	SS-18	38.5-40.0	16.1							
B-2	2211840	294382	SS-1	0.0-2.0	38.3							
B-2	2211840	294382	SS-2	2.0-4.0	47.9							
B-2	2211840	294382	SS-3	4.0-6.0	18.6							
B-2	2211840	294382	SS-4	6.0-8.0	24.0							
B-2	2211840	294382	SS-5	8.0-10.0	25.1							
B-2	2211840	294382	SS-9	16.0-18.0	18.1							
B-2	2211840	294382	SS-10	18.0-20.0	13.3							
B-2	2211840	294382	SS-11	21.0-22.5	13.3							8.9
B-2	2211840	294382	SS-13	26.0-27.5	11.7							
B-2	2211840	294382	SS-14	28.5-30.0	15.0							
B-2	2211840	294382	SS-15	31.0-32.5	13.8							
B-2	2211840	294382	SS-16	33.5-35.0	12.2							
B-2	2211840	294382	SS-17	36.0-37.5	14.4							
B-2	2211840	294382	SS-18	38.5-40.0	12.5							



 CTL Engineering, Inc. Phone: 317-295-8650	SUMMARY OF SPECIAL LABORATORY TEST RESULTS
	Project: Proposed Tippecanoe Lake Outlet Structure
	Location: Kosciusko County, Indiana
	CTL Project No.: 17050037IND

APPENDIX D

SOIL PROFILE
SEEPAGE ANALYSIS



LEGEND

- TOPSOIL
- FILL
- SILTY SAND
- SAND POORLY GRADED
- CLAYEY SILTY SAND
- CLAYEY SAND

CTL Engineering, Inc.
 1310 S. Franklin Rd.
 Indianapolis, Indiana 46239
 Phone: 317-295-8650
 Website: www.ctleng.com



SOIL PROFILE

Scale As Shown	Christopher B. Burke Engineering, LLC Proposed Tippecanoe Lake Outlet Structure Kosciusko County, Indiana
Date 1/17/17	
Drawn By CG	
Reviewed By	

- GROUND WATER DURING DRILLING
- GROUND WATER AT COMPLETION OF DRILLING
- GROUND WATER AT "T" HOURS AFTER COMPLETION
- W MOISTURE CONTENT IN PERCENT (%)
- STANDARD PENETRATION IN BLows PER FOOT (IN)

Slide Analysis Information

Proposed Tippecanoe Lake Outlet Structure

Project Summary

File Name: seepage analysis
 Slide Modeler Version: 7.029
 Project Title: Proposed Tippecanoe Lake Outlet Structure
 Analysis: Seepage Analysis
 Author: SD
 Company: CTL Engineering
 Date Created: 10/30/2017, 2:18:48 PM

General Settings

Units of Measurement: Imperial Units
 Time Units: days
 Permeability Units: feet/second
 Failure Direction: Right to Left
 Data Output: Standard
 Maximum Material Properties: 20
 Maximum Support Properties: 20

Analysis Options

Slices Type: Vertical

Analysis Methods Used

GLE/Morgenstern-Price with interslice force function: Half Sine
Spencer

Number of slices: 50
 Tolerance: 0.005
 Maximum number of iterations: 75
 Check $\text{malpha} < 0.2$: Yes
 Create Interslice boundaries at intersections
 with water tables and piezos: Yes
 Initial trial value of FS: 1
 Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Steady State FEA
Pore Fluid Unit Weight [lbs/ft³]: 62.4
Tolerance: 1e-006
Maximum number of iterations: 500
Use negative pore pressure cutoff: No
Advanced Groundwater Method: None
Mesh Element Type: 3 noded triangles
Number of Elements: 1006
Number of Nodes: 561

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

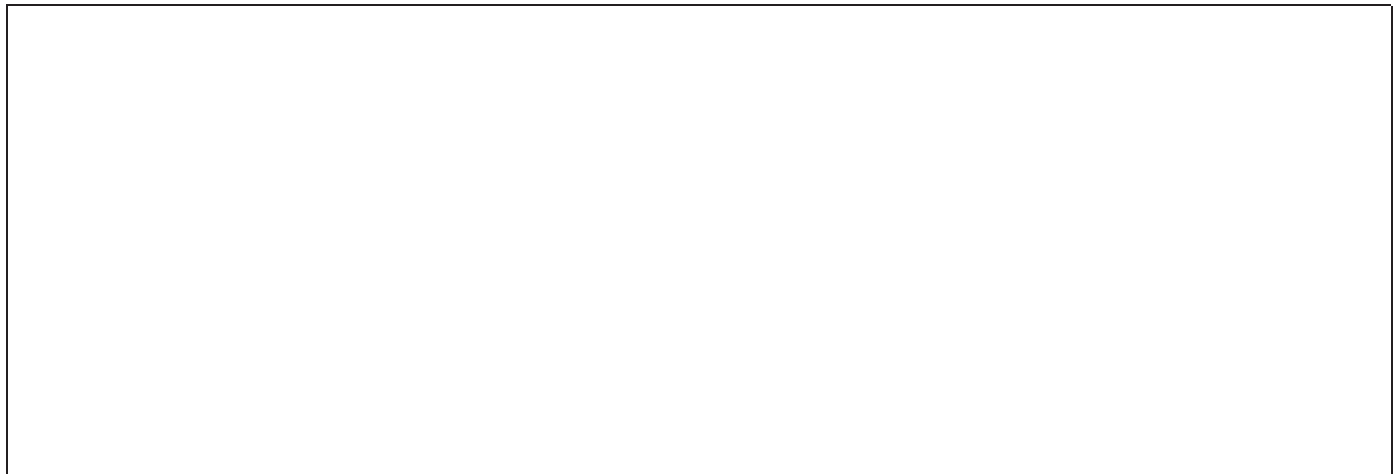
Surface Options






Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Minimum Area: Not Defined
Minimum Weight: Not Defined

Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Material Properties



Property	Concrete	Sheet Pile	Silty Sand	Till	Fine Sand
Color					
Strength Type	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	150	120	120	120	120
Cohesion [psf]		21	21	21	21
Friction Angle [deg]		35	35	35	35
Unsaturated Shear Strength Angle [deg]	0	0	0	0	0
Air Entry Value [psf]	0	0	0	0	0
Ks [feet/second]	1e-099	1e-099	0.0002	5e-007	0.0002
K2/K1	1	1	1	1	1
K Angle [deg]	0	0	0	0	0
Groundwater Model	Simple	Simple	Simple	Simple	Simple
GW Model Properties	Soil Type: General	Soil Type: General	Soil Type: Sand	Soil Type: Silt	Soil Type: Sand
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0

List Of Coordinates

External Boundary

X	Y
-100	834
-100	817.5
-100	810
-100	800
55	800
55	810
55	817.5
55	833
0	833
0	836
-1.5	835.5
-3	833
-6	833
-15	833
-35	831
-45	827
-48	827
-58	829
-81	833

Material Boundary

X	Y
-6	833
-6	831
-3	831
-3	829
-1	829
-0.5	829
0	829
0	833

Material Boundary

X	Y
-1	829
-1	820
-1	817.5
-1	813
-0.5	813
-0.5	817.5
-0.5	820
-0.5	829

Material Boundary

X	Y
-0.5	817.5
55	817.5

Material Boundary

X	Y
-100	817.5
-1	817.5

Material Boundary

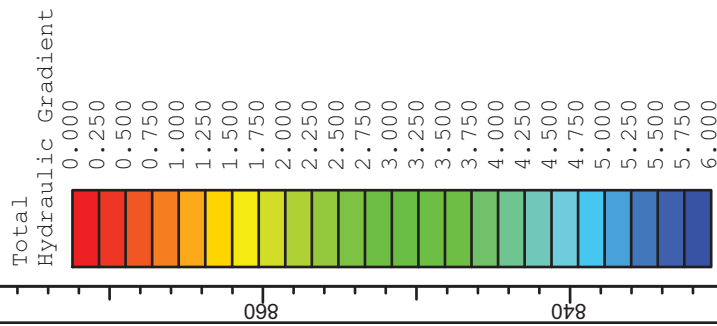
X	Y
-100	810
55	810

Material Boundary

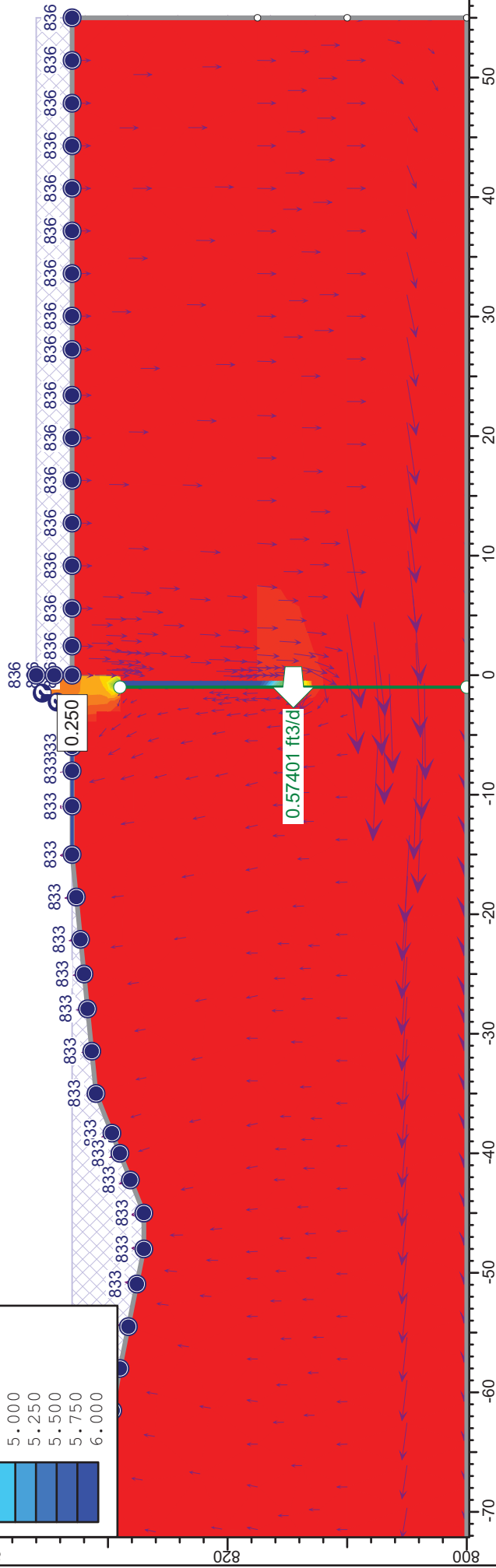
X	Y
-1	820
-0.5	820

Material Boundary

X	Y
-1	817.5
-0.5	817.5



Material Name	Color	Model	KS (ft/s)	Soil Type
Concrete		Simple	1e-099	General
Sheet Pile		Simple	1e-099	General
Silty Sand		Simple	0.0002	Sand
Till		Simple	5e-007	Silt
Fine Sand		Simple	0.0002	Sand



CTL Engineering, Inc.
www.ctleng.com

Proposed Tippecanoe Lake Outlet Structure

Seepage Analysis

Company: CTL Engineering

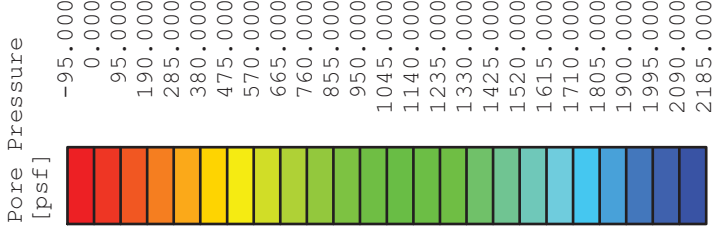
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Project	Scale	Company
Analysis Description	1:150	CTL Engineering
Drawn By	SD	File Name
Date	10/30/2017, 2:18:48 PM	seepage analysis.slim

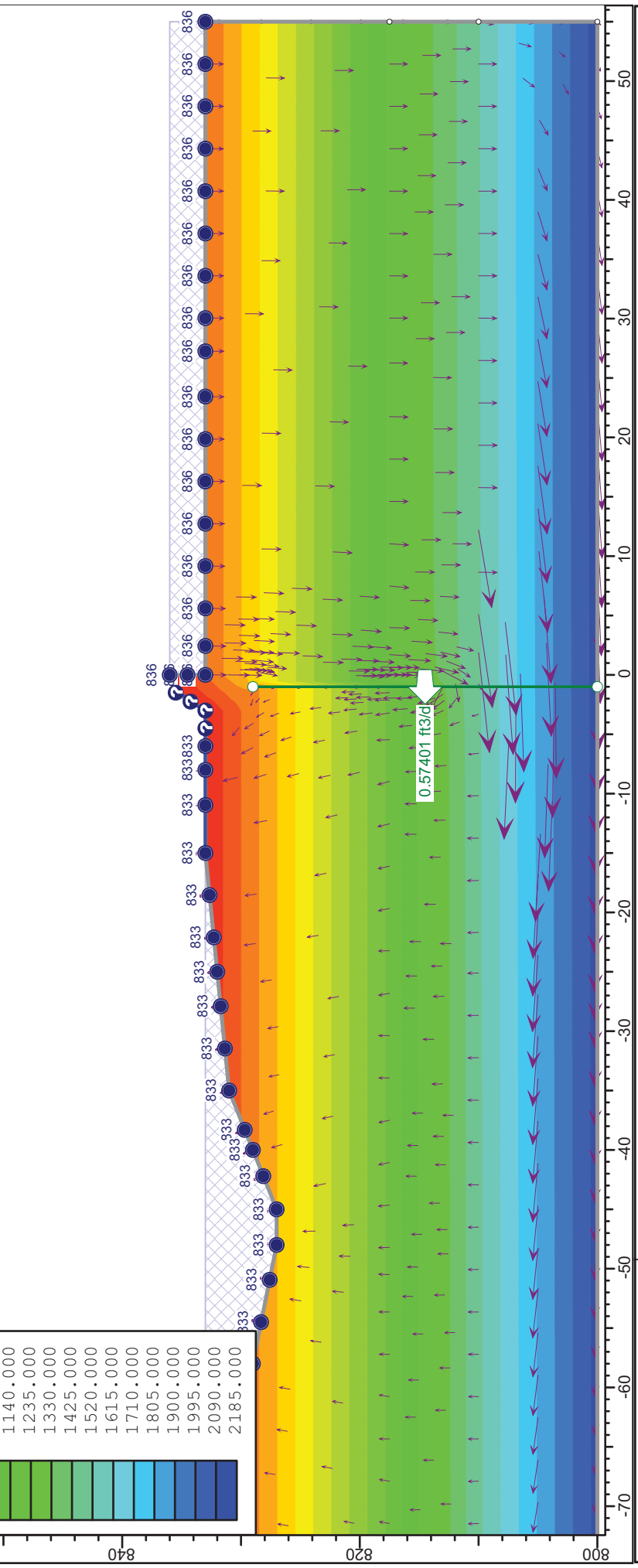
CTL Engineering, Inc.
www.ctleng.com

SLIDEINTERPRET 7.029

10/30/2017, 2:18:48 PM



Material Name	Color	Model	KS (ft/s)	Soil Type
Concrete		Simple	1e-099	General
Sheet Pile		Simple	1e-099	General
Silty Sand		Simple	0.0002	Sand
Till		Simple	5e-007	Silt
Fine Sand		Simple	0.0002	Sand



Proposed Tippecanoe Lake Outlet Structure

		Project	
CTL Engineering, Inc. www.ctleng.com		Seepage Analysis	
Drawn By	SD	Scale	1:150
Date	10/30/2017, 2:18:48 PM	Company	CTL Engineering
		File Name	seepage analysis.slim

APPENDIX B – PNEUMATICALLY-OPERATED GATE DRAWINGS
(Note - The following drawings are provided for reference only. CONTRACTOR shall coordinate with manufacturer and submit final drawings to ENGINEER for approval.)

Tippecanoe Leesburg, Indiana

OHI PROJECT 17-1995


DRAWING LIST	DESCRIPTION	REV
100	COVER SHEET AND PROJECT DESCRIPTION	1
101	SPILLWAY PLAN VIEW	1
102	MAIN ANCHOR LAYOUT AND SPACING	1
110A & B	SECTION ELEVATION	1
111	ELEVATION SURFACE FEATURES	1
112	ABUTMENT PLATE INSTALLATION	1
120	MAIN CLAMP INSTALLATION AND EPDM PLACEMENT	1
121	GATE PANEL ASSEMBLY	1
123	AIR BLADDER CONNECTION DETAILS	1
124	RESTRAINING STRAP INSTALLAION	1
125	CONDENSATE PURGE VALVE LOCATIONS OPTIONS	1
PACKAGE LIST	DESCRIPTION	COMMENT
100	GENERAL ARRANGEMENT	THIS SECT.
200	FABRICATION PACKAGE & NOTES	SEE SECTION 200
240	ABUTMENT PLATES & PACKAGE NOTES	SEE SECTION 240
300	RUBBER PACKAGE FABRICATIONS	SEE SECTION 300
400	AIR CONTROLS	SEE SECTION 400
500	AIR AND ACCESSORY SYSTEMS	SEE SECTION 500
600	PLC CABINET AND SYSTEMS	SEE SECTION 600

7									
6									
5									
4									
3									
2									
1								NEW DRAWING	
NO									REVISION DESCRIPTION

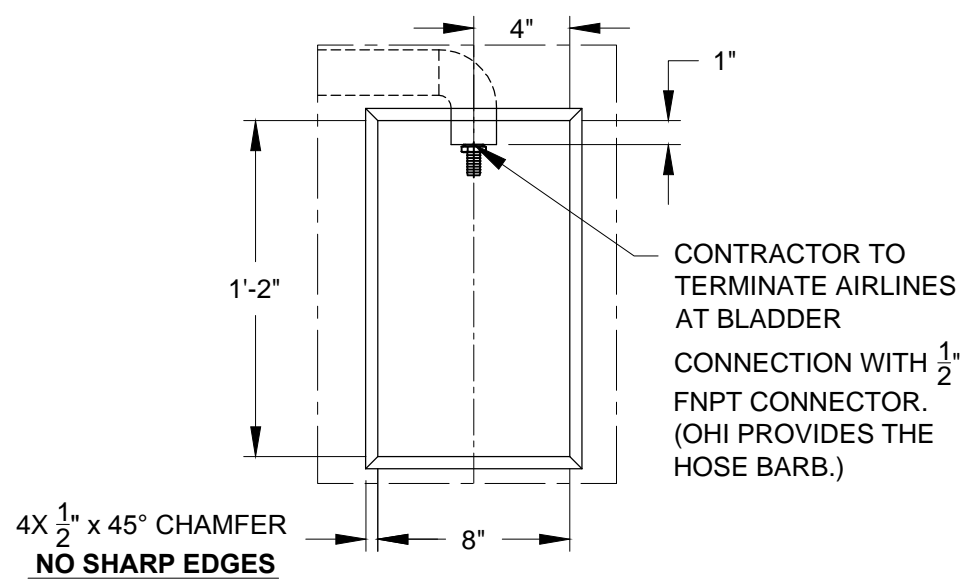
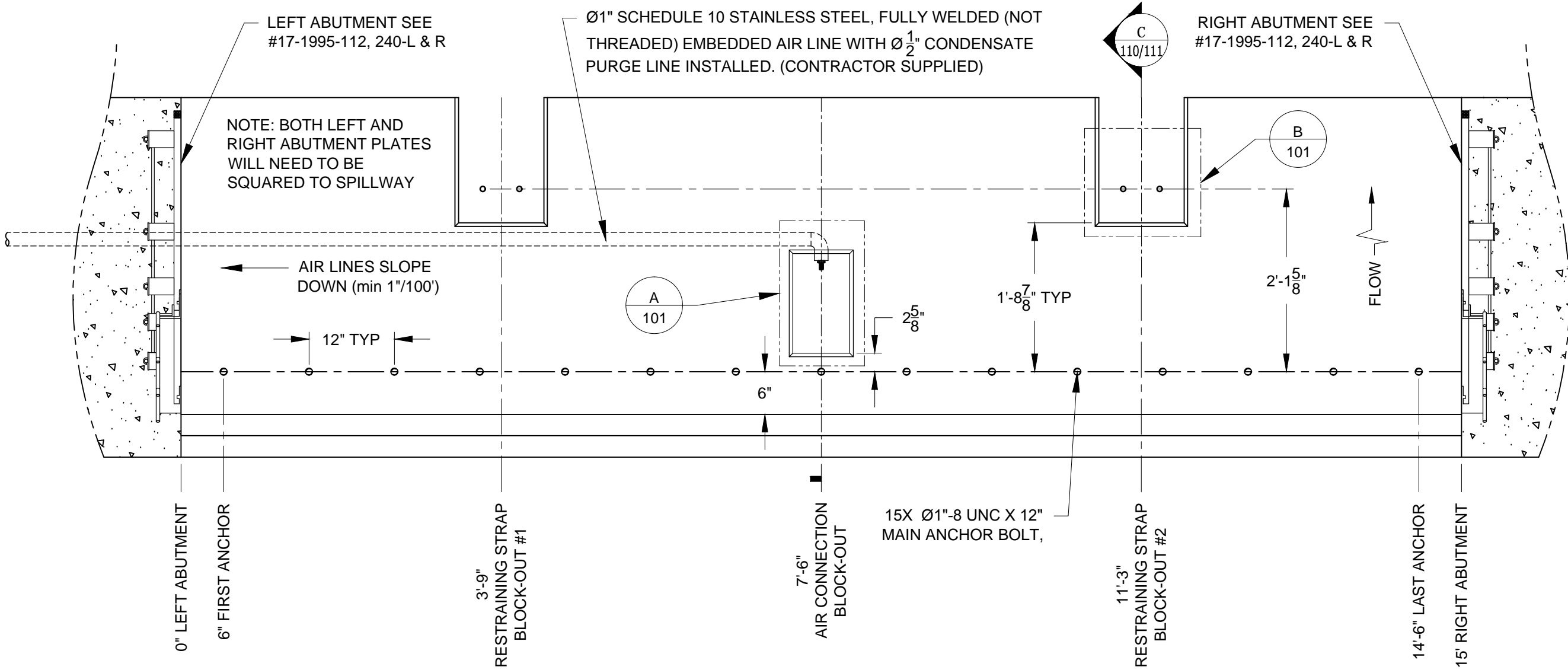
OBERMEYER ideas that hold water™
HYDRO, INC.

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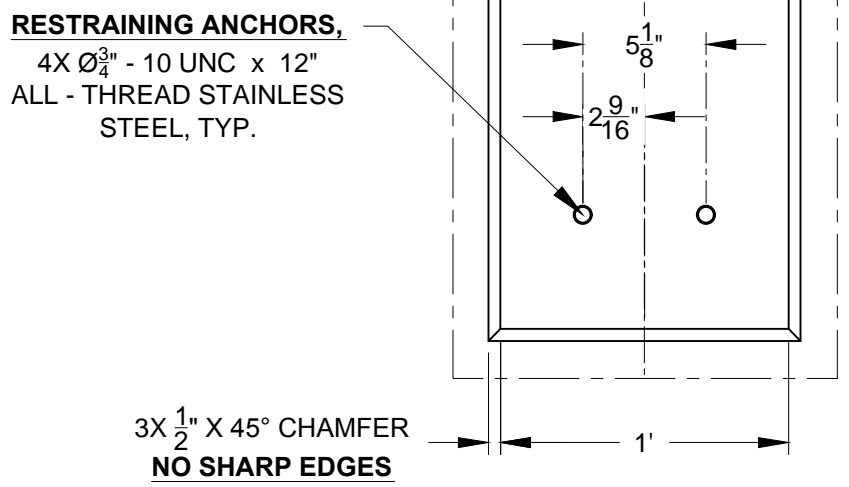
DRAWING DESCRIPTION
COVER SHEET

	SHEETS	SCALE
	1 of 1	NO SCALE
JOB		
Tippecanoe		
DWG. NO.		
17-1995-100		

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A DETAIL
AIR CONNECTION BLOCK-OUT, SEE 17-1995-111



B DETAIL
RESTRAINING STRAP ANCHOR BLOCK-OUT, TYP. 2X, SEE 17-1995-111

7					
6					
5					
4					
3					
2					
1	BAH	21 Mar 2018	NEW DRAWING		
NO				APRVD	REVISION DESCRIPTION

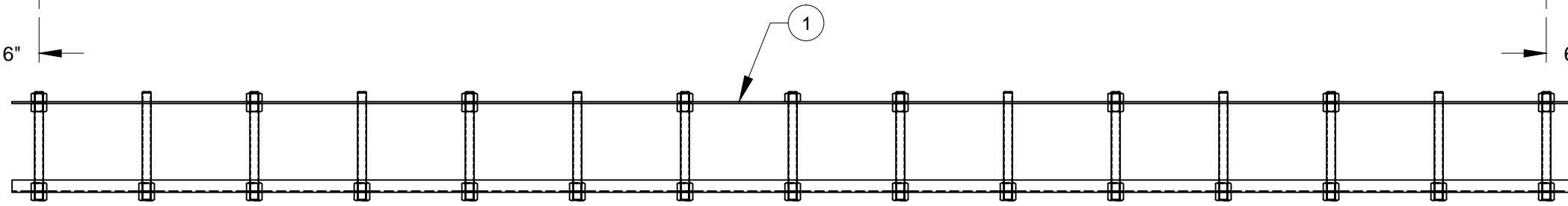
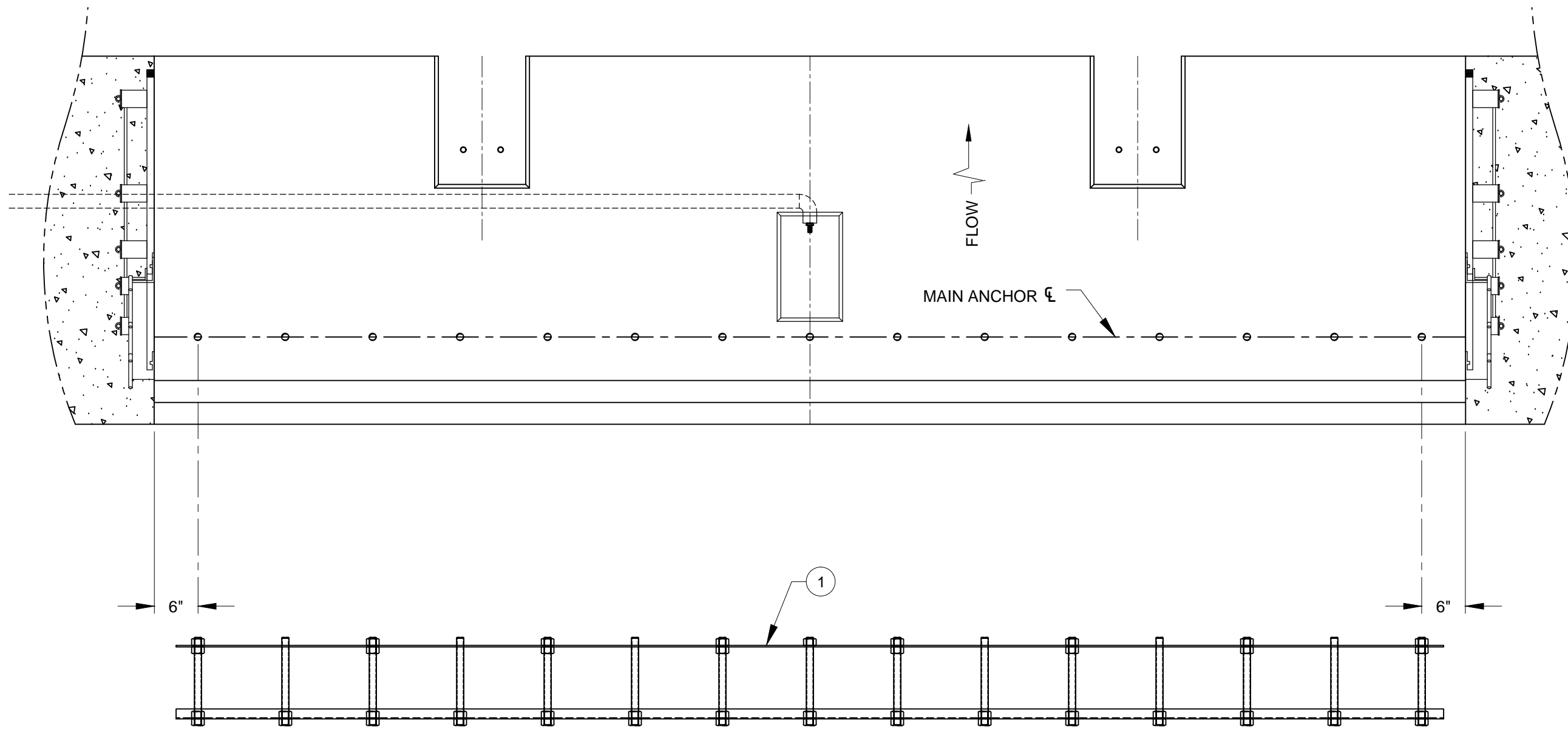
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DRAWING DESCRIPTION
SPILLWAY PLAN VIEW

SHEETS	SCALE
1 of 1	NO SCALE
JOB	Tippecanoe
DWG. NO.	17-1995-101

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ELEVATION VIEW
MAIN ANCHOR ASSEMBLY

NOTES:

1. AFTER CONCRETE IS CURED REMOVE EXPOSED STAINLESS STEEL NUTS. **DO NOT DISCARD**, USED FOR MAIN CLAP ASSEMBLY.
2. "LEFT" IS AT LEFT SIDE WHEN FACING DOWN STREAM.

BILL OF MATERIAL FOR MAIN ANCHOR INSTALLATION						
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	
STEEL						
1	17-1995-207-15	MAIN ANCHOR EMBED ASSEMBLY (15 ANCHOR)	SEE 17-1995-207-15	1	1	

7						
6						
5						
4						
3						
2						
1	BAH	21 Mar 2018	APRVD	NEW DRAWING		
NO						REVISION DESCRIPTION

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HYDRO, INC.

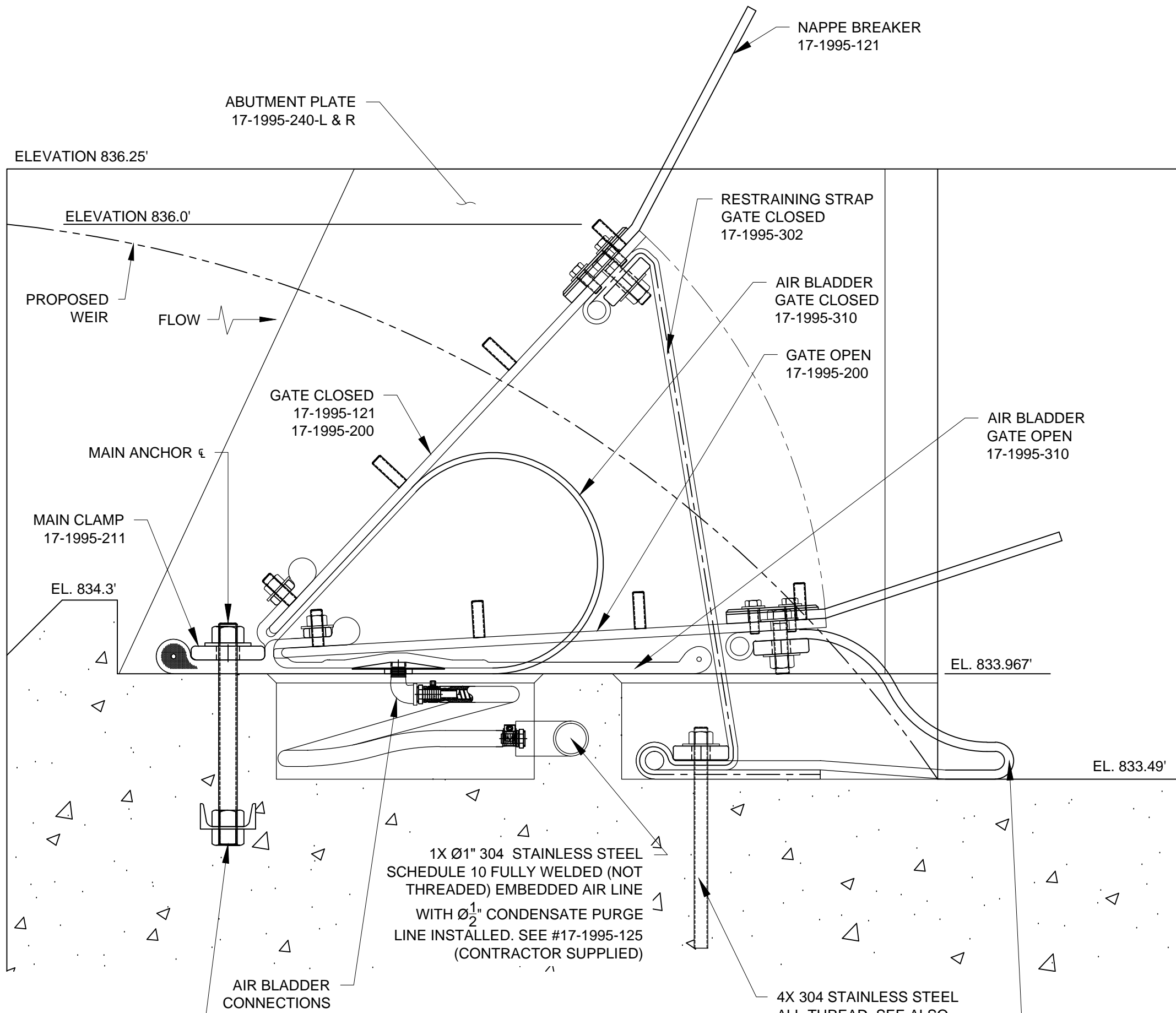
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DRAWING DESCRIPTION

MAIN ANCHOR LAYOUT AND SPACING

SHEETS	SCALE
1 of 1	NO SCALE
JOB Tippecanoe	
DWG. NO. 17-1995-102	

© OBERMEYER HYDRO, INC., 2017



SECTION ELEVATION

REF 17-1995-101

NOTES:

- 1) CONCRETE FINISH: CONCRETE UNDER GATE SYSTEM **MUST** HAVE HIGH QUALITY TROWEL FINISH AND BE FLAT WITHIN $\pm 1/8"$. A BROOM FINISH IS **NOT** ACCEPTABLE AND WILL RESULT IN ACCELERATED WEAR OF AIR BLADDERS.
- 2) THE HORIZONTAL CONCRETE CLAMPING SURFACE EXTENDING 6" DOWNSTREAM OF MAIN ANCHOR BOLT CENTERLINE AND 6" UPSTREAM OF MAIN ANCHOR BOLT CENTERLINE SHOULD BE LEVEL WITHIN $\pm 1/4"$ FROM ABUTMENT TO ABUTMENT AND SHOULD NEVER VARY MORE THAN 1/8" PER FOOT.
- 3) ALL DIMENSIONS TO WITHIN $\pm 1/8"$ OF TRUE POSITION UNLESS OTHERWISE DIMENSIONED OR NOTED ON PART DRAWING. SPACING OF ADJACENT MAIN ANCHOR BOLTS SHOULD NOT VARY MORE THAN 1/16" FROM NOMINAL SPACING.
- 4) ALL MAIN ANCHOR BOLTS TO BE PLUMB WITHIN $\pm 1/8"$. MAIN ANCHOR BOLT CENTER LINE TO BE PERPENDICULAR TO ABUTMENT FACE $\pm 0.1^\circ$.
- 5) DURING CONCRETE PLACEMENT, THE FORM WORK SUPPORTING THE ABUTMENT PLATES MUST BE HELD PLANAR, PLUMB AND PERPENDICULAR TO THE MAIN ANCHOR BOLTS WITHIN 1/8" PER FOOT AND WITHIN 1/4" OVERALL. RIGID STEEL BRACING OF FORMS IS RECOMMENDED. CONCRETE LIFTS SHOULD BE LIMITED SO AS TO NOT EXCEED ABOVE DEFLECTION LIMITS OF FORMS.
- 6) CONTRACTOR RESPONSIBLE FOR ALL CONCRETE CUTTING, GROUTING, GROUT, AIR PIPE, AIR PIPE FITTINGS, WELDING, VALVING, ELECTRICAL CONDUIT, CONDUIT FITTINGS, ASSOCIATED TOOLS, REBAR, ANCHORING AND SURFACE EPOXY, AND ANYTHING ELSE PERTAINING TO COMPONENTS NOT SUPPLIED BY OBERMEYER HYDRO, INC. OR INCLUDED IN THE OBERMEYER BILL OF MATERIALS.
- 7) THIS DOCUMENT AND ATTACHED DRAWINGS ARE PROPERTY OF OBERMEYER HYDRO, INC. AND IS NOT TO BE USED, DISCLOSED, REPRODUCED OR TRANSMITTED BY ELECTRONIC OR ANY OTHER MEANS WITHOUT PRIOR WRITTEN AUTHORIZATION.
- 8) ALL ANCHOR BOLTS, BOLTS, FASTENERS TO BE ACCURATELY TORQUED TO APPROPRIATE LEVEL AS DEFINED IN THE OBERMEYER INSTALLATION PROCEDURE.
- 9) THERE IS **NO WELDING ALLOWED** ON THE MAIN ANCHOR BOLTS. WELDING TO HEAT TREATED ANCHOR BOLTS CAN CAUSE FRACTURE AND CATASTROPHIC SYSTEM FAILURE.
- 10) ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

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OBERMEYER
ideas that hold water™
HYDRO, INC.

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DRAWING DESCRIPTION

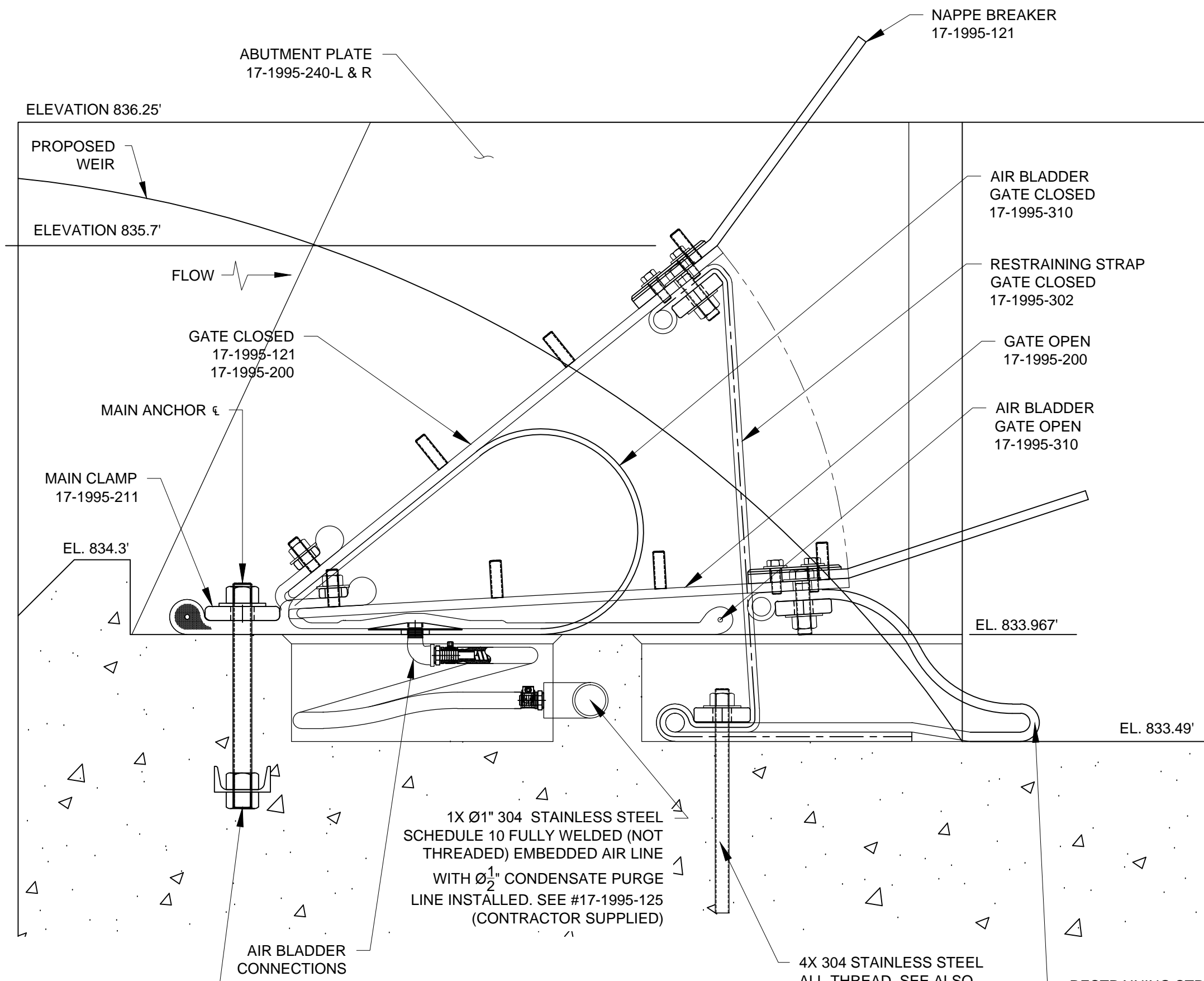
SECTION ELEVATION (AT EL. 836.0')
SECTION C-C

SHEETS	SCALE
1 of 2	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-110A	

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15X 304 STAINLESS STEEL ALL-THREAD, SEE NOTE 4, 17-1995-207-15

C



SECTION ELEVATION
REF 17-1995-101

NOTES:

- 1) CONCRETE FINISH: CONCRETE UNDER GATE SYSTEM **MUST** HAVE HIGH QUALITY TROWEL FINISH AND BE FLAT WITHIN $\pm 1/8"$. A BROOM FINISH IS **NOT** ACCEPTABLE AND WILL RESULT IN ACCELERATED WEAR OF AIR BLADDERS.
- 2) THE HORIZONTAL CONCRETE CLAMPING SURFACE EXTENDING 6" DOWNSTREAM OF MAIN ANCHOR BOLT CENTERLINE AND 6" UPSTREAM OF MAIN ANCHOR BOLT CENTERLINE SHOULD BE LEVEL WITHIN $\pm 1/4"$ FROM ABUTMENT TO ABUTMENT AND SHOULD NEVER VARY MORE THAN 1/8" PER FOOT.
- 3) ALL DIMENSIONS TO WITHIN $\pm 1/8"$ OF TRUE POSITION UNLESS OTHERWISE DIMENSIONED OR NOTED ON PART DRAWING. SPACING OF ADJACENT MAIN ANCHOR BOLTS SHOULD NOT VARY MORE THAN 1/16" FROM NOMINAL SPACING.
- 4) ALL MAIN ANCHOR BOLTS TO BE PLUMB WITHIN $\pm 1/8"$. MAIN ANCHOR BOLT CENTER LINE TO BE PERPENDICULAR TO ABUTMENT FACE $\pm 0.1^\circ$.
- 5) DURING CONCRETE PLACEMENT, THE FORM WORK SUPPORTING THE ABUTMENT PLATES MUST BE HELD PLANAR, PLUMB AND PERPENDICULAR TO THE MAIN ANCHOR BOLTS WITHIN 1/8" PER FOOT AND WITHIN 1/4" OVERALL. RIGID STEEL BRACING OF FORMS IS RECOMMENDED. CONCRETE LIFTS SHOULD BE LIMITED SO AS TO NOT EXCEED ABOVE DEFLECTION LIMITS OF FORMS.
- 6) CONTRACTOR RESPONSIBLE FOR ALL CONCRETE CUTTING, GROUTING, GROUT, AIR PIPE, AIR PIPE FITTINGS, WELDING, VALVING, ELECTRICAL CONDUIT, CONDUIT FITTINGS, ASSOCIATED TOOLS, REBAR, ANCHORING AND SURFACE EPOXY, AND ANYTHING ELSE PERTAINING TO COMPONENTS NOT SUPPLIED BY OBERMEYER HYDRO, INC. OR INCLUDED IN THE OBERMEYER BILL OF MATERIALS.
- 7) THIS DOCUMENT AND ATTACHED DRAWINGS ARE PROPERTY OF OBERMEYER HYDRO, INC. AND IS NOT TO BE USED, DISCLOSED, REPRODUCED OR TRANSMITTED BY ELECTRONIC OR ANY OTHER MEANS WITHOUT PRIOR WRITTEN AUTHORIZATION.
- 8) ALL ANCHOR BOLTS, BOLTS, FASTENERS TO BE ACCURATELY TORQUED TO APPROPRIATE LEVEL AS DEFINED IN THE OBERMEYER INSTALLATION PROCEDURE.
- 9) THERE IS **NO WELDING ALLOWED** ON THE MAIN ANCHOR BOLTS. WELDING TO HEAT TREATED ANCHOR BOLTS CAN CAUSE FRACTURE AND CATASTROPHIC SYSTEM FAILURE.
- 10) ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

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DRAWING DESCRIPTION

SECTION ELEVATION (AT EL. 835.7')
SECTION C-C

SHEETS
2 of 2

SCALE
NO SCALE

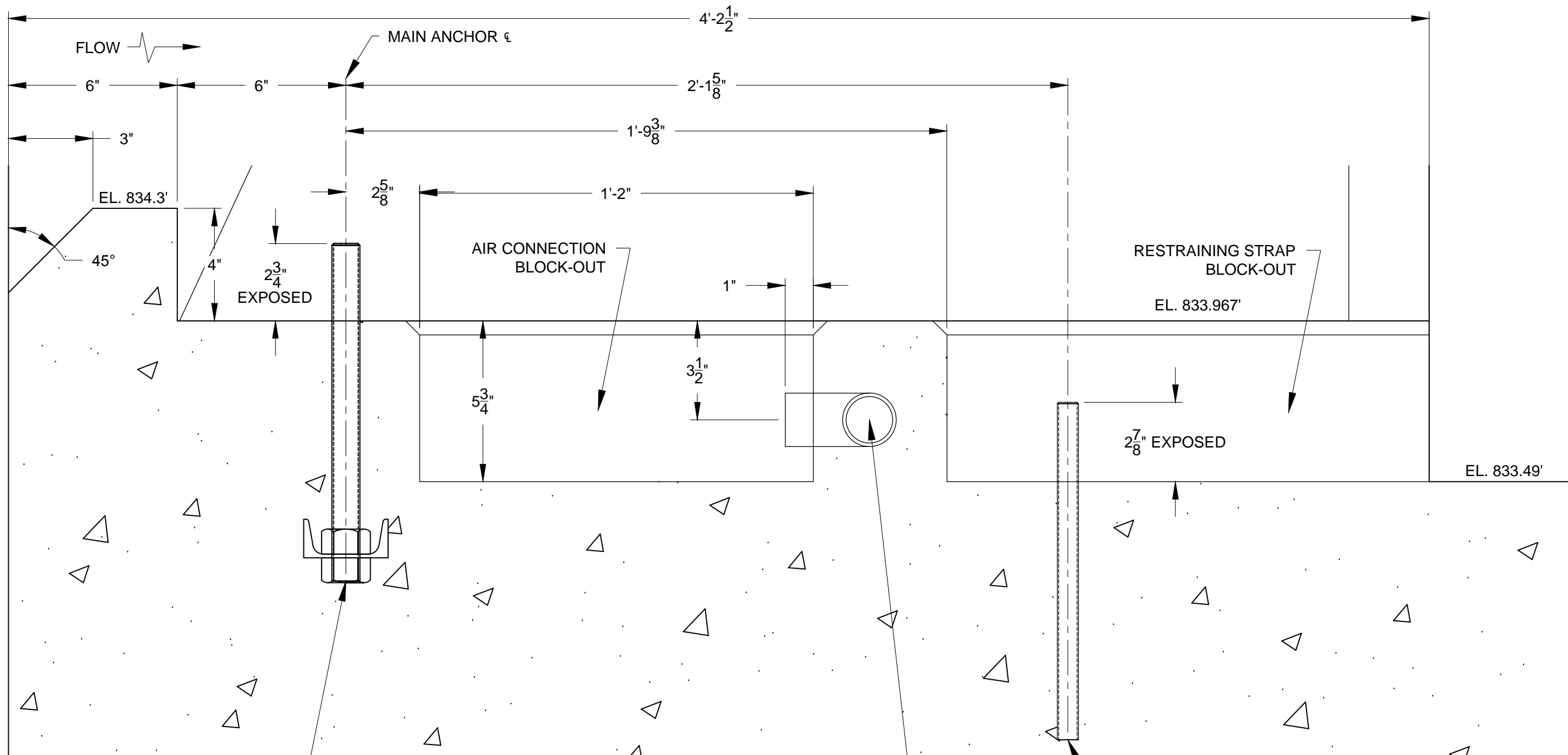
JOB
Tippecanoe

DWG. NO.
17-1995-110B

15X 304 STAINLESS STEEL ALL-THREAD, SEE NOTE 4, 17-1995-207-15

C

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15X 304 STAINLESS STEEL ALL-THREAD
1X MAIN ANCHOR EMBED ASSEMBLY
CAST-IN-PLACE ANCHORS

1X Ø1" 304 STAINLESS STEEL SCHEDULE 10 FULLY
WELDED (NOT THREADED) EMBEDDED AIR LINE WITH
Ø½" CONDENSATE PURGE LINE INSTALLED. SEE
#17-1995-125 (CONTRACTOR SUPPLIED)

4X ¾"-10 UNC X 12" STAINLESS STEEL
ALL-THREAD RESTRAINING STRAP
ANCHORS. DRILL AND EPOXY SET IN PLACE

C AIR CONNECTION & RESTRAINING STRAP BLOCK-OUT

REF 17-1995-101

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DRAWING DESCRIPTION

ELEVATION SURFACE FEATURES

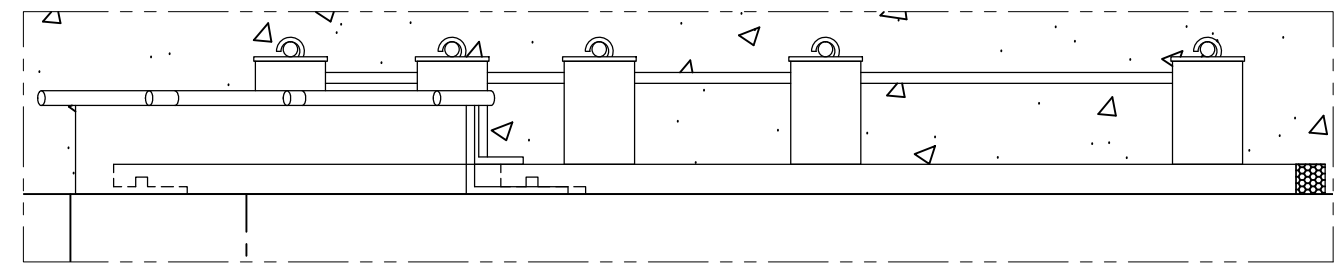
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SHEETS	SCALE
1 of 1	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-111	

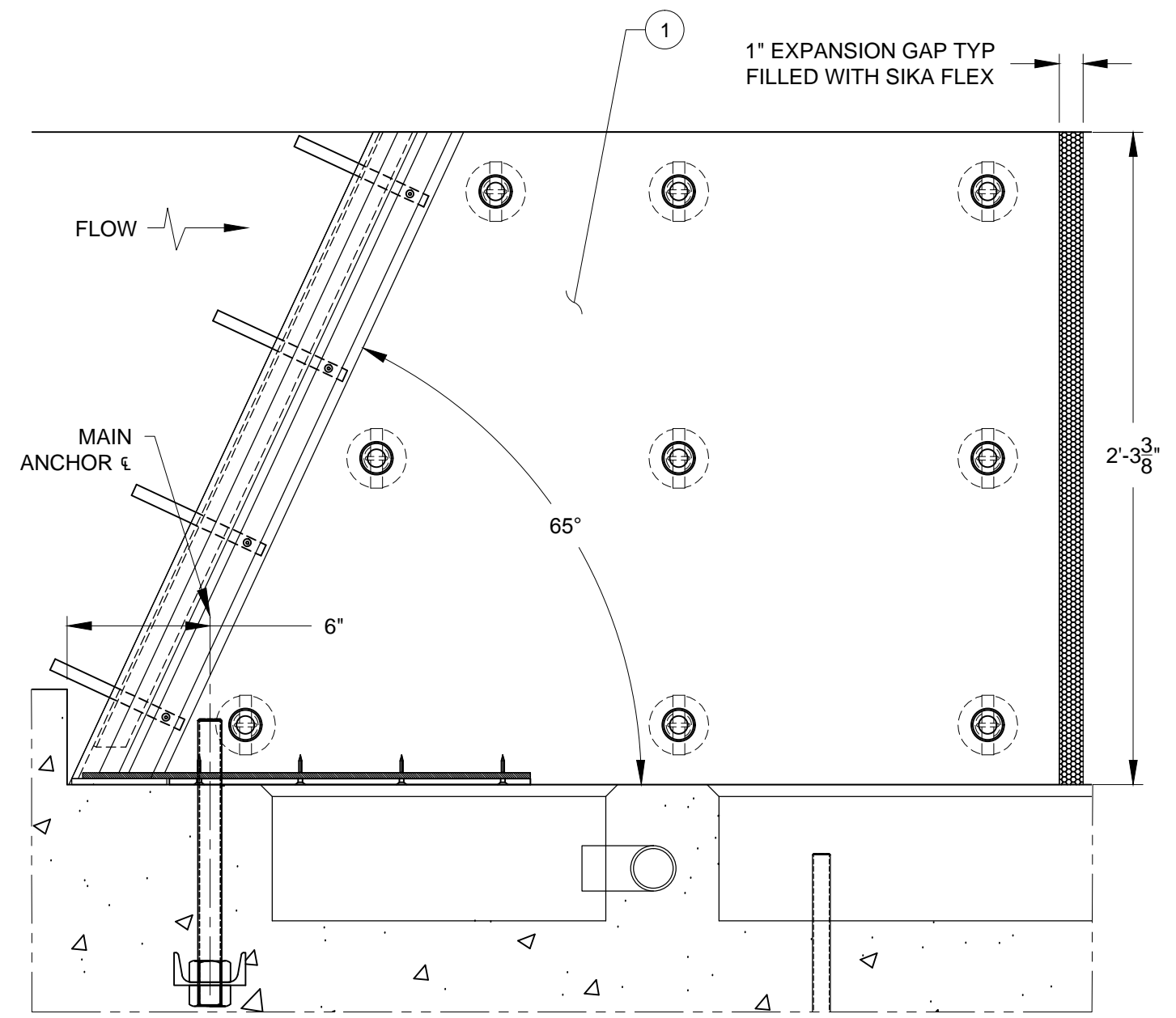
BILL OF MATERIAL FOR ABUTMENT PLATE INSTALLATION

ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL
EMBEDS					
1	17-1995-240-L	ABUTMENT PLATE ASSEMBLY, LEFT	UHMW	1	1
2	* 17-1995-240-R	ABUTMENT PLATE ASSEMBLY, RIGHT	UHMW	1	1

* ITEM 2 TO BE USED FOR RIGHT ABUTMENT IN PLACE OF ITEMS 1.



PLAN VIEW LEFT ABUTMENT



ELEVATION
LEFT ABUTMENT SHOWN

NO	REVISION DESCRIPTION	DATE	APRVD
1	NEW DRAWING	21 Mar 2018	BAH
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DRAWING DESCRIPTION
ABUTMENT PLATE INSTALLATION

SHEETS	SCALE
1 of 1	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-112	

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Tippecanoe Leesburg, Indiana

OHI PROJECT 17-1995

DRAWING LIST	DESCRIPTION	REV
200	STEEL NOTES	1
200-15	GATE PANEL (15')	1
201-X	HINGE RETAINER	1
203	RESTRAINING STRAP CLAMP	1
204-4	ABUTMENT SEAL RETAINER	1
207-15	MAIN ANCHOR EMBED ASSEMBLY (15 ANCHOR)	1
211-5	MAIN CLAMP BAR	1

NOTES:

1. GATE PANELS (200-15)

1.1 TOLERANCES: $\pm 1/16"$ ON ALL HOLE POSITIONS & WELDED STUDS NON ACCUMULATING, $\pm 1/16"$ ON LINEAR DIMENSIONS.

1.2 CHAMFER ALL CORNERS AND EDGES MINIMUM OF $1/8"$ INCLUDING RIBS AND PANEL.

1.3 REMOVE ALL WELD SPLATTER BEFORE SAND BLASTING. ALL SURFACES TO BE SAND BLASTED IN ACCORDANCE WITH SSPC-10 AND COATED WITH CERAM-KOTE 54" ENGINEERED CERAMIC COATING.

1.4 LOCATION OF HOLES, STUDS & SIZE OF FLAT PLATE ARE RELATIVE TO FLAT PLATE PRIOR TO BENDING..

1.5 PANEL MUST BE TRUE AFTER WELDING. PRELOADED FIXTURES MUST BE USED TO MAINTAIN THE STRAIGHTNESS OF THE PIVOT EDGES WITHIN $1/8"$ T.I.R. WHEN SUSPENDED AGAINST A FLAT SURFACE. ALL FOUR CORNERS MUST BE COPLANAR WITHIN $1/2"$. THE PIVOT EDGE MUST MEET SURFACE PLATE OR FLAT REFERENCE SURFACE TO WITHIN $1/8"$ OVER THE FULL LENGTH.

1.6 ALL WELDS ARE TO BE MADE IN ACCORDANCE WITH ANSI/AWS D1.1-2010 STRUCTURAL WELDING CODE FOR STEEL. A STUD WELDING PRE-QUALIFICATION 90° BEND TEST IN ACCORDANCE WITH 7.6.6.1 IS MANDATORY. SUGGESTED WELD PROCEDURE INFORMATION IS AVAILABLE FROM OHI UPON REQUEST.

1.7 TEST FIT ASSOCIATED PARTS SUCH AS NAPPE BREAKERS HINGE RETAINERS RESTRAINING STRAP CLAMPS AND SEAL RETAINERS PRIOR TO SHIPPING.

2. RETAINERS, HINGE, SEAL & RESTRAINING STRAP CLAMP (201, 202, 203 & 204)

2.1 TOLERANCES: $\pm 1/16"$ UNLESS OTHERWISE NOTED.

2.2 REMOVE ALL BURRS FROM HOLES AND EXTERIOR SURFACES. BREAK ALL CORNERS AND EDGES $1/16"$ UNLESS OTHERWISE NOTED.

2.3 SAND BLAST ALL SURFACES IN ACCORDANCE WITH SSPC-10 AND HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A123 AND ASTM A153.

3. MAIN ANCHOR CLAMP BAR (211-5)

3.1 TOLERANCES: $\pm 1/16"$ UNLESS OTHERWISE NOTED.

3.2 REMOVE ALL BURRS FROM HOLES AND EXTERIOR SURFACES. BREAK ALL CORNERS AND EDGES $1/16"$ UNLESS OTHERWISE NOTED.

3.3 SAND BLAST ALL SURFACES IN ACCORDANCE WITH SSPC-10 AND HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A123 AND ASTM A153.

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HYDRO, INC.

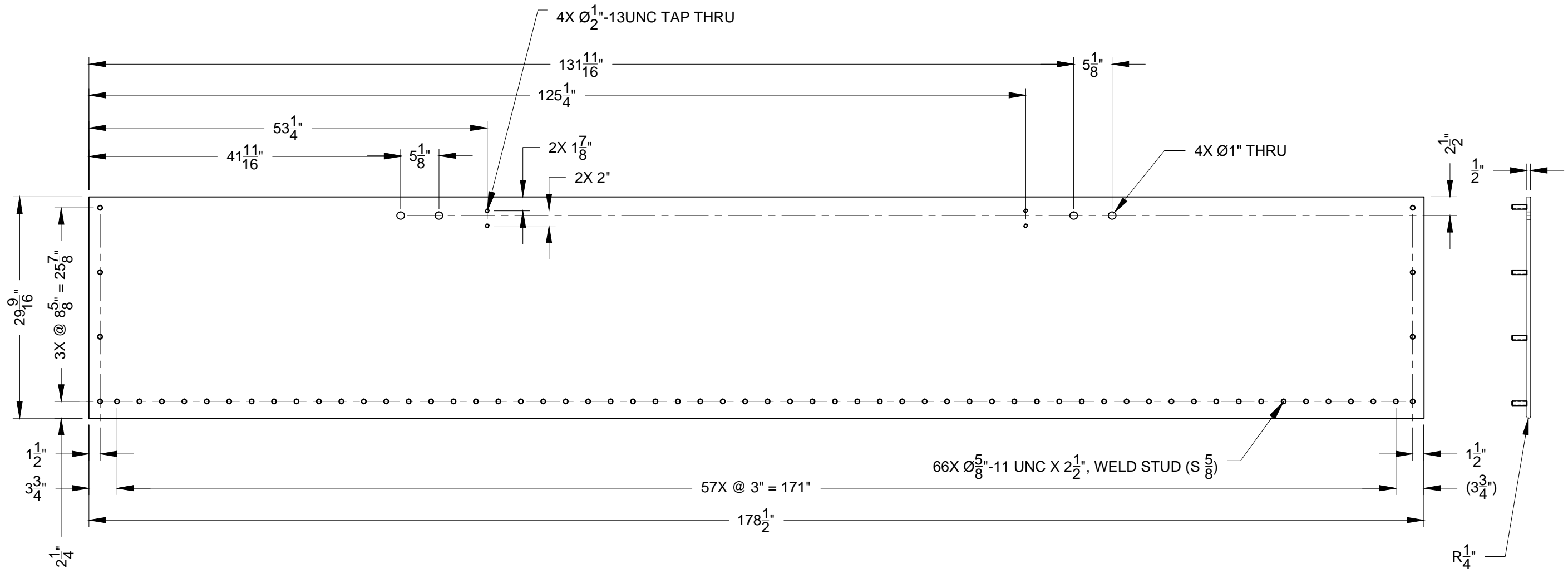
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DRAWING DESCRIPTION

STEEL NOTES

	SHEETS	SCALE
	1 of 1	NO SCALE
JOB		
Tippecanoe		
DWG. NO.		
17-1995-200		



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1	BAH	22 Mar 2018	DATE APRVD	NEW DRAWING			
NO	DRAWN	APRVD					REVISION DESCRIPTION

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DRAWING DESCRIPTION

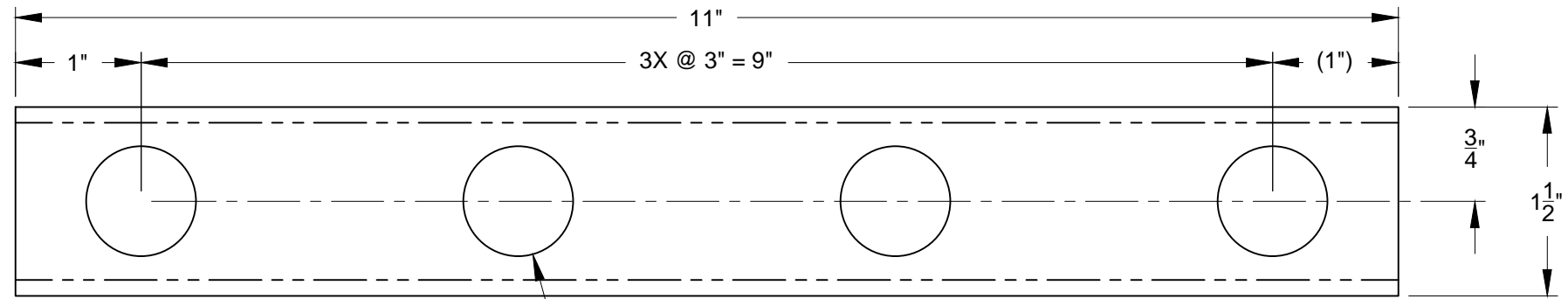
GATE PANEL (15')

SHEETS	SCALE
1 of 1	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-200-15	

BILL OF MATERIAL FOR GATE PANEL 200-15 (1 REQ.) WT: 1000 lbs TOTAL WT: 1000 lbs

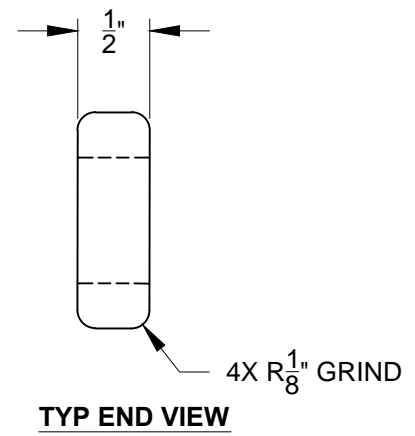
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	P1	1/2" THICK A-572 ASTM GRADE 50 ROLLED PLATE	CERAM-KOTE 54	1	1		
2	S(5/8)	5/8"-11 UNC x 2 1/2" WELD STUD (SEAL)	STAINLESS STEEL	66	66		

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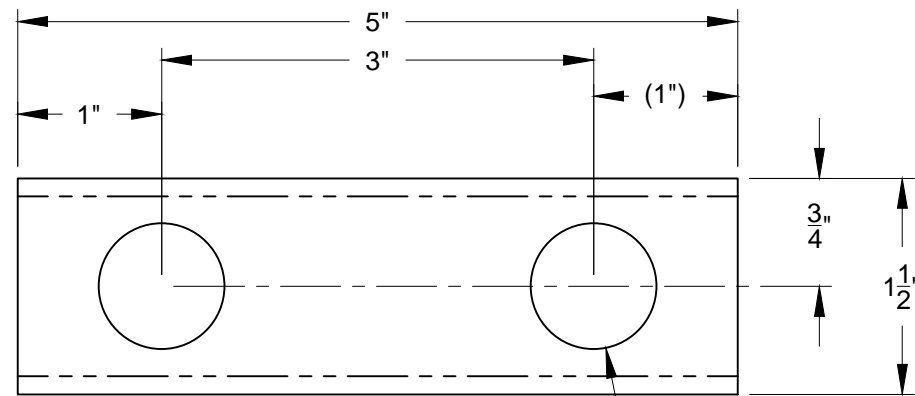


17-1995-201-4

4X $\varnothing \frac{7}{8}$ " THRU



TYP END VIEW



17-1995-201-2

2X $\varnothing \frac{7}{8}$ " THRU

NOTES:

1) SEE SHEET 200.

BILL OF MATERIAL FOR HINGE RETAINER							
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	17-1995-201-4	HINGE RETAINER, (4 HOLE), ASTM-A36 STEEL	GALVANIZED	1	14	2 lbs	28 lbs
2	17-1995-201-2	HINGE RETAINER, (2 HOLE), ASTM-A36 STEEL	GALVANIZED	1	1	1 lbs	1 lbs

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1	BAH	22 Mar 2018	NEW DRAWING	DATE APRVD			
NO				REVISION DESCRIPTION			

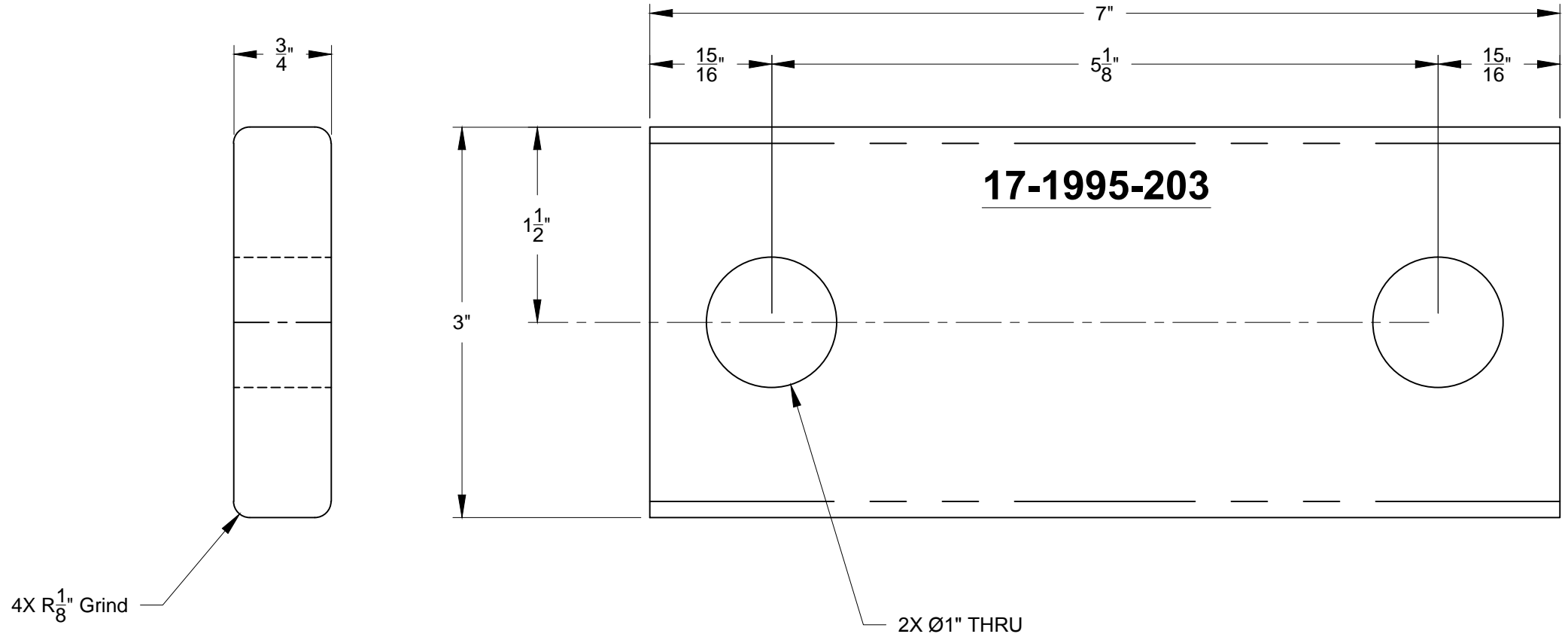
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DRAWING DESCRIPTION
HINGE RETAINER

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SHEETS	SCALE
1 of 1	NO SCALE
JOB Tippecanoe	
DWG. NO. 17-1995-201-X	



4X R $\frac{1}{8}$ " Grind

2X $\varnothing 1$ " THRU

17-1995-203


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1	BAH	22 Mar 2018	DATE APRVD	NEW DRAWING			
NO	DRAWN	APRVD					REVISION DESCRIPTION

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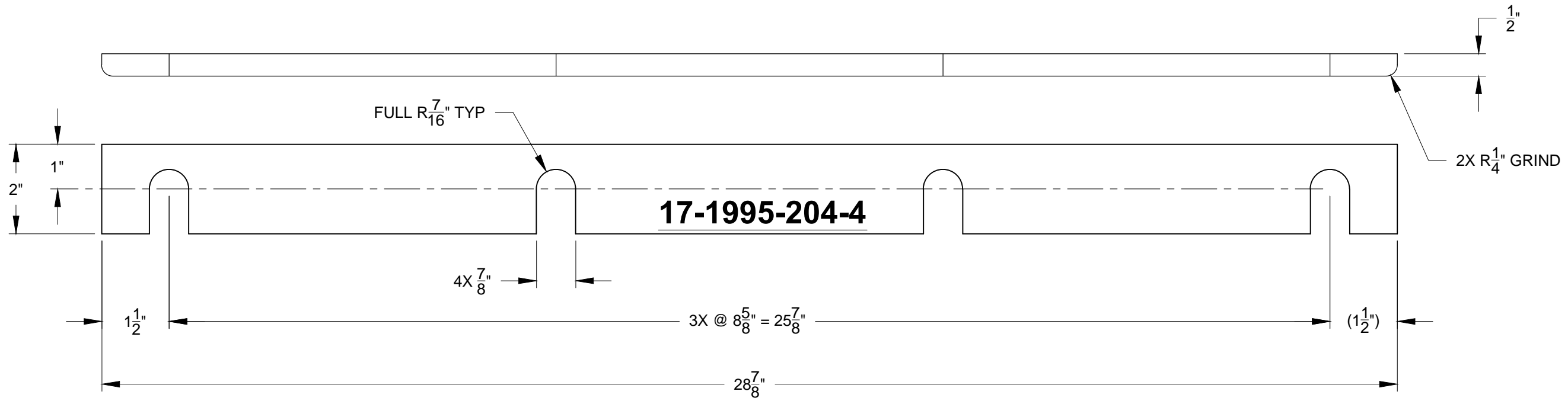
DRAWING DESCRIPTION
RESTRAINING STRAP CLAMP

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	SHEETS	SCALE
	1 of 1	NO SCALE
JOB	Tippecanoe	
DWG. NO.	17-1995-203	

BILL OF MATERIAL FOR RESTRAINING STRAP CLAMP

ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	17-1995-203	RESTRAINING STRAP CLAMP, ASTM A-572 GRADE 50	GALVANIZED	1	4	4 lbs	16 lbs



NOTES:
1) SEE SHEET 200

BILL OF MATERIAL FOR SEAL RETAINER

ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	17-1995-204-4	SEAL RETAINER, (4 SLOT), ASTM-A36 STEEL	GALVANIZED	1	2	7.5 lbs	15 lbs

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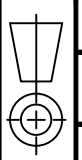
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DRAWING DESCRIPTION

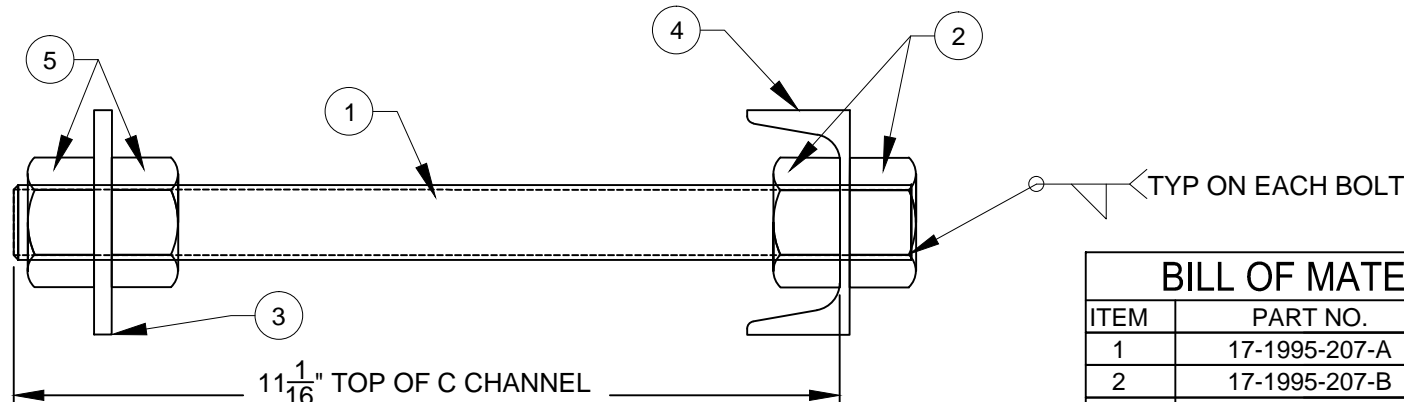
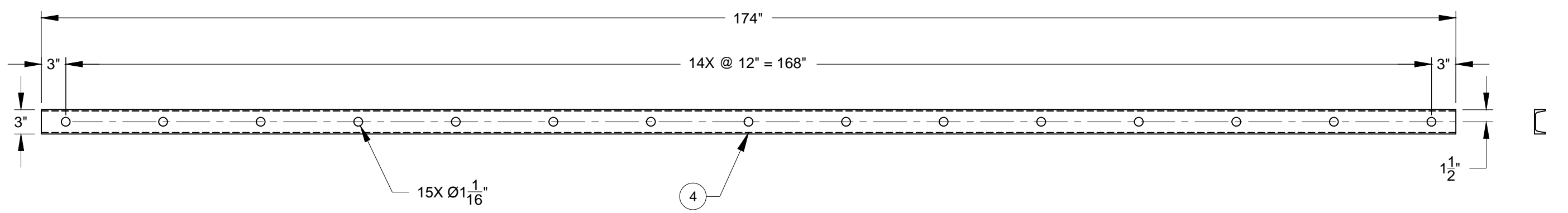
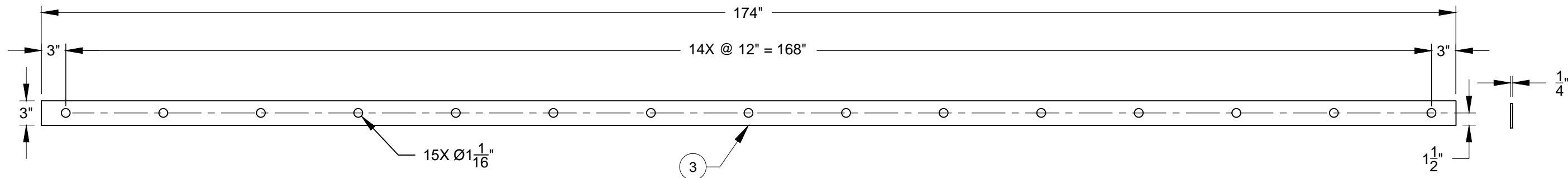
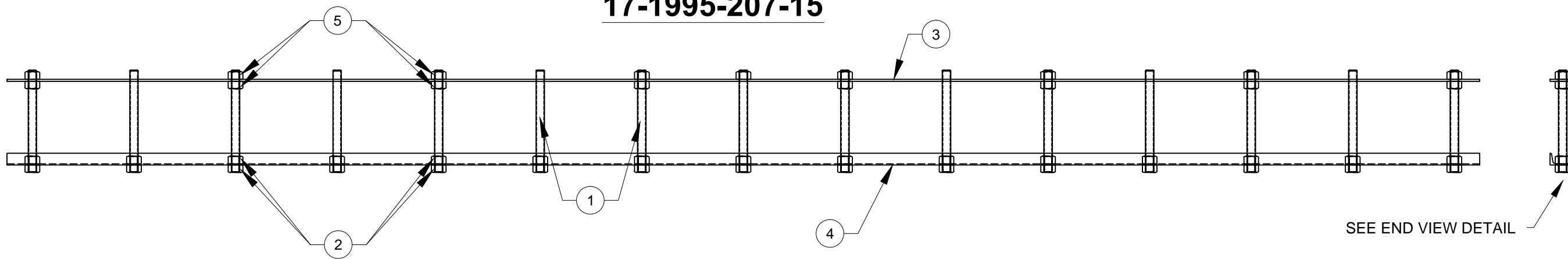
ABUTMENT SEAL RETAINER

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SHEETS	SCALE
1 of 1	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-204-4	

17-1995-207-15



11 1/16" TOP OF C CHANNEL TO TOP OF ANCHOR

END VIEW DETAIL

NOTES:
1) SEE SHEET 200.

BILL OF MATERIAL FOR MAIN ANCHOR ASSYEMBLY 207-10 (1 REQ.) WT: 311 lbs							
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT. EA.	TL. WT.
1	17-1995-207-A	Ø1"-8 UNC X 12"	304 STAINLESS	15	15		
2	17-1995-207-B	Ø1"-8 UNC, HEX NUT	BLACK	30	30		
3	17-1995-207-C	TOP PLATE, 1/4" THICK STRUCTURAL STEEL BAR, 15 HOLE	BLACK	1	1		
4	17-1995-207-D	C3-3.5 STRUCTURAL CHANNEL, 15 HOLE	STEEL	1	1		
5	17-1995-207-E	Ø1"-8 UNC, HEX NUT	304 STAINLESS	15	15		

NO	REVISION DESCRIPTION	DATE	APRVD	APRVD
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1	NEW DRAWING	23 Mar 2018	BAH	

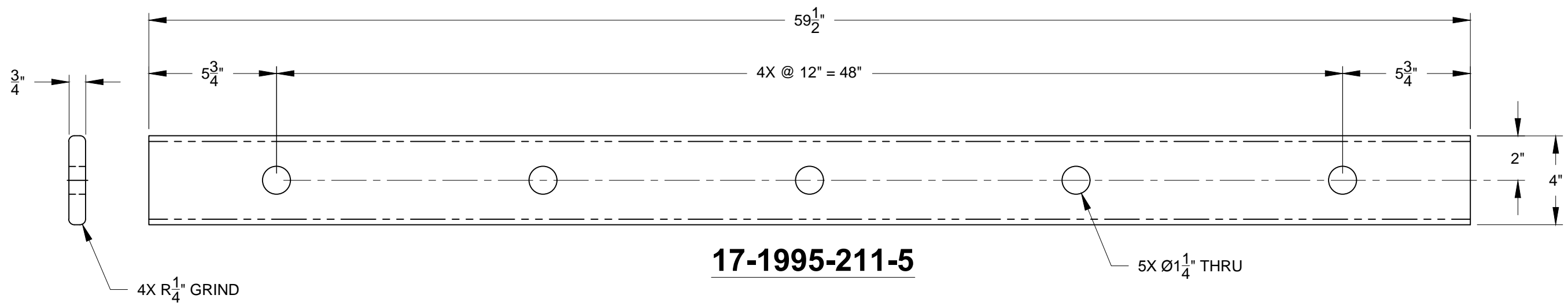
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DRAWING DESCRIPTION
MAIN ANCHOR EMBED ASSEMBLY
(15 ANCHOR)

© OBERMEYER HYDRO, INC., 2017

SHEETS	SCALE
1 of 1	NO SCALE
JOB Tippecanoe	
DWG. NO. 17-1995-207-15	



17-1995-211-5

5X Ø1 1/4" THRU

4X R 1/4" GRIND

NOTES:
1) SEE SHEET 200.

BILL OF MATERIAL FOR MAIN CLAMP BAR							
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	17-1995-211-5	MAIN CLAMP BAR, ASTM -A36 STEEL (5 HOLE)	GALVANIZED	1	3	48 lbs	144 lbs

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1		22 Mar 2018	BAH	NEW DRAWING			
NO			DRAWN	APRVD	DATE APRVD	REVISION DESCRIPTION	

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DRAWING DESCRIPTION
MAIN CLAMP BAR

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SHEETS	SCALE
1 of 1	NO SCALE
JOB Tippecanoe	
DWG. NO. 17-1995-211-5	

Tippecanoe Leesburg, Indiana

OHI PROJECT 17-1995

DRAWING LIST	DESCRIPTION	REV
240	ABUTMENT PLATE NOTES	1
240-L	ABUTMENT PLATE ASSEMBLY, LEFT	1
240-R	ABUTMENT PLATE ASSEMBLY, RIGHT	1

NOTES:

1. UHMW

- 1.1. TOLERANCES: $\pm \frac{1}{8}$ " ON ALL HOLE POSITIONS NON ACCUMULATING, $\pm \frac{1}{8}$ " ON LINEAR DIMENSIONS.
- 1.2. SURFACE SHOWN MUST HAVE SMOOTH FLAT WELDS, AND MUST HAVE FLUSH AND SECURE WELDS. WELDING AT EDGES MUST BE COMPLETE AND FLUSH WITH END EDGES

2. PERIPHERALS


- 2.1. REMOVE ALL BURRS FROM HOLES AND EXTERIOR SURFACES. BREAK ALL CORNERS AND EDGES $\frac{1}{16}$ " UNLESS OTHERWISE NOTED.
- 2.2. TOLERANCES $\pm \frac{1}{16}$ " UNLESS OTHERWISE NOTED.

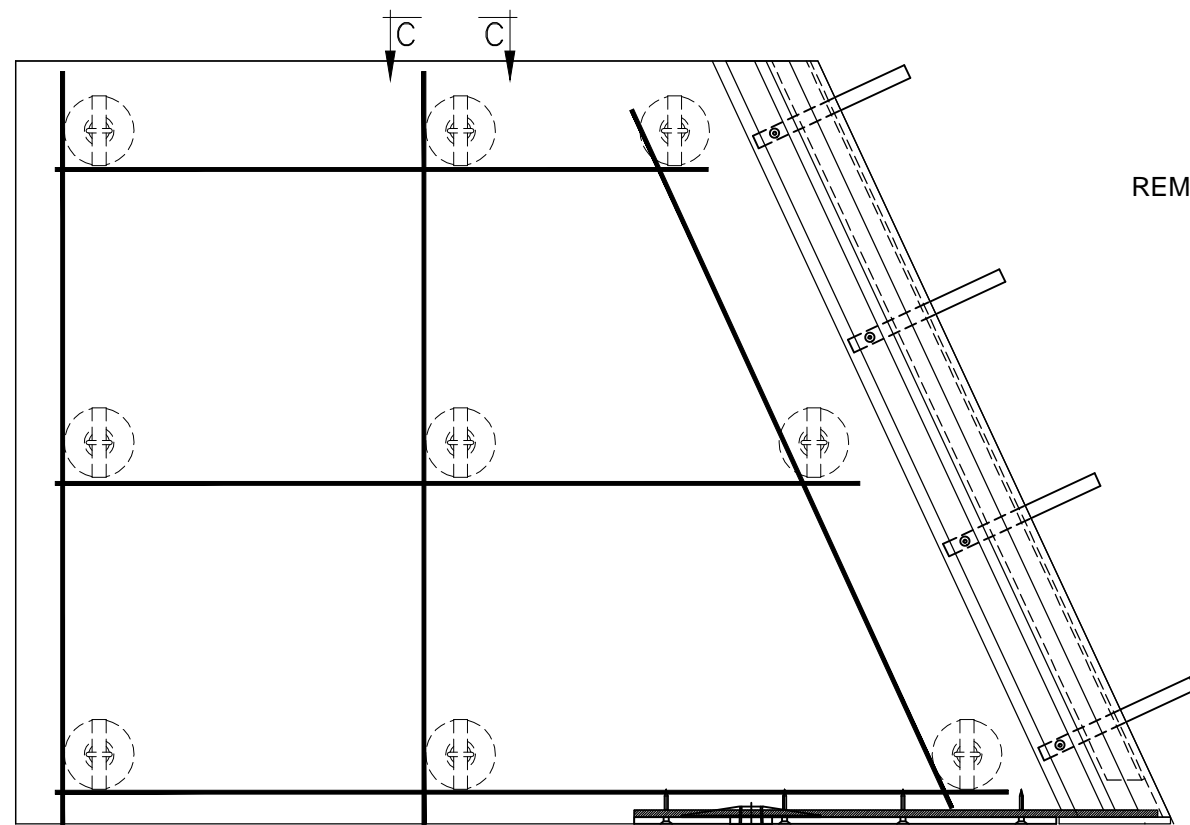
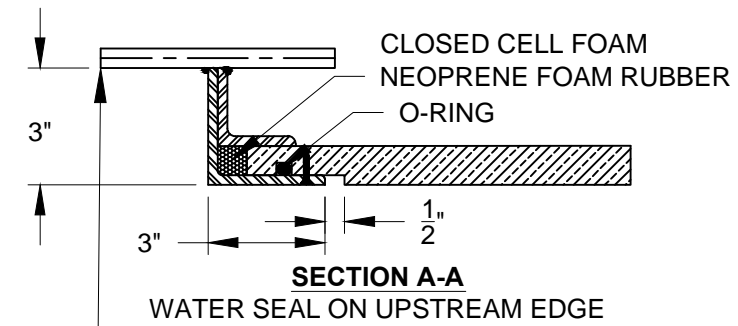
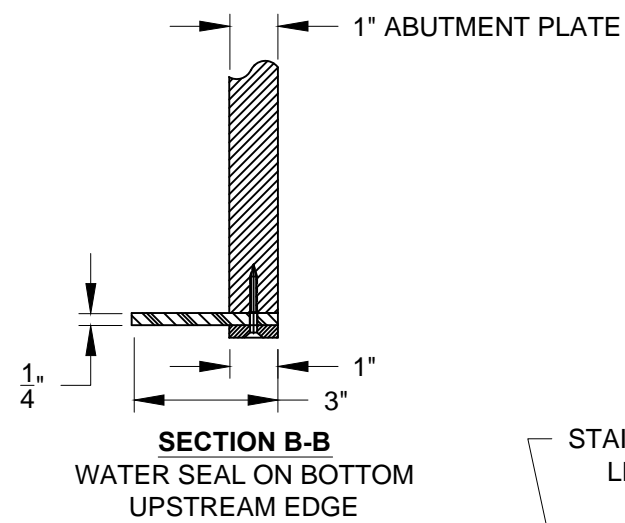
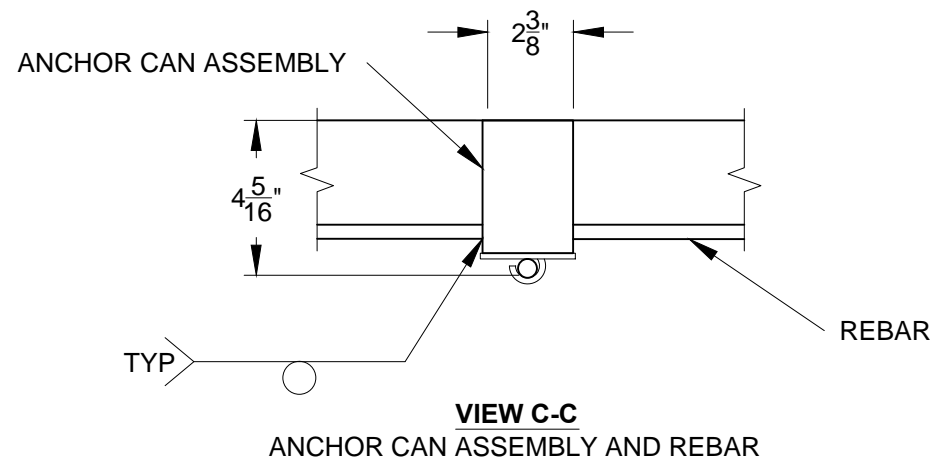
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HYDRO, INC.

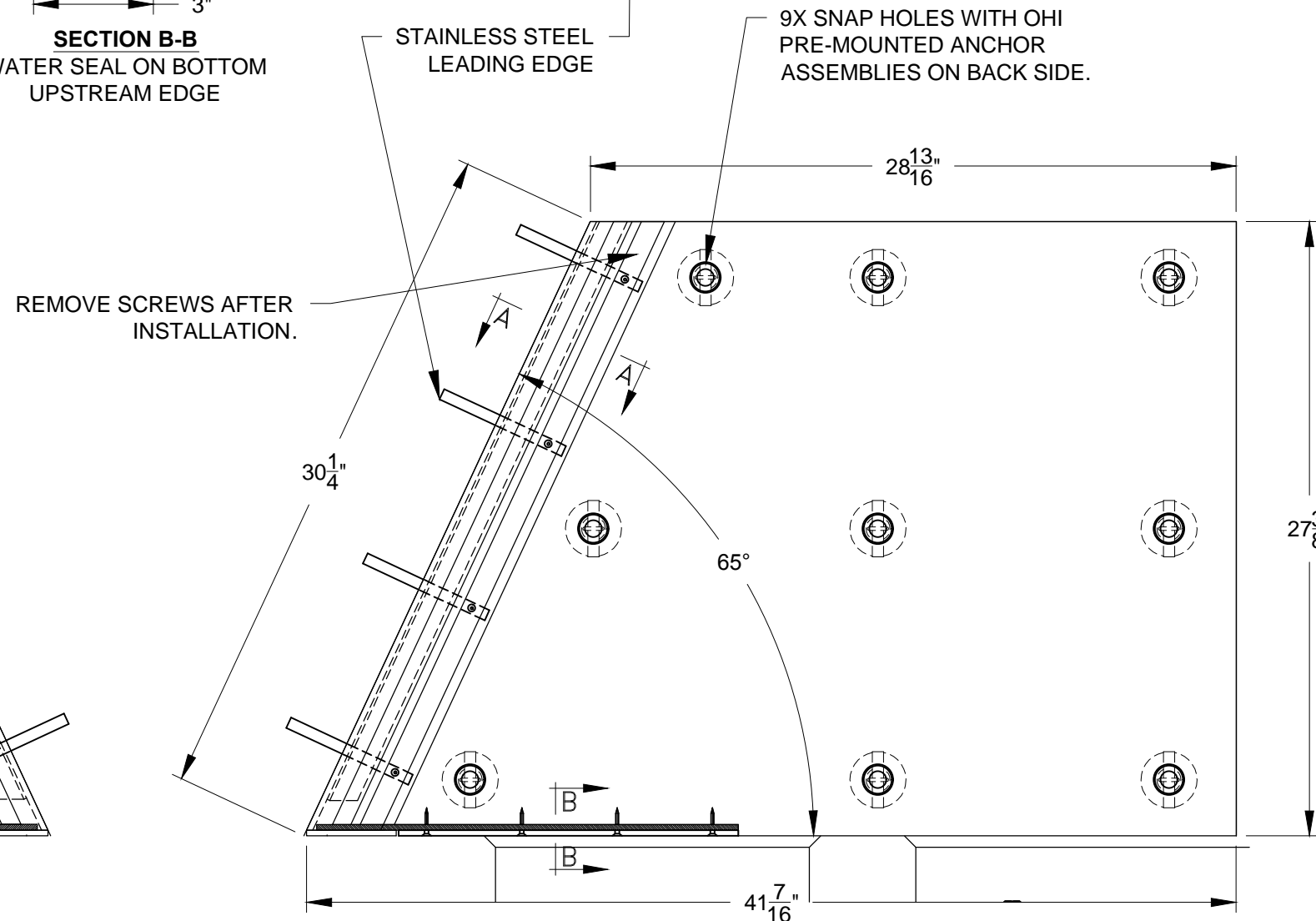
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DRAWING DESCRIPTION
ABUTMENT PLATE NOTES

	SHEETS	SCALE
	1 of 1	NO SCALE
JOB Tippecanoe		
DWG. NO. 17-1995-240		



LEFT ABUTMENT PLATE
CONCRETE SURFACE SHOWN WITH
REBAR AND ANCHOR CANS ATTACHED



LEFT ABUTMENT PLATE
GATE SURFACE SHOWN

NOTES:

- 1) MATERIAL: (MAIN PANEL) 1" UNMW (ULTRA HIGH MOLECULAR WEIGHT) POLYETHYLENE PLASTIC, (ANGLE) 304 STAINLESS STEEL ANGLE, (O-RING) RUBBER, (ANCHOR CAN) 304 STAINLESS STEEL COMPONENTS, (REBAR) #4 (1/2") STRUCTURAL STEEL REBAR.
- 2) ASSEMBLIES REQUIRED: 1X
- 3) APPROXIMATE WEIGHT: 42 LBS.
- 4) TOLERANCES: ± 1/2" UNLESS OTHERWISE NOTED.
- 5) DO **NOT** USE ANGLE ASSEMBLY OR REBAR TO SUSPEND OR LIFT PANEL ASSEMBLY.

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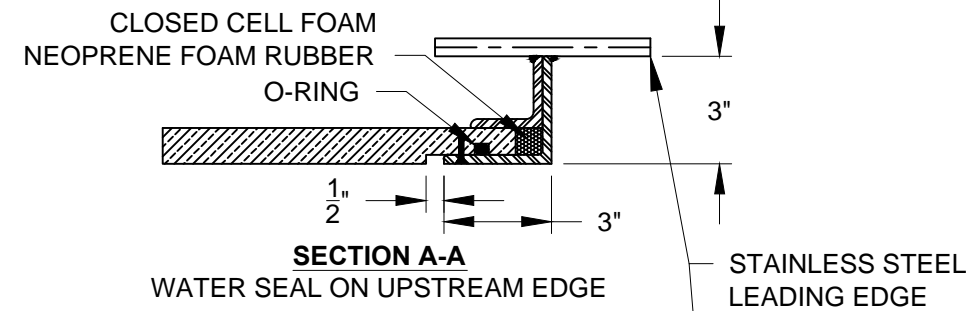
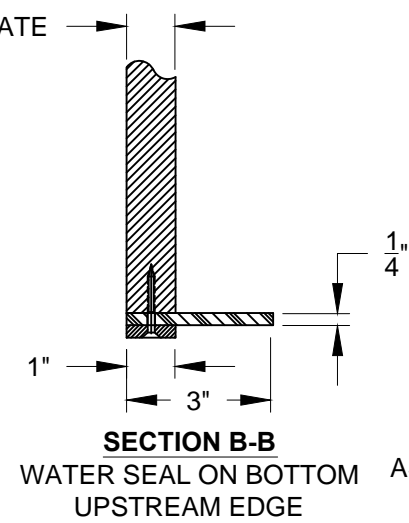
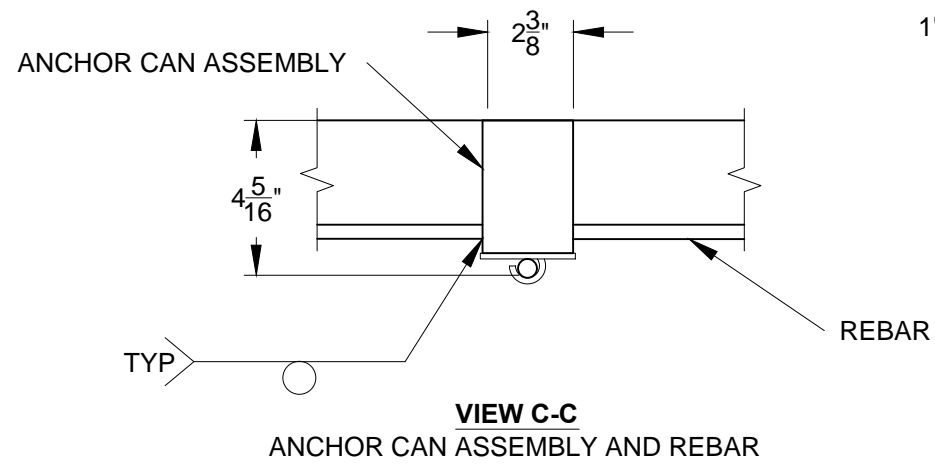
DRAWING DESCRIPTION

ABUTMENT PLATE ASSEMBLY, LEFT

DATE APRVD: 26 Mar 2018
DATE APRVD: 26 Mar 2018
DRAWN: BAH
APRVD: BAH
NEW DRAWING

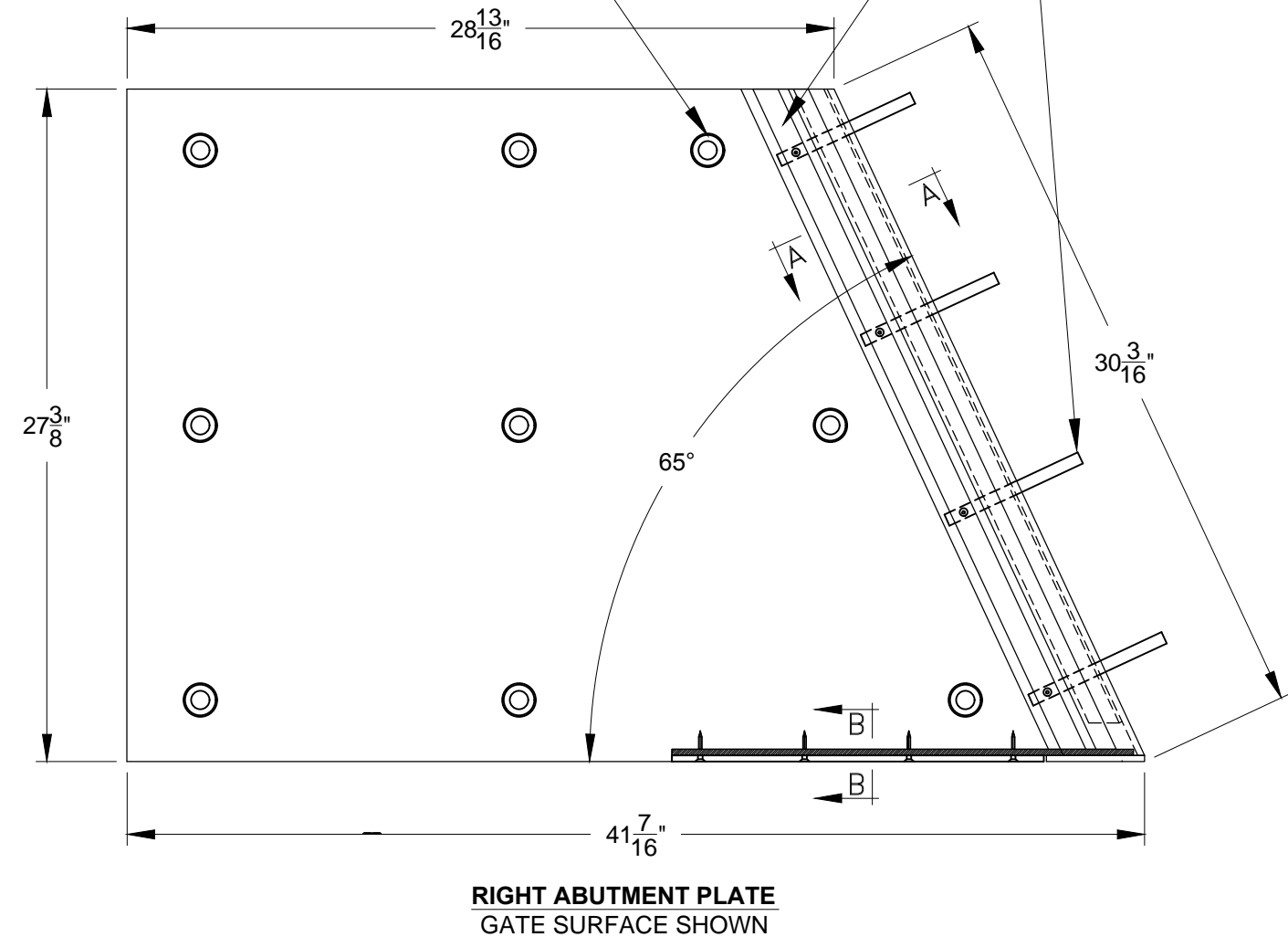
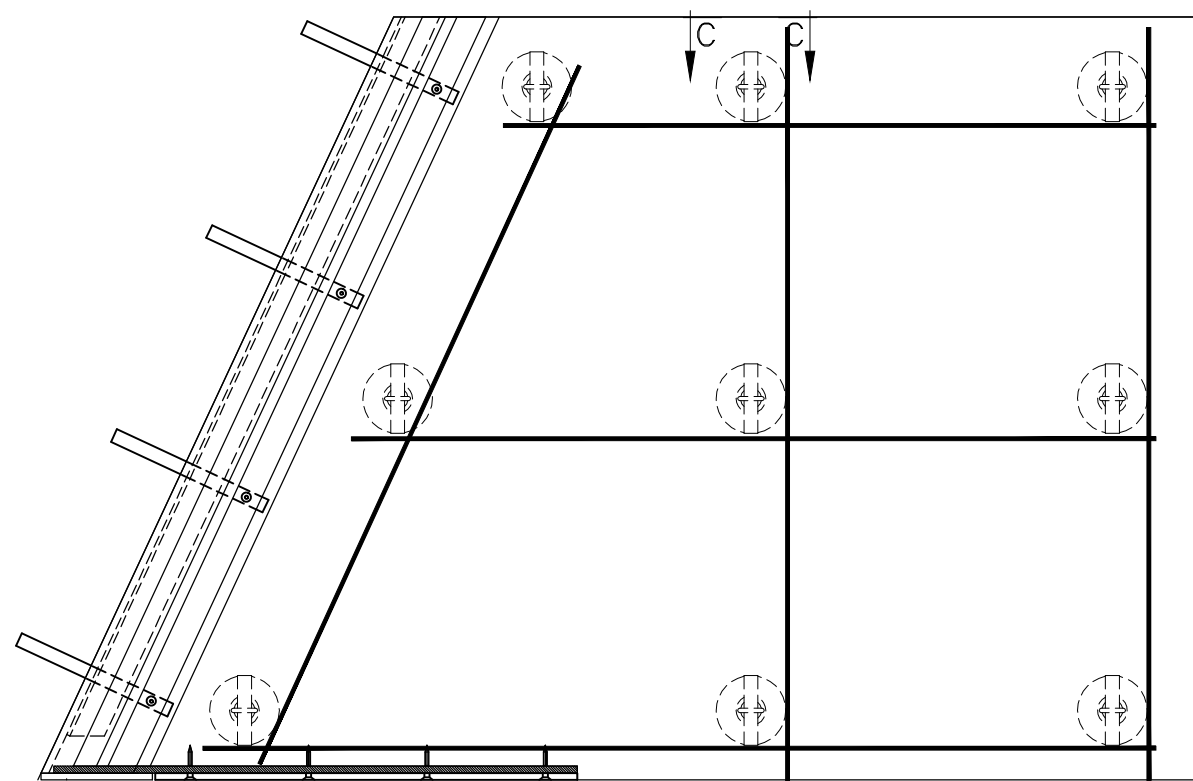
SHEETS	SCALE
1 of 1	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-240-L	

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9X SNAP HOLES WITH OHI
PRE-MOUNTED ANCHOR
ASSEMBLIES ON BACK SIDE.

REMOVE SCREWS AFTER
INSTALLATION.



NOTES:

- 1) MATERIAL: (MAIN PANEL) 1" UNMW (ULTRA HIGH MOLECULAR WEIGHT) POLYETHYLENE PLASTIC, (ANGLE) 304 STAINLESS STEEL ANGLE, (O-RING) RUBBER, (ANCHOR CAN) 304 STAINLESS STEEL COMPONENTS, (REBAR) #4 (1/2") STRUCTURAL STEEL REBAR.
- 2) ASSEMBLIES REQUIRED: 1X
- 3) APPROXIMATE WEIGHT: 42 LBS.
- 4) TOLERANCES: ± 1/2" UNLESS OTHERWISE NOTED.
- 5) DO **NOT** USE ANGLE ASSEMBLY OR REBAR TO SUSPEND OR LIFT PANEL ASSEMBLY.

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DRAWING DESCRIPTION

ABUTMENT PLATE ASSEMBLY, RIGHT

SHEETS	SCALE
1 of 1	NO SCALE
JOB	
Tippecanoe	
DWG. NO.	
17-1995-240-R	

© OBERMEYER HYDRO, INC., 2017

Tippecanoe Leesburg, Indiana

OHI PROJECT 17-1995

DRAWING LIST	DESCRIPTION	REV
300	RUBBER NOTES	1
302	RESTRAINING STRAP	1
304	ABUTMENT SEAL	1
310-15	15' BLADDER	1

NOTES:

1. FLAT BAR STYLE AIR BLADDER, (310A)

- 1.1 MATERIAL: LAYERED POLYESTER REINFORCED RUBBER.
- 1.2 TOLERANCES: $\pm \frac{1}{4}$ " UNLESS OTHERWISE NOTED.
- 1.3 WITH $\frac{3}{4}$ " NPT BRASS AIR FITTING PRE-INSTALLED AT OHI.

2. RESTRAINING STRAPS, (302)

- 2.1 MATERIAL: LAYERED POLYESTER REINFORCED RUBBER.
- 2.2 TOLERANCES: $\pm \frac{1}{4}$ " UNLESS OTHERWISE NOTED.
- 2.3 PROVIDED WITH MOLDED IN NYLON ROD AND CUT TO WIDTH DIMENSION.

3. INTERPANEL SEALS, (303)

- 3.1 MATERIAL: LAYERED POLYESTER REINFORCED RUBBER.
- 3.2 TOLERANCES: $\pm \frac{1}{4}$ " UNLESS OTHERWISE NOTED.
- 3.3 TO BE FIELD CUT AND TRIMMED TO FIT DURING INSTALLATION.

4. ABUTMENT SEALS, (304)

- 4.1 MATERIAL: LAYERED POLYESTER REINFORCED RUBBER.
- 4.2 TOLERANCES: $\pm \frac{1}{4}$ " UNLESS OTHERWISE NOTED.
- 4.3 TO BE FIELD CUT AND TRIMMED TO FIT DURING INSTALLATION.


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NO							REVISION DESCRIPTION

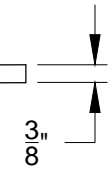
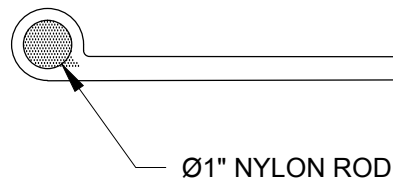
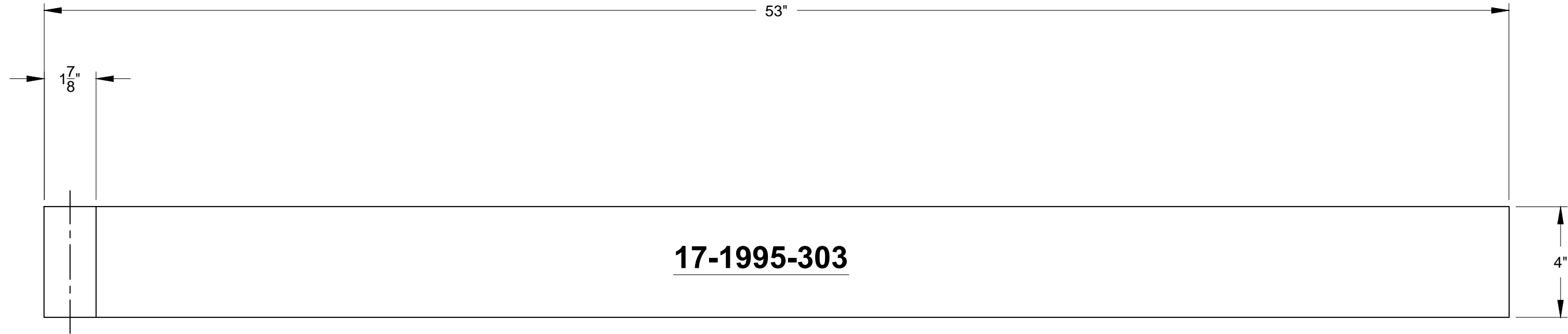
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DRAWING DESCRIPTION

RUBBER NOTES

	SHEETS	SCALE
	1 of 1	NO SCALE
JOB Tippecanoe		
DWG. NO. 17-1995-300		



NOTES:
1) SEE SHEET 300.

BILL OF MATERIAL FOR RESTRAINING STRAP							
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	17-1995-302	RESTRAINING STRAP	RUBBER	1	2	4 lbs	8 lbs

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DRAWING DESCRIPTION

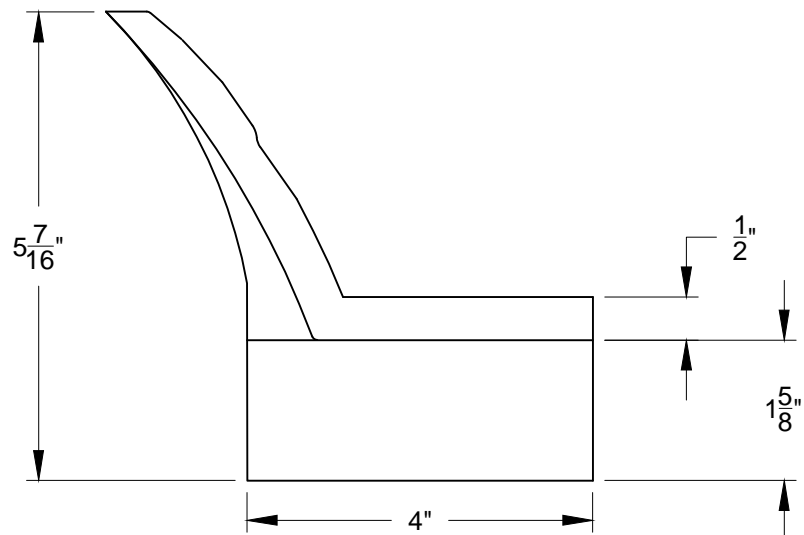
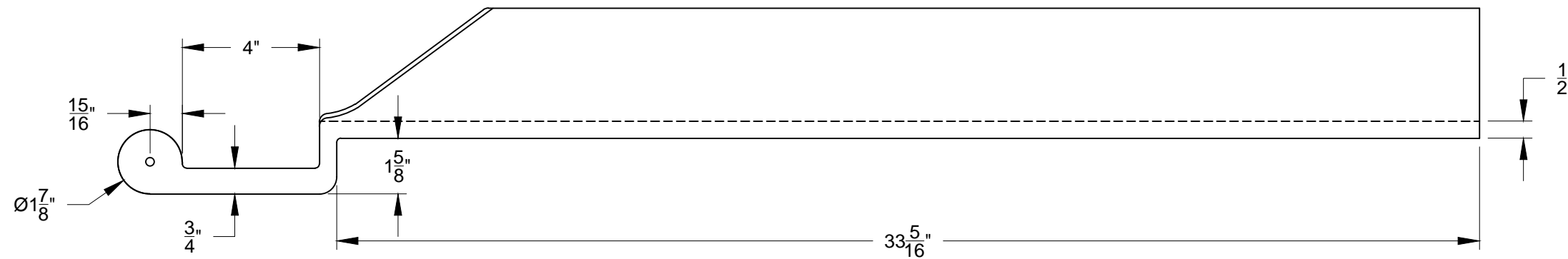
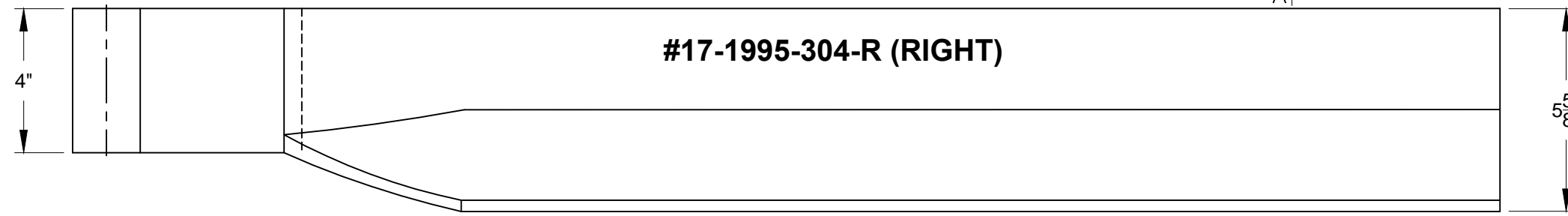
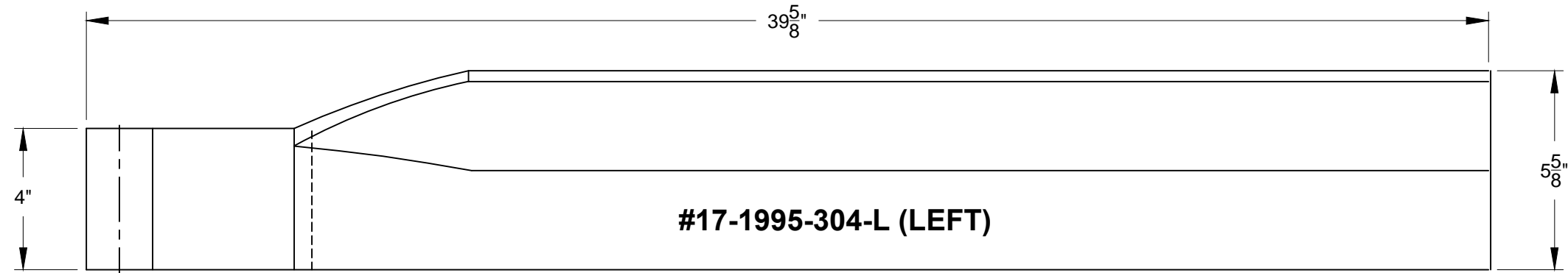
RESTRAINING STRAP

SHEETS 1 of 1 SCALE NO SCALE

JOB Tippecanoe

DWG. NO. 17-1995-302

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1	BAH	23 Mar 2018	NEW DRAWING	DATE APRVD	APRVD	REVISION DESCRIPTION	NO



NOTES:
1) SEE SHEET 300.

BILL OF MATERIAL FOR ABUTMENT SEAL							
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	17-1995-304-L	ABUTMENT SEAL, LEFT	RUBBER	1	1	10 lbs	10 lbs
2	17-1995-304-R	ABUTMENT SEAL, RIGHT	RUBBER	1	1	10 lbs	10 lbs

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NO							REVISION DESCRIPTION

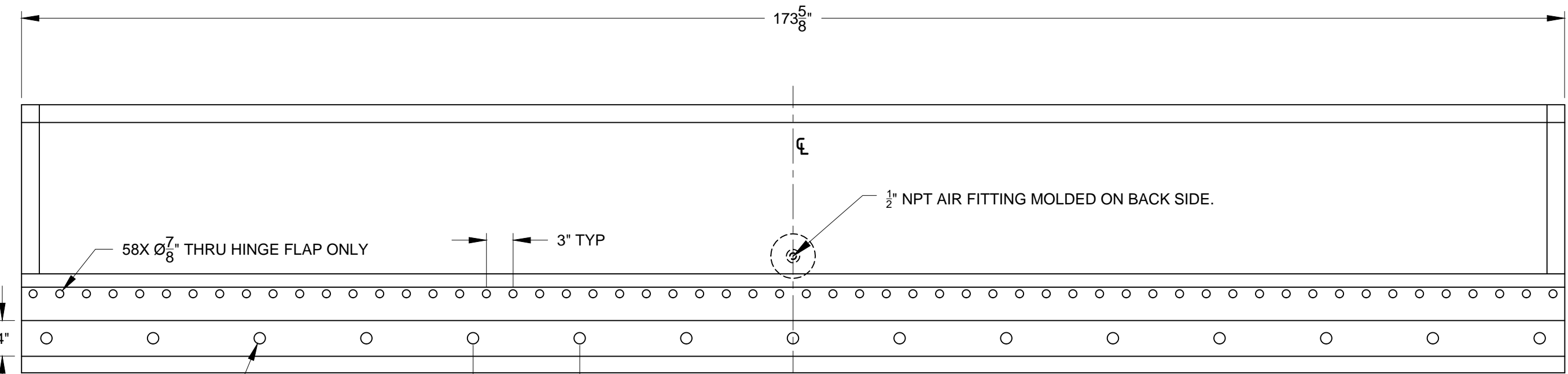
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DRAWING DESCRIPTION
ABUTMENT SEALS

SHEETS: 1 of 1
SCALE: NO SCALE
JOB: Tippecanoe
DWG. NO.: 17-1995-304

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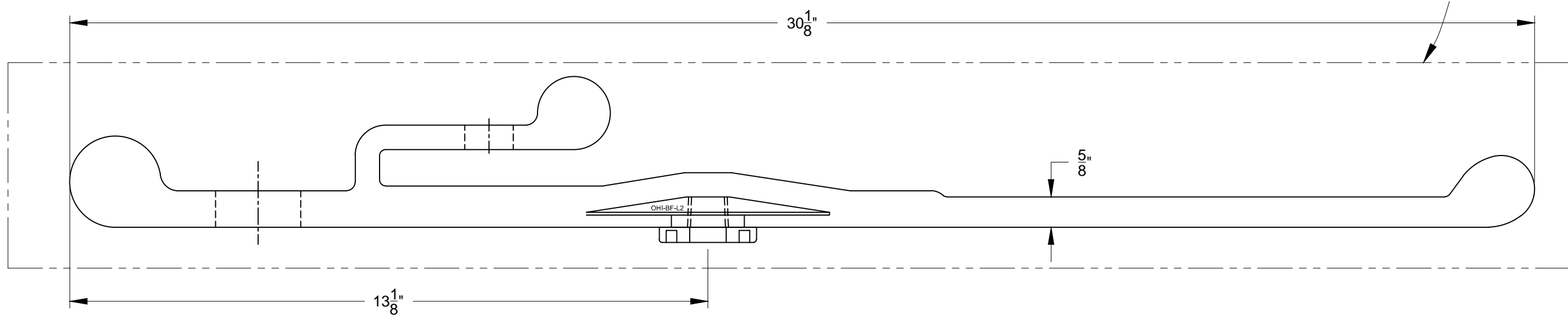
58X $\frac{7}{8}$ " THRU HINGE FLAP ONLY

3" TYP

15X $\frac{1}{4}$ " THRU

12" TYP

$\frac{1}{2}$ " NPT AIR FITTING MOLDED ON BACK SIDE.



30 $\frac{1}{8}$ "

13 $\frac{1}{8}$ "

NOTES:
1) SEE SHEET 300.

BILL OF MATERIAL FOR FLAT CLAMP STYLE AIR BLADDER							
ITEM	PART NO.	DESCRIPTION	FINISH	QTY.	TOTAL	WT.	TL. WT.
1	12-1084-310	FLAT CLAMP STYLE AIR BLADDER, (100mm)	RUBBER	1	1	182 lbs	182 lbs

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1	BAH	23 Mar 2018	APRVD	DATE APRVD	NEW DRAWING		REVISION DESCRIPTION
NO							

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DRAWING DESCRIPTION

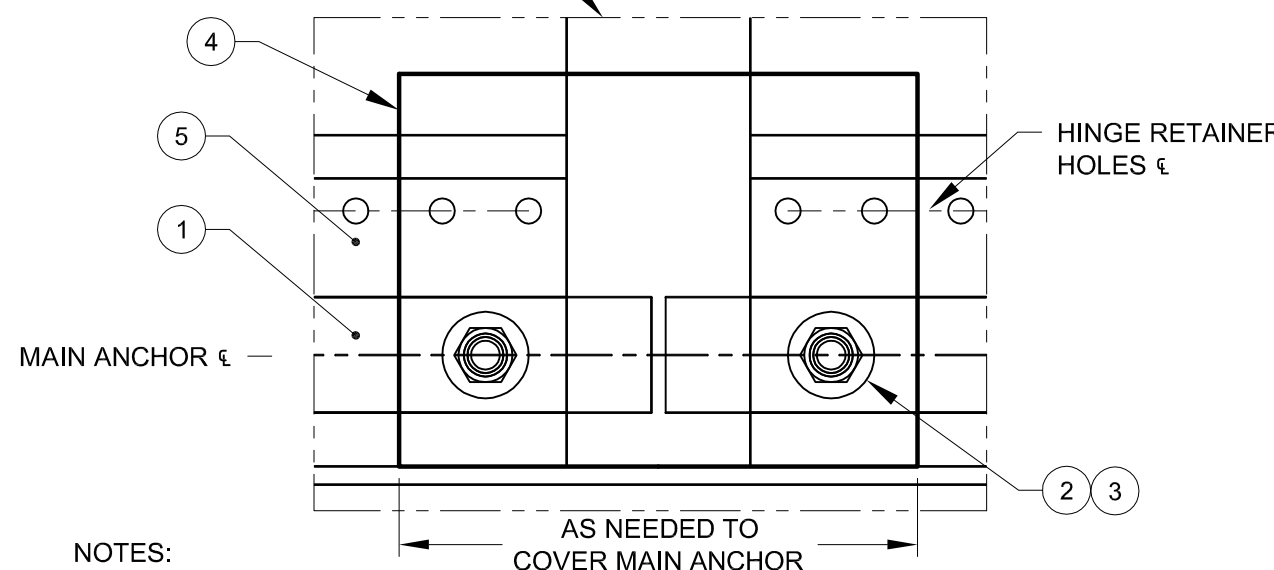
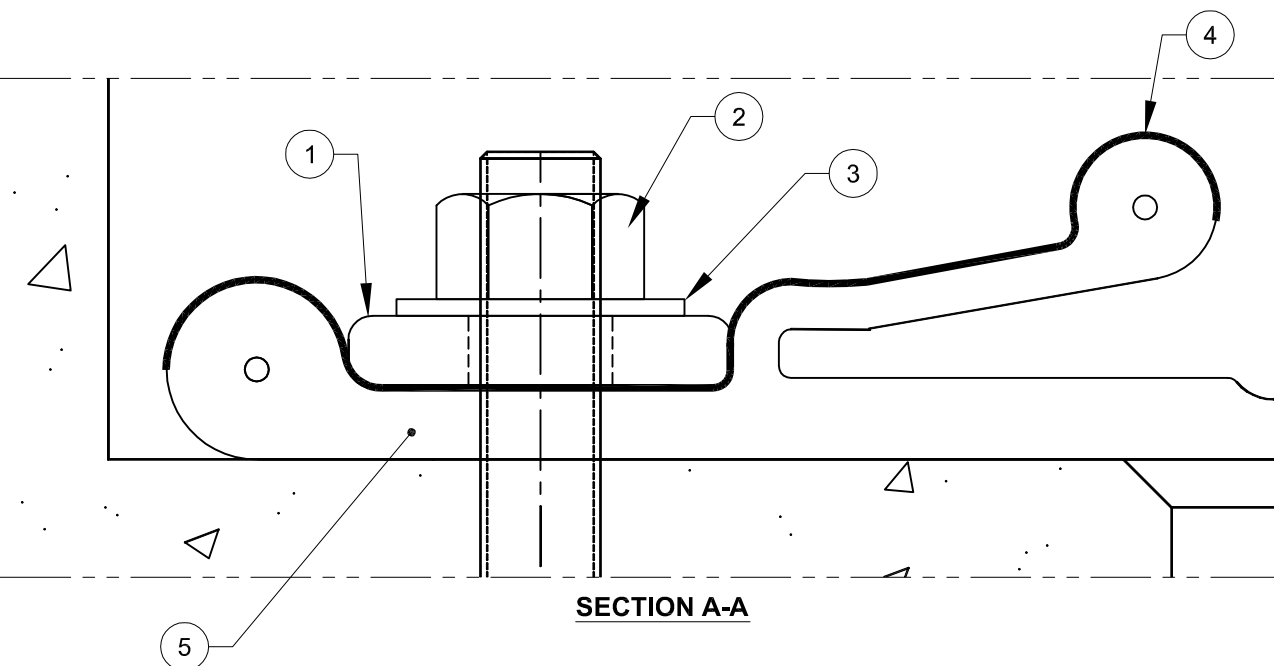
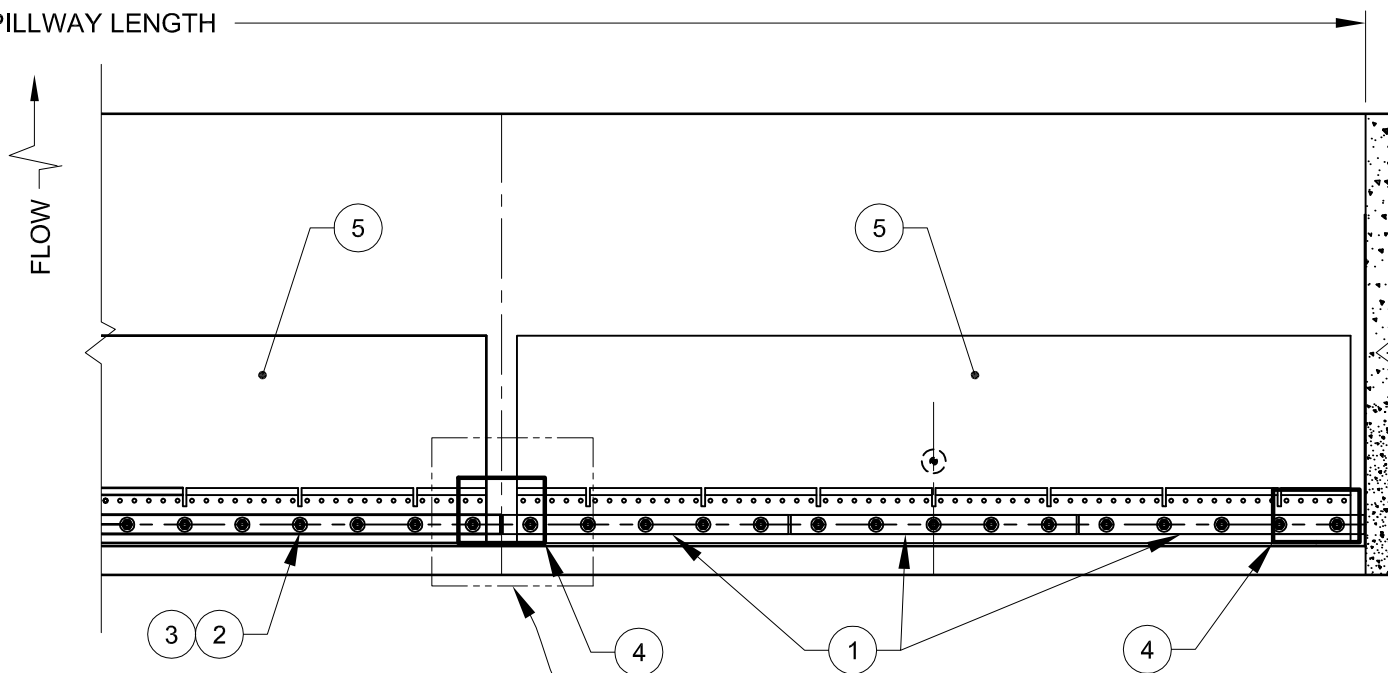
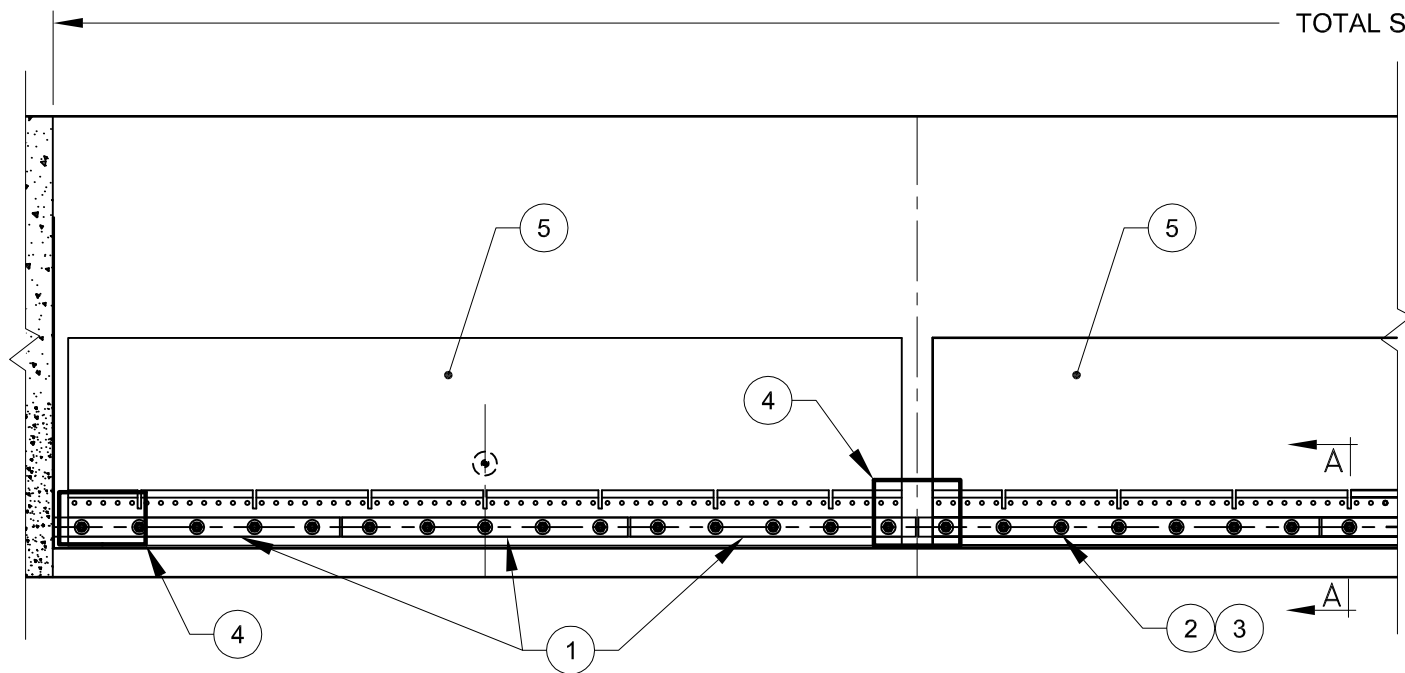
15' AIR BLADDER

SHEETS 1 of 1 SCALE NO SCALE

JOB Tippecanoe

DWG. NO. 17-1995-310-15

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- NOTES:
- 1) THE EPDM SHOULD BE WRAPPED AROUND THE END OF THE AIR BLADDER, UNDER THE MAIN ANCHOR CLAMP BAR, AND LONG ENOUGH TO COVER HINGE RETAINER HOLES CENTER LINE ON AIR BLADDER.
 - 2) SILICONE SHOULD BE USED BETWEEN THE EPDM AND THE AIR BLADDER FOR A WATER TIGHT SEAL.
 - 3) APPLY BEAD OF MARINE GRADE SILICONE AROUND ALL OUTER EDGES OF EPDM SHEET. APPLY TWO BEADS OF SILICONE ALONG BOTH SIDES OF EACH SEAM BETWEEN BLADDER.
 - 4) HOLES SHOULD BE CUT IN THE FIELD TO FIT EPDM OVER MAIN ANCHORS AND GATE STUDS. PLACE SILICONE AROUND HOLE AND ANCHOR OR STUD TO PREVENT LEAKAGE.

BILL OF MATERIAL FOR MAIN CLAMP INSTALLATION		
ITEM	PART NO.	DESCRIPTION
STEEL -120		
1	XX-XXX-211-X	MAIN CLAMP BAR
FASTENERS -120		
2		HEX NUT
3		FLAT WASHER
RUBBER -120		
4		EPDM
5	XX-XXX-310-X	FLAT CLAMP AIR BLADDER

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2		JDM	FEB 2, 2018	CHANGED MATERIALS			
1		PAC	NOV 30, 2016	NEW DRAWING			
NO		DRAWN	APRVD	DATE APRVD			REVISION DESCRIPTION

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DRAWING DESCRIPTION

OHI STANDARD

MAIN CLAMP INSTALLATION

AND EPDM PLACEMENT

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SHEETS: 1 of 1

SCALE: NO SCALE

JOB: OHI

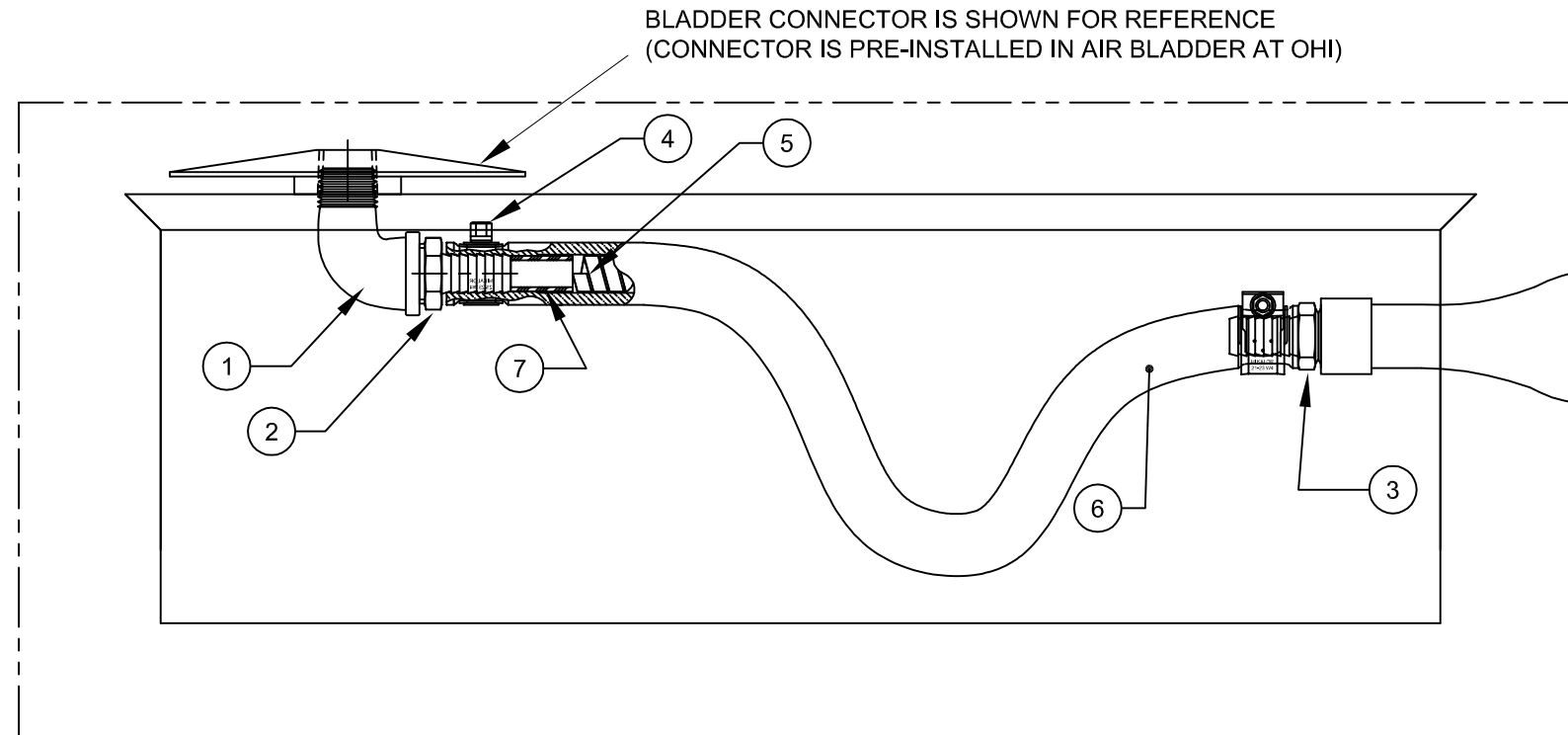
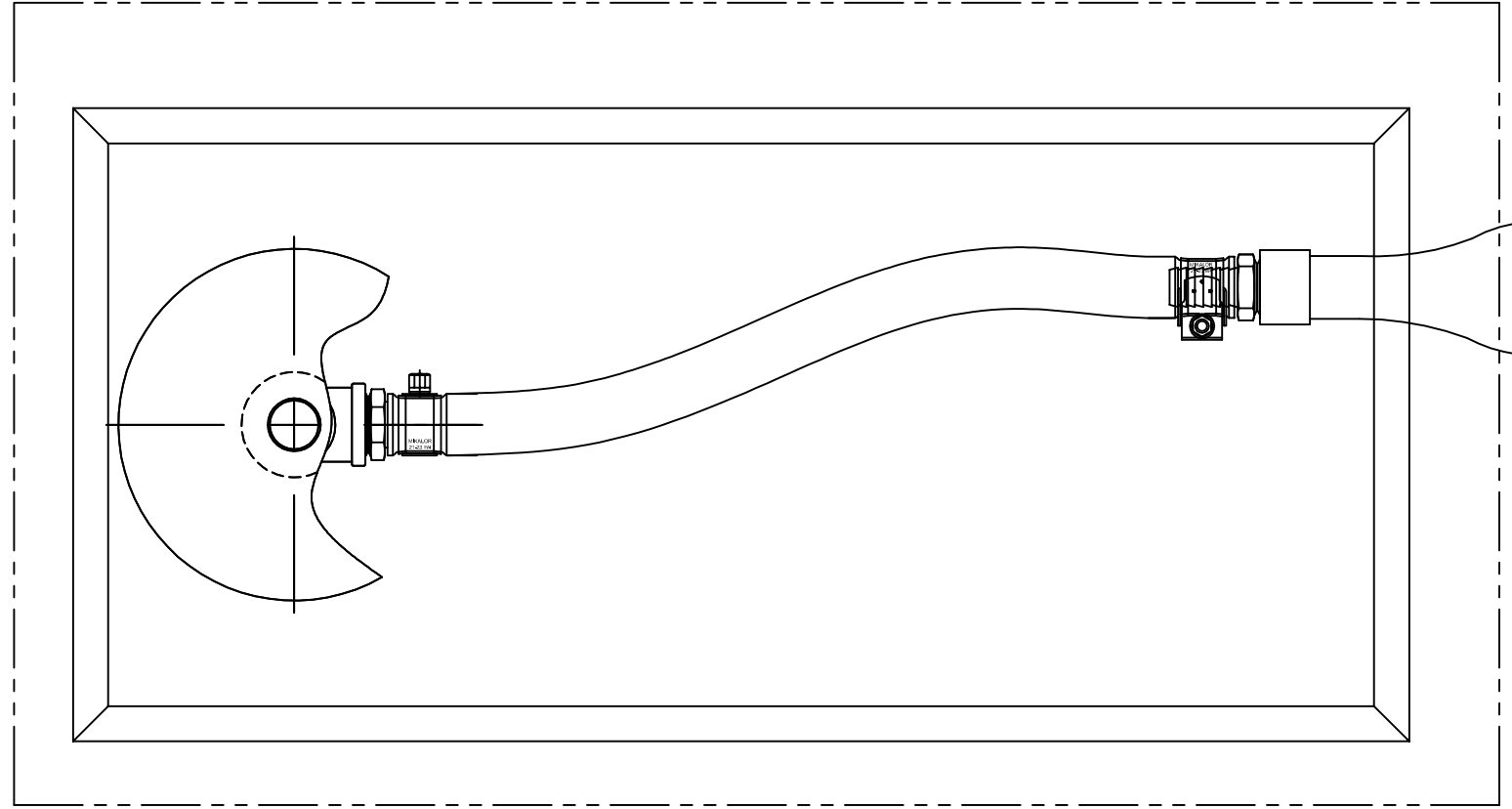
DWG. NO.: OHI-FLC-120

BILL OF MATERIAL EACH BLOCKOUT

ITEM	PART NO.	DESCRIPTION	QTY.
1		1/2" NPT ELBOW, SCH 40, BRASS	1
2		1/2" NPT TO 1/2" HOSE BARB, BRASS	1
3		1/2" NPT TO 1/2" HOSE BARB, STAINLESS	1
4		1/2" CLAMP TYPE, HOSE CLAMP, STAINLESS	2
5	OHI-HDW-SPI-12	1/2" HOSE INSERT, STAINLESS	34"
6		1/2" HOSE, EPDM, POLYESTER REINFORCED	36"
7	OHI-HDW-INS-12-1	1/2" DIA. x 1" LONG PLASTIC TUBE	1

NOTES:

- REFER TO OHI PROVIDED BILL OF MATERIALS FOR QUANTITIES.
- SPIRAL HOSE INSERT (ITEM #5), IS PUSHED THROUGH THE LENGTH OF HOSE ALLOWING 1" AT EACH END OF HOSE FOR THE BARB FITTINGS TO BE INSERTED INTO THE HOSE. (THIS IS TO INHIBIT HOSE CRIMPING AND ALLOWING MAXIMUM HOSE FLEXIBILITY).



NO	REVISION DESCRIPTION	DATE APRVD	APRVD	DRAWN
1	NEW DRAWING	3 JUNE, 2015	JFW	JDM
2	SHORTENED HOSE IN DIAGRAMS	2 FEB, 2018		
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DRAWING DESCRIPTION
 AIR BLADDER
 CONNECTION DETAILS

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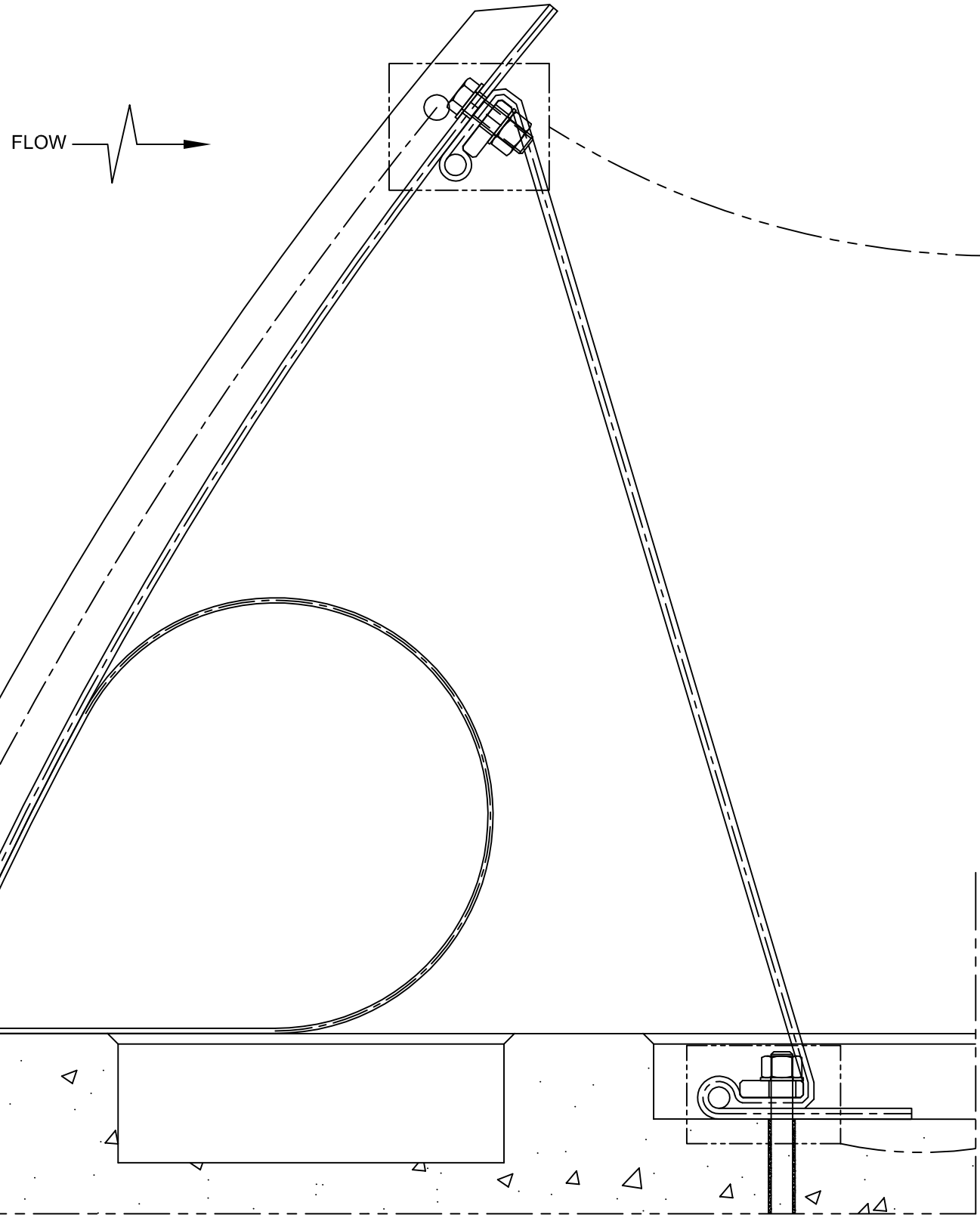
SHEETS	SCALE
1 of 1	NO SCALE
JOB	OHI
DWG. NO.	OHI-FLC-123

BILL OF MATERIAL FOR RESTRAINING STRAP INSTALLATION

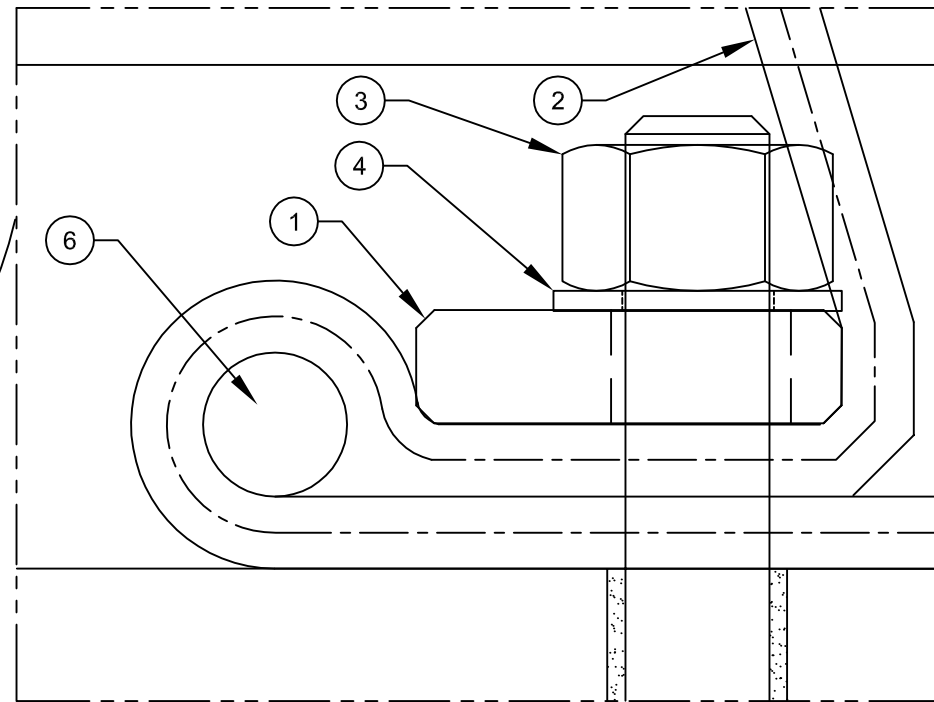
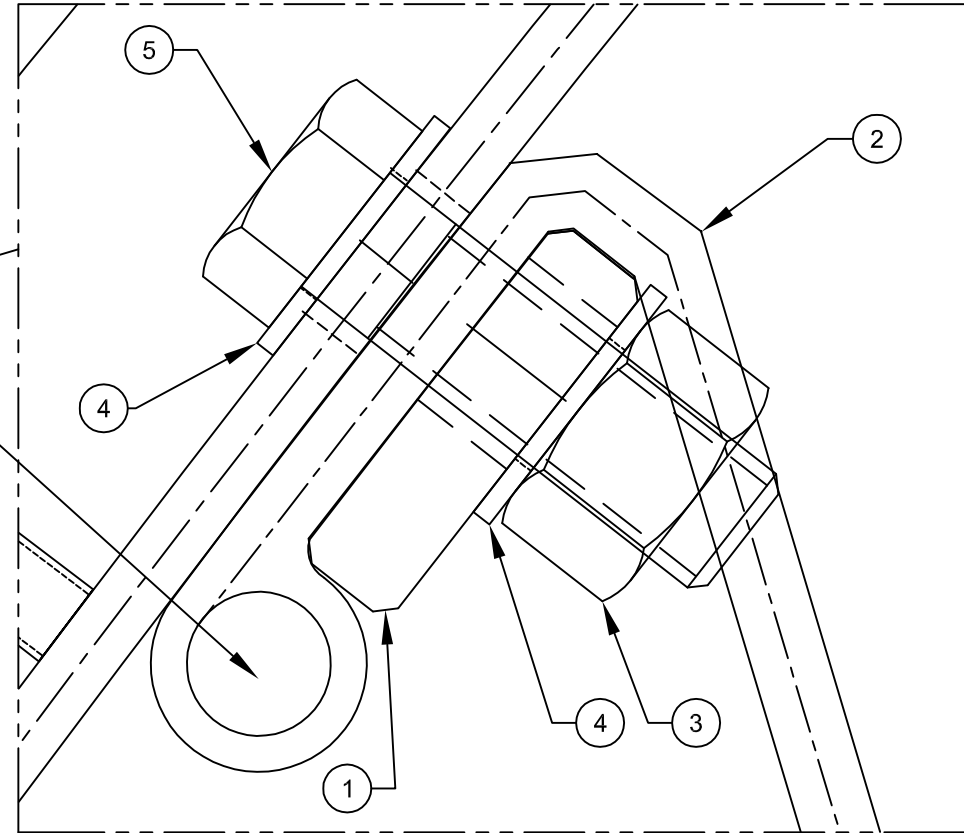
ITEM	PART NO.	DESCRIPTION
1	XX-XXXX-203	RESTRAINING STRAP CLAMP
2	XX-XXXX-302	RESTRAINING STRAP
3	AS REQUIRED	HEX NUT, UNC, STAINLESS
4	AS REQUIRED	FLAT WASHER, STAINLESS
5	AS REQUIRED	HEX HEAD BOLT, STAINLESS
6	OHI-DHW-NYR-04	Ø1" X 6" NYLON ROD

NOTE:

- 1) REFER TO OHI PROVIDED BILL OF MATERIALS FOR QUANTITIES.
- 2) DIMENSION FOR RESTRAINING STRAP IS FOR A START REFERENCE AND MAY CHANGE FOR FINAL ADJUSTED DIMENSION.
- 3) STANDARD DETAIL. PROJECT GEOMETRY MAY DIFFER.



MOLDED
END OF
RESTRAINING
STRAP



NO	REVISION DESCRIPTION	DATE	APRVD	NO
1	NEW DRAWING	3 JUNE 2015	JFW	1
2	ADDED NOTE 3	28 2017	BAH	2
3				3
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7				7

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DRAWING DESCRIPTION
RESTRAINING STRAP
INSTALLATION

© OBERMEYER HYDRO, INC., 2012


SHEETS	SCALE
1 of 1	NO SCALE
JOB	OHI
DWG. NO.	OHI-FLC-124

TIPPECANOE PROJECT

TIPPECANOE, INDIANA
OHI PROJECT NUMBER 17-1995
400 SERIES SHEET INDEX

DRAWING	DESCRIPTION	ISSUE
17-1995-400	CONTROL CABINETS AND PANELS, COVER SHEET	1
17-1995-410-1	10-3 MECHANICAL CONTROL CABINET LAYOUT	1

7					
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1		NEW DRAWING			
NO			REVISION DESCRIPTION		

 <p>Ideas that hold water™ HYDRO, INC.</p> <p><small>THIS DRAWING IS PROPERTY OF OBERMEYER HYDRO, INC. AND IS NOT TO BE USED, DISCLOSED, REPRODUCED OR TRANSMITTED BY ELECTRONIC OR ANY OTHER MEANS WITHOUT PRIOR WRITTEN AUTHORIZATION.</small></p>	<p>DRAWING DESCRIPTION</p> <p>CONTROL CABINETS AND PANELS COVER SHEET</p>	
	<p><small>© OBERMEYER HYDRO, INC., 2016</small></p>	<p>SHEETS 1 OF 1</p>
<p>JOB TIPPECANOE</p>	<p>DWG. NO. 17-1995-400</p>	

APRVD

DATE APRVD

NEW DRAWING

REVISION DESCRIPTION

NO

TIPPECANOE PROJECT

TIPPECANOE, INDIANA
OHI PROJECT NUMBER 17-1995
500 SERIES SHEET INDEX

DRAWING	DESCRIPTION	ISSUE
17-1995-500	MECHANICAL CONTROL SCHEMATIC, COVER SHEET	1
17-1995-500-1	MECHANICAL CONTROL SCHEMATIC	1
17-1995-500-2	MECHANICAL CONTROL SCHEMATIC	1
17-1995-500-3	MECHANICAL CONTROL SCHEMATIC, LEGENDS AND NOTES	1

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DRAWING DESCRIPTION

MECHANICAL
CONTROL SCHEMATIC
COVER SHEET

DRAWING

CJL

DATE APRVD

22 MAR, 2018

REVISION DESCRIPTION

NEW DRAWING

SHEETS

1 OF 1

SCALE

NO SCALE

JOB

TIPPECANOE

DWG. NO.

17-1995-500

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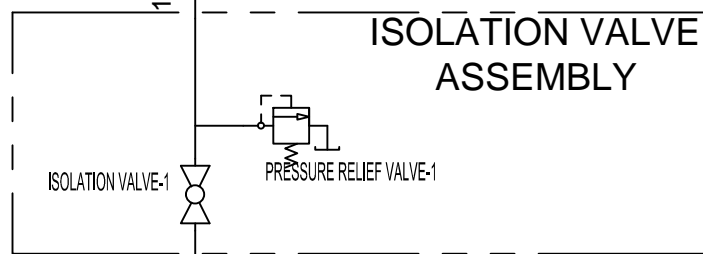
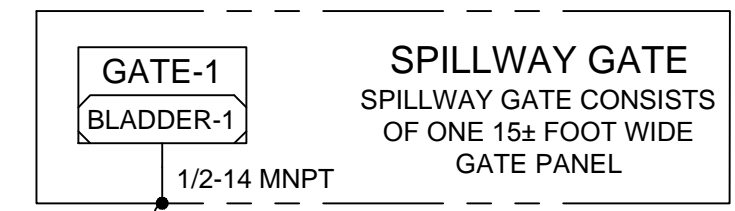
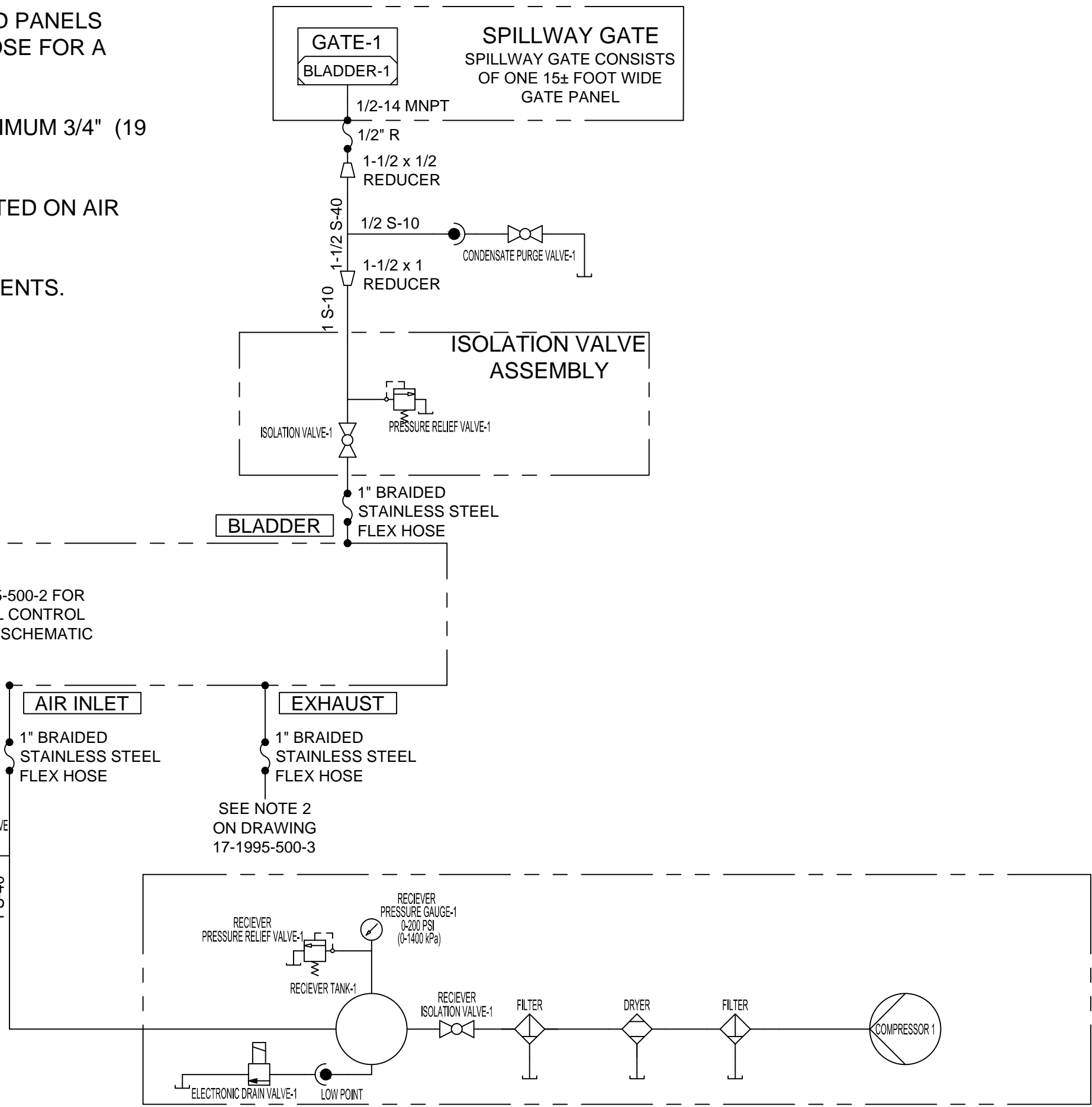
NOTES: (UNLESS OTHERWISE SPECIFIED)

- 1.) ALL AIR LINES INTO AND OUT OF CABINETS AND PANELS MUST BE BRAIDED STAINLESS STEEL FLEX HOSE FOR A MINIMUM OF 12" (31 cm) FROM THE CABINET.
- 2.) PRESSURE RELIEF VALVE-1 MUST HAVE A MINIMUM 3/4" (19 mm) ORIFICE.
- 3.) CONDENSATE PURGE VALVE-1 MUST BE LOCATED ON AIR LINE LOW POINT.
- 4.) SEE 17-1995-500-3 FOR ADDITIONAL REQUIREMENTS.

10-3 MECHANICAL CONTROL CABINET

SEE DRAWING 17-1995-500-2 FOR THE 10-3 MECHANICAL CONTROL CABINET MECHANICAL SCHEMATIC

QUICK DISCONNECT ISOLATION VALVE
QUICK DISCONNECT (FOR AUXILLARY USE)



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NO					REVISION DESCRIPTION	

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DRAWING DESCRIPTION
MECHANICAL CONTROL SCHEMATIC

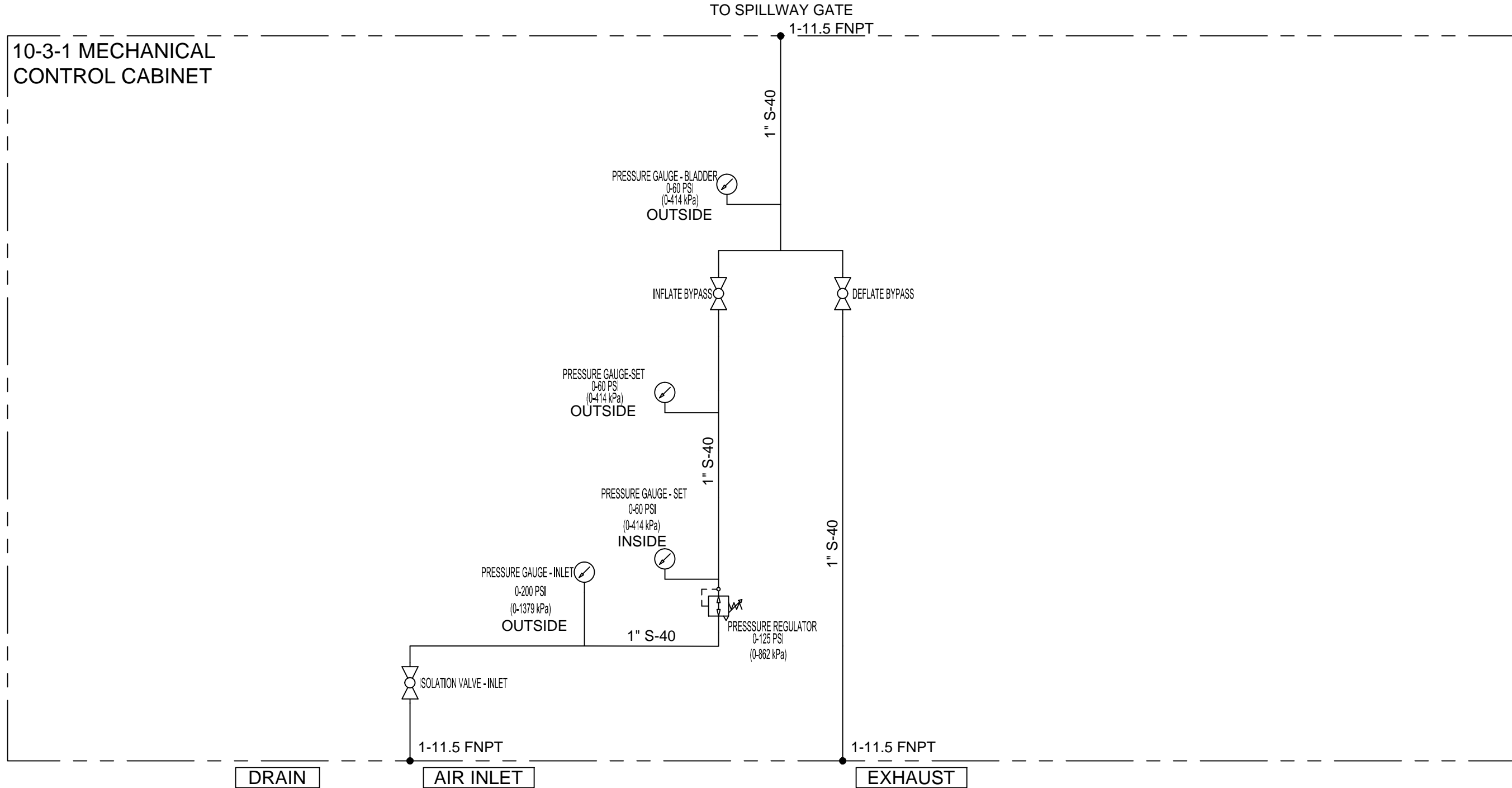
SHEETS	SCALE
1 OF 1	NO SCALE
JOB	
TIPPECANOE	
DWG. NO.	
17-1995-500-1	

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NOTES: (UNLESS OTHERWISE SPECIFIED)

1.) ALL LINES INTO AND OUT OF CABINETS AND PANELS
MUST BE BRAIDED STAINLESS STEEL FLEX HOSE
FOR A MINIMUM OF 12" (31 cm) FROM THE CABINET
OR PANEL.

2.) PRESSURE RELIEF VALVE - ACCUMULATOR MUST HAVE
A MINIMUM 1/2" (13 mm) ORIFICE.



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DRAWING DESCRIPTION
MECHANICAL
CONTROL
SCHEMATIC

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NEW DRAWING

22 MAR, 2018

DATE APRV'D

APRV'D

DRAWN

CJL

SHEETS	SCALE
1 OF 1	NO SCALE
JOB	
TIPPECANOE	
DWG. NO.	
17-1995-500-2	

PIPE SCHEDULE TABLE (A B-C)

A = NOMINAL PIPE SIZE (i.e. 1, 2, 2-1/2)
 B = PIPE MATERIAL:
 C = COPPER
 F = BRAIDED STAINLESS STEEL FLEX HOSE
 G = GALVANIZED MILD STEEL
 H = HDPE
 N = HIGH PRESSURE NYLON
 R = RUBBER
 S = 304 STAINLESS STEEL
 C = SCHEDULE (i.e. 10, 40)

NOTES: (UNLESS OTHERWISE SPECIFIED)

- 1.) ALL LINES INTO AND OUT OF THE CABINET MUST BE BRAIDED STAINLESS STEEL FLEX HOSE FOR A MINIMUM OF 12" (31 cm) FROM THE CABINET.
- 2.) PLUMB EXHAUST TOGETHER AND ROUTE TO THE OUTSIDE OF THE CONTROL BUILDING (CONTRACTOR SHALL FOLLOW LOCAL CODES).
- 3.) OBERMEYER HYDRO, INC. WILL SUPPLY;
 THE 10-2 MECHANICAL CONTROL CABINET,
 AIR BLADDER,
 FLEXIBLE AIR LINE BETWEEN AIR BLADDER AND HARD AIR LINE,
 GATE PANEL, AIR COMPRESSOR (INCLUDING AIR RECEIVER TANK, AND DRYER AND AIR FILTER)
- 4.) THE CONTRACTOR (OTHERS) WILL SUPPLY;
 ALL PIPING, HOSES, HIGH PRESSURE NYLON TUBING, BYPASS VALVE),
 CONDENSATE PURGE VALVE, AND ANY HARDWARE, UNIONS, FITTINGS, WIRING,
 CONDUIT, AND JUNCTION BOXES OR OTHER MATERIALS AND SUPPLIES REQUIRED
 TO INSTALL AND INTERCONNECT ALL OF THE ITEMS SUPPLIED BY OHI.

7								
6								
5								
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1							NEW DRAWING	
NO								REVISION DESCRIPTION

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DRAWING DESCRIPTION

MECHANICAL
CONTROL SCHEMATIC
LEGENDS AND NOTES

SHEETS	SCALE
1 OF 1	NO SCALE
JOB	
TIPPECANOE	
DWG. NO.	
17-1995-500-3	

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