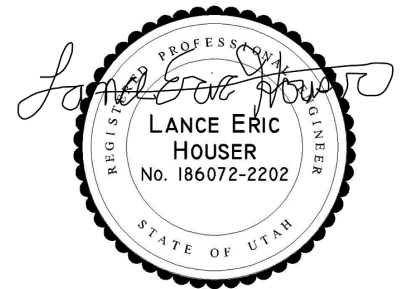


HYRUM BLACKSMITH FORK PHASE 1 CANAL PIPING, NIBLEY YEATES SPRING AND NIBLEY HOLLOW ROAD SPRINGS COLLECTION

CONSTRUCTION DRAWINGS, SPECIFICATIONS, OPERATION and MAINTENANCE



PROJECT:

I have reviewed these specifications and design plans and agree to follow the details herein. I will notify **OWNERS** prior of construction or excavation related to this project at least 1 week prior to initiation and will complete all work prior to April 15th and will keep them informed on a regular basis on the progress of the project.

Contractor:

Date

Witnessed:

Hyrum Blacksmith Fork Canal Company Date

Nibley City Engineer, City representative Date

Prepared By: Lance E. Houser **Date** 9/30/2025

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VOLUME 2, DRAWINGS

ROLES AND RESPONSIBILITIES DURING CONSTRUCTION

OWNER/OWNERS TECHNICAL REPRESENTATIVE

1. Host a pre-construction conference.
2. Obtain all required permits in any are required. Verify with Nibley City. None have been identified.
3. Ensure compliance with all federal, state, and local laws, and zoning regulations.
4. Be available for consultation and decision making for all changes that may arise during construction.
5. Hire competent contractor.
6. Authorize contractor to start work.
7. Follow quality assurance plan.
8. Observe construction and perform needed quality assurance (QA) testing and measurements in order to determine that work meets requirements of the plans and specifications.
9. Provide construction observation at key points to determine if project is being installed per plans.
10. Identify the presence of unexpected site conditions, cultural or historic resources. Investigate and determine need for design changes and provide alternatives as appropriate.
11. Ensure appropriate approvals are obtained before making changes and notify contractors of these approved changes. Negotiate any contract modifications resulting from the associated changes and implement them.
12. Assure compliance with drawing (design) and specification requirements prior to final payment.
13. Stop work of contractor when justified for safety issues or when contractor is not meeting contract requirements.
14. Certify completion of construction for individual components, and entire system indicating that construction meets the requirements of the drawings (design) and specifications. Inform landowner of the components that need inspecting and the details of the inspection to help ensure proper completion of the system.
15. Pay bills (invoices) in a timely manner.
16. Submit all documentation to the State of Utah for reimbursement per contract with the State.

CONTRACTOR

1. Participate in the pre-construction conference.
2. Prepare and submit a Stormwater Pollution Prevention Plan to Nibley City for review and approval prior to receiving Notice to Proceed. Obtain a Notice of Intent from Utah DEQ prior to initiating project.
3. Notify BLUE STAKES prior to beginning construction.
4. Inform OWNERS of planned construction schedule and details prior to beginning and during construction.
5. Provide adequate notice to OWNERS before starting the job so that all parties may be notified (72 hours advance notice).
6. Protect all survey benchmarks from damage. Protect all federal, state, and local monuments. Repair and replace any federal, state, or local survey monuments disturbed at no cost to the OWNERS.
7. Keep landowner informed of progress.
8. Provide survey during construction to maintain proper grades and lines. Survey control reference points have been provided. Alignment center line coordinates have been provided with stationing.
9. Implement required storm water best management practices per Utah Construction General Permit and Nibley City requirements..
10. Immediately inform OWNERS when unexpected site conditions are encountered.
11. Provide/perform necessary layout staking, flagging, and measurements.
12. It is the contractor's responsibility to maintain quality control. This includes all compaction testing, all concrete testing, and Proctors of source material.
13. Protect surface water and groundwater from contamination during construction.
14. Read, know, and follow the construction plans and specifications.
15. Observe and verify utility locations. Comply with Blue Stake laws.
16. Know and work safely within OSHA requirements at all times.
17. Use materials specified in construction drawings (design) and specifications. Obtain materials, equipment, and appropriately skilled personal on-site as scheduled.
18. Contractor must have a foreman (responsible decision maker) and a set of plans and specifications on-site at all times during construction.

19. Build to dimensions, elevation, and quality of workmanship specified in construction drawings (design) and specifications. Perform quality control (QC) activities such as staking, material verifications, and concrete tests where required.
20. Understand construction inspection plans. Do not proceed with work until required inspections are made.
21. Repair or replace construction not meeting plans or specification requirements.
22. Maintain redline drawings throughout project for final delivery to OWNERS.
23. Seed for revegetation any disturbed areas as required.

BID TABLE

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
1	Construction Mobilization	LS	1		\$ -
2	Construction Survey and Staking	LS	1		\$ -
3	Prepare and Implement SWPPP	LS	1		\$ -
4	Site Demolition and Grubbing	SY	1388		\$ -
5	Remove Crack Willow Trees	EA	3		\$ -
6	Remove Existing Debris Piles	EA	2		\$ -
7	Restore Disturbed Areas with Seeding	SY	1388		\$ -
8	Remove Existing 24" HDPE Pipe	LF	60		\$ -
9	Remove and Replace Tuddenham Existing Box Structure	EA	1		\$ -
10	Furnish and Install Channel Stabilization with Geotextile Fabric Included	LF	825		\$ -
11	Furnish and Install Channel Stabilization without Geotextile Fabric	LF	466		\$ -
12	Furnish and Install 36" Polymeric Coated Corrugated Metal Pipe	LF	1273		\$ -
13	Furnish and Install Fabricated Junction	EA	9		\$ -
14	Furnish and Install Fabricated 30" Riser	Ea	9		\$ -
15	Furnish and Install 8" Perforated Pipe	LF	1112		\$ -
16	Furnish and Install French Drain and Gravel Pack	CY	247		\$ -
17	Furnish and Install 3" Infiltration Gravel	CY	124		\$ -
18	Furnish and Install Pipe Backfill and Final Grading	CY	2730		\$ -
19	Furnish and Install Gravel Base	CY	12		\$ -

20	Furnish and Install Concrete For Splitter Structure and Flume Structure	CY	44		\$ -
21	Furnish and Install 4-ft Control Gate	EA	1		\$ -
22	Furnish and Install Splitter Crossing	LF	10		\$ -
23	Furnish and Install Skimmer Bar and Skimmer Boots (2)	LF	17		
24	Excavate and Grade Lower Canal Channel	CY	182		\$ -
25	Furnish and Install 4' Cutthroat Flume	EA	1		\$ -
26	Furnish and Install RipRap	CY	4		\$ -
27	Furnish and Install 36" Yeates Springs Capture Vault	EA	1		\$ -
28	Furnish and Install 10" Yeates Springs Pipe Connection	LF	60		\$ -
Total					\$ -

MEASUREMENT AND PAYMENT

1. Construction Mobilization - Bid Item 1
 - A) Measurement shall be made on a LUMP SUM BASIS.
 - B) Payment shall be:
 - (1) 25% at first pay application.
 - (2) 50% distributed as a percentage complete until project is 75% complete.
 - (3) 25% at final pay application.
 - C) Payment shall cover cost of mobilization, installation of all temporary facilities, and bringing all necessary construction equipment to the site. Upon completion of the Work, any unpaid amount of the original contract for the separate item of mobilization and temporary facilities will be paid. Also includes any and all temporary facilities including but not limited to water, power, fencing (permanent or temporary), fence removal as required, fence restoration at the end of the project, solid waste disposal, and any other temporary facilities or utilities, any and all permits required; and all other items not covered in other bid items.
 - D) Bid price includes the cost of locating and protecting in place all existing bridges, crossings, fences, power poles, and other existing utilities identified in coordination with Blue Stakes and the OWNERS, whether identified on Construction Drawings and in the Specifications.
 - E) Bid price shall include locating (through Blue Stakes) and the protection of all existing utilities (overhead/underground).
 - F) Bid price includes cost of any and all permits not specifically stated in other Bid Items.
 - G) Bid price includes the costs of scheduling and sequencing all construction purchases, installation, methods and means to complete the project by the contract specified completion date.
 - H) Payment shall include cost to protect all existing survey monuments and any cost to repair and/or restore monuments to Cache County Standards and Nibley City Standards.
2. Construction Survey and Staking – Bid Item 2
 - A) Measurement shall be made on a LUMP SUM BASIS.
 - B) Payment must be:
 - (1) paid as percent complete of entire project until project is 90 percent complete.
 - (2) 10 percent on the final pay application.

- C) Payment includes labor, materials, equipment, and costs associated with establishing on site survey control based on the referenced Cache County Control Points, providing construction staking of station centerline and elevation control to enable contractor to install the project to the required grades, verifying elevations and grades to ensure that staked and existing grades are matching with survey control and required grades prior to construction and after installation, and verifying quantities.
 - D) Payment includes labor, materials, equipment, and costs associated with restoring any construction staking disturbed during construction.
 - E) Payment includes labor, materials, equipment, and costs associated with restoring any Private, City, County survey control monuments disturbed during construction.
3. Prepare and Implement Storm Water Pollution Prevention Plan (SWPPP) – Bid Item 3
- A) Measurement shall be made on a LUMP SUM BASIS.
 - B) Payment shall be:
 - (1) 25% at first pay application.
 - (2) 50% distributed as a percentage complete until project is 75% complete.
 - (3) 25% at final pay application.
 - C) Payment covers all costs associated with preparing and maintaining, in cooperation with the OWNERS, a storm water pollution prevention plan (SWPPP) acceptable to CLIENT's Storm Water Inspector throughout the duration of the project and until the site reaches "Permanent Stabilization."
 - D) Payment includes labor, materials, equipment, and costs associated with implementing and maintaining compliance, including the BMPs specified in the SWPPP chosen by the contractor to protect water quality and meet all of the SWPPP requirements of the General Construction Permit (UTRC00000).
 - E) Payment includes the labor, materials, equipment, and costs associated with obtaining and maintaining the current Utah Division of Water Quality Notice of Intent (NOI) and Notice of Termination (NOT) at the appropriate times specified in the permit.
 - F) Payment includes labor, materials, equipment, and costs associated with implementing and maintaining compliance with all requirements of the General Permit for Construction Dewatering and Hydrostatic Testing (UTG070000) as required by the State of Utah Division of Water Quality, Department of Environmental Quality. Costs include all CONTRACTOR inspections associated with the permits and the associated documentation.
 - G) Bid price includes cost of Nibley City Land Disturbance Permit.
 - H) Bid price includes costs associated with any fines or penalties inflicted for non-compliance by the agencies responsible for enforcement at no cost to the OWNERS.

4. Site Demolition and Grubbing – Bid Item 4
 - A) Measurement shall be made on a SQUARE YARD BASIS.
 - B) Payment covers the cost of labor, equipment, and material for the initial removal of onsite deleterious material, vegetation, trees, brush, and root balls required to prepare site for existing structure removal and construction within the work zone.
5. Remove Crack Willow Trees – Bid Item 5
 - A) Measurement shall be made on per EACH BASIS. Each is defined as the entire root mass of the tree, not by the stem.
 - B) Bid price covers all labor, equipment, haul, disposal fees, and materials required for the removal and disposal of crack willow (*Salix Fragilis*). Disposal may be by hauling to an off-site preapproved alternative or by chipping and utilizing the non-root material as compost ground cover over the disturbed areas where restoration seeding is occurring.
 - C) Only trees identified and marked with ribbon by OWNERS are approved for removal.
 - D) Payment includes the removal of roots, unless directed otherwise by OWNERS.
6. Remove Existing Debris Piles – Bid Item 6
 - A) Measurement shall be made on a per EACH BASIS
 - B) Bid price covers all labor, equipment, haul and disposal fees, and materials required for the removal of the designated existing debris piles.
 - C) Bid price covers all labor, equipment, and materials required to grade and leave the site in a clean and neat condition prepared for seeding after debris pile removal.
7. Restore Disturbed Areas with Seeding – Bid Item 7
 - A) Measurement shall be made on a SQUARE YARD BASIS.
 - B) Payment covers the cost of labor, equipment and materials required to prepare area for seed the disturbed areas, obtain specified of seed mix(es), placement of seed mix, protection of seed mix, and guarantee of seed mix until established.
 - C) Costs of maintaining site after planting through seed establishment is excluded from this bid item and included in Bid Item 3, Prepare and Implement SWPPP.
 - D) Costs must include any testing required by the project specifications, including verification of seed quality if not available from the supplier.
8. Remove Existing 24" HDPE Pipe – Bid Item 89
 - A) Measurement shall be on a LINEAL FT BASIS.
 - B) Bid price includes all labor, materials, and equipment to remove 24" HDPE pipe. Price shall also include the salvage of this pipe to a location designated by the OWNER within the project area.

- C) Excavation is not included in this bid item. All excavation of soils is included in the costs associated with installing the 36" Polymeric Coated Corrugated Metal Pipe and Stabilizing the Trench.
 - D) This item only covers the additional care and time to protect the pipe and salvage it during removal.
9. Remove and Replace Tuddenham Existing Box Structure – Bid Item 9
- A) Measurement will be by LUMP SUM BASIS.
 - B) Bid price includes all labor, materials, haul costs and fees, and equipment to remove and dispose of the existing structure while protecting the ends of the existing pipes.
 - C) Bid price includes all labor, materials, and equipment to furnish and replace the structure in accordance to the plans and specifications including excavation, stabilization of the foundation if necessary, forming, reinforcement, concrete, restoring the existing 24" HDPE pipe outlet, protecting and restoring the existing Tuddenham irrigation delivery, protecting the existing Tuddenham valve and appurtenances, and fabricating and installing the specified frame and grate.
 - D) Bid price includes cost of incidental work and materials such as, de-watering, subgrade stabilization, shoring and bracing, and any temporary site work.
10. Furnish and Install Channel Stabilization with Geotextile Fabric Included – Bid Item 10
- A) Measurement shall be made on a LINEAL FOOT BASIS.
 - B) Payment covers the cost of labor, equipment, haul and disposal fees, and materials needed to excavate unstable channel material to the required grade and place the materials necessary to stabilize the channel and trench per plans and specifications where geotextile fabric is required
 - C) Payment also includes all granular borrow material used for bedding the pipe as specified in the plans.
 - D) Costs must include any testing required by the specifications.
11. Furnish and Install Channel Stabilization without Geotextile Fabric Included – Bid Item 11
- A) Measurement shall be made on a LINEAL FOOT BASIS.
 - B) Payment covers the cost of labor, equipment, haul and disposal fees, and materials needed to excavate unstable channel material to the required grade and place the materials necessary to stabilize the channel and trench per plans and specifications where geotextile fabric is NOT required
 - C) Payment also includes all granular borrow material used for bedding the pipe as specified in the plans.
 - D) Costs must include any testing required by the project specifications.

12. Furnish and Install 36" Polymeric Coated Corrugated Metal Pipe – Bid Item 12
- A) Measurement shall be made on a LINEAL FOOT BASIS.
 - B) Payment covers the cost of labor, equipment, and materials needed to furnish and install the pipe, hugger bands, and pipe joint materials as specified in the plans and specifications.
 - C) Cost EXCLUDES the backfill and grading of the pipe. Installation costs are limited to placing the pipe on grade, installing the joints and fittings on grade, and preparing for backfill. Backfill is paid for in Pay Item 18.
13. Furnish & Install Fabricated Junctions – Bid Item 13
- A) Measurement shall be made on a per EACH BASIS.
 - B) Payment covers the cost of labor, equipment, and materials needed to furnish and install the fabricated polymeric coated metal pipe fittings as shown on the construction drawings and specifications.
 - C) Cost shall include the third-party design of these prefabricated structures by the manufacturer, including designing and fabricating the fittings for the angles designated in the plan drawings.
 - D) All joint connections with hugger bands and joint seals are included in BID ITEM 12.
14. Furnish & Install Fabricated 30" Riser – Bid Item 14
- A) Measurement shall be made on a per EACH BASIS.
 - B) Payment covers the cost of labor, equipment, and materials needed to furnish and install the fabricated polymeric coated metal pipe risers attached to the CMP Pipe as shown on the construction drawings and specifications.
 - C) Cost shall include the third-party design of these prefabricated structures by the manufacturer, including designing and fabricating the risers as specified in the plan drawings.
 - D) Cost shall include the cost to furnish, fabricate and attach the 3rd Party frame and grate on the riser as specified in the plans and specifications.
 - E) Cost shall include the cost to provide coating patching as required per manufacturer directions as part of installation of frame and grate installation.
15. Furnish & Install 8 inch Perforated Drain Pipe – Bid Item 15
- A) Measurement shall be made on a LINEAL FOOT BASIS.
 - B) Payment covers the cost of labor, equipment, and materials needed to furnish and install the Perforated Drainpipe including any joints required, fittings, end caps, cutting pipe penetrations into the Polymeric Coated Corrugated Metal Pipe according to manufacturer specifications, installation of approved connections to CMP, and other pipe materials as specified in the plans and specifications.

- C) Cost EXCLUDES the backfill and grading of the pipe. Installation costs are limited to placing the pipe on grade, installing the joints and fittings on grade, and preparing for backfill. Backfill is paid for in Pay Item 18.
16. Furnish and Install French Drain and Gravel Pack - Bid Item 16.
- A) Measurement shall be made on a CUBIC YARD BASIS.
 - B) Payment covers the cost of labor, equipment, hauling costs, and materials, including filter fabric, needed for installation of the French Drain and Gravel Pack. Costs to include all excavation and placement of material in and around the Perforated Drain Pipe (Bid Item 15) as specified in the plans and specifications.
 - C) Costs must include any testing required by specifications.
17. Furnish and Install Infiltration Gravel - Bid Item 17.
- A) Measurement shall be made on a CUBIC YARD BASIS.
 - B) Payment covers the cost of labor, equipment, hauling costs, and materials for the installation of the Infiltration Gravel above the French Drains as shown in the plans and specifications. Costs to include all placement of material specified in the plans and specifications.
 - C) Payment excludes any, and all, excavation in this bid item. Any and excavation is included as incidental to Bid Item 16.
18. Furnish and Install Pipe Backfill and Final Grading - Bid Item 18.
- A) Measurement shall be made on a CUBIC YARD BASIS from the top of the bedding zone.
 - B) Payment covers the cost of labor, equipment, and materials needed to provide, haul, manage on site, place according to plans and specifications, provide final grading and shaping, compact, and in all ways comply with the project plans and specifications.
 - C) Payment for this item has been reduced by the volume of the pipe, and volume of the French Drain.
 - D) Costs must include any testing required by specifications.
19. Furnish and Install Gravel Base– Bid Item 19
- A) Measurement shall be made on a CUBIC YARD BASIS.
 - B) Payment covers the cost of labor, equipment, hauling costs, and materials for the installation of Gravel Base under the Splitter Structure and Cutthroat Flume as specified in the plans and specifications.
20. Furnish and Install Concrete for Splitter Structure and Flume Structure– Bid Item 20
- A) Measurement shall be made on a CUBIC YARD BASIS.
 - B) Payment covers the cost of labor, equipment, hauling and delivery fees, permitting fees, and materials needed to excavate, stabilize the foundation for construction, form, and construct the concrete structures as required in the plans and specifications.

- C) Measurement and Payment will include all costs associated with scheduling and sequencing concrete work with the Cutthroat Flume Placement (Bid Item 24) and Control Gate (Bid Item 21).
 - D) Costs must include any testing required by specifications.
 - E) Costs for concrete washout and disposal are EXCLUDED from this bid item and included in Bid Item 3.
21. Furnish and Install 4' Control Gate – Bid Item 21
- A) Measurement shall be made on a PER EACH BASIS.
 - B) Payment covers the cost of labor, equipment, hauling and delivery costs, and materials needed for the installation of the required control gate specified in the project plans and specifications.
 - C) Payment covers the cost of labor, equipment, and materials needed for the fabrication, delivery and installation of the irrigation slide gate as required per project plans and specifications.
22. Furnish and Install Splitter Crossing – Bid Item 22
- A) Measurement shall be made on a LINEAL FOOT BASIS.
 - B) Payment covers the cost of labor, equipment, and materials needed for the fabrication, delivery and installation of the crossing on the Splitter Structure as specified in the plans and specifications.
23. Furnish and Install Skimmer Bar and Skimmer Boots (2) – Bid Item 23
- A) Measurement shall be made on a LINEAL FOOT BASIS.
 - B) Payment covers the cost of labor, equipment, and materials needed for the fabrication, delivery and installation of the Skimmer Bar and Skimmer Boots as detailed in the Plan Drawings and Plan Specifications. Payment also covers either connection option, the A306 Stainless Steel bolts (2 on Each Boot) or the Field Welding, chosen by the owner for the Skimmer bar to the Boots.
 - C) Payment for Surveying to establish Elevation is provided under pay item 2.
24. Excavate and Grade Lower Canal Channel – Bid Item 24
- A) Measurement shall be made on a CUBIC YARD BASIS.
 - B) Payment covers the cost of labor, equipment, hauling costs, disposal offsite, and materials needed for excavating and grading the Lower Canal Channel to the grade and section specified in the plans and specifications.
 - C) Payment covers the cost of labor, equipment, and materials needed to protect any structures, either belonging to private property owners or to the OWNERS specified in the plans and specifications for protection, or as directed by the OWNERS in the field.

25. Furnish and Install 4 ft Cutthroat Flume – Bid Item 25

- A) Measurement shall be made on an EACH BASIS.
- B) Payment covers the cost of labor, equipment, and materials needed for the fabrication, delivery and installation of the IEI cutthroat flume as required per project plans and specifications.
- C) Payment covers the cost of labor, equipment, and materials needed to deliver and install leveling and smoothing grout for Cutthroat Flume installation per plans and specifications.
- D) Payment excludes the grade control, stabilization and concrete work which have been included in other Bid Items.

26. Furnish and Install Rip Rap – Bid Item 26

- A) Measurement shall be made on a CUBIC YARD BASIS.
- B) Payment covers the cost of labor, equipment, hauling costs, and materials needed for the purchase, delivery and installation of the riprap as required in the project plans and specifications.
- C) Costs must include any testing required by specifications.

27. Furnish and Install 36" Yeates Springs Capture Vault– Bid Item 27

- A) Measurement shall be made on a PER EACH BASIS.
- B) Payment shall cover the cost of labor, equipment, and materials needed to provide and install the prefabricated Yeates Springs Capture Vault as required in the construction drawings and specifications.
- C) Costs shall include excavation, foundation stabilization, gravel base, backfill and other requirements as specified in the plans and specifications.
- D) Costs must include all incidental costs including dewatering and water management during construction.
- E) Costs must include any testing required by specifications.

28. Furnish and Install 10" Yeates Spring Pipe Connection – Bid Item 28

- A) Measurement shall be made on a LINEAL FOOT BASIS.
- B) Payment covers the cost of labor, equipment, and materials needed to furnish and install the Yeates Spring Pipe Connection including any joints required, cutting pipe penetrations into the Polymeric Coated Corrugated Metal Pipe according to manufacturer specifications, installation of approved connections to CMP, and other pipe materials as specified in the plans and specifications.
- C) Cost INCLUDES the backfill and grading of this pipe.

29. Non-Listed Items

- A) The preceding list has been prepared in a best effort to include all items necessary for construction of the project.
- B) The list is not all-inclusive of items that may be necessary for final completion of the project. CONTRACTOR is responsible to include all construction items that may be necessary to complete the project as shown on the plans and described in the specifications.
- C) Any items not listed above shall be included in the item most closely related.
- D) CONTRACTOR shall inform OWNER of any significant construction items that may be considered necessary to complete the project, but which are not included on the plans and described in the specifications. OWNER will evaluate the information and provide an addendum to include the information, if deemed necessary.

END OF DOCUMENT

QUALITY ASSURANCE PLAN

HYRUM BLACKSMITH FORK CANAL PIPING, YEATES SPRING AND HOLLOW ROAD SPRINGS COLLECTION

Quality Assurance Items

- The following items should be inspected at the time of installation to ensure that the system will be functional for the life of the project. The technical representative should be notified 48 hours prior to the installation so that a staff member may be there to document the installation.

Special Quality Assurance Items:

- Preliminary site conditions and documentation.
- Review, reject and/or approve all submittals.
- Pipe invert elevations compared to reference points at start of piping, end of piping, and each junction.
- Check pipe slope daily.
- Review compaction reports.
- Trench stabilization prior to placing pipe bedding at least daily.
- Pipe bedding and backfill at least daily.
- Joint tightening per manufacturer requirements and gasket placement at least daily and randomly.
- Structure Grading and placement of bedding prior to forming for concrete.
- Concrete mix approval at least 1 week prior to concrete being ordered.
- Concrete form elevations and rebar placement prior to concrete placement.
- Observation of contractor's concrete air test, slump test, and collection of 4 break test cylinders.
- Review of break of test cylinders at 7 days, 14 days, and 28 days with one in reserve if needed for longer or re-break.
- Welds of lids to top of access junctions.
- Recoating with vendor approved poly coating of pipe, access junctions, and weld points as required.
- Grubbing extents and debris removal.

- Installation of staff gauges per specifications and drawings.
- Verification of control gate installation and operations.
- Verification of riprap size, gradation, and conditions
- Verification of riprap grade preparation and placement prior to grouting.
- Approval of riprap grout mix, air tests, slump tests, and placement.
- Verification of and inspection of SWPPP BMPs and Contractor SWPPP Compliance.
- Post construction site cleanup and restoration documentation and verification.
- Warranty compliance inspection.

GENERAL REQUIREMENTS

GENERAL:

This construction plan sets forth the requirements for this installation as shown on the drawings and described in the construction specifications. The project must be constructed at the location and to the lines and grades as shown on the drawings in accordance with the construction specifications.

RESPONSIBILITIES:

a. OWNER:

The OWNER is the official spokesperson for this project. For this project, the OWNERS are identified as:

- 1) The Hyrum Blacksmith Fork Irrigation Company and their duly appointed representative, and,
- 2) Nibley City and their duly appointed representative.

All references in the specifications and drawings to OWNER, OWNERS, or landowner must apply to both equally.

The OWNER is the person who reviewed and approved the construction plan, made all contractual agreements with the contractor, ensures construction is in accordance with the requirements as set forth in the plans, obtains all permits and is financially responsible. The OWNER is the sole person who can authorize any changes during construction that incur financial obligations. The OWNER is responsible to repair any disturbed areas by seeding, planting or other methods of mitigating damages.

b. Technical Representative:

Technical Representative may be an Engineer employed by the OWNERS and designated as such. For this project, the Technical Representative for each owner is designated as:

- 1) Scott Woolstenhume (Water Master) for HBFIC
- 2) Tom Dickinson, P.E., Nibley City Engineer for Nibley City.

All references of technical representative or technical representatives must apply to both equally. However, references to the engineer or Nibley City Engineer in the drawings or specifications, must apply to the Nibley City Engineer, due to the

technical requirements. The technical representative has the authority to review the practice during construction and conduct necessary tests and quality control reviews to ensure that all work is in compliance with the construction plan. The technical representative reviews all construction changes and insures that the OWNERS approves prior to installation. The technical representative maintains a job diary and/or construction notes and prepares as-built drawings of the project when applicable and required by the OWNERS.

c. Contractor:

The contractor/installer has a contractual agreement with the OWNERS for the project installation as set forth in the construction plan. The contractor/installer must not make changes to the construction plan without technical representative and OWNERS approval. The contractor/installer must comply with all applicable permits and conduct the work in a safe and timely manner.

CONSTRUCTION PLAN:

a. Specifications:

The construction specifications and material specifications describe minimum acceptable quality of work and materials for the project. Specifications may also reference a commercial standard such as the American Society of Testing Materials, ASTM, which identifies materials. Commercial standards set forth the minimum acceptable quality of identified materials within the industry. If a conflict arises between the drawings and specifications, the specification governs the work and/or material.

b. Drawings:

The drawings are a visual representation to supplement construction and material specifications. The drawings include location, profiles, sections, details and notes necessary to describe the work.

PERMITS:

All permits, rights of ways, and/or easements that are applicable for the construction and/or operation are the responsibility of the OWNERS and must be available for review by the contractor/installer prior to the start of construction.

SAFETY:

The contractor is responsible for compliance with all state and local laws, ordinances, codes, and/or regulations applicable, including OSHA 1910 and 1926, to the project. The technical representative will document any safety violations witnessed.

SPECIAL ENVIRONMENTAL CONSIDERATIONS: Environmental Laws, Executive Orders, Policies, etc.

The OWNERS are responsible for compliance with all wetlands, cultural resources, federal, state and local laws, ordinances, codes, and/or regulations applicable. *Any changes to the layout of the project will need to be cleared with the technical representative 48 hours prior to construction.* The technical representative will document any special environmental violations witnessed.

WORKMANSHIP:

The contractor is responsible for damage of any property that occurs during construction. The construction site must be maintained in a safe and clean manner. The contractor will be responsible for restoring temporary construction areas to pre-existing condition.

Pollution Control:

Contractor is responsible for developing a Storm Water Pollution Prevention Plan (SWPPP) and obtaining the necessary permits from the State of Utah, Division of Water Quality (UDWQ). The Contractor is responsible for following the approved plan and is liable for any fees or fines resulting from the development/violation of the plan.

A SWPPP must be submitted to the technical representatives before construction activities begin. SWPPP must comply with the General Construction permit. As a minimum the SWPPP must consist of:

- 1) Complete Nibley City Construction General Permit SWPPP Template
- 2) Obtain State of Utah NOI
- 3) Obtain a review and approval of these documents by Nibley City prior to the pre-construction meeting.
- 4) Implement the required Best Management Practices (BMPs)
- 5) Provide the required regular inspections and associated documentation.
- 6) Ensure compliance with General Construction Permit
- 7) Allow access and provide free and ready access to all records and information for periodic OWNERS verification of compliance.

Chemical pollution:

Document pollution control plan in SWPPP. The contractor must provide watertight tanks or barrels or construct a sump sealed with plastic sheets to dispose of chemical pollutants, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer wash water, or asphalt, produced as a by-product of the construction activities. At the completion of the construction work, sumps

must be removed, and the area restored to its original condition. Sump removal must be conducted without causing pollution.

Air pollution:

Document dust control BMPs and other actions to control air pollution in the SWPPP. The burning of brush or slash and the disposal of other materials must adhere to state and local regulations. Fire prevention measures must be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards must be constructed and maintained at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project must be sprinkled or otherwise treated to fully suppress dust. All dust control methods must ensure safe construction operations at all times. If chemical dust suppressants are applied, the material must be a commercially available product specifically designed for dust suppression, and the application must follow manufacturer's requirements and recommendations.

The contractor must maintain equipment in such a manner to avoid pollution of the soil, water, or air. Washing down, fueling, or servicing of equipment must not take place in any body of water. OWNERS and the technical representative must be contacted after any spill. The Contractor is responsible for all costs and must clean-up any spill immediately upon discovery. Clean-up methods must comply with guidance and methods approved by the Utah Department of Environmental Quality.

QUALITY CONTROL/QUALITY ASSURANCE:

Quality Control consists of developing, implementing, and maintaining a system to ensure that the specified quality is achieved for all materials and work performed. The contractor must maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities must include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results.

Quality Assurance is performed by the technical representative to ensure that the project is being installed per the construction drawings and specifications. The technical representative is limited to assuring that the quality control system is being followed and is not responsible or authorized to direct construction activities.

CERTIFICATION:

Inspection of the project will be performed by the technical representative during construction and after the work has been completed. If deficiencies are found the OWNERS will be notified by the technical representative verbally and/or in writing regarding corrective actions necessary before certification and payment of the project are made.

CONSTRUCTION SPECIFICATION

CS-UT-31, CONCRETE FOR MINOR STRUCTURES

1. SCOPE

The work consists of furnishing, forming, placing, finishing, and curing Portland cement concrete for structures. The structures must be constructed at the location and to the line and grades as shown in the plan.

2. SITE PREPARATION

The site must be excavated and cleared to a depth and area adequate to place gravel, concrete, and standpipe structure to the standards shown on the drawings and in this specification.

A 1 ½-inch minus gravel material must be placed beneath the structure to provide foundational support and allowing fine leveling as required. The gravel thickness must be a minimum of 6 inches unless otherwise indicated by the technical representative and must be spread to an area no less than 6 inches past the structure in all directions. The finished grade of the gravel must be as shown on the drawings.

3. MATERIALS

Portland Cement: Portland cement must conform to the requirements of ASTM C150 for the specified types of cement. Type I, II or III Portland cement must be used, unless another type is specified on the drawings.

Concrete Aggregates: The coarse and fine aggregate must conform to the durability and gradation requirements of ASTM C33. The maximum size of the aggregate must be 1 inch unless otherwise stated on the drawings.

Admixtures: Air-entraining admixtures must conform to the requirements of ASTM C260. Water-reducing and/or set-retarding admixtures must conform to ASTM C494 Types A, B, D, F or G. Plasticizing, or plasticizing and retarding admixtures must conform to ASTM C494, Types F or G, or C1017 as applicable. Accelerating or water-reducing and accelerating admixtures must be noncorrosive and conform to the requirements of ASTM C494, Types C and E.

Fly Ash: Class F fly ash meeting ASTM C618 may be used in the concrete mix as a partial substitution of Portland cement.

Reinforcing Steel: Steel bars for concrete reinforcement must be Grade 60 new, unfinished, deformed billet-steel bars conforming to ASTM A615/A615M. Welded steel wire fabric reinforcement must conform to the requirements of ASTM A1064/A1064M. Welded deformed steel wire fabric for concrete reinforcement must conform to the requirements of ASTM A1064/A1064M.

Hydrophilic type waterstops must have a minimum tensile strength of 350 psi, Elongation of 600%, Tear resistance of 50 lbs/in and specific gravity of 1.3. Hydrophilic waterstops must meet ASTM D412, D624 and D792.

Concrete Curing Compound: Curing compound refers to a liquid membrane-forming compound suitable for spraying on concrete surfaces to retard the loss of water during the concrete curing process. Curing compound must meet the requirements of either ASTM C309 or C1315. If type 1 is specified, a fugitive dye must be used.

Joint Sealant: Joint Sealant must conform to ASTM C920, Type S, Grade NS, Class 25, Use I. Sealant must have as a minimum movement capability of $\pm 35\%$ and tensile strength of 300 psi. The sealing compound if used with other joint material, such as fillers or gaskets, must be compatible.

4. CONCRETE MIX DESIGN

Concrete mixes must be composed of Portland cement, fine and coarse aggregates and clean water. Portland cement Type III and IIIA may be used upon request and acceptance by the technical representative, based on a need for early concrete strength to facilitate construction. Maximum size of the coarse aggregate must not exceed 1 inch. Fly ash may be used as a partial substitution for Portland cement in an amount of no more than 25 percent (by weight) of the cement in the concrete mix.

The compressive strength of the concrete mix must be a minimum of 4,500 psi at 28 days. The water cement ratio must be no greater than 0.5 by weight, unless noted otherwise on construction drawings.

An air-entraining admixture must be used; concrete must have air entrainment of 5 to 7 % (by volume) of the concrete at the time of placement.

Use of calcium chloride or antifreeze compounds is not permitted in any concrete mix.

Fiber mesh may be used as a secondary reinforcement to increase resistance to cracking and must not replace reinforcing steel as shown on the drawings. Fibers must be added to the concrete mix at a minimum rate of 1.5 pounds per cubic yard of concrete and a maximum of 15 pounds per cubic yard. Fiber mesh material must be 100 percent virgin polypropylene fibrillated fibers containing no

olefin materials and conform to ASTM C1116 and C1399. The individual fibers must have a graded length of ½ inch to ¾ inch and incorporated into the concrete mix per manufacturers recommendations.

The slump must be 2 to 5 inches except when superplasticizer is used in the concrete mix. When superplasticizer is used, the slump must not exceed 8 inches following addition and mixing. Additional superplasticizer must not be added to the concrete mix after discharge of the concrete at the job site has commenced

Ten days prior to the concrete placement, the contractor must provide to the technical representative, a statement of the materials and mix proportions (including any admixtures needed) intended for use. The statement must include evidence satisfactory to the technical representative that the materials and proportions will produce concrete conforming to strength and mix requirements. The identified materials and proportions constitute the "job mix." After a job mix has been approved, neither the source, character, or grading of the aggregates nor the type or brand of cement or admixture must be changed without prior notice to the technical representative. If such changes are necessary, no concrete containing new or altered material must be placed until the technical representative has approved a revised job mix.

5. STEEL REINFORCEMENT

The reinforcement must be the size, grade and overlap length as shown on the drawings and must be based on ACI 350-06, Sections 12.2.2 and 12.15, using the appropriate factors for a Class B splice. Reinforcing steel must be free from rust, oil, grease, paint or other deleterious matter. Welded wire fabric must overlap the larger of 6 inches or two mesh spacings. Installation of reinforcing into fresh concrete is not permitted. Welding of reinforcing steel is not permitted.

All reinforcing must be supported and securely fastened in-place to prevent movement during placement of the concrete. Stabbing of reinforcing steel into wet concrete must not be permitted. Vertical reinforcement must be supported by either plastic chairs or epoxy coated steel wire. Horizontal reinforcement must be supported by concrete blocks having strength equal to or greater than the 28-day compressive strength of the concrete being placed, or plastic chairs.

Maintain the following concrete coverage for concrete reinforcing:

Uniformed surface in contact with earth	3"
Formed surface in contact with earth	3"
Formed surfaces exposed to outside weather	2"
Clear distances between bars	2"

When specified on the construction drawings, the contractor must provide to the technical representative a construction plan detailing size, location, dimensions, bend angles, minimum overlap, embedment length and quantity of reinforcing steel to be placed (rebar schedule). The contractor must provide the rebar schedule to the technical representative 10 days prior to placement for approval.

6. FORMS

Concrete forms must have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration without deflecting from the prescribed lines. They must be mortar-tight and constructed so that they can be removed without hammering or prying against the concrete. Form surfaces must be smooth and free from holes, dents, sags, or other irregularities. Forms must be coated with a non-staining form release agent prior to being set into place. All form work must remain in place a minimum of 24 hours after placement of concrete. The contractor must be responsible for the construction, design, placement and removal of all form work. All shoring during placement of concrete is the sole responsibility of the contractor.

All form ties must permit their removal to a depth of 1 inch below the surface of the concrete without injury to the concrete and must not be used without use of cones. Form ties that break off at the surface of the concrete must not be permitted. Cone holes must be filled with a non-shrink concrete grout that is tamped into the hole immediately after form removal.

Items to be embedded in concrete must be positioned accurately and anchored firmly.

7. WATERSTOPS

Waterstops must be of the size, dimension and location shown on the drawings and must be held firmly in the correct position as the concrete is placed. Joints must be cemented, welded, or vulcanized as recommended by the manufacturer. Joints must be watertight. Intersecting waterstop joints must be prefabricated and supplied by the same manufacturer providing the waterstop.

8. CONSTRUCTION JOINTS

Construction joints must be made at locations shown on the drawings and of the type specified by the technical representative.

Surfaces of construction joints must be cleansed of all unsatisfactory concrete, laitance, coatings, stains, or debris by washing and scrubbing with a wire brush or wire broom and kept moist for at least one hour prior to placement of new concrete.

In addition, the top surfaces of walls and columns must be immediately and carefully protected from any condition that might adversely affect curing of concrete.

Expansion and contraction joints must be made only at locations shown on the drawings. Exposed edges on these joints must be carefully tooled, chamfered and free of mortar and concrete spillage.

Preformed expansion joint filler must be held firmly in the correct position as the concrete is placed and must be left exposed for its full length with clean and true edges.

9. SAFETY

The contractor is responsible for compliance with all state and local laws, ordinances, codes, and/or regulations applicable, including OSHA Part 1910 and 1926, to the project. The technical representative will document any safety violations witnessed.

The contractor must develop and implement safety protocols that comply with OSHA Part 1910 and 1926. As a minimum the procedures will include: catwalks and railings for work performed in excess of 4 feet above the ground (ladders may be used as work platforms only when use of small hand tools or handling of light material is involved), protective cones for all vertically exposed rebar, and construction equipment (including concrete delivery trucks) must be equipped with reverse alarms. If a concrete bucket is used, no person must either ride or at any time be directly underneath a bucket in transport.

10. PLACEMENT

Contractor must notify the technical representative 48 hours prior to the placement of concrete to allow inspection of the reinforcing steel, forms, subgrade, preparation for curing, and vibrating equipment. Concrete must not be placed until the subgrade, forms, and steel reinforcement have been inspected and approved.

Prior to placement of concrete, the forms, reinforcing steel, and subgrade must be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, rust or other harmful substances and/or coatings. Rock surfaces must be cleaned by wire brushing, wet sand-blasting, air water jets or other means satisfactory to the technical representative. Earth surfaces must be firm and damp before placing concrete. Placement of concrete on mud, dried earth, uncompacted fill or frozen subgrade will not be permitted.

No additional water must be added to the concrete at time of placement to increase slump and workability of concrete, unless water has been withheld prior to mixing of the concrete (trim water). In that event, water may be added to the

volume levels which had been withheld, such that the total water of concrete mix placed is equal to the approved mix proportions.

The maximum length of time between introduction of the cement to the aggregates and placement of the concrete in the forms must not exceed 1-1/2 hours for concrete temperatures below 85° F or 45 minutes for concrete temperatures above 85°F.

Mobile concrete mixers or volumetric batching and continuous mixing at the construction site is permitted. The batching and mixing equipment must conform to the requirements of ASTM C685 and must be demonstrated before placement of concrete by tests with the job mix to produce concrete meeting the specified proportioning and uniformity requirements.

Concrete must be consolidated by either hand spading and tamping or mechanical vibration to ensure smooth and dense concrete along form surfaces, in corners, and around embedded items. The use of vibrators to transport concrete in the forms is not permitted. Vibration must not be applied directly to the reinforcement steel, forms, or to concrete that has begun to set.

Successive layers must be placed at a fast enough rate to prevent the formation of “cold joints”. If a successive layer cannot be placed in a timely manner, a standard type construction joint must be used between layers.

Concrete must be placed in horizontal lifts not greater than 20 inches. Concrete must not be dropped more than 5 feet vertically, or 12 feet vertically for a superplasticized concrete mix. An elephant trunk, chute, or similar means must be used when applicable to minimize the vertical drop.

The depositing of concrete must be regulated so that concrete may be consolidated with a minimum of lateral movement, segregation, laitance, or honey-combing. Hoppers and chutes must be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the placing level. Temporary stays and braces can be removed when no longer needed.

Vibration is required at all joints that contain waterstops.

11. DELIVERY TICKETS

The contractor must obtain from the supplier a delivery ticket for each load of concrete before unloading at the site. A copy of the delivery ticket for each truckload of ready mix concrete must be available for review by the technical representative. The following minimum information must be included on each load ticket:

A. Name of concrete supplier and batch plant

- B. Name of purchaser and job location
- C. Date of delivery
- D. Truck Number
- E. Amount of concrete delivered
- F. Time loaded or time of first mixing of cement and aggregates
- G. Mixing water in the load as free water, including any water trimmed
- H. Type and amount of cement
- I. Type and amount of admixtures
- J. Weights of fine and coarse aggregate
- K. Percent moisture content or weight of free water contained in the aggregate.

The contractor or inspector must also include the following additional information on the load ticket:

- L. Water added by the receiver of the concrete
- M. Time the concrete arrived at the site
- N. Time the concrete was completely unloaded.

12. FINISHING OF UNFORMED SURFACES AND CURING

All flat work surfaces must be true and even, and must be free from open or rough spaces, depressions, or projections. All flatwork must be screeded to grade and then bull-floated. Vibratory screeding may be used in lieu of bull-floating.

Sloped slabs must be worked to a uniform grade, maintaining the specified thickness, and finished in a manner to insure dense concrete. All sloped surfaces must be true and even, and must be free from open or rough spaces, depressions, or projections.

Excessive floating or troweling while the concrete is soft must not be permitted. The addition of dry cement or water to the surface of the screeded concrete must not be permitted.

Concrete edges must be chamfered 3/4 inch or finished with molding tools.

Concrete must be cured for a period of at least 7 days after it is placed. Exposed concrete surfaces must be kept continually wet during the entire curing period or until curing compound is applied.

Curing compound must be thoroughly mixed immediately before applying, and must be applied at a uniform rate recommended by the manufacturer, as a minimum. It must form a uniform, continuous, adherent film over the entire surface.

Curing compound must not be applied to surfaces requiring bond with concrete remaining to be placed, construction joints, reinforcing steel, and embedded items. These areas must be wet cured.

Concrete surfaces subjected to heavy rainfall, running water and/or other moisture damage within 3 hours after curing compound has been applied must receive a second application.

13. FINISHING FORMED SURFACES AND CURING

Concrete edges must be chamfered 3/4 inch or finished with molding tools.

Concrete must be cured for a period of at least 7 days after it is placed.

Forms must not be removed without approval of the technical representative. Removal of forms must be done in such a way as to prevent damage to the concrete and in a way that will allow the concrete to take the stresses due to its own weight uniformly and gradually.

Wall forms and forms for joints with waterstops must not be removed for 24 hours after the concrete is placed. Other forms may be removed when the concrete is sufficiently cured so that the concrete will not be damaged. When forms are removed prior to the 7 day curing period the concrete surfaces must be kept continually wet during the entire curing period or until curing compound is applied.

Age of stripped concrete must be at least 7 days before any load is applied other than the weight of forms, scaffolds and succeeding lifts.

The following must be done immediately after removal of forms.

- A. Removal of all fins and other surface irregularities which affect appearance or function.
- B. Removal of all form bolts and ties to the depth of their cone.
- C. All cavities, holes and honey-combing must be thoroughly cleaned, wetted and filled with dry pack mortar. The area to be patched must be kept damp prior to patching.
- D. The patching mortar must be compacted to form a dense, well-bonded unit that is free from shrinkage cracks.
- E. All patched areas must be cured as specified in Section 11.

14. REMOVAL OR REPAIR

Concrete that is honeycombed, damaged, frozen or otherwise defective must be removed or repaired immediately upon discovery, at the contractor's expense. The technical representative must be notified of any damaged concrete. The contractor must submit to the technical representative a removal/repair plan prior to performing any repair work for concurrence.

All patching repairs must be made using a non-shrink grout material and installed per the approved plan. When proprietary patching material is proposed in the plan, the manufacturer's data sheets and written recommendations must be included in the plan.

Repair material or replacement concrete must have properties, color, and texture similar to and compatible with the concrete being repaired or replaced. Repair or replacement concrete work must be performed only when the technical representative is present.

Curing of repaired or replaced concrete must be started immediately after finish work is completed or as specified by the manufacturer of proprietary compounds.

15. SPECIAL PROVISIONS FOR CONCRETING IN HOT/COLD WEATHER

Hot Weather:

For this specification, hot weather is defined as any combination of high ambient temperature, (generally above 80°F), low relative humidity, and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

The temperature of the concrete must be less than 90°F during mixing, conveying and placement.

Special provisions must be made to immediately protect and cure the concrete due to rapid drying conditions. Concrete surfaces exposed to the air must be kept continuously wet for the first 24 hours of the curing period or until curing compound is applied.

In extreme conditions, it may be necessary to (1) restrict placement to late afternoon, or night, (2) restrict the depth of layers to assure coverage of the previous layer while it will still respond readily to vibration, (3) suspend placement until conditions improve.

Cold Weather:

For this specification, cold weather is defined as when the daily minimum ambient air temperature at the site is less than 40°F.

The temperature of the concrete at the time of placement must not be less than 50°F, nor more than 90°F. Heated water of 140°F or less may be used when cement is added to the mix.

Prior to placement of concrete, all ice, snow and frost must be completely removed from all surfaces to be in contact with the concrete.

The use of antifreeze or accelerator compounds is not allowed.

The concrete must be protected for a minimum of three days following placement with insulated blankets or heated enclosures. Combustion heaters must have exhaust flue vented out of the concrete protection enclosure and must not be permitted to dry the concrete.

Concrete must maintain a uniform temperature throughout its entire dimension to minimize thermal expansion/contraction cracks.

In both hot and cold weather concreting, the contractor must furnish to the technical representative, a record of daily maximum and minimum ambient air and concrete surface temperatures during the curing period.

16. PIPE DETAILS

Pipe entering into or leaving the structure must cast into the wall of the structure and be located as shown on the plans. The joint must be watertight.

17. SAFETY GRATES ON THE STRUCTURE

If the structure has an open top a protective cover is required on top of the structure to prevent accidental entry. Covers must be permanently attached to the structure, support the weight of an adult and allow adequate access for maintenance. The grates must be sturdy and made of steel unless otherwise approved by the engineer.

18. HEADGATES

Structures requiring headgates must have new screw-type headgates matching the appropriate size of pipe used or size of gated opening. Headgates must be mounted securely to the pipe or the structure using manufacturer's specifications. Support for the frame of the gate may be required for tall gates. The headgate frame may be supported by the structure. The headgate riser stem must be tall enough that removal of the safety grate is not required to operate the gate.

19. MEASUREMENT AND PAYMENT

Concrete is measured to the neat lines or pay limits as shown on the drawings, and the volume of concrete is computed to the nearest 0.1 cubic yard. No deduction in volume is made for chamfers or edges.

Payment for each item of concrete is made at the contract unit price for that item. The payment for concrete will constitute full compensation for completion of the concrete work, including furnishing and placing reinforcing steel, furnishing and handling concrete, joint fillers, waterstops, metal plates, dowels or dowel assemblies, and metal plates, but not including other items listed for payment elsewhere in the contract.

20. ITEMS OF WORK AND CONSTRUCTION DETAILS

The items of work include the splitter structure and the grout material for grouted riprap.

CONSTRUCTION SPECIFICATION

CS-UT-201, EXCAVATION AND BACKFILL OF TRENCHES FOR CONDUITS AND PIPELINES

1. SCOPE

This specification applies when trench excavation is necessary for installation of a conduit and/or pipeline.

2. EXCAVATION

The bottom width, side slopes, and gradeline of the trench excavation must be to the dimensions and lines shown on the drawings. The minimum depth of cover over the top of the pipe must be 30" unless otherwise specified on the drawings. The trench width must be 2 times the pipe diameter or 24 inches whichever is greater.

Excavated trenches must conform to state and local laws and regulations for trenching. Trenches must be supported as necessary to safeguard the work and workers. Trench supports must prevent sliding or settling of the adjacent ground.

3. BACKFILL

- A. The initial backfill must be select material that is 1 inch diameter or finer, placed and compacted around and above the conduit to the depth and density indicated on the drawings. All material greater than 1 inch in diameter within 6 inches of the pipe must be removed.
- B. The final backfill may be the material from the trench excavation that is less than 3 inches in diameter. The final backfill must be compacted to 85 % of standard proctor.
- C. Backfill material must contain no frozen soil, sod, brush, roots, or other perishable material.
- D. For depth of cover over the pipe see design drawings.

Table 1 lists some general properties of materials suitable for bedding. Gradation is unique for each soil in the USCS. Bedding requirements noted in drawings must supersede this table.

Table 1. USCS Soil Gradation for backfill

Material	USCS	S.G. (Min.)	Size (Max.)
Soil	SW,SP,SM,SC,ML,CL	1.75	#10 Sieve
Fine Gravel	SW,SP,SM,SC	2.00	3/4-inch
Coarse Gravel	GW,GP,GM,GC	2.40	3-inch
Clean Gravel	GW	2.40	1.5-inch

4. FINAL GRADING

All disturbed areas must be returned to original grade or design grade accounting for settlement after compaction.

5. SITE RESTORATION

All disturbed areas must be restored or revegetated as identified herein:

- A. The portion of the trench designated as maintenance access must be compacted and graded at a 2% slope toward the west hillside, so it does not create erosion. The surface must be covered with coarse gravel as covered as detailed in the design drawings.
- B. The portion of the trench associated with the spring water collection system must be consolidated clean gravel.
- C. The portions of the disturbed areas remaining that require revegetation must be restored with the following seed mix hydroseeded with a tackifier per landscape industry standards.
 - a. Suppliers:
 - i. Granite Seed (801) 768-4422.
 - ii. Wheatland Seed (801) 676-0191.
 - iii. Mountain Valley Seed (801) 486-0480.
 - iv. Substitutions: Upon approval of the Nibley City Engineer as part of the SWPPP.
 - b. Application Rates
 - i. All seeds shall be placed at a rate of 22 lbs of live seed per acre. Application rate must be adjusted by the live seed and germination rates certified for each seed type.
 - c. Seed Mix Availability

- i. If any of the specific seeds are not readily available or is excessively priced, contact Nibley City Engineer and OWNERS with recommendations for alternative from supplier of a equivalent seed.
 - d. Grass Mix:
 - i. Mountain Brome: 25 percent.
 - ii. Bluebunch Wheatgrass: 25 percent.
 - iii. Idaho Fescue: 25 percent.
 - iv. Slender Wheatgrass: 15 percent.
 - v. Indian Ricegrass: 10 percent.
 - e. Hydroseeding
 - i. Track slopes with tracked equipment straight up slope to create divots to hold seed and water.
 - ii. Planting Season: Late fall or early spring.
 - iii. Ensure tackifier does not restrict germination of native seeds.
 - iv. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at a rate of specified seed rate acre evenly in one pass.
 - v. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil.
- D. MAINTENANCE
 - a. Repair washouts or gullies.

CONSTRUCTION SPECIFICATION

CS-UT-02, CLEARING AND GRUBBING

1. SCOPE

The work consists of the clearing and grubbing of designated areas by removal and disposal of trees, snags, logs, stumps, shrubs, vegetation and rubbish.

2. REMOVAL

All trees, snags, logs, brush, stumps, and shrubs not marked (section 3) for preservation and rubbish/debris piles must be removed from within the limits of the construction areas. Unless otherwise specified, all stumps, roots and root clusters having a diameter of 1 inch or larger must be grubbed out to a depth of at least 2 feet below subgrade elevation for concrete structures and 1 foot below the ground surface for earthfills.

3. MARKING

The limits of the area(s) to be cleared and grubbed will be marked by stakes, flags, tree markings, or other suitable methods.

Trees to be left standing and uninjured will be designated by special markings placed on the trunk about 6 feet above the ground surface.

4. SALVAGE

Brush piles to be salvaged must be established as shown on the drawings.

5. DISPOSAL

Where brush accumulations are not specified on the drawings for preservation, cleared and grubbed materials must be disposed of by hauling away to selected locations approved by OWNERS. Materials may be hauled to a green-waste disposal or chipped for disposal on site as mulch for vegetative restoration and erosion control. Where cleared and grubbed materials are hauled offsite, they must be disposed of in accordance with local and state laws. Any burning operations must be subject to all public laws governing such operations.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Clearing and grubbing of the project will be based on the canal right-of-way, approved access, and project centerlines as defined in the design drawings general notes.

CONSTRUCTION SPECIFICATION

CS-UT-11, REMOVAL OF WATER

1. SCOPE

The work consists of the removal of surface water and ground water as needed to perform the required construction. This also includes the dewatering of borrow sites. It must include furnishing, constructing and operating all temporary facilities and equipment. This construction specification also includes removal of temporary facilities.

2. DIVERTING SURFACE WATER

Protective measures needed to divert stream flow and other surface water must be built, maintained, and operated during construction.

3. DEWATERING CONSTRUCTION AND BORROW SITES

The construction site must be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. Dewatering must include furnishing, installing, operating and maintaining all equipment including pumps as needed.

4. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, they must be removed or graded to present a neat appearance without interfering with permanent drainage systems or stream flows.

5. EROSION AND POLLUTION CONTROL

All temporary works must be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

- This project requires the piping of the Hyrum Blacksmith Fork Canal and the collection of spring flows along the hillside. Dealing with water during construction to allow for the installation of the pipeline and the drain collection system on a stable base will be essential to a successful and profitable project.

CONSTRUCTION SPECIFICATION

CS-UT-252, CONDUITS AND PIPELINES

1. SCOPE

The work consists of furnishing and placing circular, arched or elliptical pipe and necessary appurtenances.

2. MATERIALS

Pipe and fittings must conform to the requirements of the applicable NRCS Material Specifications listed below, for the type and grade of material being used. Where connecting bands are used, they must withstand the internal pressure of the installation without leakage.

All pipe sizes and classes must be as shown on the drawings. Any change must be approved by the technical representative prior to the purchase of the pipe.

3. MATERIAL HANDLING

The material must be delivered and handled in a manner that will not damage, or reduce its strength, or damage the coating. All special handling requirements of the manufacturer must be adhered to. When handling and placing coated or plastic pipe, care must be taken to prevent damage resulting from metal surfaces or rocks. Care must be exercised while handling the pipe during cold weather. Pipe that is mishandled must be fully inspected for damage and cracks. Damaged pipe must not be used. All fittings and couplers must equal or exceed the pressure rating of the pipe with which they will be used. They must be made of material that is recommended by the manufacturer for use with the pipe.

4. LAYING AND BEDDING

Unless otherwise specified, the pipe must be installed in accordance with the manufacturer's recommendations. The pipe must be laid such that the spigot must be inserted into the bell.

Soil material, fine gravel or coarse gravel specified as bedding material must be durable, non-compressible and be within the grading limits of the Unified Soil Classification System, USCS. The ASTM specifications for classifying soils are: ASTM D-2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), and ASTM D-2488,

Standard Practice for Description and Identification of Soils (Visual Manual Procedure).

The following table lists some general properties of materials suitable for bedding. Gradation is unique for each soil in the USCS. The bedding requirements are site specific and must be shown on the drawings using an identification symbol of the USCS.

Material	USCS	S.G. (Min.)	Size (Max.)
Soil	SW,SP,SM,SC,ML,CL	1.75	#10 Sieve
Fine Gravel	SW,SP,SM,SC	2.00	3/4-inch
Coarse Gravel	GW,GP,GM,GC	2.40	3-inch
Clean Gravel	GW	2.40	1.5-inch

Installation of the pipe must be in accordance with Construction Specification CS-UT-201, and bedding material must be hand compacted around the pipe to the depth of cover as stated on the drawings. The trench width must be 2 times the pipe diameter or 24 inches whichever is greater.

Perforated pipe must be laid with the perforations down and oriented symmetrically about a vertical center line. Perforations must be clear of any obstructions at the time the pipe is laid.

During backfilling, the pipe must be anchored to prevent separation from the bedding. The pipe must be laid so the pipeline barrel is uniformly supported, which may require special excavation for bells and/or couplings.

5. STRUTTING

When required, struts or horizontal support ties must be installed as specified on the drawings. Struts and ties must remain in place until the backfill has been placed to a height of 5 feet above the top of the pipe, or has been completed if the finished height is less.

6. JOINTS

Pipe joints must conform to the details prescribed by the manufacturer and shown on the drawings. All joints and connections must be sound,

watertight, and withstand a working pressure equal to or greater than the pipe.

The joints must be made in a manner so that the inside of the pipe is free from obstructions.

When bell type joints with gaskets are used, the spigot must be inserted into the bell to the proper markings shown on the pipe.

7. COATINGS

All coatings must be inspected after final placement and just prior to backfill. Any pinholes and/or damage must be repaired with a material that is recommended by the manufacturer.

8. NRCS MATERIAL SPECIFICATIONS

A. CORRUGATED METAL PIPE

Corrugated metal pipe and fittings must conform to the requirements of the applicable Specification for the specified classes and shapes of pipe, as listed:

Corrugated steel pipe: ASTM A-760, Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains. Refer to NRCS MS 551 Coated Corrugated Steel Pipe.

Corrugated aluminum pipe: ASTM B745, Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains. Refer to NRCS Material Specification, MS-552, Aluminum Corrugated Pipe.

The additional requirements apply for riveted seams:

- a. Unless otherwise specified, circumferential shop riveted seams must have a maximum rivet spacing of 6 inches, except that 6 rivets will be sufficient for 12-inch diameter pipe.
- b. When close riveted pipe is specified: (1) the pipe must be fabricated so that the rivet spacing in the circumferential seams must not exceed 3 inches, except that 12 rivets will be longitudinal seams that will be covered by the coupling bands the rivets must have finished flat heads or the rivets and holes must be omitted and the seams must be connected by welding

to provide a minimum of obstruction to the seating of the coupling bands.

- c. Double riveting or double spot welding for corrugated steel pipe less than 42 inches in diameter, or corrugated aluminum pipe less than 30 inches in diameter may be required. When double riveting or double spot welding is specified, the riveting or welding must be done in the manner specified for pipe 42 inches or greater in diameter.

COATINGS

Poly coatings must conform to ASTM A762 and ASTM A742.

B. PLASTIC PIPE

The pipe must conform to American Society of Testing Material (ASTM) Specification applicable for the manufacture of this pipe. Refer to NRCS Material Specification, MS-547, Plastic Pipe.

<u>Material</u>	<u>SDR¹</u>	<u>SCH 40 & 80</u>	<u>PIP²</u>
	ASTM	ASTM	ASTM
Polyethylene, PE PE-3608, PE-4710	D-2239 D-3035		
High Density Polyethylene, HDPE, PE-3608, PE-4710	D-3350, F-714		
Polyvinyl Chloride, PVC	AWWA C-900 D-2241	D-1785 D-2466	ASTM-2241-A1

*For pipelines conveying potable water, the material also requires approval of the National Sanitary Foundation, NSF.

¹ SDR, Standard Dimension Ratio

² PIP, Plastic Irrigation Pipe

FITTINGS

The fittings must be of a material, size and pressure rating compatible with the pipe materials and withstand a working pressure equal to or greater than the pipe.

JOINTS

- a. Solvent welding of joints must be in accordance with the recommendation of the pipe manufacturer.
- b. Rubber gasket joints and the gasket material must conform to ASTM D-3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- c. All joints and connections must withstand a working pressure equal to or greater than the pipe.

HDPE JOINTS

Pipe joints must conform to the details prescribed by the manufacturer and shown on the drawings. Pipe joints must be sound and watertight at the working pressure equal to or greater than the pipe. The joints must be made in a manner so that the inside of the pipe is free from obstructions. Threaded joints on HDPE pipe are not acceptable. Only the following types of joints are approved by the technical representative.

Joints can be made in three different ways: Heat fusion, Electrofusion and mechanical connectors. For installation in cold weather, extra care must be taken to ensure the proper fusion heating procedures are followed, as outlined by the pipe manufacture.

1. Heat fusion joints are accomplished in three types: Butt, Saddle and Socket fusion. The following procedures are a summary of the installation procedures. Follow the pipe manufactures installation methods or ASTM F-2620 for specific installation requirements.
 - a. Butt fusion is very common and economical. All joints made with this method must be done with a butt fusion machine for the size of pipe being used. The

procedures to follow for performing a butt fusion include but not limited to:

- (1) The ends of the pipes need to be securely fastened in the machine
- (2) The pipe ends must be properly faced or prepared with parallel surfaces
- (3) The proper alignment of the pipe profile
- (4) Heat the pipe interfaces in the machine as per pipe manufacturer's requirements.
- (5) Join the two profiles together
- (6) Hold the pipes under pressure until the fusion is complete as per pipe manufacturer's requirements.

- b. Saddle fusion is performed by heating the outside of the pipe and the matching surface of the fitting and pressing both surfaces together for the fusion process. Saddle fusion is only permitted with the proper mechanical assist tools. The procedures to follow for the saddle fusion are similar to that of the butt fusion procedures. Note that the proper heater adapters and saddle fusion machines are required.
- c. Socket fusion is accomplished by heating the inside of a fitting and the outside of the pipe. The fitting should be the proper size for the size of pipe being fused to it. Use the proper heater attachments to ensure that the material is heated to the proper temperature. Insert the pipe end into the fitting while there are both heated and apply the proper pressure until the fusion is complete. It is important during this procedure that the pipe is not twisted inside the fitting to make the connection.

2. Electrofusion is accomplished by putting a fitting around the pipe and using a machine to apply an electric current in the

area that needs to be fused together. The pipe must be cleaned and clamped in the fitting and the proper machine to apply the electric current used. Follow the pipe manufactures installation methods or ASTM F-1290 for specific installation requirements.

3. Mechanical compression fittings must be made out of material with the proper burst strength and life expectancy of the installed HDPE pipe. The technical representative will only accept mechanical fittings that prevent pipe pull out. Follow the pipe manufactures installation methods.

C. CORRUGATED POLYETHYLENE PIPE

The manufacturer of corrugated polyethylene pipe must be governed by the American Association of State Highway and Transportation Officials, AASHTO.

The pipe must comply with the requirements for test methods, dimensions and markings in AASHTO specification M-294-S. The pipe and fittings must be made from PE compounds which conform to the requirements of cell class 324420C as defined and described in ASTM D-3350.

Refer to NRCS Material Specification, MS-548, Corrugated Polyethylene Pipe

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

CONSTRUCTION SPECIFICATION

CS-UT-265, DRAINAGE FILTER

1. SCOPE

The work consists of furnishing and installing drainage filter at the location and dimensions shown on the drawings.

2. SITE PREPARATION

The site must be prepared by removing all material that will restrict or reduce the ability of the drainage filter to function.

3. MATERIALS

The materials will conform to the type specified on the drawings and must meet or exceed MS-592, Geotextile for fabric filters for the type of filter to be installed. The bedding and covering must be of the material quality and depth as shown on the drawings.

4. INSTALLATION

(1) Fabric Filters: The foundation must be unyielding to prevent forces that will elongate, tear or puncture the fabric. All splices must overlap a minimum of 8 inches unless otherwise shown on the drawings.

5. ITEMS OF WORK AND CONSTRUCTION DETAILS

- Install drainage filter around perforated drain pipe collection system as shown in design drawings and as specified in design drawings.

CONSTRUCTION SPECIFICATION

CS-UT-266, EROSION CONTROL BLANKETS

1. SCOPE

This construction specification is applicable for the furnishing and installing of erosion control blankets to the lines and grades as shown in the drawings.

2. MATERIALS

The materials will conform to the type specified on the drawings and must meet or exceed Material Specification, MS-219, Erosion Control Blanket for the type of blanket to be installed.

3. SITE PREPARATION

The final grading of the earthwork must be completed before installation. The site must be free from depressions, ridges and angular rocks greater than 1 inch. The area must be free from all sharp objects and foreign material such as wood, wire and metal.

4. INSTALLATION

If the area is to be seeded and fertilized, the operations must be completed prior to the installation of erosion control blankets. In channels, install the blanket in the reverse direction of flow such that upstream blankets overlap downstream blankets. On slopes the blankets may be installed across the slope or perpendicular to the slope. The ends and edges must be overlapped or shingled a minimum of 8 inches in the direction of flow and anchored, unless otherwise shown on the drawing. The disturbed area(s) must be seeded to the species and rates shown in the critical area planting specification sheet(s).

5. ANCHORING

Unless otherwise shown on the drawings, the upper and lower ends of each installation must be anchored by burial in a twelve-inch deep trench and stapled. The stapling must be a diamond pattern with a minimum of two staples per square yard which includes all edges and ends stapled at a maximum spacing of four foot on center. Staples must be suitable for use with erosion control fabrics.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Utilization of erosion control blankets are included for use only if chosen by the contractor as a BMP in the Storm Water Pollution Prevention Plan.

CONSTRUCTION SPECIFICATION

CS-7, CONSTRUCTION SURVEYS

1. SCOPE

The work consists of performing all surveys, measurements, and computations required by this specification.

2. EQUIPMENT AND MATERIAL

Equipment for construction surveys shall be of a quality and condition to provide the required accuracy. The equipment shall be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments shall be maintained and be available for inspection by the engineer. Equipment shall be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.

Material is field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

3. QUALITY OF WORK

All work shall follow recognized professional practice and the standards of the industry unless otherwise specified in section 9 of this specification. The work shall be performed to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data shall be complete, recorded neatly, legible, reproducible and organized to facilitate ease in review and allow reproduction of copies for job documentation. Survey equipment that requires little or no manual recording of field data shall have survey information documented as outlined in section 9 of this specification.

All computations shall be mathematically correct and shall include information to identify the bid item, date, and who performed, checked, and approved the computations. Computations shall be legible, complete, and clearly document the source of all information used including assumptions and measurements collected.

If a computer program is used to perform the computations, the contractor shall provide the engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer generated computations shall show all input data including values assigned and assumptions made.

The elevations of permanent and temporary bench marks shall be determined and recorded to the nearest 0.01 foot. Differential leveling and transit traverses shall be of such precision that the error of vertical closure in feet shall not exceed plus or minus

0.1 times the square root of the traverse distance in miles. Linear measurements shall be accurate to within 1 foot in 5,000 feet, unless otherwise specified in section 9 of this specification. The angular error of closure for transit traverses shall not exceed 1-minute times the square root of the number of angles turned.

The minimum requirements for placing slope stakes shall be at 100-foot stations for tangents, as little as 25 feet for sharp curves, breaks in the original ground surface and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross sections shall be perpendicular to the centerline. Significant breaks in grade shall be determined for cross sections. Distances shall be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level. Unless otherwise specified in section 9 of this specification, measurements for stationing and establishing the location of structures shall be made to the nearest 0.1 foot.

Elevations for concrete work, pipes, and mechanical equipment shall be determined and recorded to the nearest 0.01 foot. Elevations for earth work shall be determined and recorded to the nearest 0.1 foot.

4. PRIMARY CONTROL

The baselines and benchmarks for primary control, necessary to establish lines and grades needed for construction, are shown on the drawings and have been located on the job site.

These baselines and benchmarks shall be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The contractor shall take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the contractor or at contractor expense.

5. CONSTRUCTION SURVEYS

Before work starts that requires contractor performed surveys, the contractor shall submit in writing for the engineer's review: the name, qualifications, and experience of the individuals to be assigned to the survey tasks.

Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking
- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payments

- performing original (initial) and final surveys for determinations of final quantities
- other surveys as described in section 9 of this specification.

6. STAKING

The construction staking required for the item shall be completed before work on any item starts. Construction staking shall be completed as follows or as otherwise specified in section 9 of this specification:

Clearing and grubbing—The boundary of the area(s) to be cleared and grubbed shall be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the OWNERS before start of this work item.

Excavation and fill—Slope stakes shall be placed at the intersection of the specified slopes and ground line. Slope stakes and the reference stakes for slopes shall be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes is outlined in section 3, Quality of work.

Structures—Centerline and offset reference line stakes for location, alignment, and elevation shall be placed for all structures.

7. RECORDS

All survey data shall be recorded in fully identified standard hard-bound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations shall be bound, page numbered and cross referenced in a bound field notebook containing the index for all survey activities. All work shall follow recognized professional practice.

The construction survey records shall be available at all times during the progress of the work for examination and use by the engineer and when requested, copies shall be made available. The original field notebooks and other records shall be provided to and become the property of the OWNERS before final payment and acceptance of all work.

Complete documentation of computations and supporting data for progress payments shall be submitted to the engineer with each invoice for payment as specified in section 9 of the specification. When the contractor is required to conduct initial and final surveys as outlined in section 5, Construction Surveys, notes shall be provided as soon as possible after completion to the engineer for the purpose of determining final payment quantities.

8. PAYMENT

For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the contractor's approved construction schedule. Payment of the lump sum contract price will constitute full compensation for completion of all work under this bid item.

Payment will not be provided under this item for the purchase price of materials or equipment having a residual value.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

- Stakeout of grubbing and clearing.
- Stakeout of line and grade of all pipelines.
- Stakeout for finished grade.
- Stakeout for all structures.
- Verification of all quantities.

CONSTRUCTION SPECIFICATION

CS-94, CONTRACTOR QUALITY CONTROL

1. SCOPE

The work consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for all materials and work performed.

2. EQUIPMENT AND MATERIALS

Equipment and material used for quality control shall be of the quality and condition required to meet the test specifications cited in the contract. Testing equipment shall be properly adjusted and calibrated at the start of operations and the calibration maintained at the frequency specified. Records of equipment calibration tests shall be available to the engineer at all times. Equipment shall be operated and maintained by qualified operators as prescribed in the manufacturer's operating instructions, the references specified, and as specified in section 10 of this specification. All equipment and materials used in performing quality control testing shall be as prescribed by the test standards referenced in the contract or in section 10.

All equipment and materials shall be handled and operated in a safe and proper manner and shall comply with all applicable regulations pertaining to their use, operation, handling, storage, and transportation.

3. QUALITY CONTROL SYSTEM

The contractor shall develop, implement, and maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities shall include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results. The identification of the quality control personnel and their duties and authorities shall be submitted to the contracting officer in writing within 15 calendar days after notice of award.

The quality control system shall include, but not be limited to, a rigorous examination of construction material, processes, and operation, including testing of material and examination of manufacturer's certifications as required, to verify that work meets contract requirements and is performed in a competent manner.

4. QUALITY CONTROL PERSONNEL

Quality control activities shall be accomplished by competent personnel.

A competent person is:

One who is experienced and capable of identifying, evaluating, and documenting that materials and processes being used will result in work that complies with the contract; and,

who has authority to take prompt action to remove, replace, or correct such work or products not in compliance.

Off-site testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the OWNERS and engineer, for approval, the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

5. POST-AWARD CONFERENCE

The contractor must meet with the OWNERS before any work begins and discuss the contractor's quality control system. This may take place at the scheduled pre-construction meeting. The contracting officer and the contractor shall develop a mutual understanding regarding the quality control system.

6. RECORDS

The contractor's quality control records shall document both acceptable and deficient features of the work and corrective actions taken. All records shall be on forms approved by the OWNERS, be legible, and be dated and signed by the competent person creating the record.

- a. Unless otherwise specified in section 10 of this specification, records shall include:
- b. Documentation of shop drawings including date submitted to and date approved by the OWNERS, results of examinations, any need for changes or modifications, manufacturer's recommendations and certifications, if any, and signature of the authorized examiner.
- c. Documentation of material delivered including quantity, storage location, and results of quality control examinations and tests.
- d. Type, number, date, time, and name of individual performing quality control activities.
- e. The material or item inspected and tested, the location and extent of such material or item, and a description of conditions observed and test results obtained during the quality control activity.
- f. The determination that the material or item met the contract provisions and documentation that the engineer was notified.

- g. For deficient work, the nature of the defects, specifications not met, corrective action taken, and results of quality control activities on the corrected material or item.

7. REPORTING RESULTS

The results of contractor quality control inspections and tests shall be communicated to the engineer immediately upon completion of the inspection or test. Unless otherwise specified in section 10, the original plus one copy of all records, inspections, tests performed, and material testing reports shall be submitted to the engineer within one working day of completion. The original plus one copy of documentation of material delivered shall be submitted to the engineer before the material is used.

8. ACCESS

The contracting officer and the engineer shall be given free access to all testing equipment, facilities, sites, and related records for the duration of the contract.

9. PAYMENT

For items of work for which lump sum prices are established in the contract, payment is prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating shall be the number estimated to complete the work. The final month's prorate amount is made with the final payment. Payment as described above constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 10.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

- Proctor, gradation, and universal soil class of all imported materials
- Gradations of all drainage fill materials
- Concrete testing to include percent of air entrainment, temperature, slump, and all break tests
- All compaction testing

- Flow meter calibration
- Vendor instruction and initial oversight for installation

CONSTRUCTION SPECIFICATION

CS-44 CORRUGATED POLYETHYLENE TUBING

1. SCOPE

The work consists of furnishing and installing tubing and the necessary fittings and appurtenances as shown on the drawings and as outlined in this specification.

2. MATERIAL

Corrugated polyethylene tubing and fittings shall conform to the material requirements as outlined in Material Specification 548, Corrugated Polyethylene Tubing.

When perforations are specified, the water inlet area shall be a minimum of 1 square inch per lineal foot of tubing. The inlets shall either be circular perforations or slots equally spaced along the length and circumference of the tubing. Unless otherwise specified, circular perforations shall not exceed 3/16 inch in diameter, and slot perforations shall not be more than 1/8 inch wide.

Geotextile filter socks, when required, shall meet the material requirements outlined in section 9 of this specification.

Granular bedding material, when specified, shall conform to the requirements specified in section 9 of this specification.

The tubing shall be appropriately marked with ASTM or AASHTO designation.

3. HANDLING AND STORAGE

Tubing shall be delivered to the job site and handled by means that provide adequate support to the tubing and do not subject it to undue stresses or damage. When handling and placing corrugated poly-ethylene tubing, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.

Tubing shall be stored on a relatively flat surface so that the full length of the tube is evenly supported. Unless the tube is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

4. EXCAVATION

Unless otherwise specified or approved by the engineer, excavation for and subsequent installation of each tube line shall begin at the outlet end and progress up grade. The trench or excavation for the tubing shall be constructed to the lines, depths, cross sections, and grade shown on the drawings, specified in Section 9 of this specification, or as approved by the engineer.

Trench shields, shoring and bracing, or other suitable methods necessary to safeguard the contractor's employees and the works of improvement and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

5. PREPARING THE TUBING BED AND BLINDING THE TUBING

When a granular filter or envelope is specified, the filter or envelope material shall be placed in the bottom of the trench just before the tubing is laid. The tubing shall then be laid and the filter and envelope material placed to a depth over the top of the tubing of not less than that shown on the drawings or as specified in section 9 of this specification.

When a granular filter or envelope is not specified, the bottom of the trench shall be shaped to form a semicircular or trapezoidal groove in its center. This groove shall provide support for not less than a fourth of the outside circumference of the tubing. After the tubing is placed in the excavated groove, it shall be capped with friable material from the sides of the trench. The friable material shall be placed around the tubing, completely filling the trench to a depth of at least 3 inches over the top of the tubing. For material to be suitable, it must not contain hard clods, rocks, frozen soil, or fine material that will cause a silting hazard to the drain. Tubing placed during any day shall be blinded (place required soil material around and over pipe) and temporarily capped before construction activities are completed for that day.

6. PLACEMENT AND JOINT CONNECTIONS

All tubing shall be installed to grade as shown on the drawings. After the tubing is placed in the trench and blinded, allow sufficient time for the tubing to adapt to the soil temperature before backfilling.

Maximum allowable stretch of the tubing is 5 percent. Special precautions must be implemented on hot, bright days to ensure that the stretch limit is not exceeded and excessive deflection does not occur as a result of installation procedures, including backfill operations.

Unless otherwise specified in section 9 of this specification or shown on the drawings, connections are made with manufactured junctions comparable in strength with the specified tubing. All split fittings shall be securely fastened with nylon cord or plastic

zip ties before any backfill is placed. All buried ends shall be supplied with end caps unless otherwise approved by the engineer.

7. BACKFILLING

Unless otherwise specified in section 9 of this specification, the backfilling of the trench shall be as shown on the drawings and completed as rapidly as is consistent with the soil conditions. Automatic backfilling machines may be used only when approved by the engineer. Backfill shall extend above the ground surface and be well rounded and centered over the trench.

8. MEASUREMENT AND PAYMENT

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each kind and size of tubing is determined to the nearest foot of length measured along the centerline of the installed tubing. Payment for each kind and size of tubing is made at the contract unit price for that kind and size of tubing. Such payment constitutes full compensation for all labor, equipment, tools, and all other items necessary and incidental to furnishing, transporting, and installing the tubing, including excavation, shoring, geotextile or granular filter (when specified), backfill and all fittings, appurtenances, and other items required to complete the work. Payment for appurtenances listed separately in the bid schedule is made at the contract unit price(s) for the size and type of appurtenance listed.

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

CONSTRUCTION SPECIFICATION 24

CS-24 DRAINFILL

1. SCOPE

The work consists of furnishing, placing, and compacting drainfill required in the construction of structure drainage systems and spring water collection systems.

2. MATERIAL

Method 1—Drainfill material shall conform to the requirements of Material Specification 521, Aggregates for Drainfill and Filters. A minimum of 30 days before delivery of materials to the site, the contractor shall inform the engineer in writing of the source(s) from which drainfill material will be obtained with laboratory gradation samples verifying sample integrity.

The contractor shall provide the engineer free access to the source(s) for the purpose of obtaining samples for testing.

3. BASE PREPARATION

Foundation surface and trenches shall be clean and free of organic matter, loose soil, foreign substance, and standing water when the drainfill is placed. Earth surfaces upon or against which drainfill will be placed shall not be scarified.

4. PLACEMENT

Drainfill shall not be placed until the subgrade has been inspected and approved by the engineer. Drainfill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drainfill shall be placed uniformly in layers not to exceed 12 inches thick before compaction. When compaction is accomplished by manually controlled equipment, the layers shall not exceed 8 inches thick. The material shall be placed to avoid segregation of particle sizes and to ensure the continuity and integrity of all zones. No foreign material shall be allowed to become intermixed with or otherwise contaminate the drainfill. Over compaction is not allowed.

Traffic shall not be permitted to cross over drains at random. Equipment cross-overs shall be maintained, and the number and location of such crossovers shall be established and approved before the beginning of drainfill placement. Each crossover shall be cleaned of all contaminating material and shall be inspected and approved by the engineer before the placement of additional drainfill material.

Any damage to the foundation surface or the trench sides or bottom occurring during placement of drainfill shall be repaired before drainfill placement is continued.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at a minimum elevation of 1 foot above the upper surface of adjacent earthfill.

Drainfill over and/or around pipe or drain tile shall be placed to avoid any displacement in line or grade of the pipe or tile.

Drainfill shall not be placed adjacent to structures until the concrete has attained the strength specified in section 9 of this specification. The strength shall be determined by compression testing of concrete test cylinders cast and field cured at the project site in accordance with ASTM Method C 31 for determining when a structure may be placed into service.

When the required strength of the concrete is not specified as described above, placement of drainfill adjacent to concrete structures shall not be commenced until the following time intervals have elapsed following placement of the concrete:

Structure type	Time interval (days)
Walls backfilled on both sides simultaneously	7
Conduits and galleries, cast-in-place (with inside forms in place)	7
(inside forms removed)	14
Conduits, precast, cradled	2
Conduits, precast, bedded	1
Cantilever outlet bents backfilled on both sides simultaneously	3

5. CONTROL OF MOISTURE

The moisture content of drainfill material shall be controlled as specified in section 9 of this specification. When additional water is required, it shall be applied in a manner to avoid excessive wetting to adjacent earthfill. Except as specified in section 9 of this specification, control of moisture content will not be required.

6. COMPACTION

Drainfill shall be compacted according to the following requirements for the class of **compaction specified:**

Class A compaction—For drainfill materials with more than 70 percent passing the 3/4 inch sieve, each layer of drainfill shall be compacted to a minimum dry density of not less than the density specified in section 9 of this specification as determined by ASTM D 698. For drainfill materials with 70 percent or less passing the 3/4 inch sieve, each layer of drainfill shall be compacted to a relative density of not less than 70 percent as determined by ASTM D 4254.

Class I compaction—Each layer of drainfill shall be compacted by a minimum of two passes over the entire surface with a steel-drum vibrating roller weighing at least 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at a minimum frequency of 1,200 times per minute, or by an approved equivalent method.

Class II compaction—Each layer of drainfill shall be compacted by one of the following methods or by an approved equivalent method. (A pass is defined as at least one complete coverage of the roller wheel, tire, or drum over the entire surface for each layer.)

- a. A minimum of two passes over the entire surface with a pneumatic-tired roller exerting a minimum pressure of 75 pounds per square inch.
- b. A minimum of four passes over the entire surface with the track of a crawler-type tractor weighing at least 20 tons.
- c. Controlled movement of the hauling equipment so that the entire surface is traversed by not less than one tread track of the loaded hauling equipment.

Class III compaction—No compaction will be required beyond that resulting from the placing and spreading operations.

When compaction other than Class III compaction is specified, material placed in trenches or other locations inaccessible to heavy equipment shall be compacted by manually controlled pneumatic or vibrating tampers as specified in section 9 of this specification.

Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from cranes, hoists, or similar equipment will not be permitted.

7. TESTING

The contractor shall conduct such tests as necessary to verify that the drainfill material and the in-place drainfill meets the specification requirements.

The engineer shall be granted access to perform such tests as are required to verify that the drainfill materials and the drainfill in place meets the requirements of the specifications. These tests are not intended to provide the contractor with information needed to assure that the materials and workmanship meet the specification requirements. These verification tests will not relieve the contractor of the responsibility of performing required tests for that purpose.

8. MEASUREMENT AND PAYMENT

Method 1—For items of work for which specific unit prices are established in the contract, the volume of drainfill within the neat lines shown on the drawings are measured and computed to the nearest cubic yard. Where the engineer directs placement of drainfill outside the neat lines to replace unsuitable foundation material, the volume of such drainfill is included. The volume included is only to the extent that the unsuitable condition is not a result of the contractor's improper construction operation in the determination of the engineer.

Payment for drainfill is made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in section 9 of this specification, such payment will constitute full compensation for all labor, equipment, material, and all other items necessary and incidental to the performance of the work.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

No exceptions.

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CONSTRUCTION SPECIFICATION

CS 62, GROUTED ROCK RIPRAP

1. SCOPE

The work consists of furnishing, transporting, and the installation of grouted rock riprap revetments and blankets, including filter or bedding where specified.

2. MATERIAL

Rock for riprap shall conform to the requirements of Material Specification 523, or, if so specified, shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines, and other materials not meeting the required gradation limits.

At least 30 days before rock is delivered from other than designated sources, the contractor shall designate, in writing, the source from which rock material will be obtained and provide information satisfactory to the Nibley City Engineer that the material meets contract requirements. The contractor shall provide the Nibley City Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in section 13 of this specification.

Rock from approved sources shall be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.

When specified in section 13 of this specification or when requested by the contracting officer, a gradation quality control check shall be made by the contractor and subject to inspection by the Nibley City Engineer. The test shall be performed at the work site in accordance to ASTM D 5519 Test Method B Size, Size-Range Grading, on a test pile of representative rock. The weight or size of the test pile shall be large enough to ensure a representative gradation of rock from the source and to provide test results within a 5 percent accuracy.

Based on a specific gravity of 2.65 (typical of limestone and dolomite), and assuming the individual rock is shaped midway between a sphere and a cube, typical size/weight relationships are:

Sieve size	Approx. weight of rock	Weight of test pile
16 inches	300 pounds	6,000 pounds
11 inches	100 pounds	2,000 pounds
6 inches	15 pounds	300 pounds

The results of the test shall be compared to the gradation required for the project. Test pile results that do not meet the construction specifications shall be cause for the rock to be rejected. The test pile that meets contract requirements shall be left on the job site as a sample for visual comparison. The test pile shall be used as part of the last rock riprap to be placed.

Filter or bedding aggregates, when required, shall conform to Material Specification 521, Aggregates for Drainfill and Filters, unless filter fabric is required.

Portland cement shall conform to the requirements of Material Specification 531 for the specified type.

Pozzolan conforming to Specification ASTM C 618, Class C or F, in amounts not to exceed 25 percent based on absolute volume, may be substituted for an equivalent amount of portland cement in the grout mixture unless otherwise specified in section 13 of this specification.

Aggregates shall conform to the requirements of Material Specification 522, Aggregates for Portland Cement Concrete, except that the grading for coarse aggregate shall be as specified in section 13 of this specification.

Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter, or other deleterious substances.

Air-entraining admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Curing compound shall conform to the requirements of Material Specification 534, Concrete Curing Compound.

Other admixtures, when required, shall be as specified in section 13 of this specification.

Geotextiles shall conform to the requirements of Material Specification 592.

3. SUBGRADE PREPARATION

The subgrade surface on which the grouted rock riprap, filter, bedding, or geotextile is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved material and shall conform to the requirements of the specified class of earthfill.

Rock riprap, filter, bedding, or geotextile shall not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved.

4. PLACEMENT OF ROCK RIPRAP

The rock riprap shall be placed by equipment on the surface and to the depth specified. It shall be installed to the full section thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap shall be delivered and placed in a manner that ensures that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap shall be placed in a manner to prevent damage to structures and filter fabric, filter material or bedding. Hand placing is required as necessary to prevent damage to any new and existing structures.

5. FILTER OR BEDDING

When the contract specifies filter, bedding, or geotextile beneath the rock riprap, the designated material shall be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is required, but the surface of such material shall be finished reasonably smooth and free of mounds, dips, or windrows.

6. DESIGN OF THE GROUT MIX

The mix proportions for the grout mix shall be as specified in the construction details in section 13 of this specification. During installation, the Nibley City Engineer may require adjustment of the mix proportions whenever necessary. The mix shall not be altered without the approval of the Nibley City Engineer.

7. HANDLING AND MEASUREMENT OF GROUT MATERIAL

Material must be commercially batched and delivered by a local vendor with an approved mix. Grout must meet the specified strengths and mix in

8. MIXERS AND MIXING

The mixer, when operating at capacity, shall be capable of combining the ingredients of the grout mix into a thoroughly mixed and uniform mass and of discharging the mix with a satisfactory degree of uniformity.

The mixer shall be operated within the limits of the manufacturer's guaranteed capacity and speed of rotation.

The time of mixing after all cement and aggregates have been combined in the mixer shall be a minimum of 1 minute for mixers having a capacity of 1 cubic yard or less. For larger capacity mixers, the minimum time shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity. The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates, with the

balance of the mixing water introduced into the mixer before a fourth of the total minimum mixing time has elapsed.

When ready-mix grout is furnished, the contractor shall furnish to the engineer at the time of delivery a ticket showing the time of loading and the quantities of material used for each load of grout mix delivered.

No mixing water in excess of the amount required by the approved job mix shall be added to the grout mix during mixing or hauling or after arrival at the delivery point.

9. CONVEYING AND PLACING

The grout mix shall be delivered to the site and placed within 1.5 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to accelerated stiffening of the concrete, the time between the introduction of the cement to the aggregates and complete discharge of the grout batch shall be a maximum of 45 minutes. The engineer may allow a longer time provided the setting time of the grout is increased a corresponding amount by the addition of an approved set-

retarding admixture. In any case concrete shall be conveyed from the mixer to the final placement as rapidly as practicable by methods that prevent segregation of the aggregates, loss of mortar, displacement of the rock riprap, or a combination of these.

Grout mix shall not be allowed to free fall more than 5 feet unless suitable equipment is used to prevent segregation.

The grout mix shall not be placed until the rock riprap has been inspected and approved by the engineer for the placement of grout.

Rock to be grouted shall be kept moist for a minimum of 2 hours before grouting.

The rock riprap shall be flushed with water before placing the grout to remove the fines from the rock surfaces. The rock shall be kept moist before the grouting and without placing in standing or flowing water. Grout placed on inverts or other nearly level areas may be placed in one operation. On slopes, the grout shall be placed in two nearly equal applications consisting of successive lateral strips about 10 feet in width starting at the toe of the slope and progressing upward. The grout shall be delivered to the place of final deposit by approved methods and discharged directly on the surface of the rock. A metal or wood splash plate is used to prevent displacement of the rock directly under the grout discharge. The flow of grout shall be directed with brooms, spades, or baffles to prevent grout from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be conducted to loosen tight pockets of rock and otherwise aid in the penetration of grout to ensure the grout fully penetrates the total thickness of the rock blanket. All brooming on slopes shall be uphill.

After the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing. The surface finish, following the completion of grout installation, shall consist of one-third of the rock extended above the level of grout. The exposed rock will not have a plastered appearance.

After completion of any strip or panel, no individual(s) or equipment shall be permitted on the grouted surface for 24 hours. The grouted surface shall be protected from injurious action by the sun, rain, flowing water, mechanical injury, or other potential damaging activity.

10. CURING AND PROTECTION

The completed finished surface shall be prevented from drying for a minimum curing period of 7 days following placement. Exposed surfaces shall be maintained in a moist condition continuously for the 7-day curing period or until curing compound has been applied as specified in this section. Moisture shall be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Water or moist covering shall be used to protect the grout during the curing process without causing damage to the grout surface by erosion or other mechanisms that may cause physical damage.

The grouted rock may be coated with an approved curing compound as an alternative method to maintaining a continuous moisture condition during the curing period. The compound shall be sprayed on the moist grout surface as soon as free water has disappeared and all surface finishing has been completed. The compound shall be applied at a minimum uniform rate of 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed grout and/or concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified for the original treatment.

Grout mix shall not be placed when the daily minimum temperature is less than 40 degrees Fahrenheit unless facilities are provided to ensure that the temperature of the material is maintained at a minimum temperature of 50 degrees Fahrenheit and not more than 90 degrees Fahrenheit during placement and the curing period. Grout mix shall not be placed on a frozen surface. When freezing conditions prevail, rock to be grouted must be covered and heated to within a range of 50 to 90 degrees Fahrenheit for a minimum of 24 hours before placing grouting material.

11. INSPECTING AND TESTING FRESH GROUT

The grout material shall be checked and tested throughout the grouting operation. Sampling of fresh grout shall be conducted in conformance with ASTM C 172. The volume of each batch will be determined by methods prescribed in ASTM C 138.

The engineer shall have free access to all parts of the contractor's plant and equipment used for mixing and placing grout during the period of the contract. Proper facilities shall be provided for the engineer to sample material and view processes implemented in the mixing and placing of grout as well as for securing grout test samples. All tests and inspections shall be conducted so that only a minimum of interference to the contractor's operation occurs.

For ready-mixed grout, the contractor shall furnish to the engineer a statement-of-delivery ticket for each batch delivered to the site. The ticket shall provide as a minimum: weight in pounds of cement, aggregates (fine and coarse), water; weight in ounces of air-entraining agent; time of loading; and the revolution counter reading at the time batching was started.

12. MEASUREMENT AND PAYMENT

Method 1—For items of work for which specific unit prices are established in the contract, the volume of grouted rock riprap, including filter layers or bedding, is determined to the nearest cubic yard from the specified thickness shown on the drawings and the area on which acceptable placement has been installed. Payment for grouted rock riprap is made at the contract unit price. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the grouted rock riprap, filter layers and bedding, and geotextile material.

Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 13 of this specification.

13. ITEMS OF WORK AND CONSTRUCTION DETAILS

CONSTRUCTION SPECIFICATION

CS-71, WATER CONTROL GATES

1. SCOPE

The work consists of furnishing and installing water control gates including gate stems, hoists, lifts, and other appurtenances.

2. MATERIAL

The gates furnished shall conform to the requirements of Material Specifications 571, 572, and 573, as appropriate, and as specified in section 8 of this specification and on the drawings. All gates shall be furnished complete with hoisting equipment and other specified appurtenances.

3. INSTALLING GATES

The contractor shall install the gates in a manner that prevents leakage around the seats and binding of the gates during normal operation.

Surfaces of metal against which concrete will be placed shall be free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.

Anchor bolts, thimbles, and spigot frames shall be secured in true position within the concrete forms and maintained in alignment during concrete placement.

Concrete surfaces against which rubber seals will bear or against which flat frames or plates are to be installed shall be finished to provide a smooth and uniform contact surface.

When a flat frame is installed against concrete, a layer of concrete mortar shall be placed between the gate frame and the concrete.

When a gate is attached to a wall thimble, a mastic or resilient gasket shall be applied between the gate frame and the thimble in accordance with the recommendations of the gate manufacturer.

Wall plates, sills, and pin brackets for radial gates shall be adjusted and fastened by grouting and bolting after the gates have been completely assembled in place.

4. INSTALLING HOISTS AND LIFTS

Gate stems, stem guides, and gate lifts shall be carefully aligned so that the stem shall be parallel to the guide bars or angles on the gate frame following installation.

5. RADIAL GATE SEALS

The rubber seals for radial gates shall be installed so that the seals contact the walls or wall plates throughout the entire gate length when the gate is in the closed position.

6. OPERATIONAL TESTS

After the gate(s) and hoist(s) (or lifts) have been installed, they shall be cleaned, lubricated, and otherwise serviced by the contractor in accordance with the manufacturer's instructions. The contractor shall test the gate and hoist by operating the system several times throughout its full range of operation. The contractor shall make any changes or adjustments necessary to ensure satisfactory operation of the complete gate system.

7. MEASUREMENT AND PAYMENT

The number of each type, size, and class of gate is counted. Payment for furnishing and installing each type, size, and class of gate shall be made at the contract unit price for that type, size, and class of gate. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work including furnishing and installing anchor bolts and all specified appurtenances and fittings.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

This specification applies to the regulating gates at the spillway and all turnout and additional regulating gates designated.

71-2

(210-VI-NEH, May 2001)

MATERIAL SPECIFICATION

MS-211, BEDDING

1. SCOPE

This specification governs the quality of bedding material used in the foundation of pipelines, conduits and structures.

2. QUALITY

Soil material, fine gravel or coarse gravel specified as bedding material shall be durable, non-compressible and be within the grading limits of the Unified Soil Classification System, USCS. The ASTM specifications for classifying soils are: ASTM D-2487, Classification of Soils for Engineering Purposes, and ASTM D-2488, Standard Practice for Description and Identification of Soils (Visual Manual Procedure).

3. GRADATION

The following table lists some general properties of materials suitable for bedding. Gradation is unique for each soil in the USCS. The bedding requirements are site specific and shall be shown on the drawings using an identification symbol of the USCS.

Material	USCS	S.G. (Min.)	Size (Max.)
Soil	SW,SP,SM,SC,ML,CL	1.75	#10 Sieve
Fine Gravel- uniform grading	SW,SP,SM,SC	2.00	3/4-inch
Coarse Gravel	GW,GP,GM,GC	2.40	3-inch

MATERIAL SPECIFICATION

MS-219, EROSION CONTROL BLANKETS

1. SCOPE

This specification governs the quality of the erosion control blankets for slope and/or channel protection.

2. QUALITY

All non-thermally bonded erosion control blankets shall have polypropylene netting on both sides that is sewn with polypropylene thread of 750 denier or larger diameter. The minimum requirement for each type of blanket identified in this specification is:

Type	Material	Weight <u>OZ/SY</u>	Thickness <u>Inches</u>	Shear Stress <u>LB/SF</u>	Tensile Strength <u>LB/FT</u>	Ground Cover <u>Percent</u>	Life <u>Years</u>	Netting & Thread Ultra- Violet light Stabilized
I	Grain Straw Blanket	8.0	0.25	2.0	60	90	<1.0	No
II	Coir Fiber Blanket	9.5	0.25	3.0	125	90	>5.0	Yes
III	Polyolefin Fiber Blanket	12.0	0.50	6.0	200	50	> 5.0	Yes
IV	Wood Fiber Blanket	15.0	0.50	2.5	----	90	< 2.0	No
V	Coir Fiber Mat	20.0	0.30	----	670	50	>5.0	N/A
VI	Thermally Bonded Nylon Monofilament	8.0	0.40	6.0	180	10	>10.0	Yes*
VII	Thermally Bonded Nylon Monofilament	12.0	0.75	8.0	250	10	>10.0	Yes*
VIII	Thermally Bonded Polyvinylchloride Monofilament	25.0	0.10	5.0	140	25	>10.0	Yes*

* Material for monofilament blankets are ultra-violet light stabilized

3. FASTENERS

The fasteners shall be 11 gauge "U" shaped staples with 1 inch crowns and 6 inch legs.

MATERIAL SPECIFICATION

MS 521, AGGREGATES FOR DRAINFILL AND FILTERS

1. Scope

This specification covers the quality of mineral aggregates for the construction of drainfill and filters.

2. Quality

Drainfill and filter aggregates shall be sand, gravel, or crushed stone or mixtures thereof. Aggregates shall be composed of clean, hard, durable, mineral particles free from organic matter, clay balls, soft particles, or other substances that would interfere with the free- draining properties of the aggregates.

Coarse aggregate may be crushed limestone or other material that has limestone particles included. Aggregates from crushed limestone shall be thoroughly washed and screened to remove limestone dust, lime- stone fines, and fine soil particles. Limestone shall not be used for fine aggregates except in combination with other material, such that not more than 5 percent of the portion finer than the No. 4 sieve shall be limestone.

Aggregates shall be tested for soundness according to ASTM Method C88 and shall have a weighted average loss in 5 cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

3. Grading

Drainfill and filter aggregates shall conform to the specified grading limits after being placed or after being compacted when compaction is specified. Grading shall be determined by ASTM Method C136. The percentage of material finer than the No. 200 sieve shall be determined by the method in ASTM Designation C117.

4. Storing and handling

Drainfill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other material.

MATERIAL SPECIFICATION

MS 533, CHEMICAL ADMIXTURES FOR CONCRETE

1. Scope

This specification covers the quality of chemical admixtures for manufacturer of Portland cement concrete.

2. Quality

Air-entraining admixtures shall conform to the requirements of ASTM Specification C260.

Water-reducing and/or retarding admixtures shall conform to the requirements of ASTM Specification C494, Types A, B, D, F, or G.

Plasticizing or plasticizing and retarding admixtures shall conform to ASTM C494, Types F or G, or C1017 as applicable.

Accelerating or water-reducing and accelerating admixtures shall be noncorrosive and conform to the requirements of ASTM Specification C494, Types C and E. The manufacturer shall provide long-term test data results from an independent laboratory verifying that the product is noncorrosive when used in concrete exposed to continuously moist conditions.

MATERIAL SPECIFICATION

MS 551, COATED CORRUGATED STEEL PIPE

1. SCOPE

This specification covers the quality polymer-coated corrugated steel pipe and fittings.

2. PIPE

All pipe shall be polymer coated corrugated steel pipe and fittings conforming to the requirements of ASTM A742, A762, and A849 for the specified type, class, and fabrication of pipe and coating, and to the following additional requirements:

a. When closed riveted pipe is specified:

1. Pipe shall be fabricated with circumferential seam rivet spacing that does not exceed 3 inches except that 12 rivets are sufficient to secure the circumferential seams in 12-inch pipe.
2. Longitudinal seams that will be within the coverage area of a coupling band, the rivets shall have flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating of the coupling bands.

b. Double riveting or double spot welding for pipe less than 42 inches in diameter may be required. When double riveting or double spot welding is specified, the riveting or welding shall be performed in a manner specified for pipe 42 inches or greater in diameter.

3. COATINGS

Coatings described herein, unless otherwise specified, equally refer to the inside and outside pipe surfaces.

When coatings in addition to metallic coatings are specified, they shall conform to the requirements of ASTM A742, A762, and A849 for the specified type.

Polymer-coated pipe, unless otherwise specified on the drawings or in the construction specifications, shall be coated on each side with a minimum thickness of 0.01 inches (10 mils), designated as grade 10/10 in ASTM A762.

4. COUPLING BANDS

Coupling bands are to be provided for each section of pipe. The hardware for fastening the coupling band tightly to the connecting pipe shall be fabricated to permit tightening sufficiently to provide the required joint tensile strength and, if required, water tightness without failure of its fastening.

Gaskets, as specified in the drawings, are to be provided for each coupling band. The fabrication of coupling bands and fastening hardware, in addition to the above, shall be sufficient to provide the required gasket seating without warping, twisting, or bending.

5. FITTINGS

Fittings shall be fabricated from steel conforming to ASTM A742 and A849. The coating of fittings shall be the same as that specified for the contiguous corrugated coated pipe.

Welded surfaces and adjacent surfaces damaged during welding shall be treated by removing all flux residue and weld splatter. The affected surfaces shall be cleaned to bright metal by sand blasting, power disk sanding, or wire brushing. The cleaned area shall extend at least 0.5 inch into the undamaged section of the coated area. Repair and coating application of damaged and uncoated pipe surface areas shall be compliant with methods in ASTM A780, but modified as directed by pipe vendor for the specific coating and lining.

MATERIAL SPECIFICATION

MS 534, CONCRETE CURING COMPOUND

1. SCOPE

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the concrete curing process.

2. QUALITY

The curing compound shall meet the requirements of either ASTM Specification C309 or C1315. If Type 1 is specified, a fugitive dye shall be used.

3. DELIVERY AND STORAGE

All curing compounds shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner that prevents damage to the container and protects water-emulsion types from freezing.

MATERIAL SPECIFICATION

MS 548, CORRUGATED POLYETHYLENE PIPE

1. SCOPE

The specification covers the quality of corrugated polyethylene pipe and fittings.

2. PIPE

Corrugated polyethylene pipe shall conform to the requirements of ASTM F405, ASTM F667, ASTM F894, AASHTO M252, or AASHTO M294 for the appropriate pipe sizes and fittings.

3. FITTINGS

ASTM F405 3-6 inch diameter pipe and fittings

ASTM F667 8-, 10-, 12-, 15-, 18-, and 24-inch diameter pipe and fittings

ASTM F894 18- to 120-inch diameter pipe and fittings

AASHTO M2523- to 10-inch diameter pipe and fittings

AASHTO M29412- to 36-inch diameter pipe and fittings

MATERIAL SPECIFICATION

MS-592, GEOTEXTILE

1. SCOPE

This specification covers the quality of geotextile, including geotextile for temporary silt fence.

2. GENERAL REQUIREMENTS

Fibers (threads and yarns) used in the manufacture of geotextile shall consist of synthetic polymers composed of a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidene-chlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geotextile shall be free of defects, such as holes, tears, and abrasions. The geotextile shall be free of any chemical treatment or coating that significantly reduces its porosity. Fibers shall contain stabilizers, inhibitors, or both to enhance resistance to ultraviolet light. Geotextile other than for temporary silt fence shall conform to the requirements in tables 592–1 or 592–2, as applicable. Geotextile for temporary silt fence shall conform to the requirements in table 592–3.

Thread used for factory or field sewing shall be of contrasting color to the fabric and made of high strength polypropylene, polyester, or polyamide thread. Thread shall be as resistant to ultraviolet light as the geotextile being sewn.

3. CLASSIFICATION

Geotextiles shall be classified based on the method used to place the threads or yarns forming the fabric. The geotextiles will be grouped into woven and nonwoven types. Geotextile for temporary silt fence may be either woven or nonwoven. Slit film woven geotextile may not be used except for temporary silt fence.

Woven—Fabrics formed by the uniform and regular interweaving of the threads or yarns in two directions. Woven fabrics shall be manufactured from monofilament yarn formed into a uniform pattern with distinct and measurable openings, retaining their position relative to each other. The edges of fabric shall be selvaged or otherwise finished to prevent the outer yarn from unraveling.

Nonwoven—Fabrics formed by a random placement of threads in a mat and bonded by needle punching, heatbonding, or resin-bonding. Nonwoven fabrics shall be manufactured from individual fibers formed into a random pattern with distinct, but variable small openings, retaining their position relative to each other when bonded by needle punching, heat-, or resin-bonding. The use of heater resin-bonded nonwovens is restricted as specified in note 2 of table 592–2.

4. SAMPLING AND TESTING

The geotextile shall meet the specified requirements (tables 592–1, 592–2, or 592-3, as applicable) for the product type shown on the label. Product properties as listed in the latest edition of the "Specifiers Guide," Geosynthetics, (Industrial Fabrics Association International, 1801 County Road B, West Roseville, MN 55113-4061 or at <http://www.geosindex.com>) and that represent minimum average roll values, are acceptable documentation that the product style meets the requirements of these specifications. For products that do not appear in the above directory or do not have minimum average roll values listed, typical test data from the identified production run of the geotextile will be required for each of the specified tests (see table 592–1, 592–2, or 592-3, as applicable) as covered under clause AGAR 452.236-76.

5. SHIPPING AND STORAGE

The geotextile shall be shipped/transported in rolls wrapped with a cover for protection from moisture, dust, dirt, debris, and ultraviolet light. The cover shall be maintained undisturbed to the maximum extent possible before placement.

Each roll of geotextile shall be labeled or tagged to clearly identify the brand, class, and the individual production run in accordance with ASTM D 4873.

Table 592–1 Requirements for woven geotextiles^{1/}

Property	Test method	Units	Class I	Class II & III	Class IV
Grab Tensile strength	ASTM D 4632	Pounds	247 min.	180 min.	315 min.
Elongation at failure	ASTM D 4632	Percent	<50	<50	<50
Trapezoidal Tear Strength	ASTM D 4533	pounds	90 min.	67 min.	112 min.
Puncture Strength	ASTM D 6241	Pounds	495 min.	371 min.	618 min.
Ultraviolet Stability (retained strength)	ASTM D 4355	Percent	50 min.	50 min.	50 min.
Permittivity	ASTM D 4491	Sec ⁻¹	As specified	As specified	As specified
Apparent opening size (AOS) ^{2/}	ASTM D 4751	mm	As specified	As specified	As specified
Percent open area (POA)	USACE CWO-02215	Percent	As specified	As specified	As specified

1/ Minimum average roll value (weakest principal direction).

2/ U.S. standard sieve size.

Note: CWO is a USACE reference.

Table 592–2 Requirements for nonwoven geotextiles 1/

Property	Test method	Units	Class I	Class II ^{2/}	Class III ^{2/}	Class IV ^{2/}
Grab Tensile Strength	ASTM D 4632	Pounds	202 min.	157 min.	112 min.	202 min.
Elongation at Failure	ASTM D 4632	Percent	50 min.	50 min.	50 min.	50 min.
Trapezoidal Tear Strength	ASTM D 4533	Pounds	79 min.	56 min.	40 min.	79 min.
Puncture Strength	ASTM D 6241	Pounds	433 min.	309 min.	223 min.	433 min.
Ultraviolet Stability (retained strength)	ASTM D 4355	Percent	50 min.	50 min.	50 min.	50 min.
Permittivity	ASTM D 4491	sec ⁻¹	0.70 min. or as Specified	0.70 min. or as Specified	0.70 min. or as Specified	0.70 min. or as Specified
Apparent opening size (AOS) ^{3/}	ASTM D 4751	mm	0.22 max or as specified	0.22 max or as specified	0.22 max or as specified	0.22 max or as specified

1/ All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

2/ Needle punched geotextiles may be used for all classes. Heat-bonded or resin-bonded geotextiles may be used for classes III and IV only. They are particularly well suited to class IV.

3/ Maximum average roll value.

Table 592–3 Requirements for Temporary Silt Fence 1/

Property	Test method	Units	Requirements , Supported Silt Fence 2/	Requirements, Unsupported Silt Fence 2/	
				Woven Geotextile (Elongation <50% 3/)	Nonwoven Geotextile (Elongation ≥50% 3/)
Maximum Post Spacing		ft	4	6.5	4
Grab Tensile Strength	ASTM D 4632	Pounds	.		
Machine Direction			90	124	
X-Machine Direction			90	1001	
Permittivity	ASTM D 4491	sec ⁻¹	0.05	0.05	
Apparent opening size (AOS) 4/	ASTM D 4751	mm	0.60	0.60	
Ultraviolet Stability (retained strength)	ASTM D 4355	Percent	70 after 500 hours of exposure	70 after 500 hours of exposure	

1/ All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

2/ Silt fence support shall consist of 14-gage steel wire with a mesh spacing of 6 inches each way or prefabricated polymeric mesh of equivalent strength.

3/ As measured in accordance with ASTM D 4632.

4/ Maximum average roll value.

MATERIAL SPECIFICATION

MS 531, PORTLAND CEMENT

1. SCOPE

This specification covers the quality of Portland cement.

2. QUALITY

Portland cement shall conform to the requirements of ASTM Specification C150 for the specific types of cement. When Type I Portland cement is specified, Type IS Portland blast-furnace slag cement or Type IP Portland-pozzolan cement conforming to the requirements of ASTM Specification C595 may be used unless prohibited by the specifications.

When air-entraining cement is required, the contractor shall furnish the manufacturer's written statement providing the source, amount, and brand name of the air-entraining component.

MATERIAL SPECIFICATION

MS 535, PREFORMED EXPANSION JOINT FILLER

1. SCOPE

This specification covers the quality of preformed expansion joint fillers for concrete.

2. QUALITY

Preformed expansion joint filler shall conform to the requirements of ASTM Specification D1752, Type I, Type II, or Type III, unless bituminous type is specified. Bituminous type preformed expansion joint filler shall conform to the requirements of ASTM Specification D994, or D1751.

MATERIAL SPECIFICATION

MS 523, ROCK FOR RIPRAP

1. SCOPE

This specification covers the quality of rock to be used in the construction of rock riprap.

2. QUALITY

Individual rock fragments shall be dense, sound, and free from cracks, seams, and other defects conducive to accelerated weathering. Except as otherwise specified, the rock fragments shall be angular to subrounded. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment. ASTM D4992 provides guidance on selecting rock from a source.

Except as otherwise provided, the rock shall be tested and shall have the following properties:

Rock type 1

- ***Bulk specific gravity (saturated surface- dry basis)***—Not less than 2.5 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- ***Absorption***—Not more than 2 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- ***Soundness***—The weight loss in 5 cycles shall not be more than 10 percent when sodium sulfate is used or more than 15 percent when magnesium sulfate is used.

Rock type 2

- ***Bulk specific gravity (saturated surface- dry basis)***—Not less than 2.5 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- ***Absorption***—Not more than 2 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- ***Soundness***—The weight loss in 5 cycles shall be not more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used.

Rock type 3

- **Bulk specific gravity (saturated surface- dry basis)**—Not less than 2.3 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- **Absorption**—Not more than 4 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- **Soundness**—The weight loss in 5 cycles shall be not more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used.

3. METHODS OF SOUNDNESS TESTING

Rock cube soundness—The sodium or magnesium sulfate soundness test for all rock types (1, 2, or 3) shall be performed on a test sample of $5,000 \pm 300$ grams of rock fragments, reasonably uniform in size and cubical in shape, and weighing, after sampling, about 100 grams each. They shall be obtained from rock samples that are representative of the total rock mass, as noted in ASTM D4992, and that have been sawed into slabs as described in ASTM D5121. The samples shall further be reduced in size by sawing the slabs into cubical blocks. The thickness of the slabs and the size of the sawed fragments shall be determined by the size of the available test apparatus and as necessary to provide, after sawing, the approximate 100-gram samples. The cubes shall undergo five cycles of soundness testing in accordance with ASTM D1512.

Internal defects may cause some of the cubes to break during the sawing process or during the initial soaking period. Do not test any of the cubes that break during this preparatory process. Such breakage, including an approximation of the percentage of cubes that break, shall be noted in the test report.

After the sample has been dried following completion of the final test cycle and washed to remove the sodium sulfate or magnesium sulfate, the loss of weight shall be determined by subtracting from the original weight of the sample the final weight of all fragments that have not broken into three or more fragments.

The test report shall show the percentage loss of the weight and the results of the qualitative examination.

Rock slab soundness—When specified, the rock shall also be tested in accordance with ASTM D5240. Deterioration of more than 25 percent of the number of blocks shall be cause for rejection of rock from this source. Rock shall also meet the requirements for average percent weight loss stated below.

- For projects located north of the Number 20 Freeze-Thaw Severity Index Isoline (fig. 523–1). Unless otherwise specified, the average percent weight loss for Rock Type 1 shall not exceed 20 percent when sodium sulfate is used or 25 percent when magnesium sulfate is used. For Rock

Types 2 and 3, the average percent weight loss shall not exceed 25 percent for sodium sulfate soundness or 30 percent for magnesium sulfate soundness.

- For projects located south of the Number 20 Freeze-Thaw Severity Index Isoline, unless otherwise specified, the average percent weight loss for Rock Type 1 shall not exceed 30 percent when sodium sulfate is used or 38 percent when magnesium sulfate is used. For Rock Types 2 and 3, the average percent weight loss shall not exceed 38 percent for sodium sulfate soundness or 45 percent for magnesium sulfate soundness.

4. FIELD DURABILITY INSPECTION

Rock that fails to meet the material requirements stated above (if specified), may be accepted only if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

A rock source may be rejected if the rock from that source deteriorates in 3 to 5 years under similar use and exposure conditions expected for the rock to be installed under this specification, even though it meets the testing requirements stated above.

Deterioration is defined as the loss of more than one- quarter of the original rock volume, or severe cracking that would cause a block to split. Measurements of deterioration are taken from linear or surface area particle counts to determine the percentage of deteriorated blocks. Deterioration of more than 25 percent of the pieces shall be cause for rejection of rock from the source.

5. GRADING

The rock shall conform to the specified grading limits after it has been placed within the matrix of the rock riprap. Grading tests shall be performed, as necessary, according to ASTM D5519, Method A, B, or C, as applicable.

Figure 523–1 Number 20 freeze-thaw severity index isoline (map approximates the map in ASTM D5312)



MATERIAL SPECIFICATION

MS-571, SLIDE GATES

1. SCOPE

This specification covers the quality of metal slide gates for water control.

2. CLASS AND TYPE OF GATE

The class of gate is expressed as a numerical symbol composed of the seating head and unseating head. The two numbers are separated by a hyphen with the seating head listed first. For this purpose, the heads shall be expressed in terms of feet of water. Gates shall be of the specified types as defined:

Light duty

Type MLS-1 Cast iron with cast iron seat facings

Type MLS-2 Fabricated metal

Moderate duty

Type MMS-1 Cast iron with bronze seat facings, cast iron or galvanized structural steel guides, and galvanized steel, bronze, or stainless-steel fasteners.

Type MMS-2 Cast iron with bronze seat facings, cost iron or stainless-steel guides, and bronze or stainless steel fasteners. Guides and fasteners are stainless steel, when specified.

Heavy duty

Type MHS-1 Have gray cast iron slides, frames, guides, and yokes, and are fitted with bronze seat facings, bronze wedges and wedge blocks or wedge seat facings, and bronze stem blocks or thrust nuts; bronze or stainless-steel fasteners; and cold rolled steel stems except where stainless steel stems are specified.

Type MHS-2 Have gray cast iron slides, frame, guides, and yokes, and are fitted with stainless steel seat facings, wedges, wedge seat facings, stems and fasteners; and austenitic cast iron stem blocks or thrust nuts.

Type MHS-3 Have austenitic gray cast iron slides, frames, guides, and yokes, and are fitted with nickel-copper alloy seat facings, wedges, wedge seat facings, stems and fasteners; and austenitic cast iron stem blocks or thrust nuts.

3. QUALITY OF MATERIAL

Material for slide gates and appurtenances shall conform to the requirements of the applicable specifications listed below for the alloy, grade, type, or class of

material and the condition and finish appropriate to the structural and operational requirements.

Material	ASTM specification
Cast iron and gray cast iron	A 48, Class 30 A 126, Class B
Austenitic cast iron.....	A 436
Structural steel shapes, plates, and bars	A 36
Cold rolled steel	A 108
Carbon steel bars	A 108 or A 575
Stainless steel	A 167, A 276, A 582; Type 302, 303, 304, or 304L
Castings, nickel and nickel alloy	A 494
Carbon steel sheets and strips.....	A 1011
Zinc-coated carbon steel sheets	A 653 or A 924
Bronze bar, rods, shapes	B 21 or B 98
Naval bronze	B 21
Phosphor bronze	B 103 or B 139
Manganese bronze	B 138 or B 584
Silicon bronze	B 98 or B 584
Cast bronze	B 584
Nickel-copper alloy plate, sheet, strip.....	B 127
Nickel-copper alloy rod or bar	B 164
Rubber for gaskets and seals	D 395, D 412, D 471, D 572, or D 2240

Galvanizing (zinc coating) shall conform to the requirements of Material Specification 582.

4. **FABRICATED METAL GATES (LIGHT DUTY GATES)**

Fabricated metal gates shall be built to withstand the seating head expressed by the gate class designation. Unless otherwise specified, the gates shall be galvanized steel with flat-back frames.

5. CAST IRON GATES (LIGHT DUTY GATES)

The frame shall be cast iron of the specified type. The front face shall be machined to receive the gate guides.

The gate slide shall be cast iron and shall be fabricated to withstand the seating and unseating heads expressed by the gate class designation as defined in section 2 of this specification.

Grooves shall be cast on the vertical sides of the slide to match the guide angles.

The gates guides shall be galvanized structural steel and shall be fabricated to withstand the total thrust of the gate slide from water pressure and wedge action under maximum operating conditions.

Wedges and wedge seats shall have smooth bearing surfaces. Wedges may be cast as integral parts of the slide. Removable wedges and wedge seats shall be fastened to the slide, frame, or guides by means of suitable studs, screws, or bolts and shall be firmly locked in place after final adjustment. Each interacting set of wedge and wedge seat shall be adjustable as needed to ensure accurate and effective contact. Adjusting bolts or screws shall be bronze or galvanized steel.

Seat facings shall be machined to a smooth finish to ensure proper watertight contact.

6. FRAME OR SEAT (MODERATE AND HEAVY-DUTY GATES)

The frame shall be cast iron and of the specified type. The front face shall be machined to receive the gates guides, and the rear face shall be machined as required to match the specified attaching means. For heavy duty gates, a dovetailed groove shall be machined on the perimeter of the front face to receive the seat facing.

7. GATE SLIDE (MODERATE AND HEAVY-DUTY GATES)

The gate slide shall be cast iron, rectangular in shape, and shall have horizontal and vertical stiffening ribs of sufficient section to withstand the seating and unseating heads expressed by the gate class designation as defined in section 2 of this specification. For heavy duty gates, a dovetailed groove shall be machined on the perimeter of the slide face to receive the seat facing.

Tongues shall be machined on the vertical sides of the slide along its entire height to match the guide grooves and angles with a maximum clearance of 1/16 inch for gates smaller than 54 inches by 54 inches, and 1/8 inch for larger gates.

A nut pocket with reinforcing ribs shall be integrally cast on the vertical centerline and above the horizontal centerline of the slide. The pocket shall be of a shape adequate to receive a flat-backed thrust nut or stem block and shall be built to withstand the opening and closing thrust of the stem.

8. GATE GUIDES (MODERATE AND HEAVY-DUTY GATES)

The gate guides shall be built to withstand the total thrust of the gate slide from water pressure and wedge action. The gate guides shall be cast iron for heavy duty gates.

Grooves shall be machine-in cast iron guides to receive the tongue on the gate slide throughout the entire length of the guide.

The guides shall be of adequate length to retain a minimum of one-half the height of the gate slide when the gate is fully opened.

9. WEDGES AND WEDGE SEATS (MODERATE AND HEAVY-DUTY GATES)

Pads for supporting wedges, wedge seats (or blocks), and wedge loops (or stirrups) shall be cast as integral parts of the gate frame, slide, or guides and shall be accurately machined to receive those parts.

Wedges and wedge seats shall have smooth bearing surfaces for moderate duty gates and shall have machine finish bearing surfaces for heavy duty gates. Removable wedges may be cast as integral part of the slide for moderate duty gates. Wedges shall be fastened to the gate slide, frame, or guides with suitable studs, screws, or bolts and shall be firmly locked in place after final adjustment. Each interacting set of wedge and wedge seat shall be adjustable as needed to ensure accurate and effective contact.

10. SEAT FACING

Moderate duty gates—Seat facings shall be machined to a smooth finish to ensure proper watertight contact. Bronze facings shall be securely attached by welding or other approved methods.

Heavy duty gates—Seat facings shall be pressed or impacted into the machined dovetailed grooves on the gate slide and frame and machined to a smooth finish to ensure proper watertight contact.

11. YOKE

When a self-contained gate is specified, the yoke shall be of such design as to withstand the loads resulting from normal operation of the gate. For moderate and heavy-duty gates, cast iron yokes shall be provided with machined pads for connecting to the ends of gate guides and to receive the stem thrust cap or hand wheel lift.

12. FLUSH BOTTOM SEAL (HEAVY DUTY GATE)

When a flush bottom sealing gates is specified, a solid, square-corner type rubber seal shall be provided at the bottom of the gate opening. It shall be securely attached either to the bottom of the slide or to the frame. Metal surfaces bearing on the rubber seal shall be smooth and rounded as necessary to prevent cutting of the seal during gate operation.

13. GATE STEM AND LIFT (OR HOIST)

The gate stem and lift/hoist shall be of the specified type, size, and capacity and, if hand operated, shall be capable of moving the gate slide under normal conditions, following unseating from the wedging device, with a pull on the hand

wheel or crank of not more than 25 pounds with the specified seating and/or unseating head of water against the gate.

Unless otherwise specified, the stem shall be carbon steel and shall be furnished in sections as necessary to permit reasonable ease in installation. Couplings shall be bolted, pinned, or keyed to the stem. The stem shall be furnished with rolled or machine-cut 29-degree Acme threads of sufficient length to completely open the gate. The threads shall be smooth and of uniform lead and cross-section, such that the nut can travel the full length without binding or excessive friction. For moderate and heavy-duty gates, the stem shall be threaded for connection to the stem block or thrust nut on the gate slide.

The lift shall be compatible with the type of stem furnished. Unless otherwise specified, the lift nut shall be cast bronze for light and moderate duty gates and cast manganese bronze for heavy duty gates and shall be fitted with ball or roller thrust bearings designed to withstand the normal thrust developed during opening and closing of the gate at the maximum operating heads. All gears, sprockets, and pinions shall be machine-cut, with ratios and strength adequate to withstand expected operating loads. Sufficient grease fittings shall be provided to allow lubrication of all moving parts. An arrow and the word "open" shall be cast on the rim of the hand wheel or on the lift housing to indicate the direction of gate opening. Unless otherwise specified, the lift for the non-rising-stem gate shall be provided with an indicator capable of showing both when the gate is fully open and when it is fully closed for the moderate and heavy-duty gates.

Provisions shall be made to prevent stem rotation within the stem block or thrust nut or at the connection of the gate slide.

Stop collars shall be provided to prevent over travel in opening and closing the gate.

14. STEM GUIDES

Unless otherwise specified, stem guides shall be cast iron for light duty gates and cast iron with bronze bushed collars for moderate and heavy-duty gates. They shall be fully adjustable in two directions.

15. WALL THIMBLE (MODERATE AND HEAVY-DUTY GATES)

When a wall thimble is specified, it shall be of the same cast iron used in the gate frame and of the section, type, and depth specified. The front flange shall be machined to match the gate frame and drilled and tapped to accurately receive the gate attachment studs.

Gaskets or mastic to be installed between the thimble and the gate frame shall conform to the recommendations of the gate manufacturer and shall be furnished with the thimble.

16. FASTENERS

Unless otherwise specified, all anchor bolts and other fasteners shall be galvanized steel or bronze for light duty gates; galvanized steel or stainless steel or bronze for moderate duty gates; and, of the quality and size as recommended by the gate manufacturer for heavy duty gates. All anchor bolts, assembly bolts,

screws, nuts, and other fasteners shall be of ample section to withstand the forces created by operation of the gate while subjected to the specified seating and unseating heads. Anchor bolts shall be furnished with two nuts to facilitate installation.

17. INSTALLATION INSTRUCTIONS

Before installation, the contractor shall provide the engineer with the manufacturer's complete installation data, instructions for adjustments, and drawings or templates showing the location of all anchor bolts for each gate.

18. PAINTING

When specified, gates and accessories shall be painted by the designated paint system.

19. CERTIFICATION

The supporting data submitted to the engineer shall include the name of the manufacturer, the manufacturer's model number (for standard catalogue items), or the seating and unseating heads for which the gate is designed together with such drawings and specifications as may be necessary to show that the gate conforms to the requirements of this specification.

MATERIAL SPECIFICATION

MS 532, SUPPLEMENTARY CEMENTITIOUS MATERIALS

1. SCOPE

This specification covers the quality of supplementary cementitious materials for concrete.

2. QUALITY

Fly ash used as a partial substitution of Portland cement shall conform to the requirements of ASTM C618, Class C or F except the loss on ignition shall not exceed 3 percent, unless otherwise specified. Lot-to-lot variation in the loss on ignition shall not exceed 1 percent. When specified, fly ash shall conform to one or more of the supplementary optional physical requirements listed in ASTM C618.

Blast-furnace slag used as a partial substitution of Portland cement shall conform to ASTM Standard C989 for ground granulated blast-furnace slag.

OPERATION AND MAINTENANCE

OM-UT-423, HILLSIDE DITCH

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained hillside ditch system is an asset. The life span of this system can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require performance of periodic maintenance and operational items to maintain satisfactory performance. A good operation and maintenance program includes:

- Maintain hillside ditch capacity, storage, supporting ridge height and outlets.
- Redistribute sediment build up. If possible, correct the sediment source.
- Repair or replace damaged hillside ditch components.
- Remove debris, litter, and excess vegetation accumulation from ditches and outlet facilities.
- Support ridges, especially those with steep back slopes, can be very hazardous to humans and livestock. Maintain good vegetation on all slopes to help control erosion and stabilize slope conditions. Prevent the growth of large trees and woody vegetation, and remove large trees and woody vegetation along the support ridges and steep downslope banks which can cause root leading to canal failures.
- Control vegetation, trees and brush with approved herbicides or mechanical means.
- Eradicate or otherwise remove all rodents or burrowing animals and repair any damage caused by their activity.
- Repair and immediately respond to any apparent seeps or leaks.
- Provide for periodic inspections.
- Provide immediate inspection following rainstorms storms providing a 10-year frequency or greater runoff or significant windstorms that could cause debris

accumulation. Prompt repair or replacement of damaged components is necessary.

SPECIAL OPERATION AND MAINTENANCE REQUIREMENTS:

OPERATION AND MAINTENANCE

OM-UT-430, IRRIGATION PIPELINE

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained irrigation pipeline is an asset to the farm. This irrigation pipeline was designed and installed to transmit water to place of use. The estimated life span of this installation is at least 75 years. The life of this pipeline can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require performance of periodic maintenance and may also require operational items to maintain satisfactory performance. A good operation and maintenance program includes:

- Remove slide gates or overall system operation.
- Maintaining the design depth of cover over the pipeline.
- Limit traffic over the pipeline to designated section(s) that were designed for traffic loads. Avoid travel over pipelines by equipment when the soil is saturated.
- Avoid any deep sub-soiling or excavations operation(s) that may disturb the pipeline.
- Maintaining vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control height.
- Draining the system and components in areas that are subject to freezing. Begin draining system by opening the risers, if practical, to get most of the water out of the system, then use the drain valves. If parts of the system cannot be totally dried out, prevent flows from becoming stagnate and potentially freezing that can damage the pipe. This can be accomplished by opening turnouts that allow free drainage to sloughs or the river during non-irrigation season.
- Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.
- Always fill the pipeline at low flow rates to allow air movement to release points.
- Immediately repair any vandalism, vehicular or livestock damage.
- The irrigation pipeline, while nearly water-tight, may become subject to root intrusion over time. Periodic inspections from junction to junction to inspect for root intrusion should occur. If root intrusion begins to occur, cut the roots out of the pipe and then apply a foaming root killer/preventer to the spot. Isolate flows from the river in the canal for a period of 72 hours to 96 hours after application.

- The drainage pipe system will be dewatering the springs along the canal system all year long, and though the system is designed to lower the water table below ground surface substantially, there is a potential of root intrusion over time. Periodic inspection and maintenance will be required similar to a sewer line to prevent root intrusion. It is recommended to camera inspect the drain line every 7 to 10 years to inspect for root intrusion or line damage. If roots are intruding, these can be cut out by a special sewer cleaning tool commonly used by crews who maintain city sewer systems. The line can then be treated in a similar manner as stated above.
- If flows in the drainage pipe begin to decrease or are retarded, it may be from root intrusion, or the gravel pack may need to be back-flushed to help open up the drainage pores. This can likewise be done by a sewer-vactor truck.

SPECIAL OPERATION AND MAINTENANCE REQUIREMENTS:

OPERATION AND MAINTENANCE

OM-UT-587, STRUCTURE FOR WATER CONTROL

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained structure for water control is an asset. The structure was designed and installed to control water stage, discharge, distribution, delivery, or direction of flow. The estimated life span of this installation is at least 50 years. The life of the structure can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require periodic maintenance and may also require operational items to maintain satisfactory performance. A good operation and maintenance program includes:

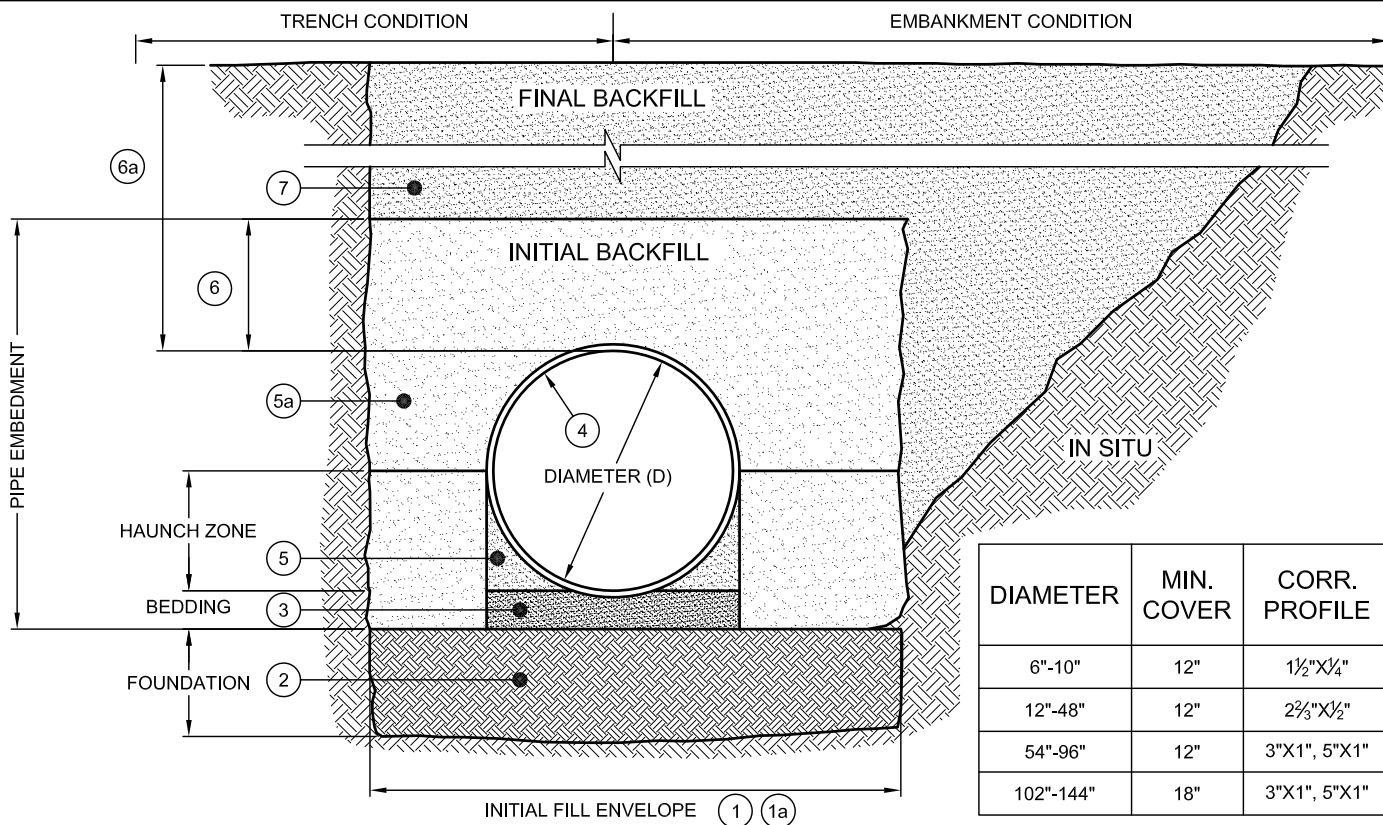
- Maintain the width, height, and side slopes of soil berms.
- Maintain safety equipment at structure, including, fences, covers, lids, ladders, alarms, etc.
- Remove accumulated soil, debris, and any blockage that restricts capacity.
- Repair any cracks or breaks. Concrete can crack. Seal the cracks with an approved material such as Sikaflex, Sikalastic-630, or an Epoxy based concrete repair product approved for outdoor use. If the settlement is present, investigate the cause and design repairs accordingly.
- If livestock are present, prevent access to components subject to damage by livestock.
- Maintain pipe connections, repair grout, seals, or other items.
- Maintain inlets and outlets to avoid erosion that can undermine the stability of the structure.
- Eradicate or otherwise remove all rodents or burrowing animals and repair any damage caused by their activity.
- Check concrete surfaces for accelerated weathering, spalling, settlement, alignment or cracks. Repair immediately, as reinforcement steel can be exposed and reduce the life of the structure.
- Repair any vandalism, vehicular, or livestock damage.

CAUTION: If your structure qualifies as a confined space (a sump, dry well or deep structure with limited ventilation) then operation and maintenance activities should be performed with safety in mind. Be cautious of entering a confined space where gases

may have settled or collected. OSHA requirements state that prior to anyone entering a confined space that proper preparation for safe entry and emergency extraction is required. Proper preparation may include, but is not limited to:

- (i) Partner supervision.
- (ii) Lifelines – 100 feet of ½ inch nylon rope of 5,400 lbs breaking strength.
- (iii) Block and tackle.
- (iv) Safety belts with lanyard.
- (v) Emergency escape unit with 5-minute oxygen packs.
- (vi) Non-explosive type lantern (6 volt).
- (vii) Combustible gas/oxygen detector. A portable combustible gas and oxygen detector is recommended.
- (viii) US Coast Guard approved life jacket or belt in water filled areas

It is suggested that permanent features be added and maintained for structures that may be entered without authorization, such as fencing, covers, locking devices, warning signs, and/or other high visibility measures.



• **BACKFILL REQUIREMENTS FOLLOW THE GUIDELINES OF ASTM A 798.**

- ① MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE TRENCH WIDTH IS THE MINIMUM AMOUNT REQUIRED FOR PROPER INSTALLATION (5.1) AND TO SUPPORT HORIZONTAL PRESSURE FROM THE PIPE (TABLE #1). THE MANUFACTURER'S SUGGESTED MINIMUM VALUE IS: $1.5D + 12"$.
- ①a MINIMUM EMBANKMENT WIDTH (in feet) FOR INITIAL FILL ENVELOPE SHALL BE: $3.0D$ BUT NO LESS THAN $D + 4'0"$ (TABLE #1).
- ② THE FOUNDATION UNDER THE PIPE AND SIDE BACKFILL SHALL BE ADEQUATE TO SUPPORT THE LOADS ACTING UPON IT (6.1).
- ③ BEDDING MATERIAL SHALL BE A RELATIVELY LOOSE MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, AND A DEPTH OF ½" PER FOOT OF FILL HEIGHT (6a), 24" MAX (FIG. #3). THE MAXIMUM PARTICLE SIZE IS NOT TO EXCEED 3" IN DIAMETER (7.1).
- ④ CORRUGATED STEEL PIPE (CSP) [HEL-COR].
- ⑤ HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION (10.1).
- ⑤a INITIAL BACKFILL FOR PIPE EMBEDMENT TO MEET GW, GP, GM, GC, SW OR SP UNIFIED SOIL CLASSIFICATION SYSTEM PER ASTM D2487, OR APPROVED EQUAL, AND COMPACTED TO 90% STANDARD PROCTOR PER ASTM D698. MAXIMUM PARTICLE SIZE NOT TO EXCEED 3" (9.2). ALL LIFTS SHALL BE PLACED IN A CONTROLLED MANNER, 6" TO 12" IN DEPTH AND COMPACTED BEFORE ADDING THE NEXT LIFT, AND NO MORE THAN ONE LIFT SIDE-TO-SIDE DIFFERENCE SHALL BE PERMITTED (10.1 & 10.2).
- ⑥ INITIAL BACKFILL ABOVE PIPE MAY INCLUDE ROAD BASE MATERIAL (AND RIGID PAVEMENT IF APPLICABLE). SEE TABLE ABOVE.
- ⑥a TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT (ASTM A796, 11.1).
- ⑦ FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD (11.1, 11.2).

NOTES:

- GEOTEXTILE SHOULD BE CONSIDERED FOR USE TO PREVENT SOIL MIGRATION INTO VARYING SOIL TYPES (PROJECT ENGINEER).
- FOR MULTIPLE BARREL INSTALLATIONS THE RECOMMENDED MINIMUM STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE NO LESS THAN 24" FOR DIAMETERS UP TO 48". FOR DIAMETERS > 48", THE MINIMUM SPACING IS DIAMETER/2 OR 36", WHICHEVER IS LESS (ASTM A796, 19.1)
- CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

233-CSP-STANDARD BACKFILL-ROUND-ASTM

CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
PIPE SOLUTIONS

DATE DRAWN: 11/15/15

REV #: —

REV DATE: —

233 - CSP ROUND
STANDARD BACKFILL DETAIL
ASTM

SCALE: N.T.S.

DRAWING TYPE: —

CMP Installation Guide





Preface

This instruction book is for your crews. Distribute it to help them install Contech® corrugated metal pipe (CMP) correctly. Proper installation of a flexible CMP culvert and storm drain systems will ensure long-term performance. CMP culverts and storm drains are typically of a single round or single pipe arch in an embankment or trench condition. However, it is not uncommon to install multi-barrel systems to meet the site-specific hydraulic conditions. Therefore, as the pipe diameter becomes larger or has multiple barrels the installation often requires special construction practices that differ from conventional small diameter (i.e. < 48" diameter) trench condition flexible pipe installation. Contech strongly suggests scheduling a pre-construction meeting with your local Sales Engineer to determine if additional measures, not covered in this guide, are appropriate for your site. All OSHA and local safety guidelines should be observed during the construction of the system and site.

Don't assume experienced workers know all the answers. Review these instructions with your supervisors and crews. It can mean a safer and better job for you and your customer. We recommend holding a preconstruction meeting with your Contech representative and all interested parties to ensure everyone involved in your project has a high level of understanding on what means and methods will be used to prepare for, install and grout the new structure(s). If you have any questions about these instructions, call your Contech Representative.

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TERMS YOU SHOULD KNOW

WARNING

Alerts you to hazards or unsafe practices that CAN result in severe personal injury or property damage.

SAFETY INSTRUCTIONS

Messages about procedures or actions that must be followed for safe handling and installation of CMP Pipe. Failure to follow these instructions can result in serious injury or death and/or damage to the pipe.

Unloading and Handling

The following equipment is recommended for unloading pipe or pipe bundles:

- Forklift
- Front-end loader with fork adapters
- Backhoe with fork adapters
- Cranes
- Non-metallic slings

Other unloading methods such as lifting lugs, chains, wire rope, cinching or hooks in the end of the pipe should not be used.

General

1. Contech recommends the use of non-metallic slings for all pipe handling requirements.
2. Hooks, chains or wire rope may damage the pipe.
3.  Do not push bundles off the trailer or permit pipe to drop to the ground.

Safety Instructions

1. Only trained and authorized equipment operators are to be permitted to unload the trailer.
2. Wear approved safety hat and shoes, gloves and eye protection.
3.  **Pipe ends may be sharp. Workers handling pipe must wear gloves made from cut-resistant materials.**
4. Park the truck and trailer on level ground before you start unloading. It is the responsibility of the consignee to direct the driver to level ground for parking the truck.
5. Keep all unauthorized persons clear of the area when the driver releases the binders from the trailer and during unloading.
6.  **Sometimes pipes are bundled together on the truck with steel straps. Do not cut the steel strapping around the bundles until the bundles have been placed on level ground, blocked or secured, and will not be moved again as a unit. It is recommended that the steel strapping be cut with appropriate sized cutting tools. Stand to the side when cutting a strap. Always be aware that pipe may move, roll or fall when a strap is cut.**
7.  **Do not lift bundles or sections of pipe by the steel strapping around the bundles.**
8. Know the capabilities and rated load capacities of your lifting equipment. Never exceed them.
9.  **Do not stand or ride on the load of pipe while it is being unloaded. Do not stand beneath or near the pipe while it is being unloaded.**
10. If unloading at multiple drop-off points, secure the remaining load and pallets between drop off points. Always unload the top pallets or bundles first.
11. The contractor shall be responsible for the safety of his/her employees and agents. Adequate safety indoctrination is his responsibility and shall be given to all personnel employed by his firm.
12. Safe practices on construction work as outlined in the latest edition of the "Manual of Accident Prevention in Construction," published by the Associated General Contractors, shall be used as a guide and observed.
13. The contractor shall comply with all applicable city, state, and federal safety codes in effect in the area where he is performing the work. This conformance shall include the provisions of the current issue of the "OSHA Safety and Health Standards (29 CFR 1926/1910)" as published by the U.S. Department of Labor.

Proper Pipe Unloading, Handling & Placement

The pipe should be unloaded off the flatbed trailer with a forklift, excavator, crane or other piece of construction equipment. The pipe should never be dropped or pushed off the flatbed trailer. Nylon slings may wrap around the pipe or steel chains may be used to connect to pipe attached lifting lugs for both unloading and placement of the pipe sections.

Pipe installation typically starts at the downstream end and progresses upstream. Sometimes the pipe is lettered or numbered to show which pipe ends should be connected. This is called match marking the ends.



Lifting CMP off the flatbed with a front end loader and forks



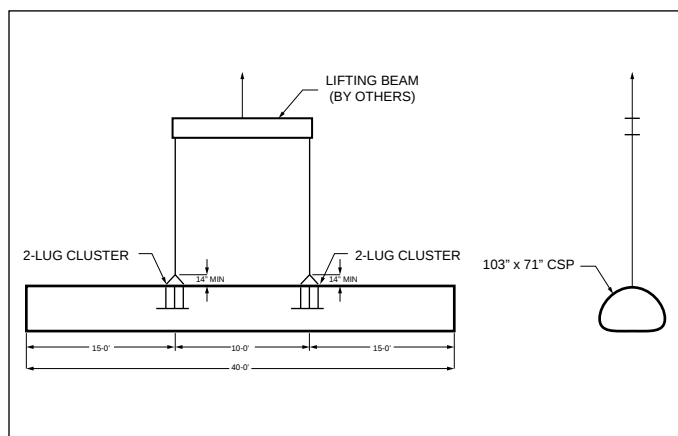
Lifting Aluminized Type 2 (ALT2) CMP with nylon slings



Lifting CMP utilizing factory attached lifting lugs



Lifting polymer-coated CMP with nylon straps



A spreader bar can be used for heavier and long length pipe.



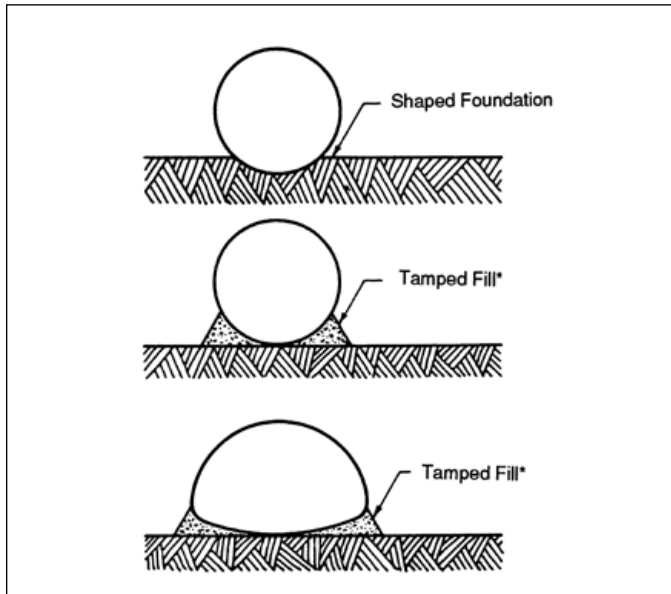
Spreader bar used to lift CMP custom fitting.

Foundation and Pipe Bedding

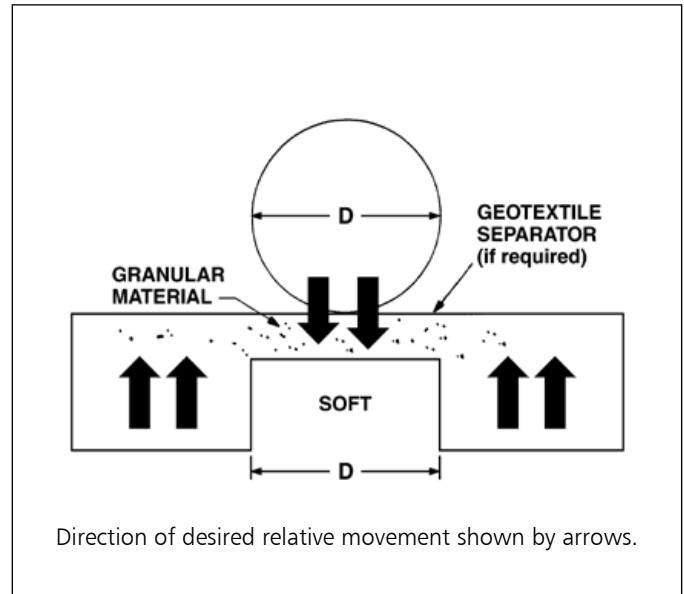
Construct a foundation that can support the design loading applied by the pipe and adjacent backfill weight as well as maintain its integrity during construction. If soft or unsuitable soils are encountered, remove the poor soils to a suitable depth and then replace with a competent granular material to the appropriate elevation. The granular material gradation should not allow the migration of fines, which can cause settlement of the pipe system or pavement above. If the structural fill material is not compatible with the underlying soils a geotextile fabric should be used as a separator.

Grade the foundation subgrade to a uniform or slightly sloping grade. If the subgrade is clay or relatively non-porous and the construction sequence will last for an extended period, it is best to slope the grade to the outlet end of the system. This will allow excess water to drain quickly, preventing saturation of the subgrade.

A 4" – 6" thick, well-graded granular material is preferred for the pipe bedding. If the existing foundation is made up of a coarse sand or other suitable granular material, imported bedding material may not be required.



Methods for attaining proper compaction under haunches of CMP and pipe-arch.



Treatment for Soft Foundations



Typical storm sewer with 4" – 6" of import granular material as pipe bedding.



Culvert foundation required undercutting and importing 18" of granular fill for pipe bedding.

Connecting Bands

There are various types of connecting bands for connecting CMP. HUGGER® bands and corrugated bands are the most common. Flat gaskets or O-ring gaskets can also be used in conjunction with connecting bands to reduce leakage in the joints



Installing a HUGGER® band on a perforated CMP



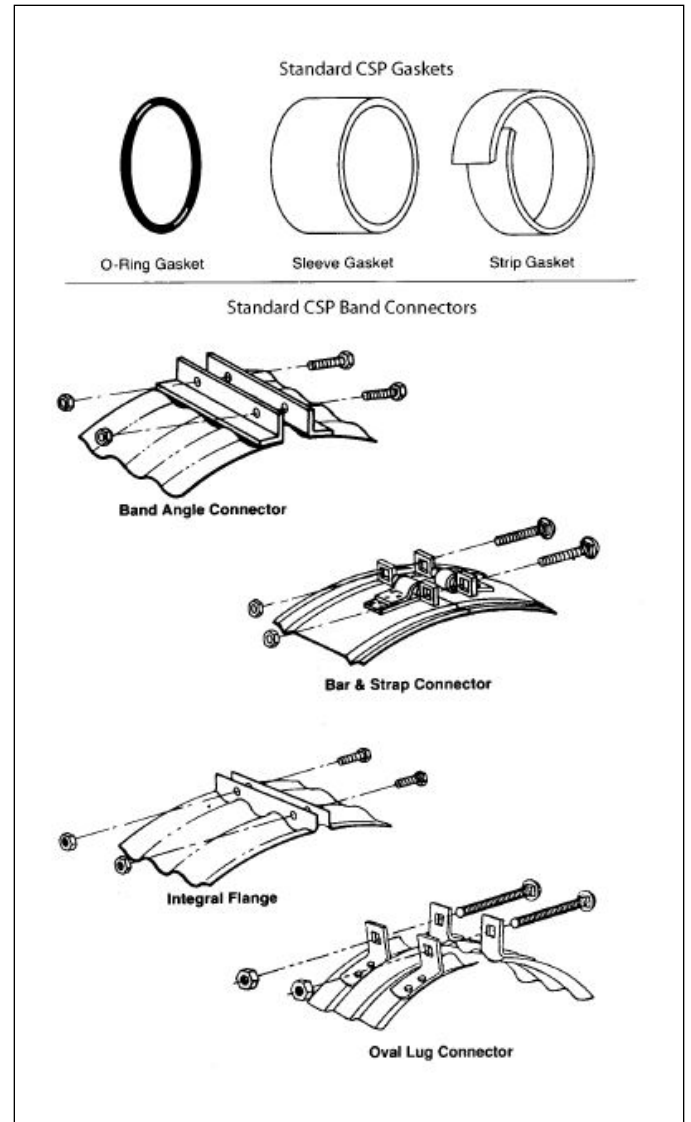
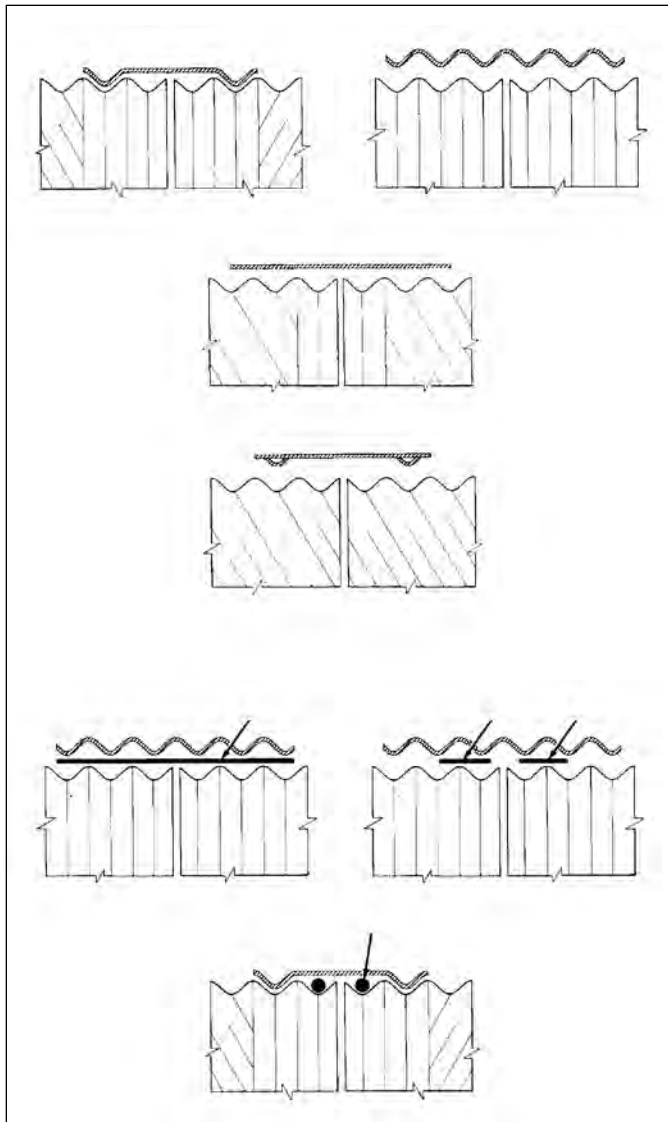
Tightening bolts on a corrugated band.



Placement of flat neoprene basket on end of CMP



Installation of corrugated band with flat neoprene gasket



Some jobs may require special bands, such as rod and lug connection, flat bands, or dimple bands.

In-Situ Trench Wall

If excavation is required, the trench wall needs to be capable of supporting the radial loads that the pipe generates as the system is loaded. If soils are not capable of supporting these loads, the pipe can deflect. Perform a simple soil pressure check using the applied loads to determine the limits of excavation beyond the spring line of the outer most pipes.

In most cases, the trench width requirements for a safe work environment and proper backfill placement and compaction take care of the concern.



Backfill Material

Corrugated Metal Pipe is a flexible pipe. All buried flexible pipes are dependent on a quality backfill material for structural support. AASHTO refers to these pipe systems as, "Soil-Corrugated Metal Structure Interaction Systems". During placement of backfill and cover the pipe will slightly deflect under load ($<2\%$ optimal). When this occurs the pipe wall goes into Ring Compression and the backfill over the pipe forms a soil arch helping to distribute the load onto side backfill of the pipe or multiple barrel pipes. Therefore, compaction in equal lifts on either side of the pipe is so important.

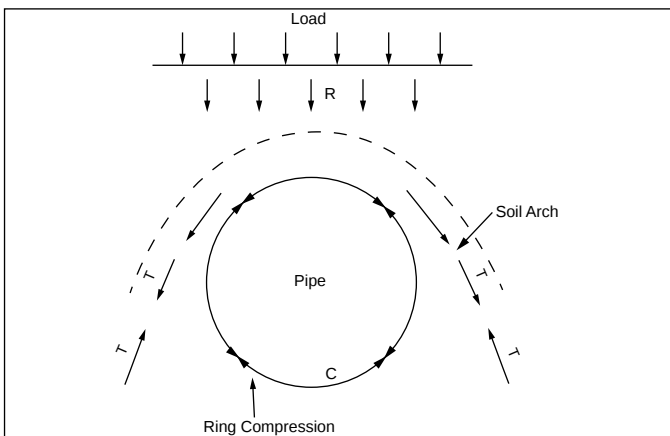
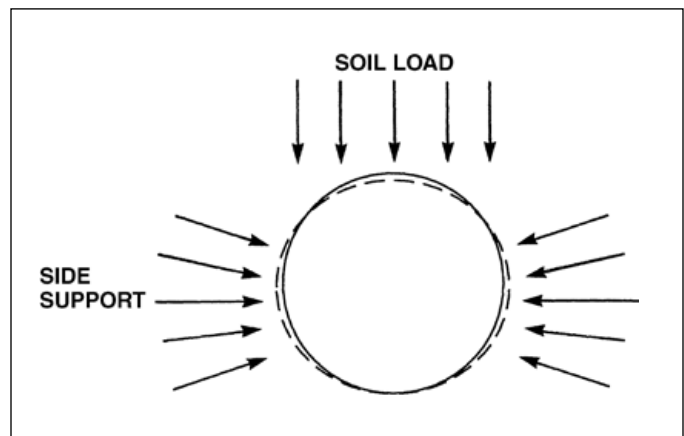


Diagram showing how load P_v is partly carried by means of a soil arch over the pipe.



Pipe side support is developed by slight pipe deflection under load.

The best backfill material is an angular, well-graded, granular fill meeting the requirements of AASHTO A-1, A-2, or A-3. Aggregate materials that are free draining and compact easily such as crushed aggregate, crushed aggregate with fines, gravely sand, and coarse sand make good backfill. The aggregate particle size shall not exceed 3" in diameter.

For solid pipe, well graded or open graded granular material can be used as backfill. Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded stone, with a particle size of 1/2" – 2 1/2" diameter is recommended for backfill around perforated pipe.

Backfill using controlled low-strength material (CLSM, "flash fill", or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill. Below are examples of acceptable backfill materials

Examples of Acceptable Backfill Material



Coarse Sand



Crushed Limestone



Crushed Granite



Crushed River Gravel

Backfill Placement

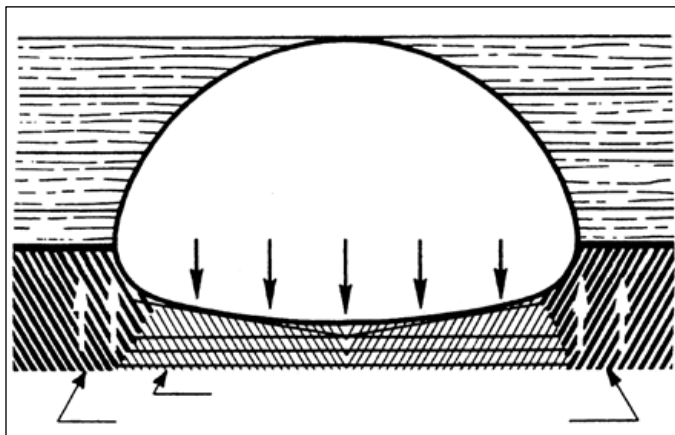
The backfill shall be placed in 8" +/- loose lifts and compact to 90% AASHTO T99 standard proctor density. Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, vibratory packer, or other effective methods. If AASHTO T99 procedures are determined infeasible by the geotechnical engineer of record, compaction is considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the geotechnical engineer of record (or representative thereof) is satisfied with the level of compaction.

For large systems, conveyor systems, backhoes with long reaches may be used to place backfill. Once minimum cover for the construction loading across the entire width of the system is reached, advance the equipment to the end of the recently placed fill, and begin the sequence again until the system is completely backfilled. This type of construction sequence provides room for stockpiled backfill directly behind the backhoe, as well as the movement of construction traffic. It is important to keep the elevation of backfill between pipes evenly. As a rule of thumb, do not allow for backfill to exceed the elevation of one side of pipe to the other by more than 24".

Material stockpiles on top of the backfilled pipe system should be limited to 9' +/- high and must provide balanced loading across all barrels. To determine the proper minimum cover over the pipes to allow the movement of construction equipment, refer to the Construction Equipment Loading Tables in this guide, or contact your local Contech Sales Engineer.

If CLSM or "flowable fill" is used as backfill, pipe flotation needs to be prevented. Typically, small lifts are placed between the pipes and then allowed to set-up prior to the placement of the next lift. The allowable thickness of the CLSM lift is a function of a proper balance between the uplift force of the CLSM, the opposing weight of the pipe, and the effect of other restraining measures. Your local Sales Engineer can help determine an appropriate lift thickness.

Pipe Arch shapes require special attention. The bedding should be firm, but slightly yielding under the pipe. A vee-shaped bedding for large pipe arched should be considered. Proper care should be given to make sure quality compaction at the haunches of the pipe arch is completed. The haunch area backfill should be a high quality granular aggregate material, compacted to a minimum of 95% to prevent deflection of the pipe.



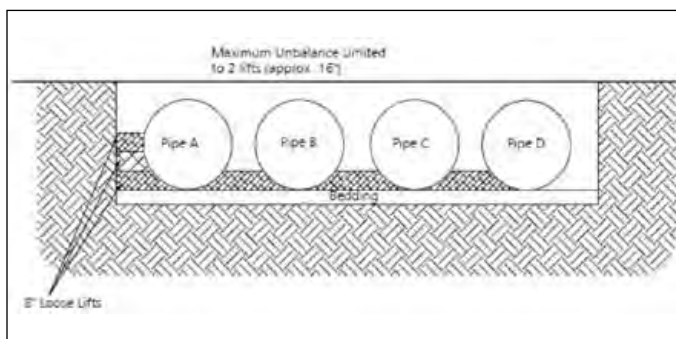
Recommended backfilling practice for larger pipe-arch, using a vee-shaped bed.



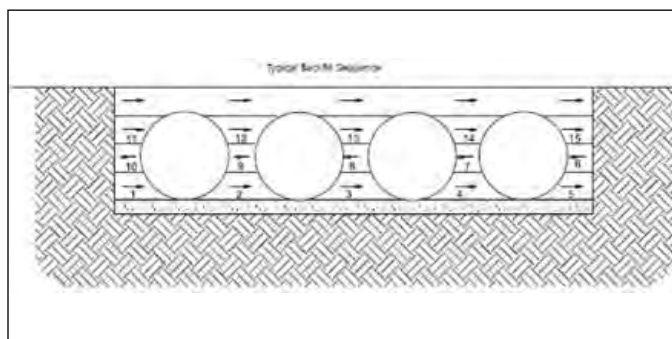
Example of backfilling for a larger pipe-arch installation.

Backfill Placement for Multi-Barrel Pipe Installation

Multi-barrel culvert installations need special attention during the backfilling process. It is important to keep the elevation of backfill between pipes evenly. As a rule of thumb, do not allow for backfill to exceed the elevation of one side of pipe to the other by more than 24". The drawings below show how proper sequencing of backfill should proceed to prevent pipe racking or pipe deflection.



Detail for Maximum Unbalanced Limit



Detail for Typical Backfill Sequence



Examples of Multi-Barrel CMP Culverts



Final Cover Placement and Construction Loading

The minimum cover specified for a project normally assumes H-20 highway live loading. Backfill must be placed and fully compacted to the minimum cover level over the structure before the pipe is subjected to design loads. The minimum cover for AASHTO H-20 Live Loading per design section 12, is span of the pipe divided by eight plus asphalt pavement.

Construction loads often exceed design highway loading. During construction, keep heavy construction equipment that exceeds legal highway loads off the pipe. Light construction equipment on tracks such as a D-3 dozer (or lighter weight) may cross over the pipe when a minimum of 12" of compacted backfill is over pipe. Since construction equipment varies from job to job, it is best to address equipment specific minimum cover requirements with your local Contech Sales Engineer during your pre-construction meeting.

Minimum Height of Cover Requirements for Tracked Equipment HEL-COR® Corrugated Steel Pipe ¹					
Diameter (inches)	Minimum Cover (Ft)	Track Width (inches) Maximum Track Pressure at Surface (psi)			
		12	18	24	30
12 – 42	1.0	29	22	18	17
	1.5	58	41	34	30
	2.0	95	65	51	44
	2.5	138	91	70	59
	3.0	189	120	91	75
	4.0	321	195	143	115
48 – 66	1.0	10.6	8.0	6.9	6.2
	1.5	24	17	14.0	12.2
	2.0	39	26	21	18
	2.5	56	37	28	24
	3.0	77	49	37	30
	4.0	132	80	59	47
72 – 96	1.0	3.2	2.5	2.1	1.9
	1.5	8.8	6.2	5.0	4.4
	2.0	16	11.1	8.8	7.5
	2.5	24	15.0	12.0	10.1
	3.0	32	20	15	12.9
	4.0	56	34	25	20
102 – 120	1.0	2.8	2.1	1.7	1.6
	1.5	6.9	4.9	3.9	3.4
	2.0	14.8	10.1	8.0	6.7
	2.5	21	14.2	10.9	9.1
	3.0	29	18	14.1	11.6
	4.0	51	31	22	18
126 – 144	1.0	2.8	2.1	1.7	1.5
	1.5	6.0	4.3	3.5	3.0
	2.0	12.0	8.0	6.4	5.4
	2.5	21	14.0	10.6	8.9
	3.0	29	18	13.9	11.4
	4.0	50	30	22	18

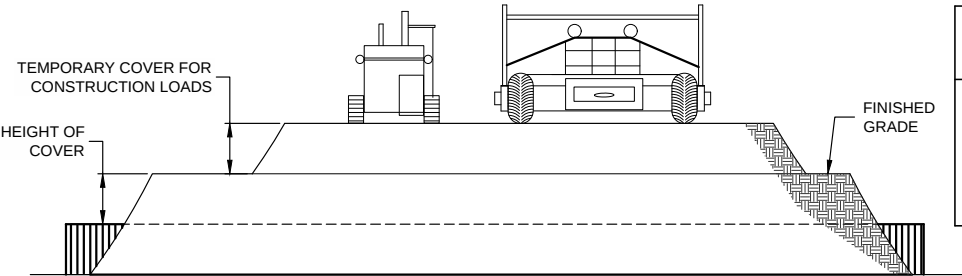
¹ The values in this table represent the maximum ground pressure permitted when performing reasonable work over the pipes, using the manufacture's published equipment specifications. (Ground pressure for track equipment is the vehicle operating weight divided by the total ground contact area for both tracks.) This table is to be used as a guide. Talk to your Contech representative if you have questions about the equipment you plan on operating over the pipes. Care should be taken to maintain adequate cover depth during construction activities.



Examples of light, tracked, construction equipment used to place final cover over the pipe system.



Examples of heavy construction equipment that may require additional minimal cover. Contech can help evaluate minimum cover for the installation contractor for all the equipment on the site.



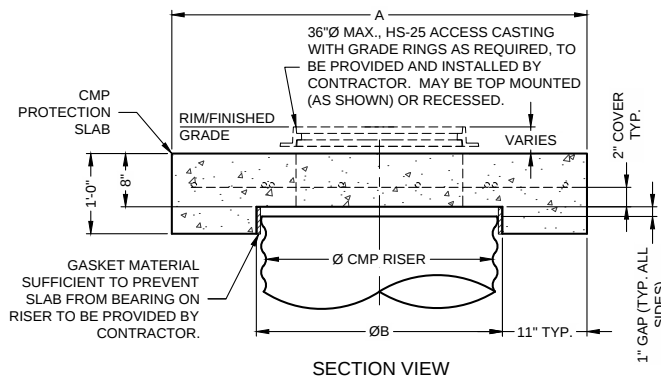
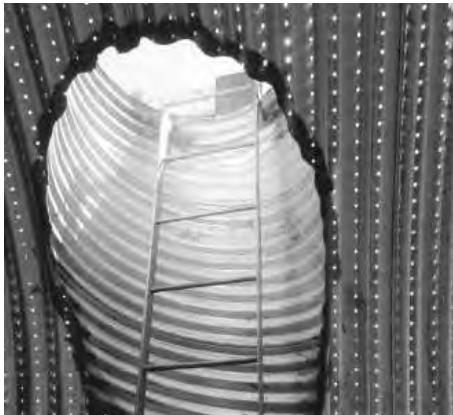
Minimum Height of Cover Requirements for Rubber-Tired Equipment Over HEL-COR® CSP

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

CMP Manhole Risers

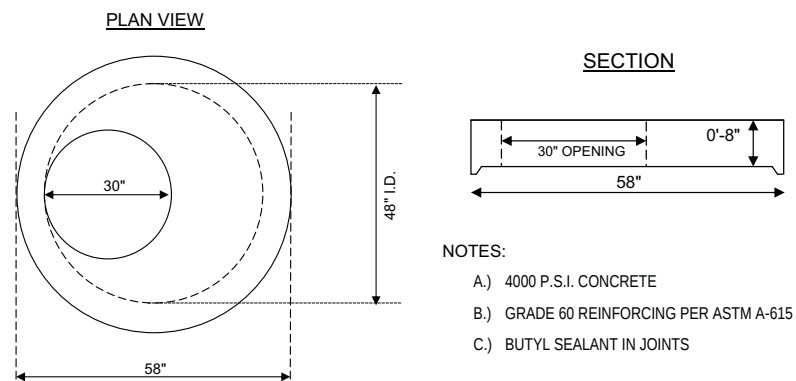
CMP manhole risers allow easy access for future maintenance of the system. If the system is installed under a parking lot or road way subject to live loads, care must be taken to ensure loads are not applied directly to the riser structure. A pre-cast or cast-in-place slab should be installed above the riser. The manhole lid and frame should not rest directly on the CMP riser.



Reinforcing Table				
Ø CMP Riser	A	ØB	Reinforcing	Bearing Pressure** (psf)
24	4'Ø	26"	#5 @ 10" OCEW	2,540
	4' x 4'		#5 @ 10" OCEW	1,900
30"	4'-6"Ø	32"	#5 @ 10" OCEW	2,260
	4'-6" x 4'-6"		#5 @ 9" OCEW	1,670
36"	5'Ø	38"	#5 @ 9" OCEW	2,060
	5' x 5'		#5 @ 8" OCEW	1,500
42"	5'-6"Ø	44"	#5 @ 8" OCEW	1,490
	5'-6" x 5'-6"		#5 @ 8" OCEW	1,370
48"	6'Ø	50"	#5 @ 7" OCEW	1,210
	6' x 6'		#5 @ 7" OCEW	1,270

** Assumed soil bearing capacity.

Precast Option for Manhole Riser Caps



NOTES:

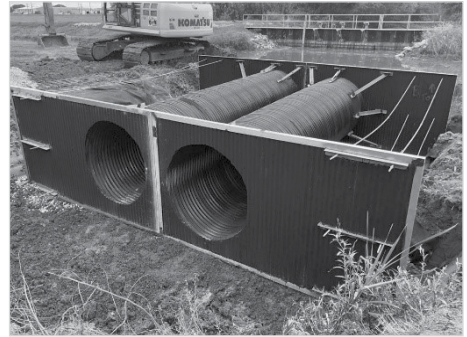
- 4000 P.S.I. CONCRETE
- GRADE 60 REINFORCING PER ASTM A-615
- BUTYL SEALANT IN JOINTS

Precast Cap Details

- Heavy Duty 4,000 psi concrete
- Standard HS25 Loading
- Available for risers up to 72-inch
- Precast Cap – ASTM A615, Grade 60
- Frame & Grate/Cover – ASTM A48

Pipe End Treatment

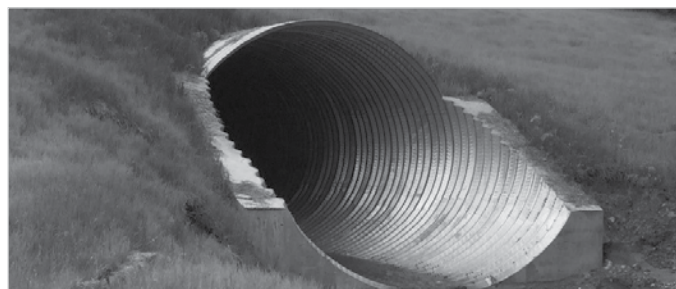
Corrugated metal pipe end treatments can consist of squared end pipe with rip rap, metal end sections, concrete headwalls, metal headwalls, skewed ends, and beveled ends. For large diameter CMP culverts, beveled ends are popular for hydraulic improvement. Beveled cut ends can be cost-effective for large diameter end treatments.



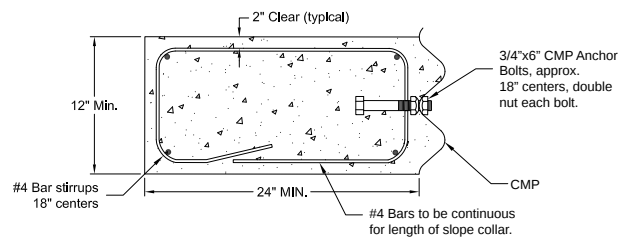
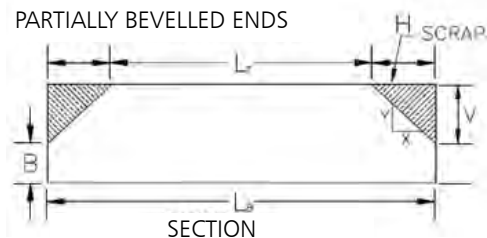
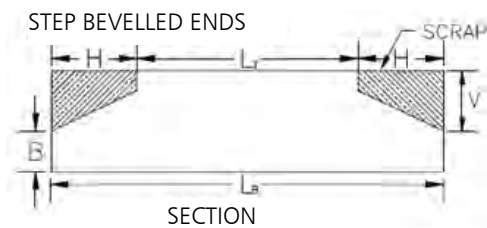
Step bevel has both a bottom and top step with 2:1 slope..



Partial bevel has only a bottom step with 2:1 slope.



Concrete slope collars and cut off wall may be required on the bevel depending on size of the pipe, skew angle, and length of the bevel.

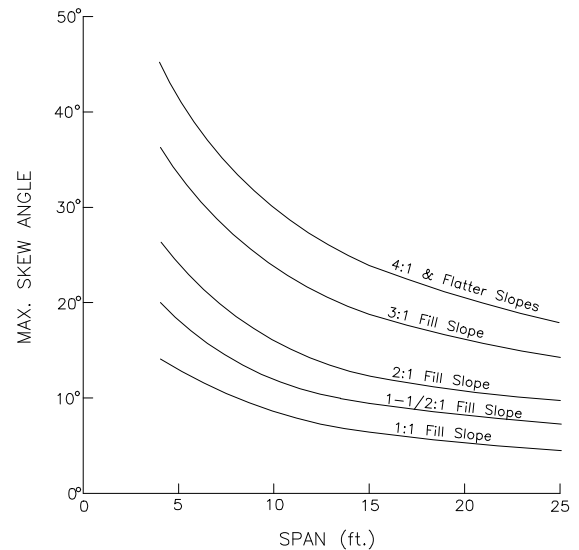
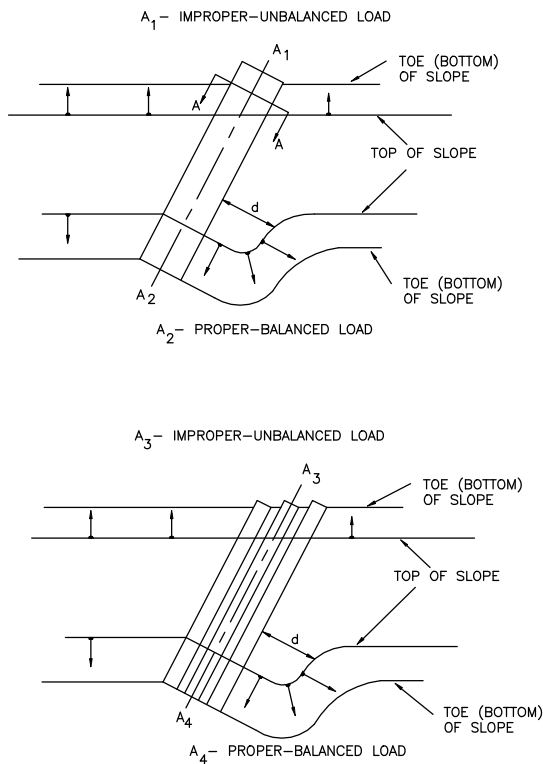


Additional Considerations

Because most systems are constructed below-grade, rainfall can rapidly fill the excavation; potentially causing floatation and movement of the previously placed pipes. To help mitigate potential problems, it is best to start the installation at the downstream end with the outlet already constructed to allow a route for the water to escape. Temporary diversion measures may be required for high flows due to the restricted nature of the outlet pipe.

Skewed Ends to Embankment

Corrugated metal pipe utilized for roadway crossings is many times skewed to the roadway embankment. This may lead to unbalanced soil loading conditions. It is important to properly balance (warp) embankment fill for both single and multiple barrel pipe installations. Additional embankment fill may need to be imported to balance the load over each side of the pipe system. Refer to ASTM A798 for additional information.



Industry References

For additional information, please reference the following sources:

- ASTM A798, Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
- AASHTO Section 26, Standard Specifications for Highway Bridges-Division II, Section 26 LRFD Bridge Construction
- AREMA Manual for Railway Engineering, Section 4.12
- National Corrugated Steel Pipe Association, Installation Manual for Corrugated Steel Pipe and Structural Plate





CMP Preconstruction Checklist

Contech Field Contact and Phone: _____

Contech Plant Contact and Phone: _____

Contractor Contact and Phone: _____

Project Name: _____

Site Address: _____

Pre-con Attendees: _____

Topics to Review:

- ☐ Truck access and pipe storage availability/expectation
- ☐ Pipe unloading and handling safety, equipment and procedures
- ☐ System layout and shop drawing review
- ☐ Shipping schedule and installation sequence
- ☐ Joint configuration and assembly
- ☐ Connection with unlike storm sewer materials
- ☐ Backfill material selection and placement strategy
- ☐ Backfill sequence, lift thickness and balanced loading
- ☐ Compaction requirement (90%) and equipment
- ☐ Additional cover requirements for heavy construction loads
- ☐ CMP riser concrete cap installation

Notes: _____

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS A WARRANTY. APPLICATIONS SUGGESTED HEREIN ARE DESCRIBED ONLY TO HELP READERS MAKE THEIR OWN EVALUATIONS AND DECISIONS, AND ARE NEITHER GUARANTEES NOR WARRANTIES OF SUITABILITY FOR ANY APPLICATION. CONTECH MAKES NO WARRANTY WHATSOEVER, EXPRESS OR IMPLIED, RELATED TO THE APPLICATIONS, MATERIALS, COATINGS, OR PRODUCTS DISCUSSED HEREIN. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE ARE DISCLAIMED BY CONTECH. SEE CONTECH'S CONDITIONS OF SALE (AVAILABLE AT WWW.CONTECHES.COM/COS) FOR MORE INFORMATION.

HUGGER Bands with gaskets have been used in thousands of successful installations. The key to success is proper installation. These instructions will help you achieve a good installation.



1 Liberally lubricate gaskets with either a soap-base lubricant such as Tylox 7 Lubricant or a vegetable base lubricant such as Crisco®.



2 Applying additional lubricant to outside pipe ends is not mandatory but is recommended to product optimum results with larger diameters or asphalt-coated pipe in cold weather. Remove any foreign matter that might become lodged between the pipe and the band.



3 Snap gaskets around and into the first annular corrugation of each pipe end.



4 Snap the gasket several times to allow for final seating.



5 Lubricate the entire inner surface of the band between the corrugations with the same lubricant.



6 Check bars for proper position.



7 If necessary, use the bolt to turn the bar so that the holes are in alignment



8 Tear off enough mastic to reach between the corrugations at the end of the band.

Installation Instructions

HUGGER® Band with Gaskets



9 Tuck the mastic over the lip of the band.
Note: With double asphalt-coated bands in warm weather (warm enough to cause the asphalt to flow), the mastic may not be necessary. For final determination, use a joint tester to evaluate performance.



10 With the necessary parts lubricated and all foreign matter between the pipe and band removed, use a Felton Puller or long bolt to start the band lap.



11 Pull the band into position. For maximum compression of the gasket, the band corrugation must be fully seated into the second corrugation from each pipe end.



12 Insert bolts and tighten the band.



13 Use a "deep-well socket" and power wrench for rapid assembly. Tap the band during tightening with a rubber mallet to ensure uniform seating of the gasket.



14 As a guide, torque bolts between 25 to 30 foot-pounds. For maximum compression of the gasket, the band corrugation must be fully seated into the second corrugation from each pipe end. Where specifications restrict infiltration/exfiltration, a test must be conducted on the assembled joint to confirm proper installation.

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS AN EXPRESSED WARRANTY OR AN IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. SEE THE CONTECH STANDARD CONDITIONS OF SALE (VIEWABLE AT WWW.CONTECHES.COM/COS) FOR MORE INFORMATION.

Specifications and data referring to mechanical and physical properties or chemical analyses relate solely to test performed at the time of manufacture on specimens obtained from specific locations of the products in accordance with prescribed sampling procedures. For specific terms and conditions of sale, refer to standard CONTECH® documents.

SERIES 8200 FABRICATED SLIDE GATES



Features

- Standard and custom sizes to fit most applications.
- Four material options to meet variable weight and corrosion resistant requirements.
- Effective, easy to use mounting and seal options.
- Rugged self-contained and non self-contained construction options.
- Smooth operating handwheel lifts are standard. Gear operated lifts and bearing lifts are optional, or used when friction loads require them.

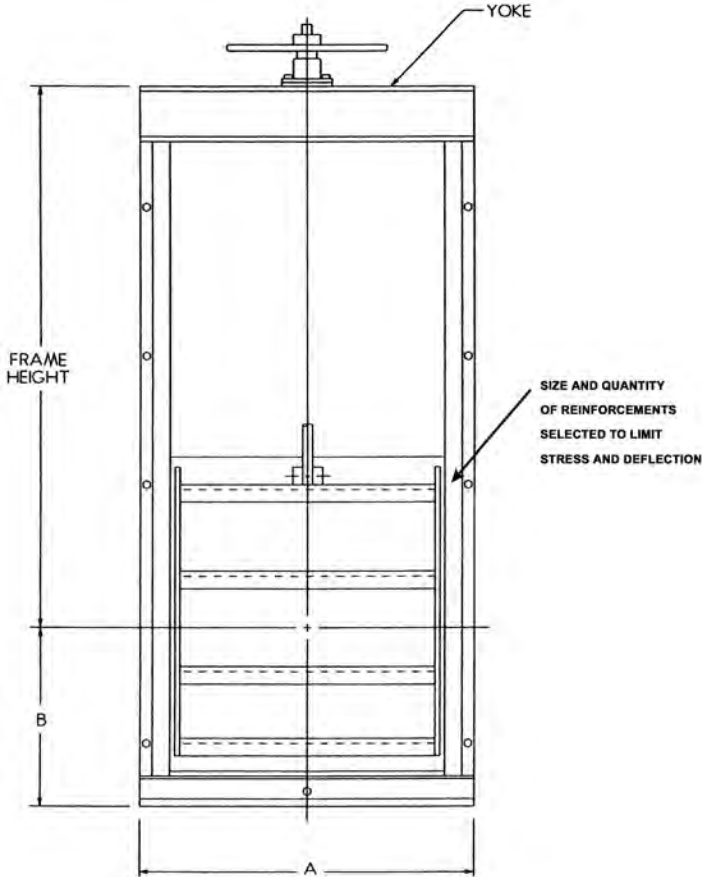
Material Specifications

Material	Application
Carbon Steel	These steel gates can be grit blast cleaned and painted to your specifications. Used where corrosion is unlikely.
Galvanized Carbon Steel	Used where an economical gate is needed but painting does not provide adequate protection against corrosion.
Stainless Steel	Made from Type 304, 304L, or 316 Stainless, or 316L Stainless Steel. Used when corrosive conditions dictate added protection.
Aluminum	Combines light weight with corrosion resistance.

Applications

Used where cost effective flow control is required. Slide gates utilize water pressure and seal design to seat the slide. Slide gates can fit a wide variety of structures and sizes. Can be used in agriculture, flood control, or municipal projects.

SPECIFICATIONS



Available Operating Ranges

Standard Seating Heads - 5 ft. and 10 ft.
Maximum Seating Head - 20 ft. (specify)

Installation

Mounted to headwall or in a channel.

Options

- Carbon Steel, Galvanized Carbon Steel, Stainless Steel or Aluminum.
- Bearing, Handwheel or Gear operated lifts.
- Self-contained or non self-contained construction.
- U.H.M.W. Poly Liner.
- J-Seals.
- Stainless Steel or Cold Finish Steel stem.

EITHER ACCEPTABLE

Dimensional Information

Width x Height	Carbon Steel & Galvanized		Stainless Steel		Aluminum		Stem Diameter	Lift		Minimum Frame Height (H)
	A	B	A	B	A	B		Model	Diameter	
12" x 12"	20.00	10.00	20.00	10.00	21.50	10.00	1.12	H-1	10"	20"
12" x 24"	20.00	16.00	20.00	16.00	21.50	16.00	1.12	H-1	10"	38"
18" x 18"	26.00	13.00	26.00	13.00	27.50	13.00	1.12	H-1	10"	29"
18" x 30"	26.00	19.00	26.00	19.00	27.50	19.00	1.12	H-1	10"	47"
24" x 24"	32.00	16.00	33.50	16.00	33.50	16.00	1.12	H-1	10"	38"
24" x 36"	32.00	22.00	32.00	22.00	33.50	22.00	1.12	H-1	10"	56"
30" x 30"	38.00	19.00	38.00	19.00	39.50	19.00	1.12	H-1	10"	47"
30" x 42"	38.00	25.00	38.00	25.00	39.50	25.00	1.50	H-2	18"	65"
36" x 36"	44.00	22.00	44.00	22.00	45.50	22.00	1.12	H-1	24"	56"
36" x 48"	44.00	28.00	44.00	29.00	45.50	28.00	1.50	H-2	18"	74"
42" x 42"	50.00	25.00	50.00	25.00	51.50	25.00	1.50	H-2	24"	65"
42" x 60"	50.00	34.00	50.00	34.00	51.50	34.00	2.00	HB	24"	92"
48" x 36"	56.00	22.00	56.00	22.00	57.50	22.00	1.12	H-2	18"	56"
48" x 48"	56.00	28.00	56.00	28.00	57.50	28.00	1.50	H-2	30"	74"

Fresno Valves & Castings, Inc.

7736 East Springfield Avenue

P.O. Box 40, Selma, CA 93662, U.S.A.

(800) 333-1658

www.fresnovalves.com



Single Wall Pipe

More goes into planning a drainage project than just calculating the slope and square footage. Each region has different weather patterns and soil types. ADS experts ensure each customer gets the best-performing pipe for his or her specific needs. With multiple variations of our single wall pipe, we have what you need for any soil type.

Reduce soil infiltration and create a water management system tailored to you with our single wall pipe.

SCAN for the digital
product catalog.





3" - 12" PRODUCT COIL FOOTAGE PER WRAP SINGLE WALL PIPE*

PIPE DIAMETER - ROLL FOOTAGE	1ST WRAP	2ND WRAP	3RD WRAP	4TH WRAP	5TH WRAP	6TH WRAP
3" - 5,500'	169	210	250	300	340	385
Total footage		379	629	929	1,269	1,654
4" - 3,200'	131	147	222	236	297	334
Total footage		278	500	736	1,033	1,267
5" - 2,000'	125	155	200	228	274	304
Total footage		280	480	708	982	1,286
6" - 1,500'	88	121	183	218	245	285
Total footage		209	392	610	855	1,140
8" - 720'	72	110	148	175	215	
Total footage		182	330	505	720	
10" - 520'	77	101	144	198		
Total footage		178	322	520		
12" - 330'	60	115	155			
Total footage		175	330			

**20' - 300' DRAINAGE PIPE REQUIREMENTS
PER ACRE (LATERALS)****

SPACING (BETWEEN PIPE)	PIPE PER ACRE (ESTIMATED)
20' (6.1 m)	2,200' (671 m)
30' (9.1 m)	1,450' (442 m)
40' (12.2 m)	1,100' (335 m)
50' (15.2 m)	900' (274 m)
60' (18.3 m)	725' (221 m)
70' (21.3 m)	638' (194 m)
80' (24.4 m)	550' (168 m)
90' (27.4 m)	500' (152 m)
100' (30.5 m)	450' (137 m)
150' (45.7 m)	338' (103 m)
200' (61 m)	225' (69 m)
250' (76.2 m)	188' (57 m)
300' (91.4 m)	150' (46 m)

8" - 15" DUAL WALL FLEX PIPE***

DIAMETER	STANDARD LENGTHS
8" (200 mm)	920' (280.4 m) Solid
	920' (280.4 m) Perf
	920' (280.4 m) Fine Slot
10" (250 mm)	550' (167.6 m) Solid
	550' (167.6 m) Fine Slot
12" (300 mm)	360' (109.7 m) Solid
	360' (109.7 m) Perf
	360' (109.7 m) Fine Slot
15" (375 mm)	165' (50.3 m) Solid
	165' (50.3 m) Perf
	165' (50.3 m) Fine Slot

*These numbers are estimates.

Fittings

Inserta Tee[®]

Save time and money with the Inserta Tee, one lateral solution that fits any type of pipe, with the same great performance you trust from ADS products. This easy-to-install connection consists of a PVC hub, rubber sleeve and stainless steel band.

KEY BENEFITS OF INSERTA TEE

- 5-10x faster installation than traditional fabricated fittings
- Watertight and sturdy, allowing no soil infiltration; requires 100 lbs of pressure to get the fitting out once installed
- Versatile enough to be installed on all products (concrete, clay, plastic, etc.) and sizes; available in 4-30" diameters
- Takes up less space than fabricated fittings and comes in multi-fit options so you can eliminate SKUs



SCAN the code for more information.

TEES

SIZE	PRODUCT CODE
4" (100 mm)	0460WT
6" (150 mm)	0661WT
8" (200 mm)	0862WT
10" (250 mm)	1063WT
12" (300 mm)	1264WT

DUAL WALL TEES

DIAMETER	N-12® PLAIN END
10" (250 mm)	1063ST
12" (300 mm)	1264ST
15" (375 mm)	1565AN
18" (450 mm)	1866AN
24" (600 mm)	2467AN
30" (750 mm)	3068AN
36" (900 mm)	3669AN
42" (1050 mm)	4251AN
48" (1200 mm)	4851AN
60" (1500 mm)	6051AN

REDUCING TEES

SIZE	PRODUCT CODE
6" x 4" (150 x 100 mm)	0660WT
8" x 4" (200 x 100 mm)	0863WT
8" X 6" (200 X 150 mm)	0836WT
10" x 4" (250 X 100 mm)	1060WT
10" x 6" (250 x 150 mm)	1036WT
10" x 8" (250 x 200 mm)	1062WT
12" x 4" (300 x 100 mm)	1260WT
12" x 6" (300 x 150 mm)	1236WT
12" x 10" (300 x 250 mm)	1263WT

SWEEPING TEES

SIZE	PRODUCT CODE
8" x 4" (200 x 100 mm)	0863WT
8" x 6" (200 x 150 mm)	0836WT
10" x 6" (250 x 150 mm)	1036WT
12" x 6" (300 x 150 mm)	1236WT

90° ELBOWS

SIZE	PRODUCT CODE
4" (100 mm)	0499WT
6" (150 mm)	0699WT
8" (200 mm)	0899WT
10" (250 mm)	1099WT
12" (300 mm)	1299WT

END CAPS (INCLUDES 1 GASKET)

DIAMETER	N-12® PLAIN END	N-12® WT
12" (300 mm)	1201AN	1201AN65B
15" (375 mm)	1501AN	1501AN65B
18" (450 mm)	1801AN	1801AN65B
24" (600 mm)	2401AN	2401AN65B
30" (750 mm)	3001AN	3001AN65B
36" (900 mm)	3601AN	3601AN65B
42" (1050 mm)	4201AN	4201AN65B
48" (1200 mm)	4801AN	4801AN65B
60" (1500 mm)	6001AN	6001AN65B

SPLIT END CAPS

DIAMETER	PRODUCT CODE
6" (150 mm)	0667AA
8" (200 mm)	0867AA
10" (250 mm)	1067AA
12" (300 mm)	1267AA
15" (375 mm)	1567AA
18" (450 mm)	1867AA
24" (600 mm)	2467AA

NON-PRESSURE PIPE END PLUG WITH GASKETS*

DIAMETER	PRODUCT CODE
8" (200 mm)	0833AA
10" (250 mm)	1033AA
12" (300 mm)	1233AA
15" (375 mm)	1533AA
18" (450 mm)	1833AA
24" (600 mm)	2433AA
30" (750 mm)	3033AA
36" (900 mm)	3633AA
42" (1050 mm)	4233AA
48" (1200 mm)	4833AA
60" (1500 mm)	6033AA

*Not intended for permanent use or vertical orientation.

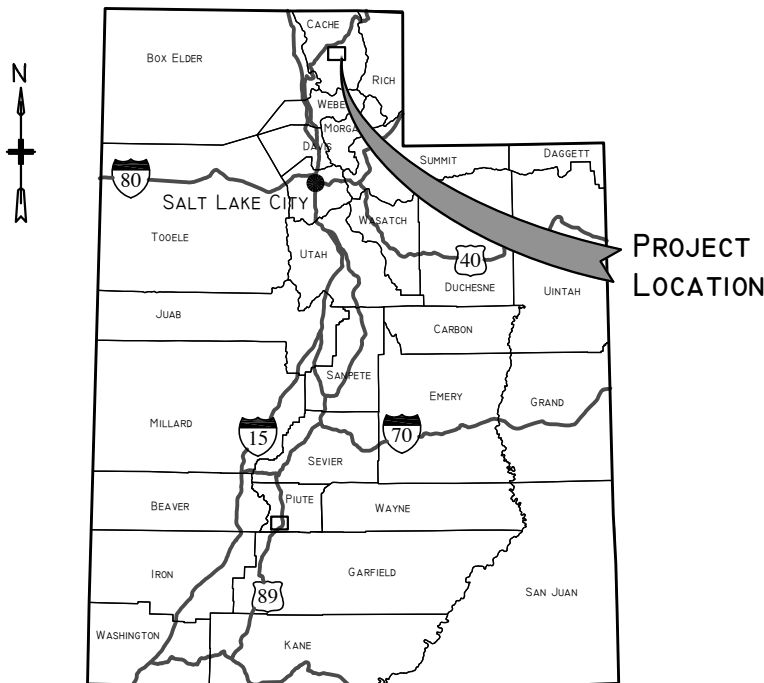
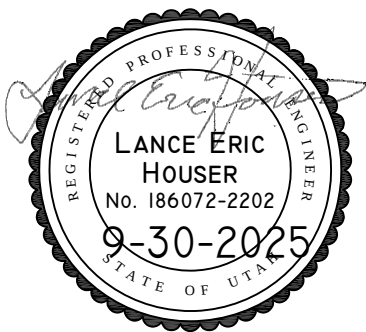
Hyrum Blacksmith Fork Irrigation Company

Canal Piping Phase 1

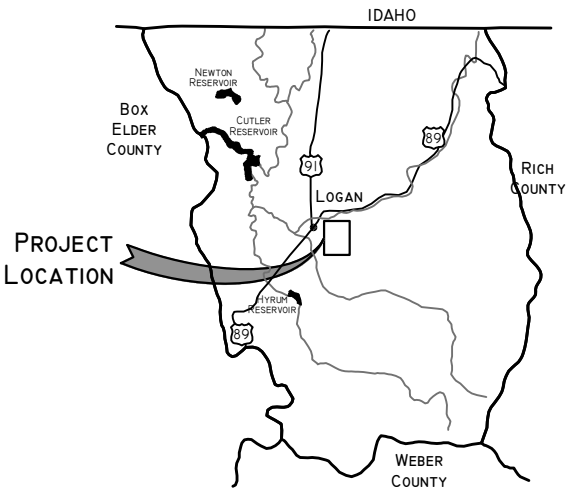
SEPTEMBER 2025

VOLUME 2

DRAWINGS



UTAH



CACHE COUNTY

Issued for
Bidding
Plot Date: 9/30/2025



FRANSON
CIVIL ENGINEERS

1276 South 820 East, Suite 100
American Fork, UT 84003
T 801 756-0309 F 801 756-0481

REGISTERED PROFESSIONAL ENGINEER
LANCE ERIC HOUSER
No. 186072-2202
9-30-2025
STATE OF UTAH

REGISTERED PROFESSIONAL ENGINEER
LANCE ERIC HOUSER
No. 186072-2202
9-30-2025
STATE OF UTAH

DESIGNER:	DRAFTSMAN:	CHECKED:	REVIEWED:	PROJECT LEADER:	PRINT DATE:
LANCE HOUSER	MATT GURR	CHECKED	REVIEWED	LANCE HOUSER	SEPTEMBER 30, 2025
NO.	DATE	INTS.	DESCRIPTION	REVISIONS	

HYRUM BLACKSMITH FORK IRRIGATION COMPANY
CANAL PIPING PHASE I
COVER SHEET, LOCATION MAPS

General.dwg
0/24012 HYRUM BLACKSMITH Canal Piping Phase 1/CADDesign Drawings
LAYOUT: Cover

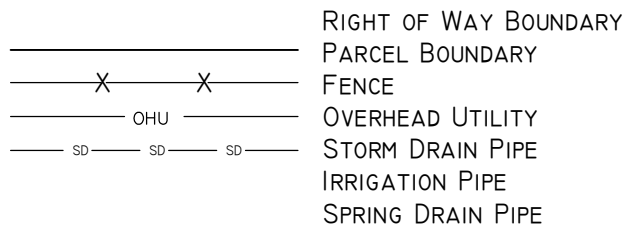
JOB NO.
24012

SHEET
G1 OF G5

G1	COVER SHEET, LOCATION MAPS
G2	SHEET INDEX, LEGEND, GENERAL NOTES
G3	CONSTRUCTION NOTES
G4	LOCATION MAPS - SURVEY CONTROL
G5	TEST PROBE & OBSERVED SPRING INFLOW

- | | |
|----|------------------------|
| S1 | SPLITTER SITE MAP |
| S2 | SPLITTER PLAN |
| S3 | SPLITTER DETAILS |
| S4 | CANAL PLAN AND PROFILE |
| S5 | CANAL SECTIONS |

- | | |
|----|---------------------------------|
| D1 | BANK STABILIZATION DETAILS |
| D2 | PIPE DETAILS |
| D3 | PIPE DETAILS 2 |
| D4 | FLUME DETAILS |
| D5 | STRUCTURE II |
| D6 | STRUCTURAL DETAILS |
| D7 | GRATE DETAILS |
| D8 | SKIMMER DETAILS |
| D9 | YEATES SPRING COLLECTION DETAIL |



1. THE TERM CONTRACTOR MUST MEAN ALL CONTRACTORS, SUBCONTRACTORS, AND ALL FOLLOW-ON CONTRACTORS. REQUIREMENTS FOR ONE MUST APPLY TO ALL.
2. CONTRACTOR ROLES AND RESPONSIBILITIES, RR-UT-01, ARE TO BE COMPLIED WITH.
3. ADDITIONAL NOTES AND CALL OUTS ARE PLACED ON DESIGN OR DETAIL DRAWINGS AND ARE TO BE ADHERED TO IN THEIR ENTIRETY.

1. ALL CONSTRUCTION MUST MEET PROJECT STANDARDS AND SPECIFICATIONS.
2. ANY AMBIGUITIES OR CONFLICTS IDENTIFIED BY THE CONTRACTOR, CONTRACTOR'S REPRESENTATIVE, OWNER, OR OWNER'S REPRESENTATIVE MUST BE IDENTIFIED IMMEDIATELY. THESE MUST BE RESOLVED BASED ON THE FOLLOWING ORDER OF PRECEDENCE :
 - 2.1. CONTRACT FOR CONSTRUCTION (FROM BID DOCUMENTS)
 - 2.2. MODIFICATIONS, ADDENDUMS, OR CHANGE ORDERS MUST TAKE PRECEDENCE OVER ALL PREVIOUS MODIFICATIONS, ADDENDUMS, OR CHANGE ORDERS.
 - 2.3. PLANS (DRAWINGS)
 - 2.3.1. WRITTEN DIMENSIONS OVER MEASURED DIMENSIONS.
 - 2.4. SPECIAL DETAILS OVER PLANS AND PROFILES.
 - 2.5. CONSTRUCTION SPECIFICATIONS.
 - 2.6. STORM WATER POLLUTION PREVENTION PLAN.
 - 2.7. MANUFACTURER DOCUMENTATION.

1. WORK ZONE SAFETY IS THE THE FIRST PRIORITY. CONTRACTOR MUST MAINTAIN A SAFE WORK ZONE COMPLIANT WITH ALL FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS.
2. ALL PERSONNEL ARE REQUIRED TO WEAR HARD-HATS, AND OTHER PPE WITHIN THE WORK ZONE.
 - 2.1. ORANGE OR FLORESCENT YELLOW VESTS OR CLOTHING MUST BE WORN WHILE WORKING ON THIS PROJECT.
3. ALL TRENCHING MUST BE IN COMPLIANCE WITH OSHA 29 CFS, PART 1926.
4. CONTRACTOR MUST CONFORM TO ALL OTHER APPLICABLE OSHA RULES AND REGULATIONS WHILE WORKING ON THIS PROJECT.

1. IT IS THE INTENT TO AVOID EXISTING UTILITIES WHERE POSSIBLE.
2. UTILITY LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE ONLY.
3. CONTRACTOR MUST FIELD VERIFY ALL UTILITY LOCATIONS BY CONTACTING BLUE STAKES AT 1-800-662-4111 OR 811, DIRECTLY CONTACTING THOSE IN THE UTILITY CONTACT LIST, AND OTHER APPLICABLE UTILITIES 72 HOURS PRIOR TO EXCAVATION. CONTRACTOR MUST CONTACT CANAL COMPANIES FOR LOCATIONS OF BURIED PIPELINES..
4. CONTRACTOR MUST MAINTAIN ALL BLUE STAKES MARKINGS IN CONSTRUCTION WORK ZONE BY NOT DISTURBING THE MARKS OR BY CALLING FOR REFRESH MARKINGS AS REQUIRED TO PROTECT THE UTILITIES AND MAINTAIN A SAFE WORK ZONE.
5. CONTRACTOR MUST POT-HOLE AND LOCATE EXISTING CROSSING UTILITIES, AND WHEN NECESSARY, OF PARALLEL UTILITIES, TO ENSURE CONSTRUCTION DOES NOT IMPACT EXISTING UTILITIES AND THAT THE LOCATION OF EXISTING UTILITIES DOES NOT AFFECT CONSTRUCTION. POT-HOLING MUST BE DONE TO PROVIDE UTILITY OWNERS ADEQUATE TIME TO RELOCATE SERVICES IF NECESSARY OR TO ALLOW ENGINEER TO REDESIGN PRIOR TO FABRICATION OF PRE-CAST STRUCTURES.
6. CONTRACTOR MUST BE SOLELY RESPONSIBLE FOR COSTS AND REPAIRS DUE TO DAMAGE OF EXISTING UTILITIES. ALL UTILITIES MAY NOT BE SHOWN ON PLANS.
7. ALL UTILITIES MUST BE KEPT IN WORKING ORDER EXCEPT AS APPROVED BY UTILITY OWNER.

1. CONTRACTOR MUST OBTAIN AND PAY FOR ALL APPLICABLE PERMITS AND CONDUCT WORK IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS.
2. CONTRACTOR MUST COMPLY WITH THE TERMS OF ALL PERMITS REQUIRED FOR THIS PROJECT.
3. CONTRACTOR MUST KEEP COPIES OF ALL REQUIRED PERMITS AT PROJECT LOCATION DURING REASONABLE WORKING HOURS.
4. THE CONTRACTOR MUST COMPLY WITH THE DEQ DWQ GENERAL CONSTRUCTION PERMIT.
5. THE CONTRACTOR MUST OBTAIN THE NOTICE OF INTENT (NOI) AND A NOTICE OF TERMINATION (NOT) AT THE APPROPRIATE TIMES FROM THE STATE OF UTAH DEQ DWQ. THE CONTRACTOR MUST BE LISTED AS THE RESPONSIBLE PARTY IN THE SWPPP.
6. DEWATERING IS REQUIRED, CONTRACTOR MUST OBTAIN DEWATERING PERMITS FROM THE STATE OF UTAH DIVISION OF WATER QUALITY AND COMPLY WITH ALL STATE REQUIREMENTS.
7. CONTRACTOR MUST COMPLY WITH ALL NIBLEY CITY PERMIT REQUIREMENTS.

**Issued for
Bidding**
Plot Date: 9/30/2025



1270 South 620 East, Suite 100
American Fork, UT 84003
T 801 756-0309 F 801 756-0481

[illegible]

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

SHEET INDEX, LEGEND, GENERAL NOTES

Generals.dwg
O\24012 HYRUM BLACKSMITH Canal Piping Phase 1\CAD\Design Drawings
LAYOUT: sheet Index

24012	JOB NO.
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SHEET

G2 OF **G5**

CONSTRUCTION NOTES

SURVEY AND CONSTRUCTION STAKING

- 1. CONTRACTOR MUST PROVIDE ALL SURVEYS FOR THE PROJECT INCLUDING BUT NOT BE LIMITED TO:
 - 1.1. CONSTRUCTION STAKING, INCLUDING CREATING ALL STAKE OUT FILES
 - 1.2. PROVIDE SURVEY FOR UTILITY RELOCATION FOR UTILITY PROVIDERS
 - 1.3. LIMITS OF DISTURBANCE
 - 1.4. LIMITS OF CONSTRUCTION EASEMENT
 - 1.5. SURVEY AND MARKING OF BOUNDARY OF WETLANDS TO BE PROTECTED, IF ANY
 - 1.6. AREAS AND LIMITS OF DEMOLITION, IF ANY
 - 1.7. VERIFICATION OF QUANTITIES FOR EACH PAYMENT REQUEST
- 2. ALL SURVEY CONTROL DATA IS INCLUDED WITHIN THESE DRAWINGS AND THE .DWG FILES WILL BE MADE AVAILABLE TO SURVEYOR AS NEEDED.
- 3. ALL SURVEY ON THE PROJECT IS IN GRID COORDINATES, UTM, STATE PLANE, TURN NETWORK.
- 4. ALL SURVEY CONTROL MONUMENTS ARE PROVIDED ON G5.
- 5. CONTRACTOR RESPONSIBLE TO PROTECT ALL SECTION CORNERS. IF DAMAGED CONTRACTOR TO REPAIR TO COUNTY STANDARDS.
- 6. CONTRACTOR MUST PROTECT AND MAINTAIN ALL BOUNDARY MARKERS AND RESTORE DAMAGED MARKERS TO OWNER SATISFACTION AT NO ADDITIONAL COST.

ACCESS RESTRICTIONS, ROAD AND LANE CLOSURES, PEDESTRIAN ACCESS AND TRAFFIC CONTROL PLAN

- 1. CONTRACTOR MUST LIMIT CONSTRUCTION ACTIVITIES TO THE PROJECT BOUNDARIES AND DESIGNATED EASEMENTS AND ACCESS POINT ROUTES AND POINTS IDENTIFIED. CONTRACTOR MUST DELINEATE LIMITS OF DISTURBANCE PRIOR TO CONSTRUCTION AS PART OF SURVEYING.
- 2. CONTRACTOR MUST PROVIDE A TRAFFIC CONTROL PLAN, ADEQUATE TRAFFIC CONTROL, SIGNING, BARRICADING, AND PEDESTRIAN DIRECTION THROUGH AND AROUND THE CONSTRUCTION WORK ZONE IN COMPLIANCE WITH THE UDOT MUTCD AS REQUIRED BY UTAH STATE LAW (R920-1).
- 3. THE TRAFFIC CONTROL PLANS MUST BE PROVIDED TO THE NIBLEY CITY ENGINEER A MINIMUM OF 48 HOURS PRIOR TO THE PRE-CONSTRUCTION MEETING TO ALLOW REVIEW. COMMENTS AND REQUIRED CHANGES MUST BE PROVIDED AT THE PRE-CONSTRUCTION MEETING. ALL CORRECTIONS MUST BE INCORPORATED INTO THE TRAFFIC CONTROL PLAN BEFORE WORK BEGINS.
- 4. TRAFFIC CONTROL PLAN MUST BE UPDATED REGULARLY AS CONSTRUCTION PROGRESSES.
- 5. CONTRACTOR MUST INSTALL AND MAINTAIN ALL TRAFFIC CONTROL AS PART OF THIS PROJECT.
- 6. CONTRACTOR MUST INSPECT TRAFFIC CONTROL DAILY TO ENSURE A SAFE WORK ZONE.
- 7. ANY SIGNIFICANT MODIFICATIONS TO THE TRAFFIC CONTROL PLAN DURING CONSTRUCTION MUST BE SUBMITTED TO THE NIBLEY CITY ENGINEER.
- 8. PROPERTY OWNERS MUST BE GIVEN 72 HOURS' NOTICE OF DRIVEWAY ACCESS RESTRICTIONS DURING CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR NOTIFYING HOMEOWNERS AS NEW PIPING AND CONCRETE ARE INSTALLED.
- 9. ACCESS TO ALL BUSINESSES WITHIN THE PROJECT AREA MUST BE COORDINATED WITH BUSINESS OWNERS AND REASONABLY MAINTAINED DURING CONSTRUCTION.
- 10. CONTRACTOR MUST COORDINATE LANE CLOSURES AND PARTIAL AND COMPLETE ROAD CLOSURES WITH THE ENGINEER.

IRRIGATION AND CANAL IMPACTS

- 1. CANAL PIPING MUST BE COMPLETED OUTSIDE OF THE IRRIGATION SEASON.
- 2. ALL CROSSINGS ARE TO BE COMPLETED AS DETAILED IN THESE DRAWINGS.
- 3. DAMAGE OF EXISTING IRRIGATION SYSTEMS AND BOXES MUST BE REPAIRED BY CONTRACTOR.
- 4. CONTRACTOR MUST ENSURE PRIVATE IRRIGATION WATER DELIVERED BY CANAL COMPANIES IS AVAILABLE TO ALL USERS OF THE SYSTEM AT THEIR SCHEDULED TIMES OF USE. COORDINATE INTERRUPTIONS WITH INDIVIDUAL USERS.

STAGING OF MATERIAL

- 1. CONTRACTOR SHALL OBTAIN ADDITIONAL SUPPLEMENTARY STAGING AREAS FOR THEIR CONVENIENCE AT NO ADDITIONAL COST TO THE OWNER.
- 2. ALL STAGING AREAS MUST BE MAINTAINED AND KEPT CLEAN OF DEBRIS AND GARBAGE. SITES MUST BE KEPT ORDERLY AND NEAT.
- 3. CONDITIONS OF STAGING AREAS MUST BE DOCUMENTED PRIOR TO INITIATING CONSTRUCTION AND PROVIDED TO OWNER..
- 4. STAGING AREAS MUST BE RESTORED TO CONDITIONS EQUIVALENT TO OR BETTER THAN THE CONDITIONS PRIOR TO THE PROJECT. PRIOR TO FINAL PAYMENT.

EXISTING CONDITIONS

- 1. CONTRACTOR MUST VIDEO RECORD CONSTRUCTION AREA PRIOR TO BEGINNING CONSTRUCTION TO VERIFY CONDITIONS BEFORE AND AFTER CONSTRUCTION AND PROVIDE TO OWNER.

WORK ON PRIVATE PROPERTY

- 1. ALL CONCRETE DRIVEWAYS AND SIDEWALKS IMPACTED BY CONSTRUCTION MUST BE SAW-CUT AT EXISTING CONSTRUCTION JOINTS. ANY SECTION DAMAGED MUST BE REPLACED AT NO ADDITIONAL COST BEYOND THAT SPECIFIED IN PLANS.
- 2. ALL ASPHALT PATCHES MUST BE TEE PATCHES PER APWA 255 EXCEPT THE MILL AND OVERLAY, WHICH IS NOT REQUIRED.
- 3. ALL FENCES MUST BE REPLACED OR RESTORED IN KIND.
- 4. LANDSCAPING MUST BE RESTORED OR REPLACED IN KIND.

DISPOSAL OF MATERIAL

- 1. ANY EXCAVATED MATERIAL NOT RECYCLED MUST BE REMOVED AND DISPOSED OF AT A SITE APPROVED BY THE OWNER.
- 2. CONCRETE AND ASPHALT MUST BE HAULED TO RECYCLE OR TO DISPOSAL AT NO ADDITIONAL COST TO

- THE OWNER.
- 3. PIPE AND ANY OTHER MATERIAL NOT SPECIFICALLY SPECIFIED AND APPROVED MUST BE REMOVED FROM SITES AND MUST BE DISPOSED.

QUALITY CONTROL TESTING FOR BACKFILL AND COMPACTION

- 1. CONTRACTOR MUST EMPLOY AN APPROVED QUALITY CONTROL TESTING AGENCY TO PROVIDE TESTING PER THE SPECIFICATIONS..

NATIVE MATERIAL

- 1. DRY NATIVE MATERIAL MAY BE USED FOR GENERAL BACKFILL.
- 2. ORGANIC MATERIAL, RUBBISH, DEBRIS, FROZEN MATERIAL, AND ANY OTHER OBJECTIONABLE MATERIALS MUST BE REMOVED.
- 3. CONTRACTOR MUST PROVIDE PROCTOR DENSITY DATA OF AND GRADATIONS OF SOURCE MATERIALS IMPORTED TO OWNER.

GRANULAR BACKFILL BORROW

- 1. GRANULAR BACKFILL BORROW MUST BE IN ACCORDANCE WITH SPECIFICATIONS AND A MAX PARTICLE SIZE OF 2 INCHES OR LESS WITHIN PIPE ZONE.
- 2. GRANULAR BACKFILL BORROW MUST BE PLACED AS PER PIPE MANUFACTURER DETAIL AND SPECIFICATIONS..

OTHER BACKFILL MATERIAL

- 1. ALL OTHER BACKFILL MATERIAL MUST COMPLY WITH MATERIAL SPECIFICATIONS (MS) AND BE INSTALLED PER CONSTRUCTION SPECIFICATIONS (CS).

GRUBBING

- 1. CONTRACTOR MUST EXCAVATE TOPSOIL FROM AREAS TO BE RELANDSCAPED OR REGRADED AND OTHER AREAS IDENTIFIED IN THESE PLANS PER CS-UT-02..

TRENCH EXCAVATION

- 1. CONTRACTOR MUST DETERMINE MEANS AND METHODS NECESSARY TO SAFELY EXCAVATE TRENCHES FOR PROJECT AT THE SPECIFIED DEPTHS IN COMPLIANCE WITH OSHA RULES AND REGULATIONS.
- 2. ALL EXCAVATIONS MUST COMPLY WITH CS-UT-252.
- 3. NATIVE SUBGRADE MATERIAL MUST BE COMPACTED TO FIRM AND UNYIELDING PRIOR TO THE PLACEMENT OF ANY NEW MATERIAL UNLESS SPECIFIED OTHERWISE IN THESE PLANS.
- 4. DEWATERING MUST BE PROVIDED AS PART OF THIS PROJECT.

CONCRETE

- 1.1. ALL CONCRETE MUST COMPLY WITH CONTRACT SPECIFICATIONS.

LANDSCAPING AND DISTURBED AREAS (WHERE REQUIRED)

- 1. CONTRACTOR MUST REPAIR DISTURBED SURFACES TO PRE-EXISTING CONDITIONS. CONTRACTOR MUST RESEED DISTURBED AREAS WITH SPECIFIED SEED MIX.

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Plot Date: 9/30/2025

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CIVIL ENGINEERS



1276 South 820 East, Suite 100
American Fork, UT 84003
T 801 756-0309 F 801 756-0481

Professional Engineer
LANCE ERIC HOUSER
No. 86072-2202
EXPIRATION DATE 07-30-2025

PROJECT LEADER:	LANCE HOUSER					
PRINT DATE:	SEPTEMBER 30, 2025					
CHECKED:	CHECKED					
REVIEWED:	REVIEWED					
REVISIONS	DESCRIPTION					
NO.	DATE	INTS.				

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

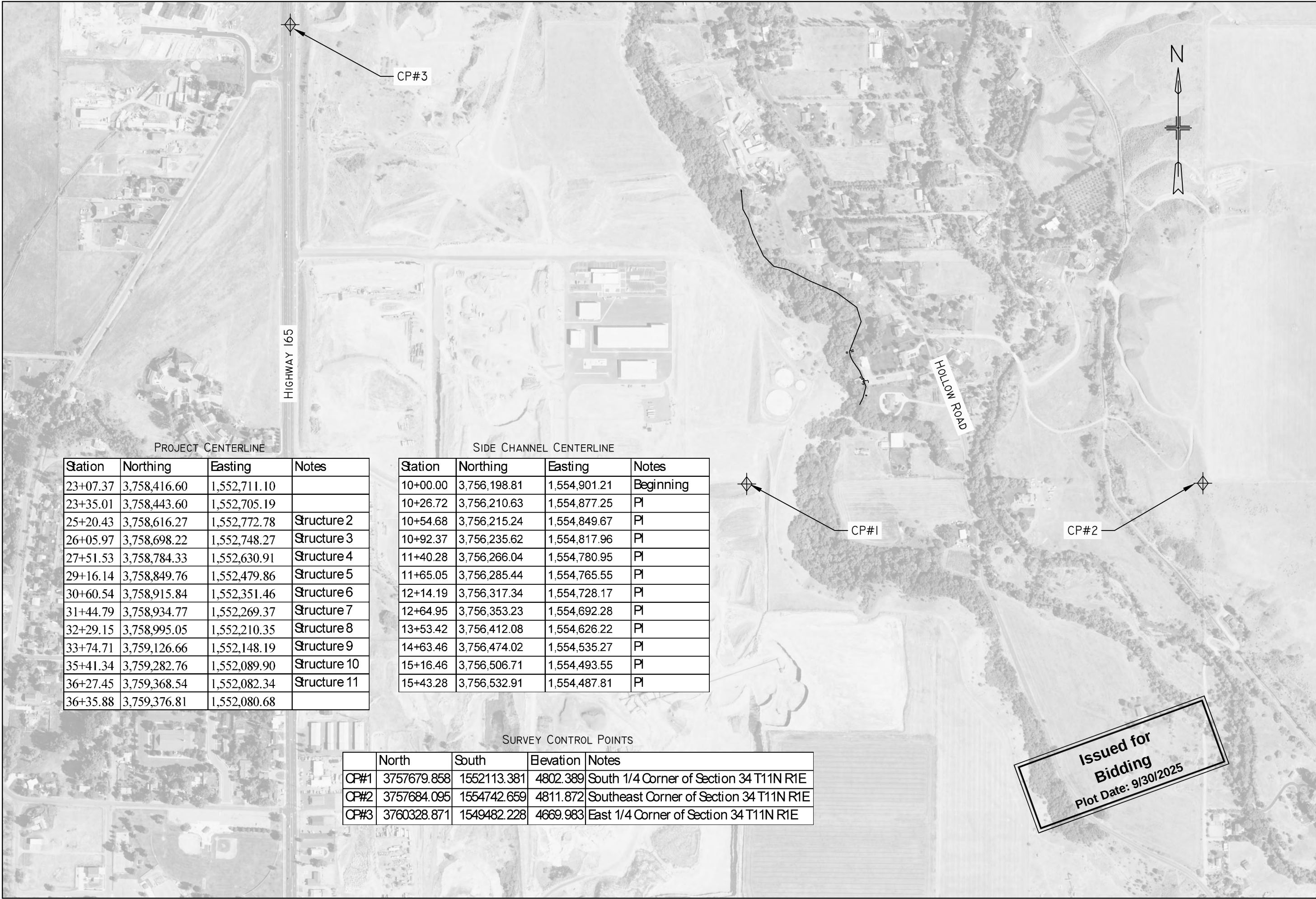
CONSTRUCTION NOTES

Generals.dwg
0/24012 HYRUM BLACKSMITH Canal Piping Phase 1/CADDDesign Drawings

JOB NO.
24012

SHEET

G3 OF G5



PROJECT CENTERLINE

Station	Northing	Easting	Notes
23+07.37	3,758,416.60	1,552,711.10	
23+35.01	3,758,443.60	1,552,705.19	
25+20.43	3,758,616.27	1,552,772.78	Structure 2
26+05.97	3,758,698.22	1,552,748.27	Structure 3
27+51.53	3,758,784.33	1,552,630.91	Structure 4
29+16.14	3,758,849.76	1,552,479.86	Structure 5
30+60.54	3,758,915.84	1,552,351.46	Structure 6
31+44.79	3,758,934.77	1,552,269.37	Structure 7
32+29.15	3,758,995.05	1,552,210.35	Structure 8
33+74.71	3,759,126.66	1,552,148.19	Structure 9
35+41.34	3,759,282.76	1,552,089.90	Structure 10
36+27.45	3,759,368.54	1,552,082.34	Structure 11
36+35.88	3,759,376.81	1,552,080.68	

SIDE CHANNEL CENTERLINE

Station	Northing	Easting	Notes
10+00.00	3,756,198.81	1,554,901.21	Beginning
10+26.72	3,756,210.63	1,554,877.25	PI
10+54.68	3,756,215.24	1,554,849.67	PI
10+92.37	3,756,235.62	1,554,817.96	PI
11+40.28	3,756,266.04	1,554,780.95	PI
11+65.05	3,756,285.44	1,554,765.55	PI
12+14.19	3,756,317.34	1,554,728.17	PI
12+64.95	3,756,353.23	1,554,692.28	PI
13+53.42	3,756,412.08	1,554,626.22	PI
14+63.46	3,756,474.02	1,554,535.27	PI
15+16.46	3,756,506.71	1,554,493.55	PI
15+43.28	3,756,532.91	1,554,487.81	PI

SURVEY CONTROL POINTS

	North	South	Elevation	Notes
CP#1	3757679.858	1552113.381	4802.389	South 1/4 Corner of Section 34 T11N R1E
CP#2	3757684.095	1554742.659	4811.872	Southeast Corner of Section 34 T11N R1E
CP#3	3760328.871	1549482.228	4669.983	East 1/4 Corner of Section 34 T11N R1E

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LANCE ERIC HOUSER

No. 86072-2202

9-30-2025

PROFESSIONAL ENGINEER

DESIGNER: LANCE HOUSER

DRAFTSMAN: MATT GURR

NO. DATE

CHECKED: LANCE HOUSER

REVIEWED: MATT GURR

REVISIONS

PROJECT LEADER: LANCE HOUSER

PRINT DATE: SEPTEMBER 30, 2025

DESCRIPTION

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

LOCATION MAP-SURVEY CONTROL

General.dwg

0/2-4012 HYRUM BLACKSMITH Canal Piping Phase I/CADD Design Drawings

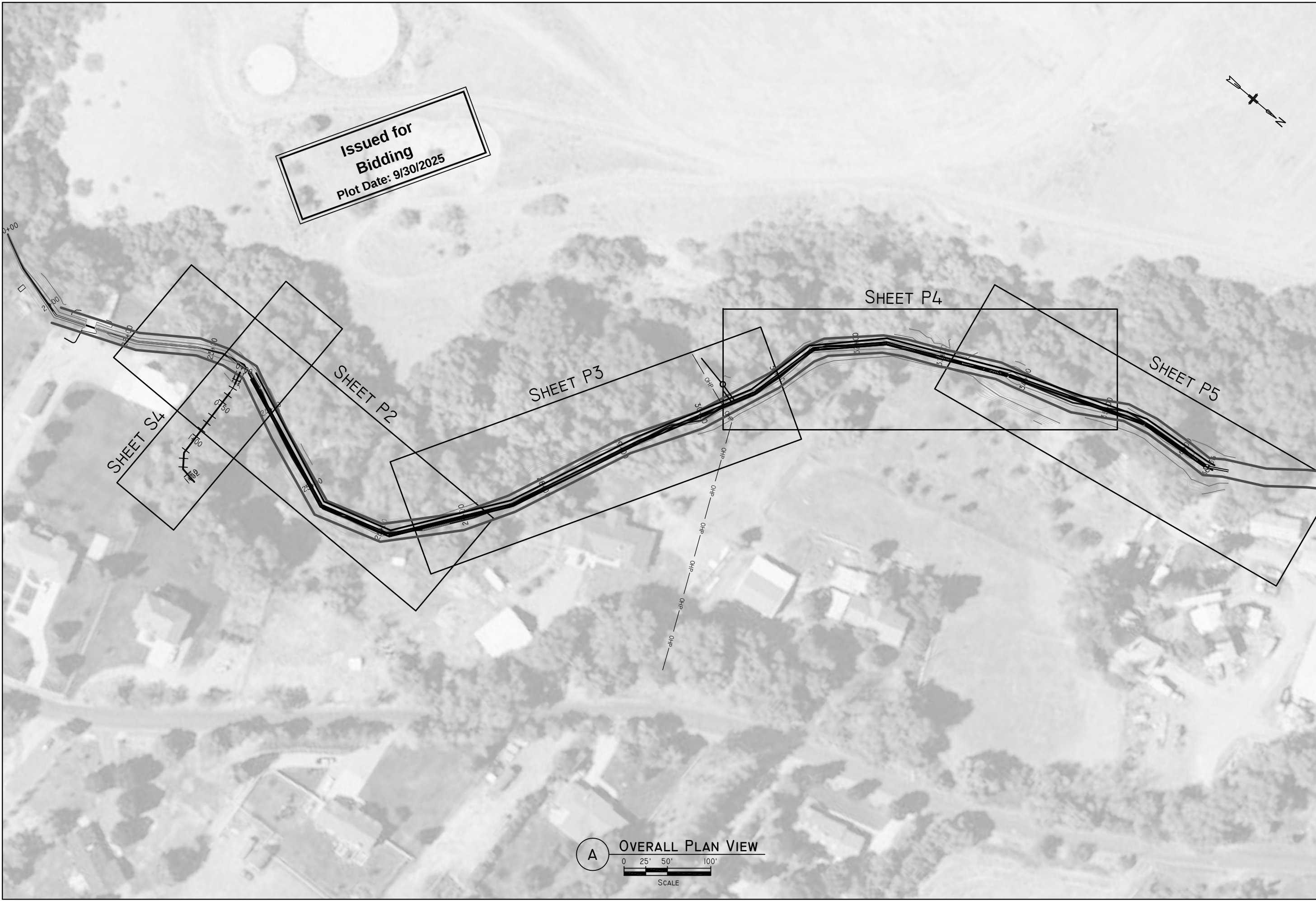
LAYOUT: Location Map

JOB NO.

24-012

SHEET

G4 OF G5



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A OVERALL PLAN VIEW
0 25' 50' 100'
SCALE

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PROFESSIONAL ENGINEER
LANCE ERIC HOUSER
No. 86072-2202
9-30-2025
UTAH

DESIGNER:	LANCE HOUSER	CHECKED:	LANCE HOUSER	PROJECT LEADER:	LANCE HOUSER
DRAFTSMAN:	MATT GURR	REVIEWED:		PRINT DATE:	SEPTEMBER 30, 2025
NO.	DATE	INTS.	REVISIONS	DESCRIPTION	

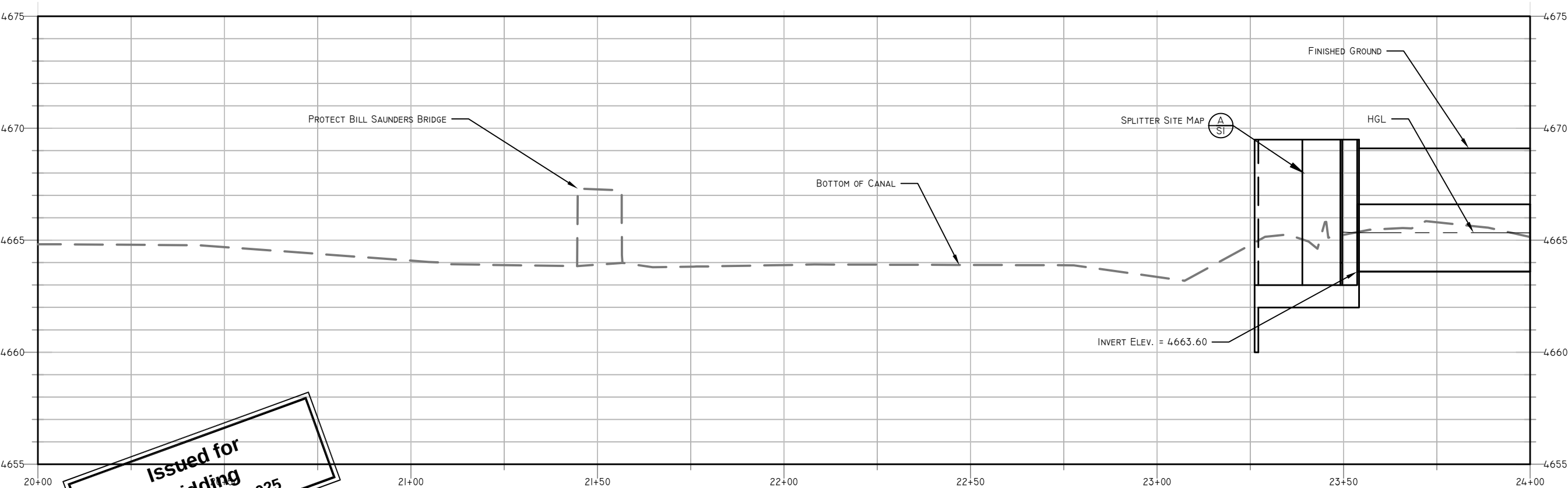
HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I
PLAN AND PROFILE OVERALL

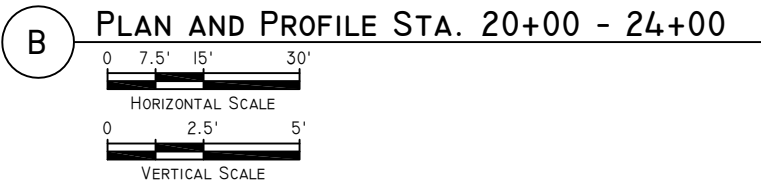
Plan and Profiles.dwg
0/24012 HYRUM BLACKSMITH Canal Piping Phase I/CADD/Design Drawings
LAYOUT: P1 OVERALL

JOB NO.
24012

SHEET
P1 OF P6



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LANCE ERIC HOUSER
No. 86072-2202
9-30-2025
PROFESSIONAL ENGINEER

DESIGNER:	LANCE HOUSER	PROJECT LEADER:	LANCE HOUSER	CHECKED:	CHECKED:	CHECKED:	CHECKED:
DRAFTSMAN:	MATT GURR	PRINT DATE:	SEPTEMBER 30, 2025	REVIEWED:	REVIEWED:	REVIEWED:	REVIEWED:
NO.	DATE	INTS.	DESCRIPTION	NO.	DATE	INTS.	DESCRIPTION

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

PLAN AND PROFILE STA. 20+00 - 24+00

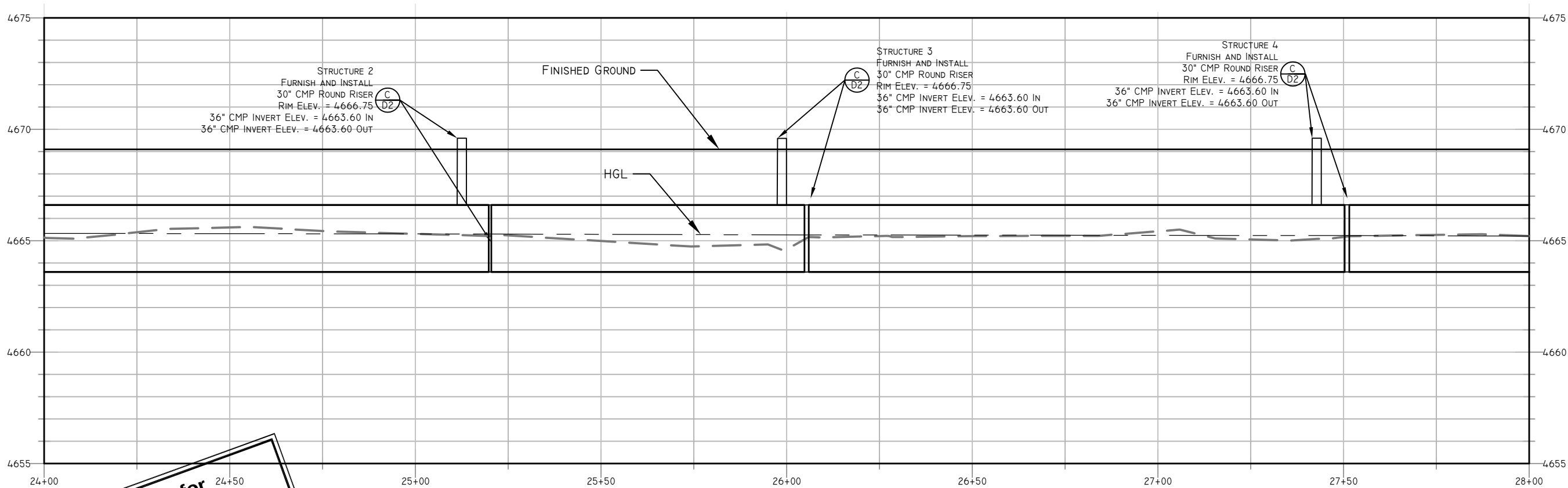
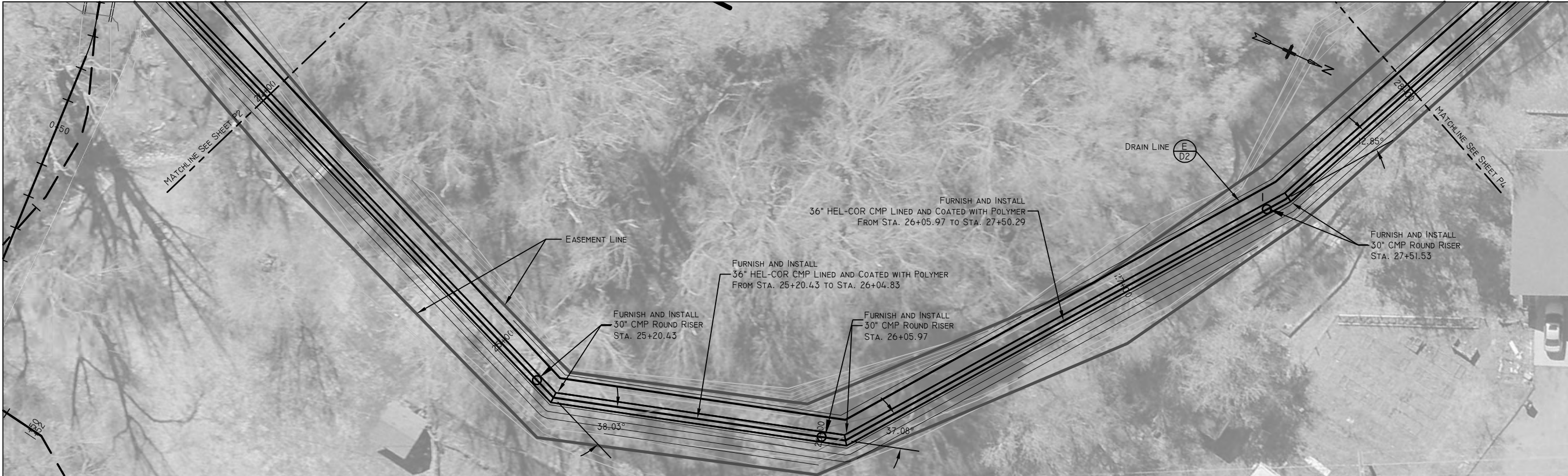
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09/24/2025 HYRUM BLACKSMITH Canal Piping Phase I/CADD/Design Drawings

JOB NO.
24-012

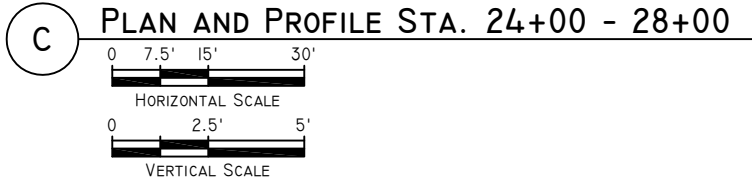
LAYOUT: P2 20-24

SHEET

P2 OF P6



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PROFESSIONAL ENGINEER

LANCE ERIC HOUSER

No. 86072-2202

STATE OF UTAH

SEPT 30 2025

DESIGNER:	LANCE HOUSER	PROJECT LEADER:	LANCE HOUSER	CHECKED:	CHECKED:	REVISIONS
DRAFTSMAN: <td>MATT GURR<td>PRINT DATE:<td>SEPTEMBER 30, 2025<td>REVIEWED:<td>REVIEWED:<td></td></td></td></td></td></td>	MATT GURR <td>PRINT DATE:<td>SEPTEMBER 30, 2025<td>REVIEWED:<td>REVIEWED:<td></td></td></td></td></td>	PRINT DATE: <td>SEPTEMBER 30, 2025<td>REVIEWED:<td>REVIEWED:<td></td></td></td></td>	SEPTEMBER 30, 2025 <td>REVIEWED:<td>REVIEWED:<td></td></td></td>	REVIEWED: <td>REVIEWED:<td></td></td>	REVIEWED: <td></td>	
NO.	DATE	INTS.				DESCRIPTION

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

PLAN AND PROFILE STA. 24+00 - 28+00

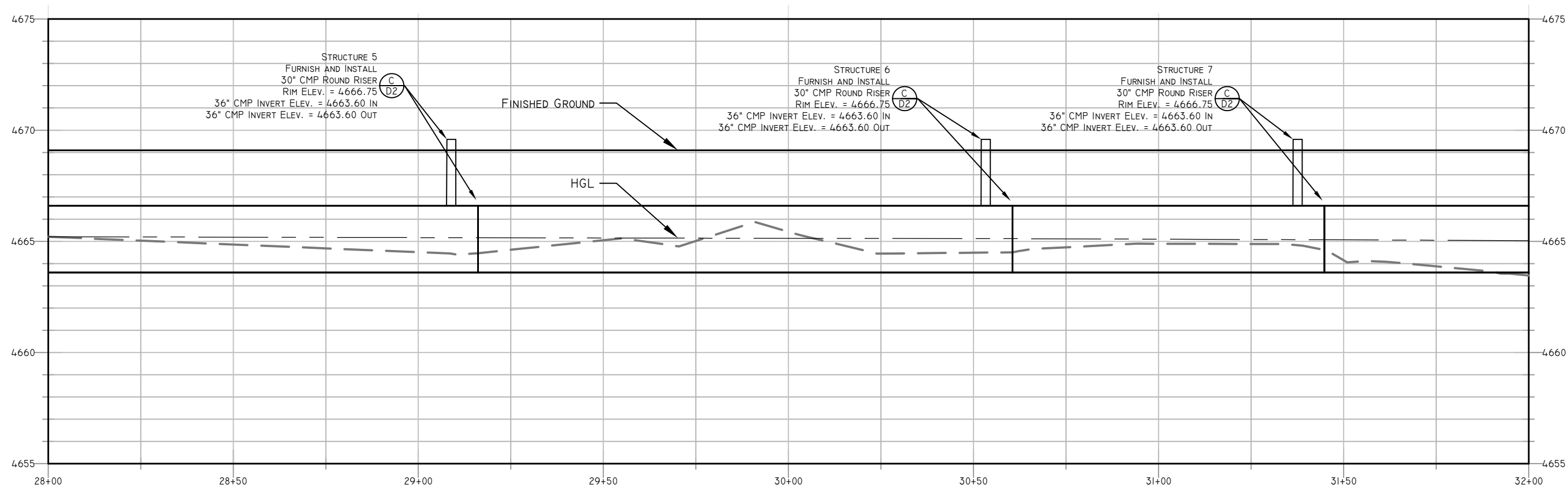
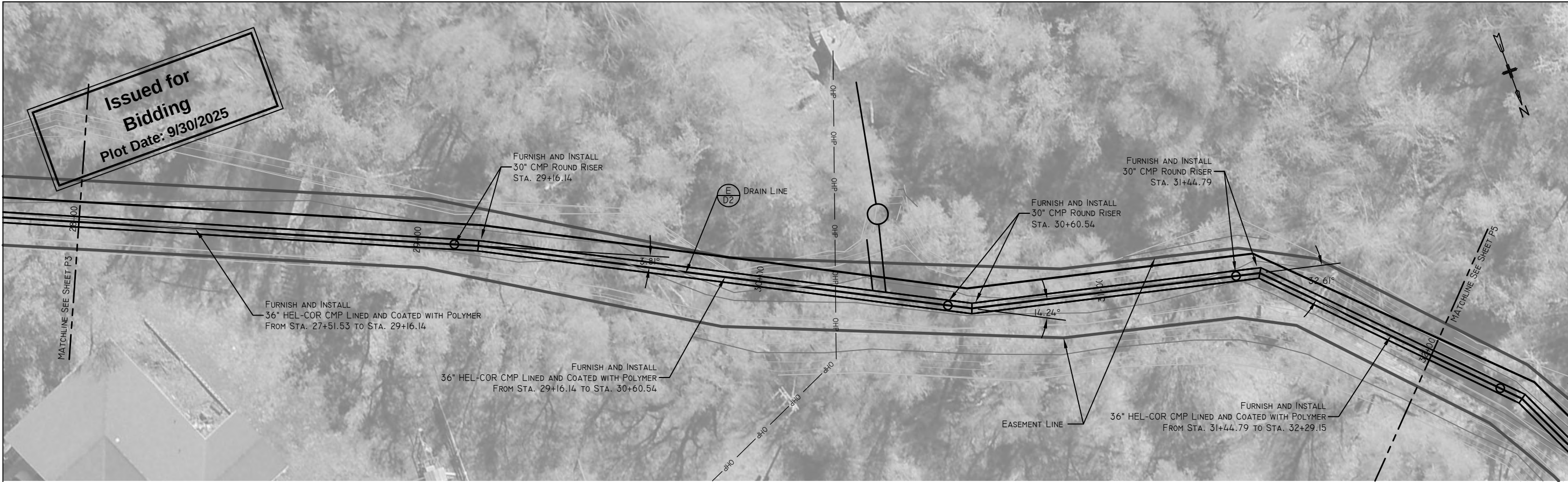
Plan and Profiles.dwg
09/24/2025 HYRUM BLACKSMITH Canal Piping Phase I/CADD Design Drawings

JOB NO.
24-012

LAYOUT: P3 24-28

SHEET

P3 OF P6



D PLAN AND PROFILE STA. 28+00 - 32+00

0 7.5' 15 30'
HORIZONTAL SCALE

0 2.5' 5'
VERTICAL SCALE

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PROFESSIONAL ENGINEER

LANCE ERIC HOUSER

No. 86072-2202

STATE OF UTAH

SEP 30 2025

PROJECT LEADER: LANCE HOUSER

PRINT DATE: SEPTEMBER 30, 2025

CHECKED: LANCE HOUSER

REVIEWED: MATT GURR

DESIGNER: LANCE HOUSER

DRAFTSMAN: MATT GURR

NO. DATE

INTS.

REVISIONS

DESCRIPTION

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CANAL PIPING PHASE I

PLAN AND PROFILE STA. 28+00 - 32+00

Plan and Profiles.dwg

0924012 HYRUM BLACKSMITH Canal Piping Phase 1/CADD Design Drawings

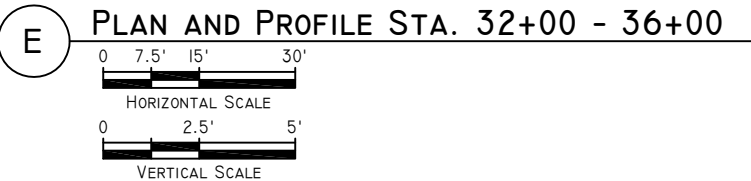
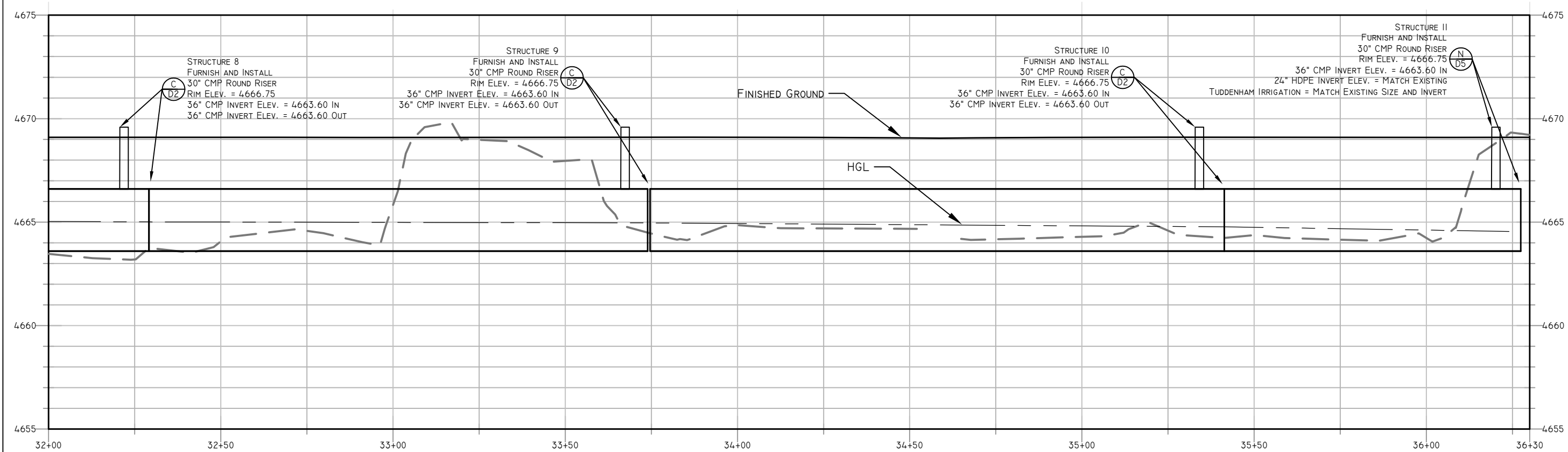
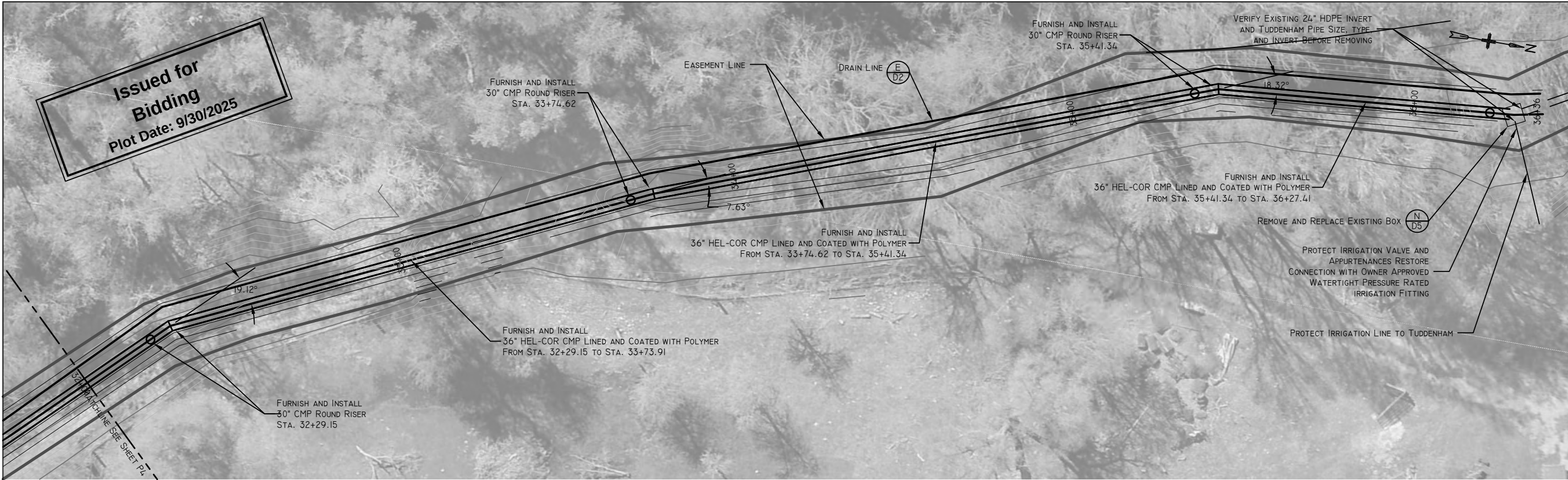
LAYOUT: P4 28-32

JOB NO.

24012

SHEET

P4 OF P6



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PROFESSIONAL ENGINEER

LANCE ERIC HOUSER

No. 86072-2202

STATE OF UTAH

PROJECT LEADER:

LANCE HOUSER

SEPTEMBER 30, 2025

CHECKED:

REVIEWED:

REVISIONS

DESIGNER:

DRAFTSMAN:

NO.

DATE

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

PLAN AND PROFILE STA. 32+00 - 36+30

Plan and Profiles.dwg

09/24/2025

HYRUM BLACKSMITH Canal Piping Phase 1/CADD/Design Drawings

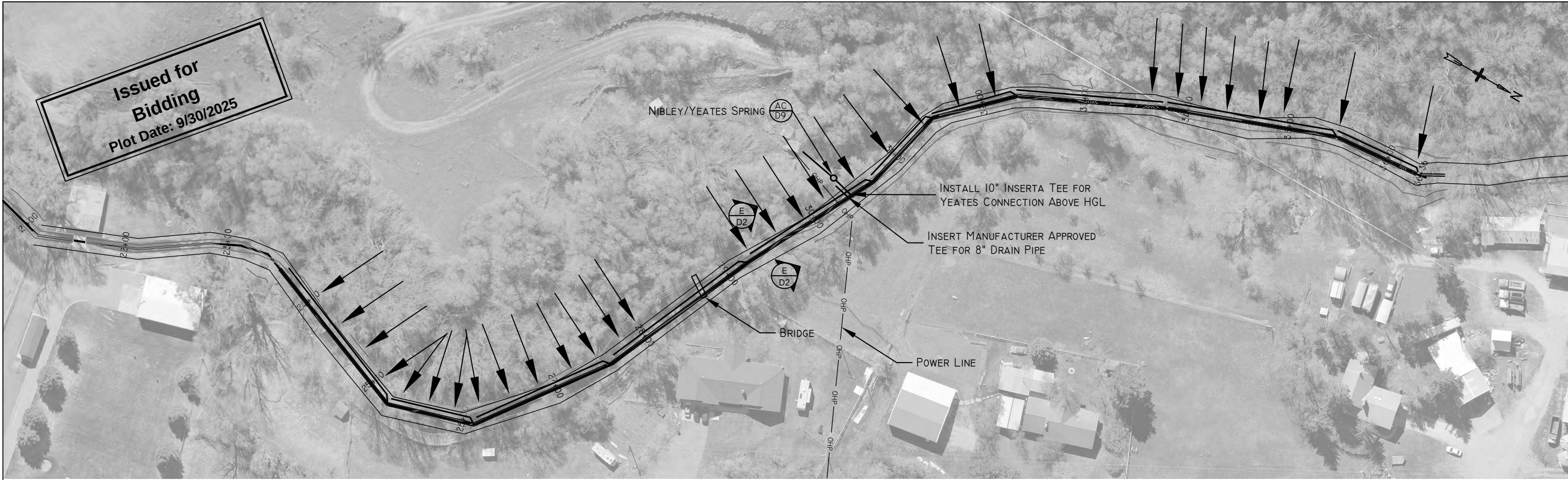
JOB NO.

24-012

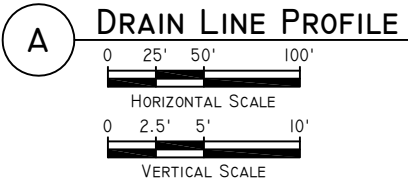
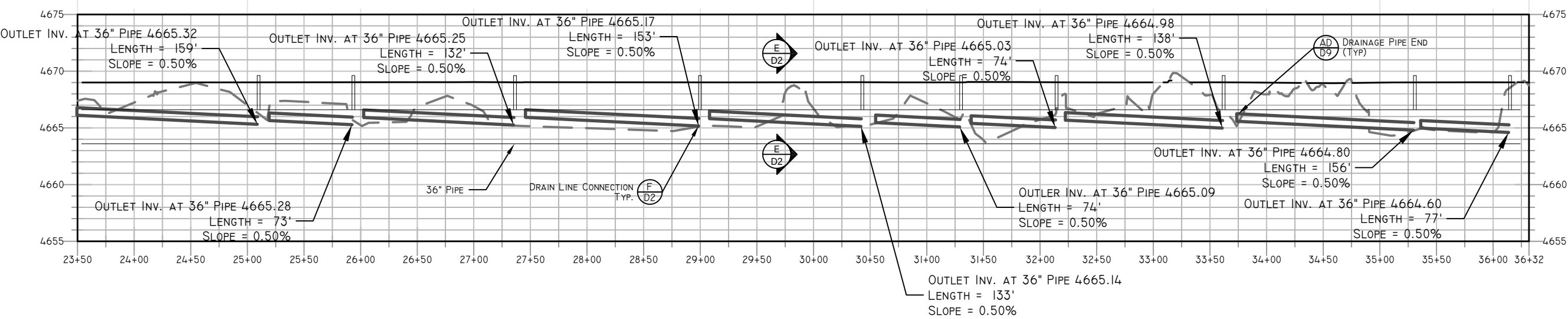
LAYOUT: P5 32-36

SHEET

P5 OF P6



NOTE: ALL DRAIN LINES ARE 8" PERFORATED HDPE PER SPECIFICATIONS



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PROFESSIONAL ENGINEER
LANCE ERIC HOUSER
No. 86072-2202
STATE OF UTAH
EXPIRATION DATE 09-30-2025

DESIGNER: LANCE HOUSER
DRAFTSMAN: MATT GURR
NO. DATE

PROJECT LEADER: LANCE HOUSER
PRINT DATE: SEPTEMBER 30, 2025

CHECKED: REVIEWED: REVISIONS

NO. DATE DESCRIPTION

HYRUM BLACKSMITH FORK IRRIGATION COMPANY
CANAL PIPING PHASE I
DRAIN PIPELINES

Plan and Profiles.dwg
09/24/2025 HYRUM BLACKSMITH Canal Piping Phase I/CADD Design Drawings
JOB NO. 24012
LAYOUT: P6 36-40

SHEET
P6 OF P6



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STATION = 23+54.29
OFFSET = -5.83
NORTHING = 3758463.69
EASTING = 1552706.79

STATION = 23+49.27
OFFSET = -4.97
NORTHING = 3758458.70
EASTING = 1552705.76

SPLITTER BOX PLAN VIEW

STATION = 23+37.42
OFFSET = -6.29
NORTHING = 3758448.14
EASTING = 1552700.21



STATION = 23+33.25
OFFSET = -5.99
NORTHING = 3758440.60

STATION = 23+25.76
OFFSET = -5.67
NORTHING = 3758433.35
EASTING = 1552701.63

STATION = 23+24.66
OFFSET = -7.54
NORTHING = 3758431.88
EASTING = 1552700.04

STATION = 23+53.97
OFFSET = 6.16
NORTHING = 3758459.02
EASTING = 1552717.84

STATION = 23+45.77
OFFSET = 5.94
NORTHING = 3758451.46

STATION = 23+49.00
OFFSET = 11.93
NORTHING = 3758452.28

STATION = 23+41.79
OFFSET = 17.31
NORTHING = 3758443.61
EASTING = 1552723.78

STATION = 23+25.77
OFFSET = 13.43
NORTHING = 3758437.46
EASTING = 1552720.29

TION = 23+26.67
 SET = 11.38
 THING = 3758437.89
 TING = 1552718.10

H CANAL PLAN AND PROFILE

 CUTTHROAT FLUME

— PROTECT EXISTING FENCE

A **SPLITTER SITE MAP**

0 3.75' 7.5' 15'

SCALE



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[illegible]

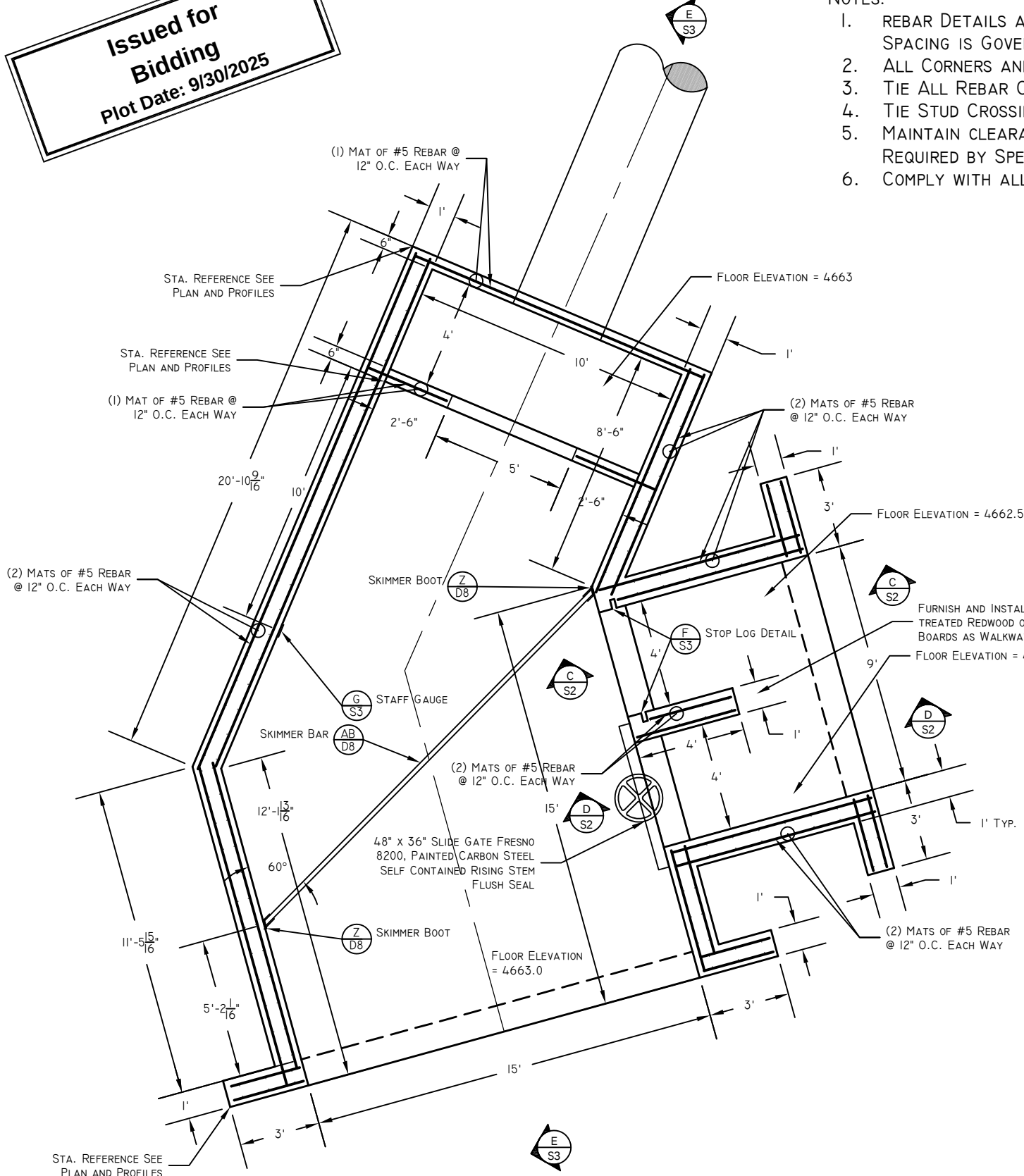
HYRUM BLACKSMITH FORK IRRIGATION COMPANY
CANAL PIPING PHASE I
SPLITTER SITE MAP

Plan and Profiles.dwg
O-24012 HYRUM BLACKSMITH Canal Piping Phase NCADDdesign Drawings
LAYOUT: Splitter

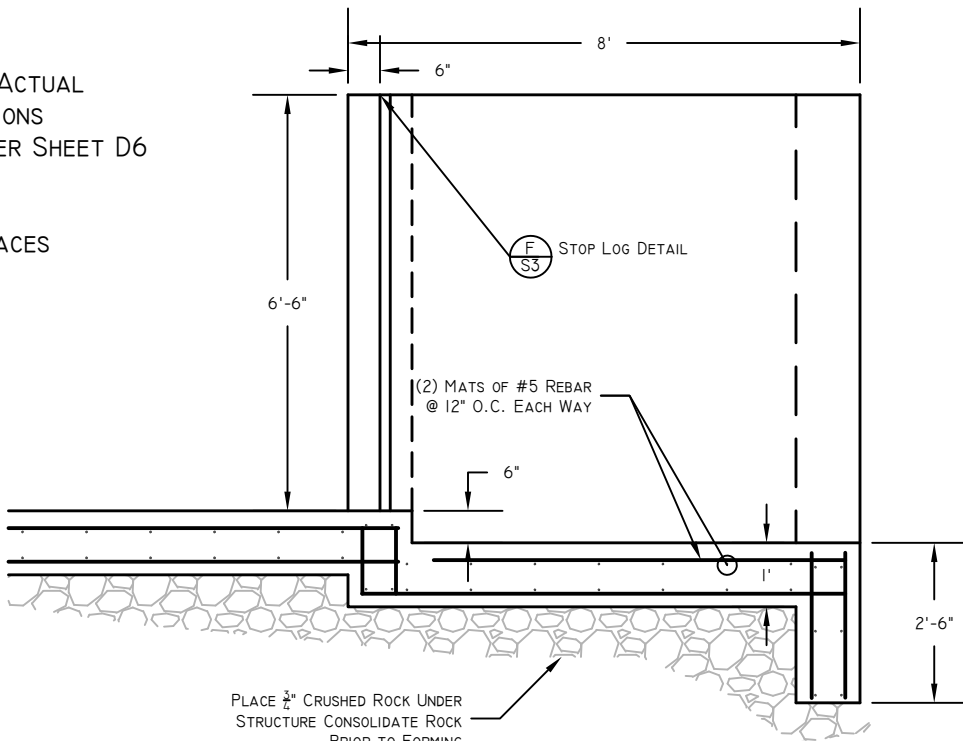
JOB NO.	24012
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SHEET	
SI	OF S5

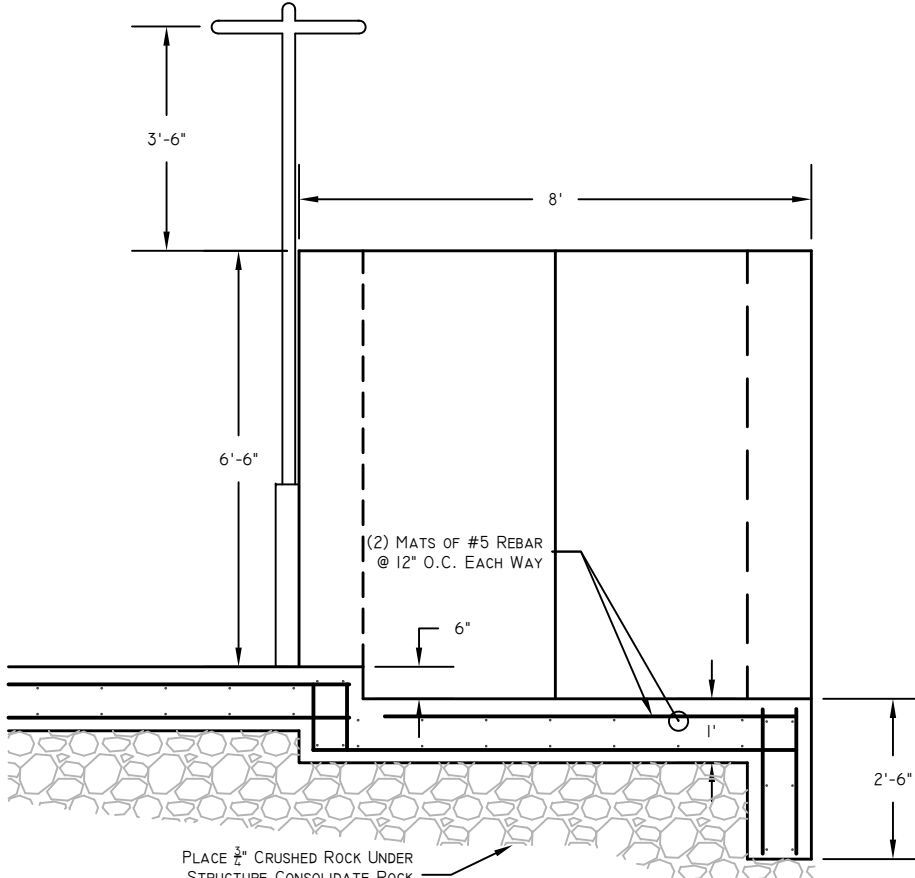
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Plot Date: 9/30/2025



- NOTES:
1. REBAR DETAILS ARE ILLUSTRATIVE ONLY. ACTUAL SPACING IS GOVERNED BY THE SPECIFICATIONS
 2. ALL CORNERS AND LAP REINFORCEMENT PER SHEET D6
 3. TIE ALL REBAR CROSSING
 4. TIE STUD CROSSINGS TO REBAR
 5. MAINTAIN CLEARANCES FROM CONCRETE FACES REQUIRED BY SPECIFICATIONS
 6. COMPLY WITH ALL SPECIFICATIONS



STOP LOGS SECTION
NOT TO SCALE



D SLIDE GATE SECTION
NOT TO SCALE

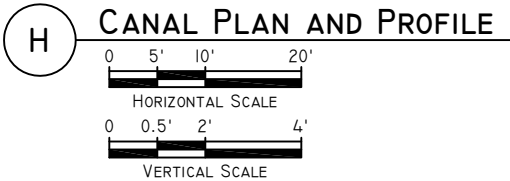
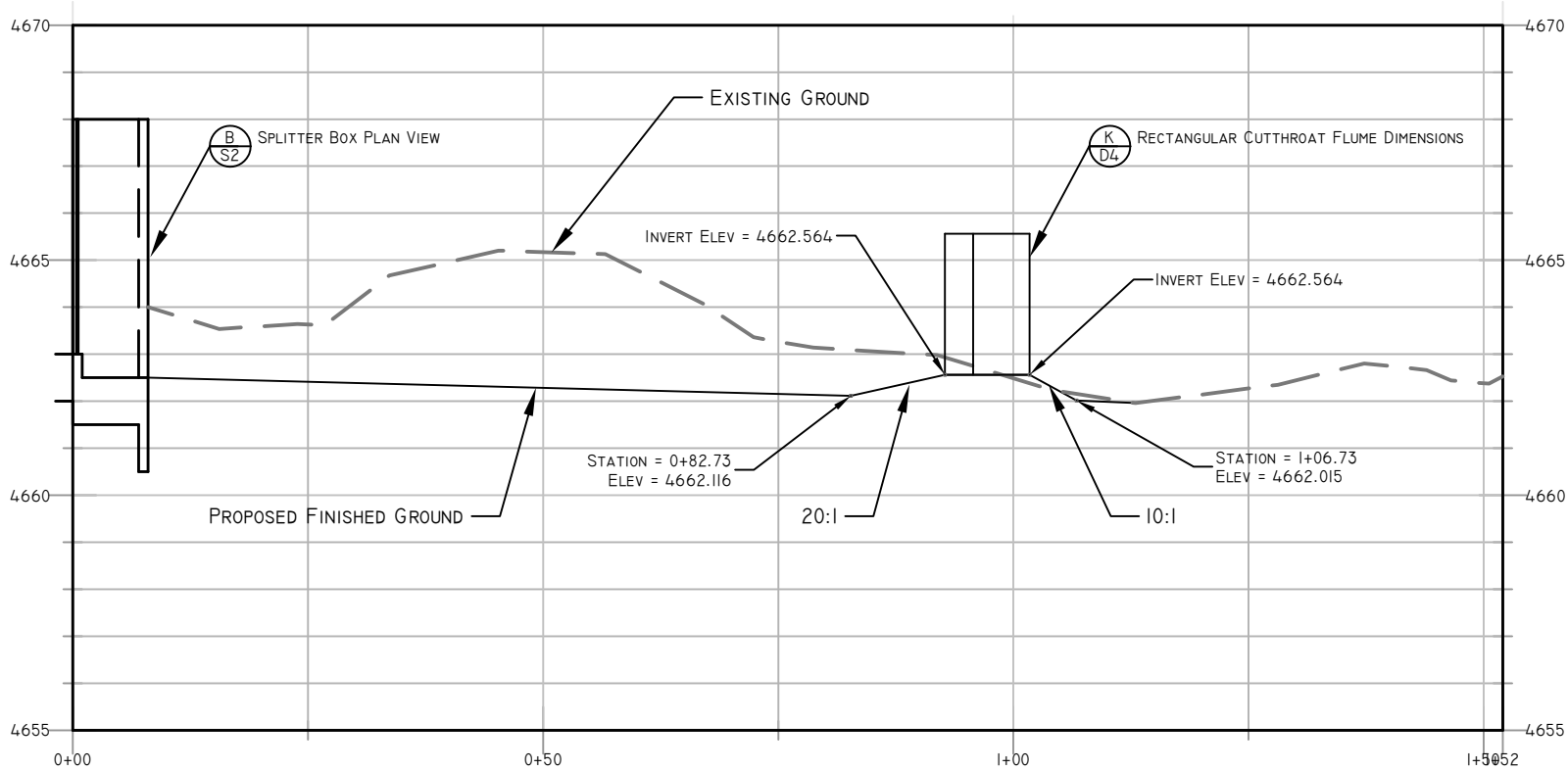
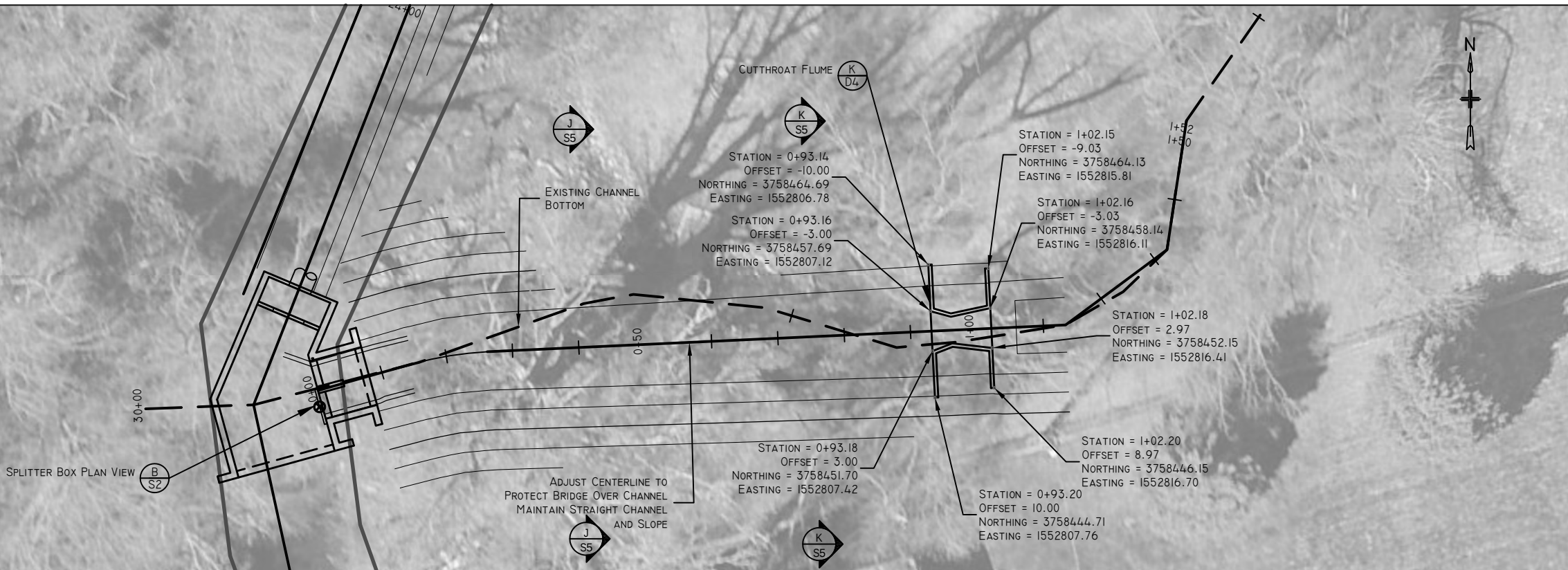


G STAFF GAUGE
NOT TO SCALE

NOTE: REFERENCE FROM
ENGINEERING SUPPLY.
AVAILABLE FROM MULTIPLE
SOURCES.

[illegible]

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Plot Date: 9/30/2025



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American Fork, UT 84003
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DESIGNER:	DRAFTSMAN:	CHECKED:	PROJECT LEADER:	DATE:
LANCE HOUSER	MATT GURR	REVIEWED	LANCE HOUSER	SEPTEMBER 30, 2025

NO.	DATE	INTS.	DESCRIPTION

HYRUM BLACKSMITH FORK IRRIGATION COMPANY

CANAL PIPING PHASE I

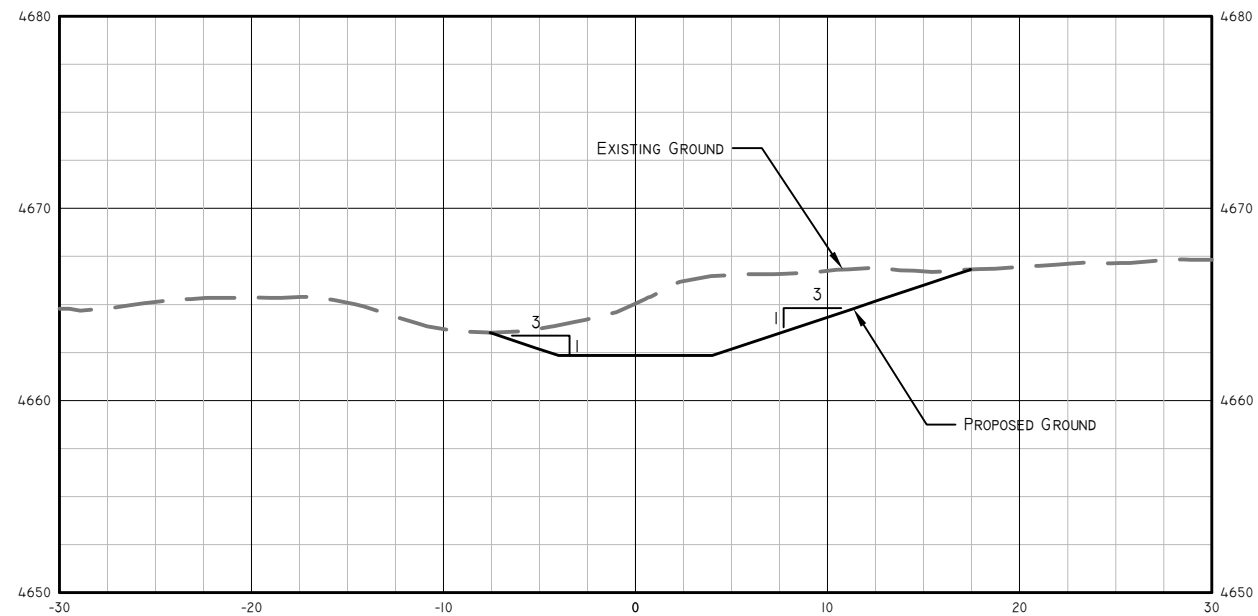
CANAL PLAN AND PROFILE

Plan and Profiles.dwg
09/24/2025 HYRUM BLACKSMITH Canal Piping Phase I/CADD/Design Drawings
LAYOUT: Canal Bottom

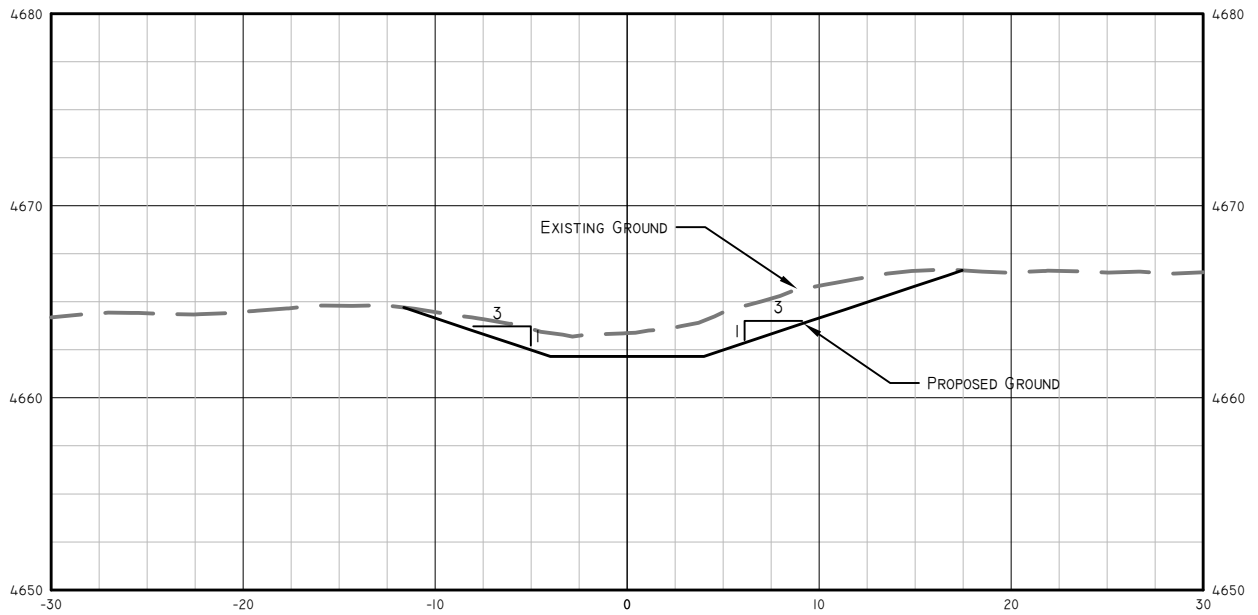
JOB NO.
24-012

SHEET
S4 OF **S5**

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Bidding
Plot Date: 9/30/2025



J SECTION @ 40+00
0 2.5' 5' 10'
SCALE



K SECTION @ 75+00
0 2.5' 5' 10'
SCALE

NOTE: APPLY RESEEDING MIX PER
LANDSCAPING REQUIREMENTS.



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DESIGNER:	LANCE HOUSER	PROJECT LEADER:	LANCE HOUSER	CHECKED:	PROJECT DATE:	REVISIONS	DESCRIPTION
				REVIEWED:	SEPTEMBER 30, 2025		
DRAFTSMAN:	MATT GARR	PRINT DATE:					
NO.	DATE	INTS.					

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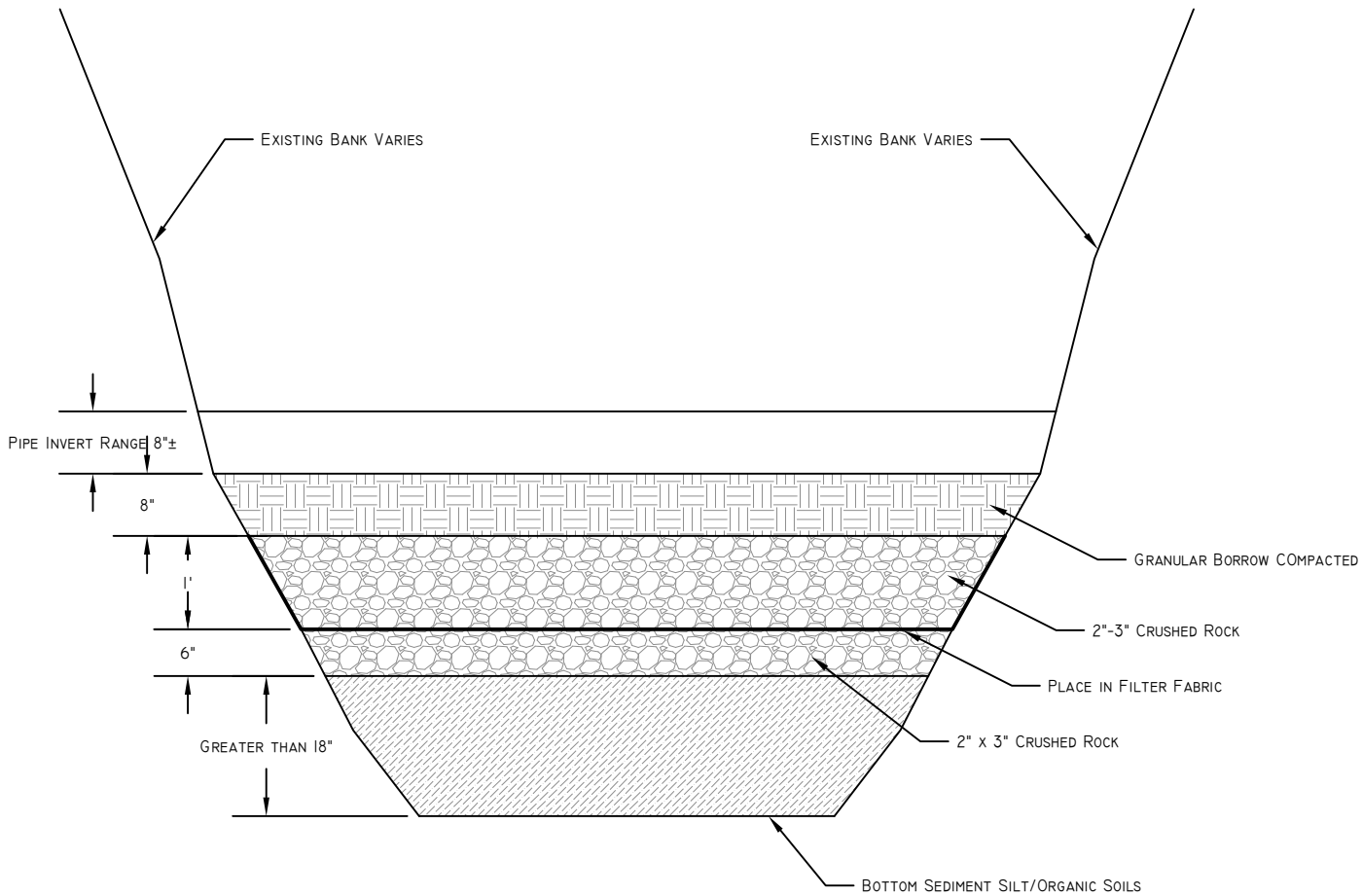
CANAL PIPING PHASE I

CANAL SECTIONS

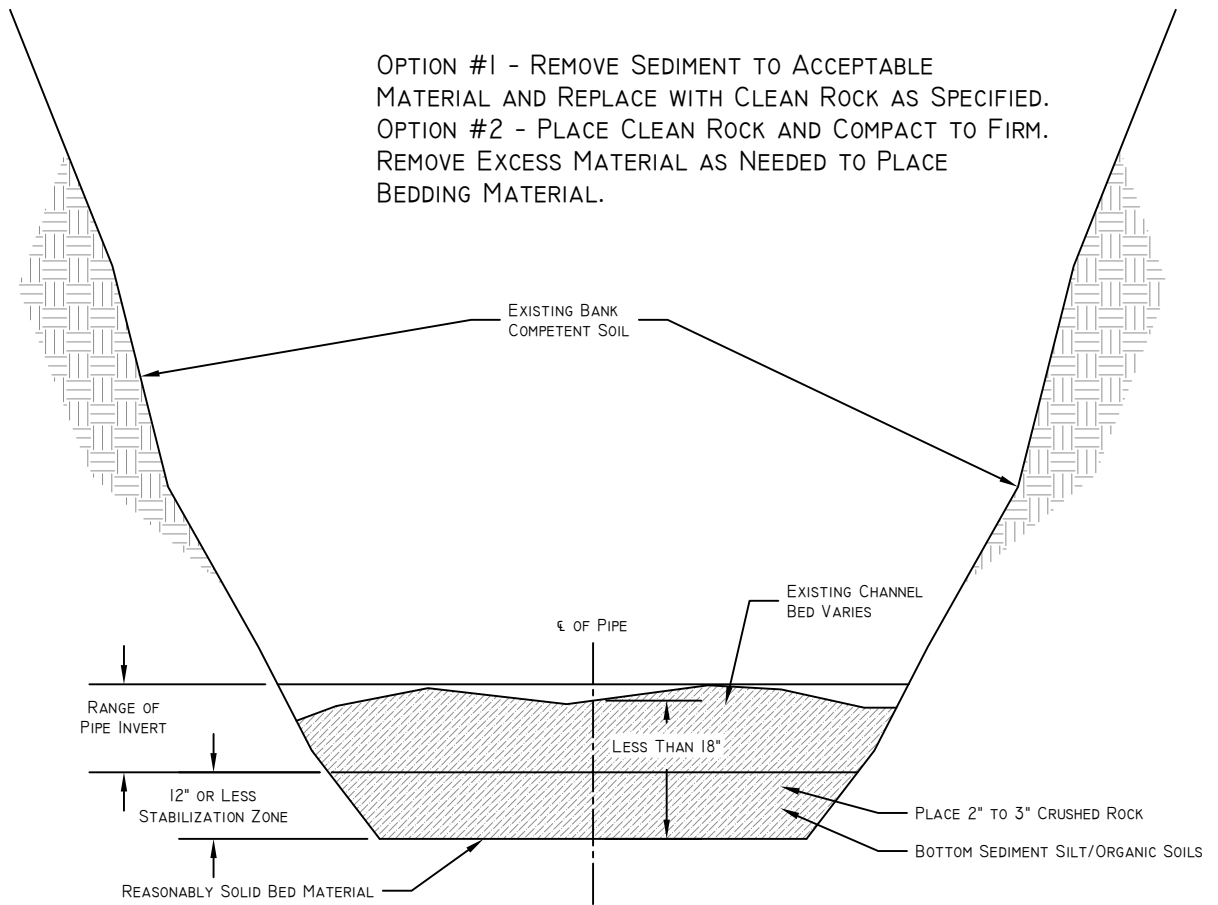
Plan and Profiles.dwg
0/24012 HYRUM BLACKSMITH Canal Piping Phase 1/CADD/Design Drawings
LAYOUT: Flume Sections

JOB NO.
24012

SHEET
55 OF 55



A CHANNEL STABILIZATION WITH GEOFABRIC FOR PIPE TRENCH
NOT TO SCALE

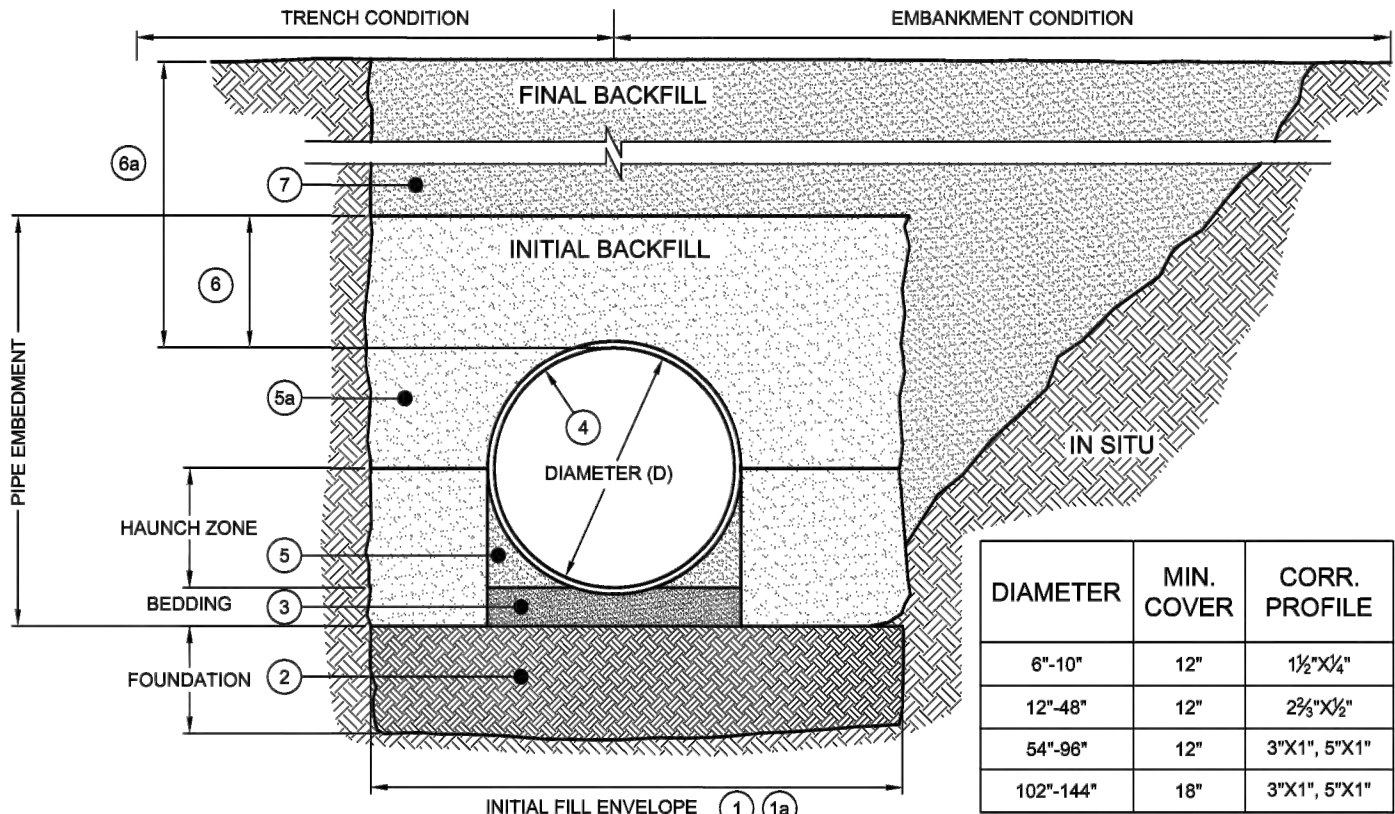


B CHANNEL STABILIZATION WITHOUT GEOFABRIC FOR PIPE TRENCH
NOT TO SCALE

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Plot Date: 9/30/2025

DESIGNER:	DRAFTSMAN:	CHECKED:	REVIEWED:	PROJECT LEADER:	PRINT DATE:	DESCRIPTION
LANCE HOUSER	MATT GURR			LANCE HOUSER	SEPTEMBER 30, 2025	
NO.	DATE	INTS.	REVISIONS			

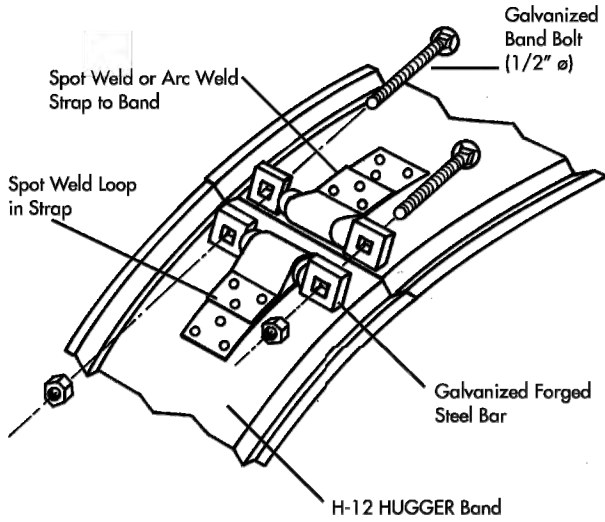
233-CSP-ROUND-ASTM.dwg - 2/11/2016 11:05 AM



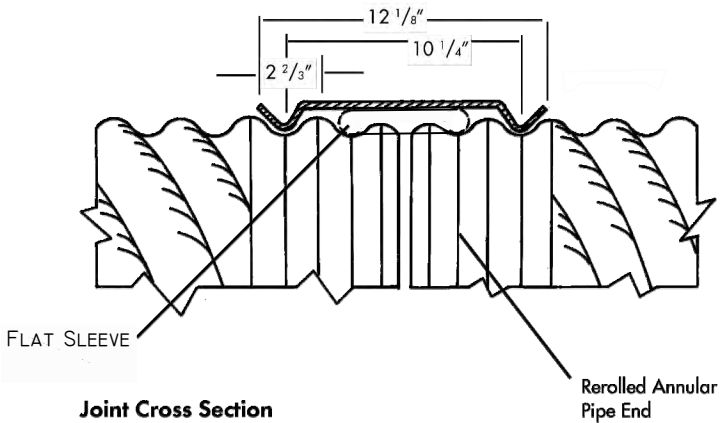
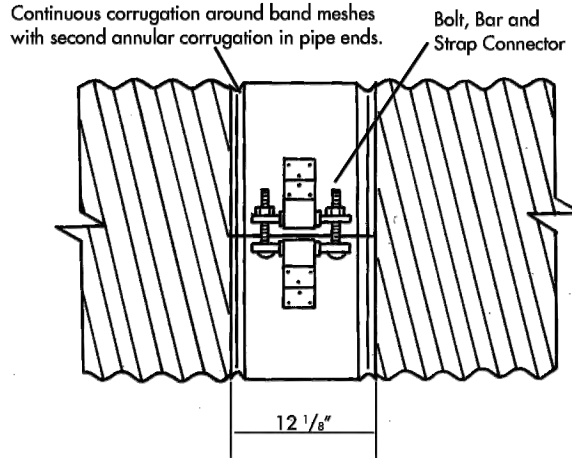
- BACKFILL REQUIREMENTS FOLLOW THE GUIDELINES OF ASTM A 798.
- MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE TRENCH WIDTH IS THE MINIMUM AMOUNT REQUIRED FOR PROPER INSTALLATION (5.1) AND TO SUPPORT HORIZONTAL PRESSURE FROM THE PIPE (TABLE #1). THE MANUFACTURER'S SUGGESTED MINIMUM VALUE IS: $1.5D + 12"$.
 - MINIMUM EMBANKMENT WIDTH (in feet) FOR INITIAL FILL ENVELOPE SHALL BE: $3.0D$ BUT NO LESS THAN $D + 4'0"$ (TABLE #1).
 - THE FOUNDATION UNDER THE PIPE AND SIDE BACKFILL SHALL BE ADEQUATE TO SUPPORT THE LOADS ACTING UPON IT (6.1).
 - BEDDING MATERIAL SHALL BE A RELATIVELY LOOSE MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, AND A DEPTH OF ½" PER FOOT OF FILL HEIGHT (6a), 24" MAX (FIG. #3). THE MAXIMUM PARTICLE SIZE IS NOT TO EXCEED 3" IN DIAMETER (7.1).
 - CORRUGATED STEEL PIPE (CSP) [HEL-COR].
 - HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION (10.1).
 - INITIAL BACKFILL FOR PIPE EMBEDMENT TO MEET GW, GP, GM, GC, SW OR SP UNIFIED SOIL CLASSIFICATION SYSTEM PER ASTM D2487, OR APPROVED EQUAL, AND COMPACTED TO 90% STANDARD PROCTOR PER ASTM D698. MAXIMUM PARTICLE SIZE NOT TO EXCEED 3" (9.2). ALL LIFTS SHALL BE PLACED IN A CONTROLLED MANNER, 6" TO 12" IN DEPTH AND COMPACTED BEFORE ADDING THE NEXT LIFT, AND NO MORE THAN ONE LIFT SIDE-TO-SIDE DIFFERENCE SHALL BE PERMITTED (10.1 & 10.2).
 - INITIAL BACKFILL ABOVE PIPE MAY INCLUDE ROAD BASE MATERIAL (AND RIGID PAVEMENT IF APPLICABLE). SEE TABLE ABOVE.
 - TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT (ASTM A796, 11.1).
 - FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD (11.1, 11.2).
- NOTES:
- GEOTEXTILE SHOULD BE CONSIDERED FOR USE TO PREVENT SOIL MIGRATION INTO VARYING SOIL TYPES (PROJECT ENGINEER).
 - FOR MULTIPLE BARREL INSTALLATIONS THE RECOMMENDED MINIMUM STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE NO LESS THAN 24" FOR DIAMETERS UP TO 48". FOR DIAMETERS > 48", THE MINIMUM SPACING IS DIAMETER/2 OR 36", WHICHEVER IS LESS (ASTM A796, 19.1).
 - CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

G PIPE STANDARD BACKFILL DETAIL
NOT TO SCALE

Physical Details



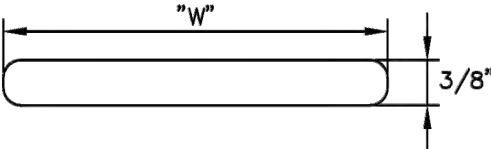
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H CONNECTORS
NOT TO SCALE

NOTE: ALL DETAILS ON THIS SHEET
PROVIDED BY CONTECH PIPE SOLUTIONS.

- NOTE:
- MATERIAL SPECIFICATION: CLOSED CELL NEOPRENE GASKET, ASTM SPECIFICATION D-1056, GRADE 2C3, SKINNED ALL FOUR SIDES, OF ONE-PIECE CONSTRUCTION.
 - DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.



NOTE:
WIDTH (W) 7"

J FLAT SLEEVE GASKET
NOT TO SCALE



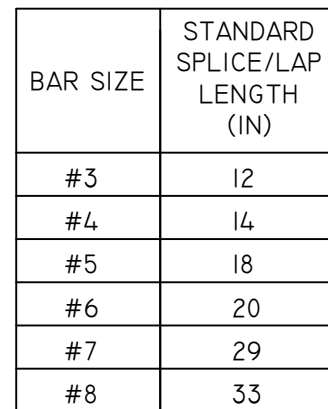
DESIGNER	DRAFTSMAN	CHECKED	REVIEWED	REVISIONS	NO.	DATE
LANCE HOUSER	MATT GURR					
PROJECT LEADER	PRINT DATE					
SEPTEMBER 30, 2025						



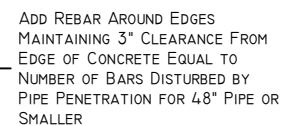
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-
- Technical drawing showing a cross-section and plan view of a flume installation. The drawing includes the following annotations and dimensions:
- Channel Tie In:** CHANNEL TIE IN SEE PLAN FOR LOCATIONS (indicated at both ends of the flume).
 - Flow Direction:** FLOW (indicated by an arrow pointing right).
 - Invert Elevation:** INVERT ELEV. PER PLANS (indicated by a vertical line and arrow pointing to the invert).
 - Finish Channel Bottom:** FINISH CHANNEL BOTTOM (indicated by a vertical line and arrow pointing to the bottom of the channel).
 - Riprap:** FURNISH AND INSTALL RIPRAP (indicated by a vertical line and arrow pointing to the riprap area).
 - Profile:** SEE PROFILE (indicated by a vertical line and arrow pointing to the profile line).
 - Rebar:** #4 REBAR @ 12" O.C. EACH WAY (indicated by a vertical line and arrow pointing to the rebar).
 - Concrete Bed Slope:** 8" CONCRETE CHANNEL BED SLOPE (indicated by a vertical line and arrow pointing to the concrete bed slope).
 - Gravel:** 8" CRUSHED ANGULAR GRAVEL (indicated by a vertical line and arrow pointing to the gravel area).
 - Dimensions:** 8" (indicated at both ends of the flume), 2' (indicated in the middle of the flume).
 - Grout:** ALL WALLS MUST BE PLUMB (indicated by a vertical line and arrow pointing to the wall).
 - Plastic Grout:** PLACE HIGHLY PLASTIC GROUT AT TIME OF FLUME INSTALLATION TO ALLOW COMPLETE CONTACT OF FLUME WITH CONCRETE AND TO PROVIDE INSTALLER ABILITY TO ENSURE LEVEL IN ALL DIRECTIONS (indicated by a vertical line and arrow pointing to the grout).
 - Coordinate Dimensions:** COORDINATE DIMENSIONS WITH VENDOR (indicated by a vertical line and arrow pointing to the coordinate dimensions).
 - Channel Tie In (Plan View):** CHANNEL TIE IN SEE PLAN FOR LOCATIONS (indicated at both ends of the flume).
 - Profile:** SEE PROFILE (indicated by a vertical line and arrow pointing to the profile line).
 - Flow Direction (Plan View):** 0.00% (indicated by an arrow pointing right).

[illegible]



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D

The diagrams show two types of pipe bends. The top diagram is a 180° bend with a horizontal inlet and outlet, a vertical dimension 'A' for the offset, and a circular cross-section with a crosshair. The bottom diagram is a 90° bend with a horizontal inlet and a vertical outlet, a horizontal dimension 'A' for the offset, and a circular cross-section with a crosshair. To the right is a table with three columns and three rows of numerical values.

6	4.5	9
7	5.25	11
8	6	12

WALL REINFORCEMENT

18"X18" BAR, MATCH SIZE AND SPACING TO LONGITUDINAL REINFORCEMENT

WALL REINFORCEMENT



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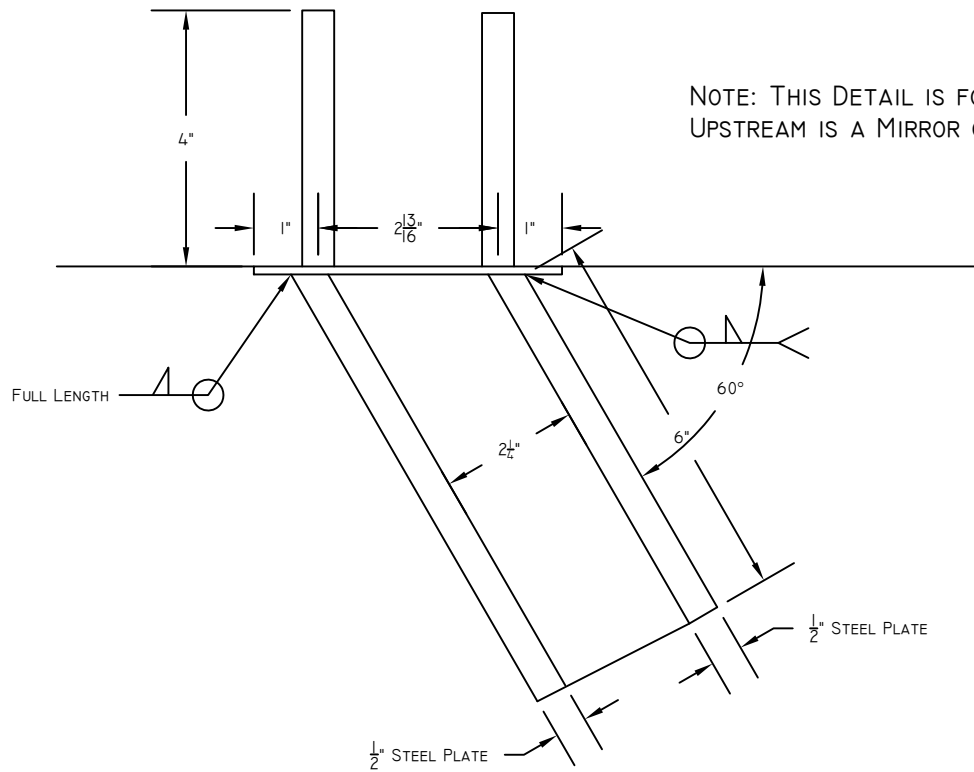
BAR SIZE	BEND DIA. D (IN)	A (IN)
3	2.25	5
4	3	6
5	3.75	8
6	4.5	9
7	5.25	11
8	6	12

[illegible]

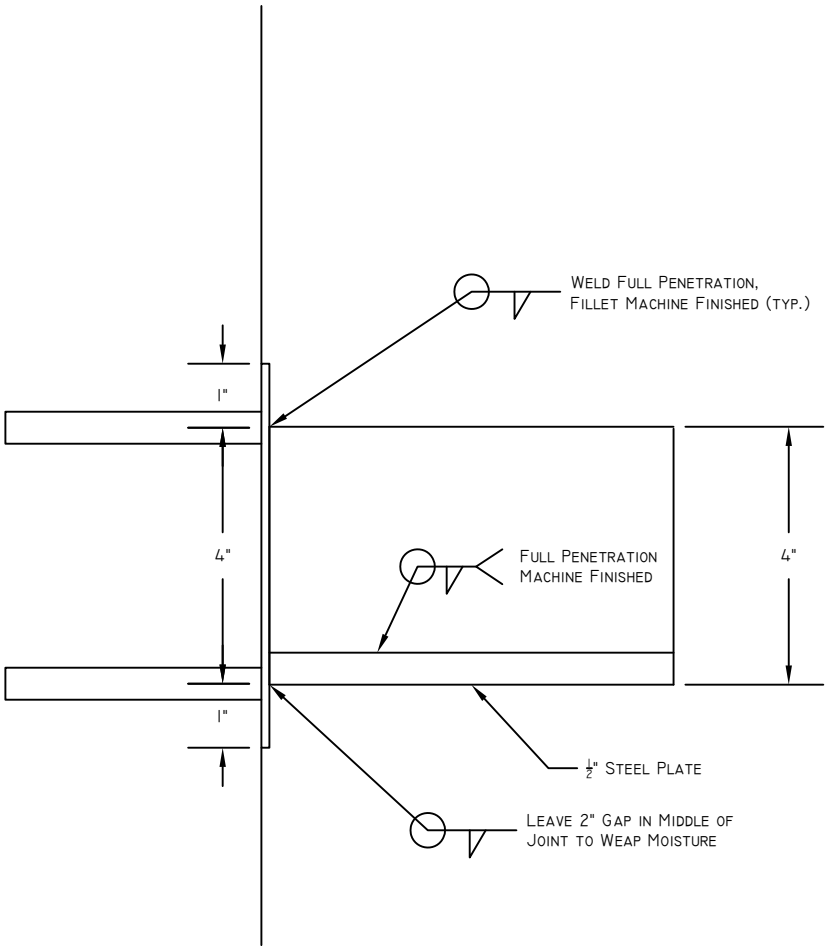
CANAL PIPING PHASE I STRUCTURAL DETAILS

PROJECT: 24012 HYRUM BLACKSMITH Canal Piping Phase 1/CADDesign Drawings
LAYOUT: Diversion

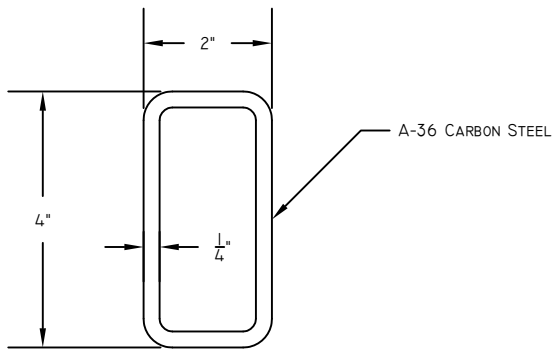
24012



Z SKIMMER BOOT PLAN VIEW
NOT TO SCALE



AA SKIMMER BOOT SIDE VIEW
NOT TO SCALE



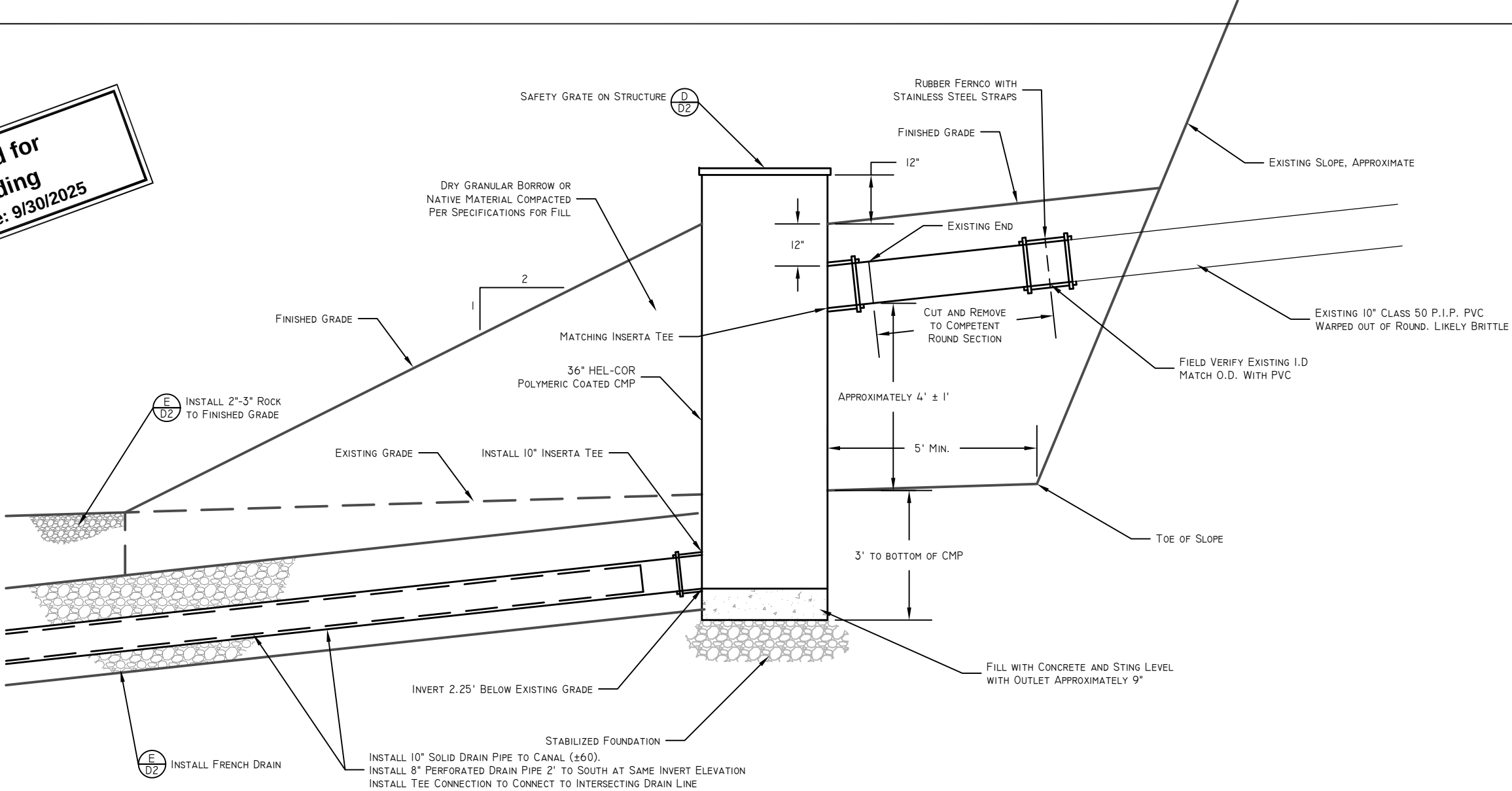
AB SKIMMER BAR
NOT TO SCALE

NOTE: MACHINE FINISH AND ENAMEL PAINT ALL WELDS

NOTE: EITHER DRILL AND BOLT SKIMMER BAR IN PLACE WITH (2) 1/2" A-306 STAINLESS STEEL BOLTS WITH NUTS AND WASHERS OR FIELD WELD IN PLACE AS DIRECTED BY OWNER.

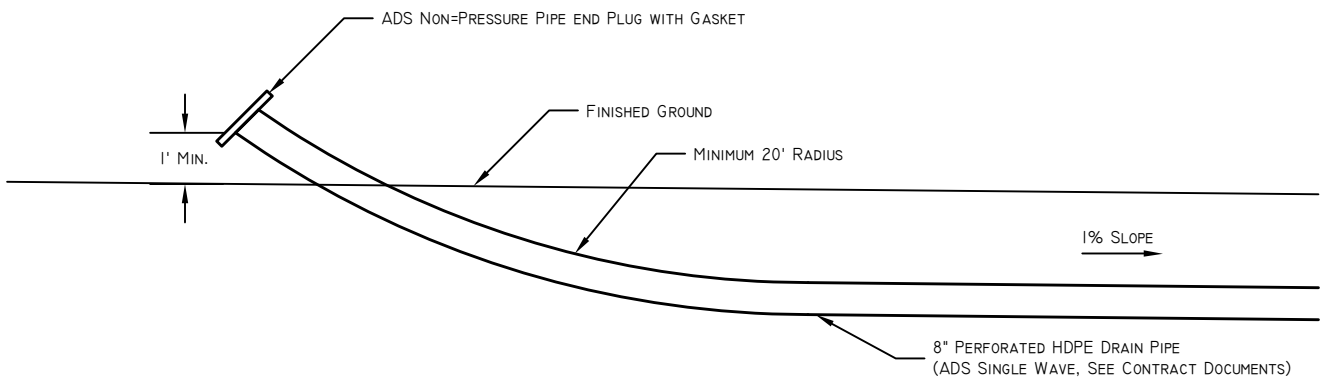
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AC YEATES SPRING COLLECTION DETAIL
NOT TO SCALE

NOT TO SCALE



AD DRAINAGE PIPE END
NOT TO SCALE

NOT TO SCALE

[illegible]

Details.dwg	CANAL PIPING PHASE I YEATES SPRING COLLECTION DETAIL
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O:\24012 HYRUM BLACKSMITH Canal Piping Phase 1\CAD\Design Drawings
LAYOUT: Yeates Spring