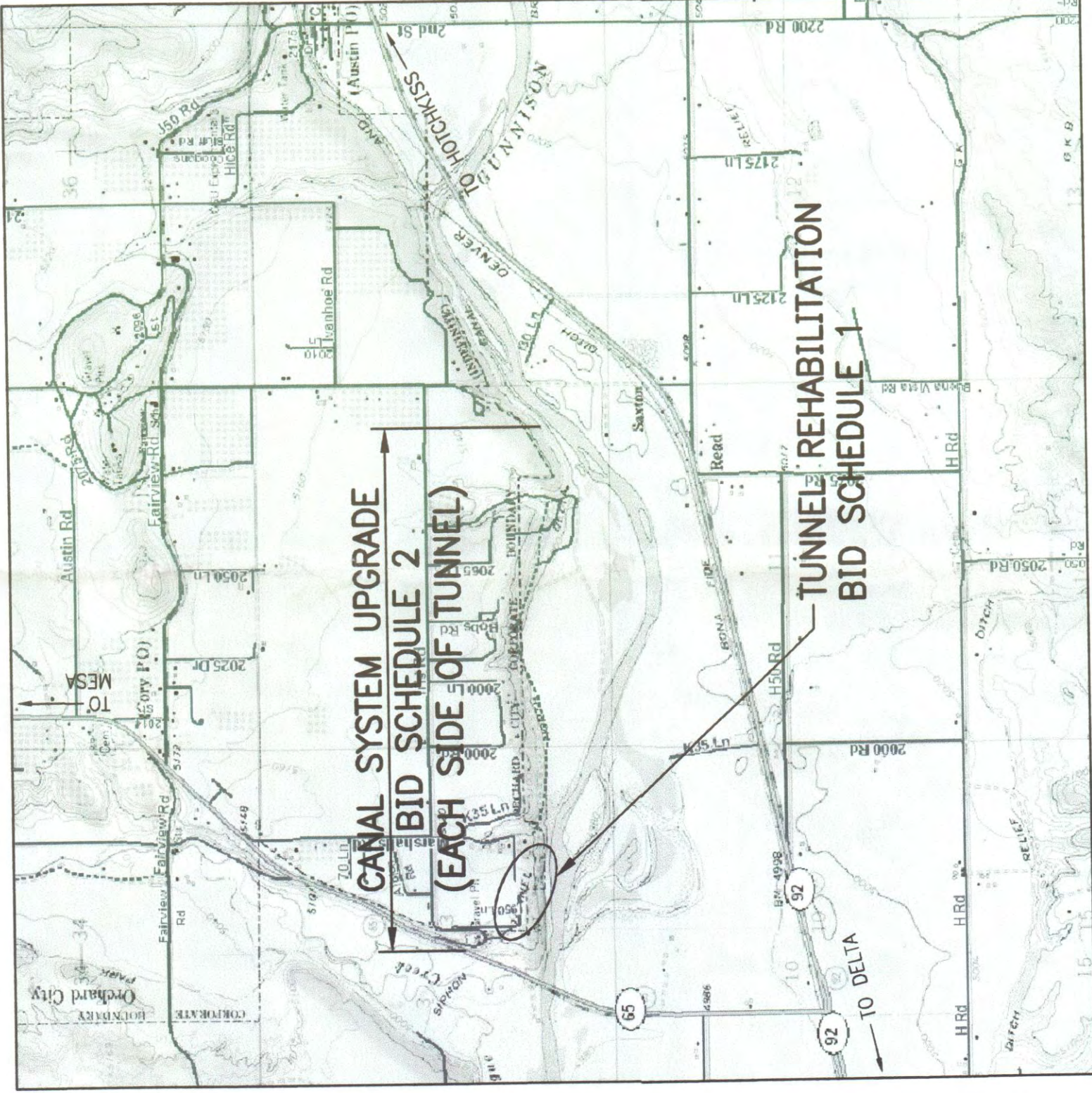


TUNNEL REHABILITATION AND CANAL SYSTEM

DELTA COUNTY, COLORADO

MARCH 2012



SHEET NO.	TITLE
1	SITE PLAN AND GENERAL CONSTRUCTION REQUIREMENTS
2	BID SCHEDULE 1 - TUNNEL REHABILITATION PLAN AND PROFILE AND DETAILS
3	BID SCHEDULE 1 - TUNNEL REHABILITATION DETAILS
4	BID SCHEDULE 2 - CANAL SYSTEM UPGRADE PLAN AND PROFILE
5	BID SCHEDULE 2 - CANAL SYSTEM UPGRADE PLAN AND PROFILE
6	BID SCHEDULE 2 - CANAL SYSTEM UPGRADE PLAN AND PROFILE
7	BID SCHEDULE 2 - CANAL SYSTEM UPGRADE DETAILS

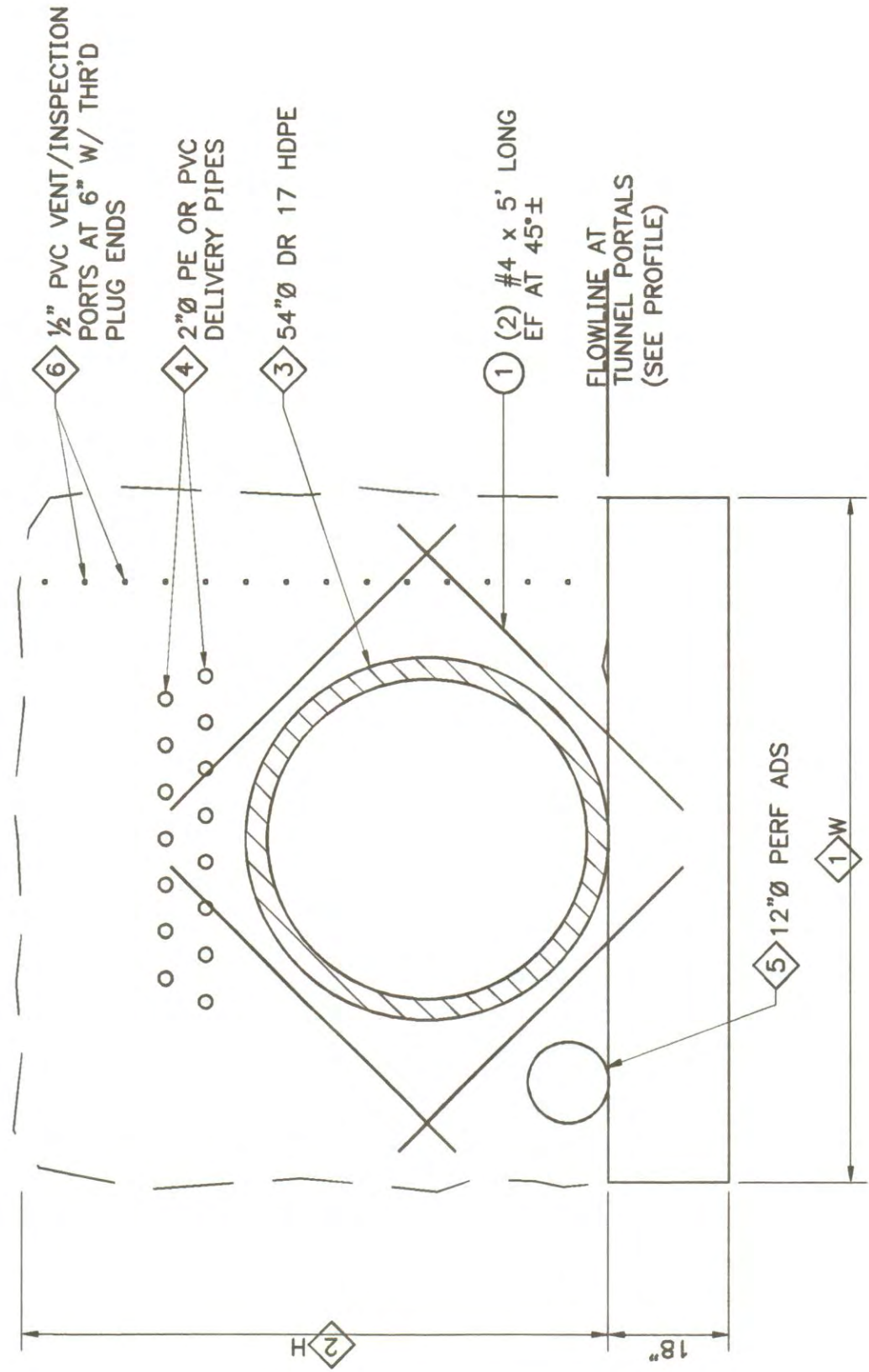
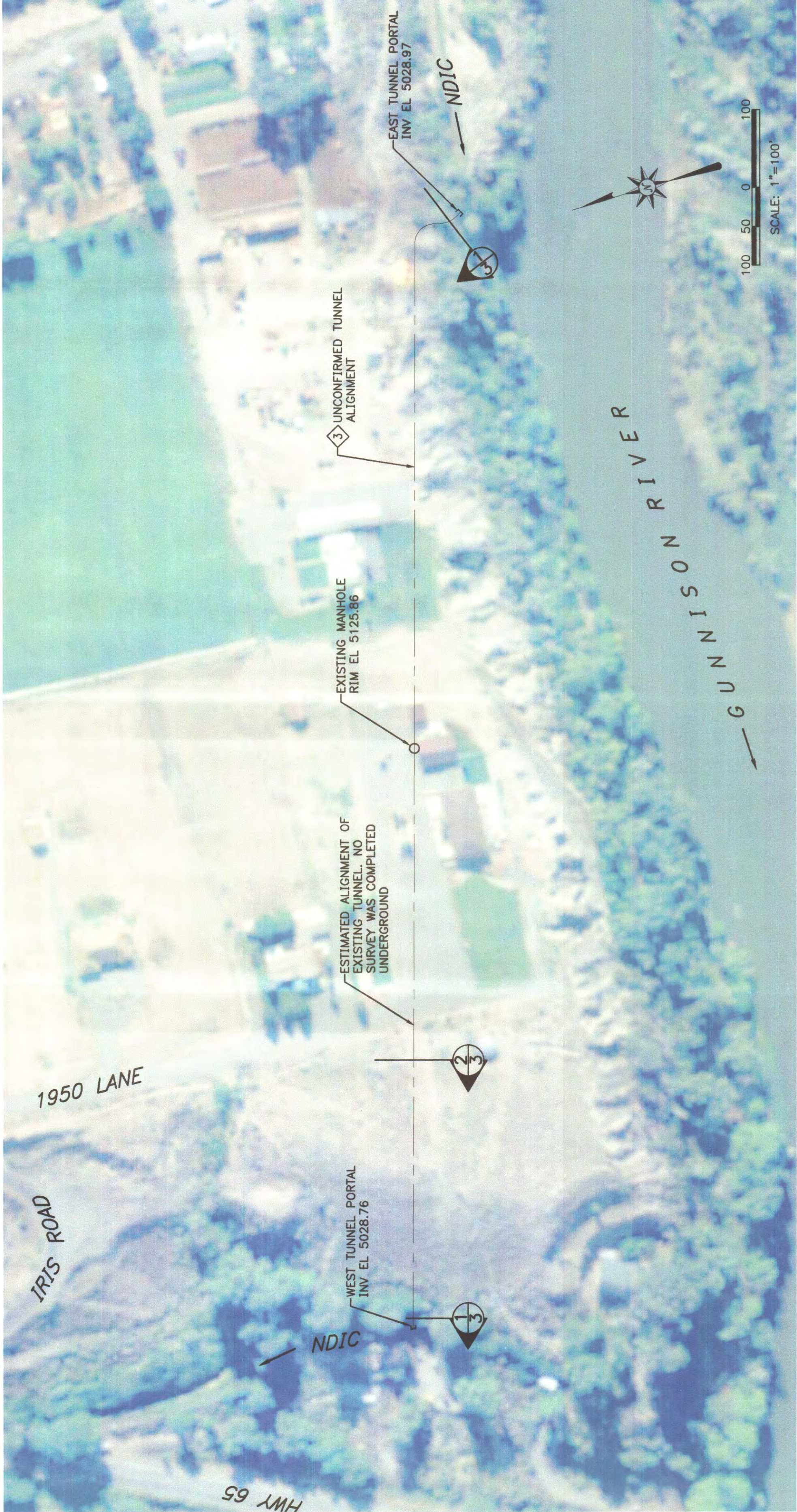


PREPARED FOR:
NORTH DELTA IRRIGATION COMPANY
Delta County, Colorado

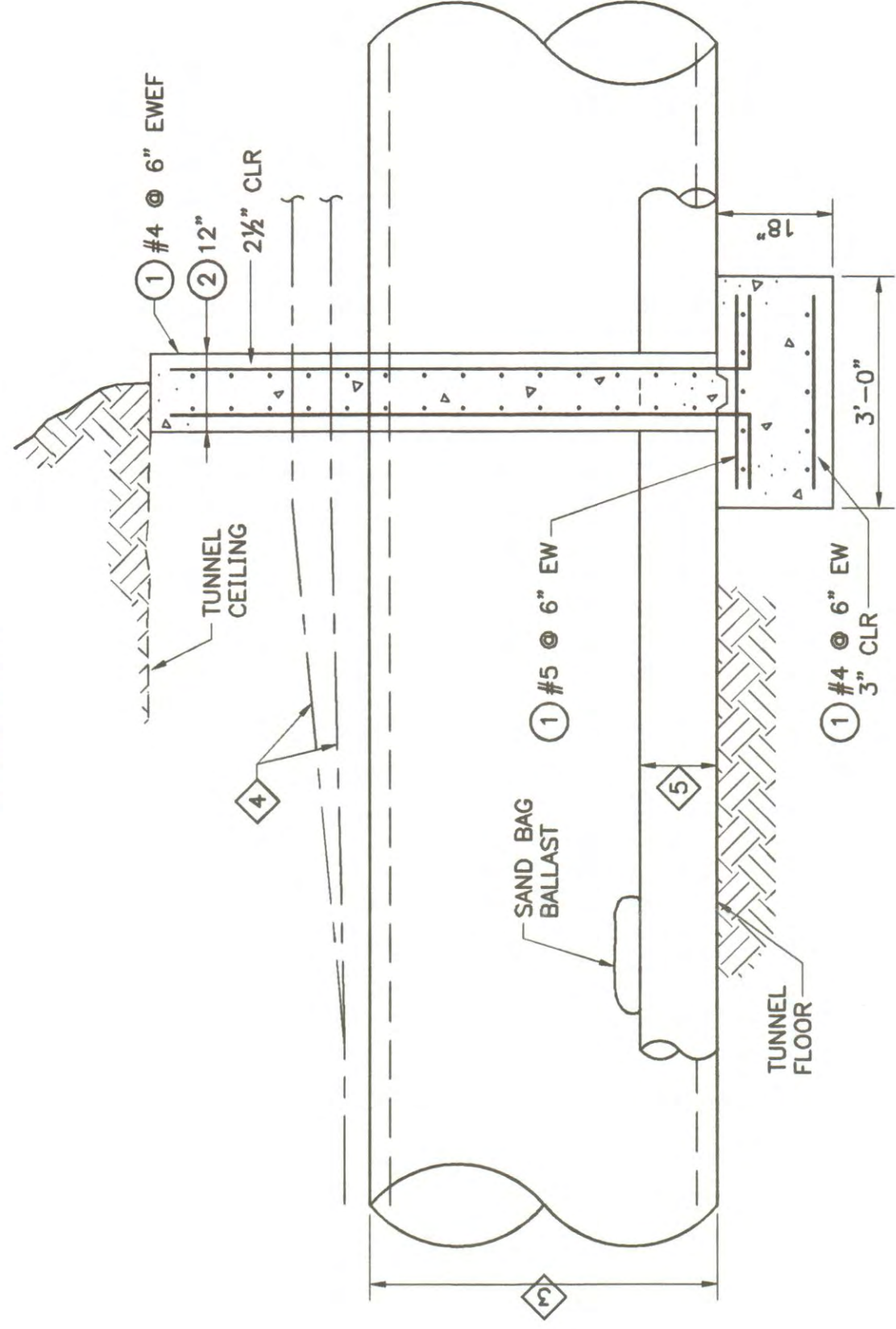


PREPARED BY:
WESTWATER ENGINEERING
Consulting Engineers
~~~~~  
Grand Junction, CO





ELEVATION



SECTION

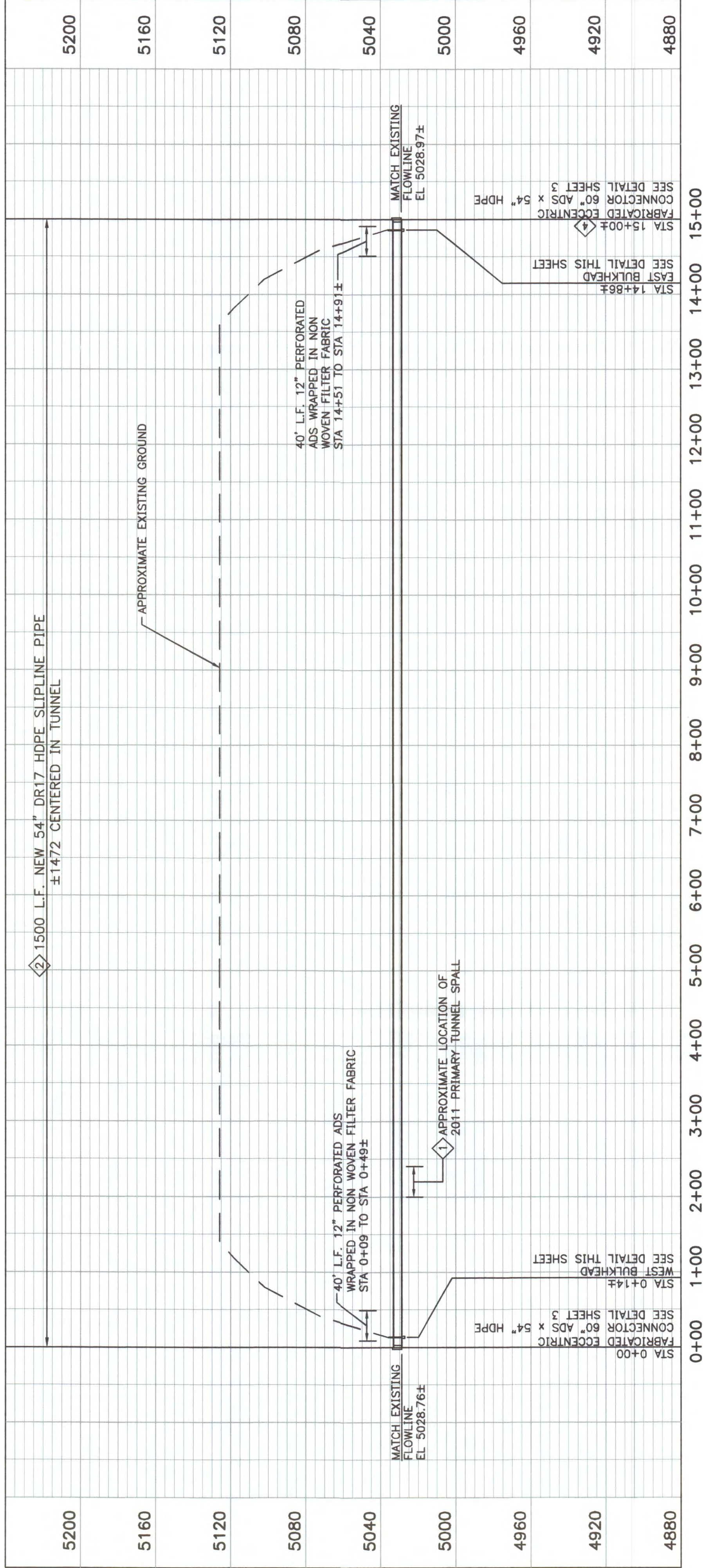
**TUNNEL BULKHEADS**  
BID SCHEDULE 1  
SCALE: 1/2"=1'-0"

**LIST OF MATERIALS**

- Grade 60 reinforcing steel, epoxy coated.
- 3,000 psi concrete with 2% air entrainment, or equivalent shotcrete for ease of installation.

**BULKHEAD GENERAL NOTES**

- Two (2) bulkheads are required, one at each tunnel portal. Excavate footing for bulkhead to match dimension across tunnel portal openings, being careful to prevent disturbance to tunnel structure.
- Form wall of bulkhead to conform with shape and dimensions of existing tunnel structure. Provide cutouts in form work configured to accommodate pipe penetrations. Height and width are variable, approximately 8' x 10' at east portal and approximately 7' x 8' at west portal.
- 54" DR17 HDPE slipline pipe for tunnel rehabilitation. Additional details for inside and outside of tunnel are shown on Sheet 3.
- 2-inch delivery pipes for cellular concrete fill between existing tunnel shell and new bulkhead. Cellular concrete shall be placed using a concrete pump. Delivery pipes to be installed in place when the work is completed. See Sheet 3 for additional details.
- 12-inch perforated ADS toe drain to be located along the eastern side of the bulkhead. ADS toe drain shall be installed along the eastern side of the bulkhead and drain to daylight. See Sheet 3 for additional details.
- Install 1/2-inch PVC vent and observation ports through bulkhead, to observe depth of cellular concrete fill in the tunnel annular space, and to vent air during filling. Vent ports shall be installed at 10-foot intervals. Install 1/2-inch MPI plugs as necessary during the tunnel backfill process.



TUNNEL REHABILITATION PROFILE

**GENERAL NOTES**

- Existing tunnel was hand excavated into native material approximately 100 years ago. Exposed material is primarily weathered shale with isolated sand and cobble lenses. Refer to Standard Specifications for Tunnel Rehabilitation, Section 2011. The primary debris pile near the west portal does not entirely block line of sight or personal passage, but is estimated to be 50-60 feet in length and was substantial enough to require shuffling down the tunnel during the 2011 irrigation season.
- 1500 L.F. new 54-inch HDPE slipline pipe to be pulled through the tunnel such that the pipe is centered, with equal length of pipe subbed out at each portal (approximately 14 feet each end).
- No underground survey of tunnel alignment and grade was conducted. However, visible alignment offset is documented at the east portal, the extent of which is unconfirmed. Inspection inside the tunnel during the 2011 irrigation season revealed a maximum offset of approximately 20 feet in length and 2-3 feet in depth, perhaps indicating scour or erosion of the tunnel floor.
- Coordinate location of fabricated access/cutouts with Contractor of Bid Schedule 2 prior to heat taping connector to slipline pipe. End of slipline pipe may need to be cut closer to east bulkhead due to limited canal footprint for extension of 60" ADS pipe, elbows, and manhole at east tunnel portal.

SCALE: HORIZONTAL 1"=100'

VERTICAL 1"=40'

REVISIONS

DATE

NORTH DELTA IRRIGATION COMPANY TUNNEL  
REHABILITATION AND CANAL SYSTEM UPGRADE  
BID SCHEDULE 1

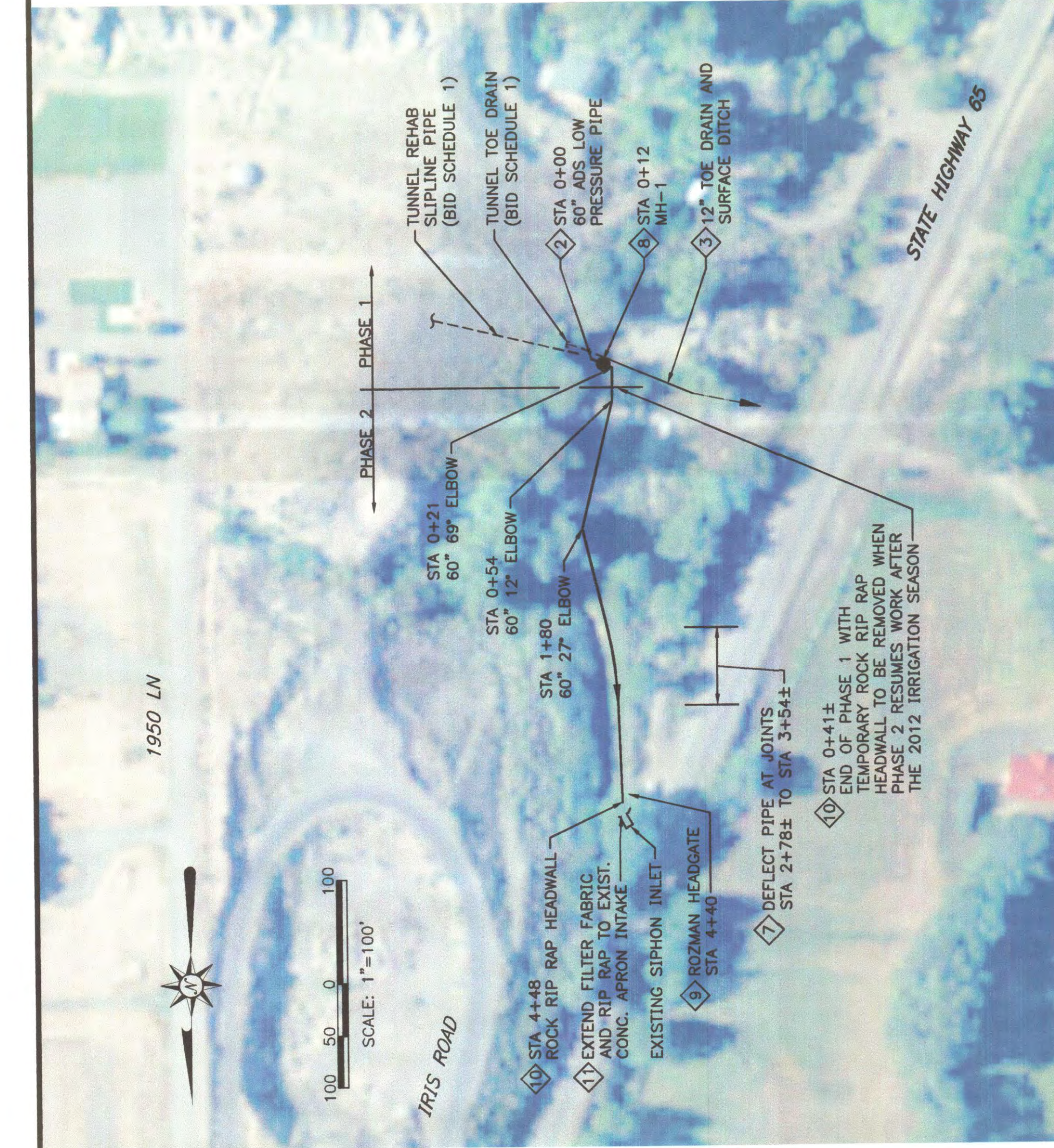
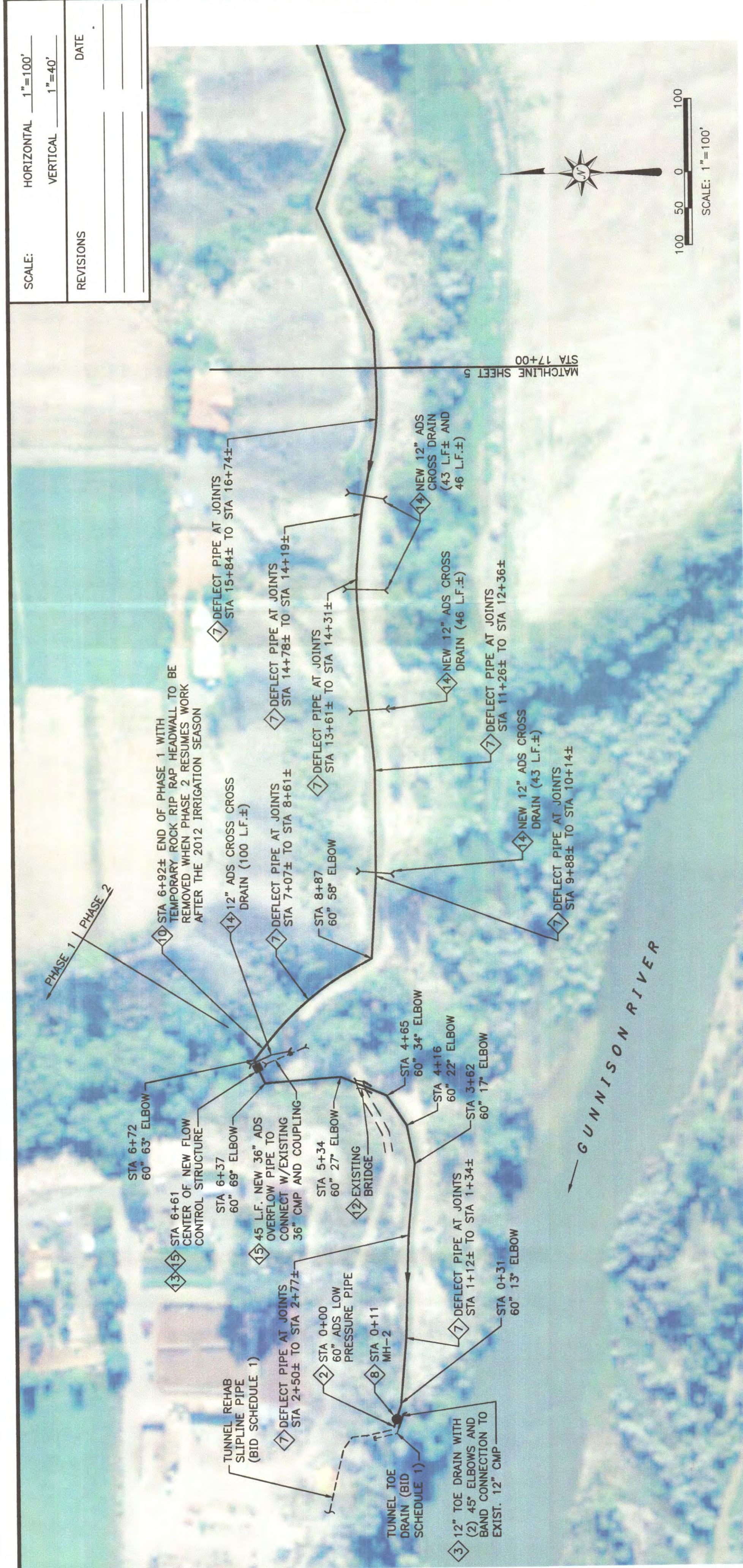
TUNNEL REHABILITATION PLAN AND PROFILE  
AND DETAILS

Design by: CRK  
Drafted by: JCG  
Date: 03-12  
Project No. 1111 NDI  
Sheet 2 of 7

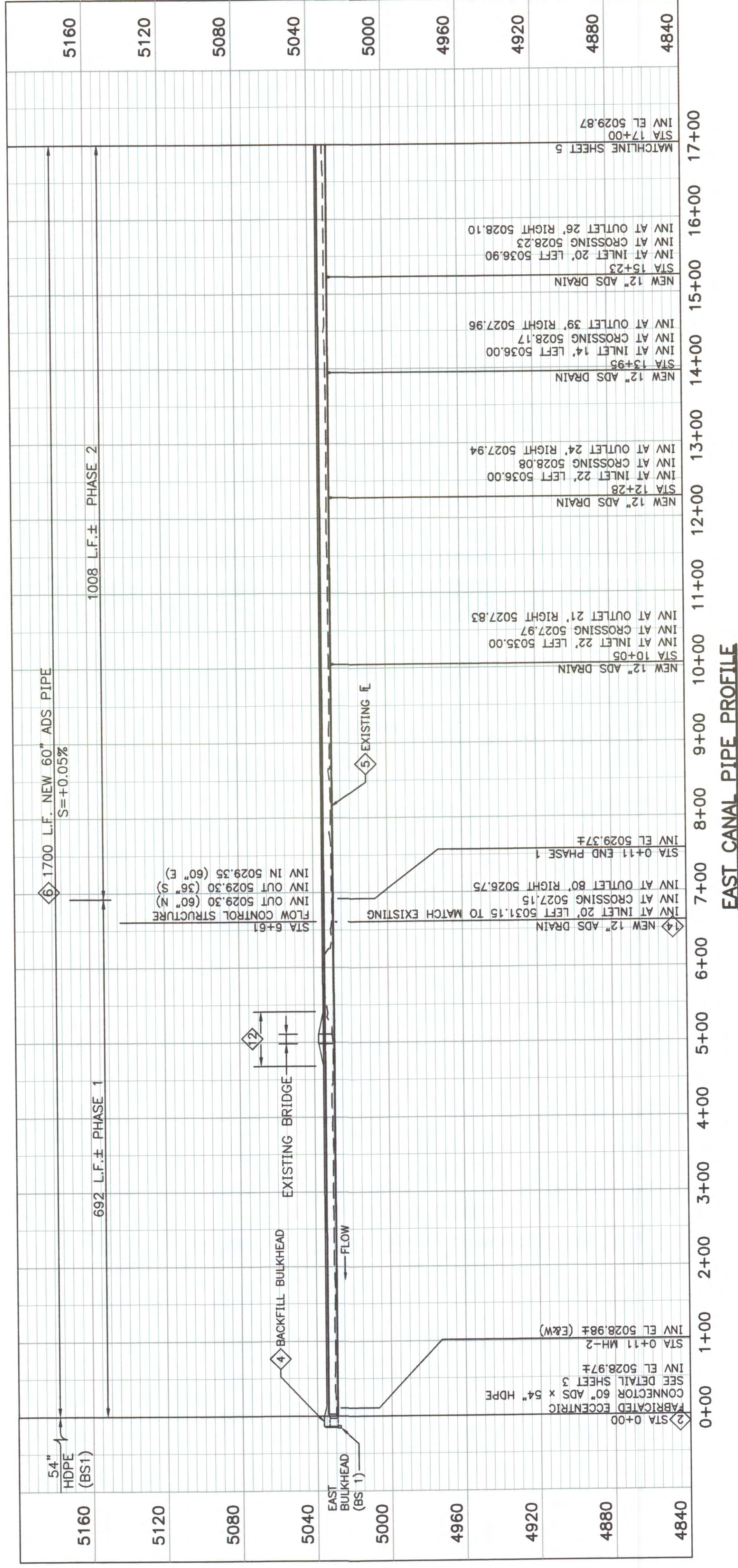
WestWater  
Engineering

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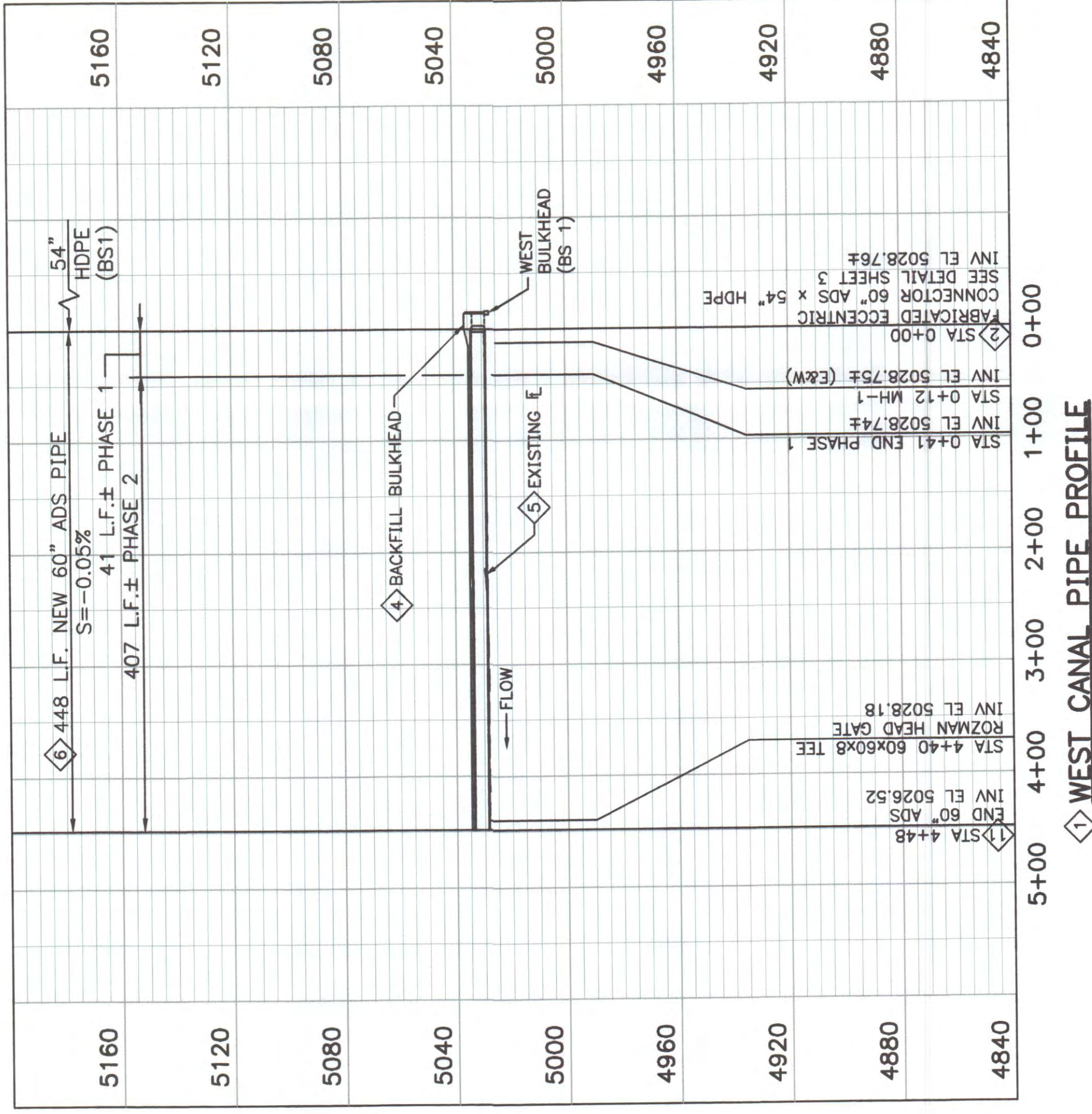




# EAST CANAL PIPE PLAN

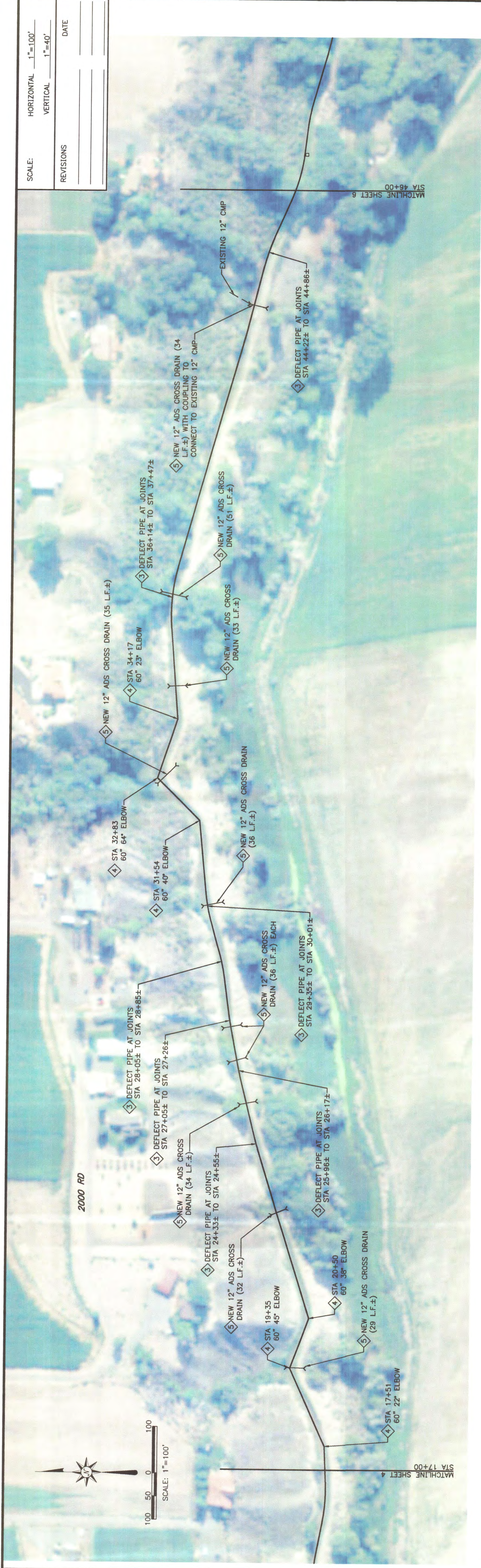


## EAST CANAL PIPE PROFILE

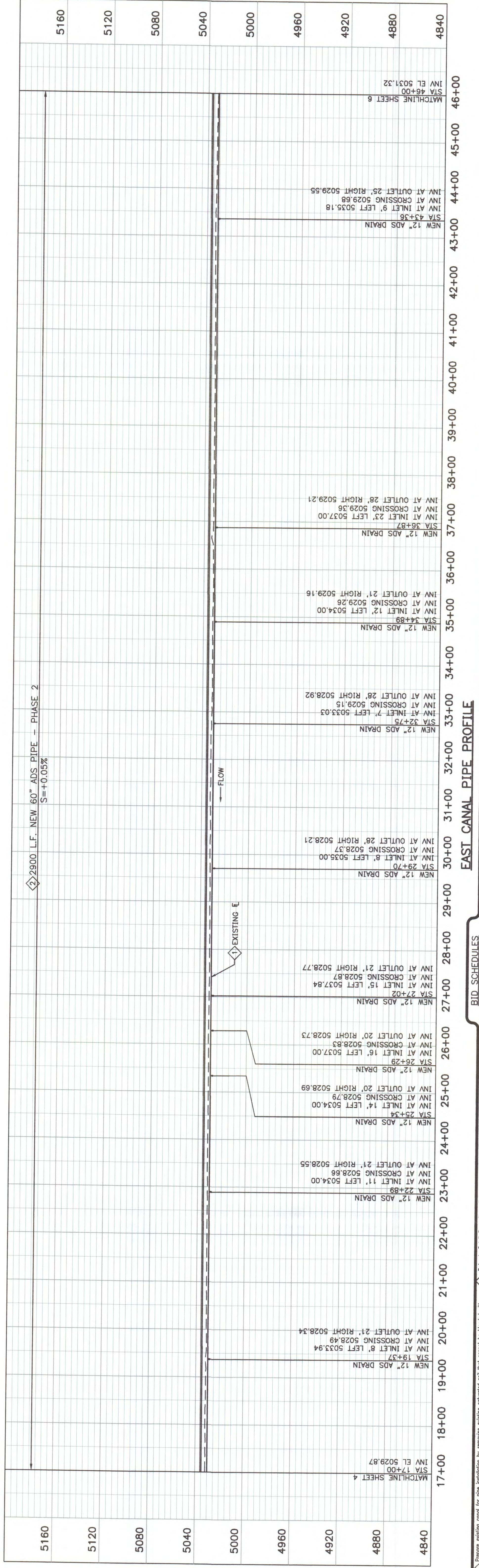


① WEST CANAL PIPE PROFILE

- [illegible]



EAST CANAL PIPE PLAN



1 Prepare existing canal for pipe installation by removing existing saturated soil that cannot be blended with adjacent dry soil. To achieve optimum mechanical bond, remove soil to achieve uniform, undisturbed, dry soil.

5 New 12-inch ADS drain pipe with ST gasketed joints and flare inlet end section to divert surface drainage from the north across new canal pipe. See profile for invert elevations at inlet, at 60' ADS canal pipe crossing, and at outlet. Also refer to Detail 1 on Sheet 7.

2. Install new 60-inch ADS low pressure pipe in accordance with manufacturer's written instructions. Pipe shall be laid to grade using a surveyors level and rod for each joint, due to the nominal slope available. Backfill pipe with 12" minimum cover. Also refer to Detail 1 on Sheet 7.

3 Maximum deflection at pipe joints is 3 degrees. Refer to Standard and Supplement Drawings Section of Specifications for joint offset dimensional tolerances.

## BID SCHEDULES

## EAST CANAL PIPE PROFILE

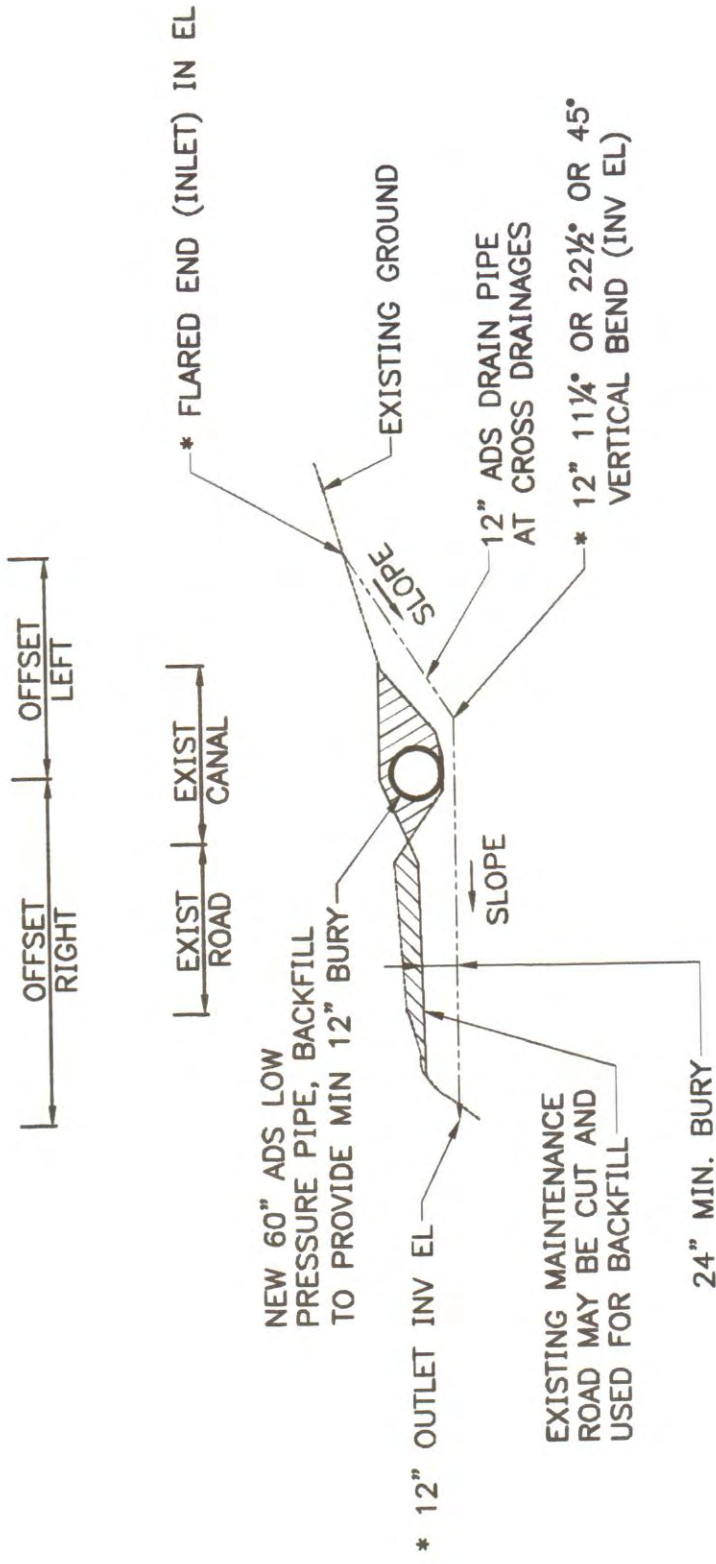


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**NORTH DELTA IRRIGATION COMPANY TUNNEL  
REHABILITATION AND CANAL SYSTEM UPGRADE**

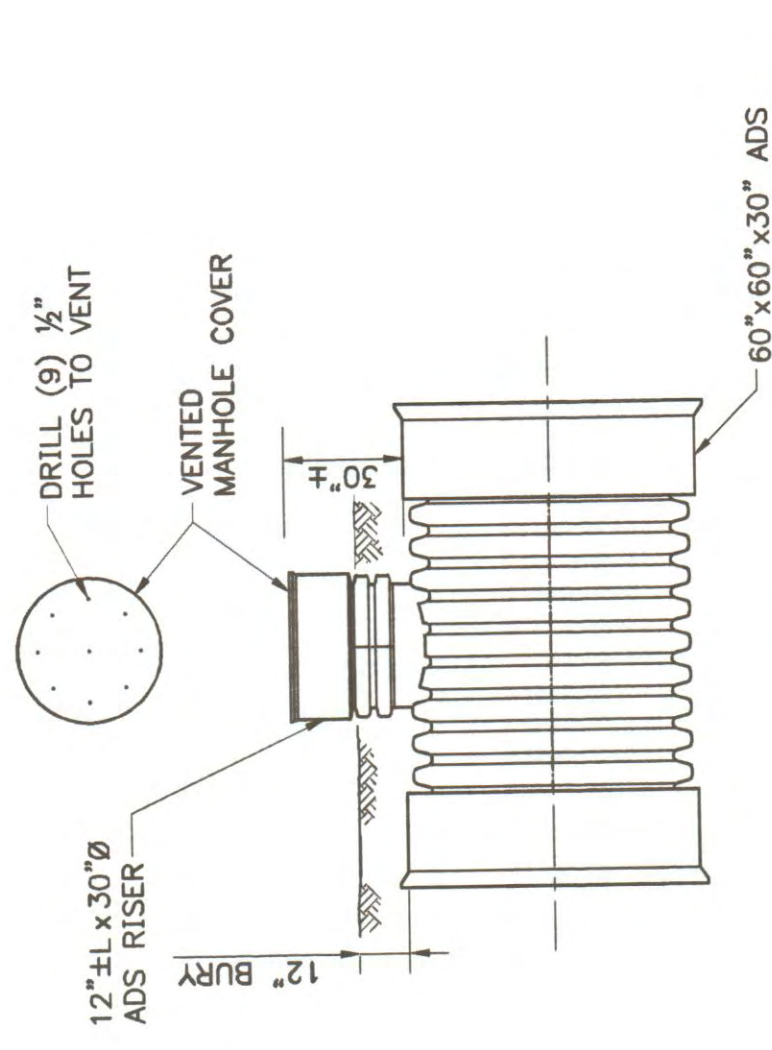
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| Design by: | Drafted by: | Date: | Project No. | Sheet |
|            |             |       |             | 5     |



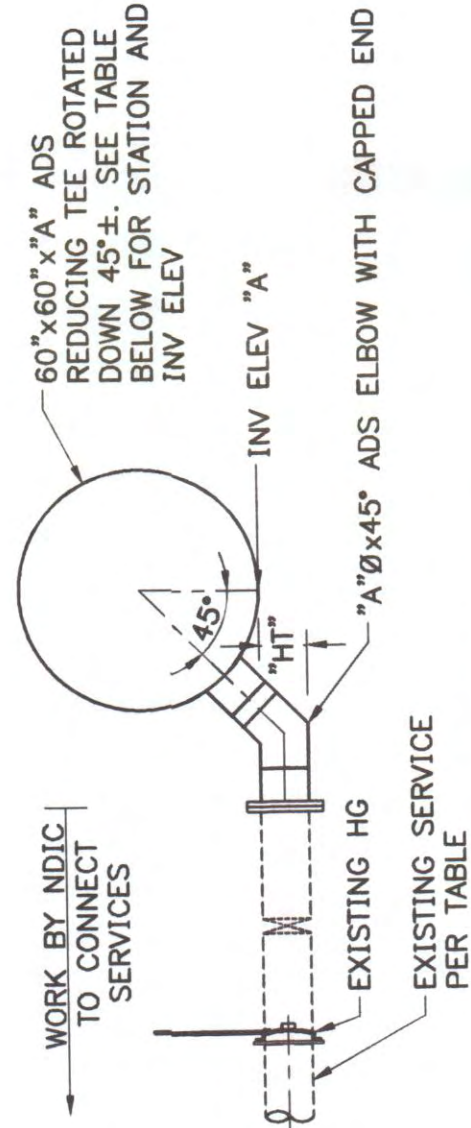


**DETAIL 1**  
**TYPICAL CANAL PIPE SECTION**

HORZ & VERT SCALE: 1"=20'  
\* REFER TO PLAN AND PROFILE SHEETS 4 AND 5 FOR 12" CROSS DRAIN PIPES OFFSET DIMENSION FROM CANAL PIPE AND INVERT ELEVATIONS



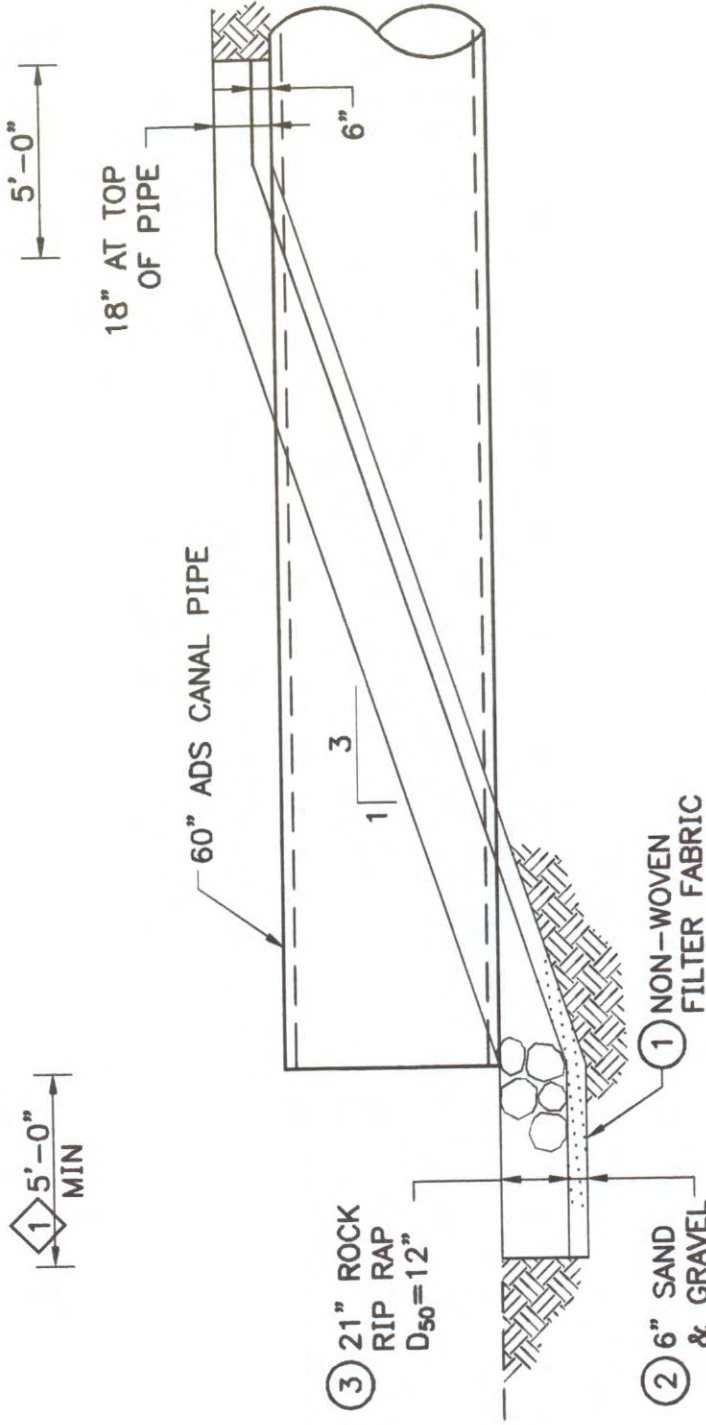
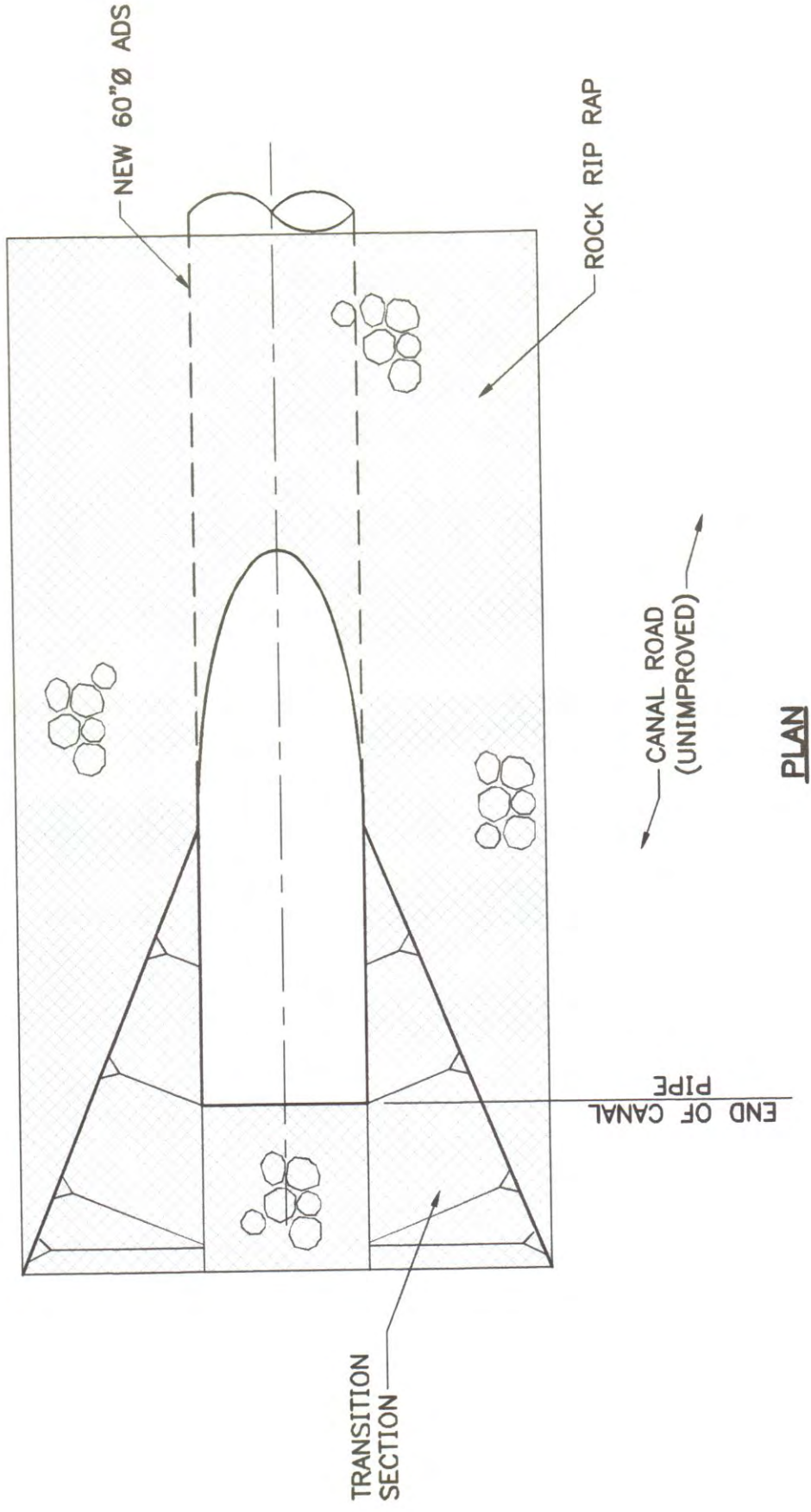
**DETAIL 2**  
**MANHOLES**  
(2) REQUIRED, (1) NEAR EACH END OF TUNNEL  
SCALE: 1/4"=1'-0"



**DETAIL 3**  
**SERVICE CONNECTION**  
(3) REQUIRED, SEE TABLE BELOW  
SCALE: 1/4"=1'-0"

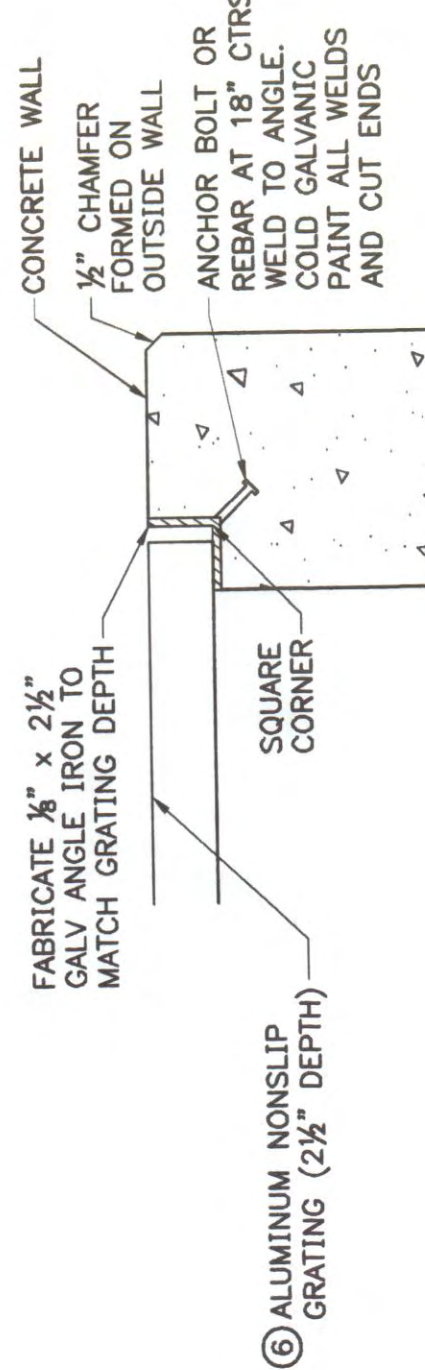
| DETAIL 3 - SERVICE CONNECTION |                     |                     |                  |       |  |
|-------------------------------|---------------------|---------------------|------------------|-------|--|
| CUSTOMER                      | "A" SERVICE         | STA 60" ADS         | INV ELEV 60" ADS | "HT"  |  |
| ROZMAN                        | 8" CMP INV 5028.18  | WEST CANAL 44+40.00 | 5028.54          | 0.36  |  |
| LONG                          | 6" CMP INV 5031.51  | EAST CANAL 46+79.00 | 5031.35          | -0.16 |  |
| LONG (EAST)                   | 10" CMP INV 5031.66 | EAST CANAL 58+54.00 | 5031.95          | 0.29  |  |

- ① Rock rip rap headwall to be installed as temporary end of pipe transitions between canal flow and rip rap (Phase 1) and as permanent end of pipe (Phase 2). Invert of pipe will be approximately 6" below existing concrete apron at inverted siphon inlet. Slope outlet transition flowline channel up and apron to match existing flowline to match existing flowline of canal and rip rap apron. Place O-ring gasket around pipe and seal annular space with non-shrink grout for watertight seal.
- ② Sub pipes through wall of structure, install with backfill. Place O-ring gasket around pipe and seal annular space with non-shrink grout for watertight seal.
- ③ 12" thick by 8'-3" high cast-in-place interior walls for stop gate and gate frames for stop gates.

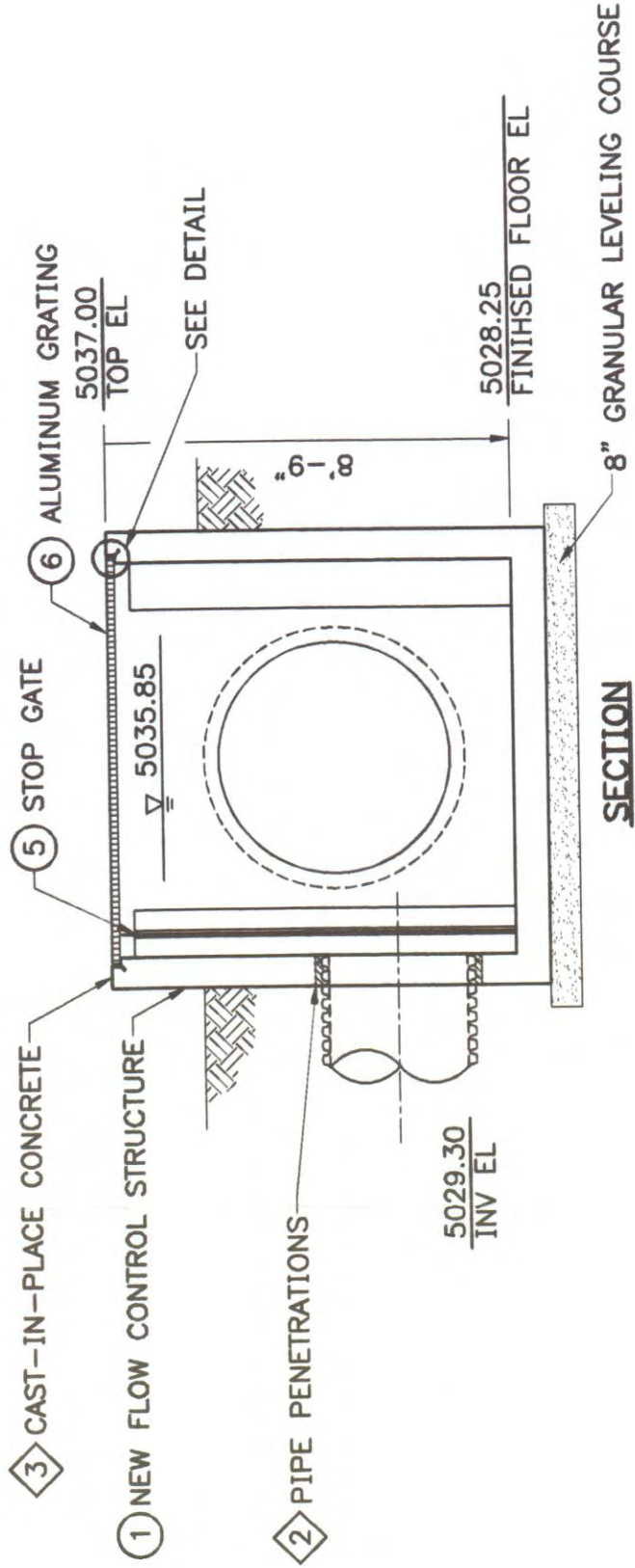
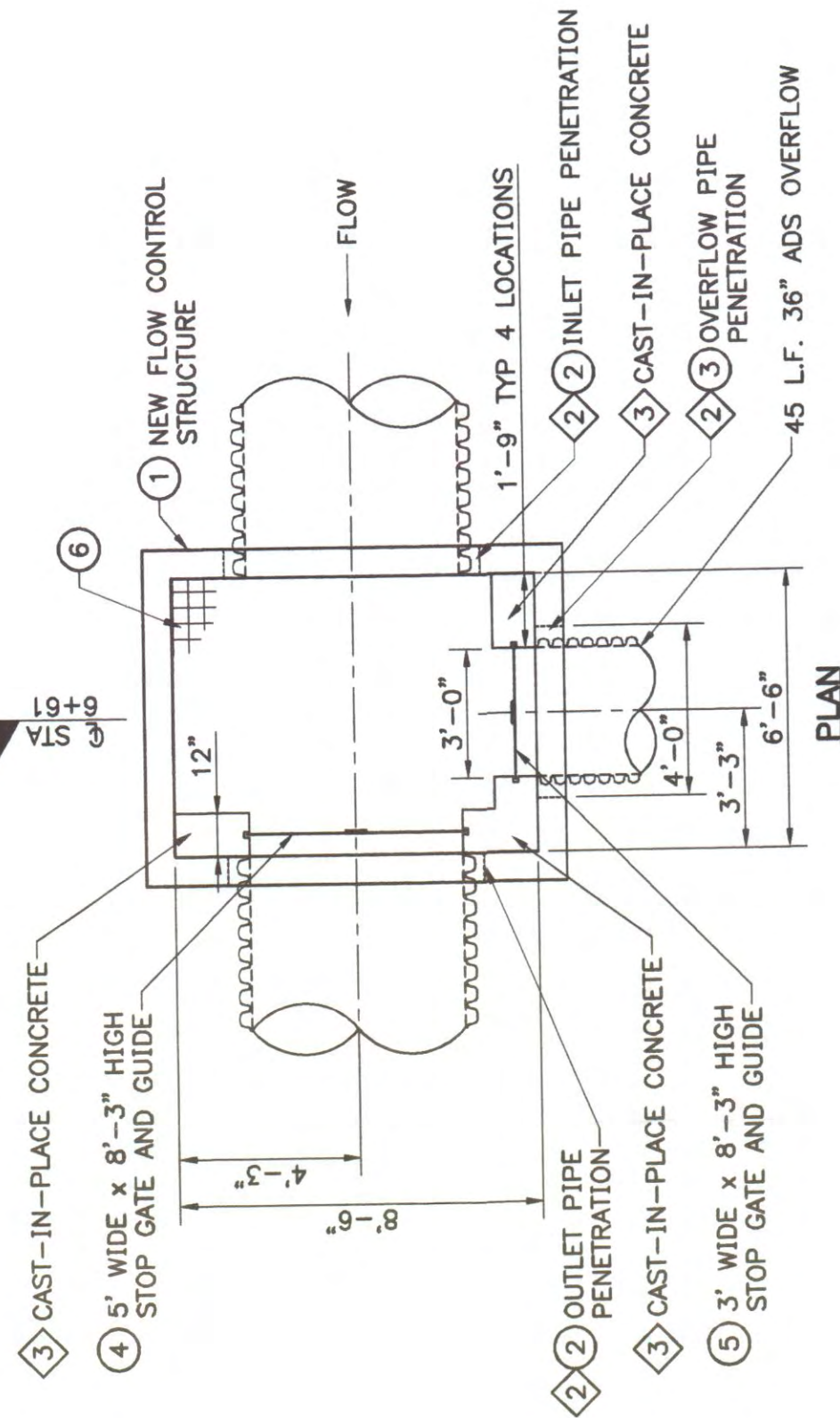


**DETAIL 4**  
**ROCK RIP RAP HEADWALL**  
SCALE: 1"=5'-0"

- LIST OF MATERIALS**
- ① Non-woven polypropylene geotextile for soil separation, filtration and protection, Mirifi 140N or equal.
  - ② Aggregate filter material, Class 4 (1 1/2" minus) per CDOT Table 703-2.
  - ③ Graded rock rip rap erosion protection, D<sub>50</sub>=12" (18" minus) per CDOT Table 506-2C.



**GRATING SUPPORT DETAIL**  
NTS



**DETAIL 5**  
**FLOW CONTROL STRUCTURE**  
SCALE: 1/4"=1'-0"

- LIST OF MATERIALS**
- ① Precast concrete vault, 6'-6" wide by 8'-6" long by 8'-9" high inside dimensions. Provide grating support around inside of perimeter walls, with bituminous coating at surface in contact with concrete.
  - ② Provide (2) 72" diameter cored or block-out holes for 60" ADS inlet/outlet pipe penetrations, with centerline of 60" inlet 3'-7 1/4" above floor and centerline of 60" outlet 3'-6 5/8" above floor.
  - ③ Provide (1) 48" diameter cored or block-out hole for 36" ADS overflow pipe penetration, centerline at 2'-6 5/8" above floor.
  - ④ 5'-0" x 8'-3" reinforced fiberglass stop gate and cast-in gate guide, Plasti-Fab or equal. Stop gate is removed to allow flow to tunnel, or installed to divert flow to overflow.
  - ⑤ 3'-0" x 8'-3" reinforced fiberglass stop gate and cast-in gate guide, Plasti-Fab or equal. Stop gate is installed to allow flow to tunnel, or removed to divert flow to overflow.
  - ⑥ Aluminum non-slip grating, 6'-6" span, 2 1/4" x 3/16" (or 1-bar) or less than 1/4" deflection under uniform load of 100 psi.

GENERAL NOTES

**WestWater Engineering**



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**NORTH DELTA IRRIGATION COMPANY TUNNEL  
REHABILITATION AND CANAL SYSTEM UPGRADE**

**BID SCHEDULE 2  
CANAL SYSTEM UPGRADE DETAILS**

Design by: JKG Date: 03-12 Project No. 1111INDL Sheet 27 of 7