

# RECLAMATION

*Managing Water in the West*

## CONCEPTUAL DESIGN REPORT TRAIL LAKE DEWATERING ALTERNATIVE

Trail Lake Section of the Main Canal  
Columbia Basin Project, Washington



U.S. Department of the Interior  
Bureau of Reclamation  
Pacific Northwest Region Design Group  
Boise, ID

July 2014

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### **Reference Drawings**

10.	222-116-20476	Main Canal – Profile and Sections – Sta. 255+85.56 to Sta. 326+90.0
11.	222-D-15597	Main Canal – Sta. 318+80 – Transition
12.	222-D-15598	Main Canal – Sta. 325+61.08 – Transition

### **Appendix B – Cost Estimates**

## 1.0 Introduction

The purpose of this conceptual design report is to document an alternative that will eliminate the continual maintenance issues involved with the repair of the concrete lining of the Columbia Basin Project's Main Canal adjacent to Trail Lake. The Main Canal conveys all the flow for the over 630,000 acres of land irrigated within the Columbia Basin Project.

A draft conceptual design report titled *Trail Lake Modifications* was produced in December 2005 by the PN Regional Office. Alternatives investigated were: Canal Breach, Corrugated Metal Pipe Culverts, and Concrete Box Culvert. These alternatives all addressed and attempted to solve the problem of excessive hydrostatic pressure on the canal lining by allowing the lake to drain into the canal during canal draw-down. A clear, best solution to addressing the maintenance issues did not emerge from that report.

The issue of Trail Lake Modifications was reinvestigated in 2014. A collaboration of engineers (two from the Ephrata Field Office and two from the PN Regional Office) met in Ephrata to discuss the full range of possible modifications. It was determined that the previously examined alternatives did not fully eliminate the continual maintenance issues. Completely dewatering the Main Canal to allow for repairing the Main Canal over successive maintenance seasons would address those issues. Thus, this report documents a way to dewater the Main Canal at the end of each irrigation season.

## 2.0 Existing Facilities

The Main Canal commences at the headworks at Dry Falls Dam at the southern end of Banks Lake. It flows for approximately 1.8 miles to the Bacon Siphon and Tunnel structures which consist of two siphons and two tunnels. At the outlet of the tunnels, the canal extends for approximately one mile as an unlined canal section and then transitions to a lined canal as it extends adjacent to Trail Lake. The lined canal section was designed for a maximum flow of 13,200 cfs. The section has a 20-foot base width and 1.5:1 side slopes. The lining is 5-inches thick, unreinforced concrete.

Trail Lake is a small lake formed in Trail Lake Coulee which approximately parallels the Main Canal. During the planning stages of the Columbia Basin Project, there was a proposal to discharge the Main Canal into the upstream end of Trail Lake and then continue the canal at the downstream end of the lake, thereby saving the cost of approximately 2.5 miles of canal construction. However, there was a concern about possible seepage losses from the lake. The evaluation of this concern is found in the report *Trail Lake Seepage, March 27, 1941*. The report contained the following conclusion "*Sufficient information has been presented in this report to conclude that Trail Lake will not serve as a reservoir in its present condition.*" The report was concerned with seepage through pervious gravel deposits and a talus slope within the lake area. As remedies to the seepage concerns it states "*Possibly the gravel bar and talus might be sealed off by a silt blanket*".

### 3.0 Problems and Needs

The problem at this site is displacement and damage to the canal’s concrete lining panels. The concrete lining panels are forced out due to hydrostatic pressure in the embankment fill. This is explained by the following sequence of events: The canal is filled at the start of the irrigation season. It is observed that Trail Lake water surface elevation begins to rise after the canal surface rises, when the canal is at the peak water surface elevation the lake rises to about the same elevation. At the end of the irrigation season the canal flow is gradually reduced and the canal water surface elevation lowers. The lake water surface elevation does not lower as quickly. The saturated embankment fill material exerts a force on the lining that is not counter-balanced by the hydrostatic pressure in the canal, resulting in a “blow-out” in the lining.

Shown in Figure 1 are water surface elevation measurements in Trail Lake for the years 2002 through 2005. The lake elevation rises at the start of the irrigation season and then recedes at the end of the irrigation season and has a maximum water surface elevation of about El. 1502.0. The canal and the lake are in some way hydraulically connected.

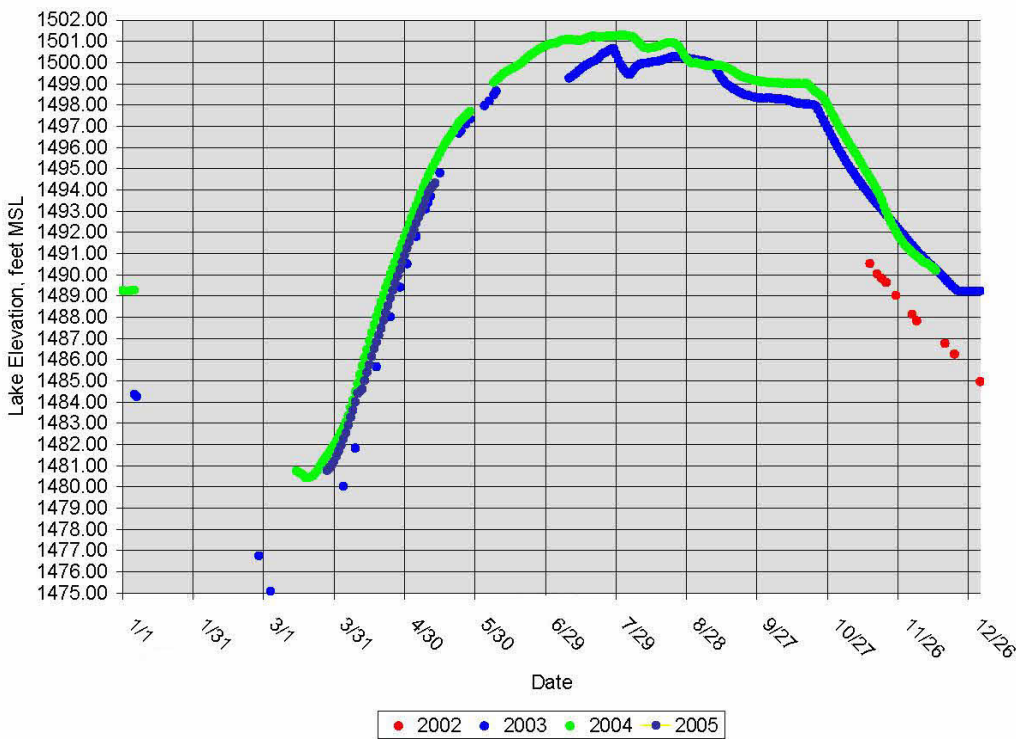


FIGURE 1 – Trail Lake Elevation

Past studies haven't looked at the need to pump out the last several feet of the canal and lake in order to obtain a dewatered condition. Past study emphasis was on balancing the hydrostatic pressure during draining of the Main Canal. Pumping is necessary because of a high point in the canal floor at El. 1491.75 at Sta. 328+25 as shown in Appendix A on Reclamation Reference Drawing 222-116-20476. The result of this high point creates a pocket of water in the Main

Canal. A drain was later installed at the low point to drain back to Trail Lake at a point in time that Trail Lake wasn't filling up as it is today. The volumes of water amount to about 50 AF in the canal and about 1,000 AF from the lake. Shown in Figure 2 is the Trail Lake Area/Capacity expressed as Area in acres and Capacity in acre-feet compared to the lake elevation in feet.

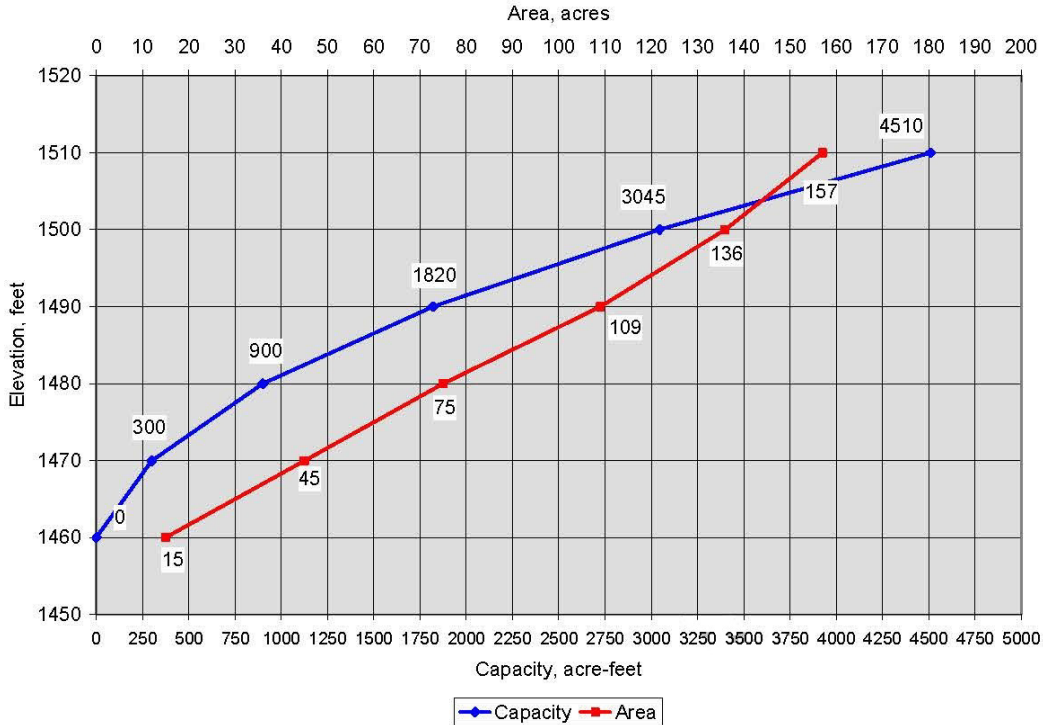


FIGURE 2 – Trail Lake Area/Capacity

## 4.0 Dewatering Alternative

The intent of this alternative is to develop infrastructure that will allow the dewatering of Trail Lake and the Trail Lake Section of the Main Canal. Doing so will allow maintenance and rehabilitation of the Main Canal free from the adverse impacts of a lake water-surface elevation higher than the canal invert. The items included in the infrastructure are: box culvert, pump station, power, pipeline, weir, and access roadway. Drawings of the Dewatering Alternative are shown in Appendix A and costs are shown in Appendix B.

### *Box Culvert*

One gated concrete box culvert with an interior opening of 8 feet by 8 feet and 130 feet long was selected. This was sized to be able to drain Trail Lake by 1,170 AF from El. 1502 feet to El. 1493 feet as the Main Canal is drained at the end of the season.

Our initial assumptions were to expect the canal to drain at 2 feet per day and to size the culvert to drain the lake at 1.5 feet per day with the ability to reach elevation 1493 within 6 days. The 6 days was set based on the need to dewater fairly quickly (within 28 days), with a reasonably sized culvert, so maintenance on the concrete lined canal banks could be started before the weather turned cold in the fall that would freeze the water that needs to be drained. The culvert is gated because we expect the maintenance of the Main Canal to take several years and will want to control the flow of water between the lake and the canal. In particular, we will want to keep from filling the lake as the canal fills in the spring by closing the gate and keeping the gate closed until the end of the irrigation season when it is time to drain the canal.

## ***Pump Station***

The pump station is needed to drain the additional 50 AF from the Main Canal and the additional 1,000 AF from Trail Lake between El. 1493 and El. 1483.

The pump was sized with similar consideration as the culvert being the approximate 28 day window from the start of draining the canal until freezing temperatures that would preclude further draining. A drainage time for the pump station was set at 10 days. In order to meet this 10 day window the pumps were sized as two 200 hp pumps operating at 12,500 gpm from a maximum water surface elevation of 1493 feet to a minimum water surface elevation of 1483 feet.

The American National Standard for Pump Intake Design was used in sizing the pump station:

- Dividing walls for pumps w/Q > 5000 gpm are required
- Limit approach velocity (to pump) to 1.5 fps
- Minimum submergence (page 3)  $S=D(1+2.3*F_D)$   $F_D= V/(g*D)^{0.5}$
- Bay width of  $2*D$
- Floor clearance of  $0.3*D - 0.5*D$
- Wall clearance of  $0.25*D \leq 4''$
- Approach velocity of conduit  $\leq 4$  fps
- Install vanes below pump volute
- See page 20 for wet well configuration
- See page 31 for inlet bell design diameter

Solutions:

- Bell Diameter:  $Q=12,500$  gpm,  $v = 5.7$  fps  $D = 30''$  inside diameter
- Clearances: Wall = 7.5'' Floor = 15'' Bay width = 60''
- Submergence:  $F_D = 0.635$   $S_D = 8$  ft. min. submergence

Associated with the pump station are two intakes: one from Trail Lake and one from the Main Canal. An open channel ditch sized for 60 cfs is need from Trail Lake and a pipeline sized for 1,000 gpm into the wetwell with a maximum head differential of 1 foot for the Main Canal.

## ***Power***

Rough guideline power line costs were obtained from an engineer at Grant County Public Utility District (PUD) who works in power line construction, installation, and new services.

Single phase power, run about 2 miles, would run around \$50,000 to \$100,000 for just the power line, not considering any easement or Right of Way costs. Single phase is available at the farmstead on Rd 31 NE, about a 1.9 mile run to the east that will provide 240 V power sufficient to run a 10 hp pump (typically).

There is three phase power available about 2.5 miles away to the south from the line that serves the Summer Falls Power Plant. This would be able to run much larger pumps at a higher voltage and would probably cost around \$150,000 to \$200,000. There is also a possibility that a line could just run right up the county road (Pinto Ridge Rd) utility Right of Way for about the same cost.

Neither of these rough cost figures appears to be prohibitive to the design concept.

The PUD has an application that we can submit that give more exact cost estimates.

## ***Pipeline***

The pipelines from the pump station will be two 30-inch-diameter HDPE pipes about 1,225 ft. long. They will be buried with 3' of cover under the access road of the Main Canal and exit into the Main Canal at Sta. 11+38 just downstream of the new downstream control weir.

## ***Downstream Control Weir***

A weir will be placed into solid rock on the Main Canal at Sta. 326+90 across the bottom width of the canal 120 feet wide and 1 foot high. The purpose of the weir is to prevent discharged water from the pump station from flowing back into the low spot in the canal at the pump station. The weir was designed to have a low profile so it would not impact the capacity of the canal but be high enough to provide a water depth for normal flow down the canal at rates equivalent to the pumping rate of the pump station.



### ***Access Roadway***

The existing Main Canal access will be improved from Pinto Ridge Road into the pumping plant. It will be a 20 foot wide surface with 6 inches of gravel about 1350 feet long.

## **5.0 Conclusions and Recommendations**

This alternative will reduce the hydro-static pressure on the canal lining as well as fully drain the canal so that maintenance can be performed during the non-irrigation season. As designed it is quite expensive compared to previous studies that only addressed the hydrostatic pressure but well suited for the intended use of also draining the Main Canal. There may be ways to reduce cost by making it more of a temporary facility rather than a permanent one. A case can be made that the pumping station will no longer be needed when the Main Canal is completely repaired. The main contribution to the rise in the lake is from the seepage through the damaged lining.

## **APPENDIX A – Drawings**

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| 2. | C-1  | Site Overview                 |
| 3. | PP-1 | Culvert – Plan & Profile      |
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| 5. | PP-3 | Pipeline – Plan & Profile     |
| 6. | PP-4 | Pipeline – Plan & Profile     |
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| 8. | D-2  | Culvert Detail Sheet          |
| 9. | D-3  | Weir Detail Sheet             |

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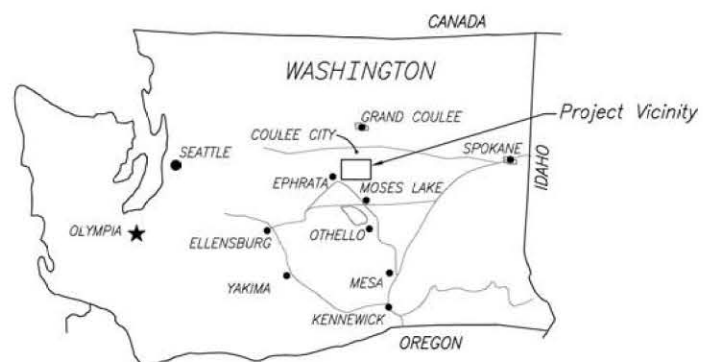


# COLUMBIA BASIN

## TRAIL LAKE CANAL

### TRAIL LAKE CANAL MODIFICATIONS

#### 30% DRAFT DESIGN DRAWINGS



LOCATION MAP

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GRANT COUNTY  
COULEE CITY, WASHINGTON

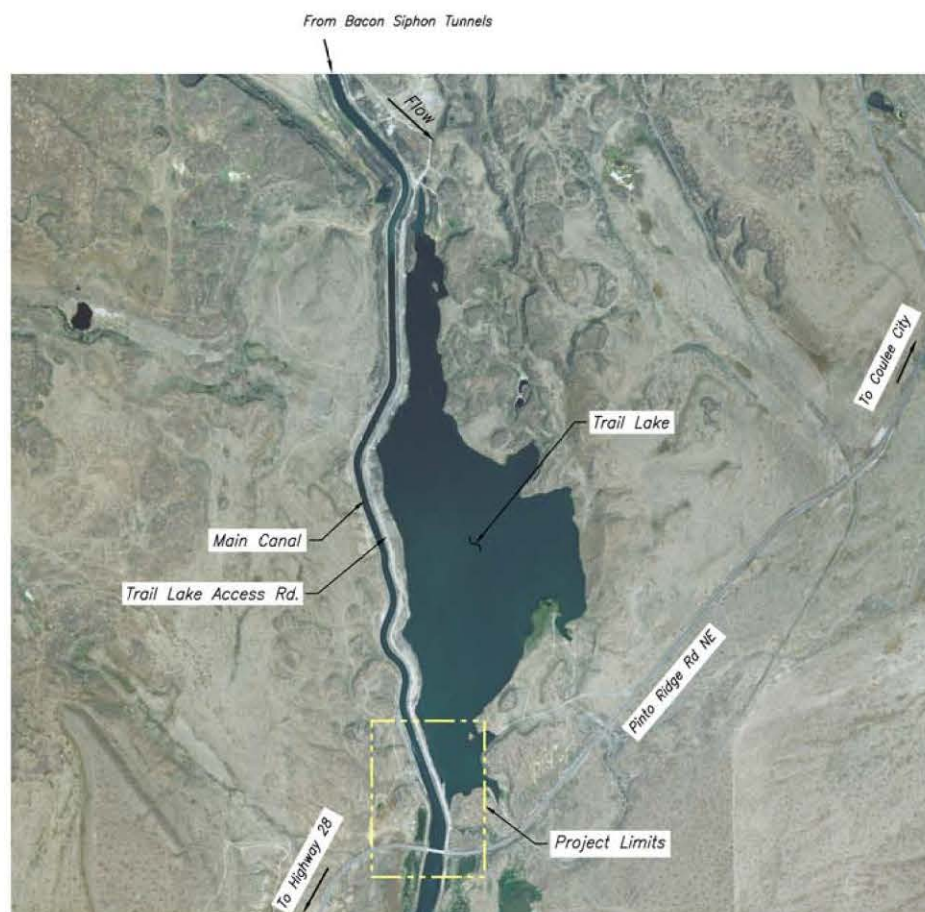
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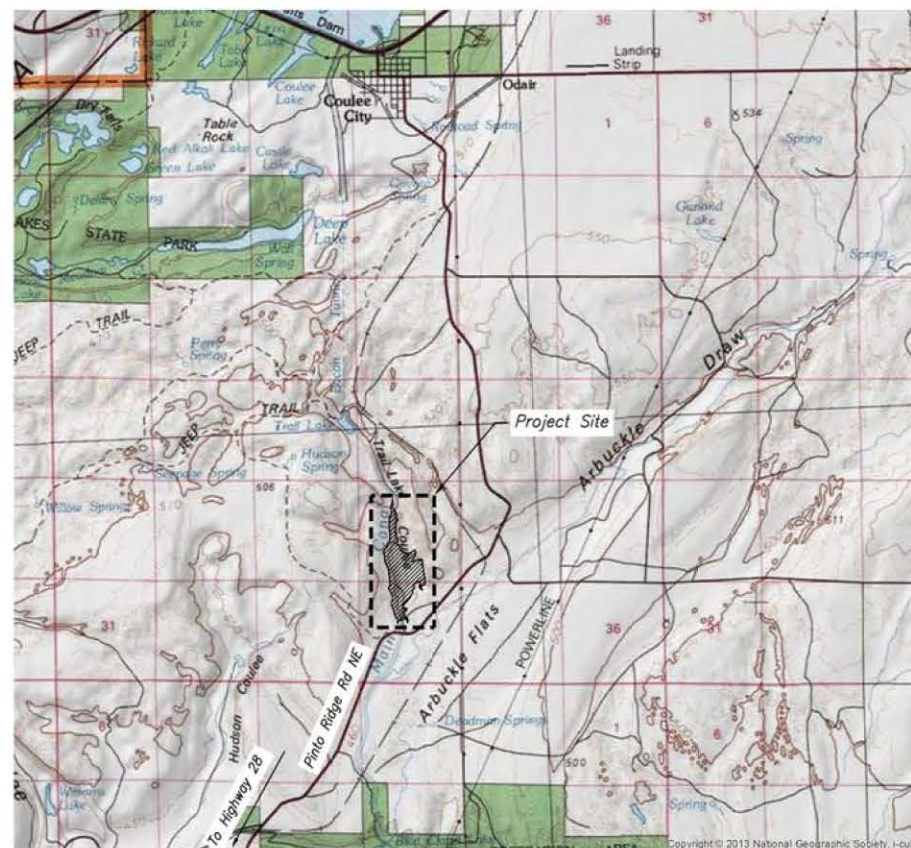
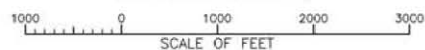
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**SHEET INDEX**

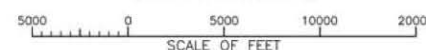
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1	G-1	LOCATION MAP & SHEET INDEX
2	C-1	SITE OVERVIEW
3	PP-1	CULVERT - PLAN & PROFILE
4	PP-2	PUMP STATION - PLAN & PROFILE
5	PP-3	PIPELINE - PLAN & PROFILE
6	PP-4	PIPELINE - PLAN & PROFILE
7	D-1	PUMP STATION DETAIL SHEET
8	D-2	CULVERT DETAIL SHEET
9	D-3	WEIR DETAIL SHEET



PROJECT SITE  
(SCALE IS APPROXIMATE)



VICINITY MAP  
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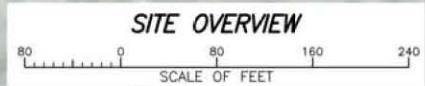
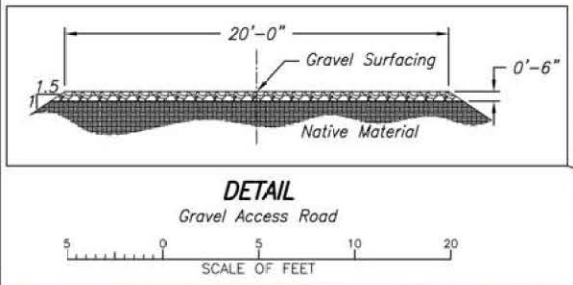
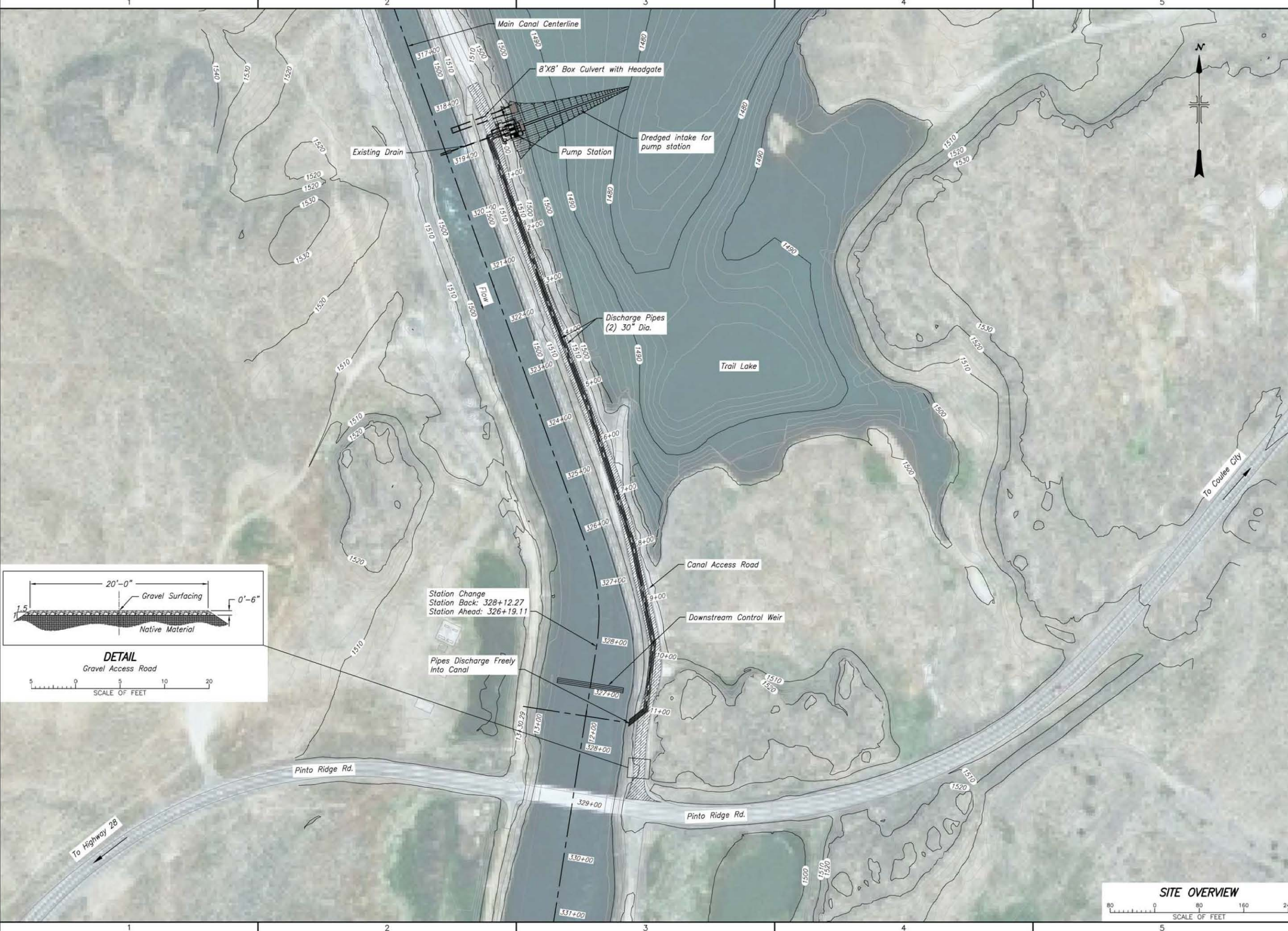
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BOISE, IDAHO 2014-07-15

LOCATION MAP &  
SHEET INDEX

G-1

SHEET 1 OF 1



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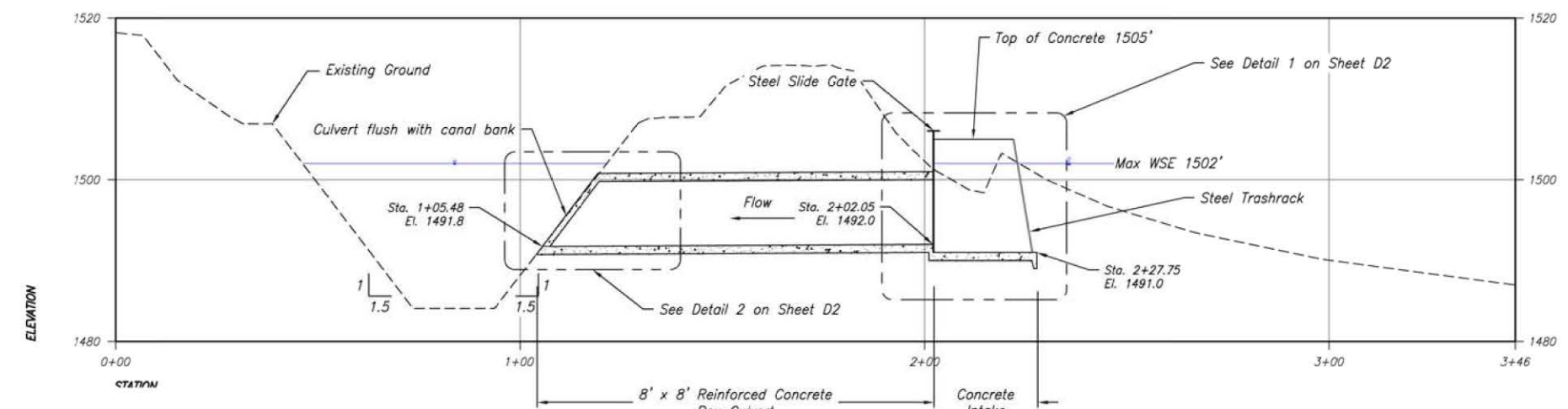
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**SITE OVERVIEW**

**C-1**  
SHEET 1 OF 1



**Plan View**  
Concrete Box Culvert  
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**Profile View**  
Concrete Box Culvert  
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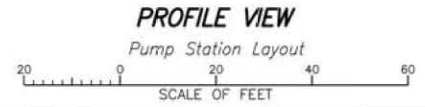
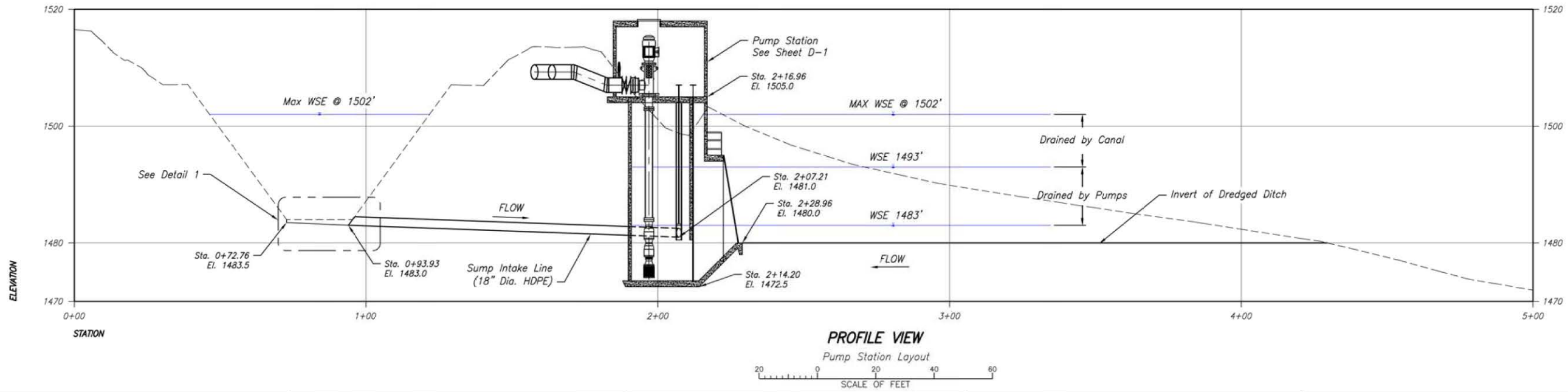
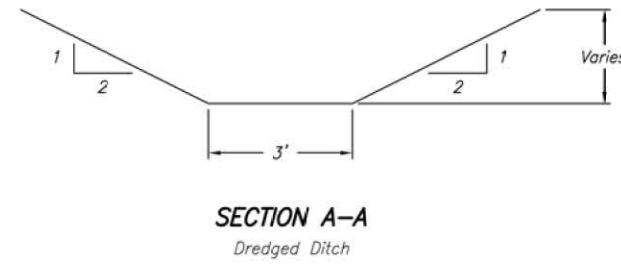
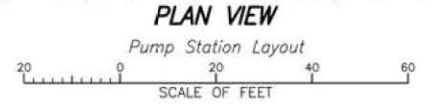
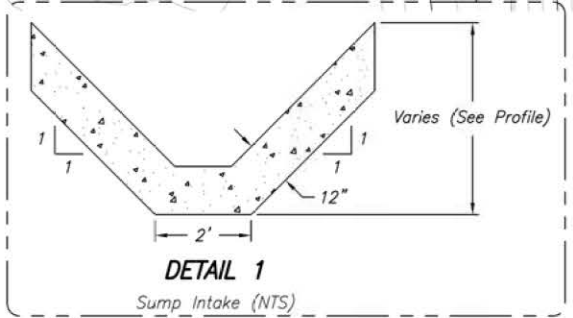
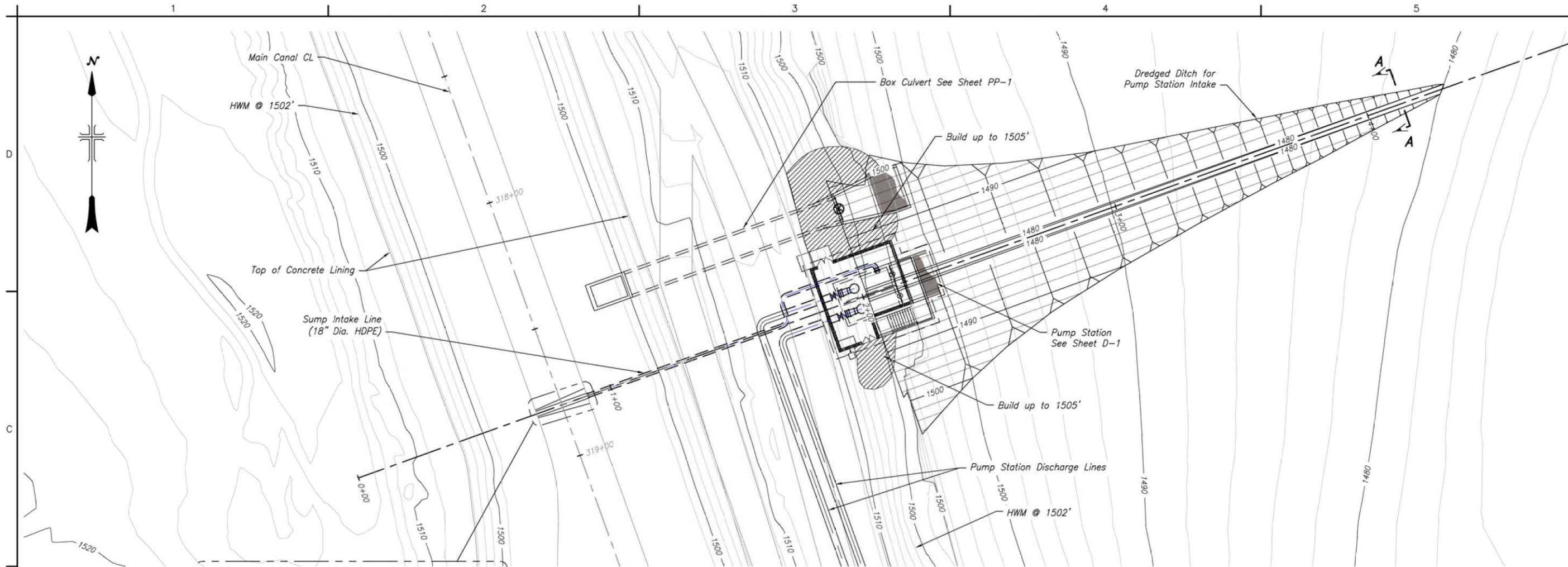
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**CULVERT  
PLAN & PROFILE**

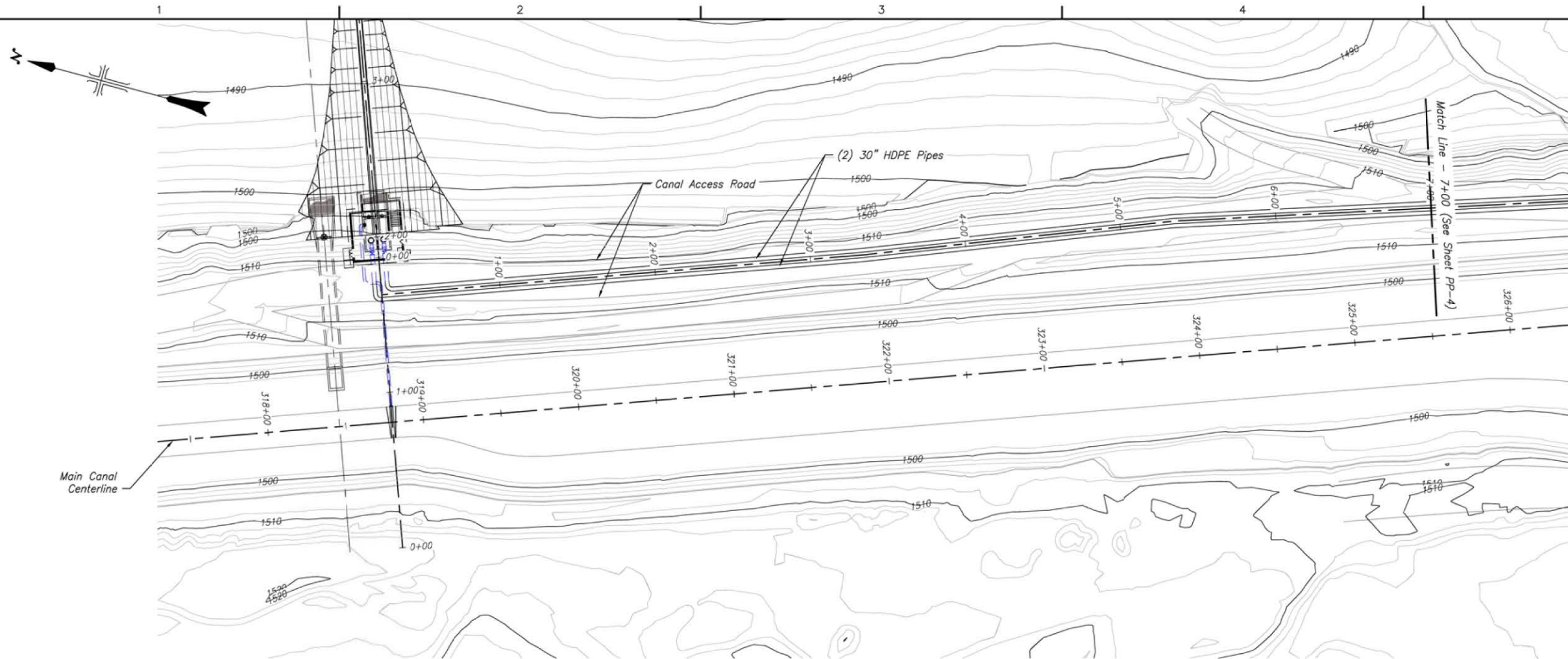


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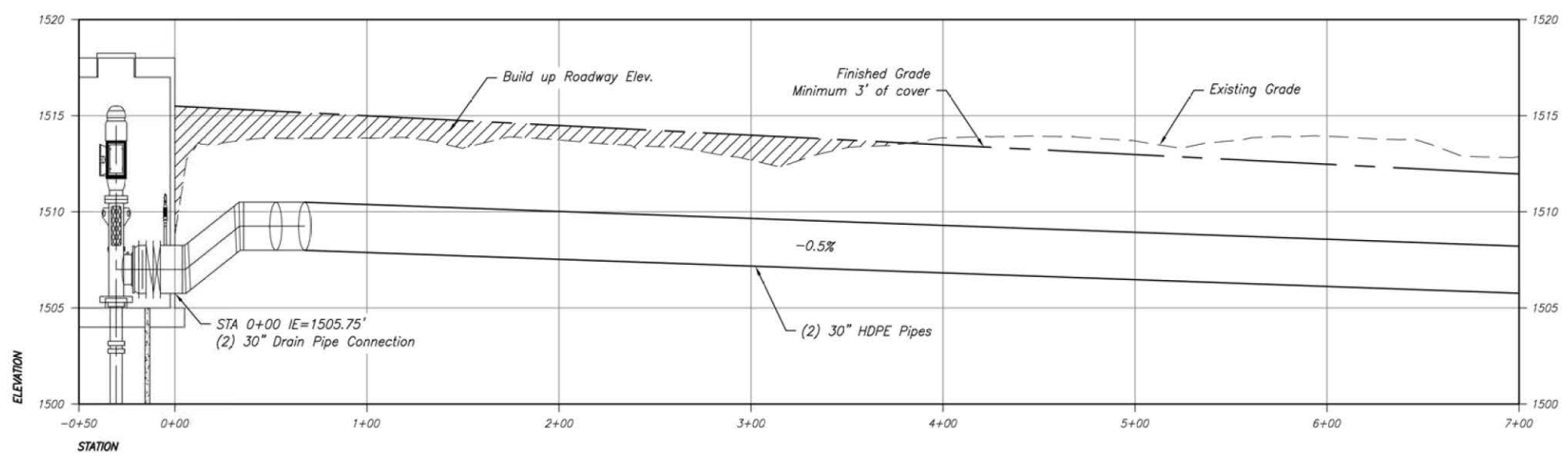
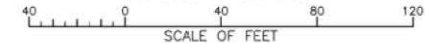
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PUMP STATION  
PLAN & PROFILE



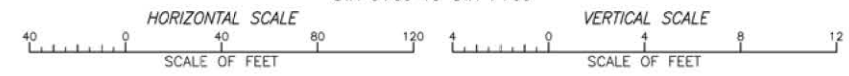
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PIPELINE - PROFILE

STA 0+00 TO STA 7+00



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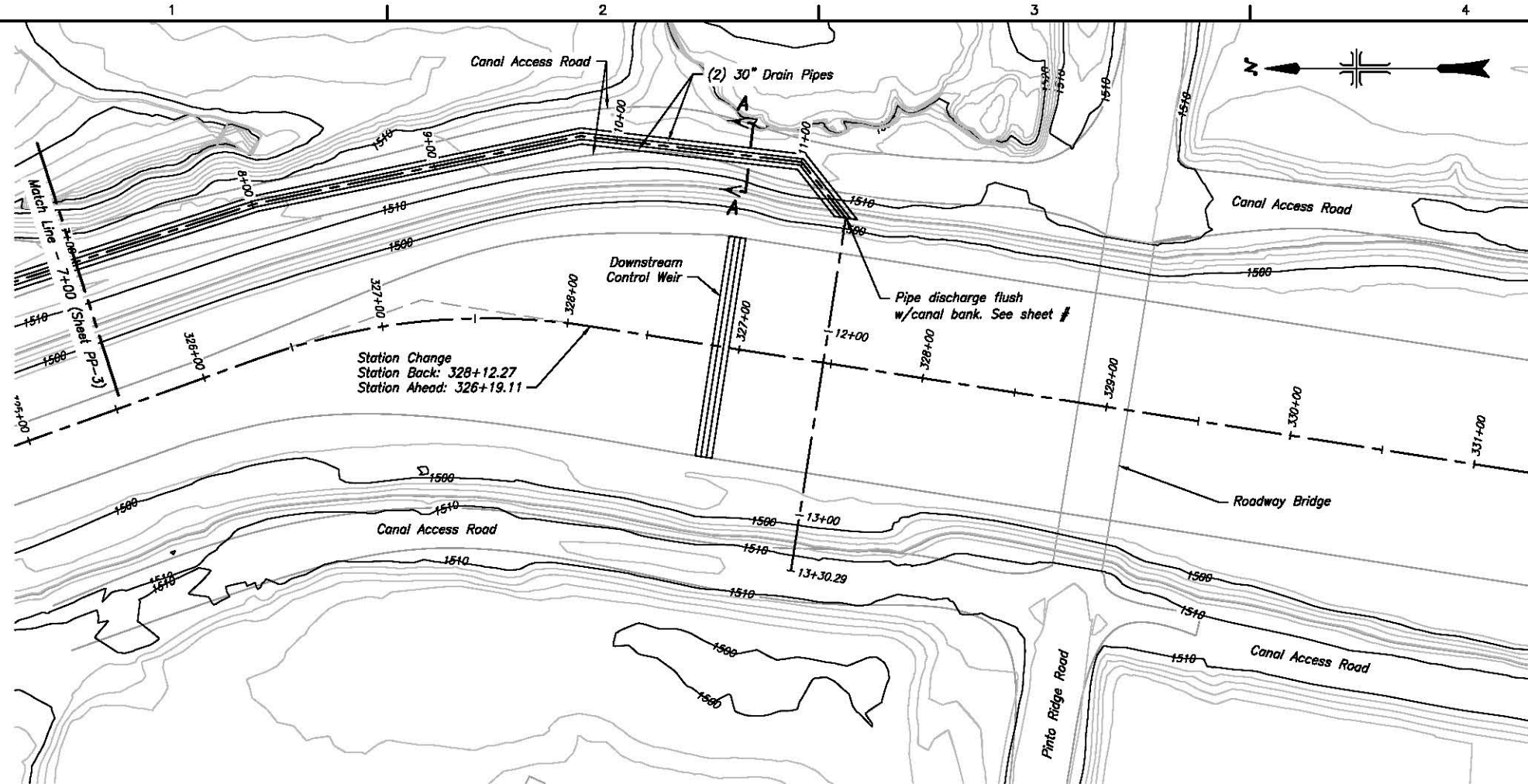
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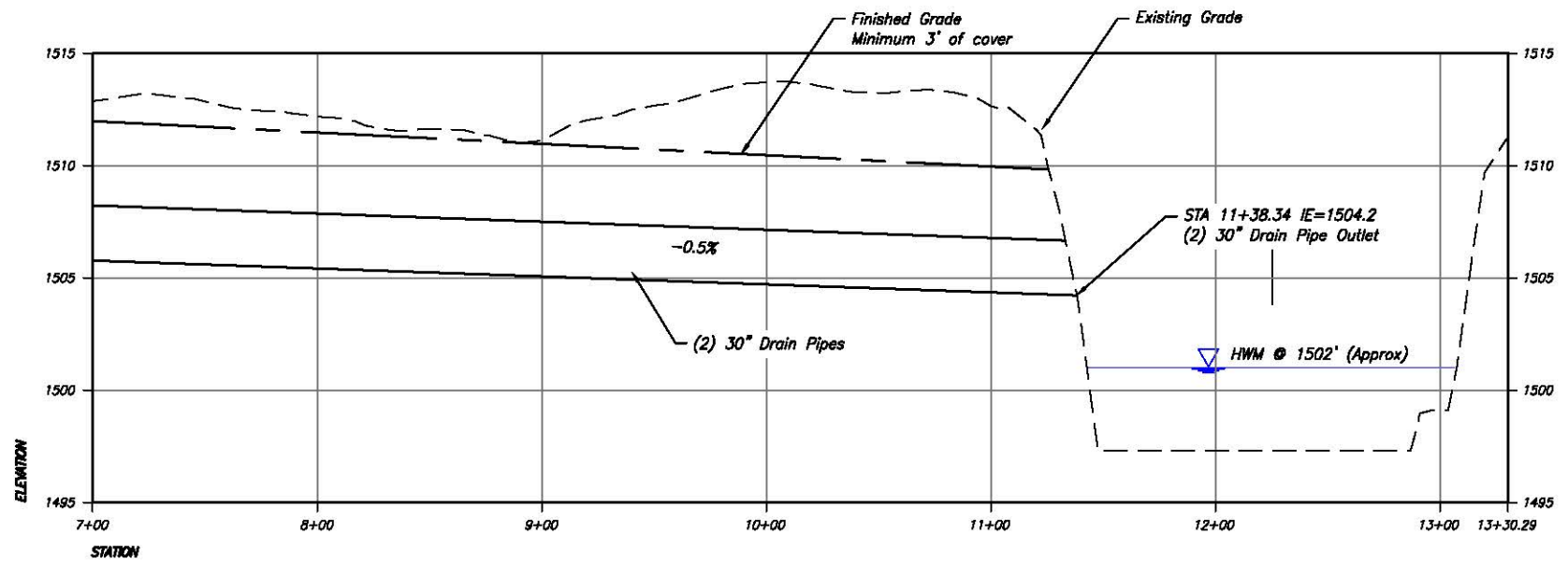
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PP-3  
SHEET 1 OF 1

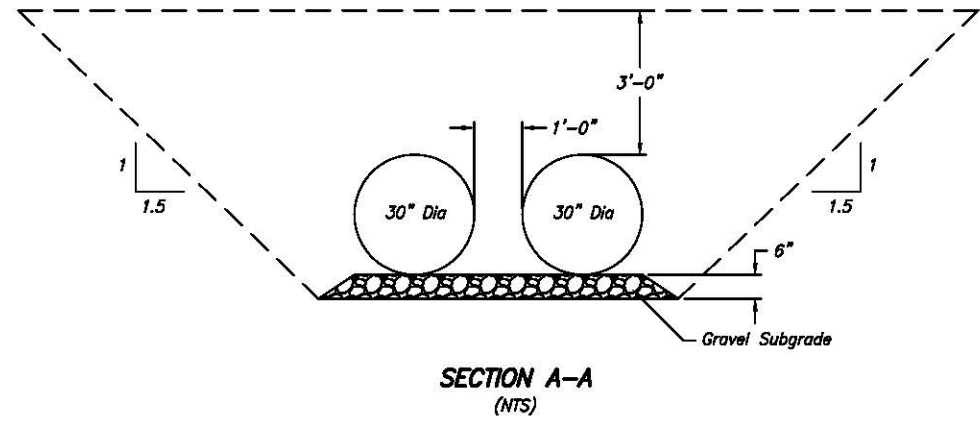




**PIPELINE - PLAN**  
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**PIPELINE - PROFILE**  
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**SECTION A-A**  
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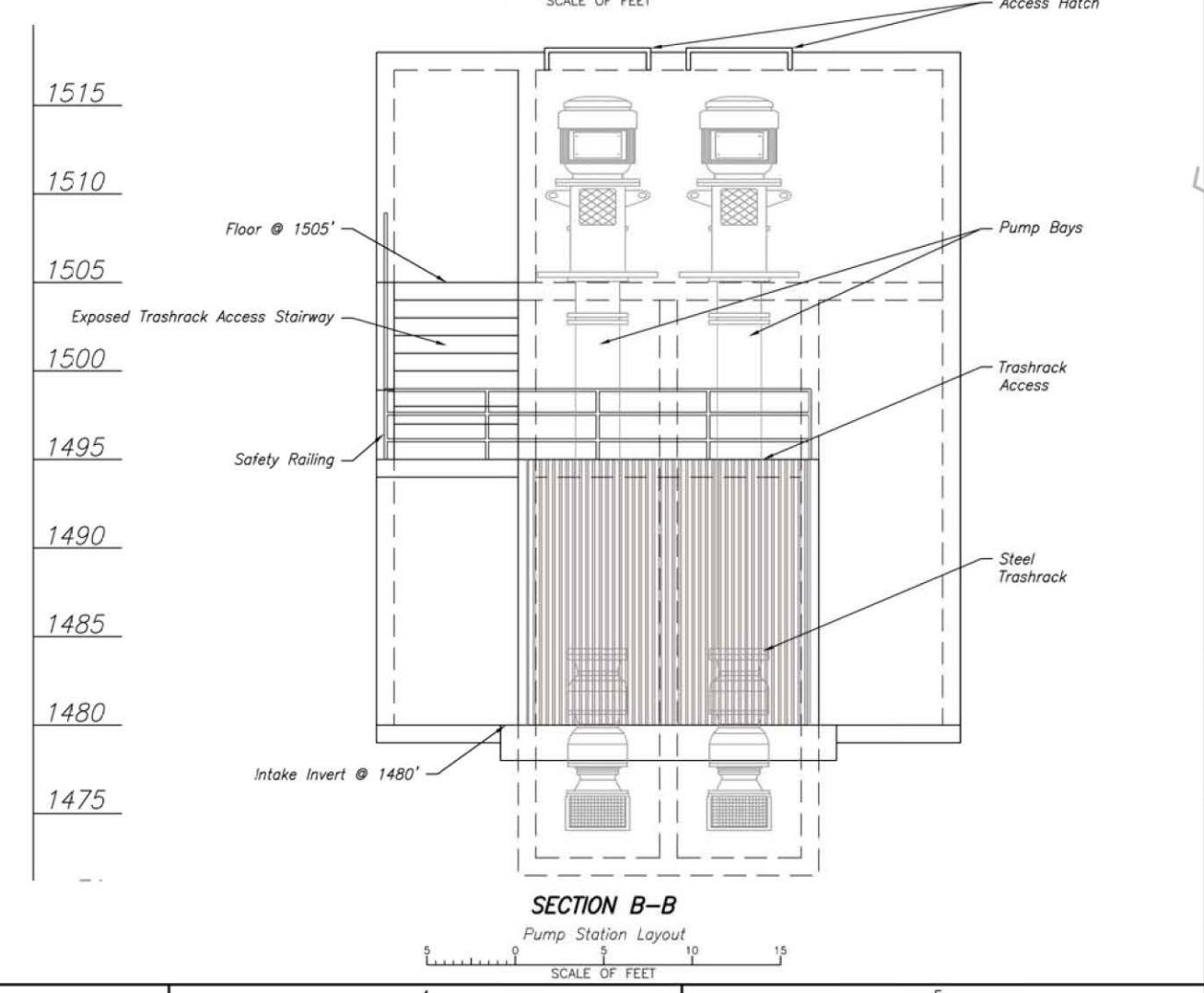
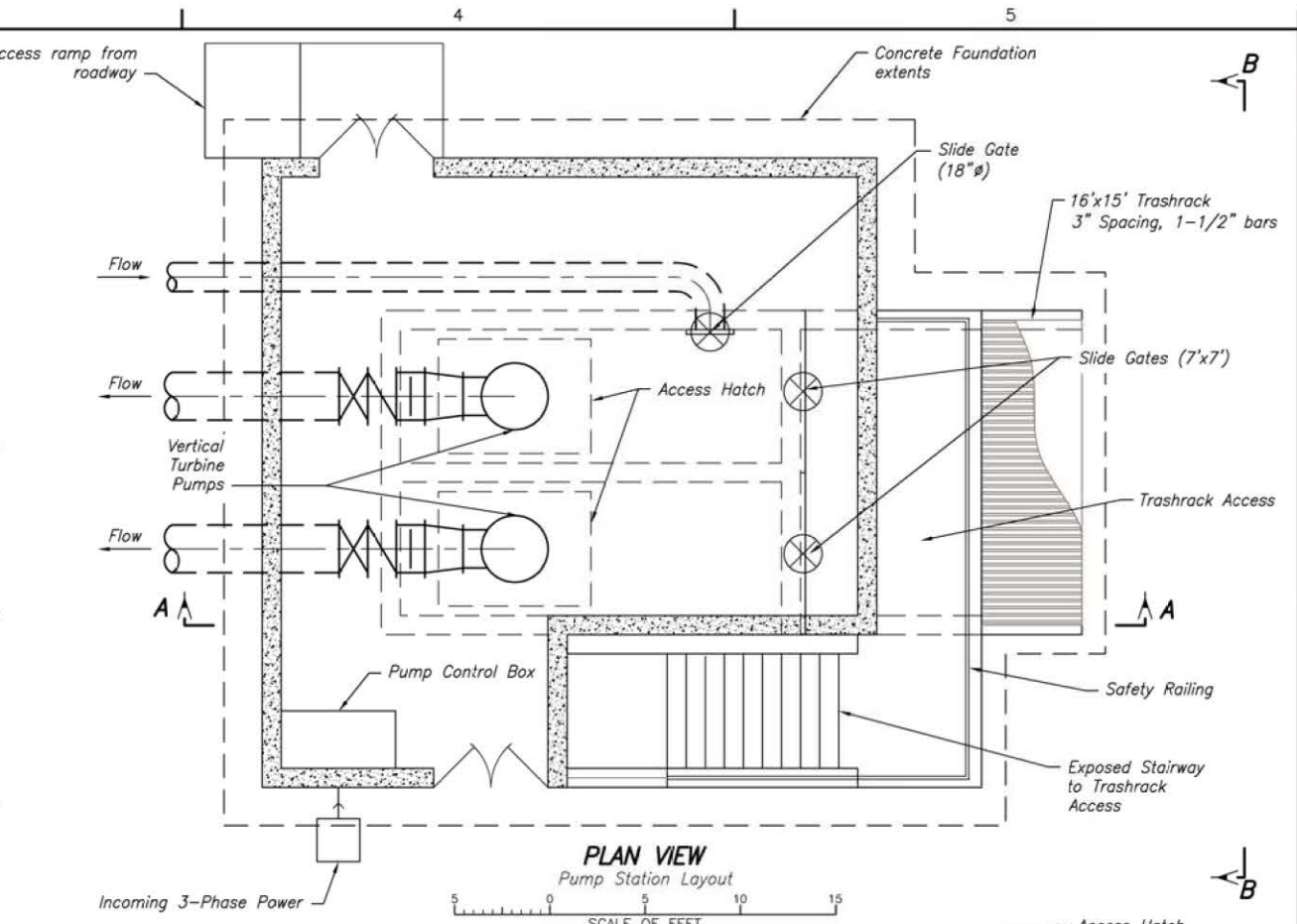
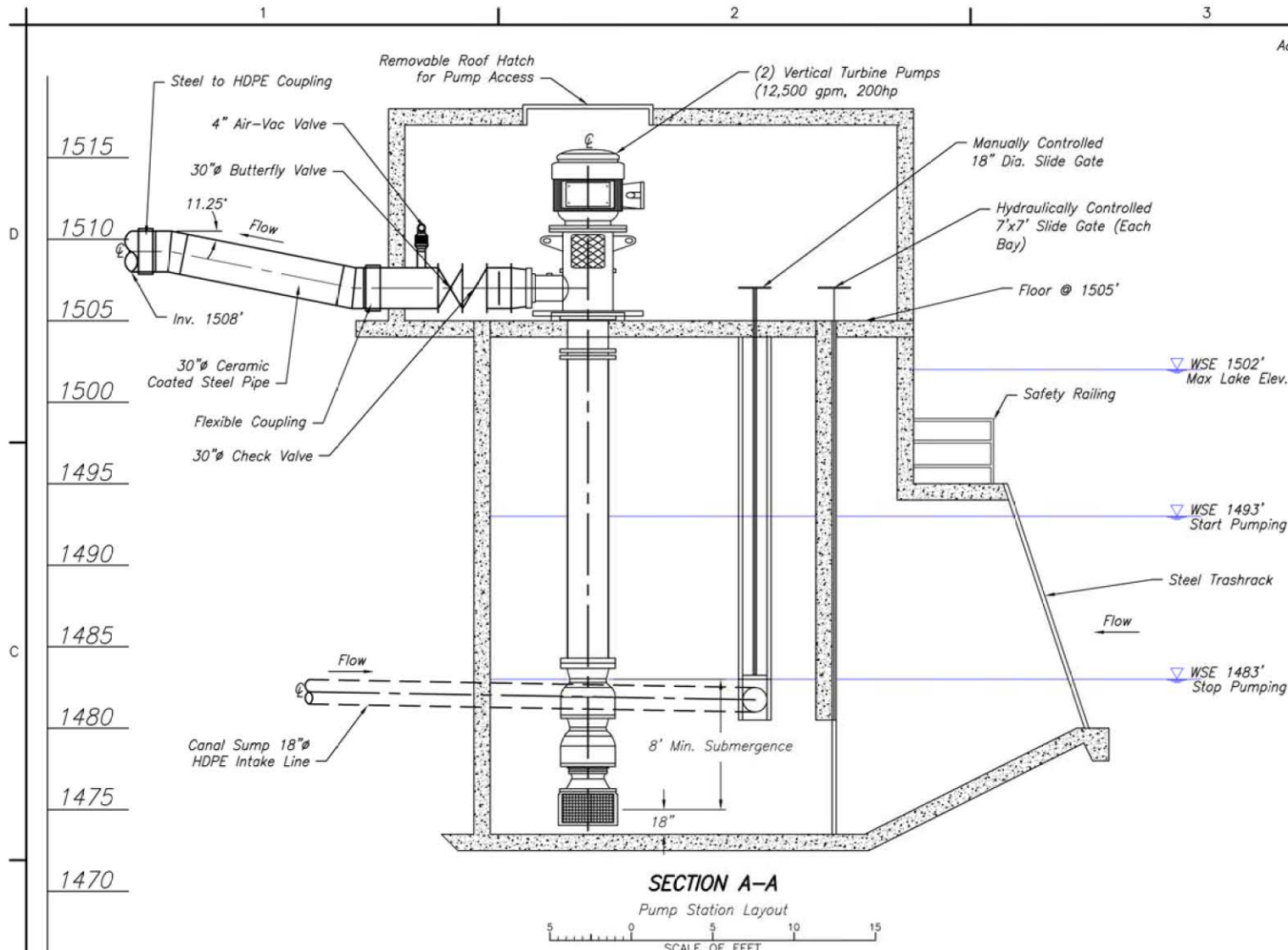
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**PIPELINE PLAN & PROFILE**

**PP-4**  
SHEET 1 OF 1



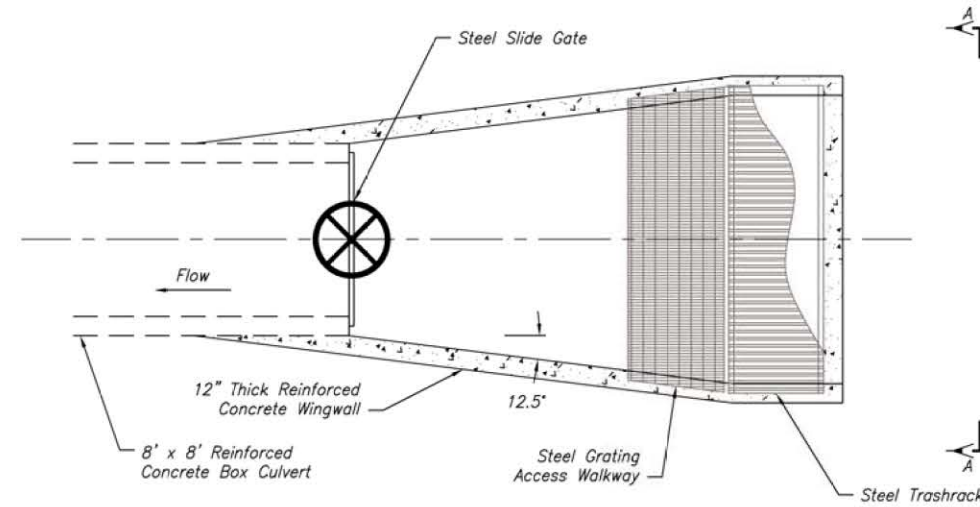
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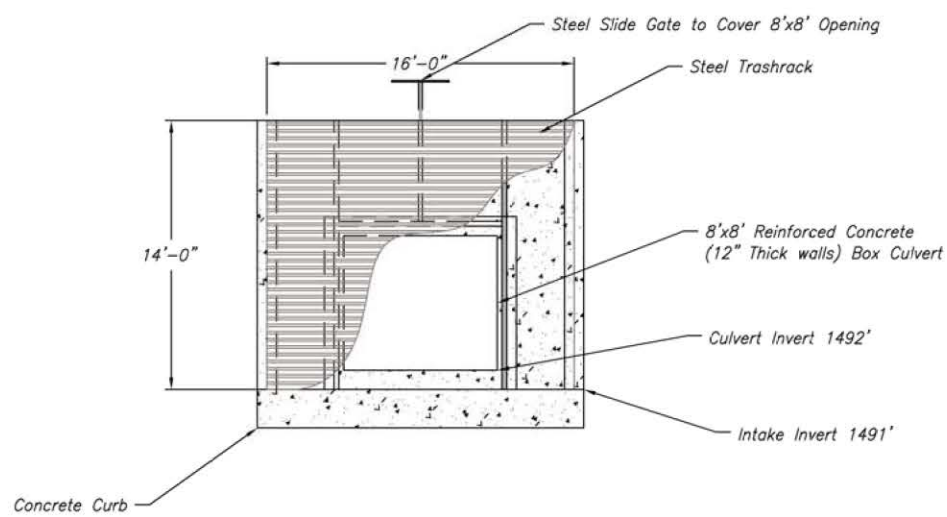
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 BUREAU OF RECLAMATION  
 COLUMBIA BASIN PROJECT - WASHINGTON  
 TRAIL LAKE CANAL MODIFICATIONS  
 TRAIL LAKE CANAL  
 TRAIL LAKE CANAL MODIFICATIONS  
 PUMP STATION DETAIL SHEET  
 Not for Distribution

DESIGNED	<i>(Signature)</i>
DRAWN	<i>(Signature)</i>
CHECKED	<i>(Signature)</i>
TECH. APPR.	NAME, PROF. ABR.
ADMIN. APPROVAL	<i>(Signature)</i>
NAME	
TITLE	
BOISE, IDAHO 2014-07-15	

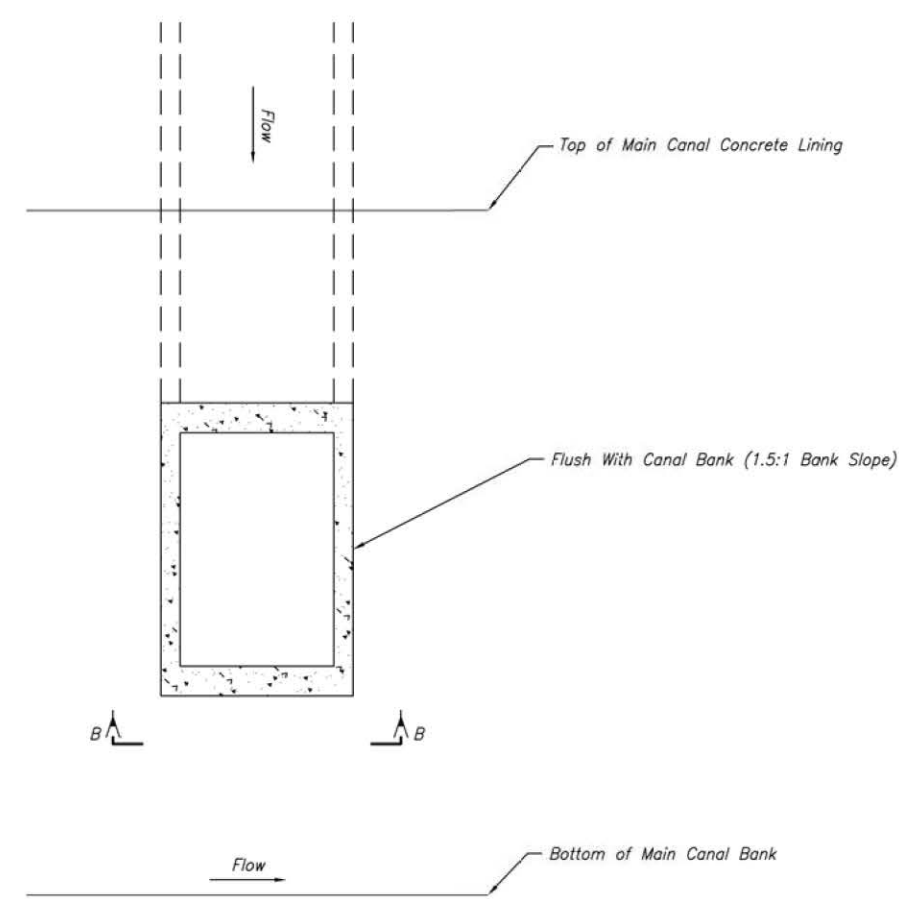
PUMP STATION  
DETAIL SHEET



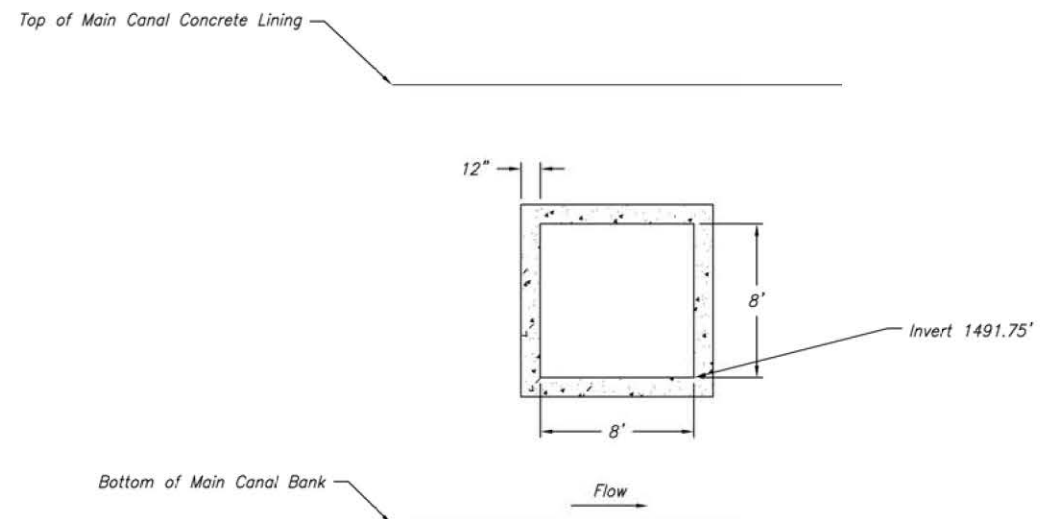
**DETAIL**  
Concrete Box Culvert  
Lake Intake Plan View  
SCALE OF FEET



**SECTION A-A**  
Concrete Box Culvert  
Lake Intake  
SCALE OF FEET



**DETAIL**  
Concrete Box Culvert  
Canal Discharge Plan View  
SCALE OF FEET



**SECTION B-B**  
Concrete Box Culvert  
Canal Discharge  
SCALE OF FEET

DATE AND TIME PLOTTED  
JULY 11, 2014 10:54  
PLOTTED BY  
ANSEL

CAD SYSTEM  
CADD 18.15  
CAD FILENAME  
07\_D-2\_30PCT\_CULVERT\_DETAIL\_SHEET.DWG

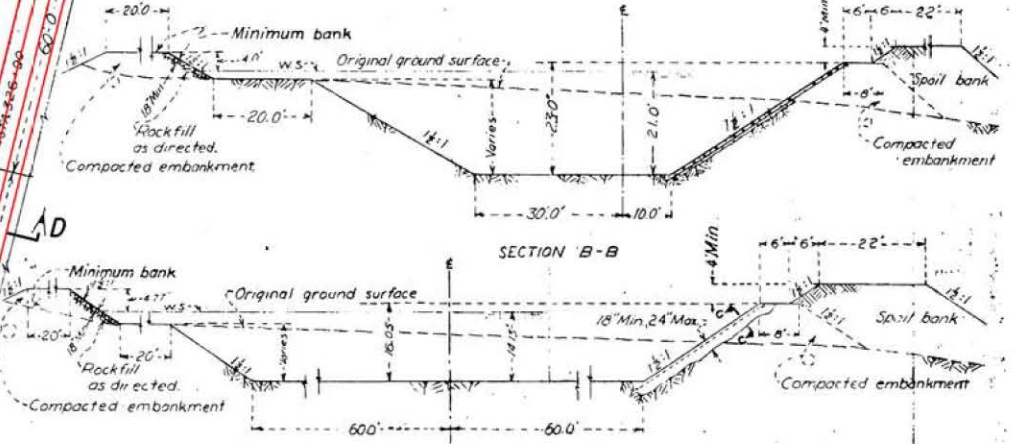
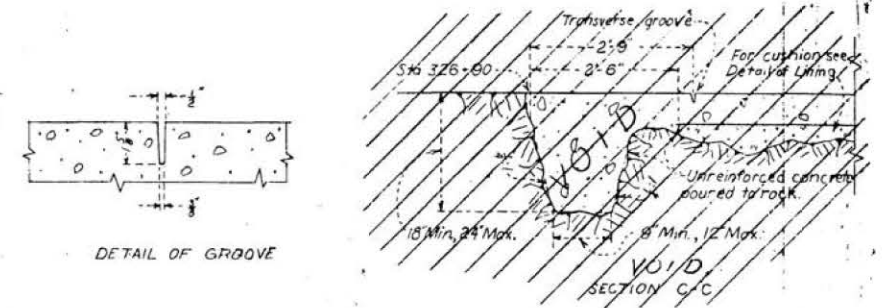
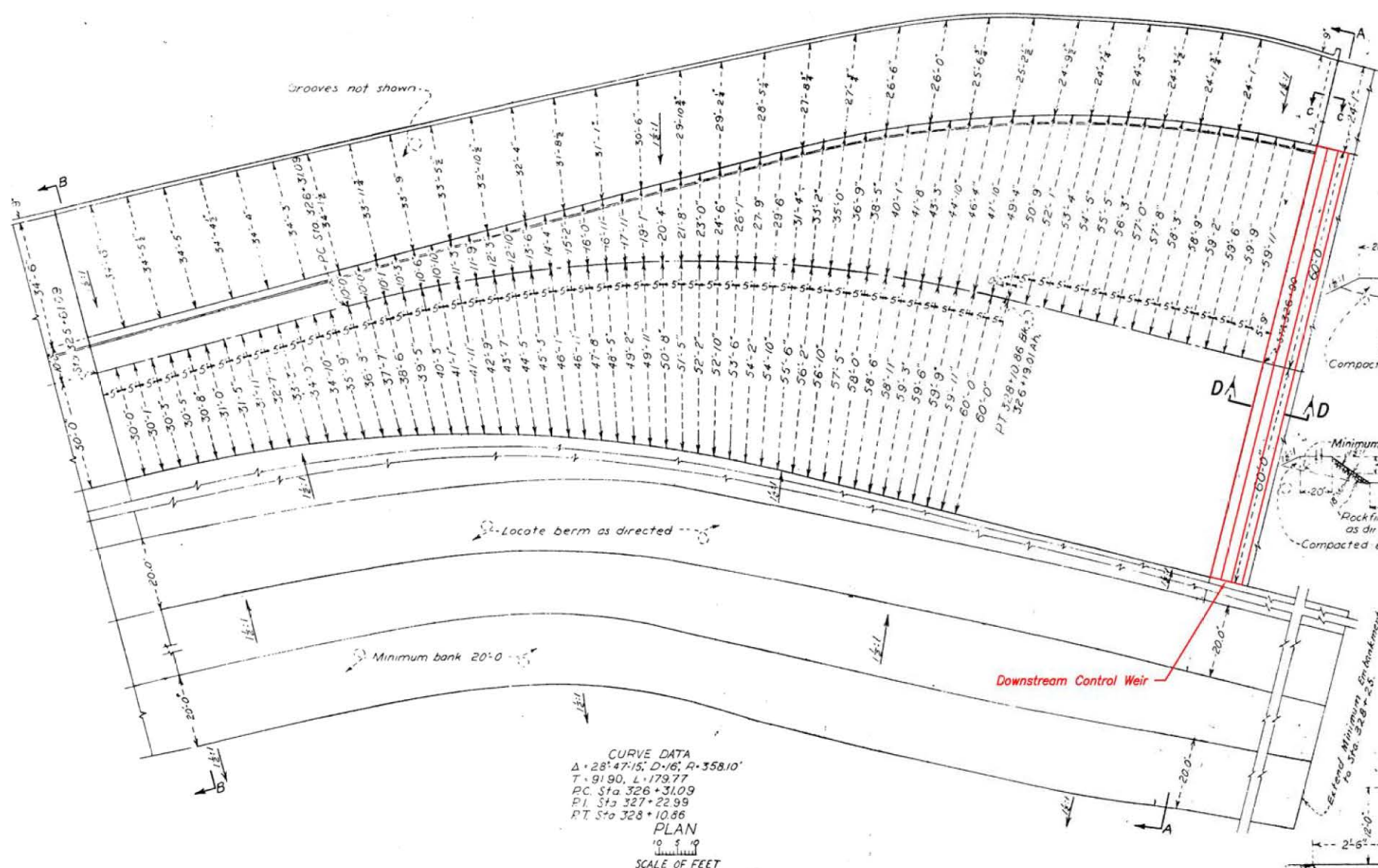
ALWAYS THINK SAFETY  
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 BUREAU OF RECLAMATION  
 COLUMBIA BASIN PROJECT - WASHINGTON  
 TRAIL LAKE CANAL MODIFICATIONS  
 TRAIL LAKE CANAL  
 TRAIL LAKE CANAL MODIFICATIONS  
 CULVERT DETAIL  
 Not for Distribution

DESIGNED	
DRAWN	
CHECKED	
TECH. APPR.	NAME, PROF. ADDR.
ADMIN. APPROVAL	
NAME	
TITLE	
BOISE, IDAHO	2014-06-13

CULVERT  
DETAIL SHEET

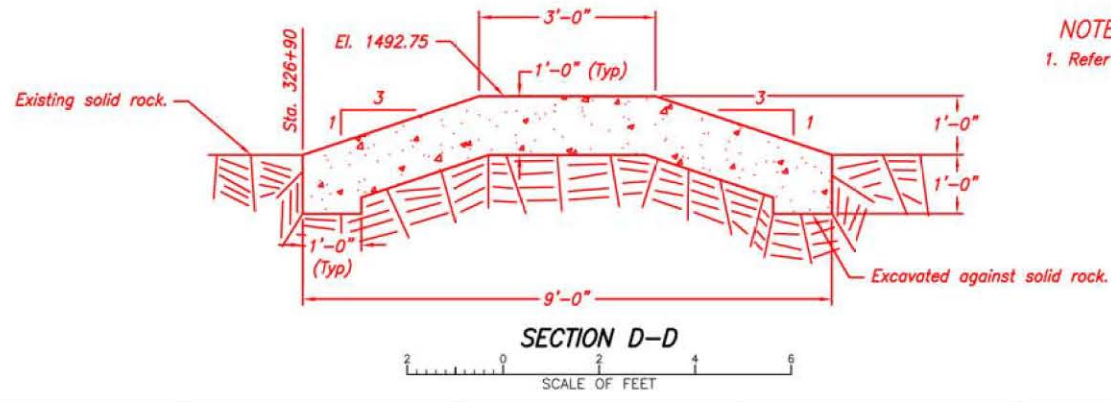
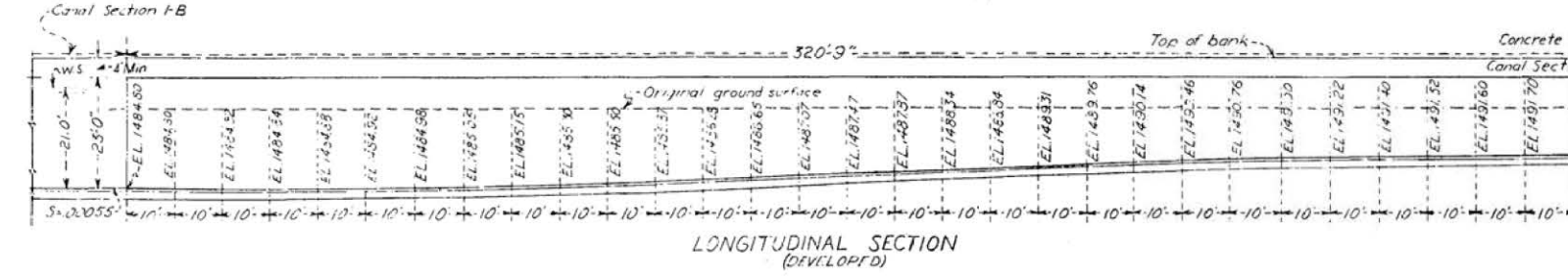
D-2  
SHEET 1 OF 1

See Detail C-C Dwg. 222-D-15598.



ESTIMATED QUANTITIES  
 (Sta 325+61.09 to Sta 326+90)  
 Concrete..... 250 cu yd.

NOTES  
 Transverse dimensions and side slopes are radial.  
 Stations and longitudinal dimensions are on E Main Canal.  
 Longitudinal groove as shown. Transverse grooves are to be placed radially at 25' centers on E Main Canal.



NOTE:  
 1. Refer to drawing 222-D-15598 for existing information

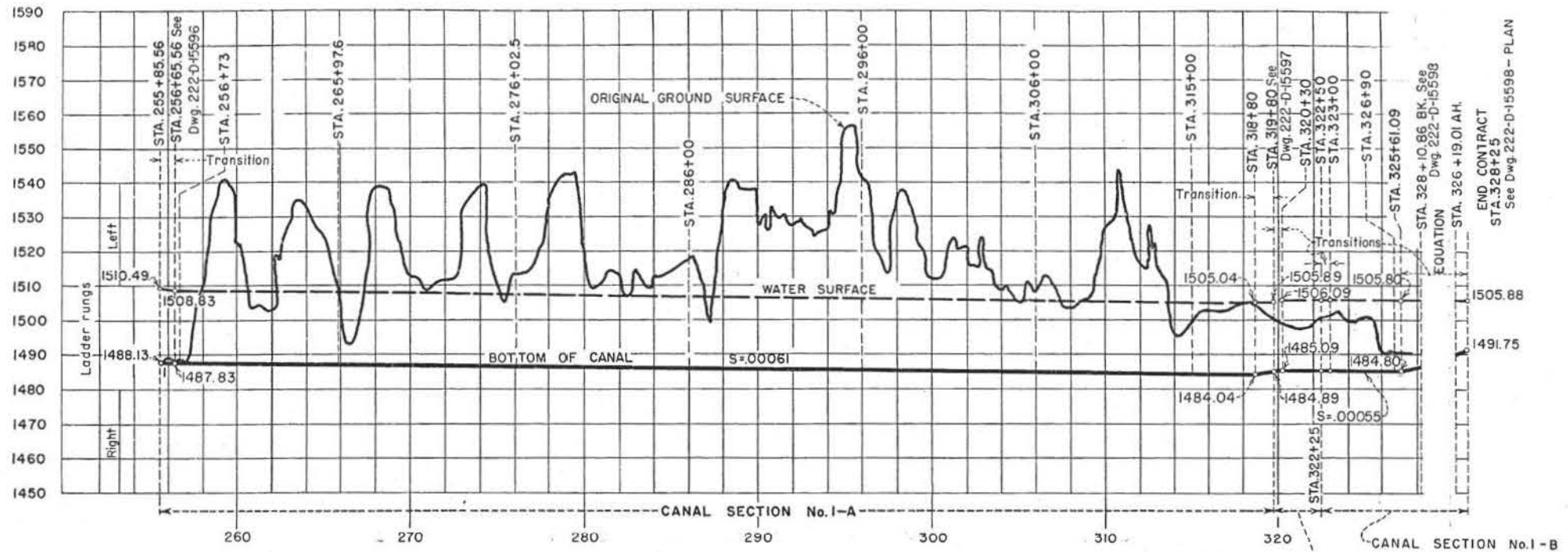
FOR ALWAYS THINK SAFETY  
 Use Only  
 COLUMBIA BASIN PROJECT - WASHINGTON  
 TRAIL LAKE CANAL MODIFICATIONS  
 TRAIL LAKE CANAL  
 WEIR DETAIL SHEET  
 Not for Distribution

DESIGNED	
DRAWN	
CHECKED	
TECH. APPR.	
ADMIN. APPROVAL	
NAME	
TITLE	

WEIR DETAIL SHEET

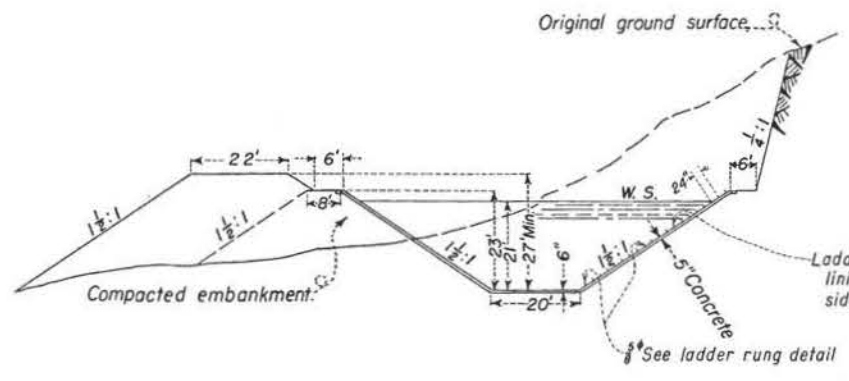
DATE AND TIME PLOTTED  
 DATE AND TIME PLOTTED  
 PLOTTED BY

CAD SYSTEM  
 CAD FILENAME  
 CAD PLOTTER

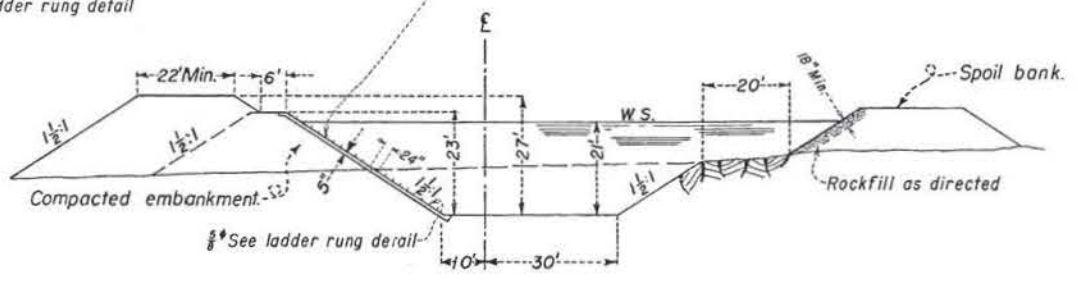


See Dwg. 222-D-15597  
FOR EXTENSION OF SEC. 1-A

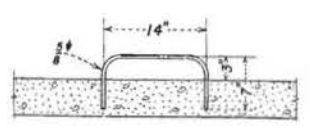
HYDRAULIC PROPERTIES								
SECTION	B	d	Area	r	S	V	Q	n
No. 1-A Lined	20	21.0	1081.50	11.30	.00061	12.21	13,200	.014
No. 1-B	40	21.0	Variable		.00055		13,200	0.025(Av)



SECTION No. 1-A  
TYPICAL CANAL SECTION



SECTION No. 1-B  
TYPICAL CANAL SECTION



LADDER RUNG DETAIL

1 - 20-54  
D 27-10

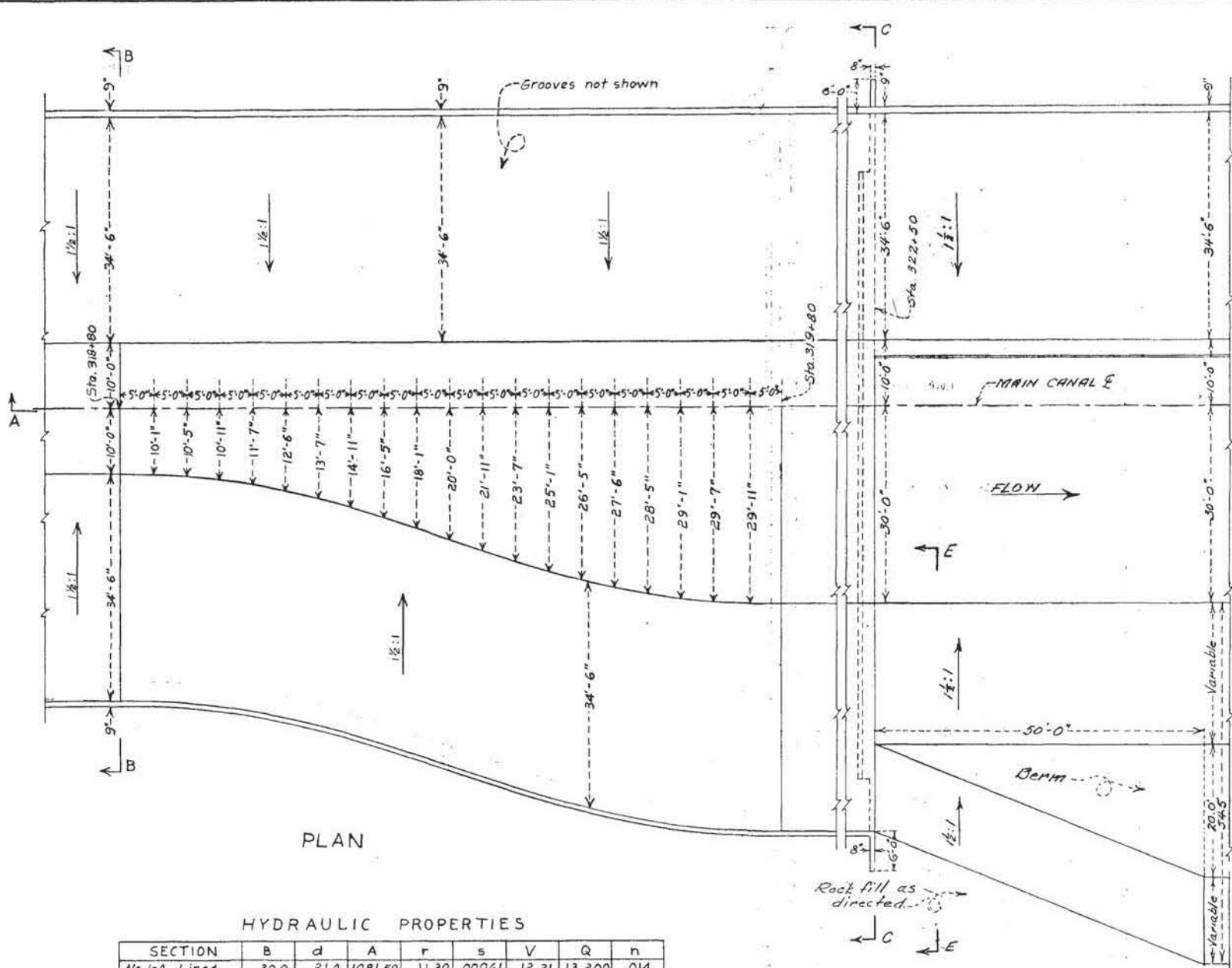
AS BUILT BY 116-LTR-1-26-54

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
COLUMBIA BASIN PROJECT - WASHINGTON  
MAIN CANAL  
PROFILE AND SECTIONS  
STA. 255 + 85.56 TO STA. 326 + 90.0

DRAWN H.O. SUBMITTED *H. O. Hanks*  
TRACED J.B.P. RECOMMENDED *C. E. Rice*  
CHECKED *J.B.P.* APPROVED *T. J. McMillan* CHIEF ENGINEER

EPHRAATA, WASH. JULY 12, 1950

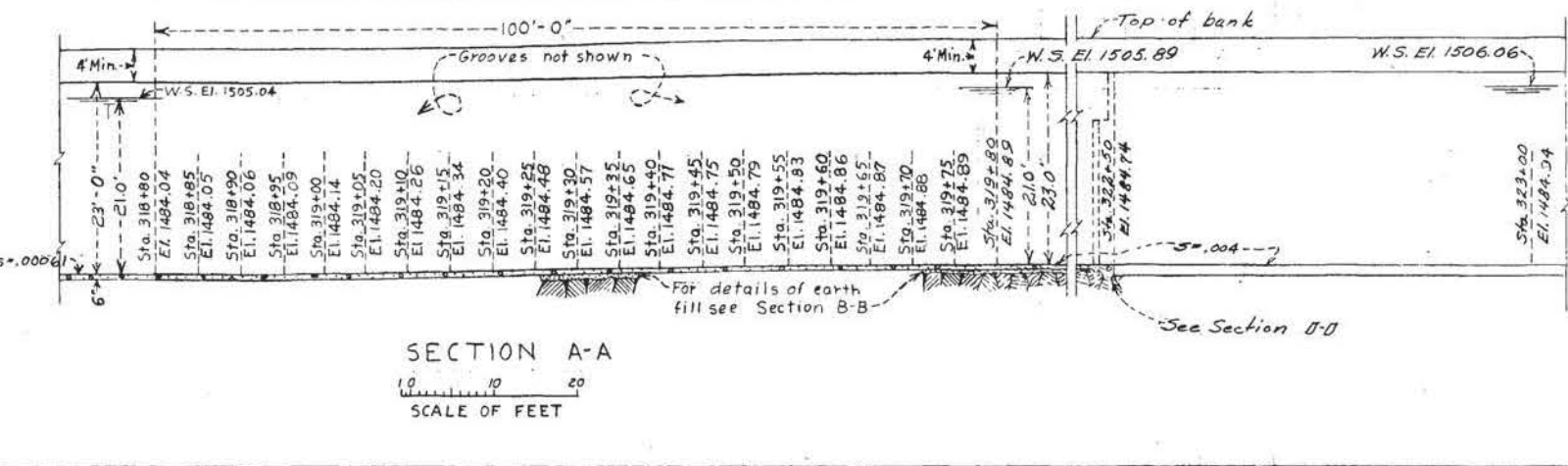
222-116-20476



PLAN

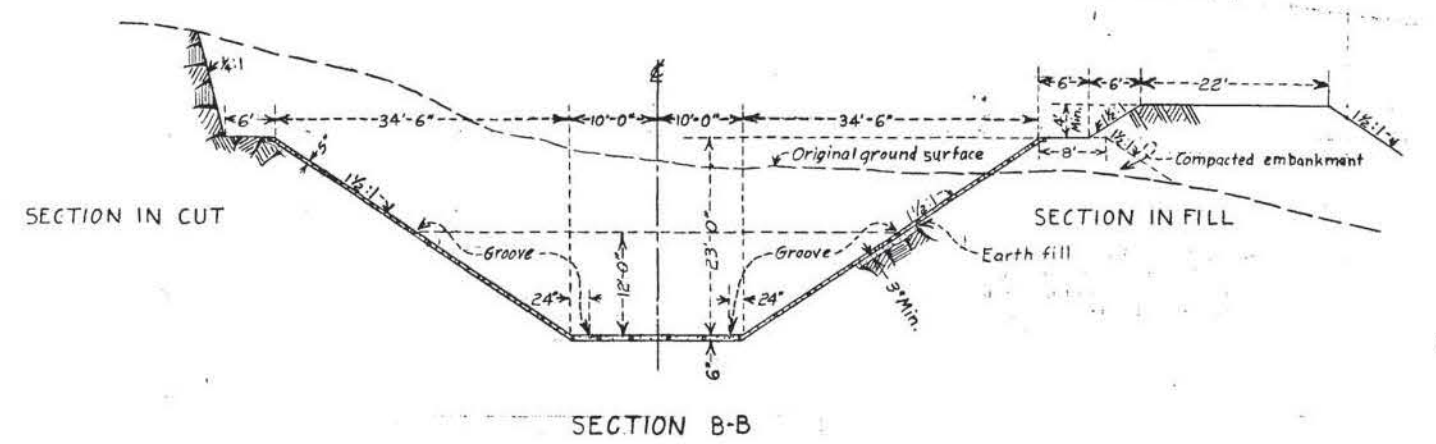
HYDRAULIC PROPERTIES

SECTION	B	d	A	r	s	V	Q	n
No. 1-A Lined	20.0	21.0	1081.50	11.30	.00061	12.21	13,200	.014
No. 1-B Unlined	40.0	21.0	Variable		.00055		13,200	.0225(Ave)

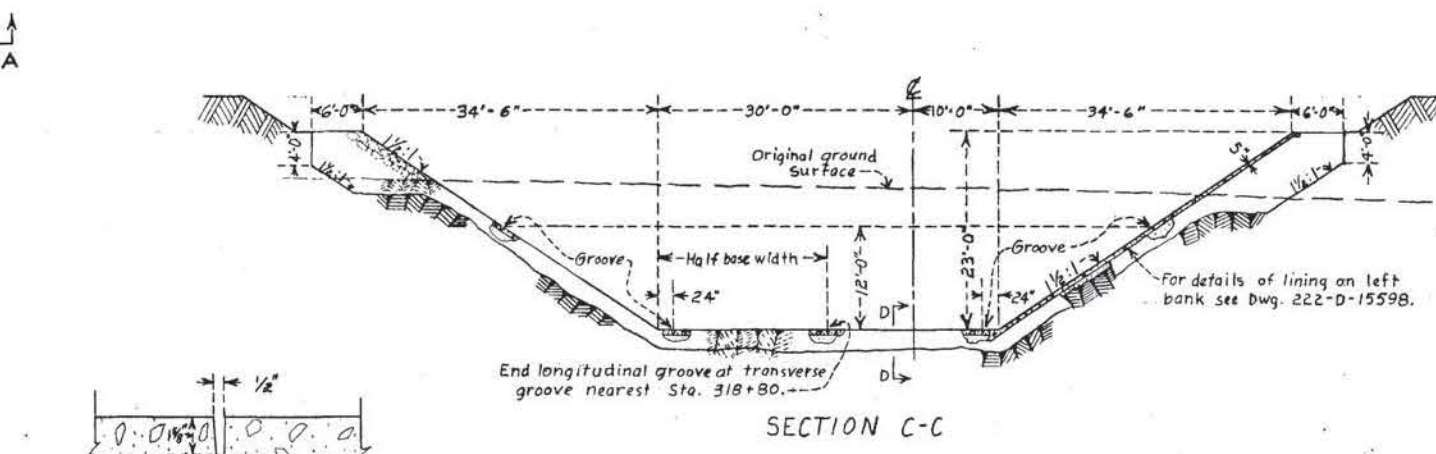


SECTION A-A

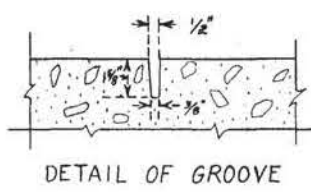
SCALE OF FEET



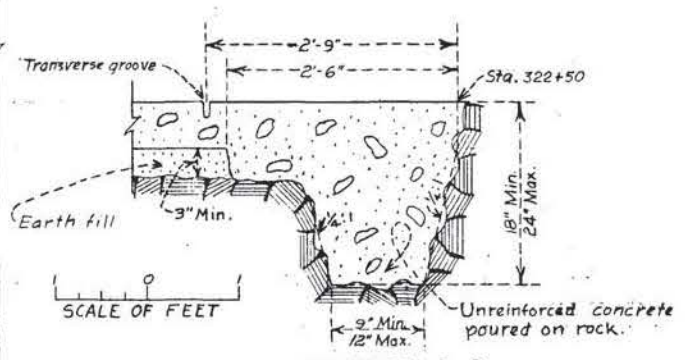
SECTION B-B



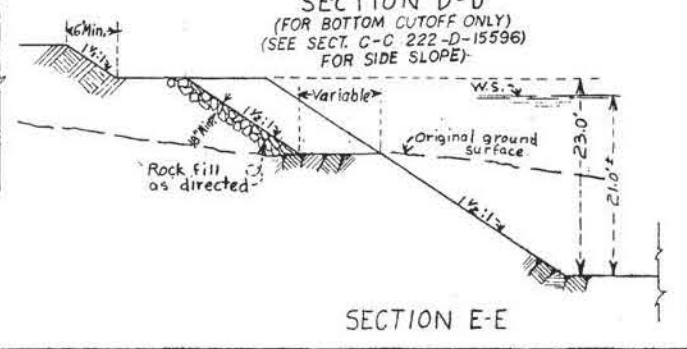
SECTION C-C



DETAIL OF GROOVE



SECTION D-D  
(FOR BOTTOM CUTOFF ONLY)  
(SEE SECT. C-C 222-D-15598  
FOR SIDE SLOPE)



SECTION E-E

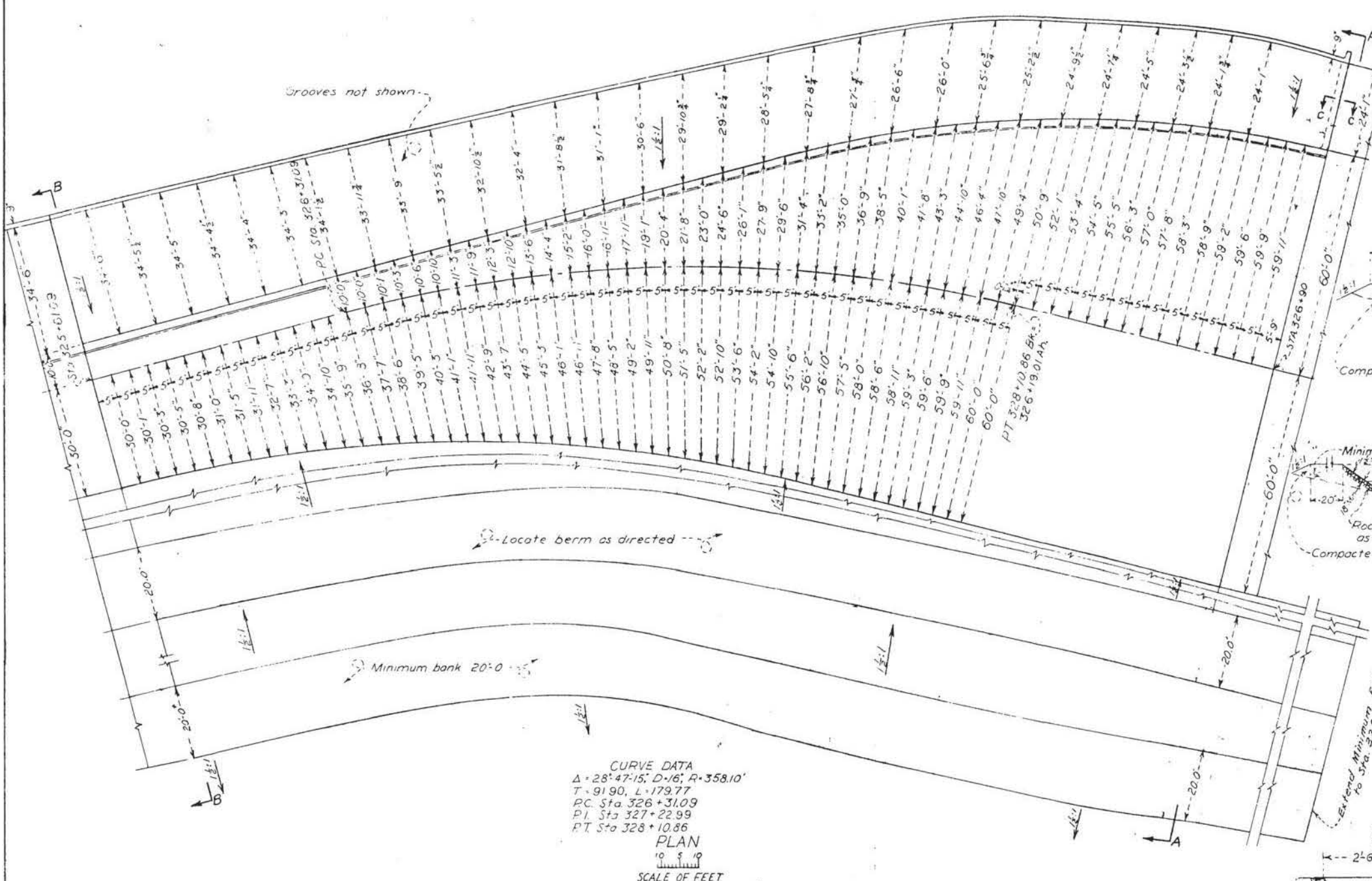
ESTIMATED QUANTITIES  
Sta. 318+80 to Sta. 319+80  
Concrete.....200 cu.yds.

NOTES

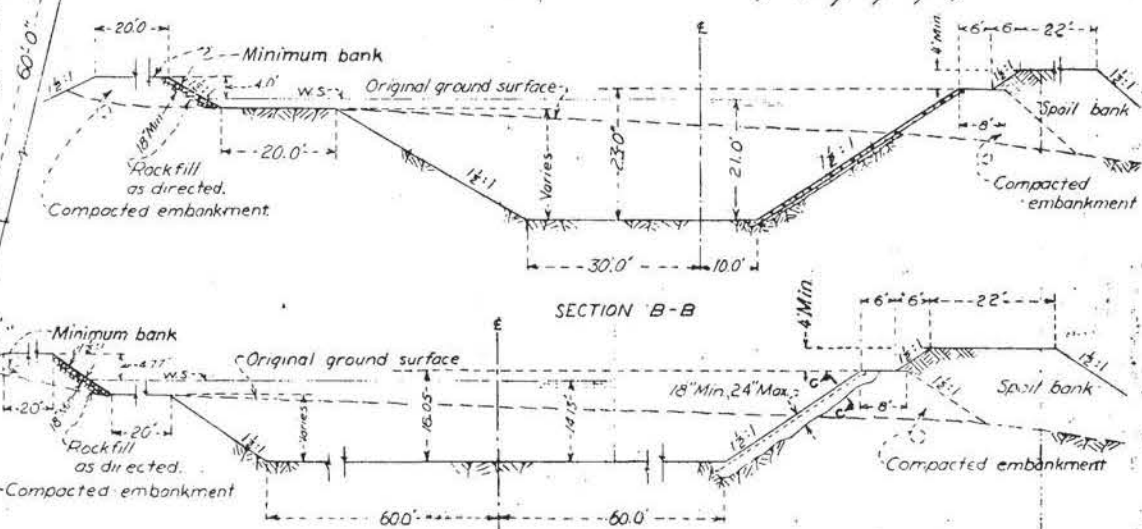
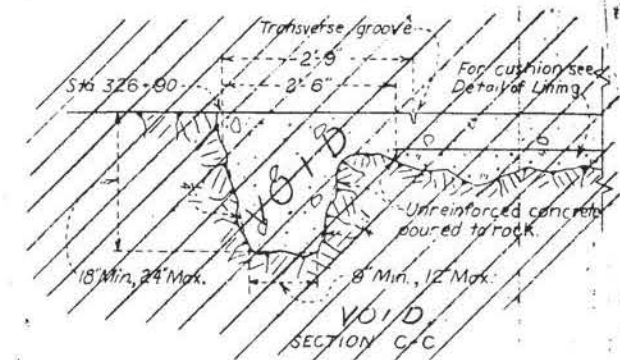
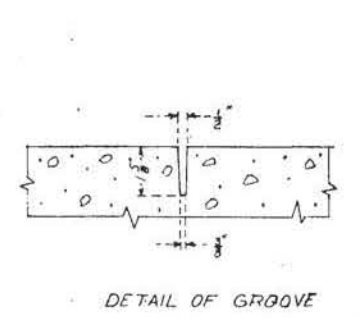
Longitudinal grooves as shown. Transverse grooves are to be placed at 25' centers on E of Main Canal.

1-20-56 0 C.P.W.	AS BUILT BY 10/27/57
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION COLUMBIA BASIN PROJECT-WASHINGTON MAIN CANAL - STA. 318+80 TRANSITION	
DRAWN J.D.G.	SUBMITTED A.P. Reilly
TRACED	RECOMMENDED
CHECKED B.M.M.	APPROVED L.D. McCalla
	CHIEF ENGINEER
DENVER, COLO	AUG. 14, 1950
	222-D-15597

See Detail C-C Dwg. 222-D-15598.



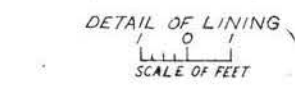
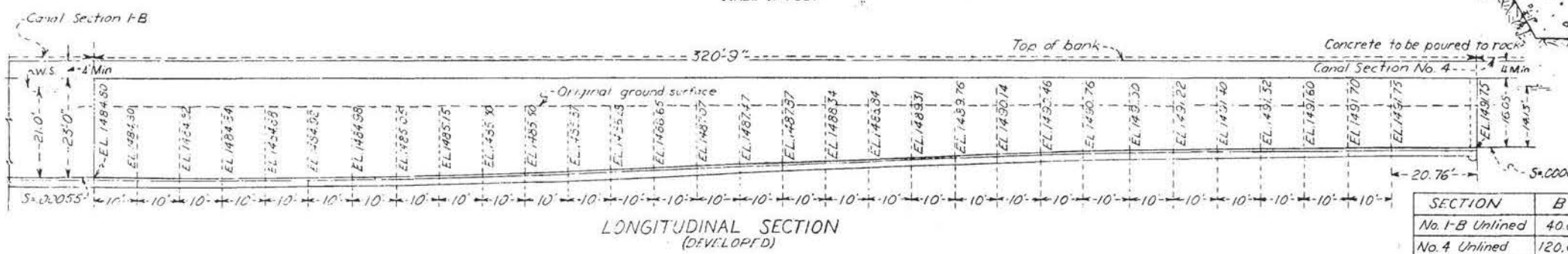
CURVE DATA  
 $\Delta = 28^\circ 47' 15''$ ,  $D = 16'$ ,  $R = 358.10'$   
 $T = 91.90'$ ,  $L = 179.77'$   
 PC Sta 326+31.09  
 PI Sta 327+22.99  
 PT Sta 328+10.86  
 PLAN  
 SCALE OF FEET



ESTIMATED QUANTITIES  
 (Sta 325+61.09 to Sta 326+90)  
 Concrete..... 250 cu yd.

NOTES

Transverse dimensions and side slopes are radial.  
 Stations and longitudinal dimensions are on E Main Canal.  
 Longitudinal groove as shown. Transverse grooves are to be placed radially at 25' centers on E Main Canal.



HYDRAULIC PROPERTIES

SECTION	B	d	A	r	s	V	Q	n
No. 1-B Unlined	40.0	21.0	Variable		0.0055		13,200	0.025 (max)
No. 4 Unlined	120.0	14.13	1995.09	1167	0.0065	6.125	13,200	.030

1-20-58 AS BUILT BY T16-LTR-176-54  
 D. P. W.  
 7/20/58  
 7/16  
 REV. 4-6-51  
 10-17-60 (2006)

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 COLUMBIA BASIN PROJECT - WASHINGTON

MAIN CANAL - STA. 325+61.09  
 TRANSITION

DRAWN G.S. SUBMITTED *[Signature]*  
 TRACED RECOMMENDED *[Signature]*  
 CHECKED *[Signature]* APPROVED *[Signature]*

DENVER, COLORADO AUG. 17, 1950 222-D-15598

MICROFILMED NOV 1671  
 KEYPUNCHED

FEB 7 - 1958

## **APPENDIX B – Cost Estimates**





# ESTIMATE WORKSHEET

<b>FEATURE:</b> <i>Trail Lake Canal Modifications Cost Estimation</i>	<b>PROJECT:</b> Trial Lake Canal Modification			
	<b>WOID:</b>		<b>ESTIMATE LEVEL:</b>	Draft
	<b>REGION:</b>	PN	<b>PRICE LEVEL:</b>	Draft
<b>FILE:</b> N:\CAD\Columbia_Basin\Trail Lakes\[Cost Estimation.xlsx]Formal Cost Estimate				

DESCRIPTION	QUANTITY	Unit	UNIT PRICE	AMOUNT
<b>Culvert</b>				
Excavation	7,000	CY	\$ 27.00	\$189,000.00
Embankment Backfill	335	CY	\$ 36.00	\$12,060.00
Concrete Reinforced	78	CY	\$ 1,500.00	\$117,000.00
Headgate 8' x 8' Metal Slide Gate, Hydraulically Controlled	1	Ea.	\$ 106,000.00	\$106,000.00
Trashrack 15' x 10' Steel Trashrack	1	Ea.	\$ 7,500.00	\$7,500.00
Demolition Concrete Canal Lining	233	SY	\$ 21.00	\$4,893.00
Metal Grating 5' x 8' Steel Walkway Grating	77	SF	\$ 32.00	\$2,464.00
Culvert 8' x 8' x 100' Reinforced Concrete Box Culvert	1	LS	\$ 76,000.00	\$76,000.00
<b>Pump Station</b>				
Excavation	7,000	CY	\$ 27.00	\$189,000.00
Embankment	170	CY	\$ 36.00	\$6,120.00
Demolition Concrete Canal Lining	4	SY	\$ 21.00	\$73.50
Dredging Channel Dredging	3,000	CY	\$ 32.00	\$96,000.00
Concrete Reinforced	304	CY	\$ 1,500.00	\$456,000.00
Pipe 30" dia. HDPE	2,400	LF	\$ 3.50	\$8,400.00
Trashrack 17' x 15' Steel Trashrack	1	Ea.	\$ 12,750.00	\$12,750.00
Headgate 7' x 7', Steel Slide Gate, Hydraulically Controlled	2	Ea.	\$ 101,000.00	\$202,000.00
Headgate 18" Dia., Steel Slide Gate	1	Ea.	\$ 2,600.00	\$2,600.00
Valve 30" dia. Butterfly	2	Ea.	\$ 10,000.00	\$20,000.00
Valve 30" dia. Check	2	Ea.	\$ 21,000.00	\$42,000.00
Fittings 30" dia. Flexible Coupling	2	Ea.	\$ 5,940.00	\$11,880.00
Pumps Vertical Turbine Pump -200hp, 12500 GPM	2	Ea.	\$ 91,500.00	\$183,000.00
Power 3 Phase	1	LS	N/A	\$200,000.00
<b>Pipeline</b>				
Excavation	910	CY	\$ 27.00	\$24,570.00
Embankment	95	CY	\$ 36.00	\$3,420.00
Surfacing 3/4" Subbase Gravel	1,040	SY	\$ 11.15	\$11,596.00
Fittings 30" dia. Flexible Coupling	4	Ea.	\$ 5,940.00	\$23,760.00
<b>Weir</b>				
Excavation	20	CY	\$ 27.00	\$540.00
Concrete Reinforced	43	CY	\$ 1,500.00	\$64,500.00
<b>Access Roadway</b>				
Surfacing 3/4" Subbase Gravel	3,000	SY	\$ 11.15	\$33,450.00
<b>SUBTOTAL</b>				<b>\$2,106,577</b>
MOBILIZATION - 10%				\$210,658
<b>SUBTOTAL OF CONSTRUCTION CONTRACT</b>				<b>\$2,317,234</b>
CONTINGENCIES - 10%				\$231,723
<b>FIELD COST</b>				<b>\$2,548,958</b>
<b>TOTAL COST</b>				<b>\$2,549,000</b>

QUANTITIES				PRICES			
BY	NS	CHECKED	RW	BY	SW	CHECKED	NS
DATE PREPARED		PEER REVIEW		DATE PREPARED		PEER REVIEW	
July 10, 2014				07/09/14			