Yakima River Basin Integrated Water Resource Management Plan

Technical Memorandum
Reconciled Opinion of Probable Construction Cost, Kachess Drought Relief Pumping Plant - Floating Pumping Plant Alternative

U.S. Bureau of Reclamation

Contract No. R13PC10006 ID/IQ

Draft

Prepared by

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Orion Marine Group
Glosten
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U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Columbia-Cascades Area Office

State of Washington
Department of Ecology
Office of Columbia

December 21, 2017

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Contents

List of Tables

Attachments

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1.0 Background and Purpose

Under contract to the US Bureau of Reclamation (Reclamation), HDR Engineering, Inc. (HDR) has recently prepared an updated conceptual design for the Kachess Drought Relief Pumping Plant, Floating Pumping Plant Alternative. In late 2016, HDR, along with subconsultant Orion Marine Group (OMG) prepared an opinion of probable construction cost (OPCC) for an earlier conceptual design for this alternative. The purpose of this technical memorandum is to document the approach used and results of the HDR Team's preparation of an updated OPCC reflecting the additional information developed during update of the conceptual design. The current updated OPCC has been prepared based on the attached set of thirty (30) drawing sheets (Attachment A) that present the updated conceptual design.

In addition to the development of the drawing set, on Wednesday, October 25, 2017 the senior members of the design team met and held a Construction Plan Workshop. The significant challenge of constructing fixed project features on the floor of the reservoir was discussed, along with discussions of how to construct the floating project features on a reservoir whose water surface elevation can experience changes of up to 80 vertical feet each year. Major construction activities, durations and sequences were developed along with an estimation of the number of "spreads" that would be needed to accomplish the marine construction activities.

A spread is the temporary barge structure that is assembled on-site for construction purposes and consists of a crane located atop a set of floats that is used on the water during construction and subsequently disassembled and removed from the project site once construction is completed. It was determined that two separate spreads would be required for construction of this project alternative. A 2-year-long Construction Schedule is envisioned for this alternative and this schedule is presented in Attachment D.

1.0 Approach

For this current OPCC development effort, HDR and OMG each prepared an independent OPCC based on the attached conceptual design drawing sheets. The independently prepared OPCC by HDR Constructors and OMG are contained in Attachments B and C, respectively. A summary comparison of the two OPCCs is contained in Table 1.

Table 1. OPCC Comparison

Bid Item	Description	QTY	Unit	LH	ORION	LH	HDR	DELTA
1000	MOBILIZATION	1	LS	10,060	$4,450,000	-	$2,966,070	$(1,483,930)
	Mobilization Total				**$4,450,000**		**$2,966,070**	
2000	**CIVIL**							
2100	CIVIL: LS-3 EAST SHORE PARKING AREA (3 ACRES)	1	LS		$325,000		$384,682	$59,682
2200	CIVIL: LS-3 EAST SHORE BOAT RAMP (20 X 600 LF)	1	LS		$700,000		$382,305	$(317,695)
2300	CIVIL: LS-2 CONTROL BUILDING AREA (5000 SF)	1	LS		$100,000		$698,325	$598,325
2400	CIVIL: LS-3 EXTEND BOAT RAMP (20X400 LF) LOW POOL	1	LS		$1,500,000		$1,500,000	-
2500	CIVIL: LS-3 ACCESS ROAD TO FLOW CONTROL STRUCTURE	1	LS		$350,000		$258,228	$(91,772)
	Civil Total			**6,125**	**$2,975,000**	**7,927**	**$3,223,540**	**-**
3000	**MARINE**							
3100	MARINE: RESERVOIR DREDGING	1	LS		$325,000		$204,797	$(120,203)
3200	MARINE: FLOW CONTROL STRUCTURE (W/ 4 GATES)	1	LS		$3,175,000		$2,079,270	$(1,095,730)
3300	MARINE: OUTLET CHANNEL	1	LS		$1,615,000		$1,615,813	$813
3400	MARINE: PIPE BRIDGE STRUCTURES, RIGID	1	LS		$975,000		$262,764	$(712,236)
3500	MARINE: PIPE BRIDGE STRUCTURES, FLEXIBLE	1	LS		$2,400,000		$1,175,454	$(1,224,546)
3600	MARINE: PUMP BARGE FACILITIES	1	LS		$7,000,000		$8,137,943	$1,137,943
3700	MARINE: BARGE ANCHORING	1	LS		$1,200,000		$865,589	$(334,411)
	Marine Total			**21,425**	**$16,690,000**	**22,650**	**$14,341,630**	**-**
4000	**MECHANICAL**							
4100	MECHANICAL: VERTICAL TURBINE PUMPS	1	LS		$10,900,000		$11,652,489	$752,489
4200	MECHANICAL: RIGHT ANGLE DRIVES	1	LS		$3,800,000		$4,558,924	$758,924
4300	MECHANICAL: MOTORS	1	LS		$1,800,000		$2,121,424	$321,424
4400	MECHANICAL: DISCHARGE PIPING	1	LS		$2,150,000		$2,340,896	$190,896
	Mechanical Total			**5,830**	**$18,650,000**	**10,500**	**$20,673,733**	
5000	**ELECTRICAL**							

Bid Item	Description	QTY	Unit	LH	ORION	LH	HDR	DELTA
5100	ELECTRICAL: INTERCONNECTION TO PSE 115 KV	1	LS		$250,000		$135,844	$(114,156)
5200	ELECTRICAL: LAKE EASTON STEPDOWN SUBSTATION	1	LS		$2,500,000		$1,834,481	$(665,519)
5300	ELECTRICAL: TWIN 34.5 KV BURIED TRANSMISSION LINES	1	LS		$2,750,000		$2,447,125	$(302,875)
5400	ELECTRICAL: KACHESS RESERVOIR STEPDOWN SUBSTATION	1	LS		$1,250,000		$1,260,644	$10,644
5500	ELECTRICAL: CONTROL BUILDING & ELECTRICAL EQUIPMENT	1	LS		$3,500,000		$4,442,083	$942,083
5600	ELECTRICAL: MARINE CABLES TO BARGE (4)	1	LS		$2,750,000		$555,435	$(2,194,565)
5700	ELECTRICAL: BARGE ELECTRICAL SYSTEMS	1	LS		$500,000		$123,379	$(376,621)
	Electrical Total			**1,400**	**$13,500,000**	**13,700**	**$10,798,991**	
6000	**FISH**							
6100	NARROWS UPSTREAM FISH PASSAGE (PHASE 1)	1	LS		$1,918,000		$1,918,000	
6200	NARROWS UPSTREAM FISH PASSAGE (PHASE 2)	1	LS		$21,816,000		$21,816,000	
	Fish Total							
7000	**PSE**							
7100	INTERCONNECTION & TRANSMISSION SYST DESIGN/REVIEW	1	LS		$250,000		$250,000	
	PSE Total				$250,000		$250,000	
	TOTAL			**44,840**	**$80,249,000**	**54,777**	**$75,987,964**	**$(4,261,036)**

LH = Labor Hours; LS = Lump Sum; PSE = Puget Sound Energy; QTY = Quantity;
DELTA = Difference between the 2 independent estimates.

		Orion Cost Estimate Breakdown Totals		HDR Cost Estimate Break Down Totals	Cost Delta
Direct Labor		$3,740,000		$4,639,160	$899,160
Permanent Materials		$29,640,000		$33,351,860	$3,711,860
Temporary Materials		$955,000		-	$(955,000)
Equipment		$7,860,000		$2,649,123	$(5,210,877)
Subcontract (OMG's * Costs accounted here)		$37,990,000		$11,760,428	$(26,229,572)
Other		$64,000		-	$(64,000)
(HDRC's * Costs accounted here)		-		$21,816,000	
Subtotal Const. Direct Costs		**$80,249,000**		**$74,216,571**	**$(6,032,429)**
Project Indirect (Overhead)		$2,620,000		$3,954,760	$1,334,760
Project Indirect (GC's)		$2,420,000		$2,471,725	$51,725
Construction Contingency	25%	$21,322,250	25%	$20,160,764	$(1,161,486)
Escalation Project (2020)	5%	$4,264,450	5%	$4,032,153	$(232,297)
Subtotal Field Const. Indirect Costs		**$30,626,700**		**$30,619,402**	**$(7,298)**
Contractor's Alternative Delivery Fee	12%	$13,305,084	12%	$12,580,317	$(724,767)
Contractor's Bonds & Insurance	1.50%	$1,862,712	2%	$2,348,326	$485,614
Washington State Sales Tax	8.0%	$10,083,480	8.0%	$9,581,169	$(502,310)
B&O Tax	0.5%	$680,635	0.5%	$646,729	$(33,906)
Builders Risk Insurance		$1,500,000		$1,500,000	-
Subtotal Other Const. Indirect Costs		**$27,431,910**		**$26,656,541**	**$(775,370)**
Total Construction Cost w/ Tax		**$138,307,610**		**$131,492,513**	**$(6,815,097)**
Orion Marine Design Assist		$430,000		$430,000	
HDR Design & Management Fee		$11,500,000		$11,500,000	
Total Project Cost		**$150,237,610**		**$143,422,513**	**$(6,815,097)**

* = Contains deferred future costs for construction of the lower portion of the Narrows Fish Passage Structure and the Public Boat Ramp.

On January 23, 2018, the lead estimators from HDR and OMG met with the HDR project manager to reconcile the differences between the two independently prepared OPCC's. Together, they collectively conducted an in-person reconciliation exercise by comparing the two independently prepared OPCCs. Each line item of each OPCC was compared, reviewed and discussed. If a large difference existed for a given line item, then the group closely examined how the number was developed and discussed what assumptions were used in the development of the line item cost. If there was a cost that was reasonably supported by both parties but the resulting cost was different; either the average of the costs was used or the bid item cost was reevaluated to identify the difference in the costs. In several instances the final cost that was reconciled was different, but not necessarily larger than either of the estimates. Additionally, there were assumptions that were identified which moved costs from one bid item to another. Table 2 – reconciled OPCC presents the final results of the fully reconciled OPCC.

Table 2. Reconciled OPCC

Bid Item	Description	QTY	UNIT	RECONCILED
1000	**MOBILIZATION**	**1**	**LS**	**$4,450,000**
2000	**CIVIL**			
2100	CIVIL: LS-3 EAST SHORE PARKING AREA (3 ACRES)	1	LS	$355,000
2200	CIVIL: LS-3 EAST SHORE BOAT RAMP (20 X 600 LF) PHASE 1	1	LS	$700,000
2300	CIVIL: LS-2 CONTROL BUILDING AREA (5000 SF)	1	LS	$100,000
2400	CIVIL: LS-3 EXTEND BOAT RAMP (20X400 LF) PHASE 2	1	LS	Future Cost
2500	CIVIL: LS-3 ACCESS ROAD TO FLOW CONTROL STRUCTURE	1	LS	$300,000
3000	**MARINE**			
3100	MARINE: RESERVOIR DREDGING	1	LS	$325,000
3200	MARINE: FLOW CONTROL STRUCTURE (W/ 4 GATES)	1	LS	$3,175,000
3300	MARINE: OUTLET CHANNEL	1	LS	$1,615,000
3400	MARINE: PIPE BRIDGE STRUCTURES, RIGID	1	LS	$730,000
3500	MARINE: PIPE BRIDGE STRUCTURES, FLEXIBLE	1	LS	$3,250,000
3600	MARINE: PUMP BARGE FACILITIES	1	LS	$7,325,000
3700	MARINE: BARGE ANCHORING	1	LS	$1,200,000
4000	**MECHANICAL**			
4100	MECHANICAL: VERTICAL TURBINE PUMPS	1	LS	$11,000,000
4200	MECHANICAL: RIGHT ANGLE DRIVES	1	LS	$4,500,000
4300	MECHANICAL: MOTORS	1	LS	$2,000,000
4400	MECHANICAL: DISCHARGE PIPING	1	LS	$2,350,000
5000	**ELECTRICAL**			
5100	ELECTRICAL: INTERCONNECTION TO PSE 115 KV	1	LS	$140,000
5200	ELECTRICAL: LAKE EASTON STEPDOWN SUBSTATION	1	LS	$1,800,000
5300	ELECTRICAL: TWIN 34.5 KV BURIED TRANSMISSION LINES	1	LS	$2,200,000
5400	ELECTRICAL: KACHESS RESERVOIR STEPDOWN SUBSTATION	1	LS	$1,110,000
5500	ELECTRICAL: 4160V CABLES, KRSS TO CONTROL BLDG	1	LS	$2,132,000
5600	ELECTRICAL: ENCLOSED GENERATOR SET	1	LS	$125,000
5700	ELECTRICAL: CONTROL BUILDING & EQUIPMENT	1	LS	$5,000,000
5800	ELECTRICAL: MARINE CABLES, CONTROL BLDG TO MOTORS	1	LS	$7,519,000

Bid Item	Description	QTY	UNIT	RECONCILED
5900	ELECTRICAL: ON BARGE ELECTRICAL	1	LS	$200,000
6000	**FISH**			
6100	NARROWS UPSTREAM FISH PASSAGE (PHASE 1)	1	LS	$1,918,000
6200	NARROWS UPSTREAM FISH PASSAGE (PHASE 2)	1	LS	Future Cost
7000	**PSE**			
7100	INTERCONNECTION & TRANSMISSION SYST DESIGN/REVIEW	1	LS	$250,000
	TOTAL DIRECT COSTS			**$65,769,000**

TOTAL DIRECT COSTS		**$65,769,000**
PROJECT INDIRECT COSTS		
Project Indirect (Overhead)	7.5%	$4,932,675
Project Indirect (GC's)	5.0%	$3,288,450
SUBTOTAL DIRECT PLUS INDIRECT COSTS		**$73,990,125**
OTHER INDIRECT COSTS		
Contractor's Alternative Delivery Fee	12.0%	$8,878,815
Contractor's Bonds & Insurance	2.0%	$1,479,803
WA State Sales Tax (unincorporated Kittitas Co)	8.0%	$5,919,210
B&O Tax	0.5%	$369,951
Builders Risk Insurance	1.0%	$739,901
SUBTOTAL OTHER INDIRECT COSTS		$17,387,679
TOTAL ALL DIRECT + INDIRECT COSTS		**$91,377,804**
Engineering and Design Costs (2018)	12.0%	$10,965,336
Construction Contingency (2020)	25.0%	$24,237,963
Escalation of Project to Midpoint Construction [A] (2020)	6.1%	$5,574,046
Total Project Cost [B]		**$132,155,149**

[A] The inflation factor used in the reconciled OPCC is 6.1 percent versus a 5 percent inflation factor used in the two un-reconciled OPCCs. The author believes the 6.1 percent inflation factor is more representative of current inflation estimates.

[B] Does not include the deferred future costs required to construct the lower portion of the Narrows Fish Passage Structure ($43.4 M in 2020$) and the lower portion of the Public Boat Ramp ($3.0 M in 2020$). However, these costs must be taken into consideration for project economics and financing as these two features must be built; but at an as-yet unknown time in the future.

2.0 Separation of Costs for Deferred Future Construction from Initial Construction

There are two future construction actions that cannot be constructed during the initial construction of the drought relief pumping plant project. The two future construction actions that must be deferred are:

1. Extension of the Public Boat Ramp on the east shore of the reservoir.
2. Extension of the Volitional Fish Passage Structure located at the downstream end of the Narrows.

The reason these two construction actions cannot be accomplished during the initial construction phase lies in the fact that the reservoir cannot be physically lowered below the elevation of the existing gravity outlet works (El 2192.75) until after:

1. The drought relief pumping plant has been constructed and is operational.
2. An actual drought occurs and is officially declared to be such. Also, it will most likely require a multi-year drought to occur for both the Public Boat Ramp and the Volitional Fish Passage Structure to be completed in their entireties to their deepest elevations in the reservoir (down to elevation 2113.0).

It is not possible to know in advance if either a single year drought or a multi-year drought will occur. Thus, it will not be possible to schedule out with any certainty when the completion of these two project features will occur in the future. For this reason, the line item costs for these two items have been removed from the original construction contract of this OPCC; as it represents the estimated costs for the initial construction contract only.

Table 2 does not include the deferred costs for construction of the lower portion of either the Narrows Fish Passage Structure ($43.4 M in 2020$) or the lower portion of the Public Boat Ramp ($3.0 M in 2020$). However, these costs must be taken into consideration for project economics and financing as these two features must be built; but at an as-yet unknown date in the future.

Tables 3 and 4 present calculation of the deferred costs for the lower portion of the Narrows Fish Passage Structure and the lower portion of the Public Boat Ramp, respectively.

Table 3. Deferred Costs – Narrows Upstream Fish Passage Structure

TOTAL DIRECT COSTS (HDR, M. Garello)		**$21,816,000**
PROJECT INDIRECT COSTS		
Project Indirect (Overhead)	7.5%	$1,636,200
Project Indirect (GC's)	5.0%	$1,090,800
SUBTOTAL DIRECT PLUS INDIRECT COSTS		**$24,543,000**
OTHER INDIRECT COSTS		
Contractor's Alternative Delivery Fee	12.0%	$2,945,160
Contractor's Bonds & Insurance	2.0%	$490,860
WA State Sales Tax (unincorporated Kittitas Co)	8.0%	$1,963,440
B&O Tax	0.5%	$122,715
Builders Risk Insurance	1.0%	$245,430
SUBTOTAL OTHER INDIRECT COSTS		**$5,767,605**
TOTAL ALL DIRECT + INDIRECT COSTS		**$30,310,605**
Engineering and Design Costs (2018)	12.0%	$3,637,273
Construction Contingency (2020)	25.0%	$7,577,651
Escalation of Project to Midpoint Construction (2020)	6.1%	$1,848,947
Total Deferred Narrows Upstream Fish Passage Structure Costs		**$43,374,476**

Table 4. Deferred Costs – Public Boat Ramp

TOTAL DIRECT COSTS (OMG, C. Bruneau)		**$1,500,000**
PROJECT INDIRECT COSTS		
Project Indirect (Overhead)	7.5%	$112,500
Project Indirect (GC's)	5.0%	$75,000
SUBTOTAL DIRECT PLUS INDIRECT COSTS		**$1,687,500**
OTHER INDIRECT COSTS		
Contractor's Alternative Delivery Fee	12.0%	$202,500
Contractor's Bonds & Insurance	2.0%	$33,750
WA State Sales Tax (unincorporated Kittitas Co)	8.0%	$135,000
B&O Tax	0.5%	$8,438
Builders Risk Insurance	1.0%	$16,875
SUBTOTAL OTHER INDIRECT COSTS		**$396,563**
TOTAL ALL DIRECT + INDIRECT COSTS		**$2,084,063**
Engineering and Design Costs (2018)	12.0%	$250,088
Construction Contingency (2020)	25.0%	$521,016
Escalation of Project to Midpoint Construction (2020)	6.1%	$127,128
Total Deferred Public Boat Ramp Costs		**$2,982,295**

3.0 Results

The reconciled OPCC resulting from the discussions at the reconciliation meeting held on January 23, 2018 along with additional line item input that resulted from a few follow-up activities that were determined to be needed during the meeting are presented in Table 2. The calculated Total Construction Cost for the reconciled OPCC for the project without the costs of the deferred future construction actions is $132.2 million in 2020 dollars.

At the current level of design, this OPCC is considered a Class 4 cost estimate (i.e. having a maturity level of project definition ranging from 1 percent to 15 percent). A Class 4 cost estimate will have an expected accuracy range having a Low that falls between -15 percent to -30 percent; and a High that falls between +20 percent to +50 percent. The authors place the maturity level of project definition for the Floating Pumping Plant Alternative at approximately 10 percent at present. Correspondingly, the authors have applied an expected range of accuracy to the calculated OPCC of a Low of -25 percent and a High of +40 percent. The basis of this range of accuracy is the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – as Applied in Engineering, Procurement and Construction for the Process Industry (Revised March 1, 2016). Applying these accuracy ranges to the calculated OPCC amount of $132.2 million results in a cost range falling between a Low of $99.1 million and a High of $185.1 million.

As presented in Tables 3 and 4, the OPCC for the deferred construction contract costs is $46.4 million in 2020 dollars. Applying the same accuracy ranges (a Low of -25 percent and a High of +40 percent) to the deferred construction costs results in a cost range for the deferred construction costs falling between a low of $34.8 million and a high of $65.0 million.

Table 5 presents the results of the OPCC estimate contained in this memorandum for: 1) the original construction contract costs only; 2) the deferred construction contract costs only; and, 3) the original construction contract costs plus the deferred construction contract costs (all in 2020 dollars).

Table 5. Floating Pumping Plant Alternative Costs (in 2020$)

OPCC Name	Original Construction Contract Only ($Million)	Deferred Construction Contract Costs Only ($Millions)	Original Plus Deferred Construction Contract Costs ($Millions)
Low Range OPCC	$99.1	$34.8	$133.9
Computed OPCC	$132.2	$46.4	$178.6
High Range OPCC	$185.1	$65.0	$250.1

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Attachment A
Drawings

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WASHINGTON STATE
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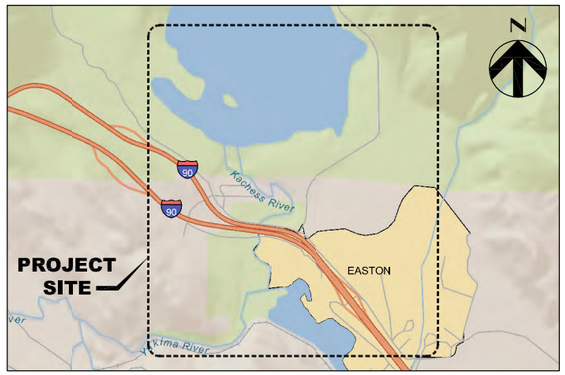
VICINITY MAP
SCALE: NO SCALE



LOCATION MAP
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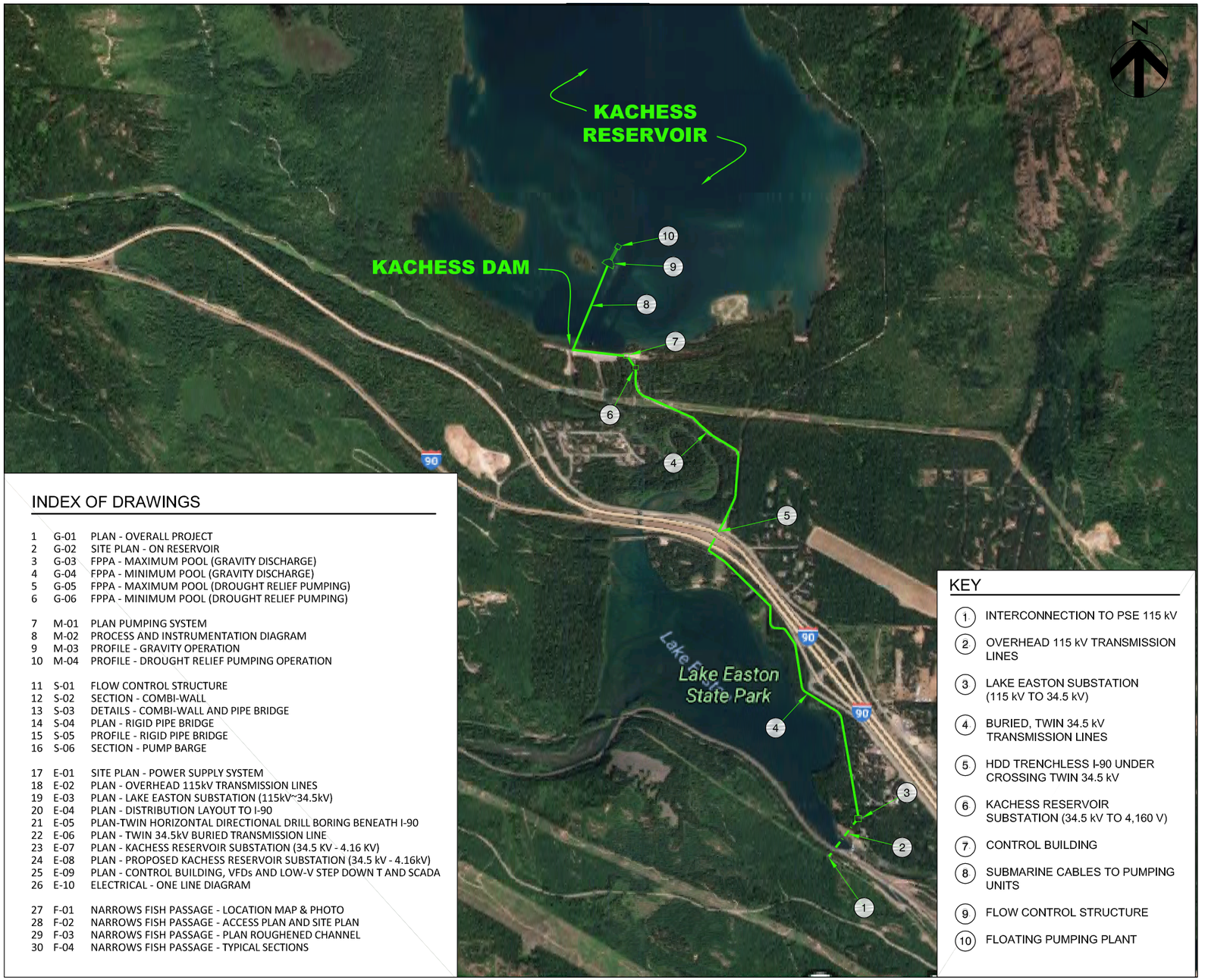
INDEX OF DRAWINGS



PLAN
0 500 1,000 2,000
APPROXIMATE SCALE IN FEET

KEY

1. INTERCONNECTION TO PSE 115 kV
2. OVERHEAD 115 kV TRANSMISSION LINES
3. LAKE EASTON SUBSTATION (115 kV TO 34.5 kV)
4. BURIED, TWIN 34.5 kV TRANSMISSION LINES
5. HDD TRENCHLESS I-90 UNDER CROSSING TWIN 34.5 kV
6. KACHESS RESERVOIR SUBSTATION (34.5 kV TO 4,160 V)
7. CONTROL BUILDING
8. SUBMARINE CABLES TO PUMPING UNITS
9. FLOW CONTROL STRUCTURE
10. FLOATING PUMPING PLANT

RECLAMATION
Managing Water in the West

HDR

ROBERT D. KING — STATE OF WASHINGTON — 26753 — REGISTERED PROFESSIONAL ENGINEER

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA PROJECT - WA
KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING — DESIGNED
B. MOBLEY — DRAWN
CHECKED
TECH. APPR.
APPROVED — ADMIN APPROVAL - TITLE
YAKIMA, WA — YYYY-MM-DD

PLAN - OVERALL PROJECT

ALTERNATIVE 3

G-01

SHEET 1 OF 30

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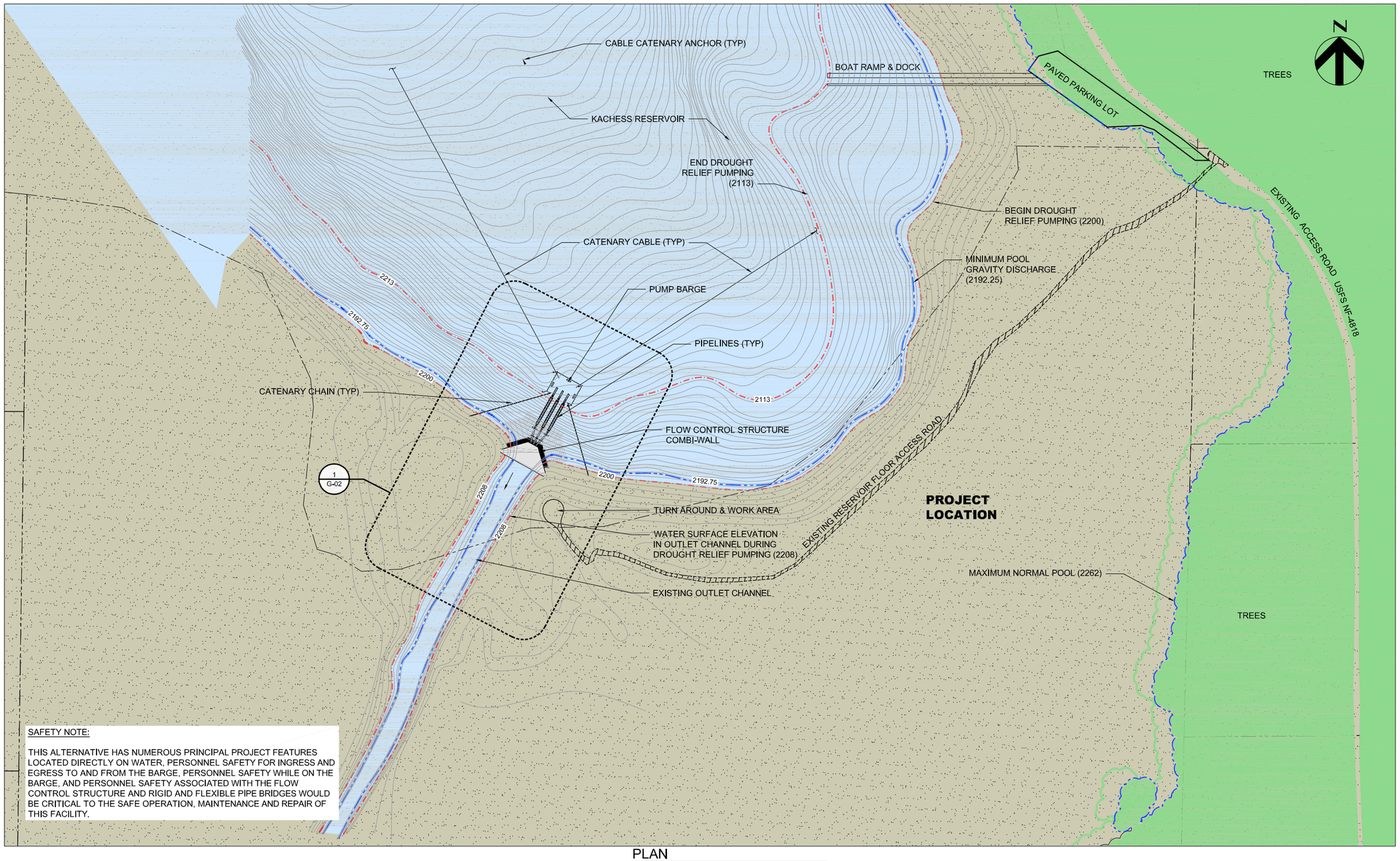
DATE PLOTTED Not Plotted



SAFETY NOTE:

THIS ALTERNATIVE HAS NUMEROUS PRINCIPAL PROJECT FEATURES LOCATED DIRECTLY ON WATER, PERSONNEL SAFETY FOR INGRESS AND EGRESS TO AND FROM THE BARGE, PERSONNEL SAFETY WHILE ON THE BARGE, AND PERSONNEL SAFETY ASSOCIATED WITH THE FLOW CONTROL STRUCTURE AND RIGID AND FLEXIBLE PIPE BRIDGES WOULD BE CRITICAL TO THE SAFE OPERATION, MAINTENANCE AND REPAIR OF THIS FACILITY.

PLAN

0 110 220 440

SCALE IN FEET

RECLAMATION
Managing Water in the West

HDR

ROBERT D. KING
STATE OF WASHINGTON
25753
REGISTERED
PROFESSIONAL ENGINEER

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA PROJECT - WA
KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING
DESIGNED
R. CARPENTER
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA
YYYY-MM-DD

SITE PLAN - ON RESERVOIR

ALTERNATIVE 3

G-02

SHEET 2 of 30

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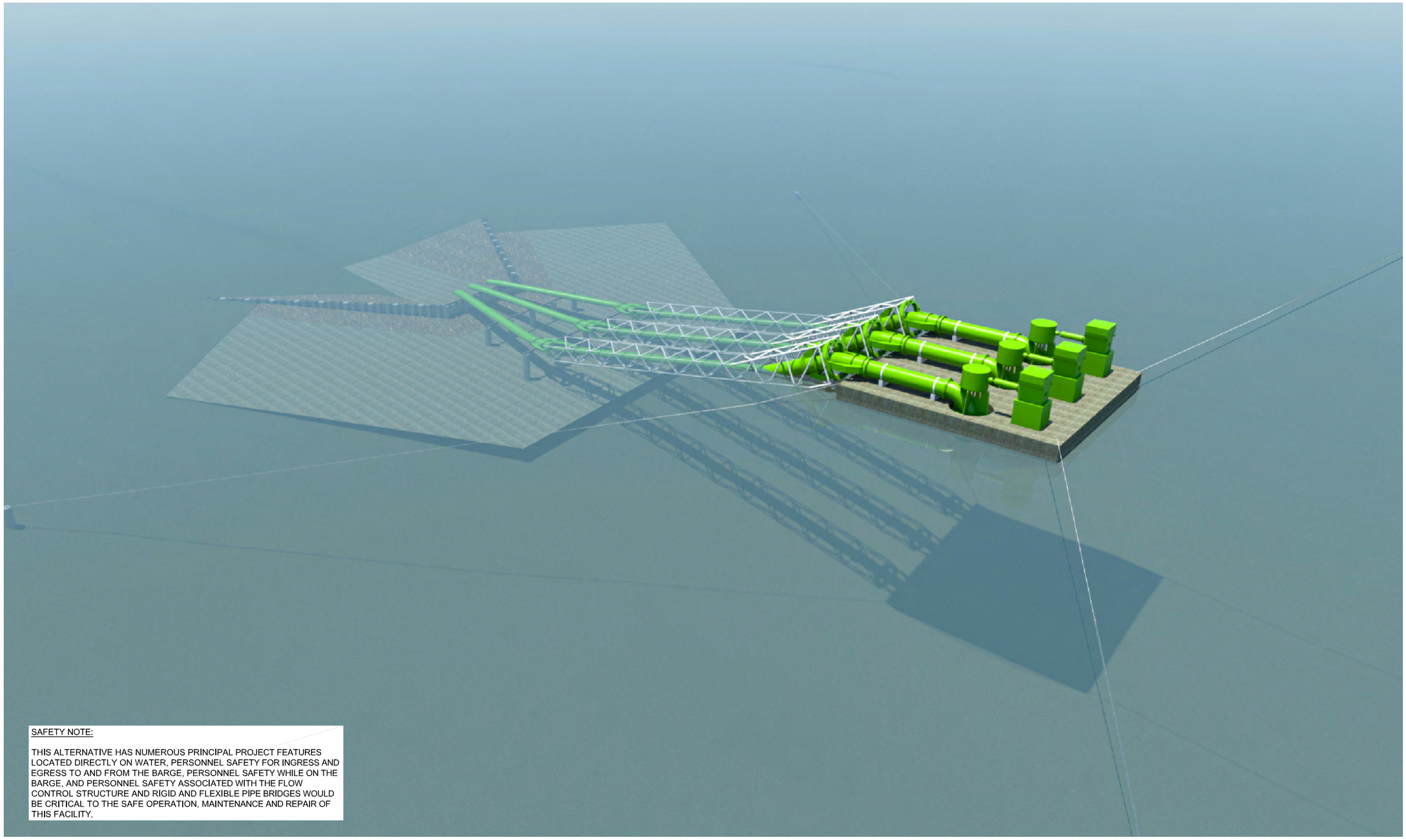

SAFETY NOTE:

THIS ALTERNATIVE HAS NUMEROUS PRINCIPAL PROJECT FEATURES LOCATED DIRECTLY ON WATER, PERSONNEL SAFETY FOR INGRESS AND EGRESS TO AND FROM THE BARGE, PERSONNEL SAFETY WHILE ON THE BARGE, AND PERSONNEL SAFETY ASSOCIATED WITH THE FLOW CONTROL STRUCTURE AND RIGID AND FLEXIBLE PIPE BRIDGES WOULD BE CRITICAL TO THE SAFE OPERATION, MAINTENANCE AND REPAIR OF THIS FACILITY.

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HDR

ROBERT D. KING
STATE OF WASHINGTON
25753
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PROFESSIONAL ENGINEER

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YAKIMA PROJECT - WA
KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING
DESIGNED
L. BRAMLETT
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA
YYYY-MM-DD

FPPA - MAXIMUM POOL
(GRAVITY DISCHARGE)

ALTERNATIVE 3

G-03

SHEET 3 OF 30

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CAD SOFTWARE AUTOCAD
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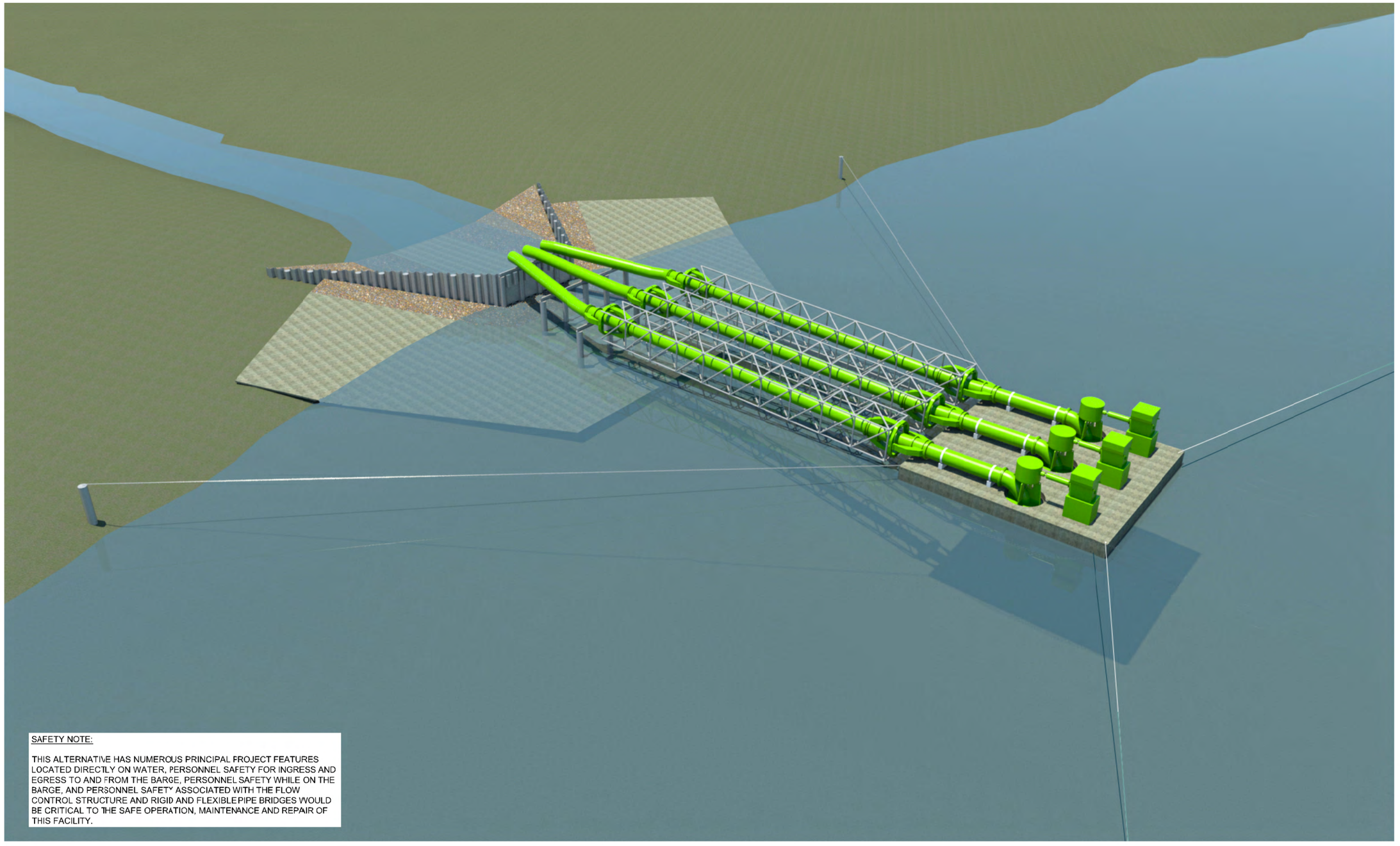
PLOT DATE Not Plotted



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ALT. 3 - FLOATING ALTERNATIVE

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DESIGNED
L. BRAMLETT
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TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA
YYYY-MM-DD

FPPA - MINIMUM POOL
(GRAVITY DISCHARGE)

ALTERNATIVE 3

G-04
SHEET 4 OF 30

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CAD FILENAME: UNKNOWN
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PLOTTED: Not Plotted
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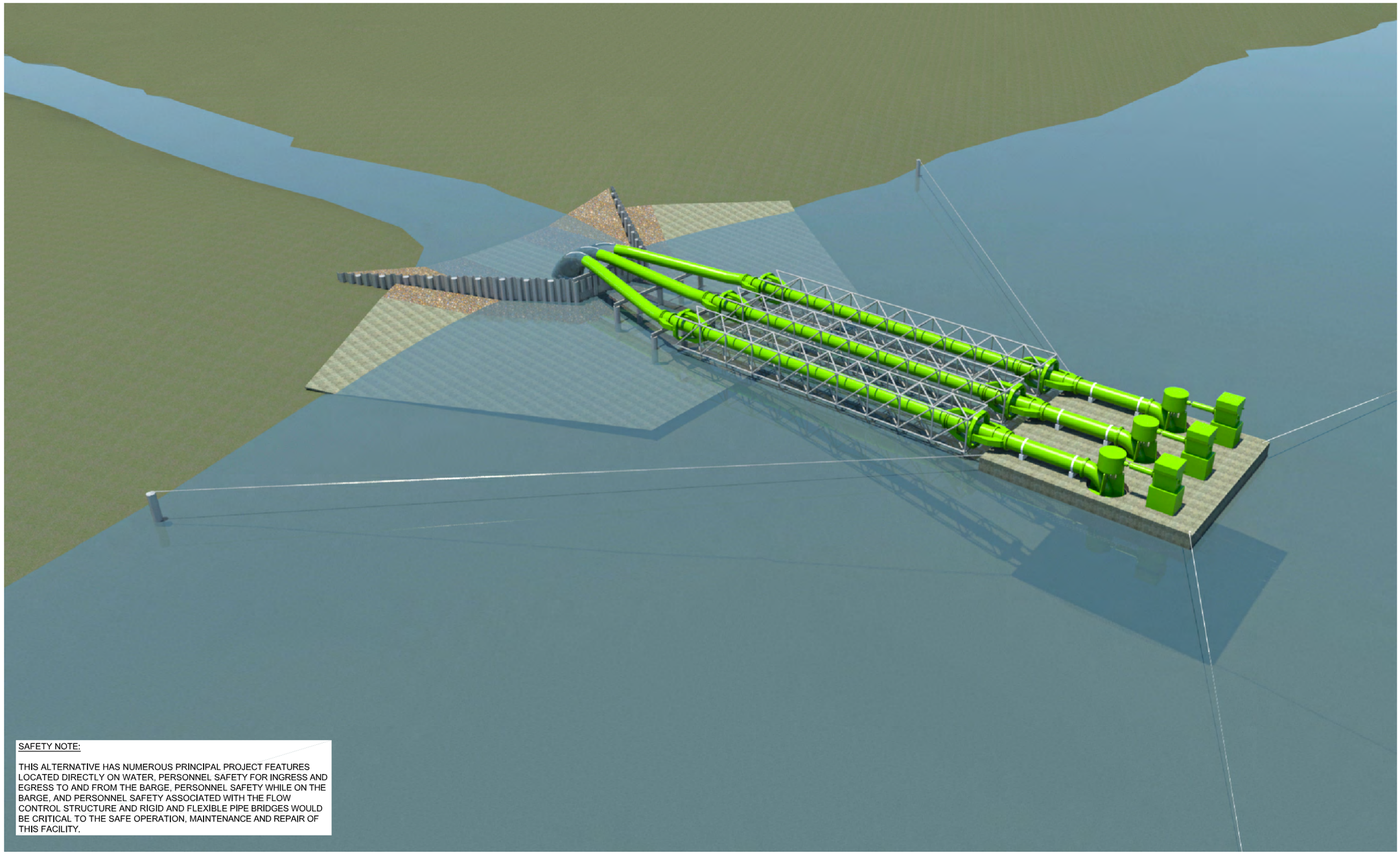

SAFETY NOTE:

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APPROVED
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YAKIMA, WA
YYYY-MM-DD

FPPA - MAXIMUM POOL
(DROUGHT RELIEF PUMPING)

ALTERNATIVE 3

G-05

SHEET 5 OF 30

CAD SOFTWARE
AUTOCAD
CAD FILENAME
UNKNOWN
PLOTTED BY
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PLOT DATE
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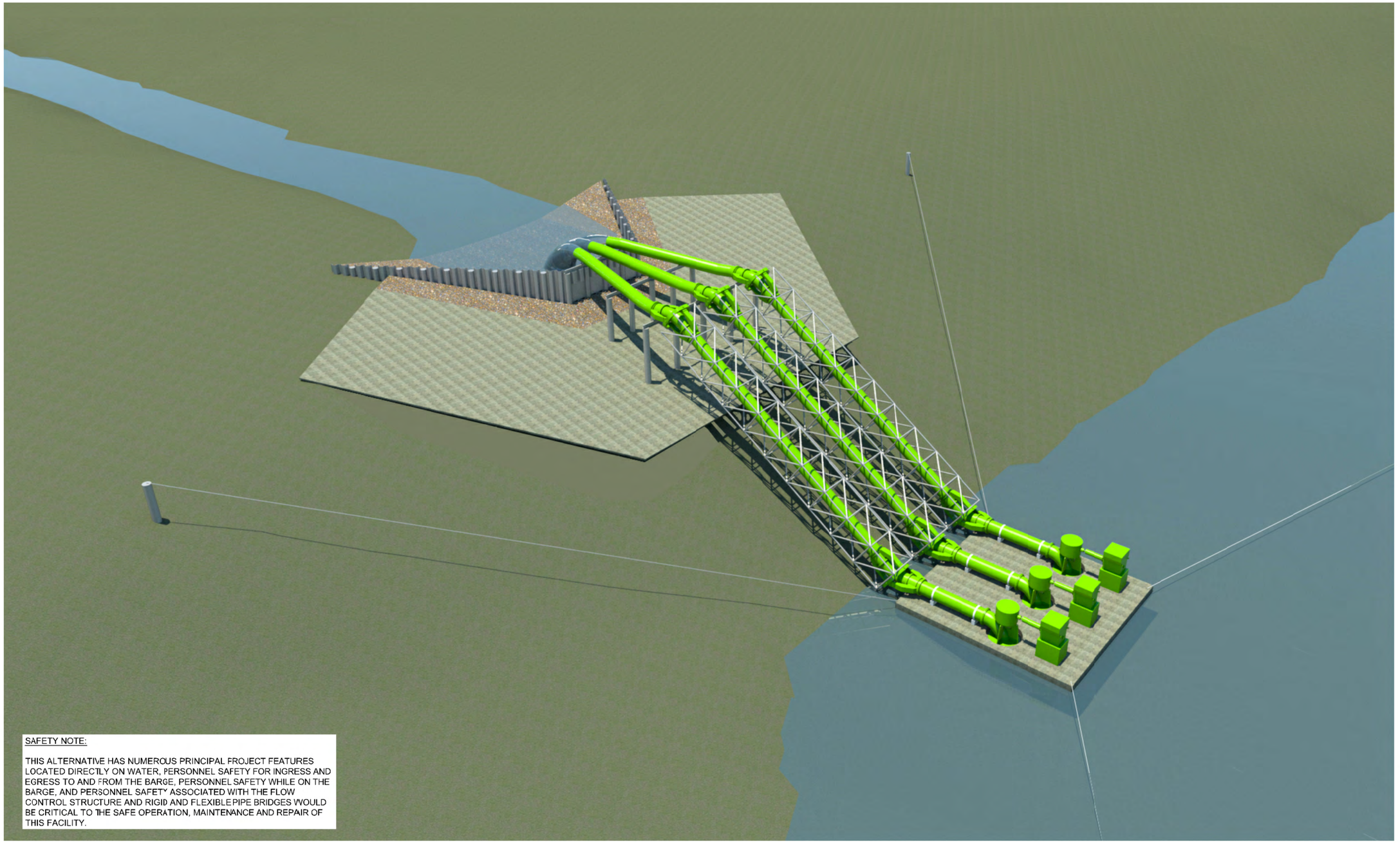

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING	*DESIGNED*
L. BRAMLETT	*DRAWN*
	CHECKED
	TECH. APPR.
	APPROVED *ADMIN APPROVAL - TITLE*
YAKIMA, WA	*YYYY-MM-DD*

FPPA - MINIMUM POOL (DROUGHT RELIEF PUMPING)

ALTERNATIVE 3

G-06

SHEET 6 OF 30

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CAD SOFTWARE
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CAD FILENAME
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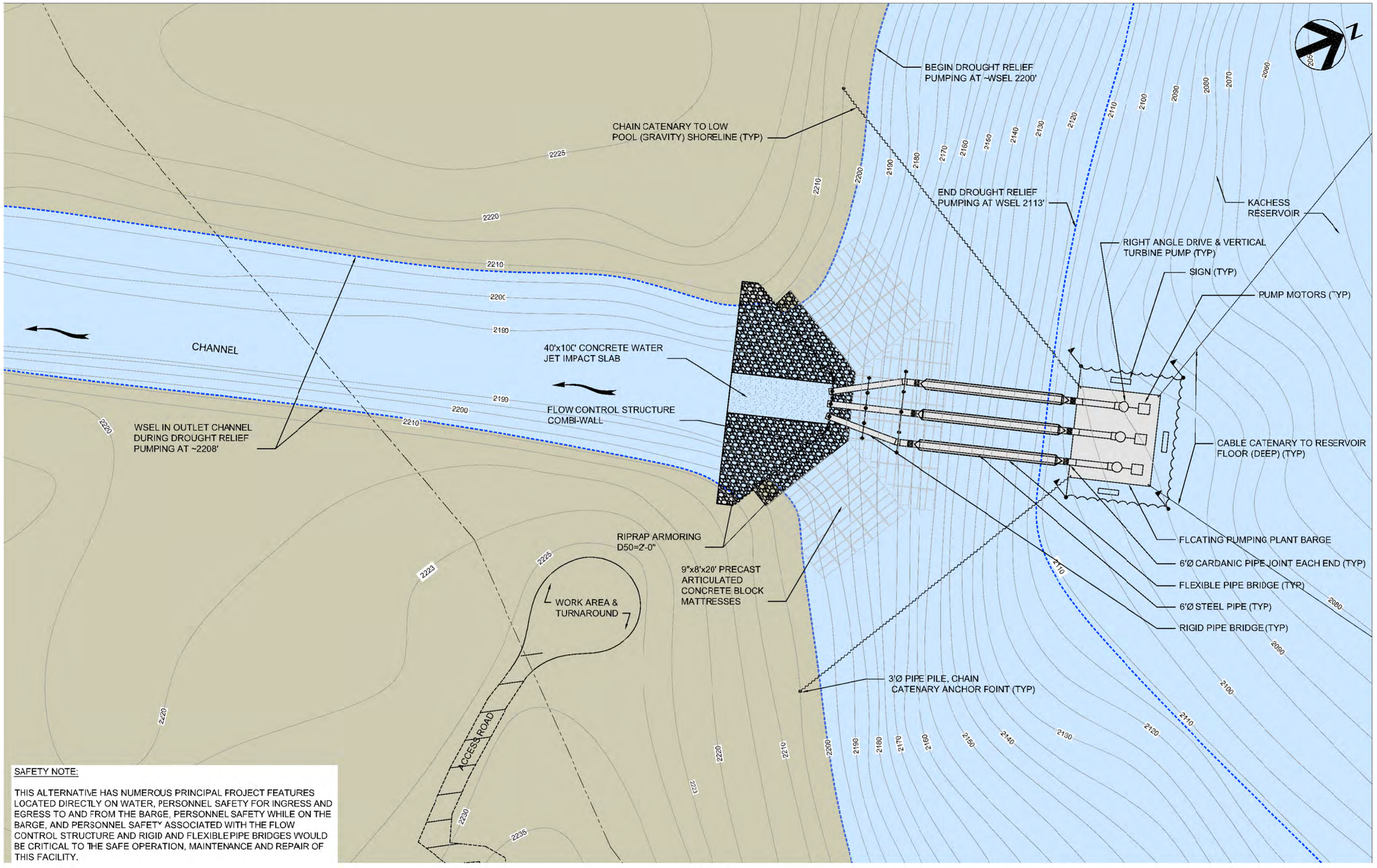

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PLAN

0 25 50 100
SCALE IN FEET

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

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R. CARPENTER
DRAWN
CHECKED
TECH. APPR.
APPROVED
FORM APPROVAL - TITLE
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YYYY-MM-DD

PLAN PUMPING SYSTEM

ALTERNATIVE 3

M-01
SHEET 7 OF 30

DATE AND TIME PLOTTED
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Not Plotted

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AUTOCAD
CAD FILENAME
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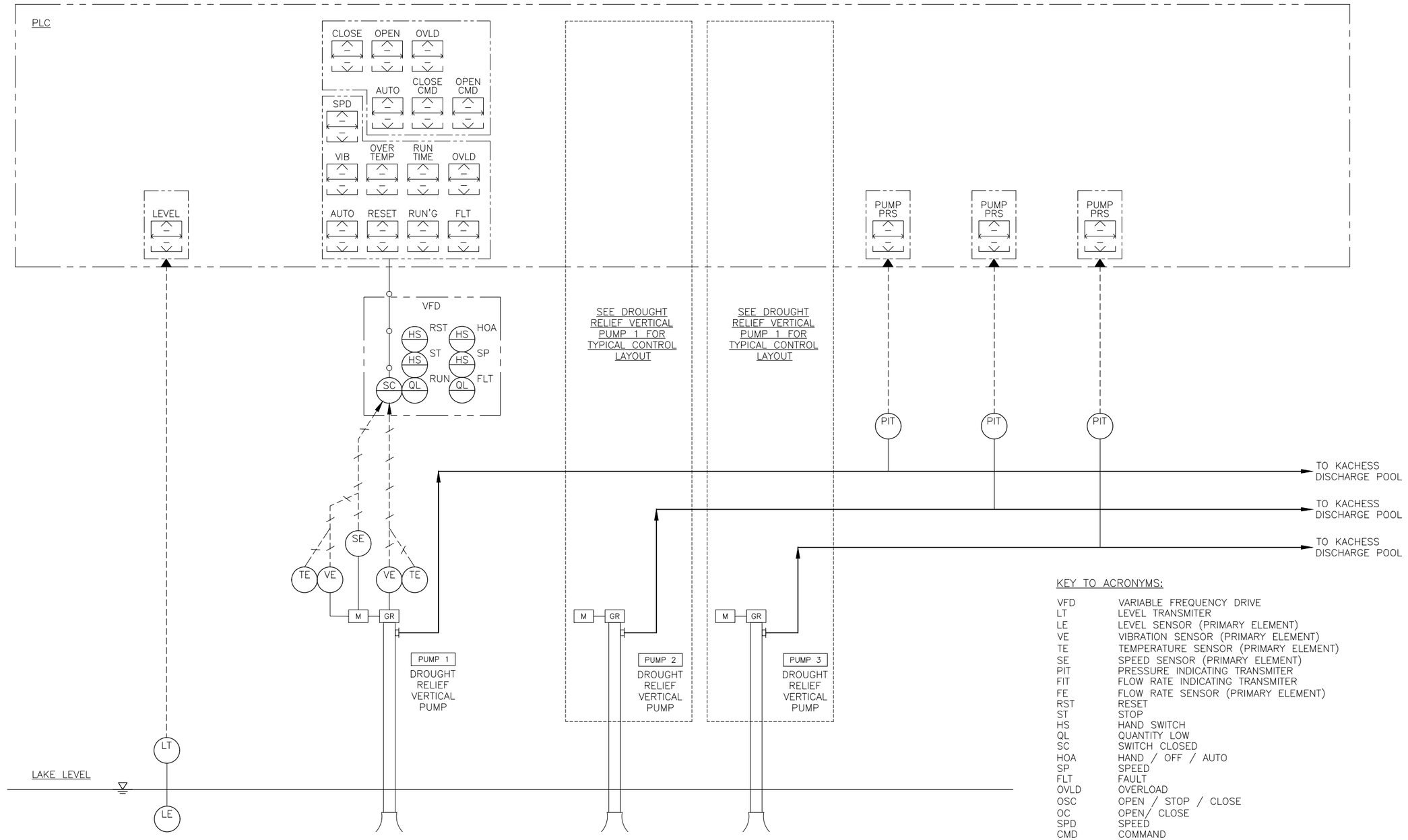

KEY TO ACRONYMS:

VFD	VARIABLE FREQUENCY DRIVE
LT	LEVEL TRANSMITER
LE	LEVEL SENSOR (PRIMARY ELEMENT)
VE	VIBRATION SENSOR (PRIMARY ELEMENT)
TE	TEMPERATURE SENSOR (PRIMARY ELEMENT)
SE	SPEED SENSOR (PRIMARY ELEMENT)
PIT	PRESSURE INDICATING TRANSMITER
FIT	FLOW RATE INDICATING TRANSMITER
FE	FLOW RATE SENSOR (PRIMARY ELEMENT)
RST	RESET
ST	STOP
HS	HAND SWITCH
QL	QUANTITY LOW
SC	SWITCH CLOSED
HOA	HAND / OFF / AUTO
SP	SPEED
FLT	FAULT
OVLD	OVERLOAD
OSC	OPEN / STOP / CLOSE
OC	OPEN/ CLOSE
SPD	SPEED
CMD	COMMAND
VIB	VIBRATION
RUN'G	RUNNING
PRS	PRESSURE
IRRIG	IRRIGATION

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

I. RINCON
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E. PILAPIL
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA
YYYY-MM-DD

PROCESS AND INSTRUMENTATION DIAGRAM

ALTERNATIVE 3

M-02

SHEET 8 OF 30

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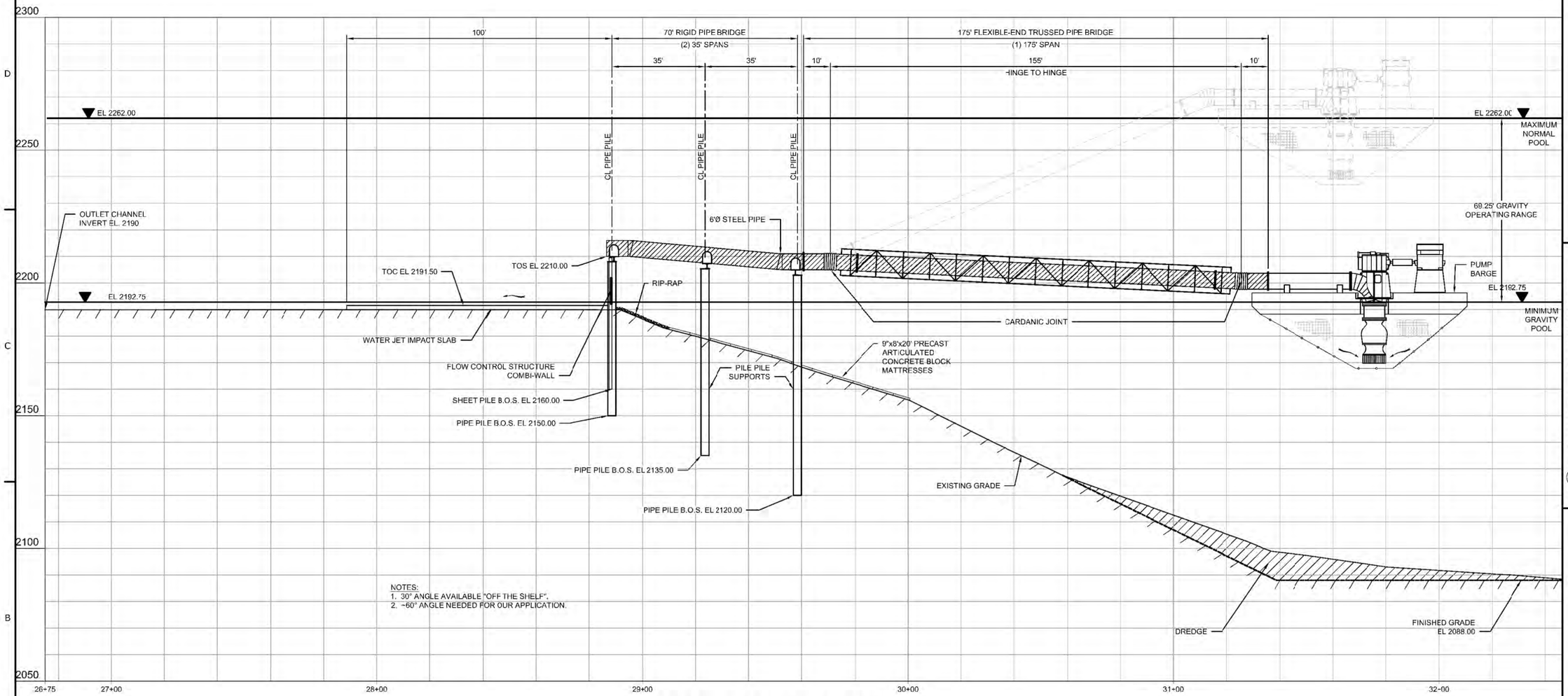

NOTES:
1. 30° ANGLE AVAILABLE "OFF THE SHELF".
2. ~60° ANGLE NEEDED FOR OUR APPLICATION.

PROFILE - GRAVITY OPERATION

SCALE: H:1" = 20' V:1"=20'

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

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R. CARPENTER
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APPROVED
AGENCY APPROVAL – TITLE
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YYYY-MM-DD

PROFILE - GRAVITY OPERATION

ALTERNATIVE 3

M-03

SHEET 9 OF 30

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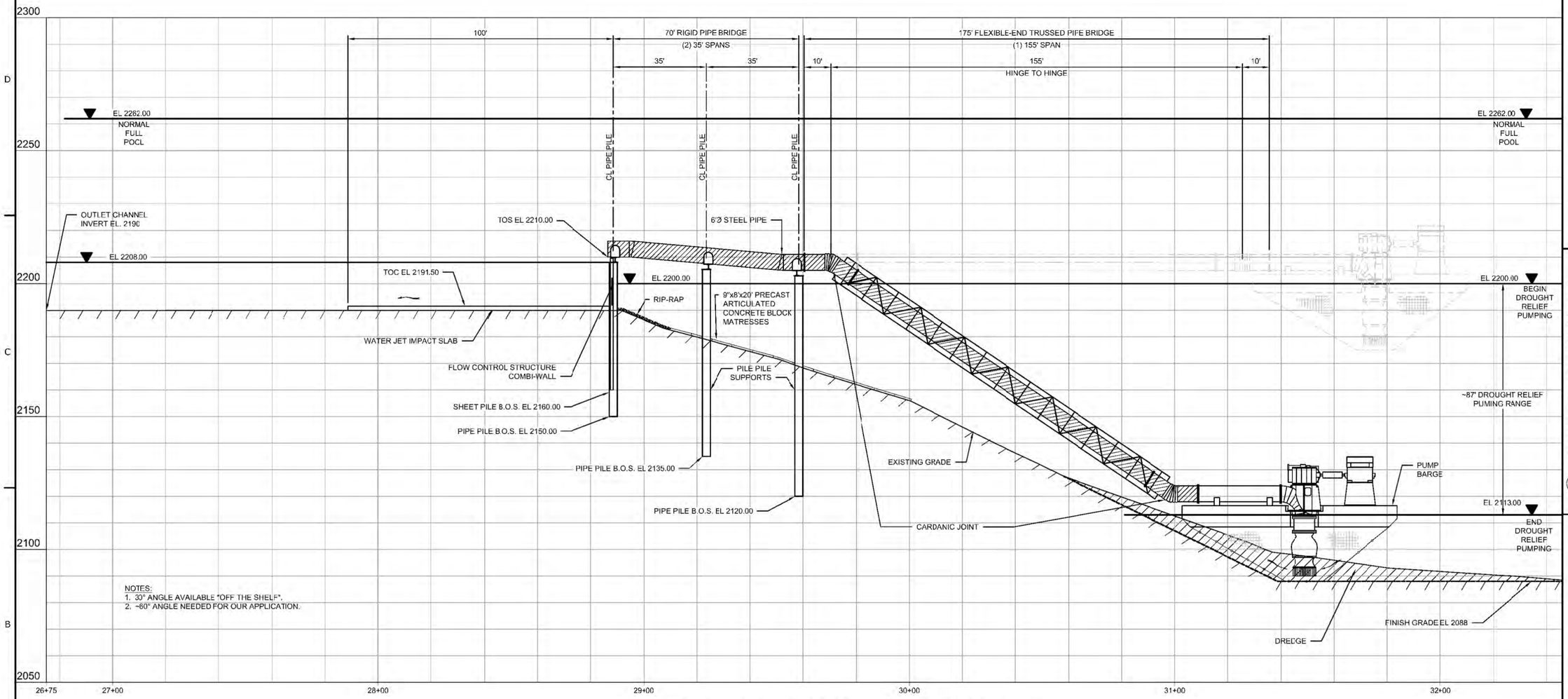

NOTES:
1. 33° ANGLE AVAILABLE "OFF THE SHELF".
2. ~60° ANGLE NEEDED FOR OUR APPLICATION.

PROFILE - DROUGHT RELIEF PUMPING OPERATION

SCALE: H:1" = 20' V:1"=20'

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING
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APPROVED
ADMIN APPROVAL — TITLE
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YYYY-MM-DD

PROFILE - DROUGHT RELIEF PUMPING OPERATION

ALTERNATIVE 3

M-04

SHEET 10 OF 30

DATE AND TIME PLOTTED
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PLOTTED BY
Not Plotted

CAD SYSTEM
AUTOCAD
CAD FILENAME
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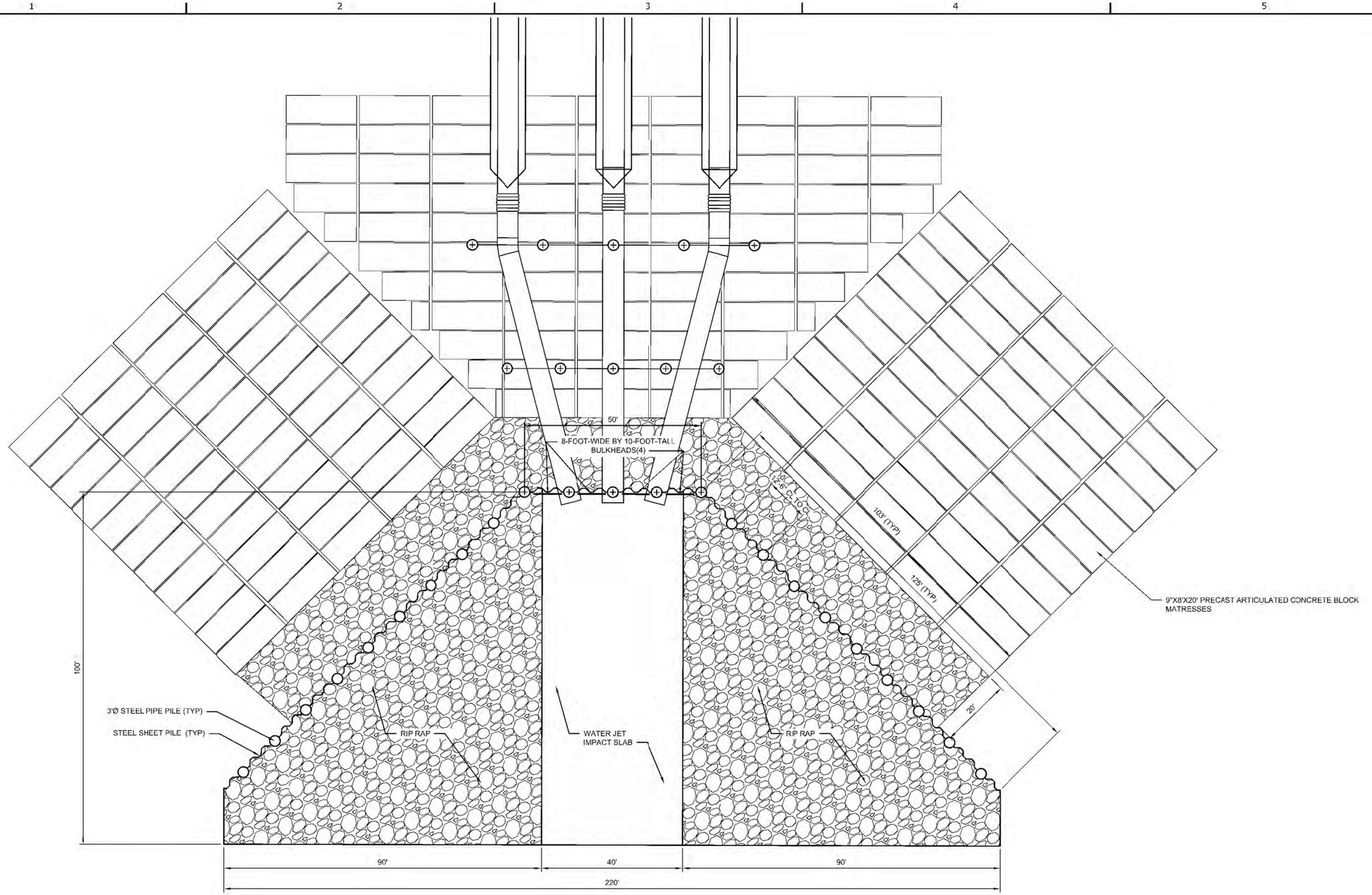

PLAN COMBI-WALLFLOW CONTROL STRUCTURE

SCALE: 1"=15'

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

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YAKIMA, WA — YYYY-MM-DD

FLOW CONTROL STRUCTURE

ALTERNATIVE 3

S-01

SHEET 11 OF 30

CAD STANDARD: AUTOCAD
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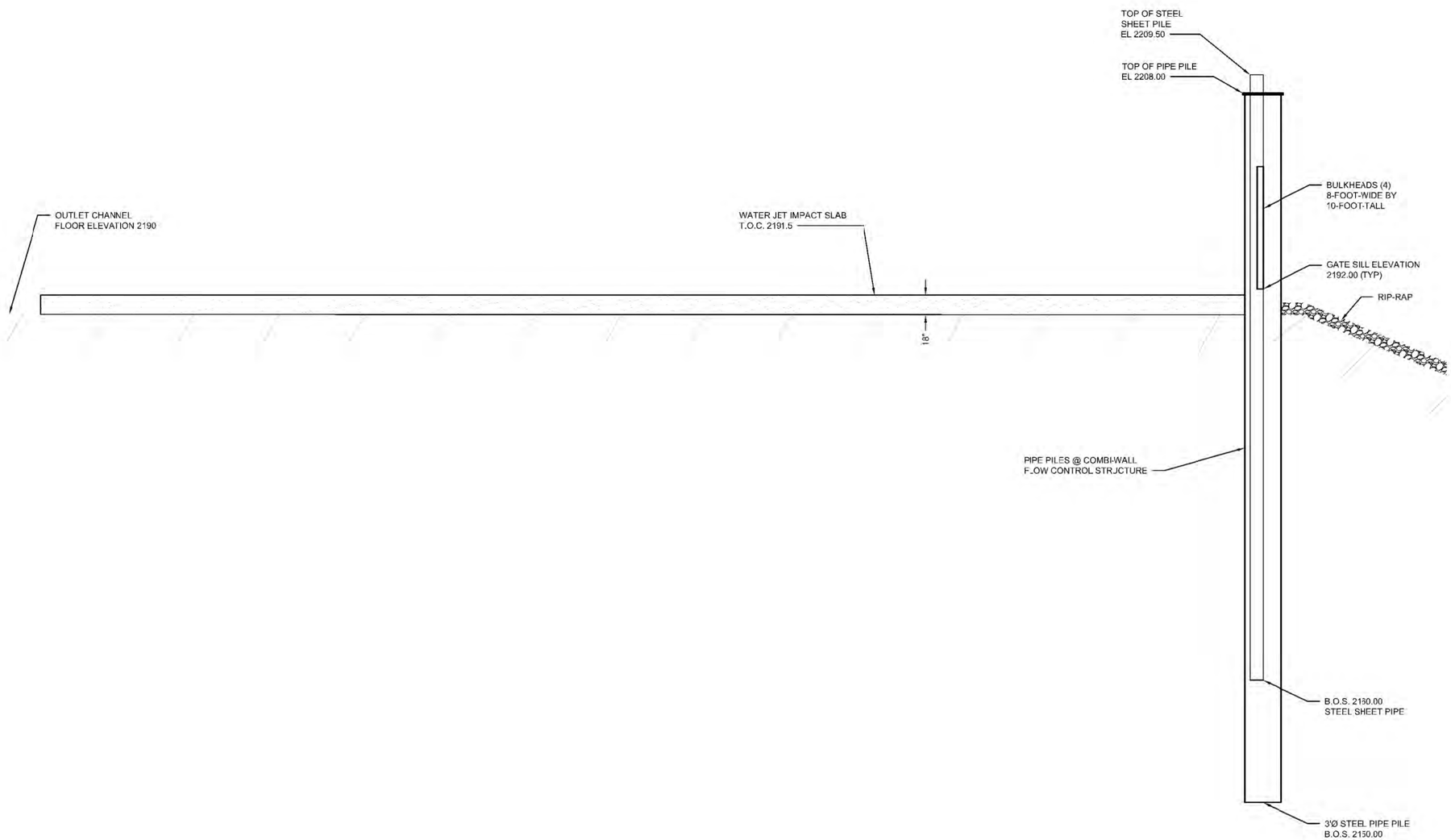

SECTION - COMBI-WALL

SCALE: 1"=5'

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

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SECTION - COMBI-WALL

ALTERNATIVE 3

S-02

SHEET 12 OF 30

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PLOTTED: Not Plotted

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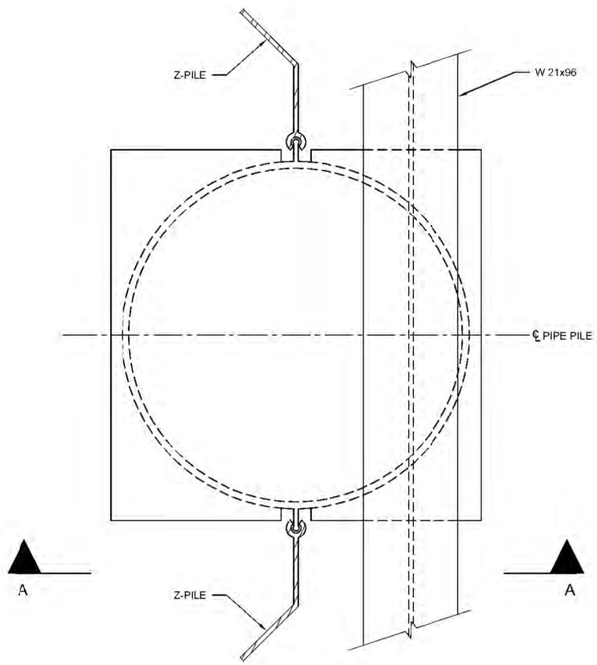
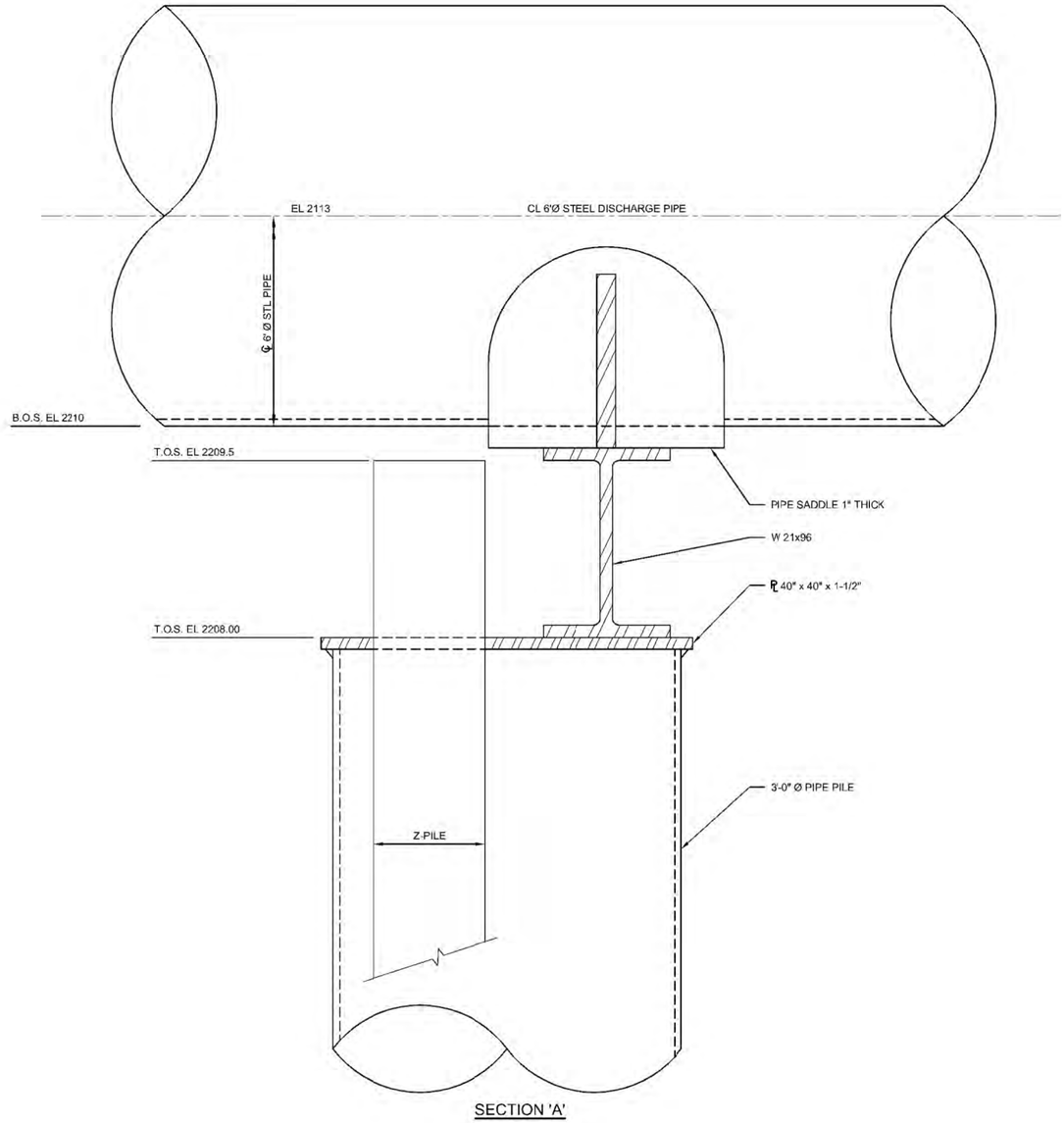


PLAN



SECTION 'A'

DETAIL
SCALE: 1-1/2" = 1'-0"

1

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ALT. 3 - FLOATING ALTERNATIVE

R. KING
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DETAILS - COMBI-WALL AND PIPE BRIDGE

ALTERNATIVE 3

S-03

SHEET 13 OF 30

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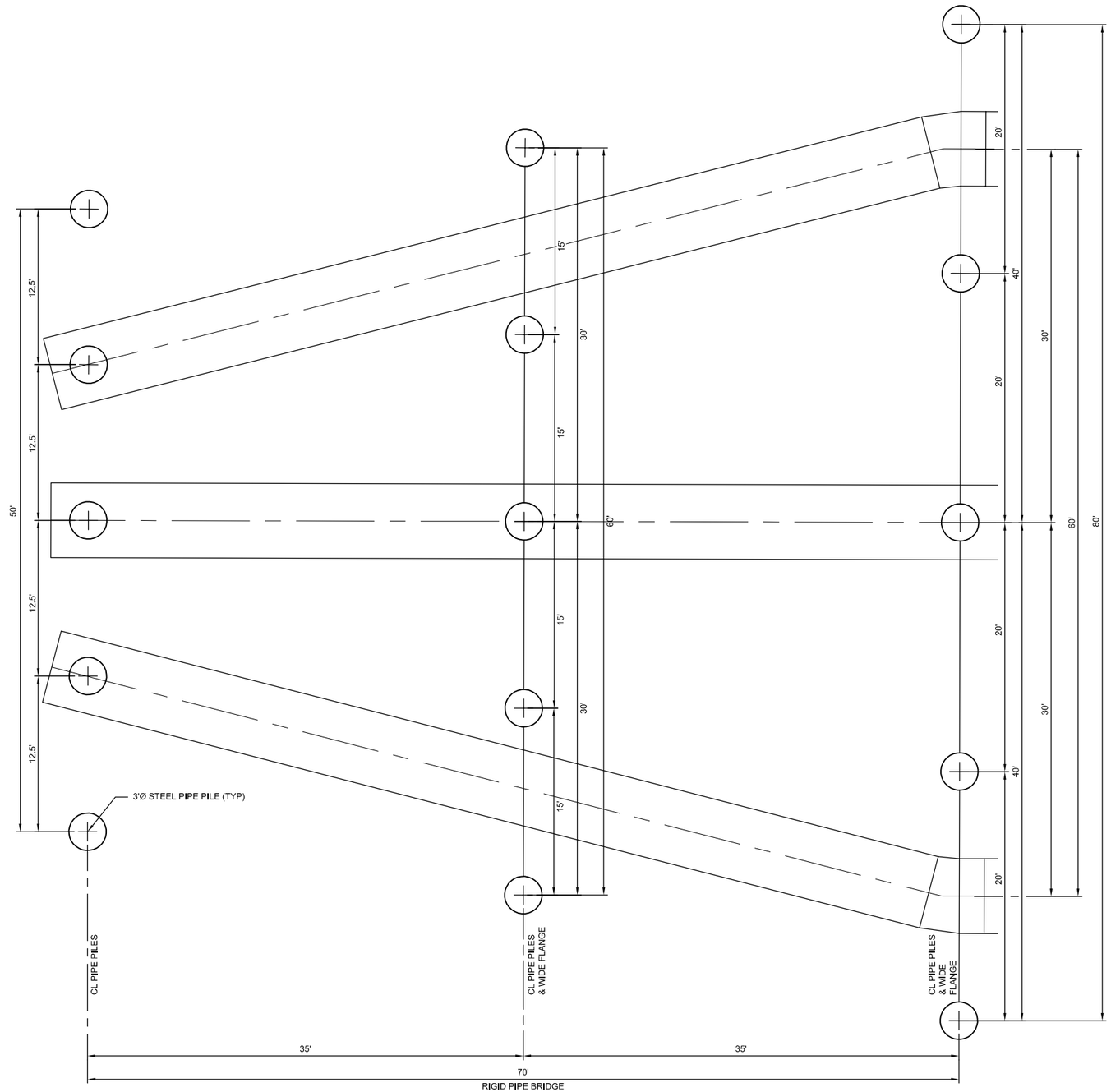

PLAN - RIGID PIPE BRIDGE
SCALE: 1"=10'

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ALT. 3 - FLOATING ALTERNATIVE

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PLAN - RIGID PIPE BRIDGE

ALTERNATIVE 3

S-04

SHEET 14 OF 30

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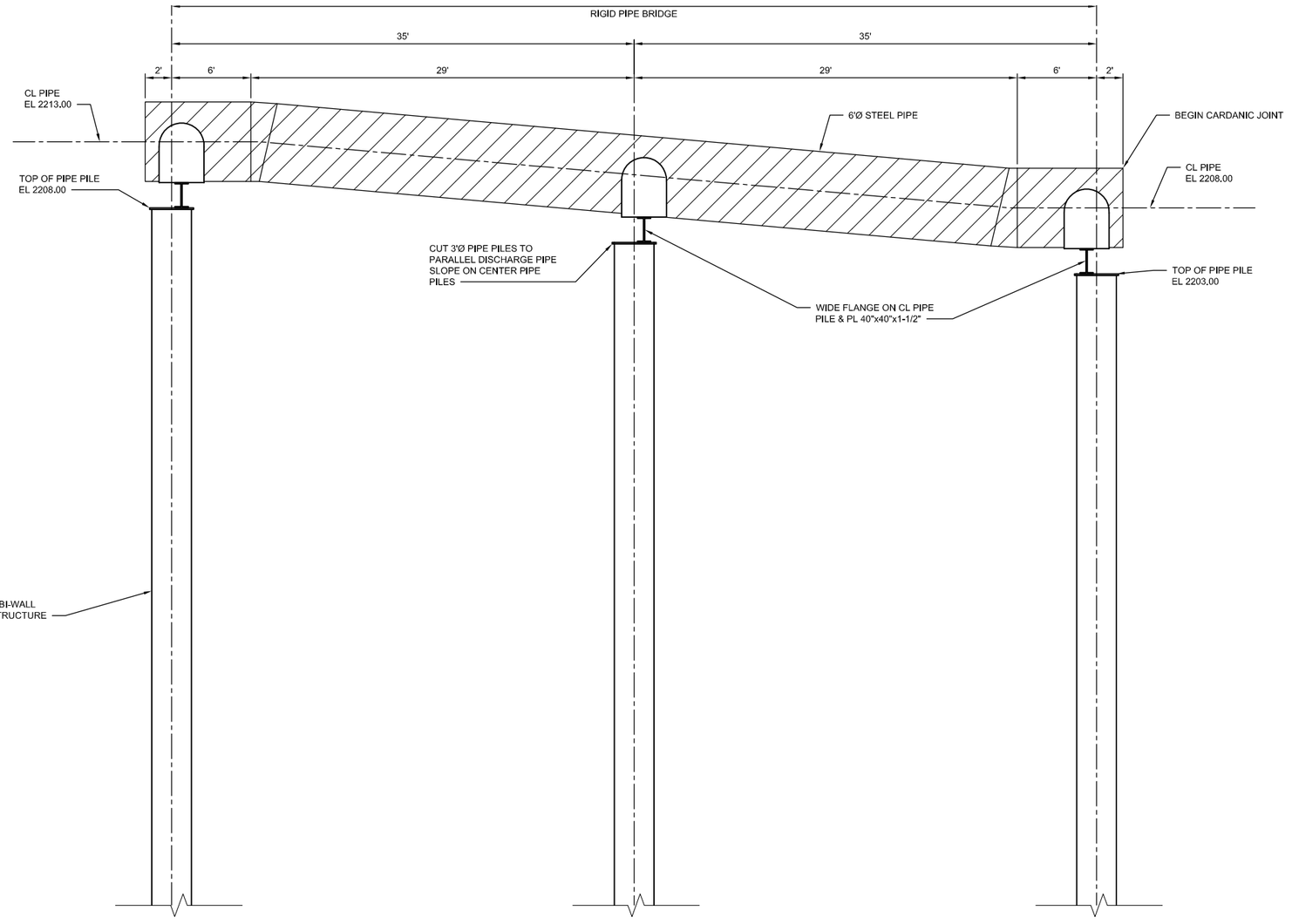

PROFILE - RIGID PIPE BRIDGE
SCALE: 1"=5'

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PROFILE - RIGID PIPE BRIDGE

ALTERNATIVE 3

S-05

SHEET 15 OF 30

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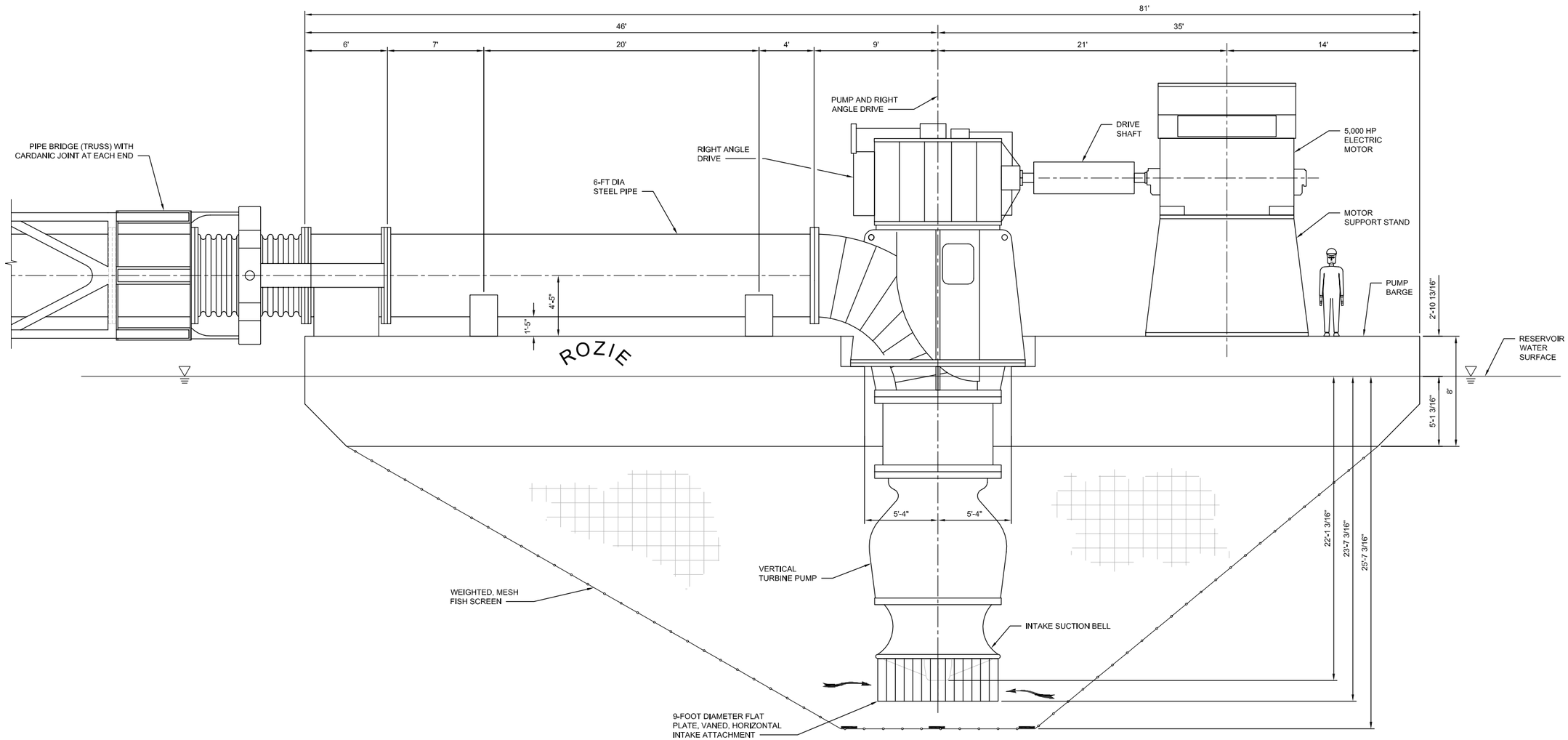
PLOT DATE Not Plotted



SECTION - PUMP BARGE

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

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TECH. APPR.
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ADMIN APPROVAL - TITLE
YAKIMA, WA
YYYY-MM-DD

SECTION - PUMP BARGE

ALTERNATIVE 3

S-06

SHEET 16 OF 30

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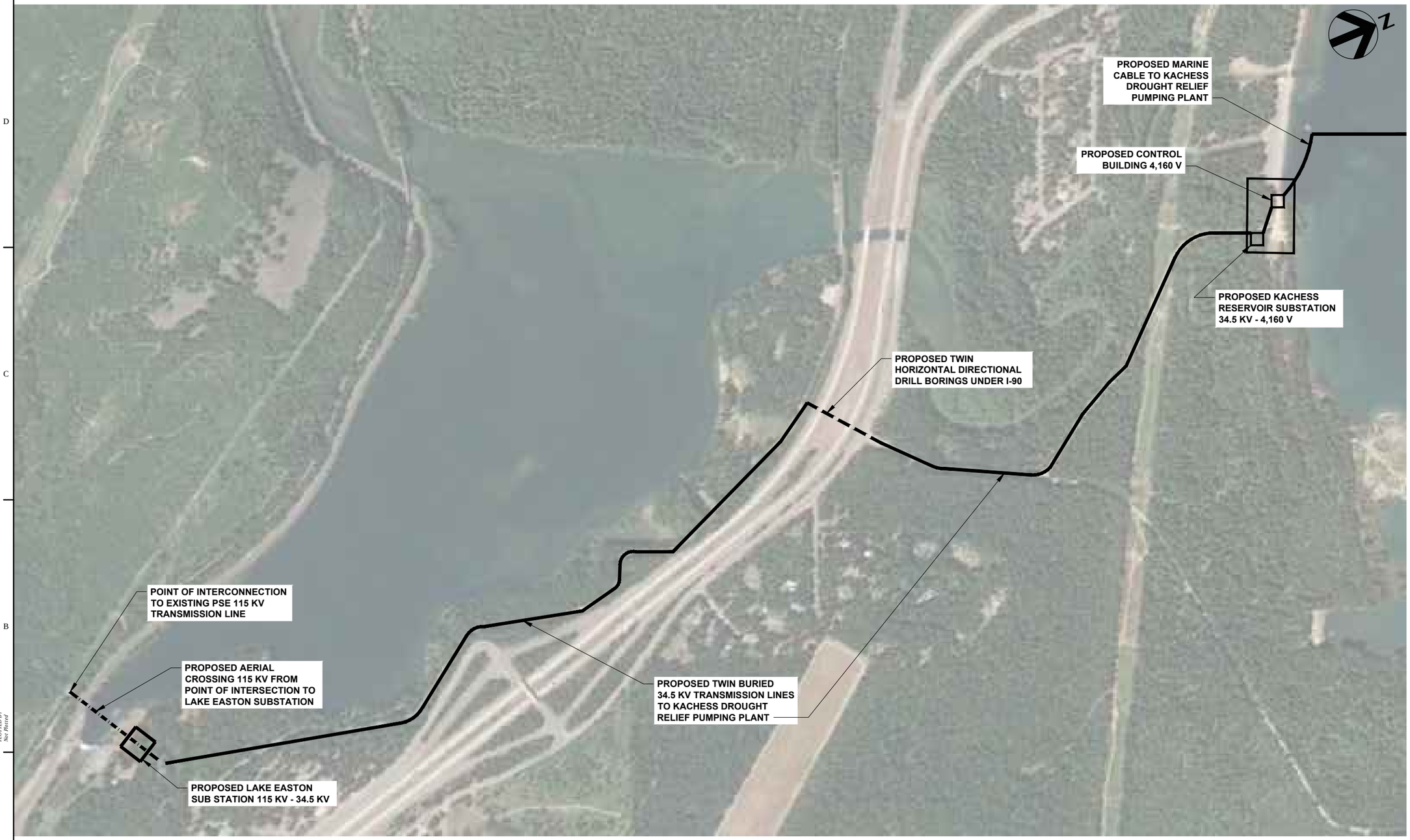

SITE PLAN – POWER SUPPLY SYSTEM

0 150 300 600

SCALE IN FEET

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ALT. 3 - FLOATING ALTERNATIVE

DESIGNED S. EVERETT / K. DEWEY
DRAWN S. BRADFORD
CHECKED
TECH. APPR.
APPROVED *ADMIN APPROVAL - TITLE*
YAKIMA, WA *YYYY-MM-DD*

SITE PLAN - POWER SUPPLY SYSTEM

ALTERNATIVE 3

E-01

SHEET 17 OF 30

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PLOTTED BY Not Plotted
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CAD FILENAME UNKNOWN

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PLAN – OVERHEAD 115 KV TRANSMISSION LINES

SCALE: 1"=30'

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KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

S. EVERETT / K. DEWEY — *DESIGNED*
S. BRADFORD — *DRAWN*
J. DOHRENDORF — *CHECKED*
TECH. APPR.
APPROVED — *ADMIN APPROVAL - TITLE*
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PLAN - OVERHEAD 115kv TRANSMISSION LINES

ALTERNATIVE 3

E-02

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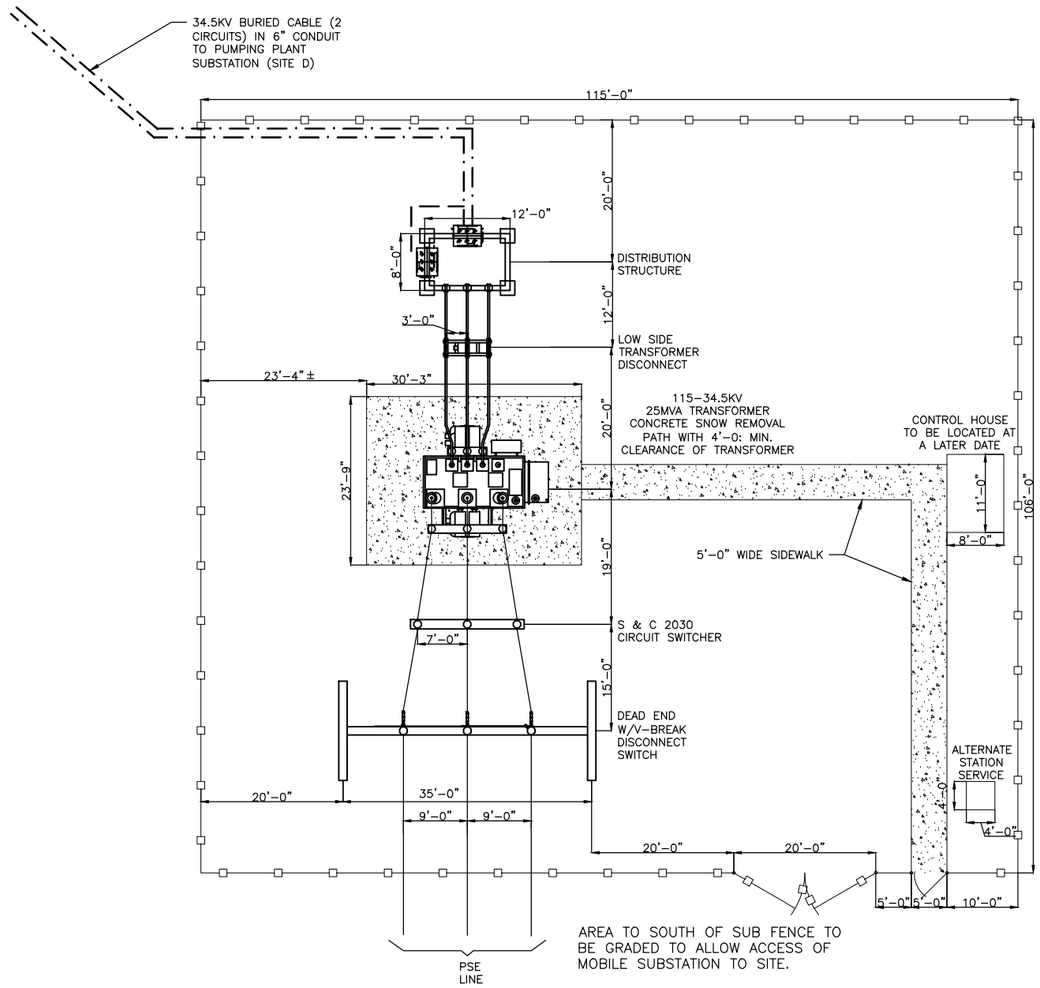

PLAN – LAKE EASTON SUBSTATION

SCALE: 3/32"=1'-0"

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Managing Water in the West

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STATE OF WASHINGTON
25753
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YAKIMA PROJECT - WA
KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

K. MOUGHAMER / S. EVERETT
DESIGNED
S. BRADFORD
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA *YYYY-MM-DD*

PLAN - LAKE EASTONS SUBSTATION (115KV-34.5KV)

ALTERNATIVE 3

E-03

SHEET 19 OF 30

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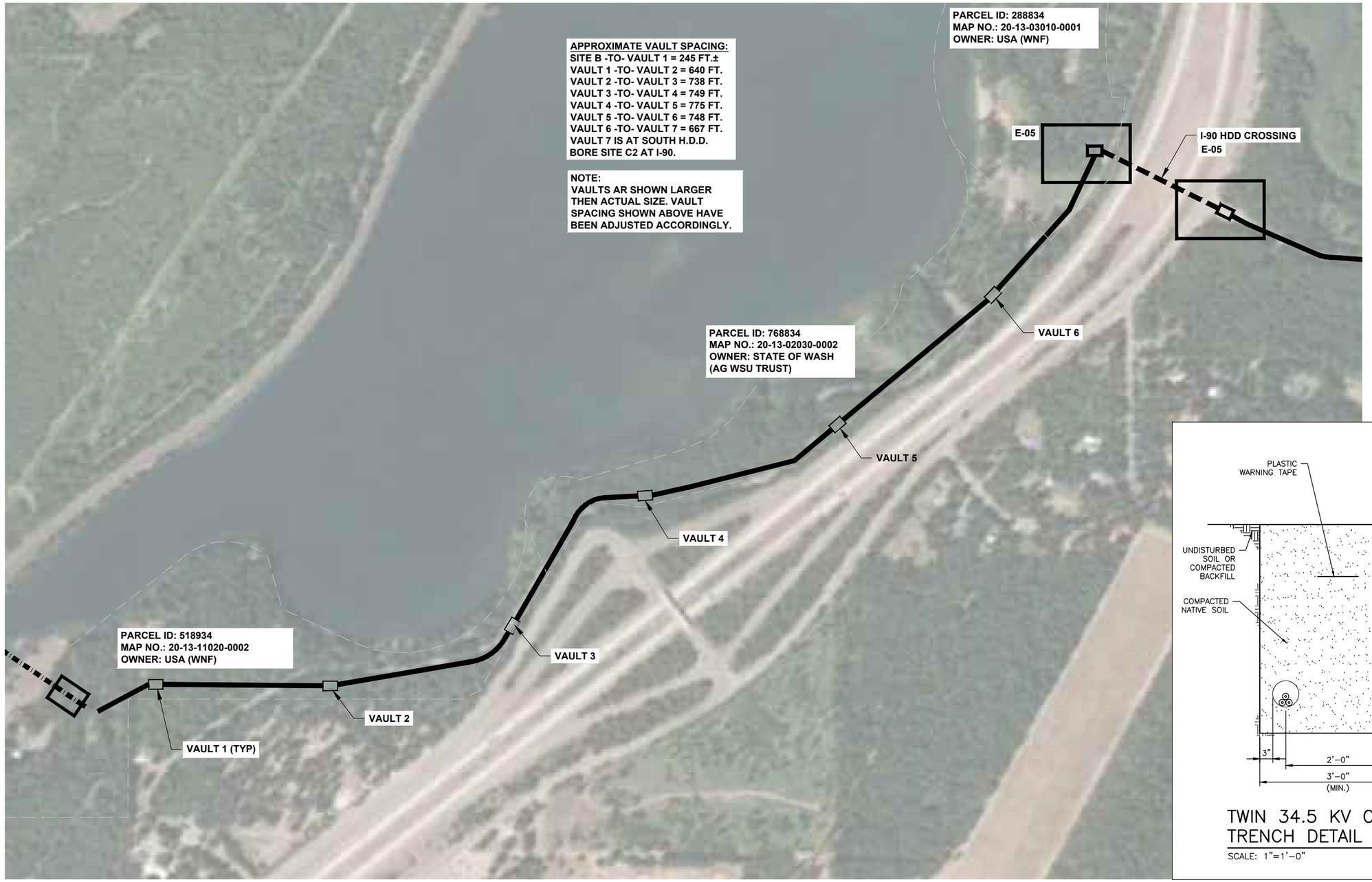
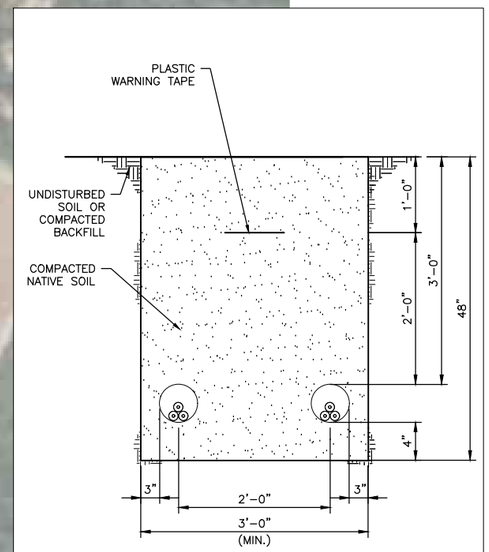


PLAN – TWIN 34.5 KV BURIED TRANSMISSION LINE ROUTE

SCALE: 1"=200'



TWIN 34.5 KV CONDUIT TRENCH DETAIL

SCALE: 1"=1'-0"

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KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

S. EVERETT / K. DEWEY — *DESIGNED*
S. BRADFORD — *DRAWN*
J. DOHRENDORF — *CHECKED*
TECH. APPR.
APPROVED — *ADMIN APPROVAL - TITLE*
YAKIMA, WA — *YYYY-MM-DD*

PLAN - DISTRIBUTION LAYOUT TO I-90

ALTERNATIVE 3

E-04

SHEET 20 OF 30

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PLAN - TWIN HORIZONTAL DIRECTIONAL DRILL BORING BENEATH I-90

SCALE: 1"=50'

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

S. EVERET / K. DEWEY
DESIGNED
S. BRADFORD
DRAWN
J. DOHRENDORF
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA *YYYY-MM-DD*

PLAN - TWIN HORIZONTAL DIRECTIONAL DRILL BORING BENEATH I-90

ALTERNATIVE 3

E-05

SHEET 21 OF 30

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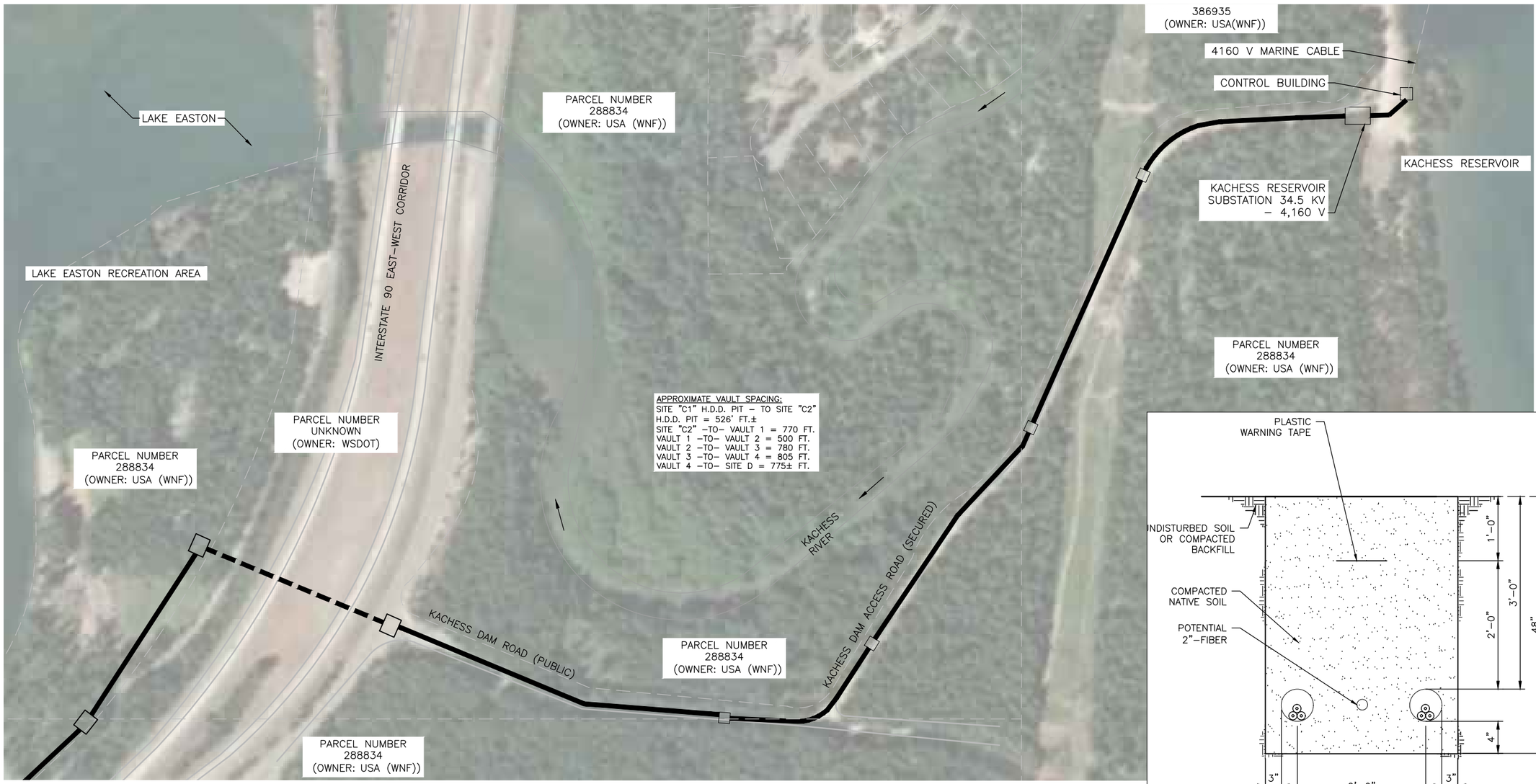
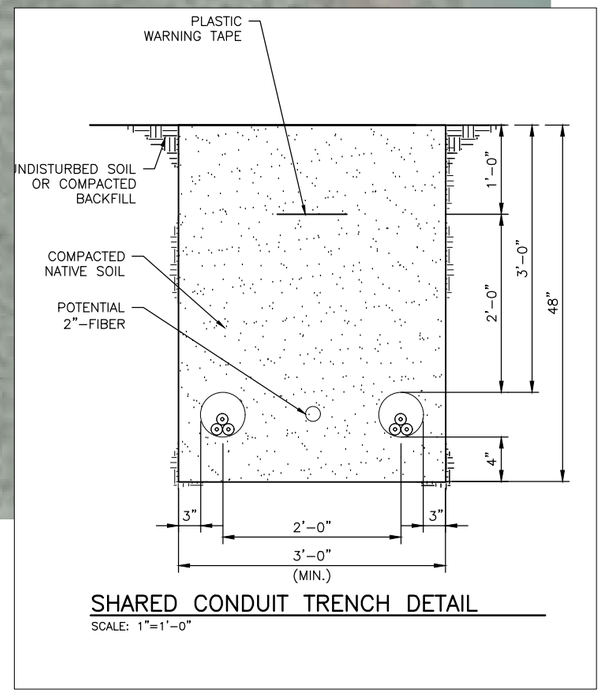


PLAN – TWIN 34.5 KV BURIED TRANSMISSION LINE

SCALE: 1"=150'



SHARED CONDUIT TRENCH DETAIL

SCALE: 1"=1'–0"

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KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

S. EVERETT / K. DEWEY
DESIGNED
S. BRADFORD
DRAWN
J. DOHRENDORF
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL – TITLE
YAKIMA, WA
YYYY-MM-DD

PLAN - TWIN 34.5 KV BURIED TRANSMISSION LINE

ALTERNATIVE 3

E-06

SHEET 22 OF 30

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CAD FILENAME
UNKNOWN

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PLAN – KACHESS RESERVOIR SUBSTATION (34.5 KV – 4.16 KV)

SCALE: 1"=400'

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KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

S. EVERETT / K. DEWEY
DESIGNED
S. BRADFORD
DRAWN
J. DOHRENDORF
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
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PLAN - KACHESS RESERVOIR SUBSTATION (34.5 KV - 4.16 KV)

ALTERNATIVE 3

E-07

SHEET 23 OF 30

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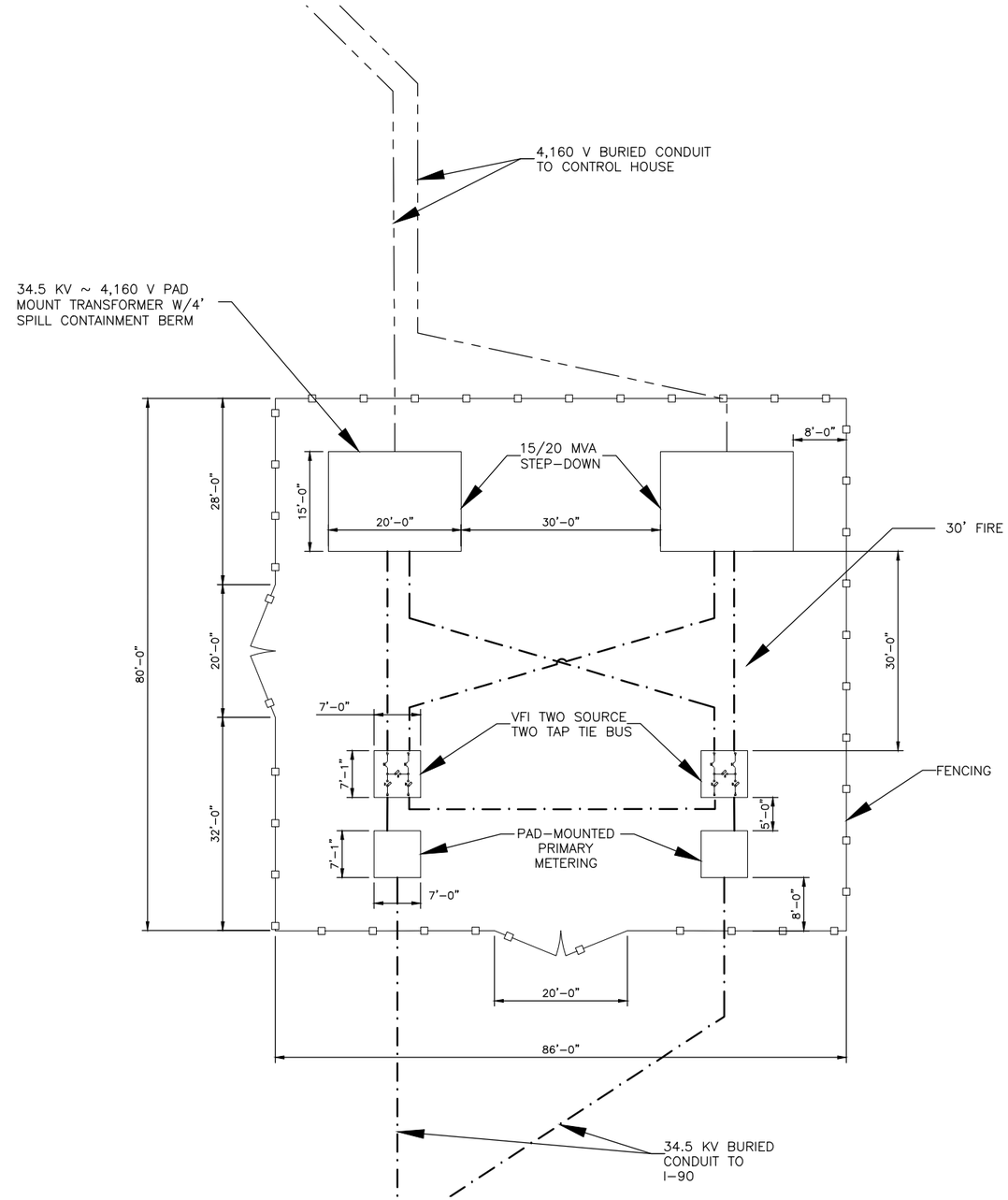

PLAN – PROPOSED KACHESS RESERVOIR SUBSTATION (34.5 KV – 4,160V)

SCALE: 3/32" = 1'-0"

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KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

K. MOUGHAMER / S. EVERETT
DESIGNED
S. BRADFORD
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA *YYYY-MM-DD*

PLAN - PROPOSED KACHESS RESERVOIR SUBSTATION (34.5 KV - 4,160V)

ALTERNATIVE 3

E-08

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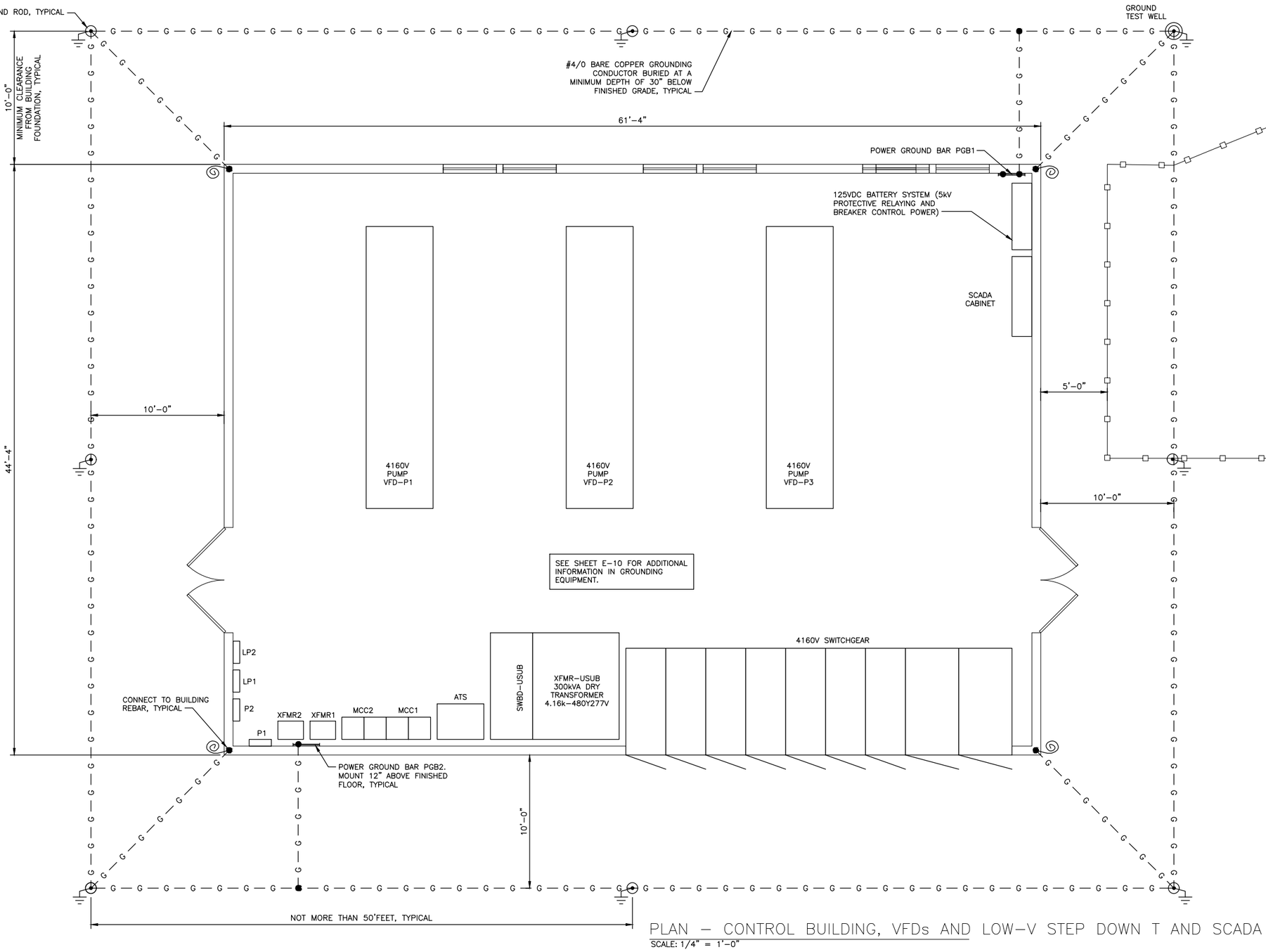

PLAN – CONTROL BUILDING, VFDs AND LOW-V STEP DOWN T AND SCADA

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

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YAKIMA PROJECT - WA
KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

J. RINCON
DESIGNED
E. PILAPIL
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
YAKIMA, WA
YYYY-MM-DD

PLAN - CONTROL BUILDING, VFDs AND LOW-V STEP DOWN T AND SCADA

ALTERNATIVE 3

E-09

SHEET 25 OF 30

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34.5kV INCOMING UTILITY FEEDER

34.5kV OKONITE OKOGUARD URO-J 133% INSULATION LEVEL 3#1/0 AND 1#4/0 GND

34.5kV INCOMING UTILITY FEEDER

52 OUTDOOR SWITCHYARD CIRCUIT BREAKER

52 OUTDOOR SWITCHYARD CIRCUIT BREAKER

XFMR-MAIN 1 16/20/25MVA AT SWITCHYARD 34.5kV-4.16kV

UL LISTED AS TYPE MV-105 COPPER, 5kV 133% INSULATION LEVEL OKONITE OKOGUARD OKOCLEAR, 6 SETS OF CONDUCTORS, EACH WITH 4#500kCMIL AND #4/0 GND

XFMR-MAIN 2 16/20/25MVA AT SWITCHYARD 34.5kV-4.16kV

5kV SERVICE SWITCHGEAR SWGR-01 (IN ELECTRICAL BUILDING)
4000A BUS

52 4000A VACUUM CIRCUIT BREAKER 40kAIC

52 4000A VACUUM CIRCUIT BREAKER 40kAIC

MAIN 1, 4000AMP BUS

MAIN 2, 4000AMP BUS

52 TIE N.O.

52 1200A VACUUM CIRCUIT BREAKER 40kAIC

52 1200A VACUUM CIRCUIT BREAKER 40kAIC

52 1200A VACUUM CIRCUIT BREAKER 40kAIC

52 1200A VACUUM CIRCUIT BREAKER 40kAIC

FULL LENGTH N

FULL LENGTH G

BONDING JUMPER, TYPICAL

EQUIPMENT GROUND, TYPICAL

FRAME CONNECTION, TYPICAL

SUBMARINE CABLE, TYPICAL OF 3 PUMPS, BETWEEN VFD (LOCATED IN ELECTRICAL BUILDING) AND VERTICAL PUMP (AT FLOATING PUMPING STATION)

VFD 4.16kV VFD-P1

VFD 4.16kV VFD-P2

VFD 4.16kV VFD-P3

DRY TYPE UNIT SUB-STATION TRANSFORMER XFMR-USUB 300kVA-480V/277V

POWER GROUND BAR (PGB1)

#4/0 AWG TO WATER PIPE

#4/0 AWG TO BUILDING STEEL

#4/0 AWG TO CONCRETE ENCASED ELECTRODE

#4/0 AWG

#4/0 AWG BUILDING GROUND RING

GROUND ROD TYPICAL

#4/0 AWG

M NOTE 3

M NOTE 3

M NOTE 3

FLOATING PUMPING PLANT

VERTICAL PUMP 1 5444 HP 1000 RPM

VERTICAL PUMP 2 5444 HP 1000 RPM

VERTICAL PUMP 3 5444 HP 1000 RPM

1200A 3P

SWITCHBOARD SWBD-USUB (IN ELECTRICAL BUILDING)
1200A-480Y/277V, 3PH, 4W

(3) DMP

30A 3P SPD

600A 3P

600A 3P

FULL LENGTH N

FULL LENGTH G

EQUIPMENT GROUND, TYPICAL

ATS 4 POLE E N L

POWER GROUND BAR (PGB2)

STANDBY-GENERATOR
(SOUND ATTENUATING WEATHERPROOF ENCLOSURE)
400kW, 0.8PF - 480V/277V, 3ø

G 600A 3P

MCC-1 (IN ELECTRICAL BUILDING)
600A-480Y/277V, 3PH, 4W

FULL LENGTH G

FULL LENGTH N

600A 3P

30A 3P SPD

(3) DMP

600A 3P

G FULL LENGTH

N FULL LENGTH

MCC-2 (IN ELECTRICAL BUILDING)
600A-480Y/277V, 3PH, 4W

30A 3P SPD

45kVA XFMR-LP1 480V-208Y/120V

45kVA XFMR-LP2 480V-208Y/120V

FLOATING SURFACE COLLECTOR (DOWNSTREAM FISH)

FUTURE TRAP AND HAND FACILITY

FUTURE HVAC LOADS

PNL P1 225A MAIN 480/277V 3ø,4W

ESSENTIAL SERVICE LOAD

PANEL LP1

SECURITY PANEL

FACP

FLOW METERING

SCADA/CONTROLS

PANEL LP2

PNL P2 225A MAIN 480/277V 3ø,4W

ELEVATOR

BRIDGE CRANE

FLOW CONTROL VALVES

COMPRESSED AIR SYSTEM

POTABLE WATER PUMPS

SANITARY SYSTEM

KEY TO ACRONYMS:

MCC	MOTOR CONTROL CENTER
VFD	VARIABLE FREQUENCY DRIVE
ATS	AUTOMATIC TRANSFER SWITCH
PNL	PANELBOARD
FACP	FIRE ALARM CONTROL PANEL
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
LP	LIGHTING PANELBOARD
XFMR	TRANSFORMER
HVAC	HEAT, VENTILATION AIR CONDITIONING

NOTES:

1. THIS PRELIMINARY ONE LINE DIAGRAM DOES NOT SHOW SYSTEM PROTECTIVE RELAYING. THIS IS TO BE SHOWN ON SEPARATE DRAWINGS DURING DETAILED DESIGN.
2. CUSTOMER POWER MONITOR WITH ETHERNET CONNECTIVITY.
3. NO FIELD MOUNTED DISCONNECT SWITCHES ARE INCLUDED IN THIS PROJECT; OPERATOR LOCK OUT TAG OUT PROCEDURES WILL BE IN PLACE FOR SAFE ISOLATION OF EQUIPMENT.
4. ALL VFDs ARE LOCATED IN ELECTRICAL BUILDING.

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ROBERT D. KING STATE OF WASHINGTON 25753 REGISTERED PROFESSIONAL ENGINEER

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YAKIMA PROJECT - WA
KITTITAS DIVISION

KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

I. RINCON DESIGNED
E. PILAPIL DRAWN
CHECKED
TECH. APPR.
APPROVED ADMIN APPROVAL - TITLE
YAKIMA, WA YYYY-MM-DD

ELECTRICAL - ONE LINE DIAGRAM

ALTERNATIVE 3

E-10

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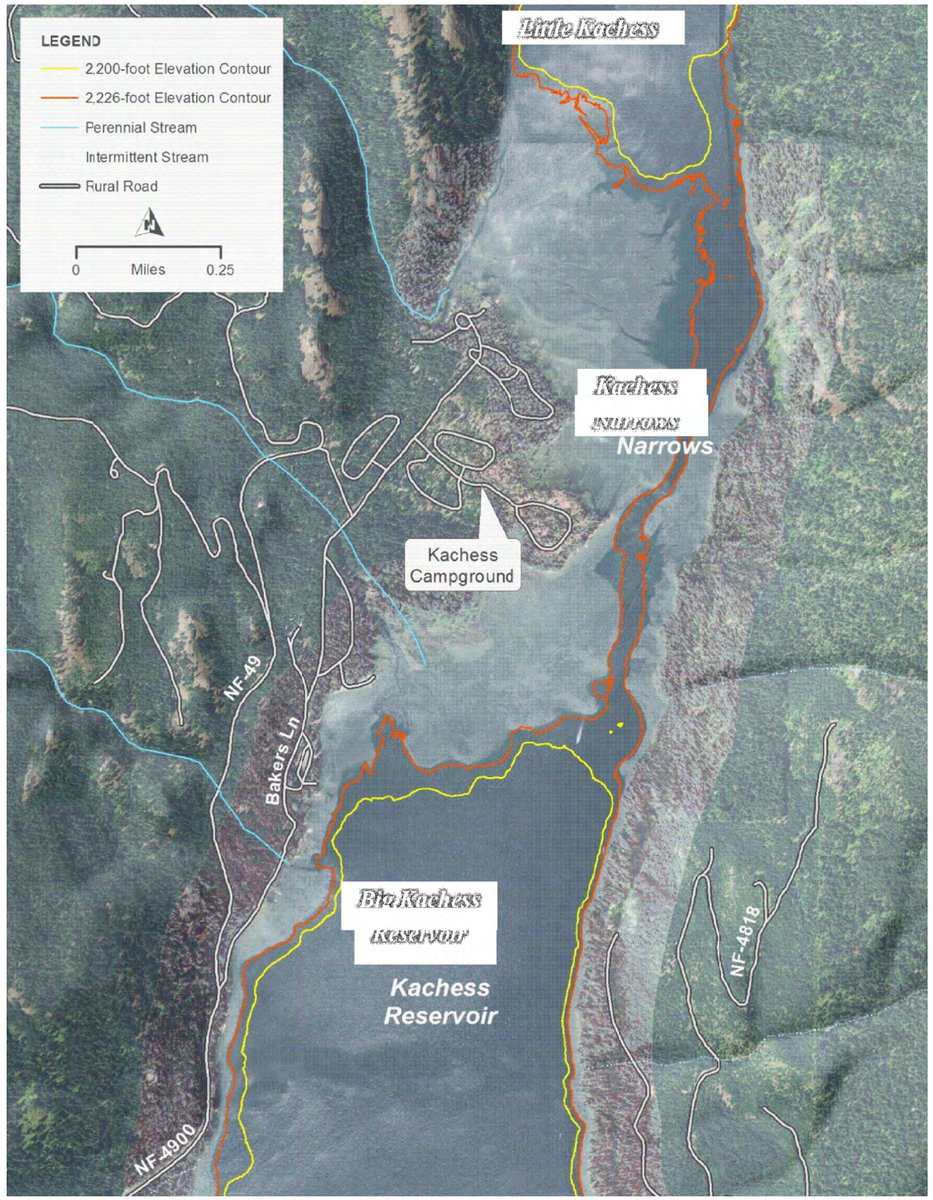

Figure 2. Aerial image of Kachess Narrows and location of the 2,226- and 2,200-foot elevation contours.

Figure 3. Photograph of the Kachess Narrows outlet to Big Kachess when drawn down to an approximate elevation of 2,208 feet.

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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING
DESIGNED
B. MOBLEY
DRAWN
CHECKED
TECH. APPR.
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NARROWS FISH PASSAGE
- LOCATION MAP & PHOTO

ALTERNATIVE 3

F-01

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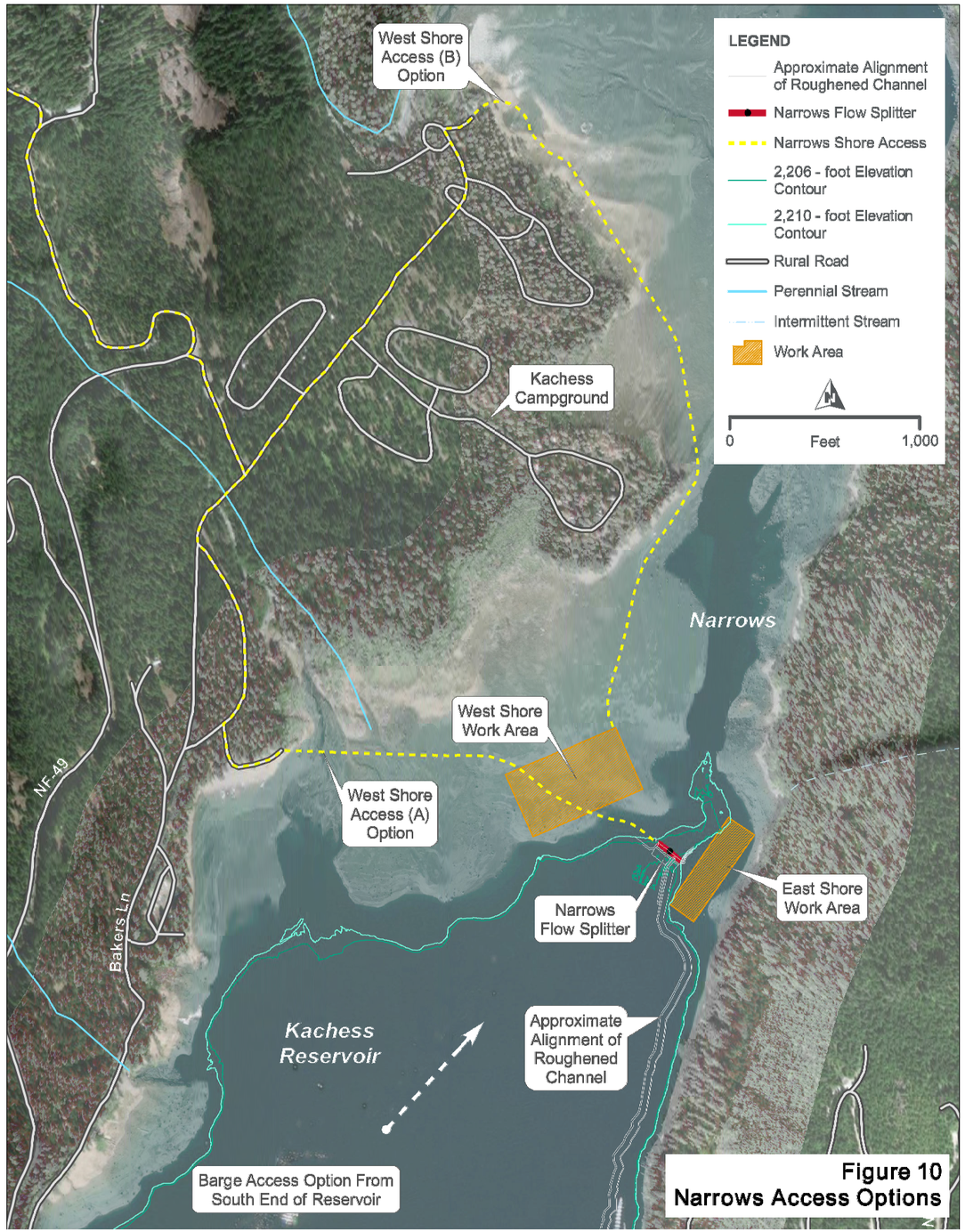

Figure 10
Narrows Access Options

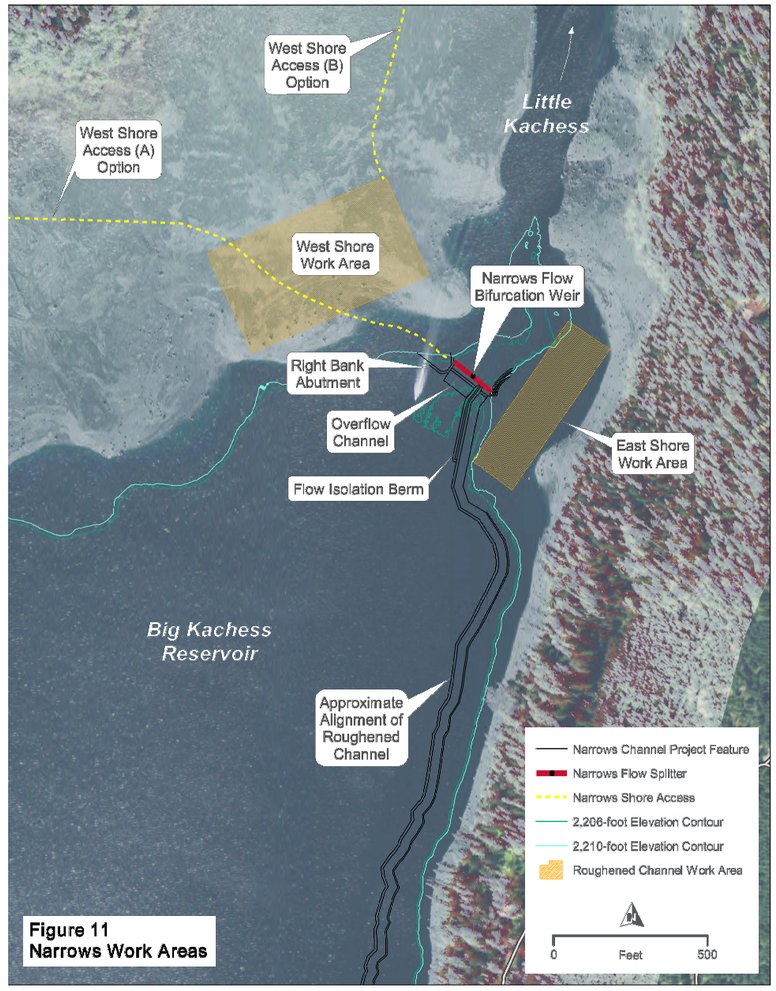

Figure 11
Narrows Work Areas

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ALT. 3 - FLOATING ALTERNATIVE

R. KING — DESIGNED
B. MOBLEY — DRAWN
CHECKED
TECH. APPR.
APPROVED — ADMIN APPROVAL - TITLE
YAKIMA, WA — YYYY-MM-DD

NARROWS FISH PASSAGE - ACCESS PLAN AND SITE PLAN

ALTERNATIVE 3

F-02

SHEET 28 OF 30

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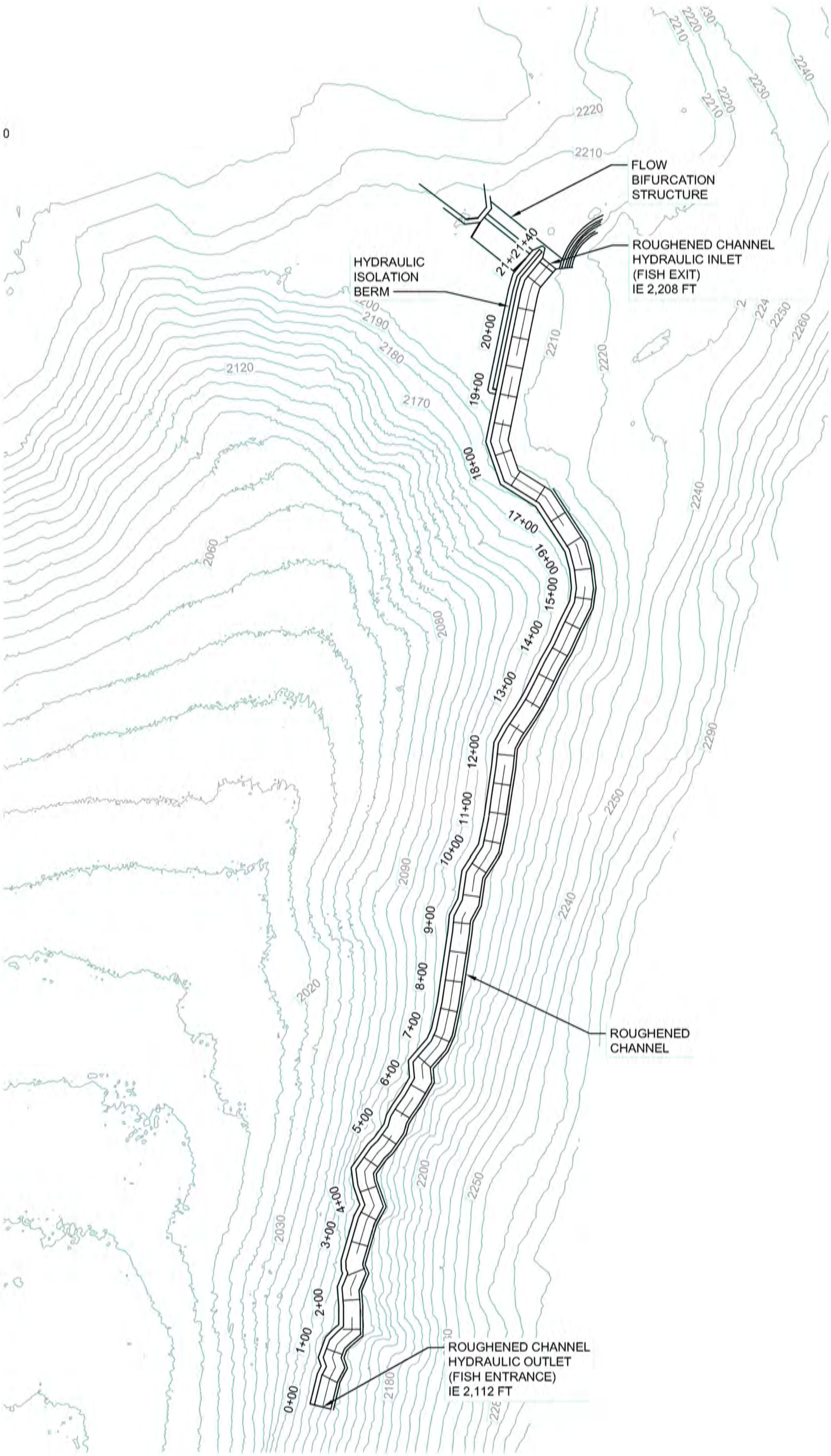

ROUGHENED CHANNEL SITE PLAN

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YAKIMA PROJECT - WA
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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING — DESIGNED
B. MOBLEY — DRAWN
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NARROWS FISH PASSAGE - PLAN ROUGHENED CHANNEL

ALTERNATIVE 3

F-03

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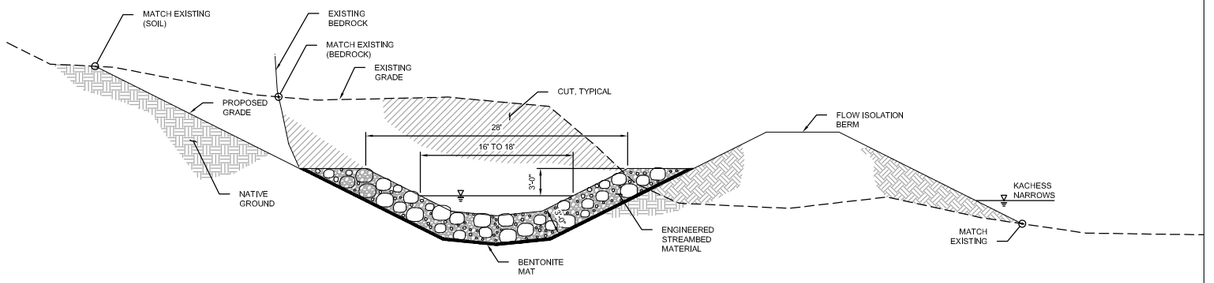
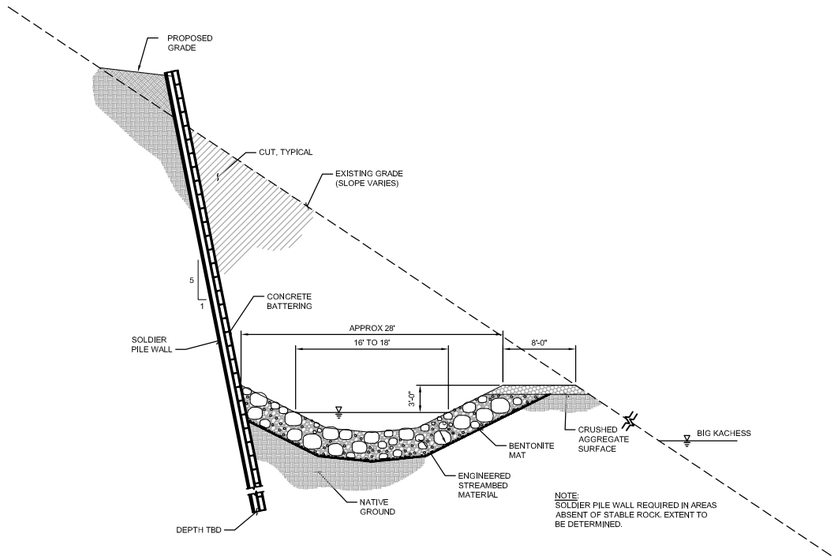


TYPICAL SECTION
STATION 18+00 TO 21+40
NTS

FIGURE 6. ROUGHENED CHANNEL DIMENSIONS AND MATERIAL COMPOSITION



TYPICAL SECTION
STATION 0+00 TO 18+00
NTS

FIGURE 7. ROUGHENED CHANNEL CROSS-SECTION WITH INTERGRATION OF SOLDIER PILE WALL USED FOR BANK STABILIZATION

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30 OF 30
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KACHESS DROUGHT RELIEF PUMPING PLANT
ALT. 3 - FLOATING ALTERNATIVE

R. KING
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B. MOBLEY
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TECH. APPR.
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YYYY-MM-DD

NARROWS FISH PASSAGE
- TYPICAL SECTIONS

ALTERNATIVE 3

F-04
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AUTOCAD
CAD FILENAME
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Not Plotted

Attachment B
HDRC OPCC

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Roza Irrigation District

Kachess Reservoir Relief Pumping Plant

Basis of Estimate

Feasibility Study OPCC

November 30, 2017

Prepared For:

ROZA
IRRIGATION DISTRICT

Table of Contents

Attachments:

- Summary Roll-Up Estimate Report
- Work Area Estimate Report

Project History

In response to an anticipated continuation of the 2015 drought into the 2016 irrigation year Roza Irrigation District hired HDR to complete a four week reconnaissance study to determine the feasibility and primary design features of an emergency floating pumping plant on Lake Kachess. This facility was sized at Roza's request to deliver 150,000 acre-feet of water during a 70-80 day irrigation season. Ultimately this emergency plan was not enacted, and now a permanent floating pump station is under consideration. The permanent floating pump station will provide 200,000 Acre Feet (AF) of drought relief pumping volume at a rate of 1,000 Cubic Feet per Second (FPS). The design concept proposed will allow the permanent floating pump barge to drawdown the Big Kachess reservoir to a Water Surface Elevation (WSEL) of approximately 2,113'. At that elevation the reservoir would contain a pool volume of approximately 200,000 (AF). See Figure 1.

Scope of Work

The design concept for this facility consists of a custom engineered floating steel pump barge with three (3) 5,500 HP electric fired vertical turbine pumps. These pumps will discharge to pipes contained in a flexible end (with Cardanic Joints) trussed pipe bridge that will be fixed to the barge and to a rigid pipe bridge that will be supported by pipe pile supports. These pipelines will discharge water to a concrete flow control structure with a water jet impact slab. From the new flow control structure, water will enter the existing outlet channel and will utilize the existing gravity outlet works to convey flow to the Kachess River. Access to the discharge basin would be provided by upgraded existing public access road which connects to an existing National Forest road. An East Shore Boat Ramp Parking Area will be constructed along with marina facilities for use during construction and ultimately for long term operations, maintenance, and repair activities for the floating pump plant.

Dredging of existing reservoir (approximately 6,000 cy) to a depth of approximately 25 feet lower than the maximum drawdown elevation of the reservoir will be done to ensure acceptable vertical clearance to the suction bells of the pumping units is maintained. The dredged material will be returned to the reservoir floor and not brought to the surface for upland disposal.

A volitional fish passage facility with be constructed at the Kachess Narrows to allow passage of bull trout.

Power for the emergency floating pumping plant would be provided by a proposed 115-kV transmission line to a proposed switchyard (complete with storage building & yard) and a control building. The control building will be constructed on the East end of the existing Kachess Dam which is N.W. of the proposed switchyard. Power and I&C cabling from the control building to the floating pump station will be provided via marine cable installed at the approximate centerline of the existing outlet channel.

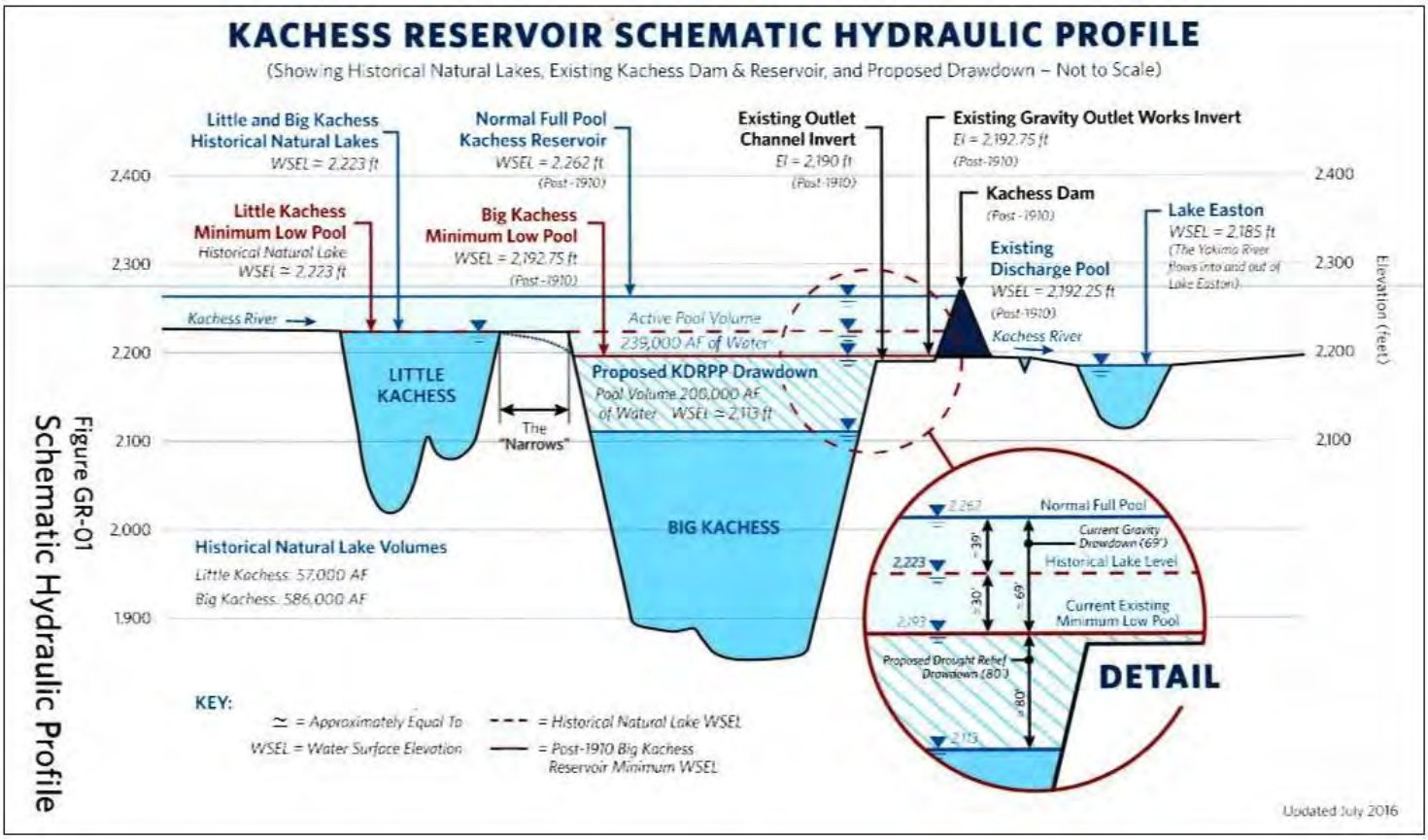


Figure 1: Hydraulic Profile Schematic

Method of Accomplishment

This estimate is based upon a single prime contractor self-performing portions of the work. All other scopes of work will be secured utilizing competitive subcontract procurement process. Major work scopes include: Site clearing and grading, barge fabrication and field erection, supply and installation of (three) pumps and all appurtenances, building erection and building trades, fish passage, boat ramp and docks, outlet structure, electrical, and instrumentation.

The contractor will staff the project with a team of qualified Construction Managers, Project Superintendents, Safety Manager, and QA/QC manager. A full time Project Manager will manage the project from the contractor's home office with support staff as necessary.

It is assumed that all work in the reservoir will be performed at optimum water level drawdown elevations. Every effort to work in dry conditions will be made by the contractor and its subcontractors to maximum labor productivity and efficiencies.

Project Schedule

The final project duration has not been established so for the purpose of this estimate we have assumed a 2 year construction period with Notice to Proceed on or around the middle of June 2018. Procurement of long lead time items will begin soon after the NTP on or around June 18, 2018. Construction will begin on or around March 11, 2019 with Substantial Completion on or around June 08, 2020.

Description	Start	Complete
Notice to Proceed	04 Jun 2018	04 Jun 2018
Procurement	18 Jun 2018	11Mar 2019
Construction	11 Mar 2019	08 Jun 2020
Demobilization	08 Jun 2020	22 Jun 2020

Figure 2 Anticipated Milestone Schedule

Estimate Methodology/Type

This estimate is based on the "Draft – KFPPA Project Description – SDEIS Concept Text" and the "KFPP DWGS Updated BK Redlines 2016-08-22" concept drawings along with additional drawings provided on 8-22-16 and updated ALT.3 – Floating Pumping Plant drawings provided on 11-6-2017. Estimating staff performed detailed analysis of all concept drawings and narratives. Detailed quantity takeoffs were performed, where necessary, utilizing Bluebeam Software. Sage Timberline Estimating Software was utilized for all labor, material and equipment price calculations.

The estimate utilizes RS Means labor rates for Yakima, WA. See Cost Data section for clarification. Material and equipment costs are adjusted utilizing the RS Means City Cost Index for Yakima, WA as well. Major Equipment pricing was provided to HDR and included vendor budgetary quotes specific to this project.

The estimate utilizes standard productivity installation rates from RS Means. These rates have been adjusted for local and site specific conditions.

Based on AACE guidance and review of the conceptual design documents and preliminary construction schedule, the estimate meets Class V methodology standards.

Cost Estimate

Total Project				
Estimate Totals				
Description	*%of Total*		*Amount*	*Totals*
Labor		$	4,639,160	
Material		$	33,351,860	
Equipment		$	2,649,123	
Subcontract		$	11,760,428	
Subtotal Const Direct Costs				**$ 52,400,571**
Contractor Overhead	8.0%	$	3,954,760	
Contractor GC's	5.0%	$	2,471,725	
Construction Contingency	25.0%	$	14,706,764	
Project Escalation (2020)	4.6%	$	3,382,556	
Subtotal Field Const Indirect Costs				**$ 24,515,805**
Contractor Fee	12.0%	$	9,229,965	
Contractor's Bonds & Insurance	2.0%	$	1,722,927	
Washington State Sales Tax	8.0%	$	7,029,541	
B&O Tax	0.5%	$	425,287	
Subtotal Other Const Indirect Costs				**$ 18,407,720**
Total Construction Cost w/Tax				**$ 95,324,096**
HDR Contractor Design Assist		$	400,000	
HDR Design & Management Fee		$	11,500,000	
Total Project Cost				**$ 107,224,096**

Figure 3 Construction Cost Summary

Cost Basis

This estimate utilizes the following financial data for all pricing included. The direct costs and indirect cost percentages are based on experience, current market conditions, and historical data.

Direct Cost Methodology

- A combination of HDR Constructors database pricing, similar project costs, and historical data were used to establish direct costs
- The HDRC database was indexed for Yakima, WA
- 2017 RS Means labor rates.
- All labor is done on normal 8 hour days, 5 days a week Monday thru Friday.
- Subcontractor pricing includes mark-ups of
    1. 10% Field Overhead/General Conditions
    2. 15% Home Office Overhead and Profit

Indirect Cost Methodology

- General Contractor Mobilization & Demobilization – 6%
    - Set up and removal of all temporary facilities, including contractor field office
    - Equipment necessary for self performed scopes of work
    - Mob/Demob of all necessary construction equipment
    - Training of all field and craft personnel

- General Contractor Field OH – 8%
    - Field OH includes, but is not limited to the following:
        - Field project staff and standard burden
        - Procurement
        - Project controls/scheduling
        - Full time QA/QC, safety, and environmental staffing

- General Contractor Field General Conditions – 5%
    - Field general conditions include, but are not limited to the following:
        - Site office facilities adequate for staff required to manage project site
        - Field office staff vehicles and equipment
        - SWPPP and minor maintenance of SWPPP measures
        - Project consumables
        - Temporary utilities
        - Temporary facilities

- Washington State Sales Tax – 8%
- Washington State B&O Tax – 0.484%

- General Contractor Fee – 12%
    - Profit based on:
        - Local market conditions
        - Size and scope of project
        - Contacting method
        - Project Risk

- Construction contingency – 25%
    - See Level of Confidence

- General Contractor Bonds & Insurance – 2.0%
    - Bonds & Insurance includes the following (under normal conditions):
        - 0.75% - Bonds
        - 0.75%- General Liability
        - 0.5%- Marine Construction

- The following allowances are included
    - Fish screening under barge
    - Grading Existing Rock from Turnaround to Outlet Channel
    - PSE Design/Review Fee's
    - Existing road repair at project completion

- The following 2016 budgetary pricing was provided to HDR from individual vendors for use in this estimate
    - Pumps, motors, and drives
    - VFD's (2017 Budgetary Pricing Obtained)
    - Electrical Gear
    - Barge Modules

Assumptions/Exclusions

Assumptions:

- This work will be completed uninterrupted, only one mobilization and demobilization.
- This project will be worked on a standard work week.
- Project to be competitively bid, not sole sourced with a minimum of three bids.
- All regulatory approvals will be obtained by others prior to mobilization
- Any/all environmental impact studies and associated permitting will be completed by others prior to mobilization.
- Subcontractors and trade labor can be procured locally or within a radius that does not require per diem upcharges.
- Location provides for sufficient lay-down and staging area.
- All procurements by the Joint Venture and its subcontractor's.
- All existing soils are suitable for re-use as backfill and any spoils will be spread on site.
- All start-up and testing to be done by vendors, sub-contractors under supervision of GC.
- Temporary construction power is available

Exclusions:

- Accelerated schedule costs
- All permits, regulatory fees, environmental fees or requirements and acquisition of such.
- Any off-site storage facilities.
- Around the clock site security measures
- Extended warranty costs
- Handling/disposal of any hazardous materials.
- Any rock excavation or excavation of unforeseen underground obstacles
- SWPPP and marine construction abatement costs.

Level of Confidence

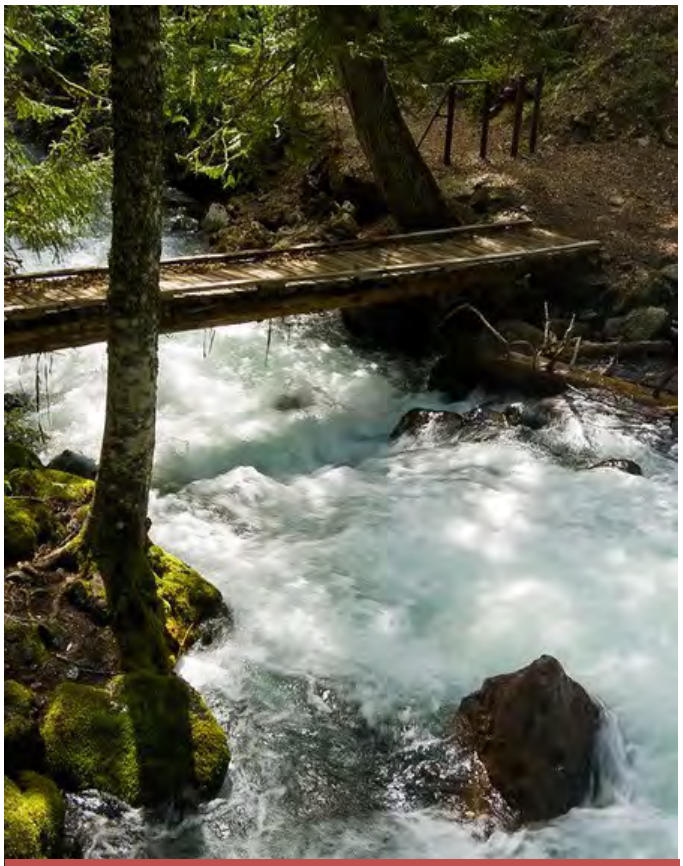
This is a Class V estimate as defined by AACE. The margin of error for this estimate classification is L: -25% / H: +50. According to these guidelines and the stated classifications, construction contingency would fall between 25% - 40% based on the conceptual design documents. The estimate utilizes 2017 RS Means as a basis for labor and it is understood that labor rates may adjust in an unknown direction based on future market conditions. The estimate incorporates a 25% construction contingency to account for fluctuating market conditions, evolution of the equipment specifications, increases to the prevailing wages and general design and estimate omissions.

Escalation

Project escalation calculated for estimated procurement of long lead items (pumps) beginning one year in advance of the start of construction. Construction is currently assumed to begin in March 2019, with completion anticipated on or before June 08, 2020. The escalation for this project is calculated utilizing the Bureau of Labor Statistics cost indexes. See Figure 4.

Single Weighted Avg Escalation			
% of Year End Committed Costs	Year	Escalation	
60%	2018	2.23%	
20%	2019	6.13%	
20%	2020	10.20%	
100%			***4.60%***

Figure 4: Escalation Weighted Average



Cost Reports

November 30, 2017

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Summary Roll-Up Estimate Report

Project name	**Roza Irrigation Alt 3 Pump Station** Easton WA
Labor rate table	CONC2017
Equipment rate table	CONC2017
Notes	Any opinions of probable construction cost or cost estimates provided by HDR, Inc. are made on the basis of information available to HDR, Inc. and on the basis of cost estimator's experience and qualifications, and represents its judgment as an experienced and qualified professional engineer. However, since HDR, Inc. has no control over the cost of labor, materials, equipment or services furnished by others, or over the contractor(s') methods of determining prices, or over competitive bidding or market conditions, HDR, Inc. does not guarantee that proposals, bids or actual project or construction cost will not vary from opinions of probable cost or cost estimates prepared by HDR, Inc.
Report format	Sorted by 'WBS_MAIN/WORK AREA/MF04_DIV/HDR04SPEC' 'WORK AREA' summary Allocate addons
Cost index	989-WA-YAKIMA

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Summary Roll-Up Estimate Report

Description		Quantity		Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
100 MOBILIZATION										
110	CONTACTOR MOBILIZATION/DEMOBILIZATION	1.00	LS			2,966,070			2,966,070.05 /LS	2,966,070
100 MOBILIZATION						***2,966,070***			***2,966,070.05 /LS***	***2,966,070***
1.00 LS										
200 CIVIL WORK										
210	EAST SHORE PARKING	1.00	LS	53,740	91,668	200,000	39,274		384,682.10 /LS	384,682
220	EAST SHORE BOAT RAMP (In-Reservoir)	1.00	LS	50,758	291,470		40,077		382,304.54 /LS	382,305
230	CONTROL BUILDING AREA (5,000 SF)	1.00	LS	346,647	287,316	16,000	48,362		698,324.98 /LS	698,325
275	RESERVOIR ROAD TURNAROUND	1.00	LS	102,465	90,525		65,238		258,227.86 /LS	258,228
200 CIVIL WORK				***553,610***	***760,979***	***216,000***	***192,951***		***1,723,539.48 /LS***	***1,723,539***
1.00 LS										
7,927.296	Labor hours									
2,347.527	Equipment hours									
300 MARINE WORK										
310	RESERVOIR DREDGING	1.00	LS	102,134		45,000	57,664		204,797.15 /LS	204,797
320	FLOW CONTROL STRUCTURE (W/4 BULKHEADS)	1.00	LS	270,870	435,921	64,800	1,307,679		2,079,270.48 /LS	2,079,270
330	OUTLET CHANNLE IMPROVEMENTS (INSIDE & OUTSIDE CHANNEL)	1.00	LS	568,183	767,470	89,157	191,002		1,615,812.78 /LS	1,615,813
340	DISCHARGE PIPES (3) & RIGID PIPE BRIDGE STRUCTURE	1.00	LS	7,394	224,250	30,800	320		262,763.95 /LS	262,764
350	DISCHARGE PIPES (3) & FLEXIBLE PIPE BRIDGE STRUCTURE	1.00	LS	1,540	520,000	653,900	13		1,175,453.69 /LS	1,175,454
360	PUMP BARGE & BARGE SYSTEMS	1.00	LS	993,030	6,198,542	120,000	826,371		8,137,942.78 /LS	8,137,943
370	PUMP BARGE CANTANARY ANCHORAGES	1.00	LS	45,478	801,930		18,180		865,588.95 /LS	865,589
300 MARINE WORK				***1,988,629***	***8,948,114***	***1,003,657***	***2,401,230***		***14,341,629.78 /LS***	***14,341,630***
1.00 LS										
22,657.250	Labor hours									
36,059.201	Equipment hours									
400 MECHANICAL WORK										

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Summary Roll-Up Estimate Report

Description	Quantity		Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
410 VERTICAL TURBINE PUMPS	1.00	LS	73,965	11,562,500		16,023		11,652,488.56 /LS	11,652,489
420 RIGHT ANGLE DRIVES	1.00	LS	49,310	4,500,000		9,614		4,558,924.150/LS	4,558,924
430 MOTORS	1.00	LS	49,310	2,062,500		9,614		2,121,424.15 /LS	2,121,424
440 ON-BARGE DISCHARGE PIPING	1.00	LS	872,026	1,455,990		12,881		2,340,896.48 /LS	2,340,896
400 MECHANICAL WORK			***1,044,612***	***19,580,990***		***48,132***		***20,673,733.34 /LS***	***20,673,733***
1.00 LS									
10,511.997 Labor hours									
1,760.001 Equipment hours									
500 ELECTRICAL WORK									
510 INTERCONNECTION TO PSE 115KV	1.00	LS			135,844			135,843.75 /LS	135,844
520 LAKE EASTON STEPDOWN SUBSTATION	1.00	LS			1,834,481			1,834,481.25 /LS	1,834,481
530 TWIN 34.5 KV BUIRED TRANSMISSION LINES	1.00	LS			2,447,125			2,447,125.00 /LS	2,447,125
540 KACHESS RESERVOIR STEP DOWN SUBSTATION	1.00	LS			1,260,644			1,260,643.75 /LS	1,260,644
550 CONTROL BUILDING & ELECTRICAL EQUIPMENT	1.00	LS	880,959	3,554,312		6,811		4,442,082.730/LS	4,442,083
560 MARINE CABLES TO BARDGE (4)	1.00	LS	154,019	401,416				555,434.85 /LS	555,435
570 BARGE ELECTRICAL SYSTEMS	1.00	LS	17,331	106,048				123,379.22 /LS	123,379
500 ELECTRICAL WORK			***1,052,309***	***4,061,777***	***5,678,094***	***6,811***		***10,798,990.55 /LS***	***10,798,991***
1.00 LS									
13,714.636 Labor hours									
179.992 Equipment hours									
600 FISH PASSAGE									
610 NARROWS VOLITIONAL UPSTREAM FISH PASSAGE (In-Reservoir) Phase 1	1.00	LS			1,646,608			1,646,607.50 /LS	1,646,608
600 FISH PASSAGE					***1,646,608***			***1,646,607.50 /LS***	***1,646,608***
1.00 LS									
700 PSE DESIGN/REVIEW									
710 INTERCONNECTION & TRANSMISSION SYSTEM DESIGN/REVIEW	1.00	LS			250,000			250,000.00 /LS	250,000
700 PSE DESIGN/REVIEW					***250,000***			***250,000.00 /LS***	***250,000***
1.00 LS									

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Summary Roll-Up Estimate Report

11/30/2017

Design Stage:

Estimate Version: R00

Estimate Totals

Description	Amount	Totals	Rate
Labor	4,639,160		
Material	33,351,860		
Equipment	2,649,123		
Subcontract	11,760,428		
Subtotal Direct Project Costs	**52,400,571**	**52,400,571**	
Contractor Overhead	3,954,760		8.000 %
Contractor GC's	2,471,725		5.000 %
Field Construction Costs	**6,426,485**	**58,827,056**	
Sales Tax Estimate (GRT Below)			
Subtotal Field Const Costs		**58,827,056**	
Construction Contingency	14,706,764		25.000 %
Field Const w/ Contingency	**14,706,764**	**73,533,820**	
Project Escalation (2020)	3,382,556		4.600 %
Escalated Construction Costs	**3,382,556**	**76,916,376**	
Contractor Fee	9,229,965		12.000 %
Construction Cost w/ Fee	**9,229,965**	**86,146,341**	
Contractor's Bonds & Insurance	1,722,927		2.000 %
Total Construction Costs	**1,722,927**	**87,869,268**	
Washington State Sales Tax	7,029,541		8.000 %
B&O Tax	425,287		0.484 %
Total Construction Cost w/ Tax	**7,454,828**	**95,324,096**	
HDR Contractor Design Assist	400,000		
HDR Design & Management Fee	11,500,000		
Total		***107,224,096***	

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Work Area Estimate Report

Project name	**Roza Irrigation Alt 3 Pump Station** Easton WA
Labor rate table	CONC2017
Equipment rate table	CONC2017
Notes	Any opinions of probable construction cost or cost estimates provided by HDR, Inc. are made on the basis of information available to HDR, Inc. and on the basis of cost estimator's experience and qualifications, and represents its judgment as an experienced and qualified professional engineer. However, since HDR, Inc. has no control over the cost of labor, materials, equipment or services furnished by others, or over the contractor(s') methods of determining prices, or over competitive bidding or market conditions, HDR, Inc. does not guarantee that proposals, bids or actual project or construction cost will not vary from opinions of probable cost or cost estimates prepared by HDR, Inc.
Report format	Sorted by 'WBS_MAIN/MF04_DIV/HDR04SPEC' 'HDR04SPEC' summary Allocate addons
Cost index	989-WA-YAKIMA

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Work Area Estimate Report

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
100 MOBILIZATION								
DIVISION 01	**GENERAL REQUIREMENTS**							
01 71 13.000	Mobilization / Demobilization			2,966,070				2,966,070
DIVISION 01 GENERAL REQUIREMENTS				**2,966,070**				**2,966,070**
100 MOBILIZATION		***0***	***0***	***2,966,070***	***0***	***0***	***2,966,070.05 /LS***	***2,966,070***
1.00 LS								
200 CIVIL WORK								
DIVISION 01	**GENERAL REQUIREMENTS**							
01 21 00.000	Allowances			200,000				200,000
DIVISION 01 GENERAL REQUIREMENTS				**200,000**				**200,000**
DIVISION 03	**CONCRETE**							
03.30.00.011a	Excavation for Building Slab Foundation	17,579			21,303			38,883
03.30.00.011b	Spread Footing (5'x5' wide) Storage Building	16,127	32,557		1,326			50,009
03.30.00.011c	Grade Beam (4' Tall x 1'-6" Wide) Storage Building	41,966	41,655		1,792			85,413
03.30.00.011d	Storage Bldg Slab on Grade (Assume 6" Thick)	51,838	84,738		5,875			142,452
DIVISION 03 CONCRETE		**127,511**	**158,949**		**30,296**			**316,756**
1,748.253	Labor hours							
457.258	Equipment hours							
DIVISION 04	**MASONRY**							
04 22 00.000	Concrete Masonry Unit	61,450	43,219		891			105,559
DIVISION 04 MASONRY		**61,450**	**43,219**		**891**			**105,559**
1,016.232	Labor hours							
43.846	Equipment hours							
DIVISION 07	**THERMAL, MOISTURE PROTECTION**							
07 61 13.000	Metal Roofing	15,838	18,000					33,838
07 72 33.000	Roof Hatches	1,882	2,188					4,069

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Work Area Estimate Report

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
DIVISION 07 THERMAL, MOISTURE PROTECTION		**17,720**	**20,188**					**37,908**
237.312 Labor hours								
DIVISION 08 OPENINGS								
08 11 00.000 Metal Doors & Frames		5,357	7,188					12,544
08 33 23.000 Steel Rolling Overhead Doors		595	2,144					2,739
DIVISION 08 OPENINGS		**5,952**	**9,332**					**15,283**
88.889 Labor hours								
DIVISION 09 FINISHES								
09 29 00.000 Gypsum Board		21,639						21,639
09 53 00.000 Acoustical Suspension System		3,096	4,908					8,004
09 67 00.000 Epoxy Flooring System		8,676	12,948		328			21,952
09 91 00.000 Painting and Protective Coatings		9,563	5,000					14,563
DIVISION 09 FINISHES		**42,974**	**22,856**		**328**			**66,158**
834.208 Labor hours								
75.84 Equipment hours								
DIVISION 12 FURNISHINGS								
12 90 00.000 Other Furnishings				16,000				16,000
DIVISION 12 FURNISHINGS				**16,000**				**16,000**
DIVISION 31 EARTHWORK								
31 23 00.000 Earthwork		13,030	68,920		12,425			94,374
31 23 00.002 Clearing and Grubbing		38,786			24,442			63,229
31 23 00.202 Gravel Parking Lot (6" thick)		3,863	22,748		3,629			30,241
31.00.00.010 Temporary Erosion & Sediment Control		6,123	1,908					8,031
31.10.00.021 Topsoil Stripping, Geofabric, and Gravel Subgrade for Boat Ramp		20,729	142,019		21,720			184,469
31.30.00.010d Turn Around GeoFab and 2' Roadbase		1,979	13,488		1,920			17,387
31.30.00.010e Turn Around Slope Protection		50,050	18,529		9,490			78,069
31.30.00.010f Turn Around Road Base Fabric and 2' Sand		18,896	57,281		20,171			96,348
31.30.00.032 Turn Around Access Road Excavation		27,602			33,658			61,260
DIVISION 31 EARTHWORK		**181,060**	**324,893**		**127,455**			**633,408**
2,337.209 Labor hours								
1,460.732 Equipment hours								
DIVISION 33 UTILITIES								
33 20 00.001 Septic Tanks and Leach Field		89,101	32,773		15,625			137,499

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
DIVISION 33 UTILITIES		**89,101**	**32,773**		**15,625**			**137,499**
1,305.194 Labor hours								
249.851 Equipment hours								
DIVISION 35	**WATERWAY & MARINE CONSTRUCTION**							
03 41 33.000	Precast and Prestressed Concrete	27,841	148,770		18,356			194,968
DIVISION 35 WATERWAY & MARINE CONSTRUCTION		**27,841**	**148,770**		**18,356**			**194,968**
360.00 Labor hours								
60.00 Equipment hours								
200 CIVIL WORK		***553,610***	***760,979***	***216,000***	***192,951***	***0***	***1,723,539.46 /LS***	***1,723,539***
1.00 LS								
7,927.296 Labor hours								
2,347.527 Equipment hours								

300 MARINE WORK

DIVISION 01	**GENERAL REQUIREMENTS**							
01 50 00.001	Crawler Crane (Land Based)	66,145			247,750			313,895
01 50 00.201	Tugboat				336,971			336,971
DIVISION 01 GENERAL REQUIREMENTS		**66,145**			**584,721**			**650,865**
624.00 Labor hours								
1,040.00 Equipment hours								
DIVISION 03	**CONCRETE**							
03.30.00.015b	Water Impact Slab on Grade (Assume 100'x40'x18" Thick)	78,459	105,843		7,357			191,658
03.40.00.020a	Outlet Channel SOG	34,629	46,245		3,921			84,795
DIVISION 03 CONCRETE		**113,087**	**152,088**		**11,278**			**276,453**
1,502.961 Labor hours								
256.223 Equipment hours								
DIVISION 05	**METALS**							
05.10.00.030	Rigid Pipe Bridge	7,394	224,250	30,800	320			262,764
05.10.00.031	Flexible Pipe Bridge	1,540	520,000	653,900	13			1,175,454
DIVISION 05 METALS		**8,934**	**744,250**	**684,700**	**334**			**1,438,218**
87.00 Labor hours								
37.50 Equipment hours								
DIVISION 10	**SPECIALTIES**							
10.00.00.011	Floating Crane (for Marine Construction)	172,736	352,500		219,375			744,611

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Work Area Estimate Report

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
10.00.00.020	Self Adjusted Barge Tensioning Anchors	5,467	453,750					459,217
10.00.00.070	Discharge Basin Dock Piles	12,684	31,413		5,074			49,170
DIVISION 10 SPECIALTIES		**190,886**	**837,663**		**224,449**			**1,252,998**
	2,051.991 Labor hours							
	921.152 Equipment hours							
DIVISION 13	**SPECIAL CONSTRUCTION**							
13 10 00. 010	Chain Catenary Anchors	17,329	185,088		18,180			220,597
13 10 00.005	Barge (81' L x 90' w x 8' dp)	276,383	4,795,000	120,000	28,950			5,220,334
13 10 00.015	Cable Catenary Anchors	22,683	163,093					185,775
DIVISION 13 SPECIAL CONSTRUCTION		**316,395**	**5,143,180**	**120,000**	**47,130**			**5,626,705**
	3,765.230 Labor hours							
	1,968.000 Equipment hours							
DIVISION 31	**EARTHWORK**							
03.30.00.015a	Excavation & Backfill	14,628			6,322			20,950
31 23 00.000	Earthwork	134,358	84,400		26,967			245,725
31 40 00.000	Shoring & Underpinning	332,877	569,288		182,568			1,084,733
31 62 16.000	Driven Steel Piling	76,675	397,355		31,540			505,570
31.00.00.010	Temporary Erosion & Sediment Control	3,936	1,226					5,163
31.30.00.010c	Access Road Slope Protection	75,486	27,945		14,313			117,744
31.30.00.030	Discharge Basin Armoring	48,027	24,428		9,417			81,873
31.30.00.031	Stilling Basin Excavation	30,921			37,577			68,498
31.30.00.040	Outlet Channel Slope Protection	44,000	145,894		29,192			219,086
DIVISION 31 EARTHWORK		**760,909**	**1,250,536**		**337,896**			**2,349,342**
	8,287.147 Labor hours							
	2,926.191 Equipment hours							
DIVISION 32	**EXTERIOR IMPROVEMENTS**							
01 21 00.001	Regrade Existing Road			89,157				89,157
DIVISION 32 EXTERIOR IMPROVEMENTS				**89,157**				**89,157**
DIVISION 35	**WATERWAY & MARINE CONSTRUCTION**							
01 71 13.000	Mobilization / Demobilization	287		45,000	564			45,852
03 41 33.000	Precast and Prestressed Concrete	154,133	394,514		48,779			597,426
35 20 00.000	Waterway & Marine Construction & Equipment	101,846			57,099			158,946
35 20 00.000a	Temporary Flume at Outlet Structure	164,367	95,805		42,729			302,901
35 20 00.001	Slide Gates (8' x 10' Stainless Steel)	71,629	278,164		4,447			354,240
35 70 00.010	Cofferdam (2 each for Flow Control Structure Construction)	40,009	51,915	64,800	1,041,804			1,198,528

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Work Area Estimate Report

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
DIVISION 35 WATERWAY & MARINE CONSTRUCTION		**532,273**	**820,398**	**109,800**	**1,195,421**			**2,657,892**
6,338.92 Labor hours								
28,910.136 Equipment hours								
300 MARINE WORK		***1,988,629***	***8,948,114***	***1,003,657***	***2,401,230***	***0***	***14,341,629.78 /LS***	***14,341,630***
1.00 LS								
22,657.250 Labor hours								
36,059.201 Equipment hours								

400 MECHANICAL WORK

DIVISION 40 PROCESS INTEGRATION

40 05 10.001	Pipe: Steel - 72" Discharge Piping	872,026	1,455,990		12,881			2,340,896
DIVISION 40 PROCESS INTEGRATION		**872,026**	**1,455,990**		**12,881**			**2,340,896**
8,495.997 Labor hours								
1,496.001 Equipment hours								

DIVISION 43 PROCESS GAS & LIQUID HANDLING, PURIFICATION & STORAGE EQUIPMENT

43 21 07.000	Pumping Equipment: Vertical Turbine	73,965	11,562,500		16,023			11,652,489
43 21 07.005	Right Angle Drives	49,310	4,500,000		9,614			4,558,924
43 21 07.010	Pump Motors	49,310	2,062,500		9,614			2,121,424
DIVISION 43 PROCESS GAS & LIQUID HANDLING, PURIFICATION & STORAGE EQUIPMENT		**172,586**	**18,125,000**		**35,251**			**18,332,837**
2,016.00 Labor hours								
264.00 Equipment hours								
400 MECHANICAL WORK		***1,044,612***	***19,580,990***	***0***	***48,132***	***0***	***20,673,733.34 /LS***	***20,673,733***
1.00 LS								
10,511.997 Labor hours								
1,760.001 Equipment hours								

500 ELECTRICAL WORK

DIVISION 13 SPECIAL CONSTRUCTION

26 09 00.000	Instrumentation & Control for Electrical Systems	49,744	237,924					287,668

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
DIVISION 13 SPECIAL CONSTRUCTION		**49,744**	**237,924**					**287,668**
649.627 Labor hours								
DIVISION 26 ELECTRICAL								
23 00 00.000	HVAC Basic Materials and Methods	13,344	4,829					18,174
26 00 00.000	Basic Electrical Materials and Methods	84,576	56,602					141,177
26 05 00.000	Electrical: Basic Requirements		26,250					26,250
26 05 19.000	Wire and Cable: 600 volt and below	7,767	9,776					17,543
26 05 26.000	Grounding	10,315	6,626					16,942
26 05 33.000	Raceways and Boxes	31,624	27,814					59,438
26 05 99.000	Power Distribution			2,582,969				2,582,969
26 11 16.000	Unit Substation			3,095,125				3,095,125
26 13 26.000	Variable Frequency Drives: Medium Voltage	60,630	1,773,805		1,747			1,836,182
26 27 26.000	Wiring Devices	4,403	1,638					6,041
26 50 00.000	Interior and Exterior Lighting	13,464	11,774					25,238
26.00.00.010	Electrical for Building	494,536	1,168,277		3,800			1,666,612
26.00.00.020	Motor Control Centers	53,839	179,065		375			233,280
26.30.00.010	Hook-up Electrical Generator to Building	48,014	150,495		889			199,397
26.30.00.040	Marine Cable Route	54,188	50,574					104,762
26.30.00.050	Combined Power & I/C Marine Cable	104,034	337,575					441,609
28 31 00.000	Fire Alarm System	21,831	18,752					40,583
DIVISION 26 ELECTRICAL		**1,002,565**	**3,823,852**	**5,678,094**	**6,811**			**10,511,322**
13,065.008 Labor hours								
179.992 Equipment hours								
500 ELECTRICAL WORK		***1,052,309***	***4,061,776***	***5,678,094***	***6,811***	***0***	***10,798,990.56 /LS***	***10,798,991***
1.00 LS								
13,714.636 Labor hours								
179.992 Equipment hours								

600 FISH PASSAGE

DIVISION 31 EARTHWORK								
31 23 00.035	KACHESS NARROWS FISH PASSAGE - Subcontractor (PHASE 1)			1,646,608				1,646,608

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

Roza Irrigation KFPPA
Kachess Floating Pumping Plant
Work Area Estimate Report

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Other Amount	Total Unit Cost	Total Amount
DIVISION 31 EARTHWORK				**1,646,608**				**1,646,608**
600 FISH PASSAGE		***0***	***0***	***1,646,608***	***0***	***0***	***1,646,607.51 /LS***	***1,646,608***
	1.00 LS							

700 PSE DESIGN/REVIEW

DIVISION 01	**GENERAL REQUIREMENTS**							
01 21 00.702	PSE Design/Review Fee			250,000				250,000
DIVISION 01 GENERAL REQUIREMENTS				**250,000**				**250,000**
700 PSE DESIGN/REVIEW		***0***	***0***	***250,000***	***0***	***0***	***250,000.00 /LS***	***250,000***
	1.00 LS							

Roza Irrigation KFPPA

Kachess Floating Pumping Plant

Work Area Estimate Report

Estimate Totals

Description	Amount	Totals	Rate
Labor	4,639,160		
Material	33,351,860		
Equipment	2,649,123		
Subcontract	11,760,428		
Subtotal Direct Project Costs	**52,400,571**	**52,400,571**	
Contractor Overhead	3,954,760		8.000 %
Contractor GC's	2,471,725		5.000 %
Field Construction Costs	**6,426,485**	**58,827,056**	
Sales Tax Estimate (GRT Below)			
Subtotal Field Const Costs		**58,827,056**	
Construction Contingency	14,706,764		25.000 %
Field Const w/ Contingency	**14,706,764**	**73,533,820**	
Project Escalation (2020)	3,382,556		4.600 %
Escalated Construction Costs	**3,382,556**	**76,916,376**	
Contractor Fee	9,229,965		12.000 %
Construction Cost w/ Fee	**9,229,965**	**86,146,341**	
Contractor's Bonds & Insurance	1,722,927		2.000 %
Total Construction Costs	**1,722,927**	**87,869,268**	
Washington State Sales Tax	7,029,541		8.000 %
B&O Tax	425,287		0.484 %
Total Construction Cost w/ Tax	**7,454,828**	**95,324,096**	
HDR Contractor Design Assist	400,000		
HDR Design & Management Fee	11,500,000		
Total		***107,224,096***	

AACE Classification Accuracy Range

Upper Range +50% **Lower Range -25%**

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Attachment C
Orion Marine Group OPCC

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ESTIMATE SUMMARY - COSTS & BID PRICES

Bid#	Client# / Bid Description	Quantity	Unit	Manhours	Direct Labor	Perm Matl	Constr Matl	Equip-ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Total Cost Unit Price	Markup	Balanced Bid Total	Balanced Bid Unit Price		Bid Price	Bid Total
1000	100	1.00	LS	10,062	895,721		390,478	2,526,225	617,941	4,430,365		4,430,365	4,430,364.52		4,430,365	4,430,364.52	F	4,450,000.00	4,450,000.00
MOBILIZATION				10,061.76															
-SUBTOTAL (MOB)				10,061	895,720		390,477	2,526,225	617,941	4,430,364		4,430,364			4,430,364				4,450,000.00
2000	200	1.00	LS																
CIVIL																			
2300		1.00	LS	600	46,381			16,740	50,000	113,121		113,121	113,121.04		113,121	113,121.04	F	100,000.00	100,000.00
CIVIL: LS-2 CONTROL BUILDING AREA (5000				600.00															
2500		1.00	LS	1,140	88,064	71,500		59,994	106,500	326,058		326,058	326,058.45		326,058	326,058.45	F	325,000.00	325,000.00
CIVIL: LS-3 EAST SHORE MARINA AREA (3 AC				1,140.00															
2600		1.00	LS	900	69,460	597,000		26,730	7,500	700,690		700,690	700,689.99		700,690	700,689.99	F	700,000.00	700,000.00
CIVIL: LS-3 EAST SHORE BOAT RAMP (20 X 6				900.00															
2750		1.00	LS	480	37,045	138,250		14,256	168,750	358,301		358,301	358,301.33		358,301	358,301.33	F	350,000.00	350,000.00
CIVIL: LS-3 ACCESS ROAD TO FLOW CONTROL				480.00															
-SUBTOTAL (CIVIL)				3,120	240,950	806,750		117,720	332,750	1,498,170		1,498,170			1,498,170				1,475,000.00
3000	300	0.00																	
MARINE																			
3300		1.00	LS	600	47,039		140,400	139,400		326,839		326,839	326,838.93		326,839	326,838.93	F	325,000.00	325,000.00
MARINE: RESERVOIR DREDGING				600.00															
3400		1.00	LS	7,211	612,265	891,250	16,941	1,564,828	93,529	3,178,813		3,178,813	3,178,813.20		3,178,813	3,178,813.20	F	3,175,000.00	3,175,000.00
MARINE: FLOW CONTROL STRUCTURE (W/ 4 GAT				7,210.78															
3500		1.00	LS	3,000	231,675	596,750		201,480	584,100	1,614,005		1,614,005	1,614,005.47		1,614,005	1,614,005.47	F	1,615,000.00	1,615,000.00
MARINE: OUTLET CHANNEL				3,000.00															
3600		1.00	LS	1,358	107,707	320,500	847	173,944	2,176	605,174		605,174	605,174.47		605,174	605,174.47	F	600,000.00	600,000.00
MARINE: PIPE BRIDGE STRUCTURES, RIGID				1,358.04															
3700		1.00	LS	2,338	183,447	3,665,100	847	267,968	2,176	4,119,539		4,119,539	4,119,539.16		4,119,539	4,119,539.16	F	4,100,000.00	4,100,000.00
MARINE: PIPE BRIDGE STRUCTURES, FLEXIBLE				2,338.04															
3800		1.00	LS	5,591	485,214	4,495,000	148,941	1,296,222	383,529	6,808,906		6,808,906	6,808,906.42		6,808,906	6,808,906.42	F	7,000,000.00	7,000,000.00
MARINE: PUMP BARGE FACILITIES				5,590.78															
3900		1.00	LS	1,680	129,841	1,017,500	27,000	161,184	58,500	1,394,025		1,394,025	1,394,025.26		1,394,025	1,394,025.26	F	1,200,000.00	1,200,000.00
MARINE: BARGE ANCHORING				1,680.00															

Bid# / Client# / Bid Description	Quantity	Unit	Manhours	Direct Labor	Perm Matl	Constr Matl	Equip-ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Total Cost Unit Price	Markup	Balanced Bid Total	Balanced Bid Unit Price		Bid Price	Bid Total
-SUBTOTAL (MARINE)			21,777	1,797,188	10,986,100	334,976	3,805,025	1,124,011	18,047,302		18,047,302			18,047,302				18,015,000.00
4000 400 ***MECHANICAL***	0.00																	
4100 MECHANICAL: VERTICAL TURBINE PUMPS	1.00	LS	3,521 3,520.59	313,328	9,250,000	282,706	1,004,042	92,647	10,942,722		10,942,722	10,942,722.49		10,942,722	10,942,722.49	F	10,900,000.00	10,900,000.00
4200 MECHANICAL: RIGHT ANGLE DRIVES	1.00	LS	420 420.00	32,460	3,600,000		40,296	60,000	3,732,756		3,732,756	3,732,756.32		3,732,756	3,732,756.32	F	3,800,000.00	3,800,000.00
4300 MECHANICAL: MOTORS	1.00	LS	630 630.00	48,690	1,725,000		60,444		1,834,134		1,834,134	1,834,134.49		1,834,134	1,834,134.49	F	1,800,000.00	1,800,000.00
4400 MECHANICAL: DISCHARGE PIPING	1.00	LS	910 910.00	71,868	687,500		87,308		846,676		846,676	846,676.20		846,676	846,676.20	F	900,000.00	900,000.00
-SUBTOTAL (MECHANICAL)			5,480	466,346	15,262,500	282,705	1,192,089	152,647	17,356,289		17,356,289			17,356,289				17,400,000.00
5000 500 ***ELECTRICAL***	0.00																	
5100 ELECTRICAL: INTERCONNECT TO PSE 115 KV	1.00	LS						150,000	150,000		150,000	150,000.00		150,000	150,000.00	F	150,000.00	150,000.00
5200 ELECTRICAL: LAKE EASTON STEPDOWN SUBSTAT	1.00	LS						1,850,000	1,850,000		1,850,000	1,850,000.00		1,850,000	1,850,000.00	F	1,850,000.00	1,850,000.00
5300 ELECTRICAL: TWIN 34.5 KV BURIED TRANSMIS	1.00	LS						2,500,000	2,500,000		2,500,000	2,500,000.00		2,500,000	2,500,000.00	F	2,500,000.00	2,500,000.00
5400 ELECTRICAL: KACHESS RESERVOIR STEPDOWN S	1.00	LS						1,250,000	1,250,000		1,250,000	1,250,000.00		1,250,000	1,250,000.00	F	1,250,000.00	1,250,000.00
5500 ELECTRICAL: CONTROL BUILDING & ELECTRICA	1.00	LS						3,500,000	3,500,000		3,500,000	3,500,000.00		3,500,000	3,500,000.00	F	3,500,000.00	3,500,000.00
5600 ELECTRICAL: MARINE CABLES TO BARGE (4)	1.00	LS	1,050 1,050.00	81,151	1,500,000		100,740	412,500	2,094,391		2,094,391	2,094,390.79		2,094,391	2,094,390.79	F	2,100,000.00	2,100,000.00
5700 ELECTRICAL: BARGE ELECTRICAL SYSTEM	1.00	LS						500,000	500,000		500,000	500,000.00		500,000	500,000.00	F	500,000.00	500,000.00
-SUBTOTAL (ELECTRICAL)			1,050	81,150	1,500,000		100,740	10,162,500	11,844,390		11,844,390			11,844,390				11,850,000.00

Bid# / Client# / Bid Description	Quantity	Unit	Manhours	Direct Labor	Perm Matl	Constr Matl	Equip-ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Total Cost Unit Price	Markup	Balanced Bid Total	Balanced Bid Unit Price		Bid Price	Bid Total
6000 600 ***FISH PASSAGE***	0.00																	
6100 FISH: NARROWS UPSTREAM FISH PASSAGE (PHAS	1.00	LS						1,918,000	1,918,000		1,918,000	1,918,000.00		1,918,000	1,918,000.00	F	1,918,000.00	1,918,000.00
-SUBTOTAL (FISH PASSAGE)								1,918,000	1,918,000		1,918,000			1,918,000				1,918,000.00
6500 700 ***PSE***	0.00																	
6600 PSE: INTERCONNECT/ TRANSMISSION SYSTEM D	1.00	LS						250,000	250,000		250,000	250,000.00		250,000	250,000.00	F	250,000.00	250,000.00
-SUBTOTAL (PSE)								250,000	250,000		250,000			250,000				250,000.00
Totals:			41,489	3,481,357	28,555,350	1,008,160	7,741,800	14,557,850	55,344,518		55,344,518 [55,344,515]			55,344,518				55,358,000.00 [0.0 %]

Code between Balanced Bid & Bid Price: U=Unbalanced, F=Frozen, C=Closing Biditem (item to absorb unbalancing differences).
[bracketed numbers represent adjusted quantities]
** in front of the Biditem indicates a Non-Additive item

Markup % is shown as a percentage of cost

Ins Direct (BRI) Call 4Qu	% of JB
Ins. Indirect (Gen. Lia)	% of JB
B&O Tax (0.50% WA + City)	% of JB
Duty - Foreign Materials	LS
Contingency	% of TC
Retainage Bond ($6.50/Tho	% of JB
Zone Pay Adjustment	% of DH
Markup on Resource Costs	

********* TOTAL	JOB =====>		41,489	3,481,357	28,555,350	1,008,160	7,741,800	14,557,850	55,344,518		55,344,518			55,344,518				55,358,000.00

Spread Indirects On TOTAL COST Spread Markups On TOTAL COST Spread Addons&Bonds On TOTAL COST

-----Estimate Notes-----
Bid Date: 12/01/2017 Owner: Engineering Firm:

ESTIMATE SUMMARY - COSTS & BID PRICES

Bid#	Client# / Bid Description	Quantity	Unit	Manhours	Direct Labor	Perm Matl	Constr Matl	Equip-ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Total Cost Unit Price	Markup	------Balanced Bid------ Total	Unit Price	Bid Price	Bid Total

Estimator in Charge: 01

Desired Bid (if specified)= 0.00 Sort: Hold Acct: N Subitem: N NonAdd: N
Last Summary on 01/24/2018 at 10:13 AM.
Last Spread on 03/07/2018 at 9:34 AM.

Attachment D
Construction Schedule

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	YEAR	2019																																																			
	MONTH	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr	May	May	May	May	May	Jun	Jun	Jun	Jun	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Aug	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec
	WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Long Lead Procurement Items																																																				
	Vertical Column Discharge Pumps (3) (64 Weeks)							🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
	Motor (52 Weeks)																			🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
	Right Angle Drive (46 Weeks)																									🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
	Cardanic Joints (52 Weeks)																															🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
	Pipes (26 weeks)																																																				
	Switchgear & Transformer (30 weeks)																																				🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
	VFD (36 weeks)																														🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
	Marine Cable (36 weeks)																				🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
SPREAD 1 - WORKING BARGE & CRANE																																																				
1	DREDGING (CLAMSHELL AND SIDECAST)																																																				
2	CONSTRUCT COMBI-WALL																																																				
3	CONSTRUCT TEMPORARY FLUME																																																				
DRY SIDE COMBI-WALL FEATURES																																																				
4	IMPACT SLAB CONCRETE PLACEMENT																																																				
5	INSTALLATION OF FOUR (4) BULKHEADS																																																				
6	CHANNEL SIDESLOPE RIP RAP PLACEMENT																																																				
WET SIDE COMBI-WALL FEATURES																																																				
7	ON-SHORE CHAIN PIPE PILES																																																				
8	FIXED PIPE SUBSTRUCTURE CONSTRUCTION																																																				
9	ARTICULATED CONCRETE MAT PLACEMENT																																																				
10	RIP RAP PLACEMENT																																																				
11	FIXED PIPE INSTALLATION																																																				
SPREAD 2 - WORKING BARGE & CRANE																																																				
1	MARINE ELECTRICAL CABLE PLACEMENT																																																				
2	OFF-SHORE ANCHORS & CABLE PLACEMENT																																																				
3	ON-SHORE CHAIN PLACEMENT																																																				
4	TESTING OF ANCHORS																																																				
PUMP BARGE																																																				
5	ON-SHORE ASSEMBLY-WELD, PAINT & PREPARE																																																				
6	OUTFIT BARGE AS MUCH AS POSSIBLE ON LAND																																																				
7	LAUNCH & TEMPORARILY MOOR BARGE																																																				
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9	FINAL MOORING OF BARGE																																																				
FLEXIBLE PIPE BRIDGE																																																				
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11	LAUNCHING OF THREE FLEXIBLE PIPE BRIDGES																																																				
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13	FINAL CONNECTIONS																																																				
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15	FISH NET INSTALLATION																																																				
16	COMMISSIONING OF FLOATING PUMPING PLANT																																																				

	YEAR	2020																																																		
	MONTH	Year 2	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr	Apr	May	May	May	May	Jun	Jun	Jun	Jun	Jul	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Sep	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec
	WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Long Lead Procurement Items																																																					
	Vertical Column Discharge Pumps (3) (64 Weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																																	
	Motor (52 Weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																																	
	Right Angle Drive (46 Weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																																	
	Cardanic Joints (52 Weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																					
	Pipes (26 weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																									
	Switchgear & Transformer (30 weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																																						
	VFD (36 weeks)	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																																						
	Marine Cable (36 weeks)	🟧	🟧	🟧																																																
SPREAD 1 - WORKING BARGE & CRANE															🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩									
1	DREDGING (CLAMSHELL AND SIDECAST)														🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩																														
2	CONSTRUCT COMBI-WALL																						🟩	🟩	🟩	🟩	🟩	🟩	🟩																							
3	CONSTRUCT TEMPORARY FLUME																											🟨	🟨																							
DRY SIDE COMBI-WALL FEATURES																																																					
4	IMPACT SLAB CONCRETE PLACEMENT																												🟨	🟨	🟨	🟨	🟨																			
5	INSTALLATION OF FOUR (4) BULKHEADS																												🟨	🟨	🟨	🟨	🟨	🟨	🟨																	
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9	ARTICULATED CONCRETE MAT PLACEMENT																																		🟩	🟩	🟩	🟩														
10	RIP RAP PLACEMENT																																						🟩	🟩												
11	FIXED PIPE INSTALLATION																																								🟩	🟩	🟩	🟩									
SPREAD 2 - WORKING BARGE & CRANE										🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦					
1	MARINE ELECTRICAL CABLE PLACEMENT									🟦	🟦	🟦	🟦	🟦																																							
2	OFF-SHORE ANCHORS & CABLE PLACEMENT														🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦																														
3	ON-SHORE CHAIN PLACEMENT																											🟨	🟨	🟨	🟨																					
4	TESTING OF ANCHORS																															🟨	🟨	🟨																		
PUMP BARGE																																																					
5	ON-SHORE ASSEMBLY-WELD, PAINT & PREPARE									🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨																													
6	OUTFIT BARGE AS MUCH AS POSSIBLE ON LAND														🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨																													
7	LAUNCH & TEMPORARILY MOOR BARGE																						🟦	🟦	🟦																											
8	PUMP, MOTOR & RIGHT ANGLE DRIVE INSTALLATION																									🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦																		
9	FINAL MOORING OF BARGE																																		🟦																	
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13	FINAL CONNECTIONS																																			🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨									
14	SECURITY BOOM INSTALLATION																																												🟦	🟦							
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16	COMMISSIONING OF FLOATING PUMPING PLANT																																												🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	