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WATER RESOURCES DEPT.
SALEM, OREGON

**BOARDMAN COAL PLANT
CARTY RESERVOIR
FINAL PROOF REPORT
AND
CLAIM TO BENEFICIAL USE
PERMIT R 6276**

**PORTLAND GENERAL ELECTRIC COMPANY
PORTLAND, OREGON**

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R 6276

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B. Final Proof Map

Drawing D-10820

C. Reference Drawings

Drawing	D10728
"	HC-1079
"	HC-102
"	HC-103
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"	D10820

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SALEM, OREGON

BOARDMAN COAL PLANT
CARTY RESERVOIR FINAL PROOF REPORT
AND CLAIM TO BENEFICIAL USE
Application No. 51520, Permit No. R 6276

1. Name of Registrant: Portland General Electric Company (PGE)

Mailing Address: 121 SW Salmon Street
Portland, Oregon 97204
Attention: Robin Tompkins
Telephone No.: 503-464-8850

2. Source of Water: Columbia River

3. Reservoir Location: The reservoir is located approximately
12 miles southwest of Boardman, Oregon,
just south of the Columbia River in
Morrow County.

4. General Description

The Boardman Plant is a nominal 540 MW coal-fired-electric generating plant located about 12 miles southwest of Boardman, Oregon, and about 10 miles south of the Columbia River. The major plant components include the power building complex, the coal unloading/handling facility, and the cooling reservoir. The 1450 acre cooling reservoir (Carty Reservoir) provides all the cooling and process water for the plant. This includes water for condenser cooling, service water, fire protection, coal dust suppression, ash handling, and boiler makeup. Water for the reservoir is supplied by an existing farm irrigation system through a pumping plant located on Willow Creek Cove, an arm of the Columbia River. The Boardman Plant was constructed during the years 1976 through 1979 and cost approximately \$500 million to build. Drawing D-10728 (included under reference drawings) shows the locations of the diversion point, pumping plant, pipelines, reservoir, and plant site.

The following paragraphs describe the various components of Carty Reservoir.

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A. CARTY RESERVOIR

Carty Reservoir is a 1450 acre cooling pond for the Boardman Plant. The Reservoir occupies a low-lying area formed by the junction of Sixmile and Fourmile Canyons. It is bounded on the west and north by the West Dam, the principal structure, which includes an outlet works and an overflow spillway. The reservoir is contained on the east end by the Saddle Dam. Running west from about the midpoint of the Saddle Dam is a Divider Dike. The warm water entering the reservoir from the condenser is discharged to the south side of the Divider Dike where it must flow a longer path around the end of the dike before returning to the intake structure. This longer flow path improves the efficiency of cooling in the reservoir by maximizing the length of time for evaporative cooling.

The spillway is located at the east end of the West Dam. The outlet works, located through the deepest section of the West Dam, provides for emergency dewatering of the reservoir, should that be required. The dewatering flow would travel down Sixmile Canyon where it would discharge into the Columbia River. A 9-foot diameter culvert was tunneled under Interstate Highway I84 and the Union Pacific Railroad to carry the estimated maximum dewatering flow of 435 cfs to the Columbia.

The reservoir was constructed under Water Resources Department Permit R 6276 issued January 12, 1976, with addendum. The reservoir and related structures cost about \$26 million to build in 1976. The water to fill and maintain the reservoir was and is supplied by the Taggares pumping plant under Water Resource Department Permit No. 39188. Taggares subleases the land from Boeing Agri-Industrial Co. (Boeing) who have a long term lease from the State of Oregon for these state-owned lands. PGE has an agreement with Boeing authorizing use of the pump station and the pipeline.

At the normal high water surface elevation of 677 ft. (MSL) Carty Reservoir has a surface area of approximately 1450 acres and a volume of about 38,300 AF. At normal low water, elevation 667 ft. (MSL), the surface area is reduced to about 1100 acres and the volume to 26,000 AF. The area-capacity

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curve is shown on drawing HC-1079 (included under reference drawings).

Carty Reservoir and the related dams and spillway are located in the following parcels of property.

<u>Township</u>	<u>Range</u>	<u>Section</u>	<u>Tract</u>	<u>Description</u>
2 North	24 East	2	W/2 of NW/4	Reservoir/dams
		2	SE/4 of NW/4	Reservoir/dams
		2	N/2 of SW/4	Reservoir/dams
		3	All	Reservoir/dams
		4	All	Reservoir/dams
		8	N/2 of S/2	Reservoir/dams
		8	E/2 of NE/4	Reservoir/dams
		8	SW/4 of NE/4	Reservoir/dams
		9	N/2 of NW/4	Reservoir/dams
		9	SW/4 of NW/4	Reservoir/dams
		10	E/2 of NW/4	Reservoir/dams
		10	W/2 of NE/4	Reservoir/dams
3 North	24 East	33	S/2 of S/2	Reservoir/dams
		33	N/2 of SE/4	Reservoir/dams
		34	S/2 of SW/4	Reservoir/dams

A plan of the reservoir is shown on drawing D-10820 (Final Proof Map) and HC-102 (included under reference drawings). The following is a detailed description of the hydraulic structures of Carty Reservoir.

a. West Dam

The West Dam is a 6,863 foot long, compacted-earthfill-embankment dam with a central, impervious clay core (Zone I). The outer shell of the dam is a compacted random earth embankment, Zone II. A nearly vertical chimney sand drain was placed in the embankment fill (Zone II) just downstream of the central core. This drain collects any seepage passing through the core and transports it downward to a horizontal sand drainage blanket that

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daylights in a drainage ditch at the downstream toe of the dam. This drainage system helps reduce the phreatic pressures in the downstream embankment. The upstream and downstream side slopes of the dam are 3 horizontal to 1 vertical. A 3 foot thick layer of riprap is placed on the upstream face to protect against wave erosion. The dam is approximately 88 feet above ground at the deepest section. The crest elevation is 688 feet (MSL).

The dam was founded on a combination of bedrock and cemented gravels. There was a concern about excessive settlement at the deepest section of the dam (where the total dam height from the bottom of the foundation to the crest was 118 feet - excavated 30 feet below ground level) so the foundation was excavated all the way down to the Pomona basalt bedrock. The portion of the bedrock directly under the core was thoroughly hand cleaned and open joints and fractures were filled with dental concrete. Just prior to placing the core material a layer of slush grout was applied to the foundation rock. The foundation under the zone II shells was machine cleaned prior to placing the embankment fill. At the shallower portions of the dam where settlement was not a concern, the foundation was excavated down to The Dalles Formation, a cemented gravel material.

To reduce seepage under the dam a 7,423 foot long grout curtain was installed for the entire length of the dam and spillway. The holes were on a maximum of 10 foot centers and varied in depth from 25 feet to nearly 100 feet deep at the deeper sections of the dam.

The minimum safety factor for the West Dam is 2.5 for the steady state seepage case. Details of the West Dam are shown on drawings HC-103 and HC-104 (included under reference drawings).

b. Saddle Dam

The Saddle Dam is a compacted-earthfill-embankment dam approximately 4,128 feet long. It has a maximum height above the ground of 53 feet. The crest elevation is 687.0 feet (MSL). The design is similar to the West Dam with a central, impervious core (Zone 1), drainage chimney and

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blanket, and outer random earth (Zone II) compacted shells. The upstream and downstream side slopes of the dam are 2.5 horizontal to 1 vertical. A 3 foot thick layer of riprap is placed on the upstream face to protect against wave erosion.

The dam is founded on The Dalles Formation, a cemented gravel. The foundation was excavated through 6 to 12 feet of loess and 15 to 20 feet of loose Dalles Formation. Excessive settlement was not a concern here since the dam is much lower than the West Dam.

To reduce seepage under the dam a 4,500 foot long grout curtain was constructed along the centerline of the entire length of the dam. The holes were on a maximum of 10 foot centers and varied in depth from 25 feet at the abutments to 50 feet in the channel section.

The minimum safety factor for the Saddle Dam is 2.1 for the steady state seepage case. Details of the Saddle Dam are shown on drawings HC-106 and HC-107 (included under reference drawings).

c. Divider Dike

The approximately 8,300 foot long, compacted-earth-embankment Divider Dike runs east-west down the center of the reservoir. There is equal water pressure on each side. Since there was no concern with public safety the design was based on slope stability and settlement of a totally saturated structure. Also since seepage was not a concern, the dam was founded directly on the natural loess materials occurring on the bottom of the reservoir. The base of the dam is very wide, sloping upward from the base on a 3 horizontal to 1 vertical to a bench at elevation 662 feet (MSL). From the bench the dike cross section steps inward 45 feet on each side and rises to the crest elevation of 686 feet (MSL) on a 2.5 horizontal to 1 vertical slope. The crest width is 24 feet. A 3 foot layer of riprap is placed on both side slopes beginning at elevation 662 feet (MSL) and extending to the crest to protect against wave erosion.

Details of the Divider Dike are shown on drawings HC-105

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and HC-106 (included under reference drawings).

d. Outlet Works

The outlet works is constructed through the lower portions of the West Dam and is designed to drain the reservoir in the event of an emergency. The works consists of an inlet gate located on the upstream slope of the dam, a 48 inch diameter concrete encased steel pipe running under the dam, and an outlet structure discharging into Sixmile Canyon. Any discharge would flow down the 10 miles of the canyon, eventually reaching the Columbia River. The upstream gate is a 4 foot by 4 foot slide gate with a stainless steel stem running up the upstream face of the dam to an operator located at the dam crest. The outlet structure is a square vertical concrete box extending approximately 45 feet upward from the downstream end of the 48 inch diameter steel pipe to above the ground surface. Two 5 feet by 7 feet vertical slide gates are mounted at the discharge of the outlet structure to control discharge. These gates provide an alternate way to shut off the flow through the 48 inch diameter discharge pipe should the upstream slide gate fail to close.

Details of the outlet works are shown on drawings HC-201 and HC-202 (included under reference drawings).

e. Spillway

The reinforced concrete spillway is located at the east abutment of the West Dam. It consists of an uncontrolled overflow labyrinth crest and a concrete chute. The spillway entrance is a 120 foot wide by 17.5 feet high rectangular concrete structure with a 361 foot labyrinth overflow weir constructed in a sawtooth pattern within the 120 foot width. The crest elevation of the spillway is 677.5 feet (MSL). The spillway chute extends about 580 feet down the slope to a flip bucket/plunge pool type of energy dissipator. The plunge pool is riprapped. The chute is 120 wide at the beginning and reduces to 50 feet

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about half way down the chute. The spillway is designed to pass the probable maximum flood (PMF) which is estimated at 13,200 cfs.

Details of the spillway are shown on drawings HC-209 (included under reference drawings).

B. HISTORY OF THE BOARDMAN SITE PLANT DEVELOPMENT AND RESERVOIR
MAKEUP

In the early 1970's PGE planned to construct up to two coal fired plants and up to two additional 1260-MW thermal plants at the then named Thermal Power Generation Facility (now called the Boardman Coal Plant). A 5000 acre reservoir was to be constructed adjacent to the plants for cooling water. Four 2,500 HP pumps, located in a pumping plant on the Columbia River near Threemile Canyon, would pump the required initial fill and makeup to Carty through a 11-mile, 51-inch diameter pipeline. However, shortly after the initial water permit applications were submitted, the demand for new generation eased and PGE investigated ways to reduce costs to both the ratepayers and stockholders. A more conservative development plan was followed and ultimately resulted in the construction of only one 540-MW coal fired plant. Additional plants were to be added as the economics of new generation construction turned favorable.

With only one plant at the site there was no longer an immediate need for a 5000 acre cooling reservoir. Therefore, PGE decided to construct the reservoir in two stages. The first stage would consist of building the 1450 acre reservoir and the 540 MW coal plant. When there was a sufficient need for economical power, PGE planned to proceed with stage 2 which would expand the reservoir to 5000 acres and add up to two 1260 MW thermal plants to the site. This staged development is also described in the addendum to the permit to construct the reservoir, Permit No. R 6276.

With smaller demands PGE could save additional money if the pumping plant and pipeline construction at Threemile Canyon could be deferred until the full reservoir was constructed. Boeing agreed to allow use of the existing Willow Creek Cove

pump station and pipeline. As a result the initial water permit application was amended (Permit No. 39188, with addendum) to address the plan to develop Carty in two stages and the change in the point of diversion.

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The smaller reservoir has been constructed and the Boardman Plant went into commercial operation in 1980. The reservoir was initially filled and is being maintained using the irrigation piping and the pumping plant at Willow Creek Cove.

C. CLAIM TO BENEFICIAL USE

PGE has constructed the hydraulic structures for the 1450 acre reservoir. Initial fill was started in late 1977. The completion notice for the reservoir was sent to the Water Resources Department in October 1978. The reservoir elevation reached the minimum pool elevation of 667 feet (MSL) on March 13, 1979 and the maximum pool elevation of 677 feet (MSL) about April 1, 1980.

PGE has been submitting estimated annual water balance tables to the Water Resources Department (included in the annual "Ecological Monitoring Program for the Boardman Coal-Fired Plant" reports) for Carty reservoir since the initial filling of the reservoir. These water balance reports show that the reservoir reached the 677 elevation in April of 1980. In addition, a PGE letter dated June 6, 1980 (R. Halicki to J. E. Sexson, Attn. Al Petska) was sent to the Water Resources Department stating that the 677 foot elevation was reached on March 27, 1980.

The estimated reservoir volume at the maximum elevation of 677 feet (MSL) is 38,300 acre feet. The area at that elevation is estimated at 1450 acres. At the minimum reservoir elevation of 667 feet (MSL) the estimated volume is 26,000 AF and the area is 1100 acres. These values are obtained from the area-capacity curves prepared by Bechtel (drawing HC-1079) at the completion of construction of the Boardman Plant.

Annual water requirements to fill the reservoir have varied from a low of about 7,000 acre feet (AF) when the plant was idle and the reservoir was at the minimum elevation, to nearly 13,000 AF when the plant operated and/or the reservoir was near the maximum elevation. During extremely hot years with

full year plant operation annual water supply needs approach 15,000 acre feet.

This claim to beneficial use is for the 1450 acre, 38,300 AF reservoir including all related hydraulic structures; the West Dam with outlet works and spillway, Saddle Dam, and Divider Dike. The reservoir, dams, outlet works and spillway were constructed and are in service. The reservoir has been filled to the maximum elevation of 677 feet (MSL). Water stored in the reservoir under permit R6276 is stored for use in the operation of the Boardman Plant.

Water will continue to be diverted from Willow Creek Cove, a backwater of the Columbia River, via the Taggares/Boeing pump stations and the 72 inch/60 inch pipeline to Carty Reservoir and to the plant. A flow meter, installed in the 60 inch diameter line just upstream of reservoir, measures flows into Carty Reservoir.

Since the Boardman Plant went into commercial operation in 1980, it has produced 23,926,189 MWH's of economical electrical power for the citizens of the State of Oregon.

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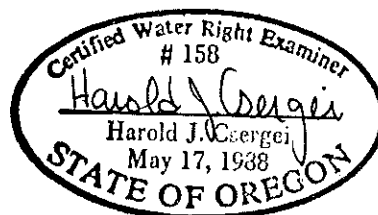
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The final proof survey and inspection of the use as found to be completed under the terms and conditions of permit number R 6276 was completed by me on March 14, 1996, and the facts contained in this report and accompanying final proof map, Drawing Number D-10820, are correct to the best of my knowledge.



I, Robin Ingers, having been duly sworn, depose and say that I am the Asst. General Counsel of Portland General

Electric Company, agree to the findings of the Certified Water Rights Examiner and do submit this site report and map as my Claim of Beneficial Use of the water as provided under the terms and condition of my permit number R 6276.

hjc/cartypro.rpt
May 8, 1996

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CARTY RESERVOIR FILL METER READINGS TAKEN ON 8/11/95

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Date - Time	Flow Meter Readings (1)		Totalizer Readings (2)	
	ft/sec	ft ³ /sec (3)	gal/day	ft ³ /sec (4)
08/11/95-0850	4.060	79.17	53,827,000	83.28
08/11/95-0900	4.362	85.02	53,827,000	83.28
08/11/95-0910	4.255	82.97	53,764,000	83.19
08/11/95-0920	4.251	82.89	53,813,000	83.26
08/11/95-0930	4.376	85.33	53,398,000	82.62
08/11/94-0940	4.278	83.42	53,574,000	82.89
08/11/95-0950	4.215	82.19	53,447,000	82.70

- (1) Reading from the velocity dial on the flow meter.
- (2) Reading obtained from totalizer on flow meter.
- (3) Calculated by multiplying the area of the 5 ft diameter flow pipe by the velocity.
- (4) Calculated by converting the gallons per day into cubic feet per second.

**CARTY RESERVOIR FILL PIPE METER READINGS
TAKEN ON 3/14/96**

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Date - Time	Meter Reading (1)	Meter Reading converted to GPM
	ft ³ /sec	gal/min
03/14/96-0838	0.4	186
03/14/96-0853	6.1	2741
03/14/96-0908	60.3	27069
03/14/96-0923	78.9	35426
03/14/96-0938	107.6	48294
03/14/96-0953	120.8	54219
03/14/96-1008	126.0	56553
03/14/96-1023	131.4	58977
03/14/96-1038	135.2	60682
03/14/96-1038.3	134.8	60503
03/14/96-1038.45	136.4(2)	61211

- (1) Reading were taken from the Accusonic 4 path, ultra-sonic, digital flow meter located in the 60" diameter Carty fill pipeline just upstream of the meteorological tower.
- (2) During the fill exercise a total of 6-1250 hp pumps were pumping at the Willow Creek Cove pumping station and 8-1250 hp pumps pumping at the Booster pump station. All water being pumped from the Willow Creek pumping station was being pumped to Carty Reservoir.

BOARDMAN CO. PLANT
CARTY RESERVOIR MONTHLY WATER BALANCE

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Description	1994											
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Reservoir Elevation: End	667.5	667.9	668.9	669.5	670.7	669.8	667.3	665.7	666.4	667.5	669.2	669
Reservoir Elevation: start	667.9	667.5	667.9	668.9	669.5	670.7	669.8	667.3	665.7	666.4	667.5	669.2
Elevation Difference, Ft	-0.4	0.4	1	0.6	1.2	-0.9	-2.5	-1.6	0.7	1.1	1.7	-0.2
Reservoir Area: End, Acre	1095	1118	1155	1172	1215	1183	1100	1045	1070	1095	1162	1155
Reservoir Area: Start, Acre	1118	1095	1118	1155	1172	1215	1183	1100	1045	1070	1095	1162
Average Area, Acre	1107	1107	1137	1164	1194	1199	1142	1073	1058	1083	1129	1159
Volume= Elev. x Area, AF	443	443	1137	698	1432	-1079	-2854	-1716	740	1191	1918	-232
Fill:												
Boeing Fill, AF (digital)	0	939	1942	1903	2295	276	122	165	2351	1998	2943	617
PGE Fill, AF	65	65	65	65	65	65	65	65	65	65	65	65
Total Fill= PGE + Boeing, AF	65	1004	2007	1968	2360	341	187	230	2416	2063	3008	682
Withdrawal:												
Boeing Irrigation, AF	0	0	37	69	0	199	1681	547	0	12	0	0
PGE Plant Use, AF	2	2	2	2	2	2	2	2	2	2	2	2
Total Withdrawal, AF	2	2	39	71	2	201	1683	549	2	14	2	2
Net Fill= Fill - Withdrawal	63	1002	1968	1897	2358	140	-1496	-319	2414	2049	3006	680
Losses:												
Net Fill, AF	63	1002	1968	1897	2358	140	-1496	-319	2414	2049	3006	680
Change in Volume, AF	-443	443	1137	698	1432	-1079	-2854	-1716	740	1191	1918	-232
Total Loss= Fill-Volume, AF	-506	-559	-832	-1199	-926	-1219	-1358	-1397	-1674	-858	-1088	-912
												-12526

July 29, 1996

GEORGE M HUTCHERSON
MANAGER CIVIL ENGINEERING & CONTRACT CONSTRUCTION
PORTLAND GENERAL ELECTRIC COMPANY
121 SW SALMON STREET
PORTLAND OR 97204

REFERENCE: File R-51520 and 51521

This will acknowledge that your claim of beneficial use and map in the name of PGE were received on May 21, 1996. These will be reviewed in the future to insure they are complete and correct.

Please contact me if you have any questions.

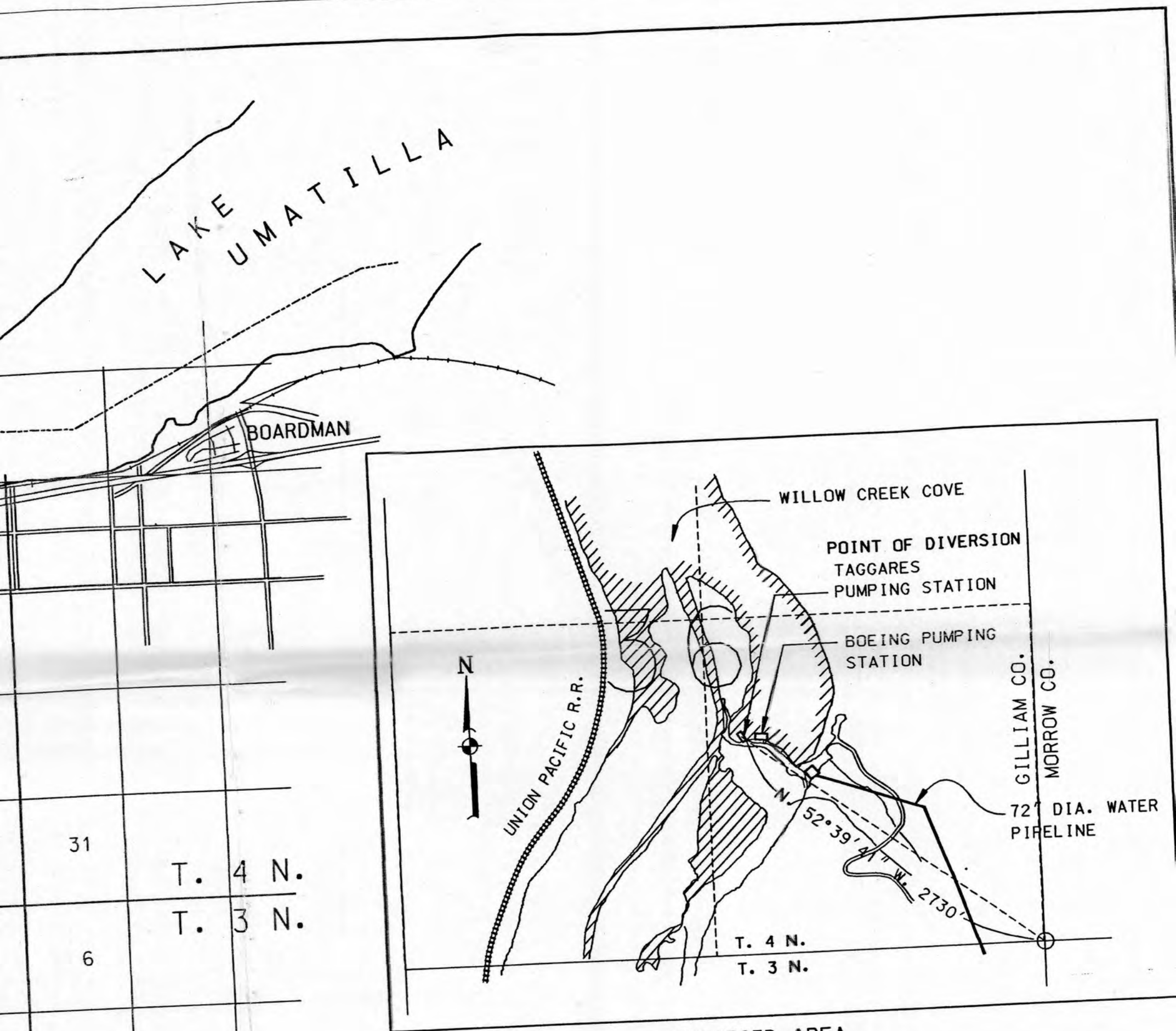
Sincerely,



DON KNAUER
Program Representative



Commerce Building
158 12th Street NE
Salem, OR 97310-0210
(503) 378-3739
FAX (503) 378-8130



ENLARGED AREA
SCALE: 1 INCH = 1000 FT

LEGEND

 - AREA OF BENEFICIAL USE

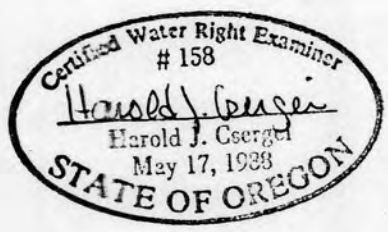
REFERENCE DRAWING

BOARDMAN COAL PLANT
D10820 SHEET 1 OF 1

CARTY RESERVOIR
FINAL PROOF MAP
PERMIT NUMBER R6276

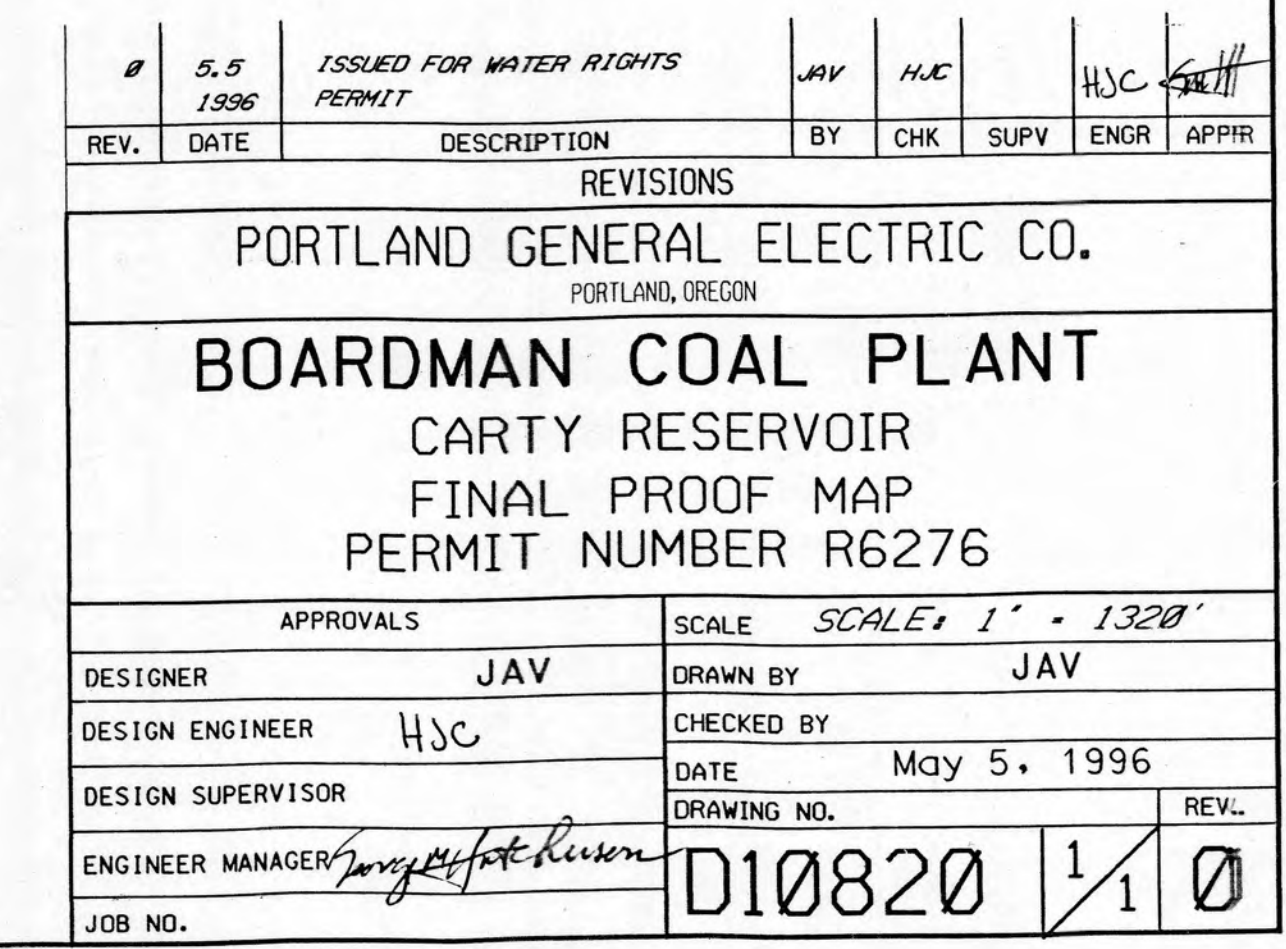
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0	5/5	ISSUED FOR WATER RIGHTS	JAV			HSC
REV	DATE	PERMIT NUMBER 39188	BY	CHK	SUPV	ENG
REVISIONS						
PORTLAND GENERAL ELECTRIC PORTLAND, OREGON						
BOARDMAN COAL PLANT CARTY RESERVOIR MAKEUP AND PROCESS WATER SYSTEM WATER RIGHTS FINAL PROOF MA PERMIT NUMBER 39188						
APPROVALS			SCALE 1" = 1			
DESIGNER	JAV	DRAWN BY	JAV			
DESIGN ENGINEER	HSC	CHECKED BY				
DESIGN SUPERVISOR		DATE	MAY 5, 1996			
ENGINEER MANAGER		DRAWING NUMBER				
JOB NUMBER		D10728	1			

USE OF THIS MAP IS TO IDENTIFY
TION OF THE WATER RIGHT. IT
INTENDED TO PROVIDE INFORMATION
TO THE LOCATION OF PROPERTY
P BOUNDARY LINES.

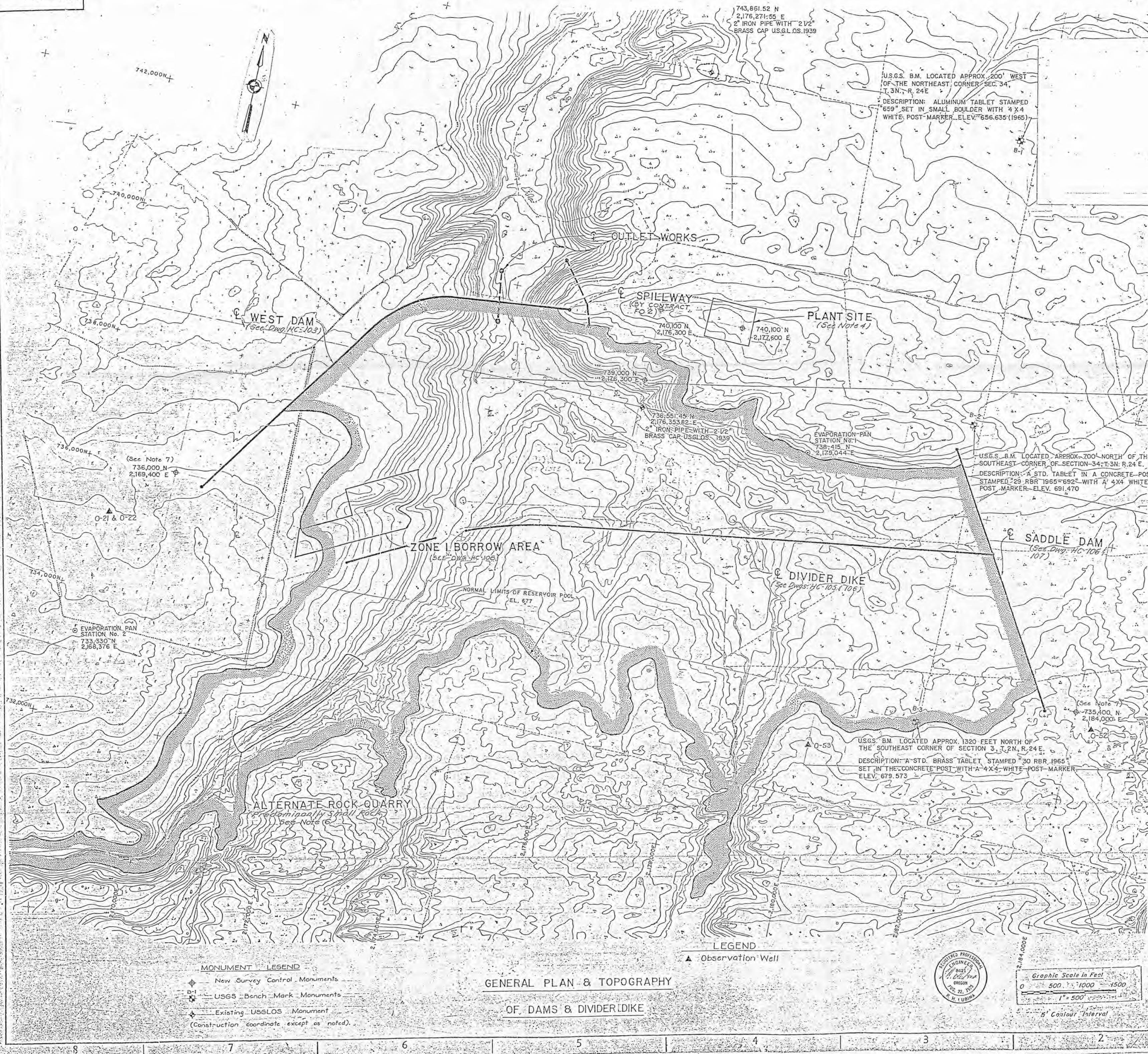


 *RESERVOIR PERMIT BOUNDARY*

 *FEE OWNED PROPERTY*

Certified Water Right Examiner
158
Harold J. Caergei
Harold J. Caergei
May 17, 1988
STATE OF OREGON

#	5.5 1996	ISSUED FOR WATER RIGHTS PERMIT	JAV	HJC		HJC	6/11
REV.	DATE	DESCRIPTION	BY	CHK	SUPV	ENGR	APPR
REVISIONS							
PORTLAND GENERAL ELECTRIC CO.							
PORTLAND, OREGON							
BOARDMAN COAL PLANT							
CARTY RESERVOIR							
FINAL PROOF MAP							
PERMIT NUMBER R6276							
APPROVALS			SCALE 1" = 1320'				
DESIGNER	JAV		DRAWN BY		JAV		
DESIGN ENGINEER	HJC		CHECKED BY				
DESIGN SUPERVISOR			DATE		May 5, 1996		
ENGINEER MANAGER	[Signature]		DRAWING NO.		REV.		
JOB NO.			D10820		1/1		0



NOTES

1. Grid system is based on Oregon Coordinate System, North Zone.
2. Topography is from aerial surveys by CH2M-Hill, 1973.
3. See Dwg. I-C-001 for location of Riprap Quarry.
4. See Dwg. I-C-0006 for plant site excavation available for use in selected zones of the Dams and Dike.
- 5.
6. The quarry may be expanded horizontally within the reservoir area but shall not extend deeper than 15 ft below the floor of the existing canyon.
7. Values are Lambert corrected.
8. For Lambert corrected values of construction coordinates, see Pettijohn Eng. Co. dwg. TS-145-4.
9. See Dwg. HC-1079 for Area Capacity Curves.

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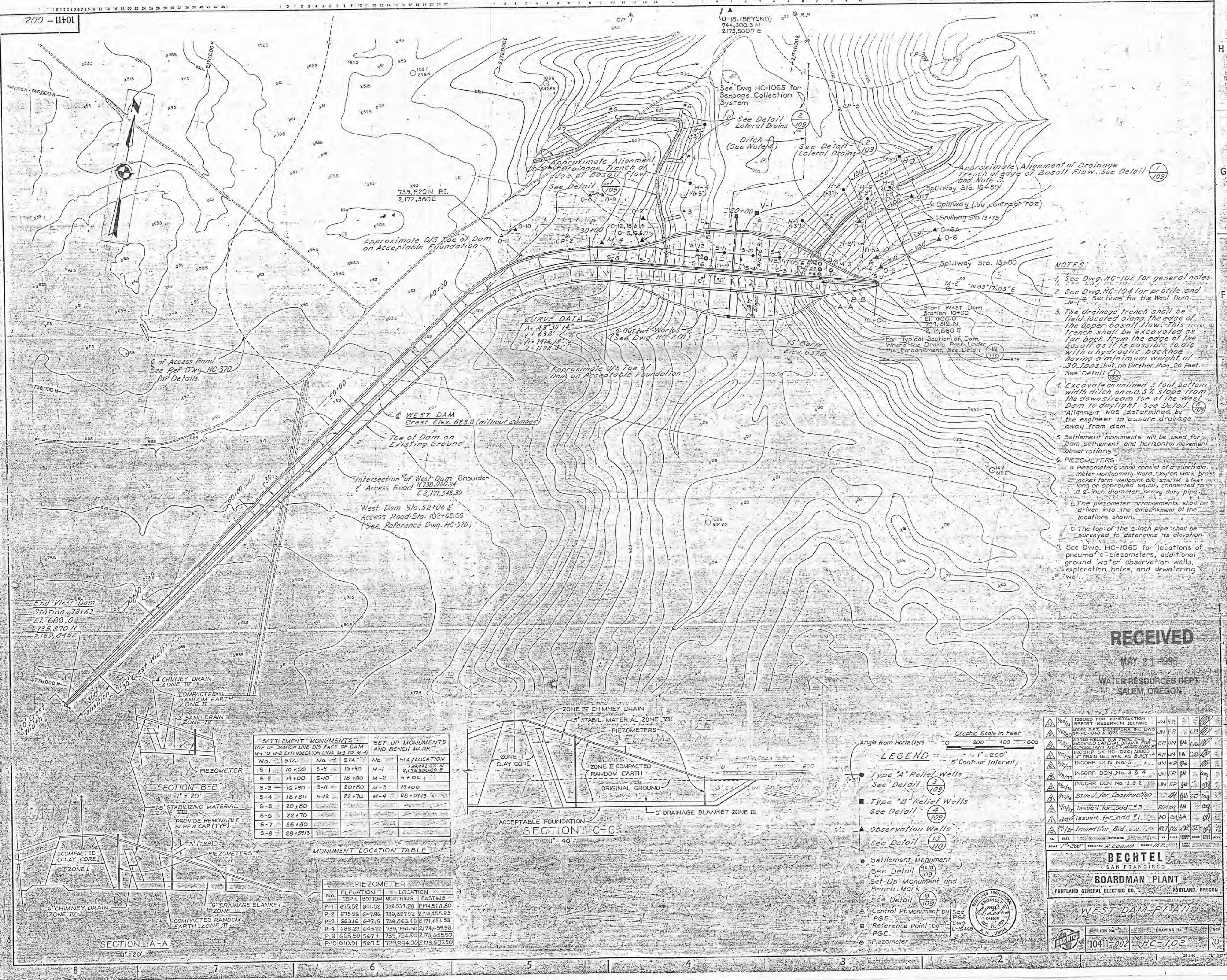
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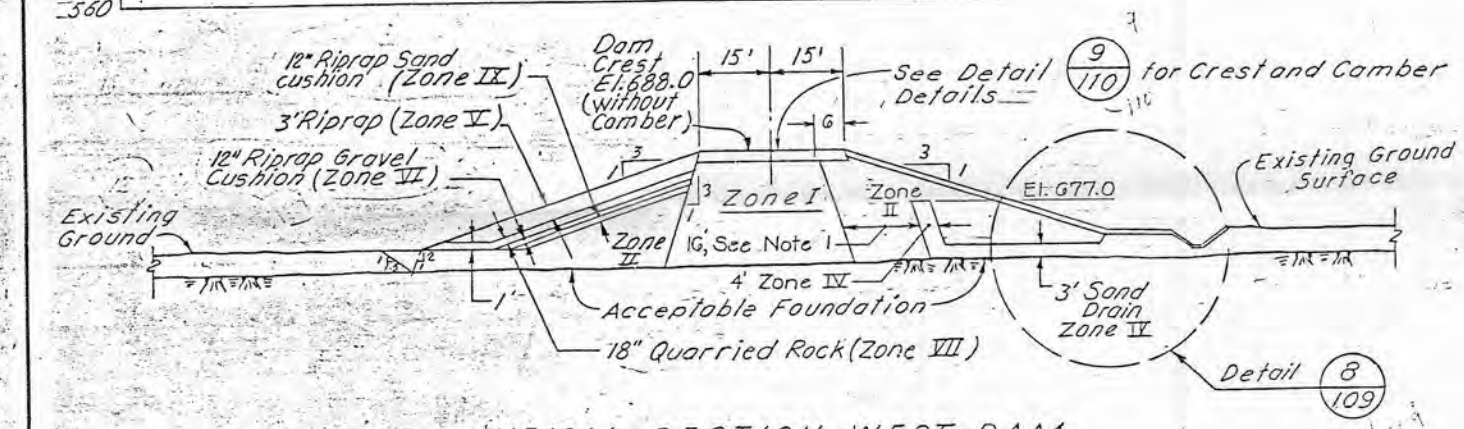
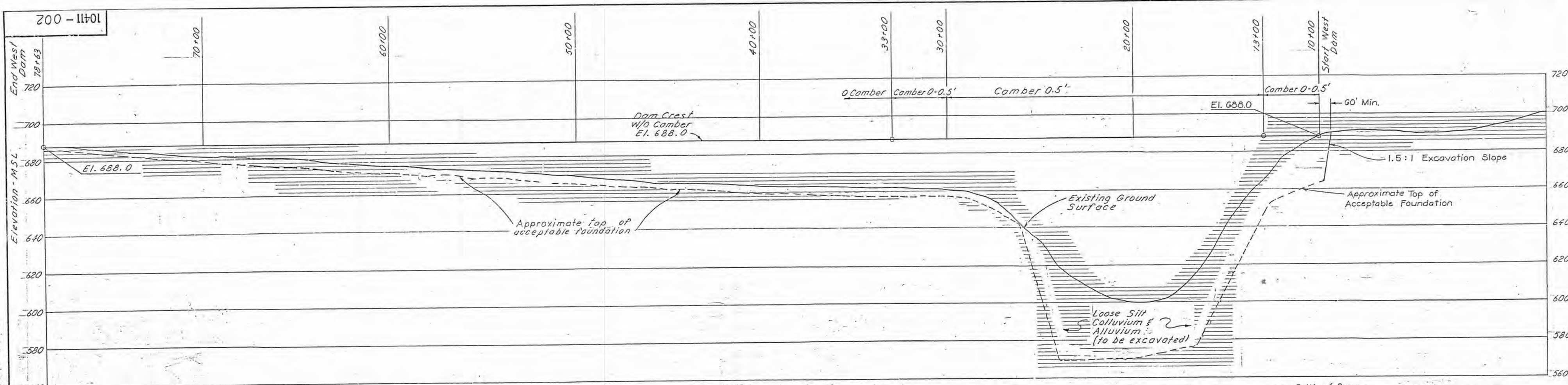
BECHTEL
SAN FRANCISCO

BOARDMAN PLANT

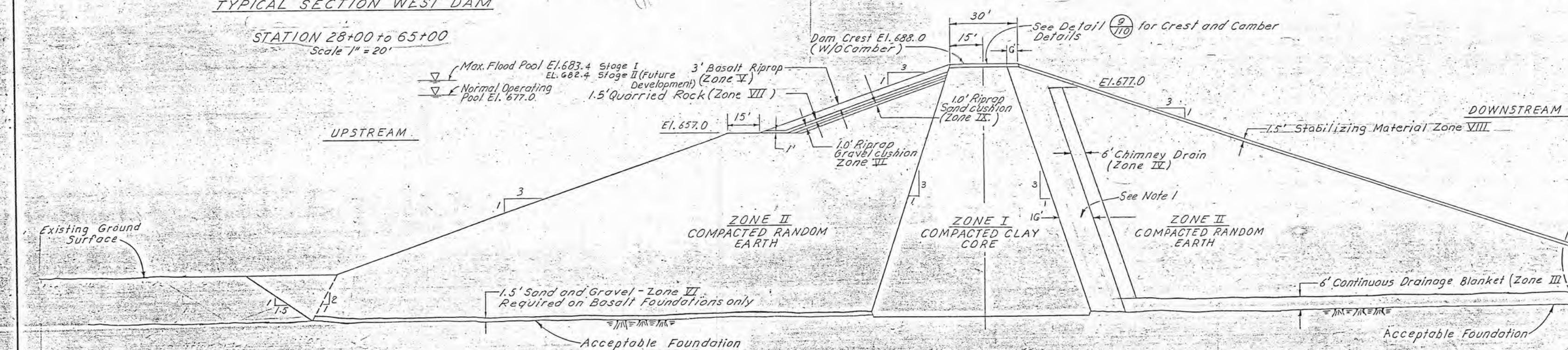
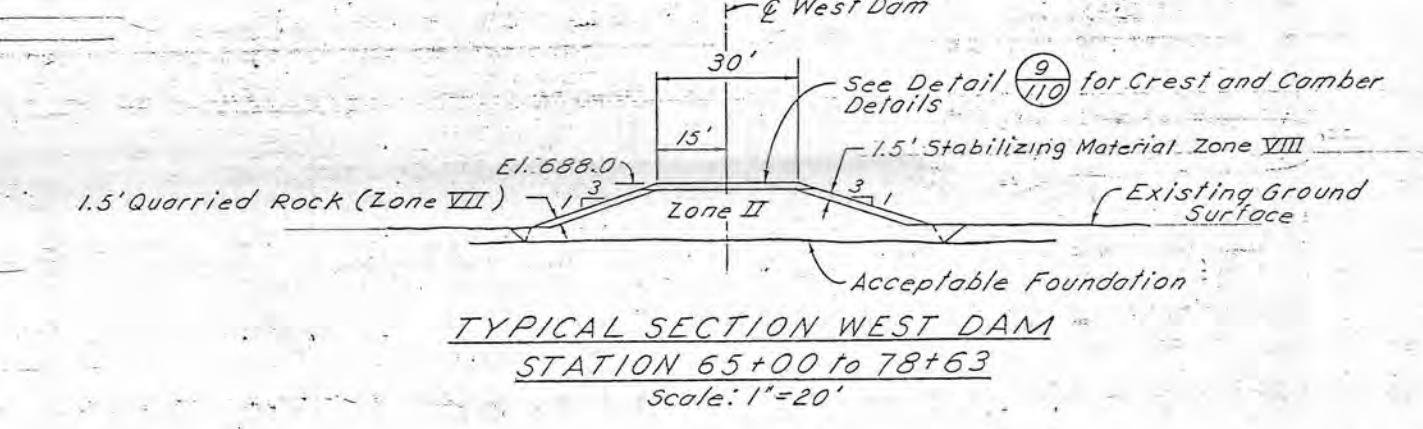
GENERAL PLAN AND TOPOGRAPHY
OF WEST DAM, SADDLE DAM
AND DIVIDER DIKE

	JOB No.	DRAWING No.	REV.
	10411-002	HC-102	6





CENTERLINE PROFILE - WEST DAM
 Horizontal - 1" = 200'
 Vertical - 1" = 20'



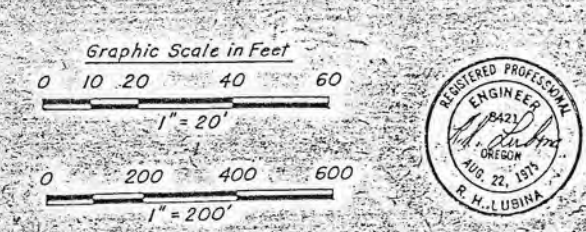
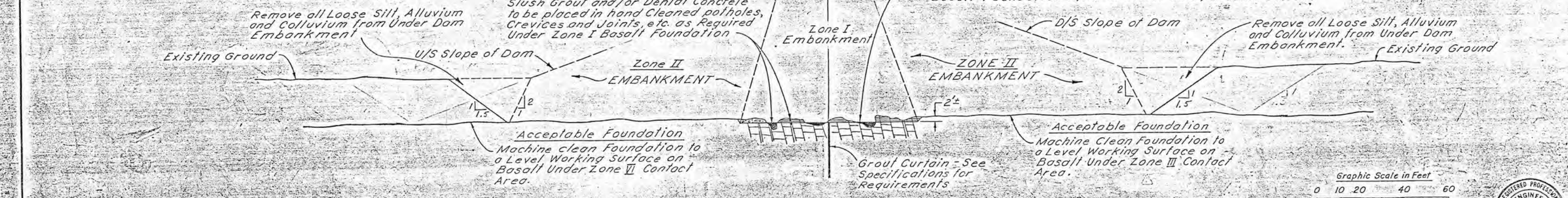
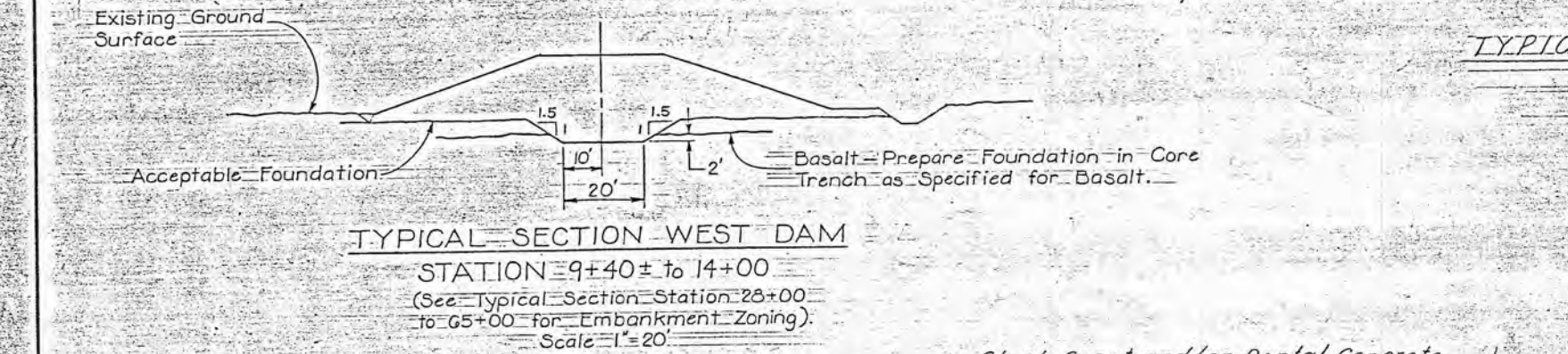
See Detail (6) 109 for D/S Toe Detail in Main Channel and Detail (7) 109 for D/S Toe Detail of the Abutments.

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Notes:
 1. The Zone II material located between the Zone I Core and the Zone II Chimney Drain shall be loess containing not more than 85 percent by dry weight of particles passing the no. 200 sieve



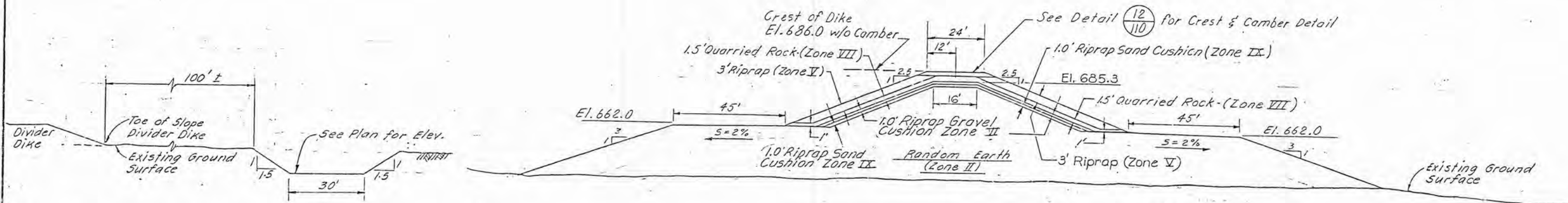
10/18	Incorp. SK-HC-1005, 1007 & 1026; Rev. 05 Built	FF	JN	SA	10/18
10/24	Incorp. DGN No. 1 & 2	JN	FF	SA	10/24
11/16	West Abut. Core Trench	JN	FF	SA	11/16
11/16	Issued for Construction	FF	SA	11/16	11/16
11/16	Issued for add #3	FF	SA	11/16	11/16
11/16	Issued for add #1	FF	SA	11/16	11/16
11/16	Issued for Bid	FF	SA	11/16	11/16
11/16	Issued for Bid	FF	SA	11/16	11/16

BECHTEL
 SAN FRANCISCO

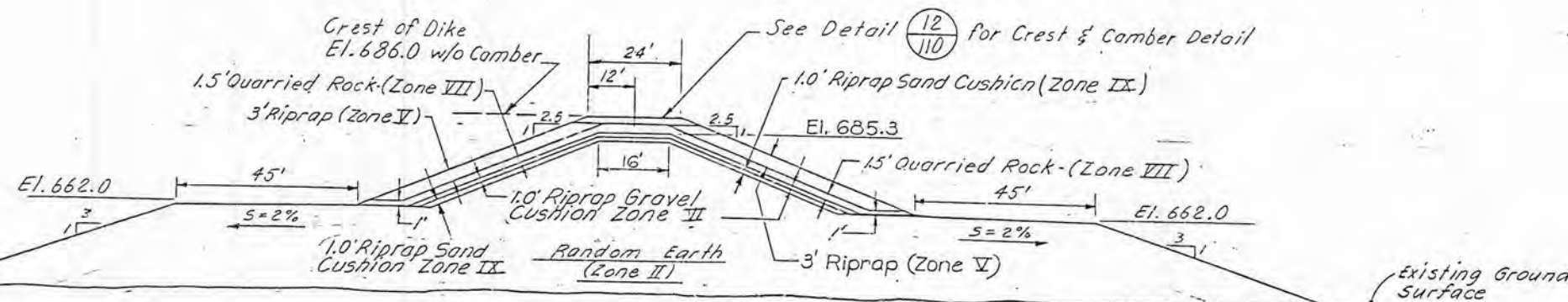
BOARDMAN PLANT
 PORTLAND GENERAL ELECTRIC CO. - PORTLAND, OREGON

WEST DAM
PROFILE & SECTIONS

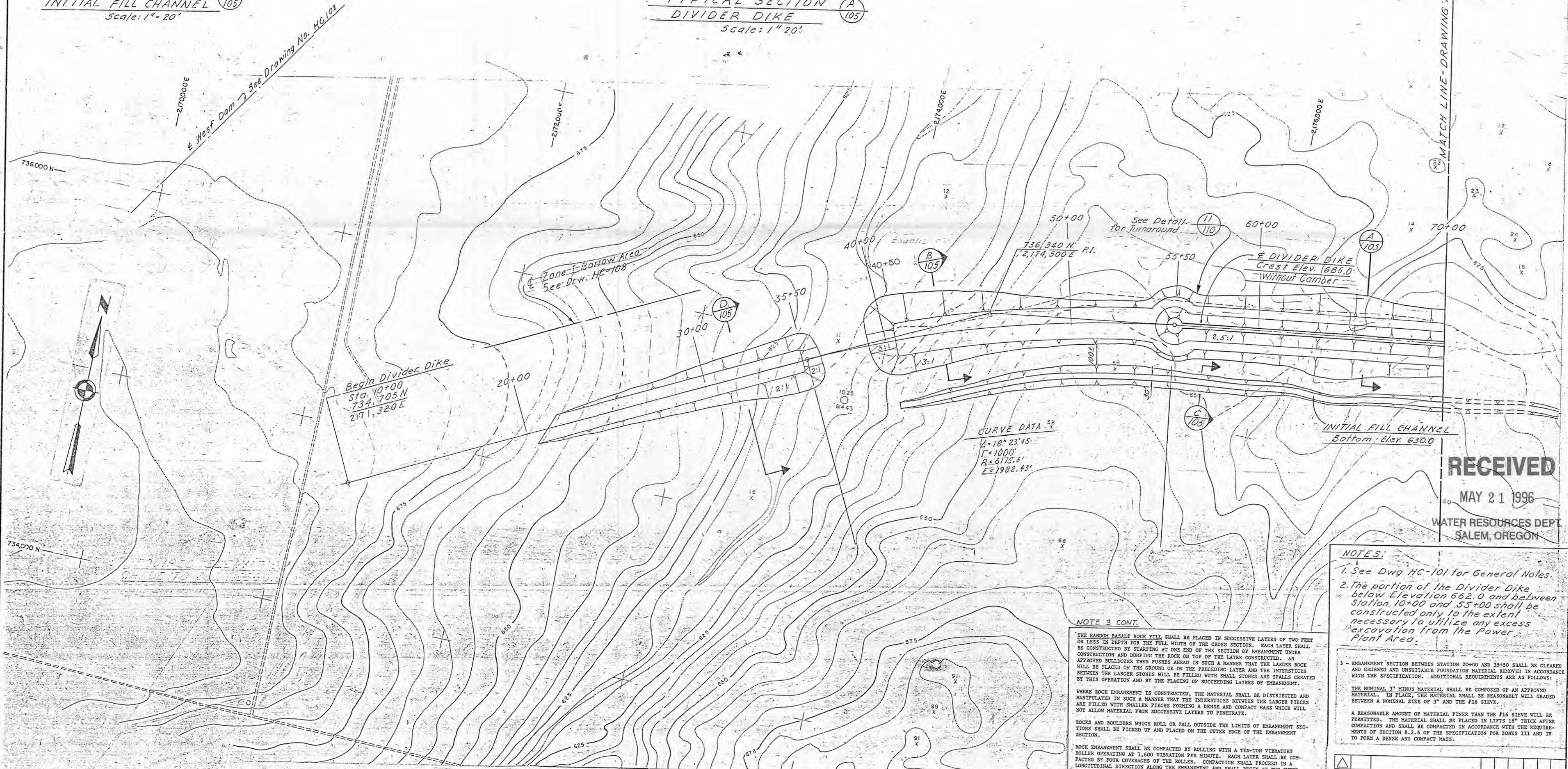
JOB No.	DRAWING No.	REV.
10411-002	HC-104	6



TYPICAL SECTION C
INITIAL FILL CHANNEL
Scale: 1" = 20'



TYPICAL SECTION A
DIVIDER DIKE
Scale: 1" = 20'



NOTE 3 CONT.

THE RANDOM BASALT ROCK FILL SHALL BE PLACED IN SUCCESSIVE LAYERS OF TWO FEET OR LESS IN DEPTH FOR THE FULL WIDTH OF THE CROSS SECTION. EACH LAYER SHALL BE CONSTRUCTED BY STARTING AT ONE END OF THE SECTION OF EMBAZMENT UNDER CONSTRUCTION AND DUMPING THE ROCK ON TOP OF THE LAYER CONSTRUCTED. AN APPROVED BULLDOZER THEN PUSHES AHEAD IN SUCH A MANNER THAT THE LARGER ROCK WILL BE PLACED ON THE GROUND OR ON THE PRECEDING LAYER AND THE INTERSTICES BETWEEN THE LARGER STONES WILL BE FILLED WITH SMALL STONES AND SPALLS CREATED BY THIS OPERATION AND BY THE PLACING OF SUCCEEDING LAYERS OF EMBAZMENT.

WHERE ROCK EMBAZMENT IS CONSTRUCTED, THE MATERIAL SHALL BE DISTRIBUTED AND MANIPULATED IN SUCH A MANNER THAT THE INTERSTICES BETWEEN THE LARGER PIECES ARE FILLED WITH SMALLER PIECES FORMING A DENSE AND COMPACT MASS WHICH WILL NOT ALLOW MATERIAL FROM SUCCEEDING LAYERS TO PENETRATE.

ROCKS AND Boulders WHICH ROLL OR FALL OUTSIDE THE LIMITS OF EMBAZMENT SECTIONS SHALL BE PICKED UP AND PLACED ON THE OUTER EDGE OF THE EMBAZMENT SECTION.

ROCK EMBAZMENT SHALL BE COMPACTED BY ROLLING WITH A TEN-TON VIBRATORY ROLLER OPERATING AT 1,600 VIBRATION PER MINUTE. EACH LAYER SHALL BE COMPACTED BY FOUR COVERAGES OF THE ROLLER. COMPACTION SHALL PROCEED IN A LONGITUDINAL DIRECTION ALONG THE EMBAZMENT AND SHALL BEGIN AT THE OUTER EDGE AND PROGRESS TOWARDS THE CENTER.

NOTES:

1. See Dwg HC-101 for General Notes.
2. The portion of the Divider Dike below Elevation 662.0 and between Station 10+00 and 55+00 shall be constructed only to the extent necessary to utilize any excess excavation from the Power Plant Area.
3. EMBAZMENT SECTION BETWEEN STATION 20+00 AND 35+50 SHALL BE CLEARED AND GRUBBED AND UNSUITABLE FOUNDATION MATERIAL REMOVED IN ACCORDANCE WITH THE SPECIFICATION. ADDITIONAL REQUIREMENTS ARE AS FOLLOWS:
THE NOMINAL 3" MINUS MATERIAL SHALL BE COMPOSED OF AN APPROVED MATERIAL. IN PLACE, THE MATERIAL SHALL BE REASONABLY WELL GRADED BETWEEN A NOMINAL SIZE OF 3" AND THE #16 SIEVE.
A REASONABLE AMOUNT OF MATERIAL FINER THAN THE #16 SIEVE WILL BE PERMITTED. THE MATERIAL SHALL BE PLACED IN LIFTS 18" THICK AFTER COMPACTION AND SHALL BE COMPACTED IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 8.2.6 OF THE SPECIFICATION FOR ZONES III AND IV TO FORM A DENSE AND COMPACT MASS.

NO.	DATE	REVISIONS	BY	CHKD	APPD
1	10/1/82	AS BUILT	FR	JN	BAK
2	9/2/84	INCORP. FCN No. C-42	JN	FR	BAK
3	3/1/87	INCORP. FCR No. C-24 & C-25	JN	FR	BAK
4	10/1/82	REV. PLAN ADDED SECT. D & NOTE 3 (DCN No. 1)	FR	JN	BAK
5	1/1/84	Issued for Construction	FR	JN	BAK
6	1/1/84	Issued for add. # 3	FR	JN	BAK
7	1/1/84	Issued for Bid	FR	JN	BAK

SCALE SHOWN: DESIGNED A. LUBINA, DRAWN A.C.

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PORTLAND GENERAL ELECTRIC CO. PORTLAND, OREGON

DIVIDER DIKE
PLAN AND SECTIONS
STATION 10+00 TO 70+00

JOB No.	DRAWING No.	REV.
10411-002	HC-105	6

34x44 "E" SIZE



SETTLEMENT MONUMENTS (ON LINE M-II to M-12)		SET-UP MONUMENTS AND BENCH MARK	
No.	STA	No.	STA
S-21	10+00	M-11	8+00
S-22	14+12.8	M-12	55+28
S-23	18+25.6		
S-24	22+38.4		
S-25	26+51.2		
S-26	30+64.0		
S-27	34+76.8		
S-28	38+89.6		
S-29	43+02.4		
S-30	47+15.2		
S-31	51+28.0		

MONUMENT LOCATION TABLE

Graphic Scale in Feet
0 200 400 600
1" = 200'
Contour Interval 5 Ft.

LEGEND

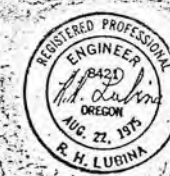
- - Settlement Monuments
See Detail 
- ⊙ - Set-Up Monument and Bench Mark
See Detail 
- Δ - Control Point Monument by
PGE. See PGE Dwg.

▲ - Observation Well - See Detail

NOTES:

1. See Dwg. HC-102 for General Notes
2. See Dwg. HC-107 for Profile and Sections for Saddle Dam
3. Excavate an unlined 3 foot Bottom width ditch on a 0.5% slope from the downstream toe of the Saddle Dam to daylight. Engineer to assure drainage away from the dam.
4. Settlement monument will be used for dam settlement and horizontal movement observations.

5. All work by FOI contractor, except as otherwise shown.



NO.	DATE	REVISIONS	BY	CHKD	ISSUED	EXEN	PLAN	APPR
△	1/10/61	AS BUILT - F-22 ISSUED FOR CONSERVOR SEAPAGE	UN	FR				02
△	3/10/60	Issued for Construction - F-22 Contract	JN	FR				04
△	3/26/59	SCED CORRECTED FOR INCORPORATING SCED 10-10-64. ISSUED FOR BIDS -	UN	FR				04
△	4/10/60	Added Final Payment; Issued for Client Approval F-22 Work	UN	FR				04
△	4/10/60	ADDED PGE'S CONTROL PT. MODN.	F.P.	UN				04
△	4/10/60	Incorp. SK-HC-1026; Rev. As Built	F.P.	UN				04
△	1/10/60	Incorp. DCN No. 1	UN	FR				04
△	1/23/60	Issued for Construction						04
△	1/14/60	Issued for add #1	MD	04				04
△	1/11/60	Issued for Bid. 11	RT	04				04

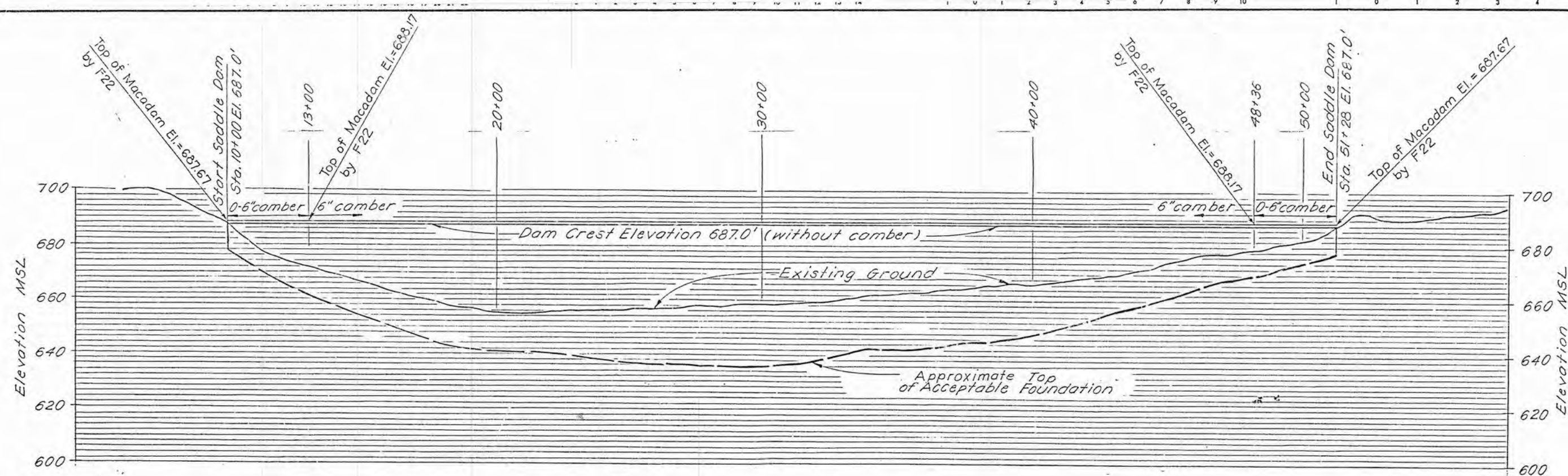
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SAN FRANCISCO

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PORTLAND GENERAL ELECTRIC CO. PORTLAND, OREGON

PPLAN OF SADDLE DAM AND
DIVIDER DIKE STA 70+00 to 122+90

	JOB No.	DRAWING No.	REV.
	10411-002	HC-106	9

1 34x44 "E" SIZE



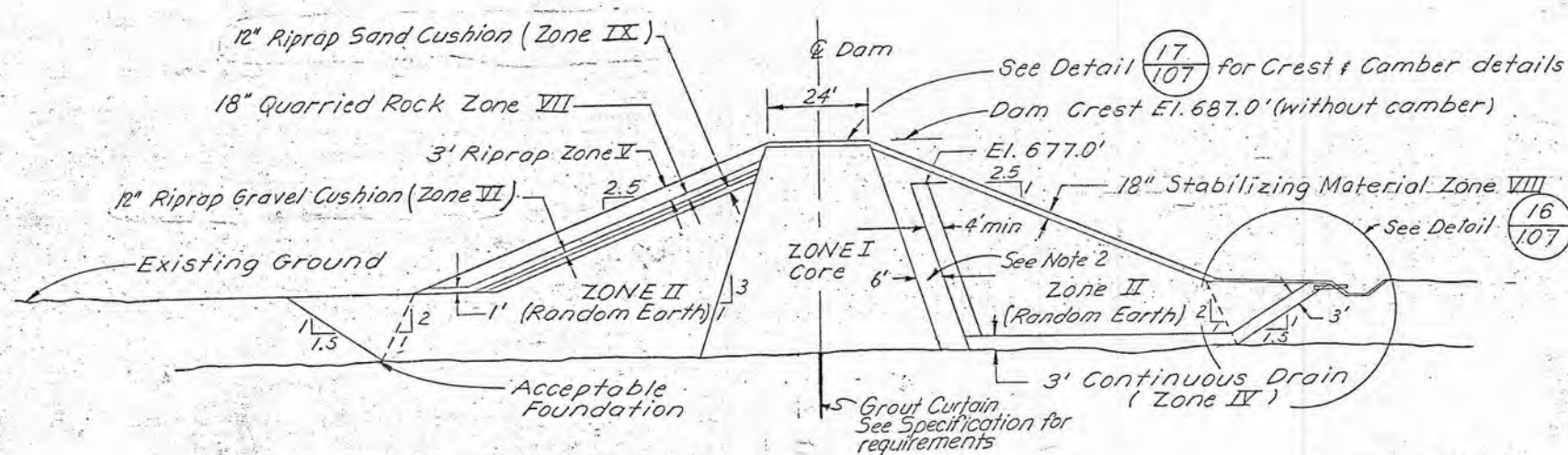
SADDLE DAM

E PROFILE

Scale: Vertical-1"=20'
Horizontal-1"=200'

NOTE:

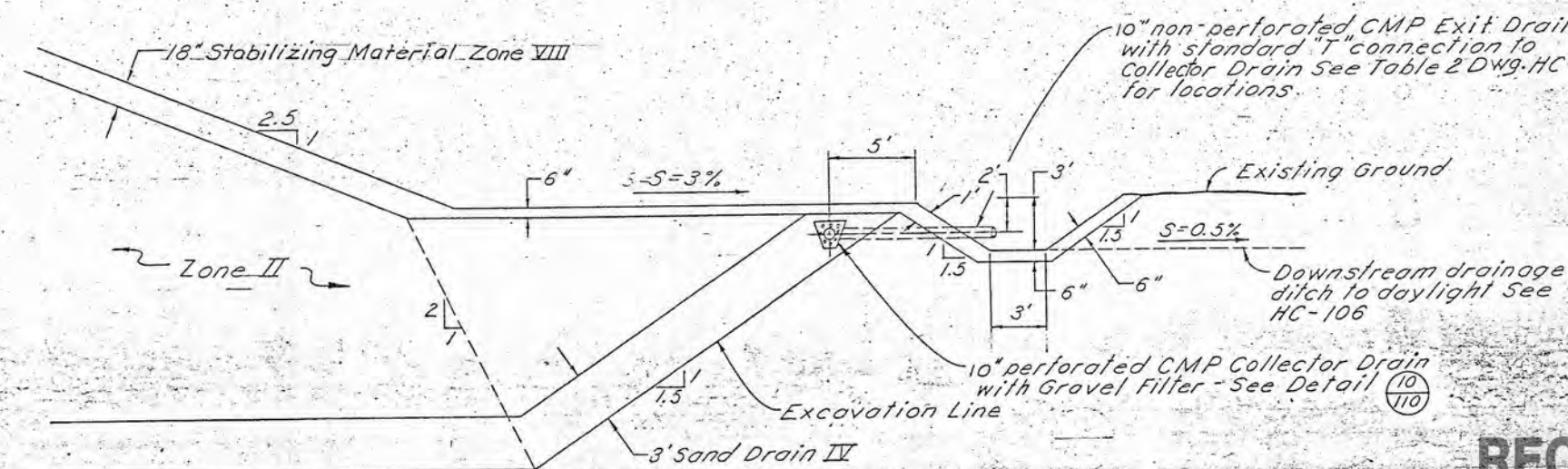
1. See Dwg. HC-102 for General Notes.
2. The Zone II material located between the Zone I Core and the Zone III Chimney Drain shall be less than 85 percent by dry weight of particles passing the no. 200 Sieve.
3. All work by FOI contractor except as otherwise shown.
4. Guardrail shall be Type 2A with Type A End Pieces. Refer to State of Oregon, State Highway Division Standard Drawing No. 2126 and 2126A.



TYPICAL SECTION

SADDLE DAM

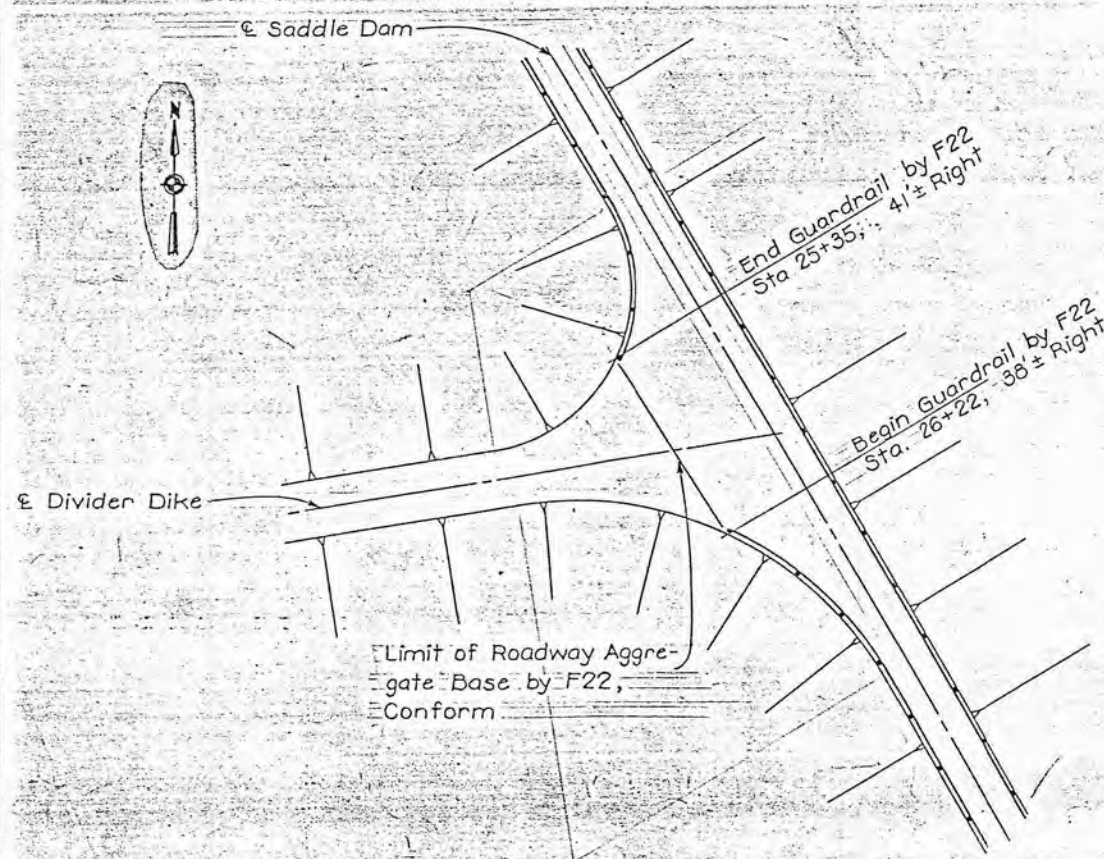
Scale 1"=20'



DETAIL 16/107

DOWNSTREAM TOE - SADDLE DAM

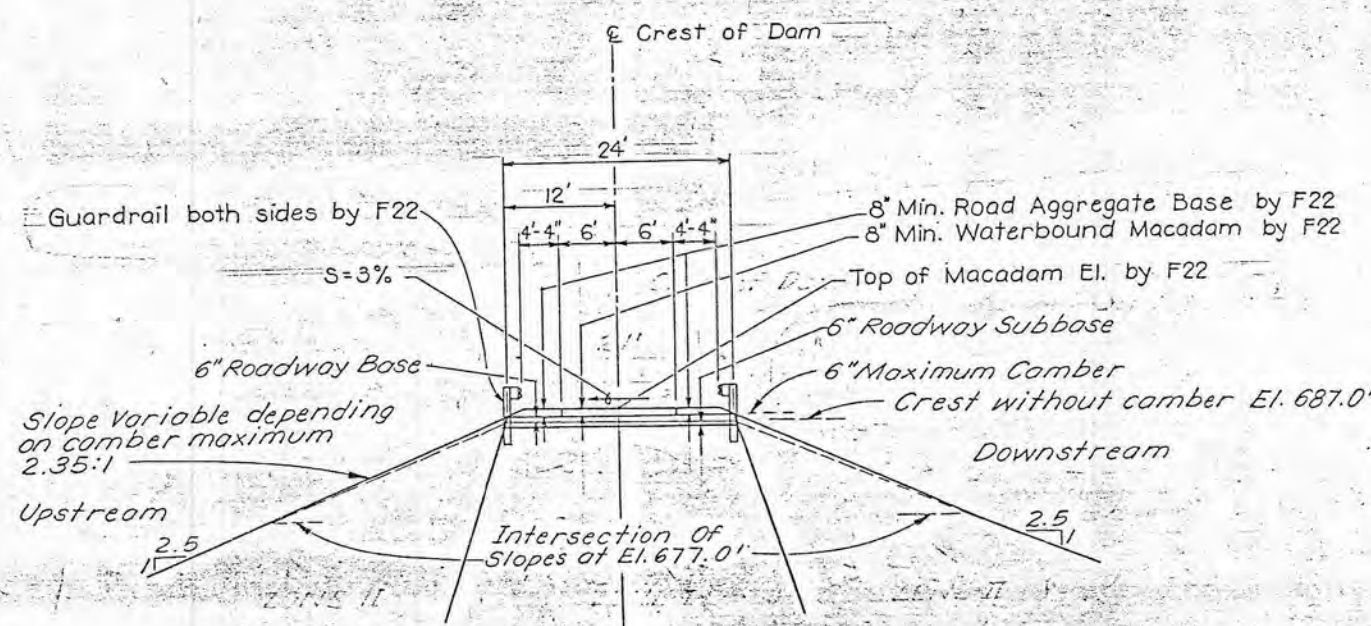
Scale 1"=5'



DETAIL 18/106

PLAN OF INTERSECTION

Scale 1"=40'



DETAIL 17/107

SADDLE DAM CREST & CAMBER

Scale 1"=10'

Graphic Scale in Feet

0 5 10 15

1"=5'

0 10 20 30

1"=10'

0 10 20 40 60

1"=20'

0 200 400 600

1"=200'

0 40 80 120 160

GRAPHIC SCALE 1"=40'



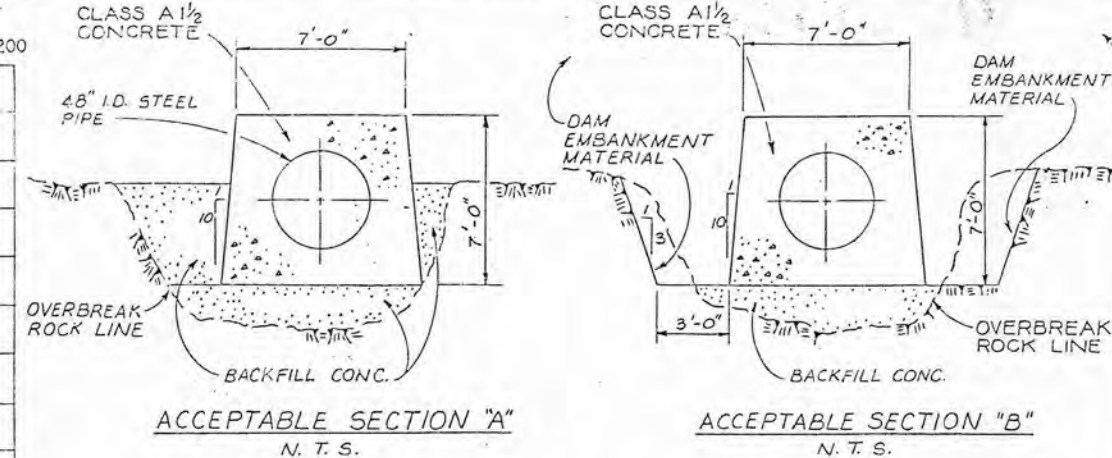
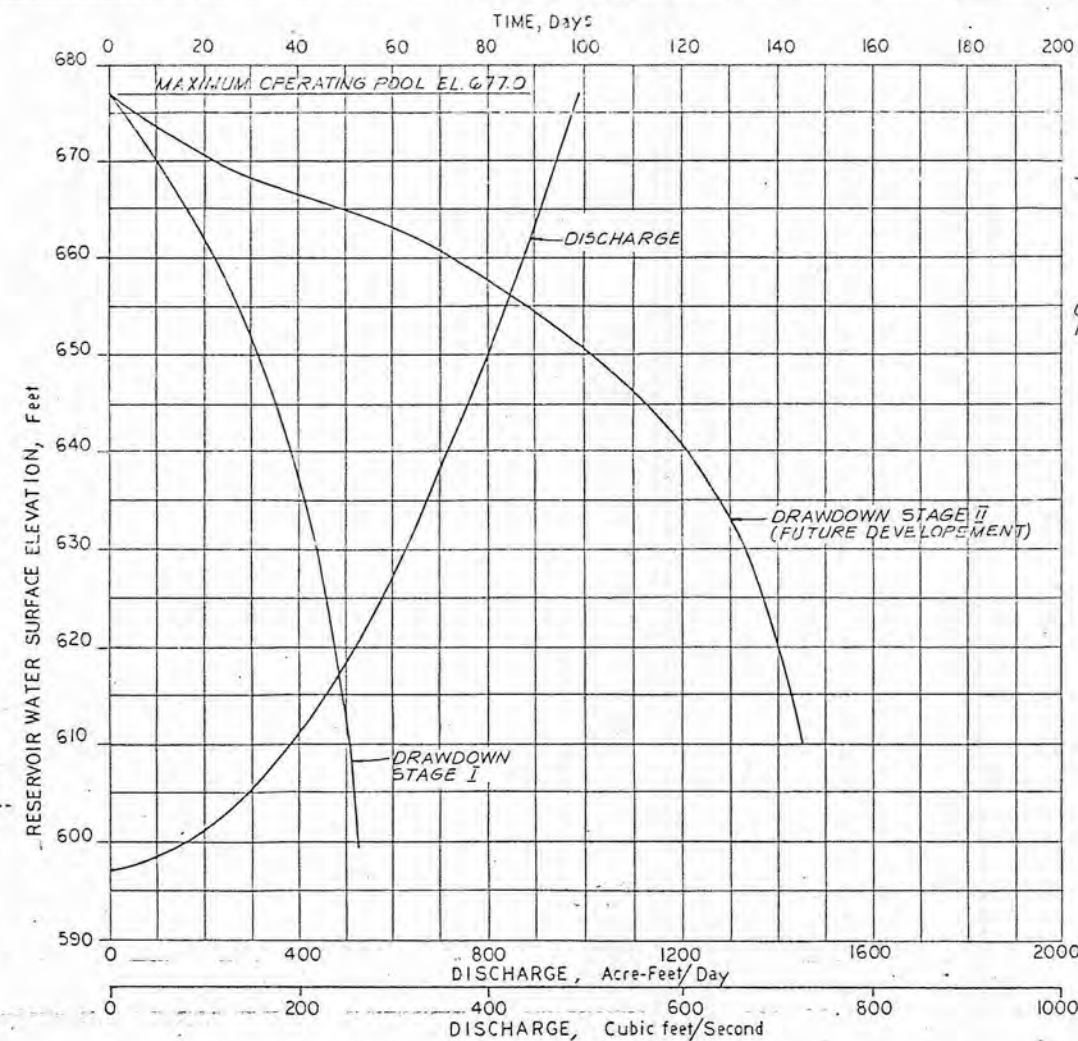
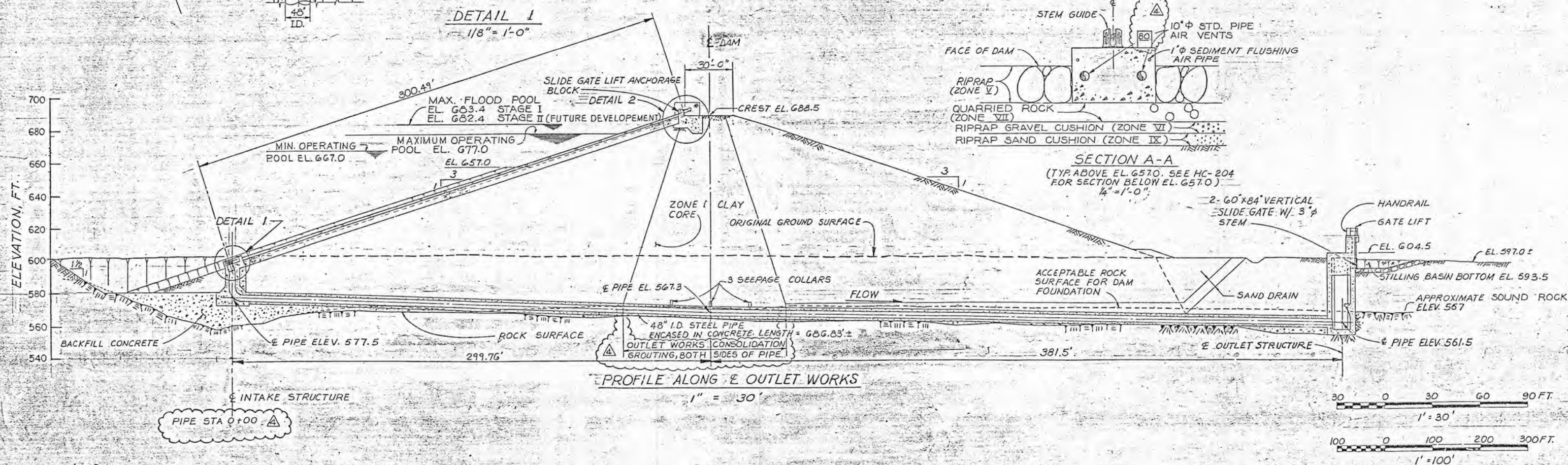
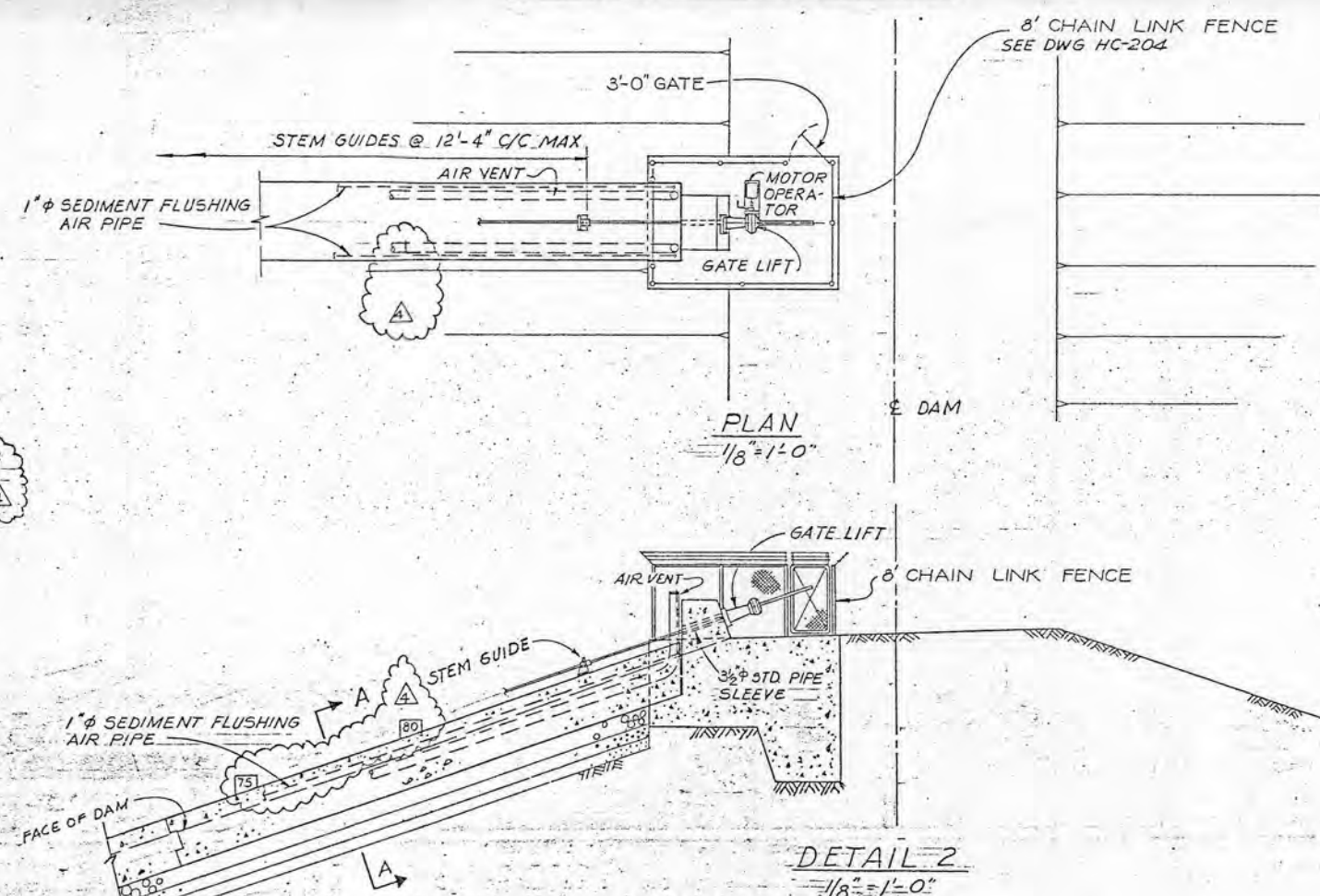
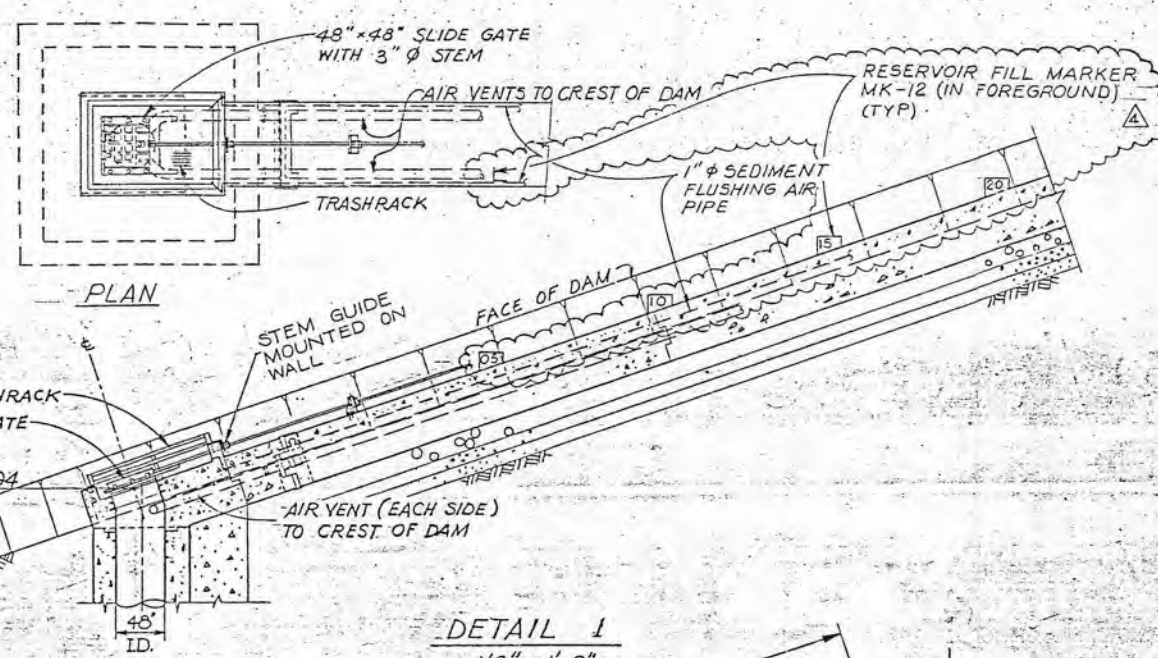
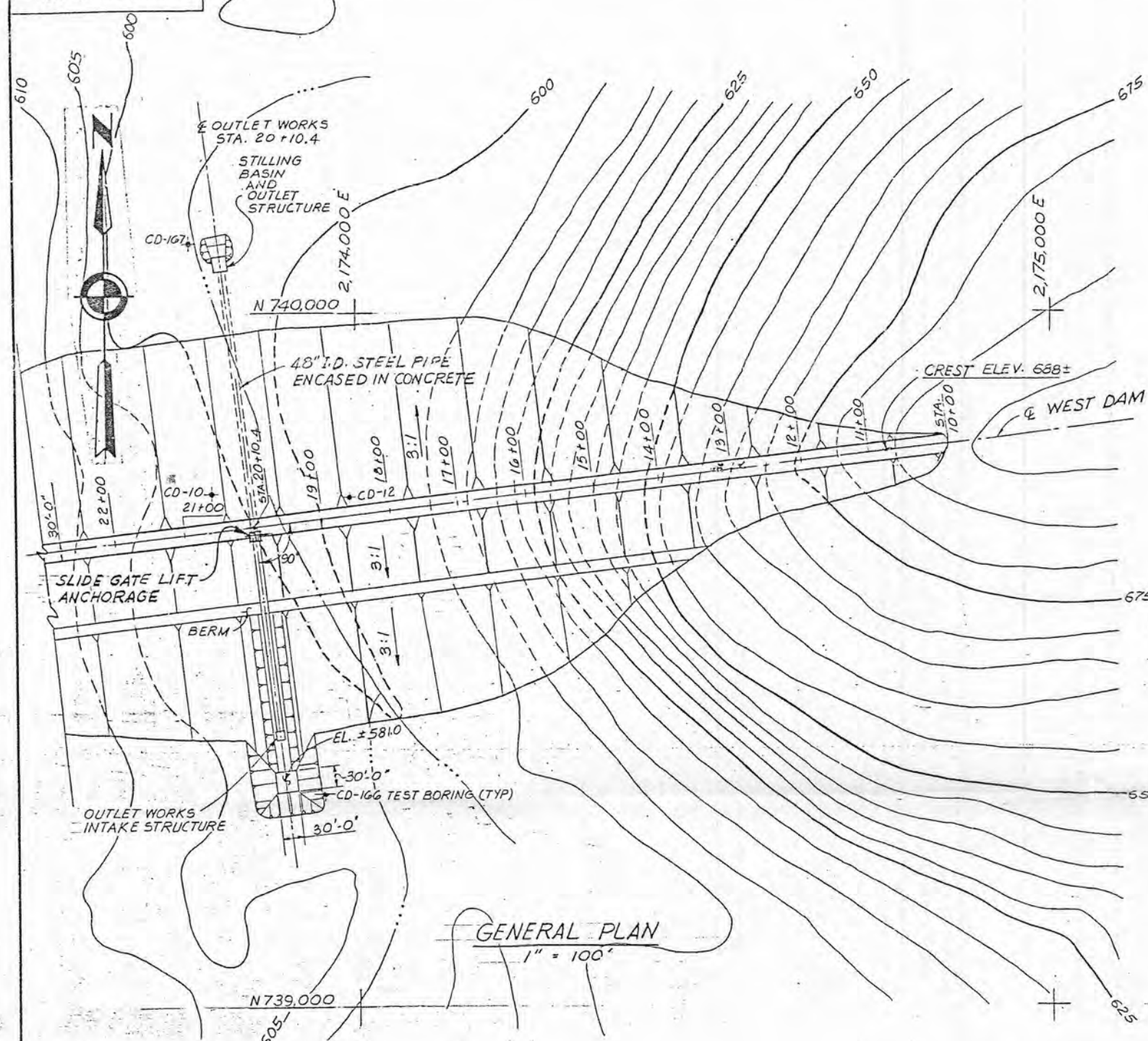
NO.	DATE	REVISIONS	BY	CHKD	DESIGN	ENGR	APPV
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1/06/91		Issued for Construction - F-22 Contract	JN	FR			
1/06/91		Issued for Bids - F22	JN	FR			
1/06/91		Added Final Pavement: Issued for Client Approval F22 Work	JN	FR			
1/06/91		Revised as Built	FR	JN			
1/06/91		Incorp. DCN No. 1	JN	FR			
1/06/91		Issued for Construction	JN	FR			
1/06/91		Issued for add. #3	REM	JN			
1/06/91		Issued for Addendum No. 1	JN	FR			
1/06/91		Issued for Bid	RLT	FR			

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PORTLAND GENERAL ELECTRIC CO. PORTLAND, OREGON

SADDLE DAM
PROFILE & TYPICAL SECTION

JOB No.	DRAWING No.	REV.
10411-002	HC-107	9



CONDUIT SECTIONS OUTSIDE OF DAM ZONE I
CLAY CORE
(FOR CONDUIT IN ZONE I CLAY CORE
SEE SECTION E-E DWG. HC-204)

NOTES:

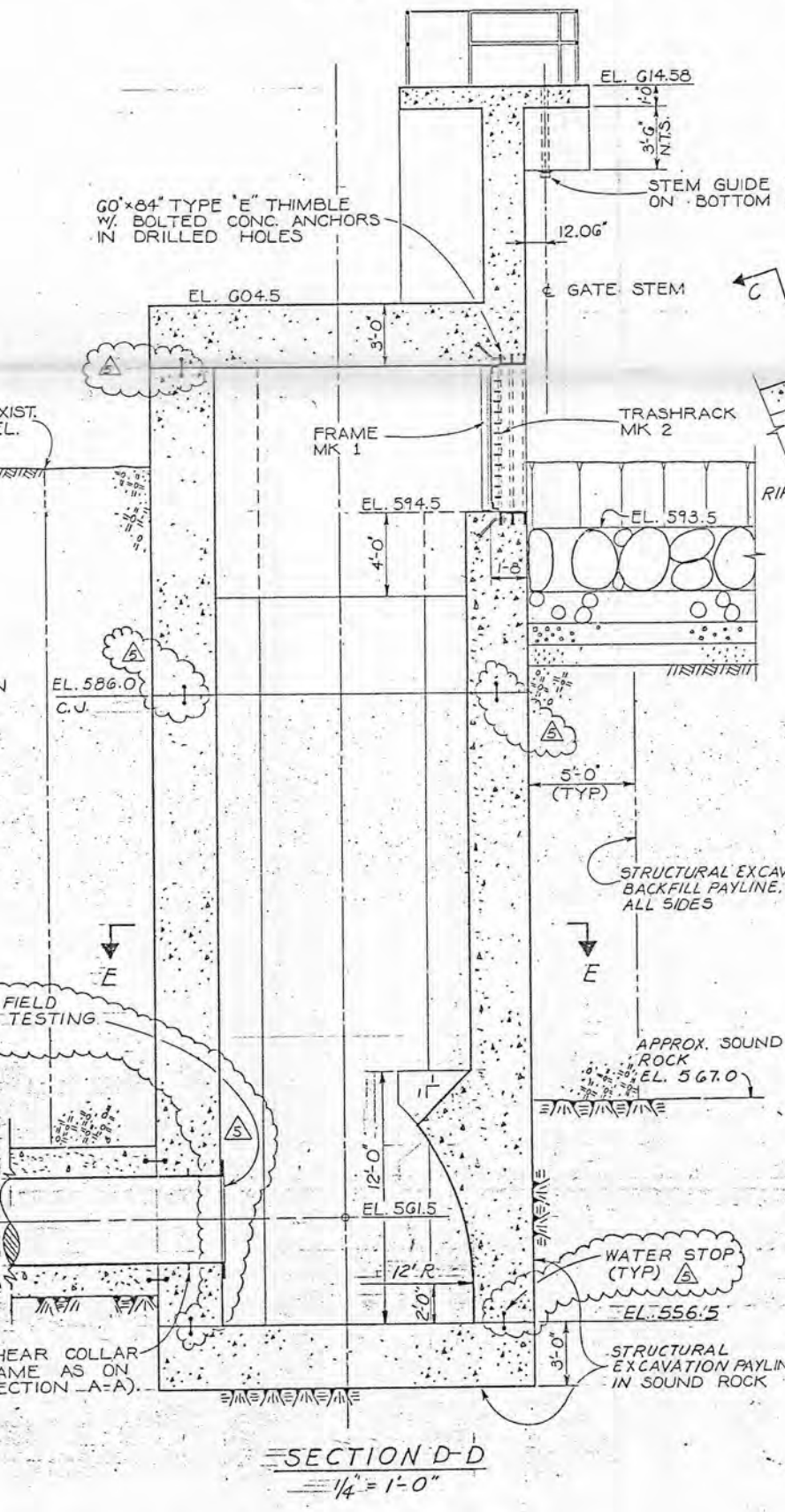
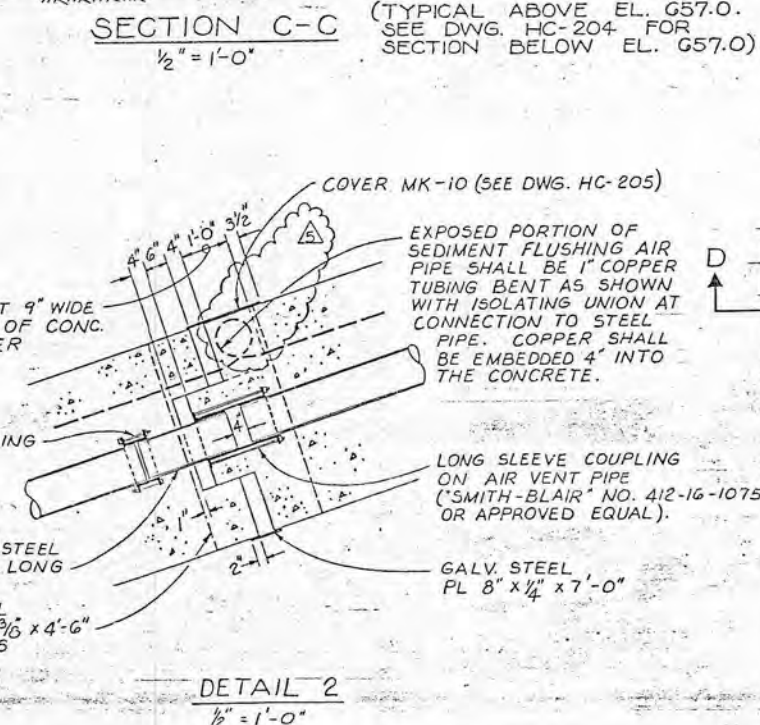
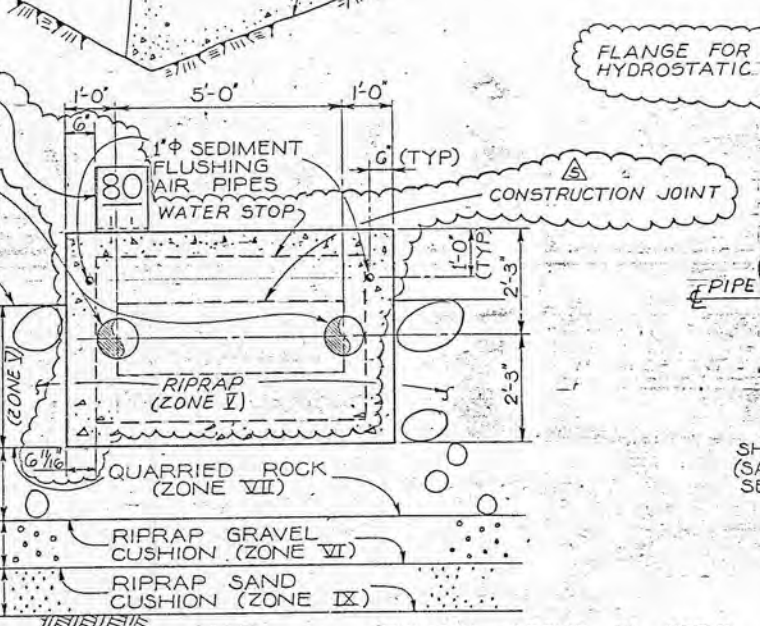
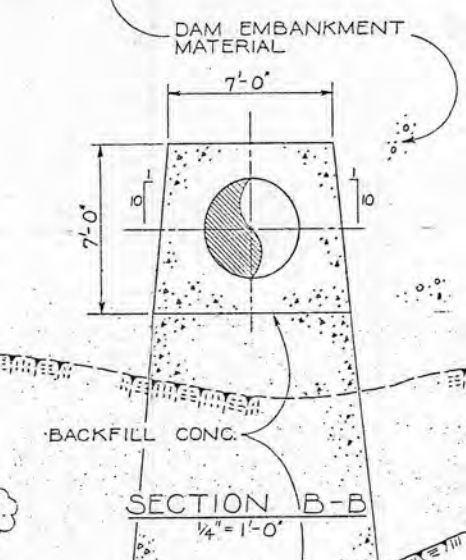
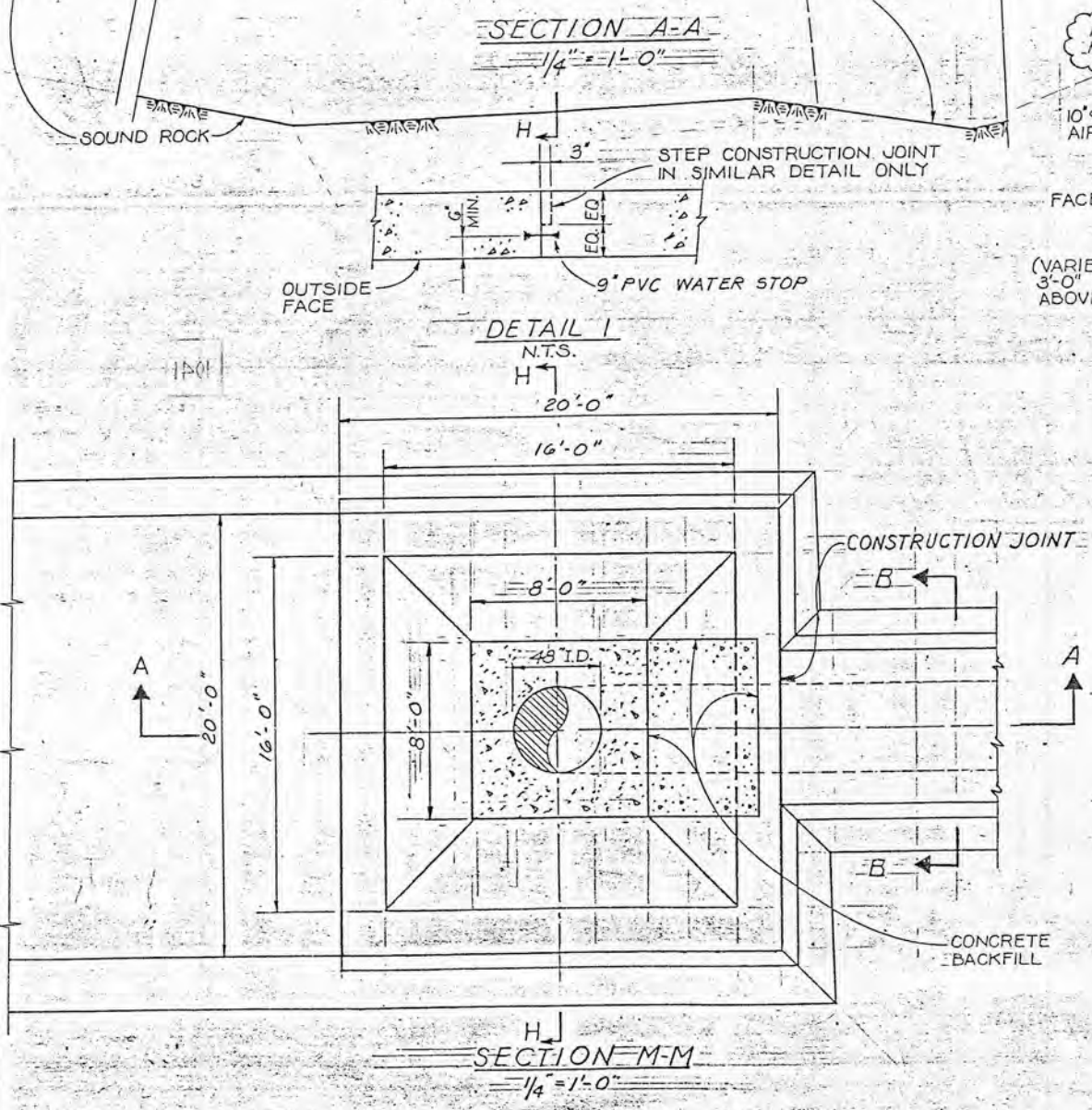
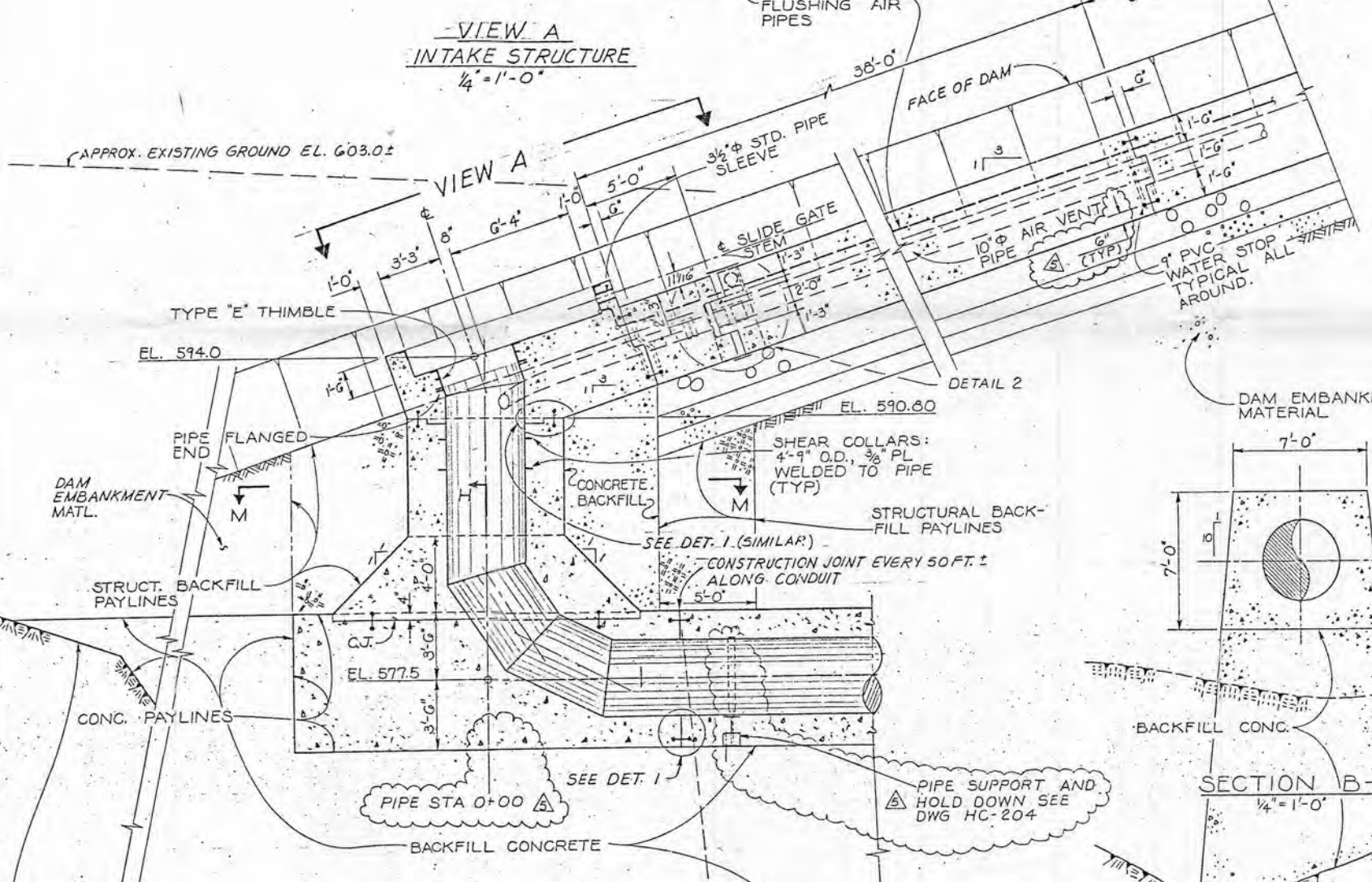
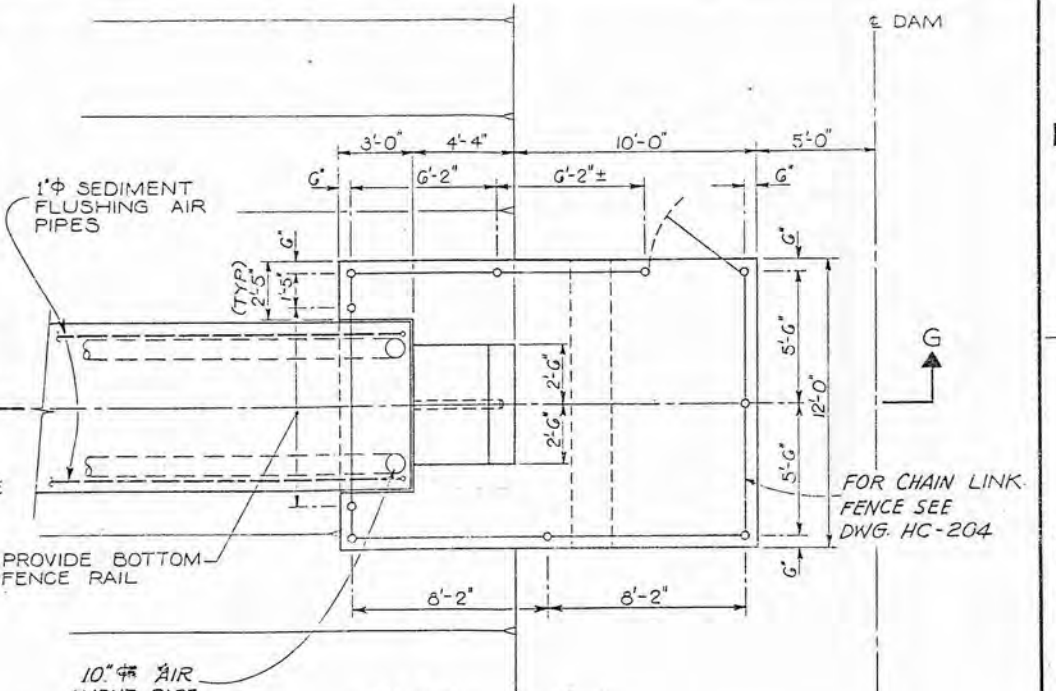
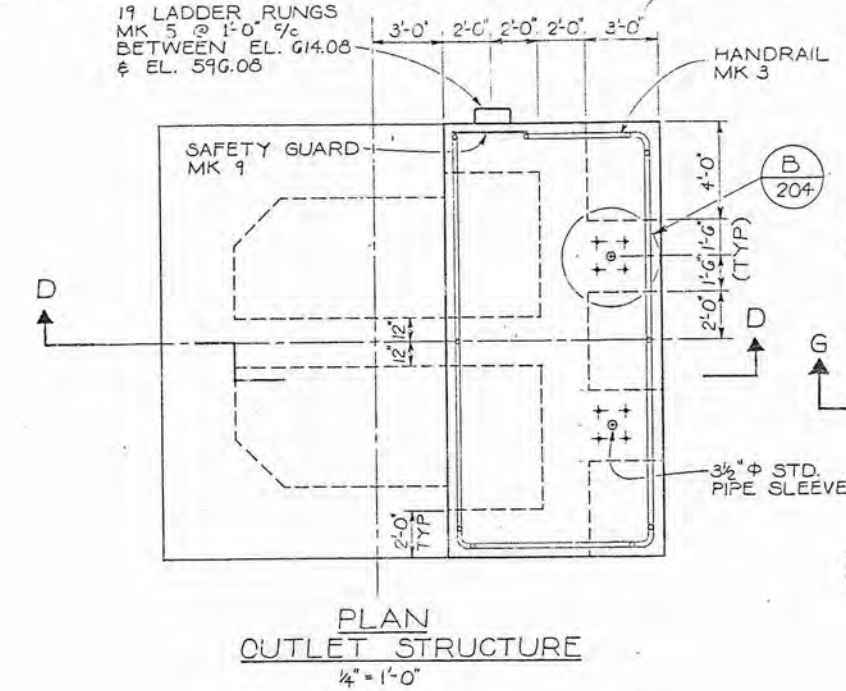
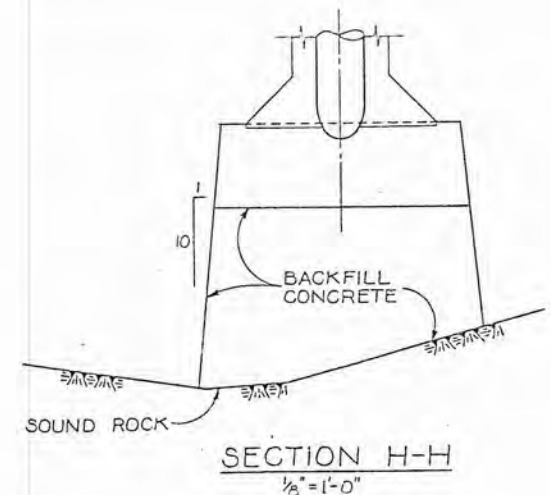
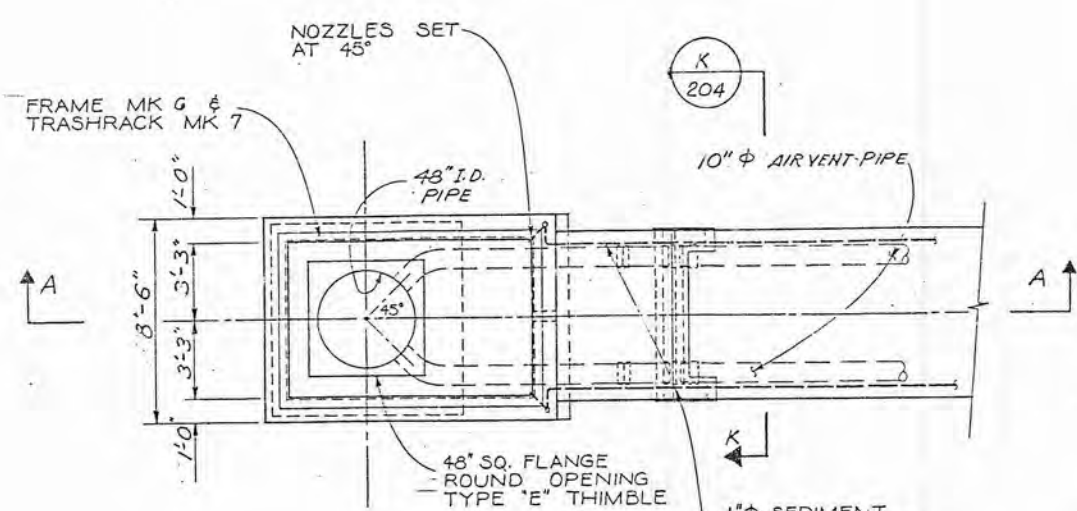
1. FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE DWG. HC-202.
2. FOR GENERAL LOCATION SEE DWG. HC-102.

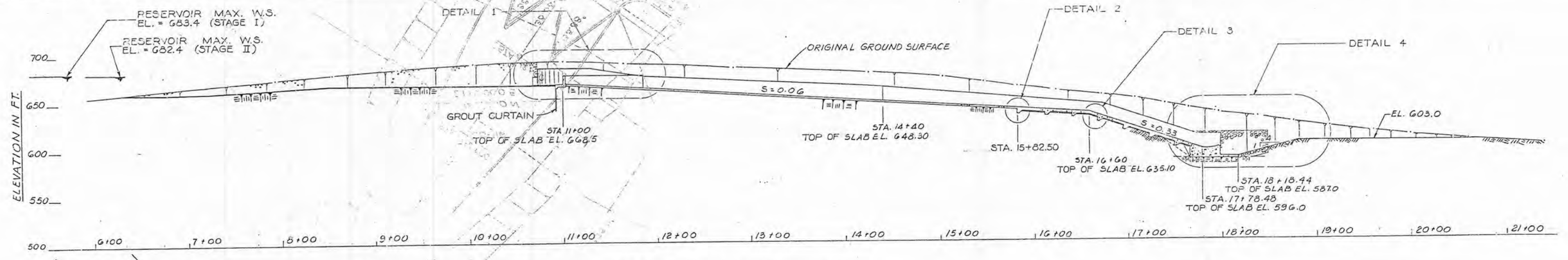
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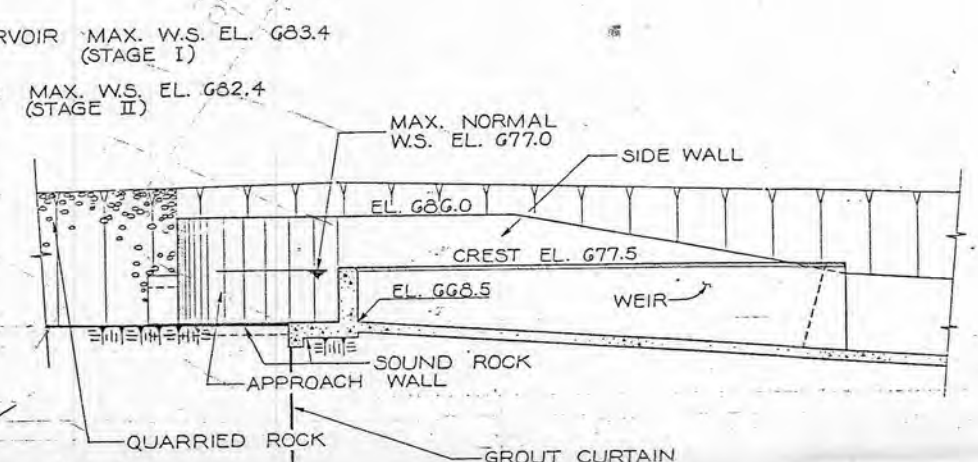
WATER RESOURCES DEPT.
SALEM, OREGON

10/70	REVISED AS BUILT	FR	UN		
3/3/77	INCORP. 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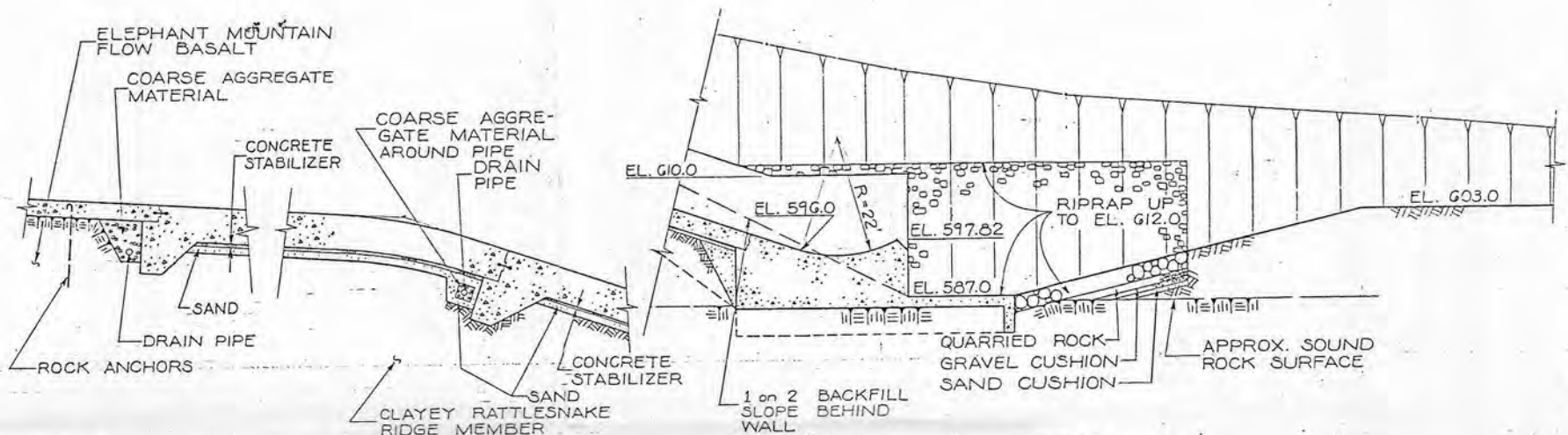




PROFILE ALONG SPILLWAY
1" = 50'



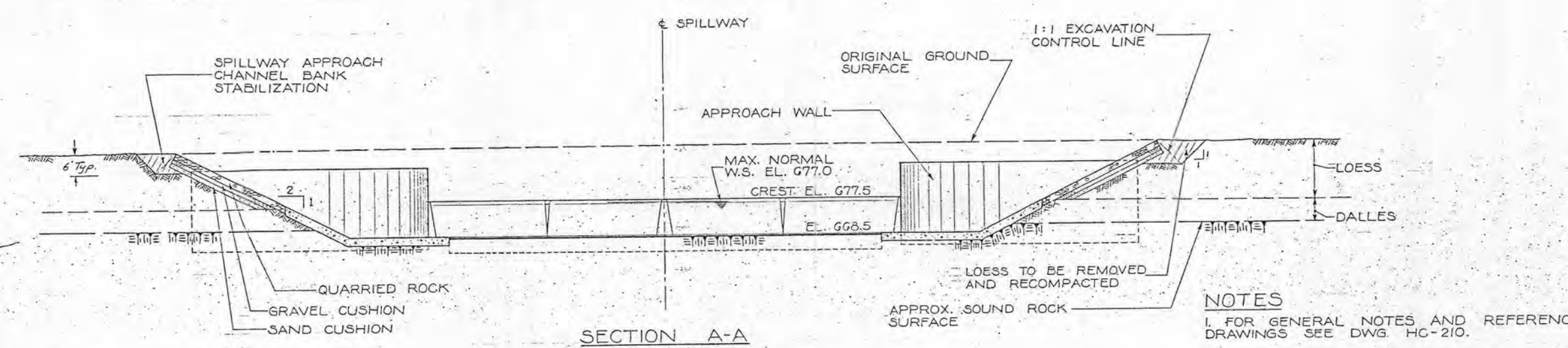
DETAIL 1
1/8" = 1'-0"



DETAIL 2
1/8" = 1'-0"

DETAIL 3
1/8" = 1'-0"

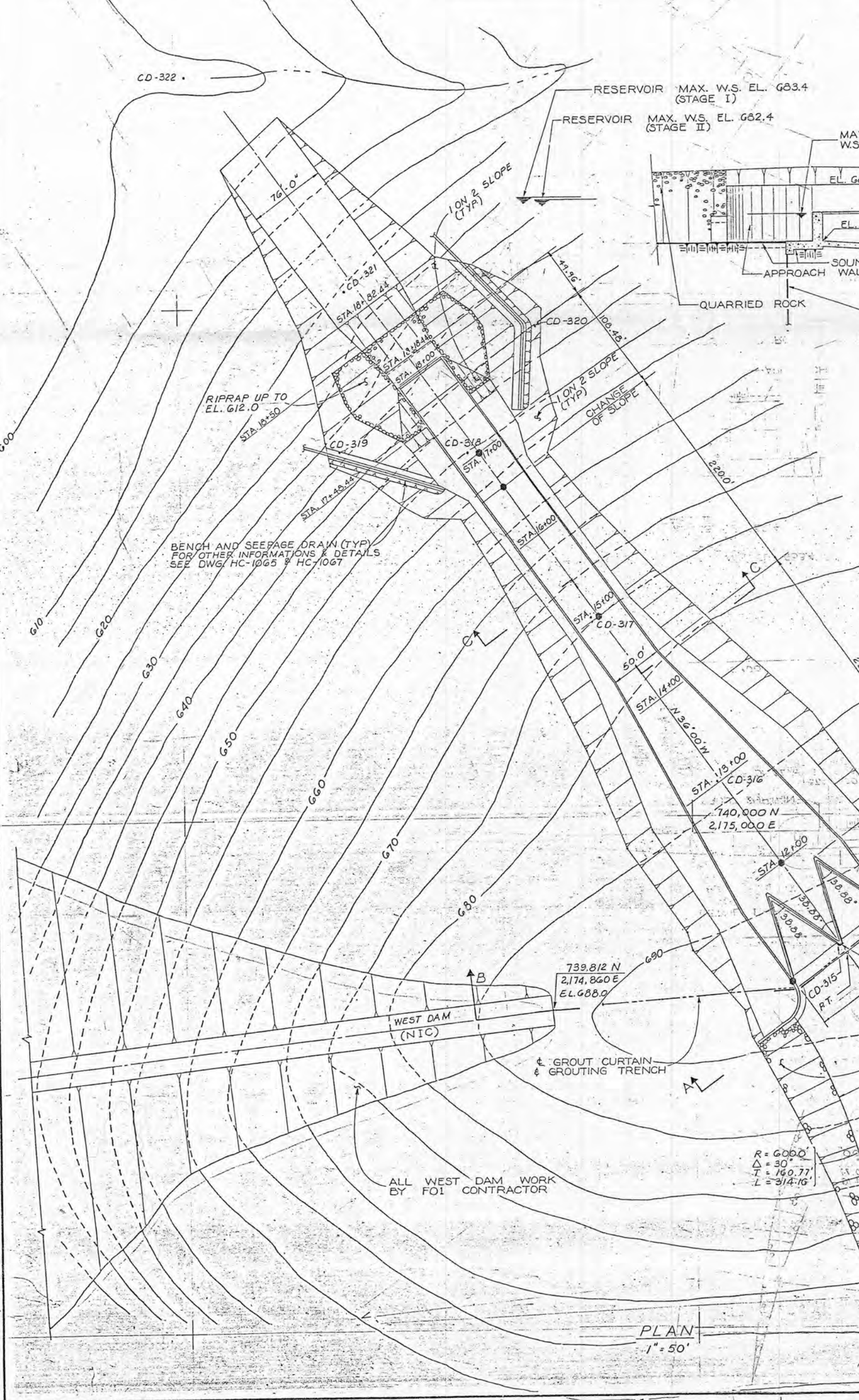
DETAIL 4
1/8" = 1'-0"



SECTION A-A
1/8" = 1'-0"

SECTION C-C
1/8" = 1'-0"

NOTES
1. FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE DWG. HC-210.



PLAN
1" = 50'

RECEIVED
MAY 21 1996
WATER RESOURCES DEPT.
SALEM, OREGON

NO.	DATE	REVISION	BY	CHKD	DESIGN	ENGR	APPR
1	10/1/84	ISSUED FOR BIDS	UN	FR	UN	FR	UN
2	1/15/85	ISSUED FOR DESIGN REPORT	UN	FR	UN	FR	UN
3	1/15/85	REV. APPR. CHANNEL, WALLS, AND REVISIONS AS BUILT	UN	FR	UN	FR	UN
4	1/15/85	INCORP. DCN. NO. 1 & 2	UN	FR	UN	FR	UN
5	1/15/85	ADDED FEES DEFLECTION-SETTLEMENT PT. MON.	UN	FR	UN	FR	UN
6	1/15/85	ADDED BENCH & SEEPAGE DRAIN	UN	FR	UN	FR	UN



BECHTEL
SAN FRANCISCO

BOARDMAN PLANT
PORTLAND GENERAL ELECTRIC CO. PORTLAND, OREGON

DAM SPILLWAY
GENERAL ARRANGEMENT

JOB No.	DRAWING No.	REV.
10411-002	HC-209	5

