STORAGE RIGHT APPLICATION MAP
TAX LOT 100

Located in Section 26, T.16.S, R.23.E W.M.
Deschutes Basin, Crook County, Oregon

NOTES

1. This map was prepared for the purpose of identifying the location of water rights only and is not intended to provide legal dimensions or locations of property ownership lines.

Vicinity Map

EXPLANATION

203 Tax Lot ID Number

Tax Lot Boundary

NW-NW | NE-NW | NW-NE | NE-NE
SW-NW | SE-NW | SW-NE | SE-NE
NW-SW | NE-SW | NW-SE | NE-SE
SW-SW | SE-SW | SW-SE | SE-SE

100 | 26 | 35 | 1700 | 1800

2640'

Proposed Pump Station No.1

726' Proposed 8" Pipe

Proposed Beaver Creek East Reservoir Site (Off-Channel)

822'

618'

West Side Ditch

East Side Ditch

Beaver Creek

CERTIFIED WATER RIGHTS EXAMINER
82917 CWRE
JAMES B. NEWTON
JUNE 8, 2009
STATE OF OREGON

EXPIRES: 12/31/2018
RENEWS:

0' 1,320' 2,640'

SCALE: 1" = 1,320'

CASCADE GEOENGINEERING
360.907.4162 cascadegeoengineering.com

Storage Right Application Map
Beaver Creek East Reservoir
Blue Mountain Ranch
Deschutes Basin, Crook County, Oregon

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
J. Newton	R2D	APR 2018	CG1016-101	1

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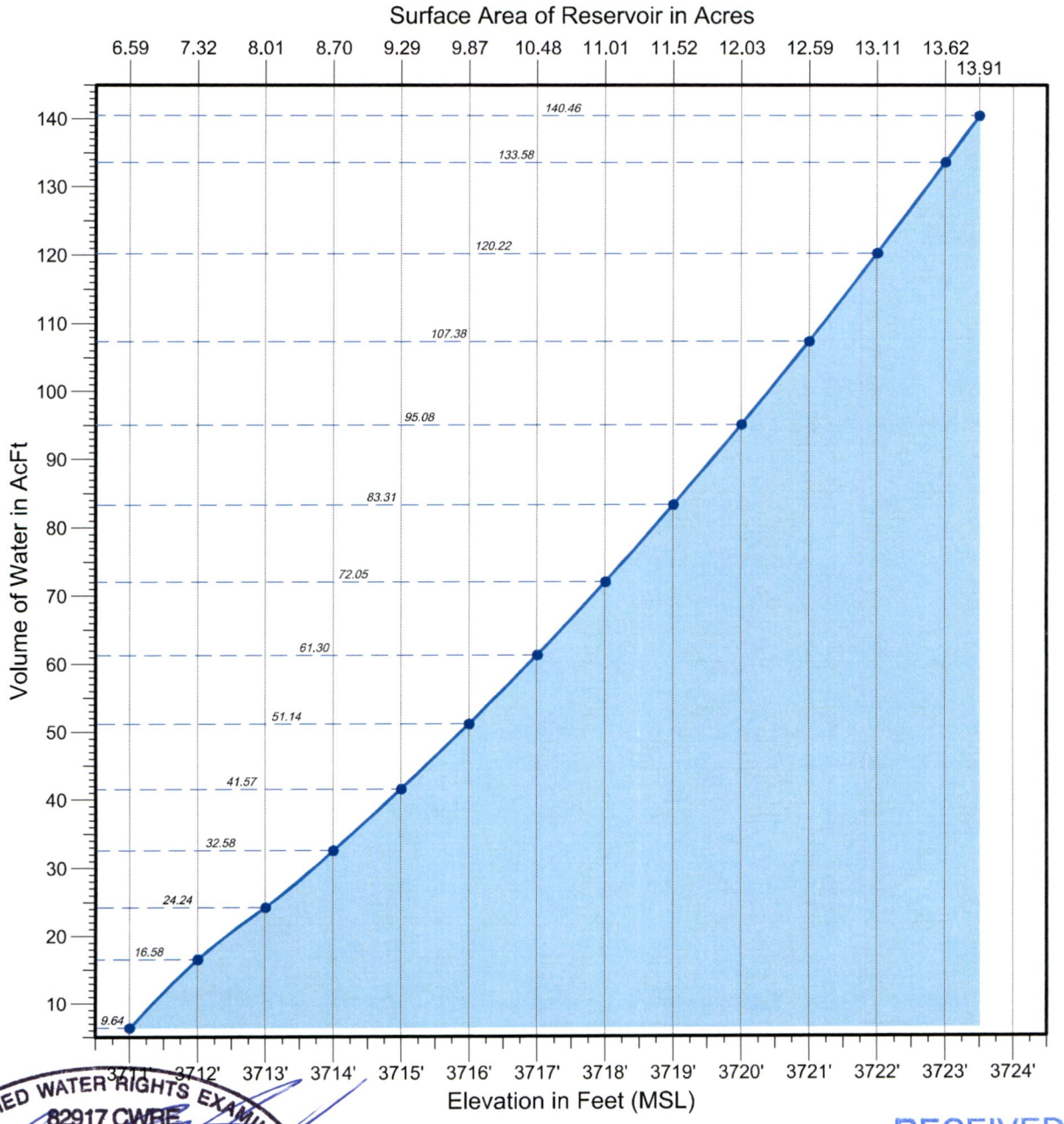
R-88586



CERTIFIED WATER RIGHTS EXAMINER
82917 CWRE
JAMES B. NEWTON
JUNE 8, 2009
STATE OF OREGON

EXPIRES: 12/31/2018
RENEWS:

RECEIVED
JUN 06 2018
OWRD

CASCADE GEOENGINEERING
360.907.4162 cascadegeoengineering.com

Area-Capacity Curve
Beaver Creek East Reservoir
Blue Mountain Ranch
Deschutes Basin, Crook County, Oregon

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
J. Newton	R2D	APR 2018	CG1016-101	2

R-88586

STORAGE RIGHT APPLICATION MAP
TAX LOT 100

Located in Section 26, T.16.S, R.23.E W.M.
Deschutes Basin, Crook County, Oregon

NOTES

1. This map was prepared for the purpose of identifying the location of water rights only and is not intended to provide legal dimensions or locations of property ownership lines.

Vicinity Map

EXPLANATION

203 Tax Lot ID Number

Tax Lot Boundary

NW-NW NE-NW NW-NE NE-NE
SW-NW SE-NW SW-NE SE-NE
100
26
NW-SW NE-SW NW-SE NE-SE
SW-SW SE-SW SW-SE SE-SE
1800
1700
35

2640'

726'

822'

618'

Proposed Pump Station No.1

Proposed 8" Pipe

Proposed Beaver Creek East Reservoir Site (Off-Channel)

West Side Ditch

East Side Ditch

Beaver Creek

RECEIVED
JUN 06 2018
OWRD

0' 1,320' 2,640'

SCALE: 1" = 1,320'

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Storage Right Application Map
Beaver Creek East Reservoir
Blue Mountain Ranch
Deschutes Basin, Crook County, Oregon

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
J. Newton	R2D	APR 2018	CG1016-101	1

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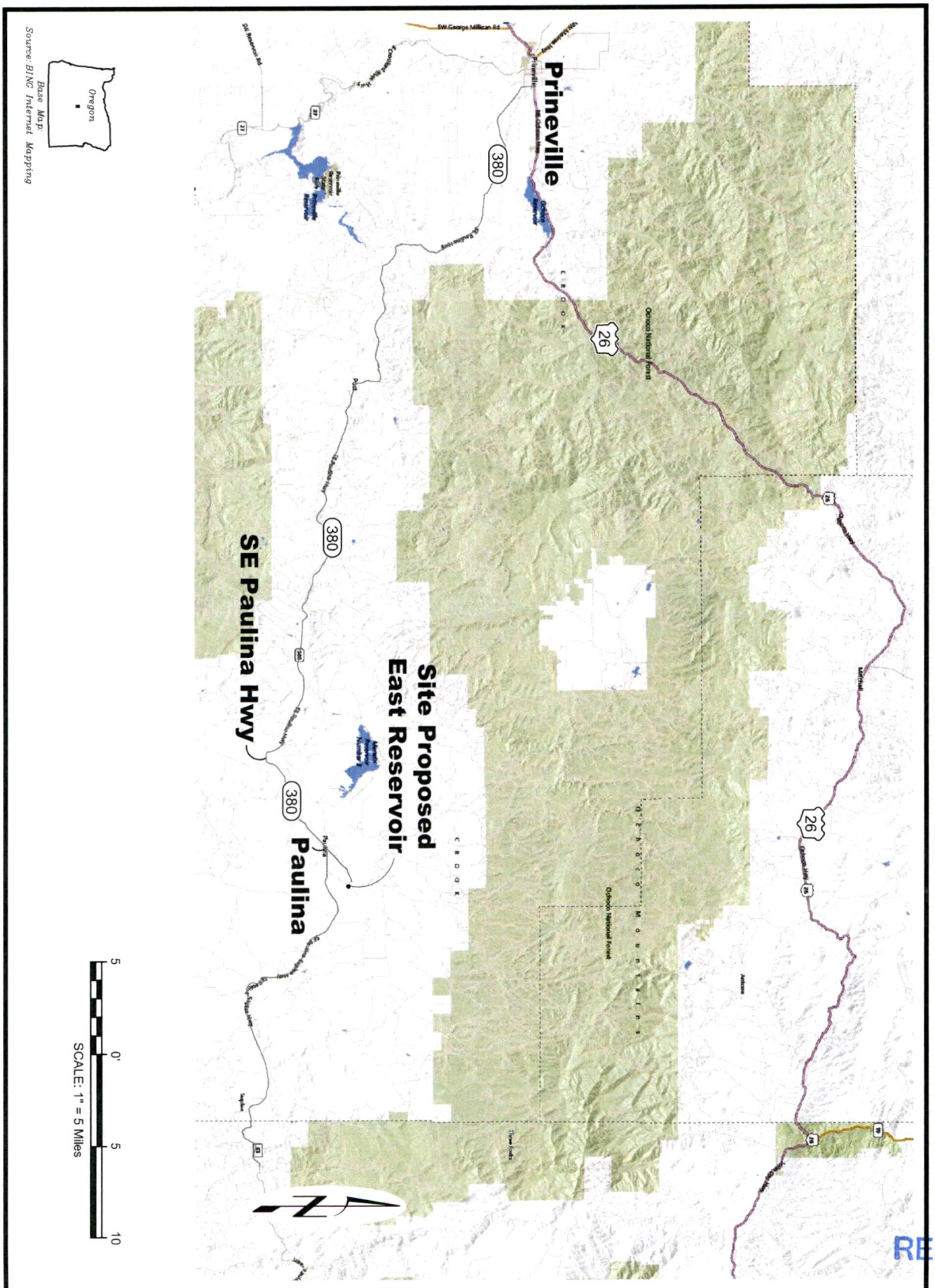
R-88580



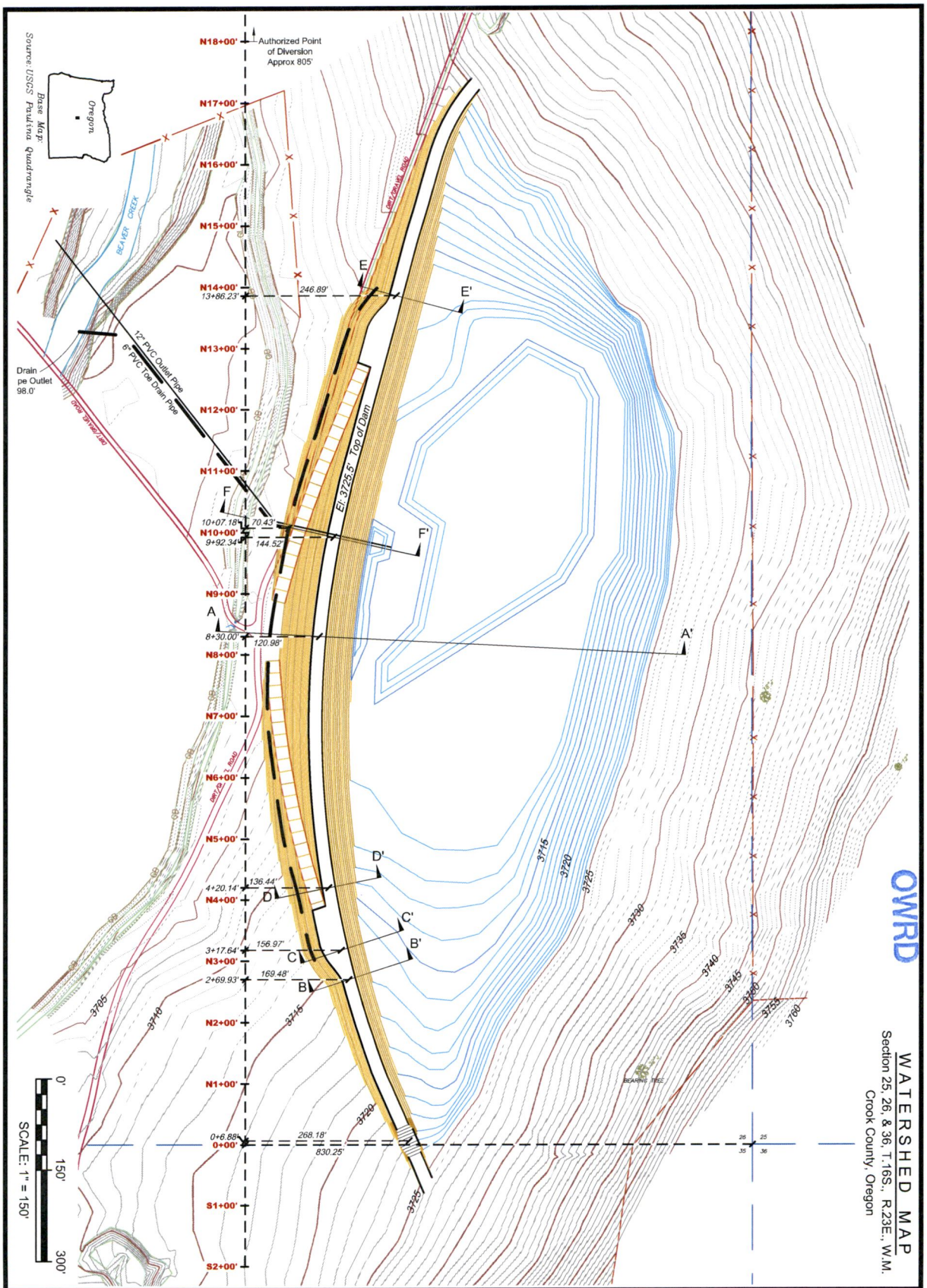
NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

Vicinity Map

Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
D.Newton	S.Schenck	April 25, 2013	1050-112	1

R-88586



WATERSHED MAP

Section 25, 26, & 36, T.16S., R.23E., W.M.
Crook County, Oregon

OWRD

RECEIVED
JUN 06 2018

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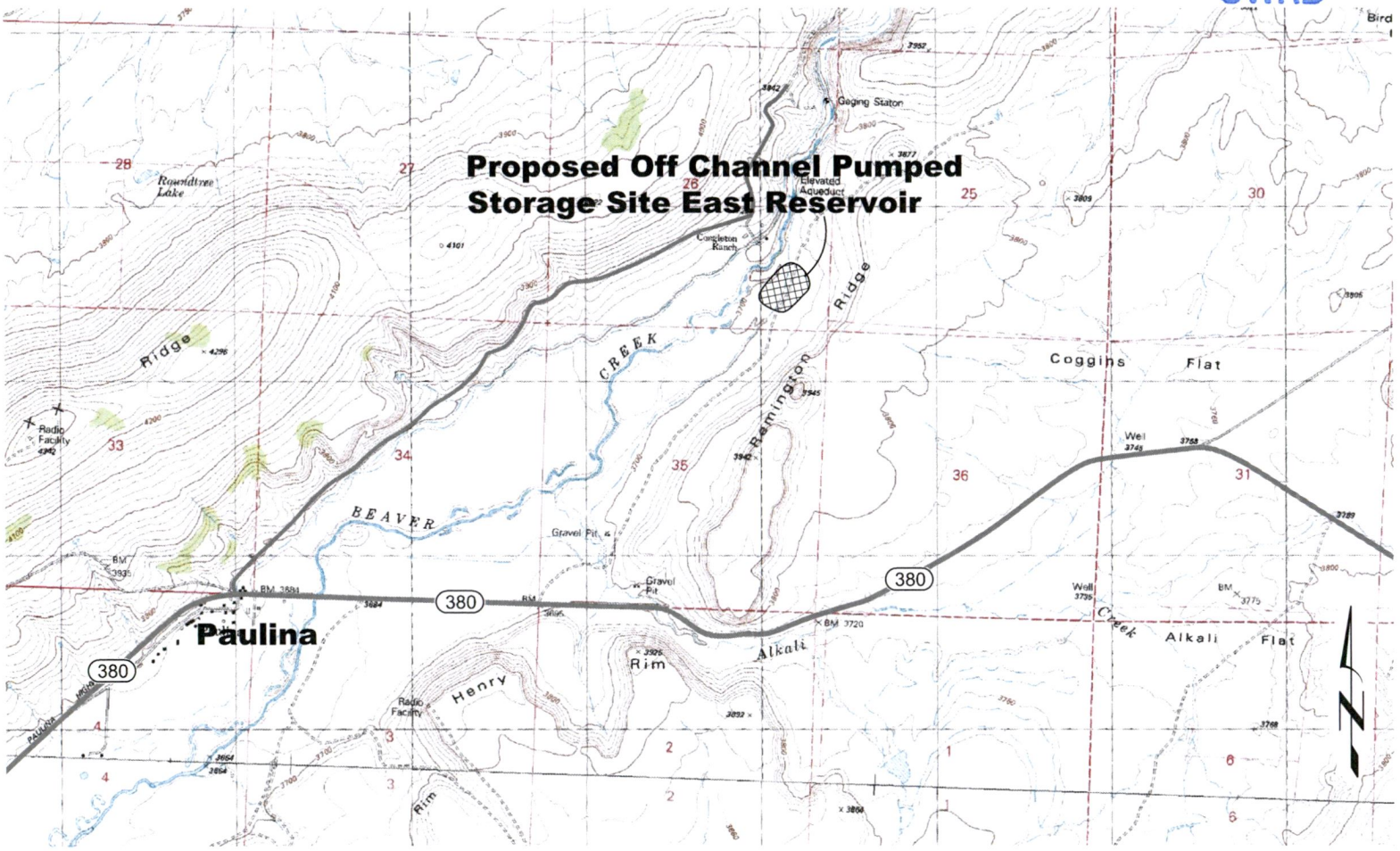
Ph: 541 504-9960 Fax: 541 504-9961

East Dam & Reservoir Layout

Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
D.Newton	S.Schenck	April 25, 2013	1050-112	2

R-86586

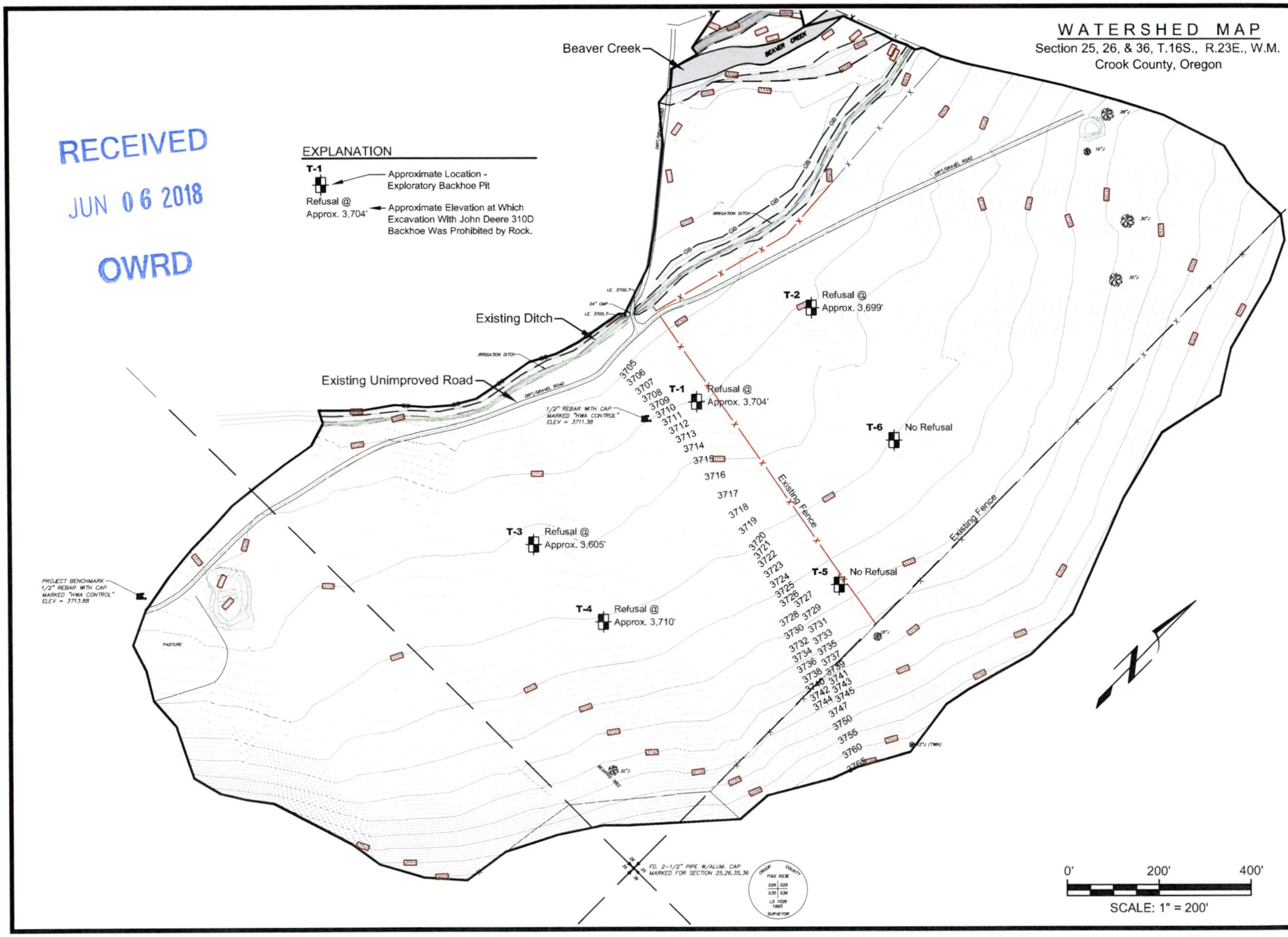


Physiographic Features
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
D.Newton	S.Schenck	April 25, 2013	1050-112	3

R-86936


WATERSHED MAP
Section 25, 26, & 36, T.16S., R.23E., W.M.
Crook County, Oregon
EXPLANATION
T-1
Approximate Location - Exploratory Backhoe Pit
Refusal @ Approx. 3,704'
Approximate Elevation at Which Excavation With John Deere 310D Backhoe Was Prohibited by Rock.
Beaver Creek
Existing Ditch
Existing Unimproved Road
T-1 Refusal @ Approx. 3,704'
T-2 Refusal @ Approx. 3,699'
T-3 Refusal @ Approx. 3,605'
T-4 Refusal @ Approx. 3,710'
T-5 No Refusal
T-6 No Refusal
Existing Fence
Existing Fence
1/2" REBAR WITH CAP MARKED "HWA CONTROL" ELEV = 3711.38
PROJECT BENCHMARK 1/2" REBAR WITH CAP MARKED "HWA CONTROL" ELEV = 3713.88
FD. 2-1/2" PIPE W/ALUM. CAP MARKED FOR SECTION 25,26,35,36
0' 200' 400'
SCALE: 1" = 200'

Approximate Locations of Exploration Backhoe Pits
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

FIGURE 4

PROJECT NO. 1050-112

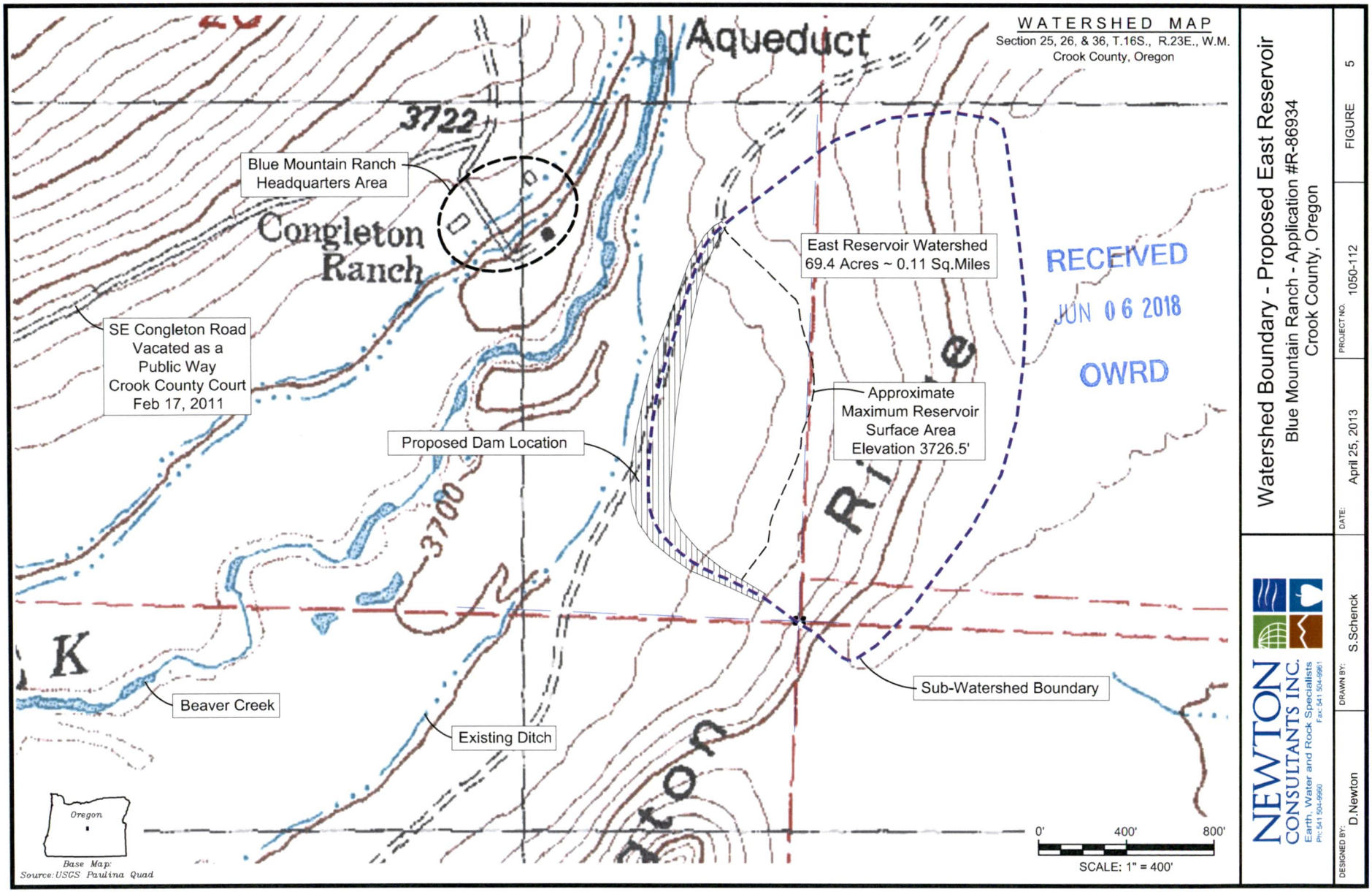
DATE: April 25, 2013

DRAWN BY: S.Schenck

DESIGNED BY: D.Newton

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

R-88586

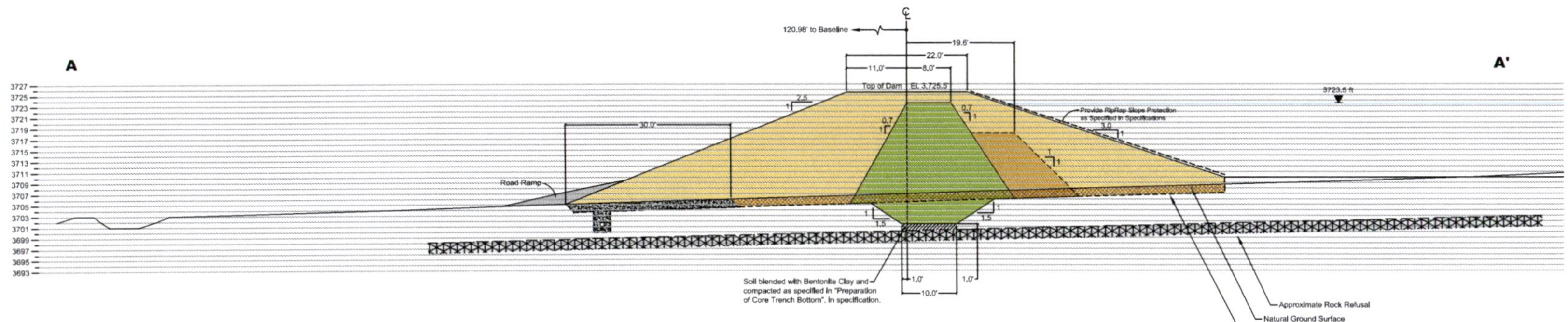


Watershed Boundary - Proposed East Reservoir
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	FIGURE
D.Newton	S.Schenck	April 25, 2013	1050-112	5

R 86896



Section A-A'

Scale: 1" = 10'

LEGEND

DAM EMBANKMENT MATERIALS

Four soil units are identified in the proposed reservoir area. Three of the soil units are to be used to construct the dam embankment.

Soil Unit No. 1 consists of organic topsoils and are to be stripped to a minimum depth of 1 to 1.5 feet as determined by the Engineer and removed from the site. These soils could be stockpiled for other use.

Soil Unit No. 2 consists of sandy silt to very silty fine sand. This unit lies beneath the organic topsoil unit and varies in thickness from approximately 1 foot to 3.5 feet. This soil unit is planned for the core of the dam, including backfill for the cutoff trench as shown on the drawings.

Soil Unit No. 3 consists generally of well-graded to poorly-graded, silty gravelly sands. This unit lies beneath the silt soils of Unit No. 2. This soil unit is planned for use in the upstream "shell" as shown on the drawings, and in the downstream part of the embankment, between the core and the downstream slope of the dam. This soil unit contains some cobbles and small boulders. Cobbles greater than 6 inches in size and all boulders shall be removed from the embankment fill.

Soil Unit No. 3 is also a source of material for the toe drain gravel. It is planned that Soil Unit No. 3 materials are screened to remove the material sizes finer than 3/8-inch size to generate toe drain gravel. The screened material 3/8-inch and finer can be used in the embankment fill by spreading and blending with other Soil Unit No. 3 material going directly from borrow areas to the dam embankment.

Soil Unit No. 4 consists generally of poorly graded silty sand. This material is also for use in the dam embankment against the upstream side of the dam core as shown on the drawings. The purpose of this use as part of the dam core is to help reduce permeability of the dam. Soil Unit No. 4 is also planned for use as trench backfill for the outlet pipe.

0' 10' 20'
SCALE: 1" = 10'

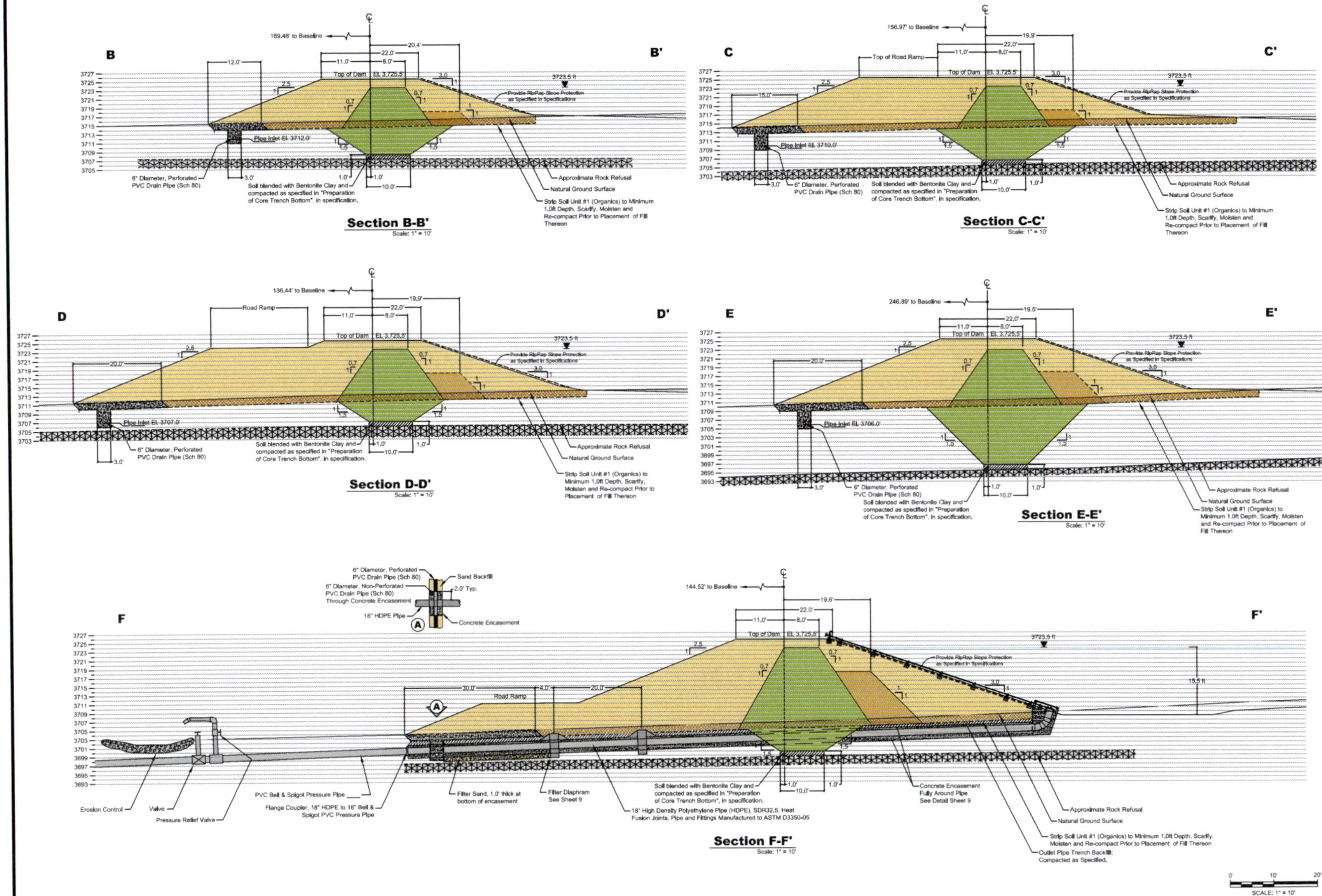
Dam Cross Section
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

PROJECT NO.	DATE	SHEET
1050-112	April 25, 2013	7 OF 10
DESIGNED BY: D.Newton	DRAWN BY: S.Schenck	

NEWTON CONSULTANTS INC.

NO.	DATE	BY	REVISIONS
01	24Jul2013	DJN	Correct Top of Dam Elevation
02	24Jul2013	DJN	Add Note on Preparation of Core trench Bottom
03	29Jul2013	DJN	Added RipRap Protection Specification

R-86934


Section B-B'
Scale: 1" = 10'
169.48' to Baseline
Top of Dam EL 3,725.5'
3723.5 ft
Provide RipRap Slope Protection as Specified in Specifications
Pipe Inlet EL 3712.0'
6" Diameter, Perforated PVC Drain Pipe (Sch 80)
Soil blended with Bentonite Clay and compacted as specified in "Preparation of Core Trench Bottom", in specification.
Approximate Rock Refusal
Natural Ground Surface
Strip Soil Unit #1 (Organics) to Minimum 1.0ft Depth, Scarify, Moisten and Re-compact Prior to Placement of Fill Thereon
Section C-C'
Scale: 1" = 10'
156.97' to Baseline
Top of Road Ramp
Pipe Inlet EL 3710.0'
Section D-D'
Scale: 1" = 10'
136.44' to Baseline
Road Ramp
Pipe Inlet EL 3707.0'
Section E-E'
Scale: 1" = 10'
246.89' to Baseline
Pipe Inlet EL 3706.0'
Section F-F'
Scale: 1" = 10'
144.52' to Baseline
6" Diameter, Perforated PVC Drain Pipe (Sch 80)
6" Diameter, Non-Perforated PVC Drain Pipe (Sch 80) Through Concrete Encasement
18" HDPE Pipe
Sand Backfill
2.0' Typ.
Concrete Encasement
Road Ramp
15.5 ft
Erosion Control
Valve
Pressure Relief Valve
PVC Bell & Spigot Pressure Pipe
Flange Coupler, 18" HDPE to 18" Bell & Spigot PVC Pressure Pipe
Filter Sand, 1.0' thick at bottom of encasement
Filter Diaphram See Sheet 9
18" High Density Polyethylene Pipe (HDPE), SDR32.5, Heat Fusion Joints, Pipe and Fittings Manufactured to ASTM D3350-05
Concrete Encasement Fully Around Pipe See Detail Sheet 9
Outlet Pipe Trench Backfill; Compacted as Specified.
SCALE: 1" = 10'

Dam Cross Sections
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

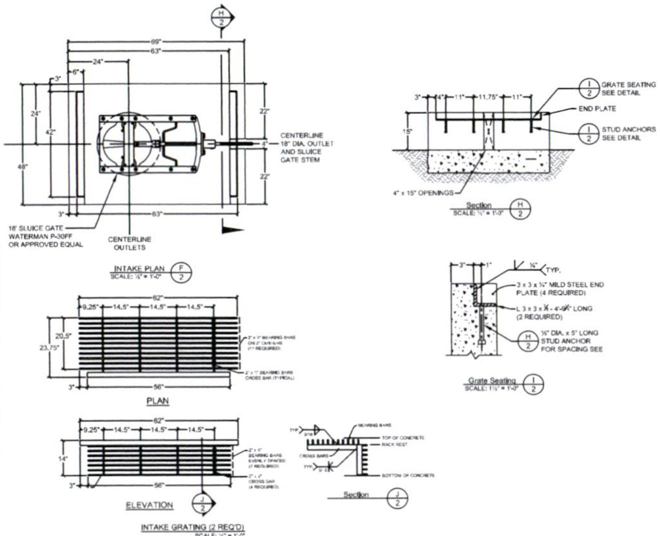
SHEET 8 OF 10

PROJECT NO. 1050-112 | DESIGNED BY D.Newton | DATE April 25, 2013 | DRAWN BY S.Schenck

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists

NO.	DATE	BY	REVISIONS
01	24Jul2013	DJN	Modify to Fully Encased Outlet Pipe
02	29Jul2013	DJN	Added RipRap Protection Specification

R-88586



Model 90-01 Pressure Relief Valve

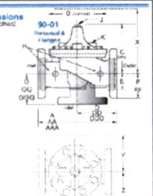
Model 90-01 (Uses Basic Valve Model 100-01)

Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class				
		Flanged			Grooved	Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400	400
ASTM B62	Bronze	B16.24	225	400	400	400

Note: * ANSI standards are for flange dimensions only. Flanged valves are available faced but not drilled.
‡ End Details machined to ANSI B2.1 specifications.
Valves for higher pressure are available; consult factory for details

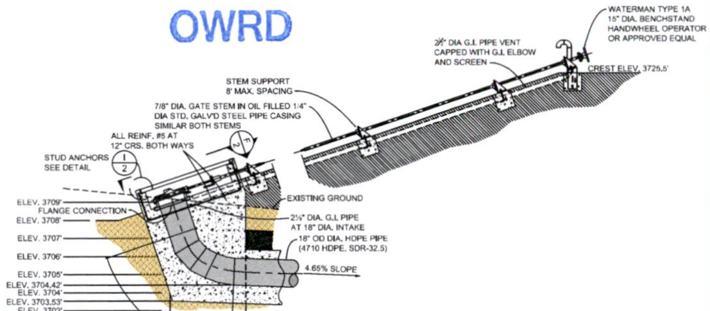
Dimensions (In Inches)



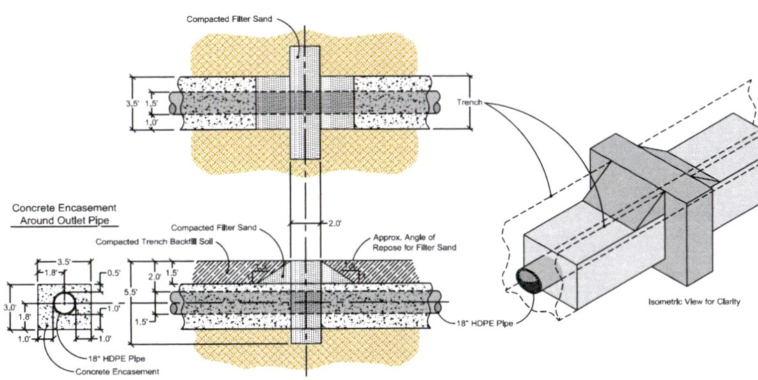
Model 90-01 Dimensions (In Inches)

Valve Size (Inches)	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36
A Threaded	7.25	7.25	7.25	9.38	11.00	12.50	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	—	—	8.50	9.38	11.00	12.00	15.00	20.00	25.38	29.75	34.00	39.00	41.38	46.00	52.00	61.50	63.00	76.00
AAA 300 ANSI	—	—	9.00	10.00	11.62	13.25	15.62	21.00	26.38	31.12	35.50	40.50	43.50	47.64	53.62	63.24	64.50	76.00
AAAA Grooved End	—	—	8.50	9.00	11.00	12.50	15.00	20.00	25.38	—	—	—	—	—	—	—	—	—
B Dia.	5.62	5.62	5.62	6.62	8.00	9.12	11.50	15.75	20.00	23.62	28.00	32.75	35.50	41.50	48.00	53.16	56.00	66.00
C Max.	5.50	5.50	5.50	6.50	7.56	8.19	10.62	13.38	16.00	17.12	20.88	24.19	25.00	39.06	41.50	43.93	64.60	61.50
CC Max. Grooved End	—	—	4.75	5.75	6.88	7.25	9.31	12.12	14.62	—	—	—	—	—	—	—	—	—
D Threaded	3.25	3.25	3.25	4.75	5.50	6.25	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	—	—	4.00	4.75	5.50	6.00	7.50	10.00	12.69	14.88	17.00	19.50	20.81	—	—	30.75	—	—
DDD 300 ANSI	—	—	4.25	5.00	5.88	6.38	7.88	10.50	13.25	15.58	17.75	20.25	21.62	—	—	31.62	—	—
DDDD Grooved End	—	—	—	4.75	—	6.00	7.50	—	—	—	—	—	—	—	—	—	—	—
E	1.12	1.12	1.12	1.50	1.69	2.06	3.19	4.31	5.31	9.25	10.75	12.62	15.50	12.95	15.00	17.75	21.31	24.56
EE Grooved End	—	—	2.00	2.50	2.88	3.12	4.25	6.00	7.56	—	—	—	—	—	—	—	—	—
F 150 ANSI	—	—	2.50	3.00	3.50	3.75	4.50	5.50	6.75	8.00	9.50	10.50	11.75	15.00	16.50	19.25	22.50	25.50
FF 300 ANSI	—	—	3.06	3.25	3.75	4.13	5.00	6.25	7.50	8.75	10.25	11.50	12.75	15.00	16.50	19.25	24.00	25.50
G Threaded	1.88	1.88	1.88	3.25	4.00	4.50	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	—	—	4.00	5.25	4.00	4.00	5.00	6.00	8.00	8.62	10.75	14.88	15.69	—	—	22.06	—	—
GGG 300 ANSI	—	—	4.25	5.50	4.31	4.38	5.31	6.50	8.50	9.31	14.50	15.62	16.50	—	—	22.90	—	—
GGGG Grooved End	—	—	—	3.25	—	4.25	5.00	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	.375	.375	.375	.375	.50	.50	.75	.75	1	1	1	1	1	1	1	1	2	2
J NPT Cover Center Plug	.25	.25	.25	.50	.50	.50	.75	.75	1	1	1.25	1.5	2	1.5	1.5	1.5	2	2
K NPT Cover Tapping	.375	.375	.375	.375	.50	.50	.75	.75	1	1	1	1	1	1	1	1	2	2
Stem Travel	0.4	0.4	0.4	0.6	0.7	0.8	1.1	1.7	2.3	2.8	3.4	4.0	4.5	5.1	5.63	6.75	7.5	8.5
Approx. Ship Wt. Lbs.	15	15	15	35	50	70	140	285	500	780	1165	1600	2265	2982	3900	6200	7700	11720
X Pilot System	11	11	11	13	14	15	17	29	31	33	36	40	40	43	47	68	79	85
Y Pilot System	9	9	9	9	10	11	12	20	22	24	26	28	30	32	34	39	40	45
Z Pilot System	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	42	47

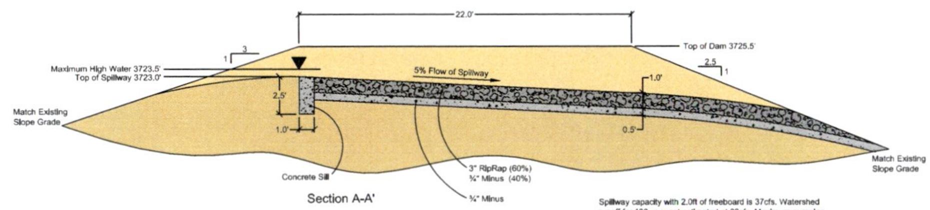
Note: The top two flange holes on valve size 36 are threaded to 1 1/2" 6 UNC.



INTAKE STRUCTURE
SCALE: 1" = 4'-0"

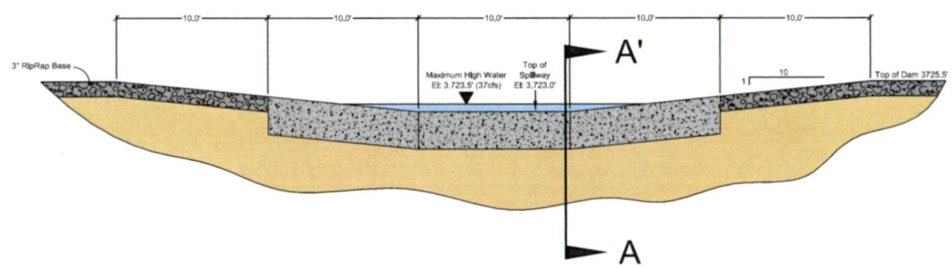


FILTER DIAPHRAM
SCALE: 1" = 4'-0"



Section A-A'

Spillway capacity with 2.0ft of freeboard is 37cfs. Watershed runoff for 100-yr event estimated at 33cfs. Maximum pumping rate into reservoir is 2.0cfs. Required spillway capacity is 35cfs.



Details
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

SHEET 9 OF 10

PROJECT NO.	1050-112	DATE:	April 25, 2013
DESIGNED BY:	D.Newton	DRAWN BY:	S.Schenck

NEWTON CONSULTANTS INC
Earth, Water and Rock Specialists

EXPIRES 12/31/2014

NO.	DATE	BY	REVISIONS
01	24Jul2013	DJN	Concrete Outlet Pipe Encasement Detail
02	24Jul2013	DJN	Correct Top of Dam, Max. Water Level Elevations
03	24Jul2013	DJN	Spillway Capacity with Pumping Flow

R-88586

MATERIAL SPECIFICATIONS - EAST RESERVOIR

GEOTEXTILE FILTER FABRIC FOR TOE DRAIN

Material Specification

All gravel drain rock in the toe drain shall be wrapped and fully enclosed inside geotextile filter fabric to allow water passage from earth materials outside the toe drain into the gravel drain rock and to prevent movement of soils into the gravel drain rock. Geotextile filter fabric shall meet the following specifications:

SPECIFICATION FOR NONWOVEN GEOTEXTILE FILTER FABRIC TOE DRAIN FOR EAST RESERVOIR

PROPERTY	TEST METHOD	UNITS	ROLL VALUE	SPEC (MINIMUM)
Mechanical				
Grab Tensile Strength	ASTM D-4632	lbs	MARV	100
Grab Elongation	ASTM D-4632	%	MARV	50
Puncture Strength	ASTM D-4833	lbs	MARV	65
Trapezoidal Tear	ASTM D-4533	lbs	MARV	50
Hydraulic				
Apparent Opening Size (AOS)	ASTM D-4751	US Sieve/mm	MARV	70/0.212
Permeability	ASTM D-4491	cm/sec	MARV	0.22
Water Flow Rate	ASTM D-4491	gpm/sq.ft.	MARV	135
Endurance				
Ultra Violet Resistance	ASTM D-4355	% retained @ 500 hours	MARV	70

NOTE: "MARV" indicates minimum average roll values; calculated as the mean mean minus two standard deviations, yielding a 95% confidence level.

Placement

1. Geotextile shall be cut to the required width, making allowance for conformance of the geotextile during subsequent compaction of the toe drain gravel.
2. Contact between the geotextile and the adjacent soil shall be assured during construction.
3. The geotextile shall be overlapped a minimum of 2 feet at all longtitudinal and transverse joints.
4. Care should be taken to place the geotextile tightly against the soil so no void spaces occur behind the fabric. Cobbles or boulders shall be removed from surface upon which the fabric will be placed such that the fabric has uniform support. Also, folds or wrinkles shall be avoided.
5. The geotextile which will be used for top overlap of the toe drain gravel shall be temporarily used to cover the excavated material on either side of the toe drain trench to protect the toe drain gravel from contamination by backfill soil falling into and mixing with the drainage gravel.
6. The granular toe drain gravel shall be placed and compacted on top of the geotextile in lifts at least 1 foot thick and no more than 1.5 feet thick. A maximum drop height of 3 feet is allowed. Additional lifts shall be added until the depth of the toe drain gravel meets the requirements shown on the design drawings.
7. After full placement and compaction of the toe drain gravel, the protruding edges of the geotextile shall be overlapped onto the top of the toe drain gravel. The top overlapping part of the geotextile should be toward the toe of the dam. The overlap shall protect the toe drain rock from contamination. A minimum overlap of 18 inches is required.

TOE DRAIN GRAVEL

Material Specification

Toe drain gravel shall be screened from native silty gravelly sand deposits in the reservoir borrow area designated as Soil Unit #3. These materials appear to be more prevalent in the area of exploratory pits T-1, T-3, T-4 and T-5. The native materials shall be screened to remove the fraction coarser than 2-inch and to remove the fraction finer than 3/8-inch. The resulting toe drain gravel shall be consistent with the following grain size distribution:

SPECIFICATION FOR TOE DRAIN GRAVEL
SCALP OFF THE MINUS 3/8" SIZE
SOILS REPRESENTED BY SAMPLES TP-1, TP-2, TP-4, TP-5
(WELL GRADED SILTY GRAVELLY SANDS)
TOE DRAIN GRAVEL GRADATION AFTER SCALP

SIZE	PERCENT PASSING
2"	100
1 1/2"	77 - 100
1"	50 - 100
3/4"	32 - 57
1/2"	18 - 35

NOTE: Gradation based on analysis of grain size distributions for samples TP-1, TP-2; both well graded silty gravelly sands

Placement

Toe drain gravel shall be thoroughly wetted and placed on top of the geotextile fabric by dumping and then spreading ahead of a dozer. Dozer or heavy equipment traffic shall not be allowed directly on the fabric. The minimum thickness of toe drain gravel during its placement on the fabric shall be 1 foot. The toe drain gravel shall be maintained in a wet condition while being placed and compacted. The toe drain gravel shall be compacted by at least 6 passes with a heavy drum roller compaction machine.

SLOTTED PIPE FOR TOE DRAIN

Material Specification

Slotted pipe shall be installed in the toe drain as shown on the drawings. The toe drain pipe shall slope from each end toward the low point at station N10+07.18'. Caps shall be installed at each end of the slotted toe drain pipe. At the low point, the slotted toe drain pipe will connect in a tee to a non-slotted pipe intended to convey seepage water away from the dam as shown on the drawings. Specifications for the slotted and non-slotted pipe are below:

Pipe Type:	PVC Schedule 80
Maximum Slot Width:	0.25 inch
Rows of Slots:	5
Slot Length:	1.9 inches
Slot per Row per Foot:	12

Non-Slotted Toe Drain Pipe

Pipe Type: PVC Schedule 40

Placement

The toe drain gravel shall be placed and compacted to an elevation at least 6 inches above the top of the toe drain pipe. The trench for the toe drain pipe shall be excavated into the drain gravel. The toe drain pipe shall be placed in the trench. End caps shall be placed over each end of the slotted toe drain pipe. A tee and coupling of the toe drain pipe with the non-slotted drain pipe shall be installed. The toe drain pipe trench shall then be backfilled with toe drain gravel. The remaining toe drain gravel shall be placed and compacted as shown on the drawings.

CAST-IN-PLACE CONCRETE

1. This work shall consist of construction of the encasement for the outlet control valve and outlet pipe elbow assembly in conformance with these specifications and in reasonable close conformity to the lines, grades and dimensions shown on the construction drawings or established by the Engineer.
2. Portland cement concrete shall conform to the following mix specifications:
   - Bulk proportion guideline: Cement, Sand, Gravel - 1 to 2.25 to 3.2 (by weight)
   - Water: Just enough water to permit ready working into the forms without objectionable separation (52 to 55 lbs per bag of cement). Concrete should slide, not run off a shovel.
   - Maximum particle size: 1 ½ inches

FILTER SAND

Material Specification

Filter sand shall be placed in diaphragms around the HDPE outlet pipe and around the outlet pipe at the toe drain as shown on the drawings. The diaphragms are located at the fusion-welded joints in the HDPE pipe. Filter sand shall consist of material meeting the ASTM C 33 Specifications for fine concrete aggregate (or Oregon Department of Transportation Specification, Section 02690.30). The grain size distribution of the fine aggregate shall be consistent with the following:

GRADATION FOR OUTLET PIPE FILTER MATERIAL

SIEVE SIZE	PERCENT PASSING
3/8 Inch	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	2 - 10

Placement

The dam embankment fill shall be placed and compacted in lifts to an elevation of 3 feet above the top elevation of the HDPE outlet pipe. The trench for the outlet pipe shall be excavated through the compacted dam embankment fill. At each fusion-welded pipe joint location, the trench wall and the trench bottom shall be excavated to form a slot into the side walls and the trench bottom at least 2 feet deep and 2 feet wide. Filter sand shall be thoroughly wetted, placed in the slots across the trench bottom and compacted. After the outlet pipe is placed in the trench, wet filter sand shall be placed in the slots in the trench walls and compacted in 12-inch thick lifts. The filter sand should be filled over the pipe to the top of the trench. The filter sand shall be allowed to flow from the slots into the pipe trench and seek its angle of repose. Trench backfill soils shall be placed and compacted in lifts not to exceed 8 inches in thickness over the top of the filter sand slope as the trench is backfilled.

DAM EMBANKMENT MATERIALS

Placement

1. The natural ground surface in all areas to receive fill shall be stripped of organic and deleterious materials to a minimum depth of 1 to 1.5 feet as determined by the Engineer during field observation of stripping activities. The stripped natural ground surface shall be scarified to a minimum depth of 12 inches, brought to proper moisture content and recompacted to at least 92 percent of the maximum dry density in accordance with ASTM Test Method D-1557 (Modified Proctor).

2. Soil Unit No. 2 material shall be placed in the core trench and the dam core, in lifts with a maximum uncompacted thickness of 6 inches, brought to a uniform moisture content of optimum plus 5 percent and compacted to at least 92 percent of the maximum dry density in accordance with ASTM Test Method D-698 (Standard Proctor).

3. Soil Unit No. 3 material shall be placed in the dam embankment as shown on the drawings, in lifts with a maximum uncompacted thickness of 6 inches, brought to a moisture content of optimum plus 5 percent and compacted to at least 92 percent of the maximum dry density in accordance with ASTM Test Method D-1557 (Modified Proctor). Soil Unit No. 3 materials shall be spread over the embankment surface and blended to avoid concentrations of gravels or layers that could provide pathways for water to migrate through the dam embankment. Blending shall result in an integrated fill matrix of silt, sand and gravels without sand or gravel layering.

4. Soil Unit No. 4 material shall be placed in the dam embankment as shown on the drawings, in lifts with a maximum uncompacted thickness of 6 inches, brought to a moisture content of optimum plus 5 percent and compacted to at least 92 percent of the maximum dry density in accordance with ASTM Test Method D-1557 (Modified Proctor).

CORE TRENCH

The core trench as shown on the drawings is intended to reduce potential for seepage through the foundation materials. The core in the dam above the core trench is intended to reduce seepage through the dam embankment.

Sidewall Inclination

The walls of the core trench shall be excavated at an inclination of 1.5 to 1.0 (horizontal to vertical units). The soils are essentially cohesionless and when exposed in the core walls with drying, sloughing of these materials into the core trench is likely. The 1.5 to 1.0 inclination is intended to reduce sloughing potential.

Preparation of Core Trench Bottom

The gravelly, silty sand deposits in the site area are underlain by rock, which appears to be basalt based on fragments retrieved from exploratory backhoe pits. The rock is fractured and suggests potential for leakage from the reservoir through fractures. Excavation of the core trench is planned to avoid disturbance to the rock; therefore, at least 1 foot of undisturbed soil material will be left in place above the surface of the rock. Preparation to receive fill shall be done according to the following steps to help reduce potential for seepage beneath the dam core:

1. Prior to placement of any Soil Unit #2 material in the core trench, the remaining soil material on the bottom of the trench shall be cleaned of all rocks. If the soil is dry, lightly moisten it, then plow, disc or till the soils to a depth of 6 to 12 inches, then roll or drag the surface until it is smooth.
2. Apply a mixture of powder and sodium bentonite (Pond Sealer) to the soil surface at a rate of 2.5 pounds per square foot of soil surface area.
3. Spread the bentonite with a fertilizer or seed spreader to promote even spreading.
4. Mix the bentonite with the top 6 to 12 inches of soil by discing, tilling or by hand raking. It is extremely important for the bentonite to be mixed uniformly with the soil. Multiple passes are recommended to reduce potential for bare or thin spots.
5. Compact the soil surface by rolling or tamping.

OUTLET PIPE

Material Specification

Pipe:

Under dam reservoir outlet pipe is to be High Density Polyethylene (HDPE) with heat fusion joints. SDR 32.5, 18" nominal I.D. pipe and fittings manufactured to ASTM D 3350-05.

Outlet distribution pipe to be located outside of dam footprint is to be Schedule 40 Polyvinyl Chloride (PVC) gasket pipe (bell & spigot joint with retained ring style gasket) 18" nominal I.D. manufactured to D 1784 & D 1785.

Installation

HDPE pipe to be installed with flange and head fusion joints as noted in Outlet drawing and in accordance with ASTM D 2774-04. Pipe joints shall be installed consistent with ASTM F 2620 and ASTM D 3261. The 40-foot long HDPE pipe sections will be fusion-welded together with filter diaphragms to e constructed at each welded pipe joint as shown on the construction plans. Downstream of each filter diagram, an additional bentonite-soil diaphragm of relatively low permeability will be installed around the outlet pipe. This diaphragm will consist of Soil Unit 4 materials mixed with bentonite (Pond Seal) in the proportion 1 pound bentonite per 35 pounds of soil.

PVC gasket pipe is to be installed in accordance with ASTM D 3139 and in accordance with the following steps (provided by Harvel Plastics, Inc.):
Step 1) Make certain pipe ends and gasket areas are free of dirt and debris. Support spot end of pipe above ground to prevent dirt contamination when lubricant is applied.
Step 2) Apply a light coating of recommended lubricant to spigot end and sealing section of gasket.
Step 3) Align pipe ends. Push spot end into gasket bell so that the reference mark is even with the entrance of the gasket bell.

Thrust blocks will be designed and installed as needed, depending on the final alignment of the PVC pipe.

Backfill

Pipe cover should be a minimum of 24" over top of pipe, or 12" below maximum freeze depth, whichever is greater.

The trench bottom should be continuous, relatively smooth, and free of rocks and debris. Adequate backfill should be placed immediately after installation prior to filling or testing the line, to help distribute the effects of expansion/contraction evenly over each pipe length. The initial backfill material should consist of particles of ½" in size or less, and properly tamped. Where hardpan, ledge rock, or large boulders are encountered, the trench bottom should be padded with sand or compacted fine-grain soils to provide adequate resistance to points loads exerted on the pipe. Pipe connections joints should be left exposed for visual inspection of during leak testing.

All backfill installation should be in accordance with ASTM D 2774. Backfill specifications adapted from installation instructions provided by Harvel Plastics, Inc.

EROSION PROTECTION - DAM AND SPILLWAY

Riprap

Riprap material for the upstream embankment slope and spillway shall consist of well-graded, durable rock with a specific gravity of at least 2.4.

Slope Protection for Upstream Dam Face

Rock for riprap shall be graded as follows:

6-inch thick base layer:	3-inch minus rock (coarse sandy gravel or gravel)
18-inch thick layer:	12-inch riprap

Riprap shall consist mostly of rocks in the 12-inch size, intermixed in a well-graded matrix with smaller rock sizes to provide an interlocked structure.

Where in the Engineer's judgment, the spillway outfall channel will be subject to erosion of natural ground, protective measures will be required. Such measures may include riprap and or wire mesh with shotcrete at the direction of the Engineer. The subgrade for all slope protection shall be shaped to the dimensions and grades shown on the plans.

The subgrade upon which slope protection will be placed shall be shaped in the dimensions and grades shown on the construction drawings or as established by the Engineer.

Emergency Spillway

The emergency spillway should be constructed consistent with the detail reflected on the Details Sheet 9. Initial placement of the emergency spillway should be constructed with a concrete sill (minimum compressive strength of 2,000 pounds per square foot) with minimum dimensions of 1-foot top width, 2.5 feet depth and a length of 30 feet. The trench for the concrete sill shall be excavated to the completion depth of 2.5 feet and formed to allow for the lower 1 foot of concrete to seal against a clean trench wall of native earth materials. Following sill placement, excavation of the spillway flow area shall be excavated to a minimum depth of 18 inches allowing for adequate placement of 18 inches of riprap material and a 2% slope across the spillway control section. A base of ¾" minus crushed rock shall be placed and compacted to a firm condition to achieve an overall thickness of 0.5 feet. The upper 12 inches of spillway excavation shall consist of riprap consisting of relatively uniform mixture of approximately 60% 3 inch riprap and 40% ¾ minus crushed rock. The riprap spillway section will continue down slope beyond the 22 foot wide spillway control section generally matching the native slope for approximately 100 feet down slope to convey spillway water beyond the toe of the dam. Additional spillway length may be required if conveyed spillway water shows signs of migration to the toe of the dam.

Specifications
Blue Mountain Ranch - Application #R-86934
Crook County, Oregon

PROJECT No: 1050-112 | DATE: April 25, 2013 | SHEET 10 OF 10
DESIGNED BY: D. Newton | DRAWN BY: S. Schenck

NEWTON CONSULTANTS INC
Earth, Water and Rock Specialists
Post Falls, Idaho

NO.	DATE	BY	REVISIONS
01	25Jul2013	DJN	Added Erosion Protection Note;

PATH:

R-88586