WestWater Engineering

2516 FORESIGHT CIRCLE, #1 GRAND JUNCTION, COLORADO 81505 (970) 241-7076 FAX: (970)241-7097

November 5, 2007, 2007

Mr. Steve Moore
US Army Corps of Engineers
402 Rood Ave., Room 142
Grand Junction, CO 81501

RE: Overland Reservoir Wetland Delineation and Jurisdictional Determination Request

Dear Steve:

WestWater's wetland delineation for the subject property is attached for your review. This report includes the Mountain West Interm Regional Supplement data sheets in addition to the 1987 COE data sheets and the COE Approved Jurisdictional Determination Form. The aerial photo, Figure 2, in the document is supplemented with the attached map 1 at a 1:200 scale to clarify wetland delineation points and polygons.

Please feel free to contact our office if you have any questions regarding this evaluation, or if we can be of assistance in any way.

Sincerely,

Brett F. Fletcher
Environmental Scientist/ Wetland Biologist

attachment:

<u>COE Jurisdictional Determination Request</u>
<u>Proposed Expansion of Overland Reservoir</u>
<u>Delta County, Colorado</u>

Prepared by WestWater Engineering
November 2007

This is a request for Army Corps of Engineers (COE) Jurisdictional Determination (JD) and confirmation of a wetland delineation performed on the site of the proposed Overland Reservoir Enlargement Project, in the Grand Mesa National Forest, Delta County, Colorado (see Map 1). The delineation was performed by WestWater Engineering (WWE) Biologists on the following dates: June 14-15, July 5, August 1, 2, 7-10, and October 20, 2007. Wetland areas were identified in accordance with the January 1987 Corps of Engineers Wetlands Delineation Manual. Onsite reviews of the delineation with COE were held on May 26, and October 10, 2007. Project information follows:

PROJECT INFORMATION		
Project Proponent:	Overland Ditch and Reservoir Company 26093 Moss Rock Road Hotchkiss, CO 81419	 Ph: (970) 835-8922 Fax: (970) 872-7474
Land Owner:	United States Forest Service Paonia Ranger District P.O. Box 1030 Paonia, CO 81428	 Ph: (970) 527-4131
Wetland Consultant:	WestWater Engineering 2516 Foresight Circle #1 Grand Junction, CO 81505	 Ph: (970) 241-7076 Fax: (970) 241-7097
Project Location:	Sections 22 and 23, Township 11S, Range 91W	
Project Description:	Expansion of current Overland Reservoir's storage capacity	

Overland Reservoir is located 20 miles north of Hwy 139 out of Paonia, CO. and 7 miles west on Forest Service Road 705 (Figure 1). Overland Ditch and Reservoir Company (ODRC) currently holds 6200 acre-feet of absolute and 970 acre-feet of conditional water rights. The existing reservoir has a capacity of 6200 acre-feet with an inundated area of approximately 254 surface acres. The proposed project would increase the capacity of the reservoir 970 acre-feet for a total storage capacity of 7170 acre-feet and a footprint of 268 surface acres, an increase of 14 acres. The additional storage could satisfy requirements to adjudicate 970 acre-feet of conditional storage to absolute. Overland Reservoir's storage is used for irrigation and once the head gate has been opened water levels in the reservoir decrease rapidly. The capacity of the ditch that carries Overland's discharge is approximately 60cfs. Average daily flows in the ditch during irrigation season are 58cfs, which equates to an average elevation drop in the reservoir of 6 inches per day from existing Ordinary High Water Mark (OHWM). This JD will be used to avoid, minimize, and mitigate project related impacts in the project design. ODRC will submit an appropriate COE permit application following completion of project design and project coordination with United States Forest Service (USFS).

Delineation Methods – The delineation included the areas adjacent to the current OHWM of the existing reservoir and wetlands below the existing OHWM. Additionally, wetlands outside the footprint of the reservoir were delineated to identify and avoid potential impacts during construction. The wetland boundaries were identified on the basis of the vegetation, soils and hydrology present at the site. Wetland boundary delineations included identification of vegetation composition and structure. Shallow soil borings (18 ± inches deep) were augured for observation of soils and hydrologic characteristics in addition to observation of drainage patterns and other hydrologic indicators. Areas exhibiting fen characteristics, deep organic soils, were core sampled with 2.5 inch split spoon. Core samples were taken to a depth of 32 inches; once collected the core samples were air dried for approximately 2 weeks. Organic litter (living roots and sticks) and obvious mineral layers were removed from the samples. Dry core samples were sent to the Colorado State University Soil, Water, and Plant Testing Laboratory to be tested for percent total organic carbon (by weight) and texture. The wetland and fen boundaries based on this evaluation were marked with numbered colored flags, with unique numbering schemes for each of the specific wetland areas. Boundary flags were surveyed by Western Engineers Inc. Boundary flag coordinates are listed in Table 3.

Delineation Findings – WestWater identified 19 wetland areas, representing four wetland types: fringe wetland, forested wetland, wet meadows, and fens (Figure2). Wetland areas within the project area that were beyond of scope of future project design were identified but not delineated. These wetlands included the fringe wetland associated with Overland's irrigation ditch and the wetlands surrounding fens 3 & 5 below the south dam.

Fringe wetlands around the reservoir represent the largest wetland type in the project area, 58.52 acres. Out of the 58.52 acres, 49.18 of wetlands exist at or below OHWM, polygons L, M, & N. Fringe wetlands are also associated with the ditch below the south dam; seepage from under the dam maintains a flow of water through the creek, polygon O which is 0.75 acres. Fringe wetland soils showed light oxidation in pore linings and rhizospheres, 2-4% within the first 6 inches. During initial site visits these wetlands were inundated below OHWM and vegetation appeared to be emergent littoral. Rapid decline in reservoir water levels continually exposed wetland vegetation throughout the growing season. Boundary lines L, M, & N show the final vegetative line below OHWM. Dominant species in annually inundated wetlands were *Carex utriculatis, C. aquatilis.*

Forested wetlands accounted for 8.17 acres of fringe wetland that was above OHWM and 0.42 acres of forested wetland, polygon D, that is not adjacent to the reservoir. Polygon D is on the east side of the reservoir and has a road crossing through it. This wetland was delineated in association with potential road improvements. Soils in forested wetlands showed a loamy gleyed matrix and oxidation within the first 6 inches along with exhibiting a strong hydrogen sulfide odor. Dominant species associated with the reservoir fringe were *Picea engelmannii, Salix planifolia, Salix monticula, Carex utriculatis, C. aquatilis* and *Caltha leptosepala.*

Wet meadow wetlands occurred beyond the footprint of the reservoir totaled 9.14 acres. The soils in polygon C, which were typical of all wet meadow wetlands, showed a histic epipedon above dark low chroma and gleyed soil. Dominant species *include Picea engelmannii, Salix planifolia, Salix monticule, Salix geyeriana, Carex utriculatis, C. aquatilis, Caltha leptosepala, and Pedicularis groenlandica.*

Fens were surrounded by other wetland types within the project area. Three fens, fen 4, 6, and 7, are below OHWM and total 0.84 acres. The area of fen 6 was expanded to the edge of fen 2 after soil test results indicated that this area has organic soils. To show the area of the enlarged fen, boundary lines were adjusted as follows: flag F6-12 was connected to F2-9, flag F6-15 was connected to F2-12, flag locations F6-12A, 13, and 14 were removed as boundary identifiers, and flags F2-9-12 serve as the eastern boundary flags of F-6 (Inset in Figure 2). Fens F-6 and F-2 were not combined as one fen because of differences in vegetative composition, structure, and topography. The total acreage of fens that exist at or below high water is 1.04 acres. Forested wetland polygon B contained one fen, fen 2, with an area of 0.17 acres. There were 3 fen areas that occurred in wet meadow wetlands beyond the footprint of the reservoir and outside of the project design. Polygon C contains a 5 acre fen and fens 3 & 5 below the south dam have a combined area of 5.22 acres. Fens 3 & 5 are separated by an elongated 0.75 acre ditch that was constructed as the original reservoir spillway with 1.03 acres of fen (fen 5) occurring west and 4.19 acres of fen (fen 3) occurring east of the ditch. Although the ditch is believed to have been a fen at one time, it is considered a fringe wetland in its current condition. Wetlands existing beyond the boundaries of fens 3 & 5 were not delineated because they were beyond the project design area. Fens 3 & 5 were delineated to evaluate their restoration and mitigation potential. Fen soil tests revealed properties of histosols, organic soils, in all suspected fen areas. Dominant species within fens were *Carex utriculatis, C. aquatilis,* and 2 species of moss *Tomentypnum nitens*, and *Dreplanocladus adunces.*

Table 1. Overland Reservoir Wetlands

Wetland Type	Polygon label	Flag Numbers	Area	Comments
Fringe wetlands	L	1-112	30.82	Transect at Flag 44
(occurring below OHWM	M	1-30	9.29	
along boundaries L, M, & N)	N	1-46	9.07	
	O	K 31-34	0.75	Ditch
		F5 19-31		
		F3 27-39		
Forested wetlands	A	1-194	1.16	
(occurring above OHWM	B	1-56	3.33	Transect at Flag 5
along boundaries A, B, & H)	H	1-62	3.68	
	D	1-21	0.42	
Wet meadows	C	1-134	6.34	Transect at Flag 1
	E	1-25	0.65	
	G	1-16	0.65	
	I	1-14	0.51	
	J	1-20	0.16	
	K	1-34	0.73	
Fens	F-1	1-22	1.48	
	F-2	1-16	0.17	Transect at Flag 1
	F-3	1-39	4.19	
	F-4	1-8	0.11	
	F-5	1-31	1.03	
	F-6	1-16	0.68	
	F-7	1-11	0.25	

Table 2. Fen soils Total Organic Carbon (TOC), Texture test results, and sample locations.

Sample ID	TOC	Mineral Texture	% Sand	% Silt	%Clay	Easting	Northing
F-6*	24.83	Sandy Loam	76	12	12	271383	4329087
F-2	32.34	Sandy Loam	66	26	8	271401	4329075
F-3.1	36.73	Sandy Loam	78	8	14	271375	4328619
F-3.2.1	22.19	Sandy Loam	76	8	16	271445	4328714
F-3.2.2	37.30	Sandy Loam	76	8	16	271445	4328714
F-4	30.05	Sandy Loam	74	10	16	270790	4329780
F-5.1	30.95	Loamy Sand	82	8	10	271324	4328630
F-5.2	35.29	Sandy Loam	76	12	12	271324	4328630
F-6	32.61	Sandy Loam	76	12	12	271350	4329090
F-7.1	17.49	Sandy Loam	74	10	16	271163	4330124
F-7.2	39.04	Sandy Loam	74	10	16	271163	4330124

* F-6 sample point that led to the expansion of fen 6 to the fen 2 boundary line (Inset in Figure 2).

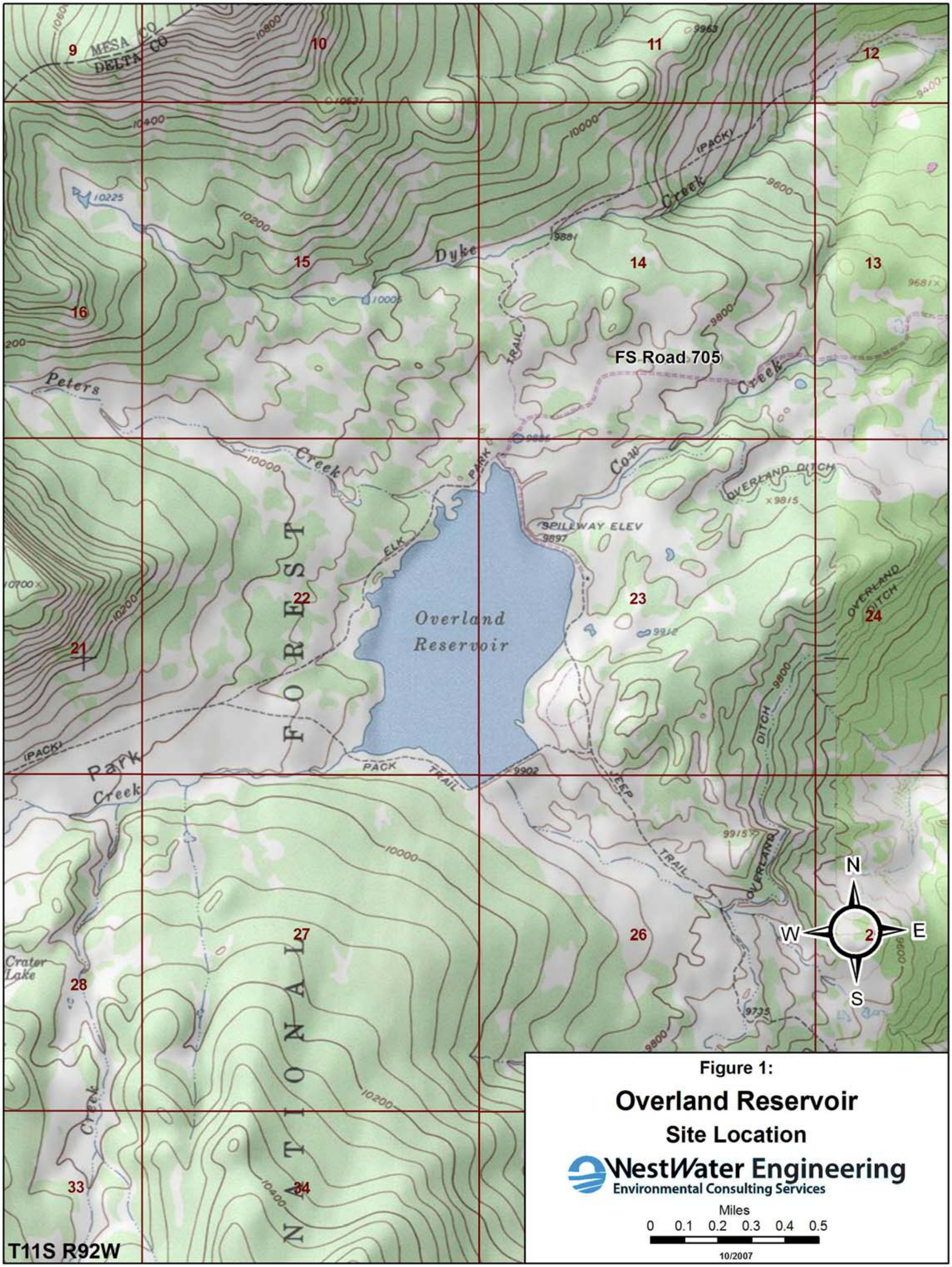
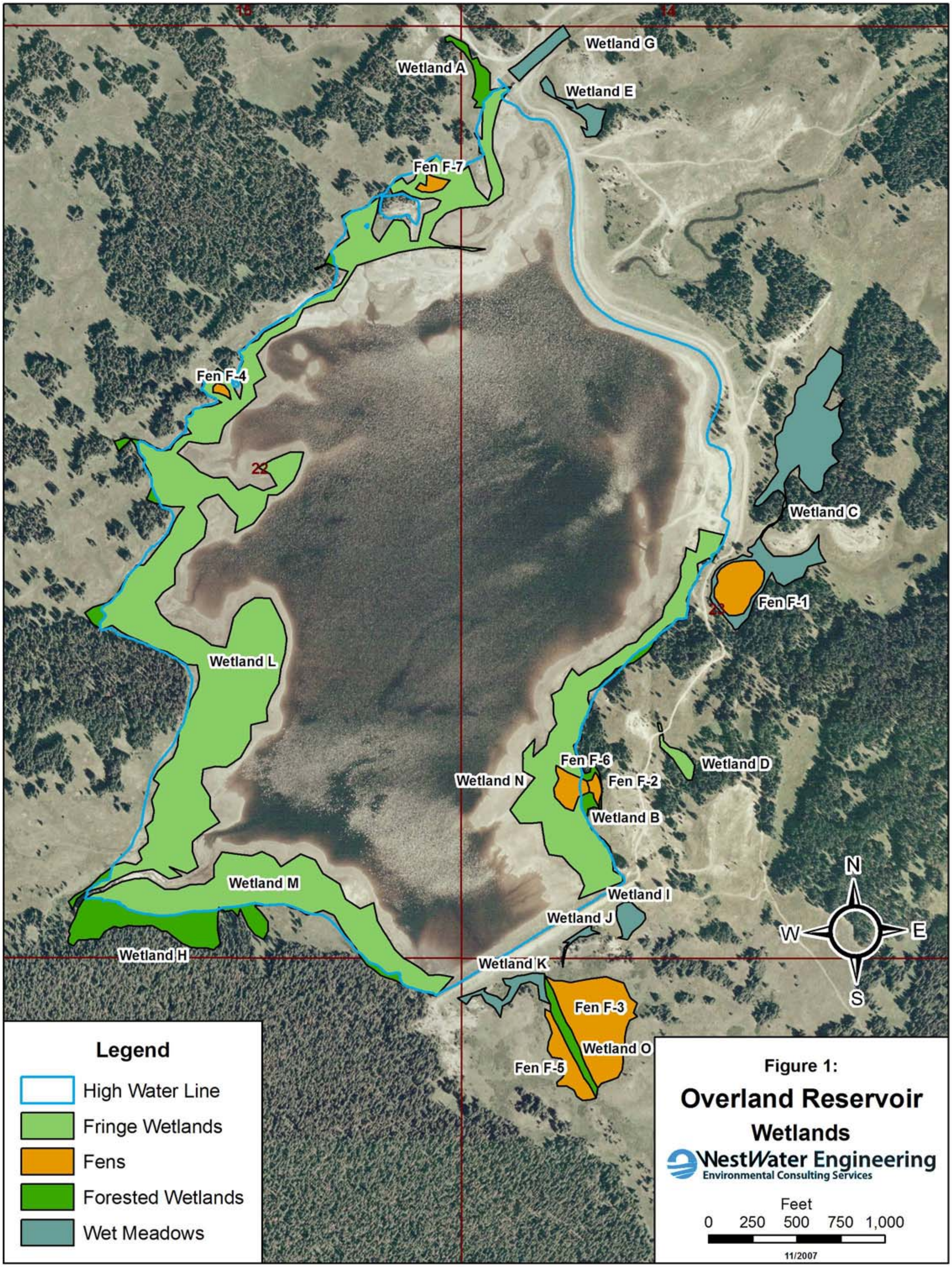


Figure 1:

Overland Reservoir

Site Location



15
14
22
Wetland G
Wetland A
Wetland E
Fen F-7
Fen F-4
Wetland C
Fen F-1
Wetland L
Fen F-6
Wetland N
Fen F-2
Wetland D
Wetland B
Wetland M
Wetland I
Wetland J
Wetland H
Wetland K
Fen F-3
Wetland O
Fen F-5
N
W
E
S
Legend
High Water Line
Fringe Wetlands
Fens
Forested Wetlands
Wet Meadows
Figure 1:
Overland Reservoir
Wetlands
WestWater Engineering
Environmental Consulting Services
Feet
0 250 500 750 1,000
11/2007

Table 3. Wetland Flag Numbers and Locations								
Pt	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**
A1	4330285.22	271258.72	**A51**	4330122.39	271080.49	**A101**	4329778.69	270803.61
A2	4330299.22	271258.88	**A52**	4330109.87	271085.10	**A102**	4329796.42	270797.85
A3	4330313.89	271260.07	**A53**	4330115.31	271103.03	**A103**	4329808.69	270786.74
A4	4330323.05	271253.39	**A54**	4330106.23	271116.69	**A104**	4329817.88	270774.32
A5	4330328.97	271244.05	**A55**	4330100.12	271136.58	**A105**	4329805.25	270764.86
A6	4330342.26	271238.16	**A56**	4330101.79	271154.76	**A106**	4329797.40	270749.39
A7	4330338.68	271229.91	**A57**	4330096.22	271168.70	**A107**	4329781.38	270745.54
A8	4330349.14	271226.39	**A58**	4330083.80	271161.77	**A108**	4329771.99	270757.01
A9	4330362.98	271223.03	**A59**	4330073.88	271138.51	**A109**	4329758.88	270780.16
A10	4330369.13	271216.08	**A60**	4330049.18	271132.47	**A110**	4329752.99	270762.22
A11	4330374.98	271202.85	**A61**	4330027.77	271126.60	**A111**	4329751.34	270748.54
A12	4330381.21	271191.70	**A62**	4330027.95	271114.26	**A112**	4329748.15	270732.14
A13	4330377.68	271183.33	**A63**	4330050.42	271112.83	**A113**	4329735.05	270719.06
A14	4330370.17	271184.74	**A64**	4330063.74	271102.62	**A114**	4329716.84	270718.43
A15	4330371.24	271194.64	**A65**	4330066.05	271086.41	**A115**	4329706.81	270726.57
A16	4330362.52	271202.10	**A66**	4330055.79	271078.83	**A116**	4329703.48	270711.87
A17	4330352.66	271214.85	**A67**	4330027.83	271059.95	**A117**	4329693.02	270697.76
A18	4330340.03	271223.07	**A68**	4330038.77	271050.41	**A118**	4329679.56	270689.97
A19	4330330.50	271229.18	**A69**	4330049.49	271047.43	**A119**	4329677.84	270677.68
A20	4330314.49	271233.41	**A70**	4330066.10	271053.00	**A120**	4329684.62	270662.46
A21	4330297.57	271234.36	**A71**	4330080.41	271057.52	**A121**	4329695.52	270644.55
A22	4330283.82	271231.70	**A72**	4330107.29	271063.81	**A122**	4329702.21	270611.66
A23	4330272.64	271228.07	**A73**	4330094.54	271045.45	**A123**	4329696.64	270592.91
A24	4330265.54	271236.62	**A74**	4330085.45	271030.27	**A124**	4329678.59	270599.82
A25	4330256.06	271230.12	**A75**	4330083.13	271011.71	**A125**	4329688.95	270610.66
A26	4330254.99	271244.29	**A76**	4330075.00	270996.77	**A126**	4329698.66	270621.98
A27	4330231.57	271244.35	**A77**	4330059.97	271002.76	**A127**	4329691.18	270627.61
A28	4330201.01	271242.77	**A78**	4330036.67	271008.86	**A128**	4329674.37	270635.04
A29	4330211.45	271229.35	**A79**	4330027.34	270992.85	**A129**	4329653.59	270645.64
A30	4330197.17	271237.47	**A80**	4330013.83	270975.32	**A130**	4329635.55	270654.72
A31	4330177.88	271237.62	**A81**	4329990.63	270963.72	**A131**	4329615.08	270654.95
A32	4330174.67	271245.10	**A82**	4329985.16	270946.95	**A132**	4329594.83	270645.66
A33	4330158.87	271248.14	**A83**	4329983.15	270950.57	**A133**	4329587.77	270659.49
A34	4330143.36	271249.98	**A84**	4329993.21	270970.68	**A134**	4329583.83	270675.82
A35	4330128.63	271252.64	**A85**	4329984.10	270988.80	**A135**	4329580.36	270689.35
A36	4330115.82	271257.23	**A86**	4329978.80	271004.67	**A136**	4329579.97	270710.35
A37	4330094.51	271250.41	**A87**	4329957.36	270991.68	**A137**	4329565.98	270699.47
A38	4330116.95	271229.65	**A88**	4329929.46	270979.71	**A138**	4329551.28	270690.84
A39	4330138.21	271223.46	**A89**	4329925.75	270953.43	**A139**	4329534.24	270683.13
A40	4330154.68	271218.08	**A90**	4329916.30	270926.07	**A140**	4329520.56	270670.96
A41	4330147.53	271206.71	**A91**	4329887.03	270911.37	**A141**	4329508.02	270660.73
A42	4330149.72	271192.30	**A92**	4329895.89	270891.37	**A142**	4329495.33	270649.95
A43	4330158.05	271175.99	**A93**	4329877.94	270856.01	**A143**	4329481.88	270638.50
A44	4330176.14	271164.39	**A94**	4329864.80	270846.54	**A144**	4329481.21	270625.26
A45	4330164.40	271151.25	**A95**	4329857.69	270828.80	**A145**	4329462.89	270610.18
A46	4330151.34	271131.50	**A96**	4329845.70	270811.94	**A146**	4329449.28	270600.19
A47	4330134.64	271124.03	**A97**	4329828.95	270819.15	**A147**	4329430.90	270589.53
A48	4330126.66	271111.48	**A98**	4329808.69	270809.25	**A148**	4329418.48	270573.45
A49	4330138.22	271102.84	**A99**	4329785.82	270816.15	**A149**	4329410.79	270547.88
A50	4330131.90	271091.31	**A100**	4329763.22	270812.31	**A150**	4329401.76	270533.46

Table 3. Wetland Flag Numbers and Locations								
Pt	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**
A151	4329385.38	270544.33	**B7**	4328994.83	271406.49	**C1**	4329464.21	271661.76
A152	4329381.68	270546.68	**B8**	4329004.39	271398.77	**C2**	4329460.01	271647.23
A153	4329371.76	270561.72	**B9**	4329022.23	271390.53	**C3**	4329454.69	271635.75
A154	4329378.93	270580.14	**B10**	4329037.99	271393.94	**C4**	4329443.64	271624.55
A155	4329366.54	270595.50	**B11**	4329041.34	271403.46	**C5**	4329436.25	271621.89
A156	4329359.38	270609.64	**B12**	4329038.83	271413.51	**C6**	4329429.11	271618.11
A157	4329352.08	270625.38	**B13**	4329025.71	271411.99	**C7**	4329421.88	271617.57
A158	4329344.61	270640.95	**B14**	4329038.84	271415.96	**C8**	4329406.55	271617.16
A159	4329335.64	270658.11	**B15**	4329052.80	271416.71	**C9**	4329398.11	271613.94
A160	4329330.77	270673.77	**B16**	4329068.42	271418.17	**C10**	4329390.17	271617.22
A161	4329319.71	270690.26	**B17**	4329081.55	271418.17	**C11**	4329369.19	271635.36
A162	4329307.96	270707.64	**B18**	4329101.31	271414.06	**C12**	4329357.60	271643.14
A163	4329305.78	270725.70	**B19**	4329121.53	271401.40	**C13**	4329349.70	271650.32
A164	4329283.78	270728.38	**B20**	4329102.48	271399.00	**C14**	4329340.84	271655.06
A165	4329267.75	270725.08	**B21**	4329100.17	271389.95	**C15**	4329342.62	271661.59
A166	4329245.26	270712.38	**B22**	4329123.01	271377.86	**C16**	4329351.64	271669.02
A167	4329235.76	270709.45	**B23**	4329134.05	271375.21	**C17**	4329360.87	271678.96
A168	4329222.33	270704.24	**B24**	4329148.97	271371.03	**C18**	4329375.37	271685.20
A169	4329206.53	270698.53	**B25**	4329159.26	271386.09	**C19**	4329387.92	271688.99
A170	4329191.00	270690.17	**B26**	4329173.97	271383.93	**C20**	4329397.82	271695.64
A171	4329167.47	270687.69	**B27**	4329191.02	271391.63	**C21**	4329407.59	271706.04
A172	4329147.61	270678.64	**B28**	4329200.60	271395.95	**C22**	4329424.78	271714.01
A173	4329138.62	270667.33	**B29**	4329211.44	271404.10	**C23**	4329438.64	271722.92
A174	4329125.32	270652.11	**B30**	4329227.49	271397.90	**C24**	4329421.25	271729.34
A175	4329111.15	270643.50	**B31**	4329241.18	271400.88	**C25**	4329413.57	271743.19
A176	4329102.60	270653.93	**B32**	4329249.25	271417.36	**C26**	4329418.89	271752.52
A177	4329075.20	270640.19	**B33**	4329260.35	271427.56	**C27**	4329424.21	271761.79
A178	4329056.34	270643.58	**B34**	4329269.91	271440.43	**C28**	4329429.04	271776.40
A179	4329040.07	270640.10	**B35**	4329279.39	271448.36	**C29**	4329447.01	271785.06
A180	4329029.50	270627.74	**B36**	4329285.28	271462.75	**C30**	4329451.01	271800.68
A181	4329012.32	270632.36	**B37**	4329289.53	271478.85	**C31**	4329453.64	271816.06
A182	4329002.13	270631.78	**B38**	4329296.55	271490.75	**C32**	4329467.70	271807.96
A183	4328988.07	270615.18	**B39**	4329306.84	271504.40	**C33**	4329479.37	271804.49
A184	4328972.79	270620.07	**B40**	4329315.12	271511.63	**C34**	4329475.59	271785.70
A185	4328964.53	270609.76	**B41**	4329327.80	271518.54	**C35**	4329501.17	271805.22
A186	4328969.45	270590.83	**B42**	4329340.46	271528.51	**C36**	4329490.28	271797.90
A187	4328964.64	270572.58	**B43**	4329350.25	271539.20	**C37**	4329468.89	271773.77
A188	4328956.86	270562.71	**B44**	4329358.62	271554.42	**C38**	4329465.99	271756.34
A189	4328948.75	270549.81	**B45**	4329363.14	271572.48	**C39**	4329465.76	271740.23
A190	4328929.41	270528.94	**B46**	4329378.32	271578.42	**C40**	4329465.75	271726.19
A191	4328921.28	270516.72	**B47**	4329394.48	271573.49	**C41**	4329478.76	271714.22
A192	4328914.43	270503.00	**B48**	4329406.64	271578.82	**C42**	4329496.32	271704.44
A193	4328903.86	270491.78	**B49**	4329420.33	271586.01	**C43**	4329507.19	271710.07
A194	4328890.06	270498.55	**B50**	4329435.40	271596.35	**C44**	4329516.77	271717.99
B1	4328911.24	271450.29	**B51**	4329456.66	271593.82	**C45**	4329520.19	271727.16
B2	4328921.37	271450.02	**B52**	4329465.87	271614.43	**C46**	4329534.01	271743.57
B3	4328930.61	271434.40	**B53**	4329461.75	271621.21	**C47**	4329528.40	271737.81
B4	4328960.63	271432.26	**B54**	4329474.87	271629.11	**C48**	4329537.35	271743.10
B5	4328971.68	271429.32	**B55**	4329492.34	271636.54	**C49**	4329547.30	271745.03
B6	4328983.86	271420.65	**B56**	4329505.56	271642.19	**C50**	4329551.28	271751.51

Table 3. Wetland Flag Numbers and Locations								
Pt	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**
C51	4329568.42	271750.52	**C101**	4329645.59	271737.20	**D17**	4329160.94	271520.32
C52	4329577.20	271748.70	**C102**	4329638.59	271736.67	**D18**	4329168.99	271520.88
C53	4329591.43	271747.85	**C103**	4329624.82	271733.64	**D19**	4329184.36	271517.56
C54	4329599.42	271752.85	**C104**	4329613.16	271738.23	**D20**	4329181.90	271522.95
C55	4329609.80	271759.14	**C105**	4329593.48	271723.17	**D21**	4329169.84	271525.92
C56	4329616.19	271766.75	**C106**	4329603.89	271731.14	**E1**	4330199.46	271422.20
C57	4329622.17	271773.89	**C107**	4329582.82	271716.58	**E2**	4330200.41	271439.99
C58	4329614.15	271775.42	**C108**	4329569.92	271703.75	**E3**	4330212.09	271449.70
C59	4329601.31	271773.48	**C109**	4329563.70	271698.81	**E4**	4330228.16	271452.52
C60	4329591.94	271780.75	**C110**	4329555.24	271695.00	**E5**	4330245.34	271458.33
C61	4329578.80	271791.99	**C111**	4329553.84	271701.76	**E6**	4330249.25	271441.41
C62	4329573.63	271800.54	**C112**	4329558.35	271710.80	**E7**	4330256.48	271427.27
C63	4329577.49	271812.13	**C113**	4329567.22	271719.07	**E8**	4330249.32	271408.09
C64	4329589.30	271815.94	**C114**	4329576.60	271728.51	**E9**	4330263.18	271402.18
C65	4329605.57	271818.11	**C115**	4329580.28	271737.19	**E10**	4330266.00	271386.29
C67	4329617.47	271828.71	**C116**	4329574.15	271745.31	**E11**	4330270.56	271372.98
C67	4329626.04	271844.21	**C117**	4329565.30	271749.62	**E12**	4330291.43	271367.04
C68	4329640.02	271832.89	**C118**	4329554.75	271744.99	**E13**	4330306.39	271356.37
C69	4329655.35	271833.12	**C119**	4329547.45	271743.71	**E14**	4330294.91	271346.27
C70	4329665.49	271845.84	**C120**	4329539.19	271741.89	**E15**	4330285.11	271350.30
C71	4329678.15	271852.68	**C121**	4329529.20	271736.01	**E16**	4330273.71	271365.07
C72	4329694.87	271848.63	**C122**	4329524.42	271730.79	**E17**	4330280.39	271350.34
C73	4329706.53	271845.49	**C123**	4329520.11	271719.43	**E18**	4330270.97	271364.56
C74	4329719.31	271847.50	**C124**	4329510.59	271709.72	**E19**	4330262.83	271379.94
C75	4329733.50	271856.74	**C125**	4329501.29	271704.41	**E20**	4330249.82	271400.37
C76	4329722.41	271844.78	**C126**	4329494.09	271697.52	**E21**	4330252.07	271390.67
C77	4329715.83	271832.05	**C127**	4329487.82	271693.94	**E22**	4330238.08	271413.48
C78	4329723.32	271819.72	**C128**	4329483.71	271688.09	**E23**	4330227.78	271423.08
C79	4329735.49	271829.05	**C129**	4329482.35	271683.03	**E24**	4330211.41	271424.76
C80	4329749.26	271834.51	**C130**	4329476.82	271681.94	**E25**	4330218.04	271414.53
C81	4329762.13	271841.14	**C131**	4329470.97	271690.33	**TCU**	4329463.91	271657.75
C82	4329779.98	271853.25	**C132**	4329466.26	271687.97	**TCW**	4329461.83	271659.86
C83	4329792.78	271854.76	**C133**	4329467.53	271681.07	**F1-1**	4329458.75	271655.68
C84	4329810.87	271855.74	**C134**	4329470.61	271672.93	**F1-2**	4329454.43	271645.71
C85	4329825.08	271834.51	**D1**	4329164.77	271526.26	**F1-3**	4329447.05	271633.88
C86	4329812.32	271824.52	**D2**	4329151.81	271527.42	**F1-4**	4329436.37	271626.44
C87	4329801.89	271814.22	**D3**	4329141.42	271537.90	**F1-5**	4329424.49	271628.66
C88	4329788.84	271807.38	**D4**	4329137.68	271552.33	**F1-6**	4329414.03	271622.75
C89	4329775.39	271791.97	**D5**	4329129.90	271565.27	**F1-7**	4329398.99	271621.62
C90	4329762.19	271789.26	**D6**	4329118.25	271574.66	**F1-8**	4329389.48	271627.36
C91	4329755.85	271776.76	**D7**	4329108.65	271579.99	**F1-9**	4329378.48	271634.62
C92	4329742.50	271770.18	**D8**	4329093.07	271577.34	**F1-10**	4329366.00	271645.49
C93	4329726.75	271770.03	**D9**	4329083.52	271573.79	**F1-11**	4329365.30	271657.16
C94	4329712.86	271764.47	**D10**	4329083.71	271566.50	**F1-12**	4329368.84	271671.06
C95	4329705.74	271754.07	**D11**	4329089.98	271561.46	**F1-13**	4329383.51	271681.83
C96	4329694.01	271749.58	**D12**	4329099.65	271555.35	**F1-14**	4329394.87	271686.15
C97	4329683.31	271746.98	**D13**	4329109.73	271549.42	**F1-15**	4329405.53	271696.05
C98	4329674.07	271735.32	**D14**	4329120.90	271542.62	**F1-16**	4329415.01	271703.86
C99	4329661.82	271733.97	**D15**	4329131.52	271531.98	**F1-17**	4329426.78	271708.43
C100	4329654.08	271735.51	**D16**	4329142.00	271521.20	**F1-18**	4329440.20	271709.72

Table 3. Wetland Flag Numbers and Locations								
Pt	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**
F1-19	4329450.43	271701.98	**F3-29**	4328584.63	271383.31	**F6-1**	4329036.15	271368.34
F1-20	4329459.83	271694.92	**F3-30**	4328597.12	271376.73	**F6-2**	4329041.44	271353.94
F1-21	4329460.60	271680.76	**F3-31**	4328610.74	271371.50	**F6-3**	4329041.44	271353.94
F1-22	4329459.51	271667.49	**F3-32**	4328626.19	271367.90	**F6-4**	4329060.64	271336.60
TF2U	4329064.07	271418.89	**F3-33**	4328642.38	271360.35	**F6-5**	4329075.68	271334.80
TF2W	4329064.45	271415.95	**F3-34**	4328657.54	271353.65	**F6-6**	4329087.65	271342.15
F2-1	4329064.66	271417.33	**F3-35**	4328671.03	271345.58	**F6-7**	4329093.03	271343.98
F2-2	4329073.82	271417.46	**F3-36**	4328684.97	271339.27	**F6-8**	4329105.57	271339.70
F2-3	4329081.07	271416.74	**F3-37**	4328698.99	271334.02	**F6-9**	4329114.96	271340.33
F2-4	4329089.07	271414.71	**F3-38**	4328713.88	271329.20	**F6-10**	4329110.69	271348.35
F2-5	4329096.36	271411.30	**F3-39**	4328727.95	271323.69	**F6-11**	4329102.93	271360.17
F2-6	4329102.06	271407.70	**F4-1**	4329787.92	270785.80	**F6-12**	4329097.15	271372.87
F2-7	4329096.02	271404.87	**F4-2**	4329792.08	270772.08	**F6-15**	4329059.90	271377.67
F2-8	4329088.73	271401.43	**F4-3**	4329785.92	270766.10	**F6-16**	4329036.15	271368.33
F2-9	4329087.33	271392.91	**F4-4**	4329776.63	270765.28	**F7-1**	4330116.50	271171.58
F2-10	4329079.46	271394.51	**F4-5**	4329774.97	270775.66	**F7-2**	4330131.54	271185.54
F2-11	4329075.95	271395.93	**F4-6**	4329770.31	270787.27	**F7-3**	4330135.50	271168.98
F2-12	4329067.93	271396.81	**F4-7**	4329763.23	270796.47	**F7-4**	4330139.32	271154.81
F2-13	4329065.43	271402.92	**F4-8**	4329777.52	270793.60	**F7-5**	4330144.13	271145.57
F2-14	4329057.86	271404.58	**F5-1**	4328695.12	271308.91	**F7-6**	4330131.52	271144.51
F2-15	4329040.95	271412.58	**F5-2**	4328684.04	271308.85	**F7-7**	4330122.74	271143.41
F2-16	4329053.84	271413.61	**F5-3**	4328670.74	271316.03	**F7-8**	4330128.60	271133.94
F3-1	4328752.63	271310.92	**F5-4**	4328653.58	271320.56	**F7-9**	4330118.26	271125.44
F3-2	4328743.06	271326.98	**F5-5**	4328639.15	271314.41	**F7-10**	4330112.75	271135.70
F3-3	4328743.03	271341.45	**F5-6**	4328623.91	271311.94	**F7-11**	4330111.14	271153.59
F3-4	4328739.47	271355.08	**F5-7**	4328611.44	271319.37	**G1**	4330319.10	271291.30
F3-5	4328741.36	271364.69	**F5-8**	4328608.61	271334.23	**G2**	4330327.02	271304.98
F3-6	4328743.62	271376.85	**F5-9**	4328600.41	271342.12	**G3**	4330336.18	271316.60
F3-7	4328745.29	271389.65	**F5-10**	4328587.07	271342.86	**G4**	4330346.25	271329.26
F3-8	4328746.68	271403.69	**F5-11**	4328576.06	271336.46	**G5**	4330356.60	271341.58
F3-9	4328747.95	271416.54	**F5-12**	4328567.84	271326.29	**G6**	4330365.38	271353.68
F3-10	4328743.57	271427.79	**F5-13**	4328561.08	271327.45	**G7**	4330373.85	271363.56
F3-11	4328736.14	271446.55	**F5-14**	4328561.53	271342.71	**G8**	4330383.01	271373.97
F3-12	4328724.21	271451.88	**F5-15**	4328553.85	271355.10	**G9**	4330393.39	271388.29
F3-13	4328710.13	271457.47	**F5-16**	4328542.79	271360.03	**G10**	4330374.45	271399.35
F3-14	4328700.95	271469.39	**F5-17**	4328535.18	271369.77	**G11**	4330366.03	271386.25
F3-15	4328684.78	271461.74	**F5-18**	4328536.37	271383.50	**G12**	4330356.67	271375.55
F3-16	4328677.81	271468.53	**F5-19**	4328539.13	271393.75	**G13**	4330345.08	271362.29
F3-17	4328671.63	271455.13	**F5-20**	4328551.99	271387.56	**G14**	4330324.94	271338.08
F3-18	4328659.29	271449.71	**F5-21**	4328562.14	271382.19	**G15**	4330316.18	271326.91
F3-19	4328645.33	271446.43	**F5-22**	4328574.52	271373.38	**G16**	4330299.06	271309.43
F3-20	4328630.98	271445.39	**F5-23**	4328585.45	271368.28	**H1**	4328852.33	270489.75
F3-21	4328616.18	271441.05	**F5-24**	4328599.54	271362.26	**H2**	4328847.06	270492.54
F3-22	4328603.00	271442.58	**F5-25**	4328610.37	271356.39	**H3**	4328841.50	270490.00
F3-23	4328586.18	271439.85	**F5-26**	4328623.23	271350.39	**H4**	4328833.07	270488.55
F3-24	4328573.70	271432.41	**F5-27**	4328637.90	271343.21	**H5**	4328826.76	270497.80
F3-25	4328568.26	271416.66	**F5-28**	4328651.43	271336.86	**H6**	4328837.70	270506.89
F3-26	4328564.37	271403.92	**F5-29**	4328666.20	271330.55	**H7**	4328836.26	270518.79
F3-27	4328556.51	271397.04	**F5-30**	4328676.62	271324.73	**H8**	4328838.19	270528.94
F3-28	4328570.94	271388.27	**F5-31**	4328689.71	271319.02	**H9**	4328836.81	270543.25

Table 3. Wetland Flag Numbers and Locations								
Pt	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**
H10	4328849.69	270552.62	**H58**	4328744.20	271064.77	**K12**	4328729.11	271205.27
H11	4328858.55	270569.49	**H59**	4328738.64	271079.16	**K13**	4328735.20	271208.51
H12	4328855.75	270580.28	**H60**	4328734.10	271089.91	**K14**	4328727.07	271187.41
H13	4328859.81	270593.71	**H61**	4328730.97	271102.03	**K15**	4328723.25	271174.50
H14	4328858.02	270608.35	**H62**	4328722.59	271121.26	**K16**	4328718.18	271159.17
H15	4328858.27	270624.31	**I1**	4328875.60	271450.81	**K17**	4328707.27	271173.89
H16	4328857.80	270636.06	**I2**	4328869.77	271438.93	**K18**	4328720.18	271184.41
H17	4328848.97	270651.30	**I3**	4328854.04	271436.93	**K19**	4328723.62	271199.47
H18	4328847.74	270659.42	**I4**	4328843.83	271438.74	**K20**	4328709.51	271207.35
H19	4328838.73	270670.46	**I5**	4328828.12	271445.16	**K21**	4328703.08	271219.24
H20	4328826.73	270685.00	**I6**	4328816.89	271447.02	**K22**	4328697.42	271223.82
H21	4328819.05	270700.42	**I7**	4328814.70	271439.13	**K23**	4328683.15	271231.72
H22	4328817.23	270717.13	**I8**	4328811.17	271455.54	**K24**	4328702.40	271236.42
H23	4328817.34	270726.57	**I9**	4328824.21	271464.31	**K25**	4328710.05	271250.73
H24	4328813.29	270739.63	**I10**	4328836.16	271480.28	**K26**	4328725.88	271261.03
H25	4328823.36	270751.93	**I11**	4328846.64	271487.51	**K27**	4328739.28	271269.31
H26	4328845.18	270747.78	**I12**	4328855.75	271486.69	**K28**	4328743.29	271284.93
H27	4328857.89	270747.71	**I13**	4328865.15	271473.39	**K29**	4328735.86	271298.04
H28	4328867.07	270747.66	**I14**	4328874.91	271464.05	**K30**	4328711.89	271300.03
H29	4328886.67	270750.97	**J1**	4328837.83	271392.85	**K31**	4328703.95	271318.83
H30	4328878.79	270761.55	**J2**	4328831.83	271380.80	**K32**	4328717.28	271312.88
H31	4328880.51	270772.81	**J3**	4328824.66	271369.24	**K33**	4328733.67	271310.06
H32	4328870.05	270783.94	**J4**	4328815.11	271353.67	**K34**	4328756.31	271310.59
H33	4328882.86	270787.33	**J5**	4328809.12	271343.89	**L1**	4330289.82	271295.71
H34	4328852.57	270800.30	**J6**	4328809.40	271353.84	**L2**	4330265.09	271276.28
H35	4328837.89	270811.71	**J7**	4328799.84	271346.45	**L3**	4330239.12	271267.66
H36	4328829.50	270826.61	**J8**	4328788.52	271343.81	**L4**	4330213.23	271260.95
H37	4328844.43	270835.30	**J9**	4328776.71	271340.93	**L5**	4330179.75	271260.55
H38	4328860.15	270834.89	**J10**	4328767.10	271342.61	**L6**	4330154.57	271269.84
H39	4328874.03	270824.96	**J11**	4328779.84	271344.35	**L7**	4330129.56	271278.15
H39A	4328887.39	270812.99	**J12**	4328789.22	271346.80	**L8**	4330104.13	271275.96
H40	4328886.81	270831.25	**J13**	4328801.29	271350.62	**L9**	4330086.81	271250.40
H41	4328887.86	270846.92	**J14**	4328812.03	271362.79	**L10**	4330084.75	271223.96
H42	4328888.33	270862.96	**J15**	4328818.51	271372.35	**L11**	4330082.93	271200.38
H43	4328882.46	270876.09	**J16**	4328818.12	271384.64	**L12**	4330074.52	271178.25
H44	4328878.98	270888.55	**J17**	4328822.45	271396.67	**L13**	4330058.58	271159.73
H45	4328869.50	270902.47	**J18**	4328822.81	271407.72	**L14**	4330032.88	271146.76
H46	4328872.33	270917.95	**J19**	4328826.83	271400.08	**L15**	4330017.23	271148.73
H47	4328876.15	270931.05	**J20**	4328829.20	271393.89	**L16**	4330019.26	271173.38
H48	4328867.17	270949.79	**K1**	4328758.17	271291.04	**L17**	4330013.40	271196.96
H49	4328846.01	270960.71	**K2**	4328754.92	271276.21	**L18**	4330007.49	271221.17
H49A	4328835.31	270967.19	**K3**	4328754.05	271263.08	**L19**	4330010.85	271243.13
H50	4328818.39	270978.66	**K4**	4328748.97	271250.59	**L20**	4330012.46	271116.01
H51	4328808.14	270986.44	**K5**	4328749.23	271237.76	**L21**	4330008.73	271092.16
H52	4328797.10	270991.00	**K6**	4328739.38	271242.02	**L22**	4329999.61	271059.43
H53	4328779.91	271003.45	**K7**	4328735.31	271251.11	**L23**	4329988.80	271020.56
H54	4328771.80	271015.62	**K8**	4328720.73	271244.32	**L24**	4329964.04	271004.22
H55	4328761.40	271027.51	**K9**	4328711.86	271236.72	**L25**	4329948.88	270974.43
H56	4328757.57	271036.37	**K10**	4328719.25	271226.93	**L26**	4329939.58	270947.09
H57	4328751.87	271052.85	**K11**	4328724.64	271211.20	**L27**	4329907.28	270906.19

Table 3. Wetland Flag Numbers and Locations								
Pt	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**	**Pt**	**NORTHING**	**EASTING**
L28	4329879.55	270897.64	**L77**	4329339.83	270750.85	**M14**	4328974.50	270894.83
L29	4329866.16	270868.03	**L78**	4329334.80	270775.39	**M15**	4328963.85	270919.57
L30	4329838.87	270842.61	**L79**	4329360.59	270783.41	**M16**	4328940.45	270932.13
L31	4329801.40	270857.72	**L80**	4329386.38	270790.42	**M17**	4328921.21	270961.05
L32	4329787.53	270836.03	**L81**	4329406.67	270805.70	**M18**	4328895.21	270970.36
L33	4329766.53	270840.62	**L82**	4329419.95	270828.99	**M19**	4328877.40	270995.30
L34	4329719.60	270784.49	**L83**	4329417.49	270854.95	**M20**	4328886.79	271018.84
L35	4329710.88	270779.95	**L84**	4329393.64	270866.36	**M21**	4328855.36	271024.42
L36	4329688.92	270773.52	**L85**	4329371.49	270876.93	**M22**	4328837.57	271034.09
L37	4329687.47	270747.73	**L86**	4329347.34	270881.14	**M23**	4328820.89	271044.14
L38	4329692.58	270721.11	**L87**	4329322.12	270877.56	**M24**	4328804.77	271053.47
L39	4329673.07	270701.21	**L88**	4329295.97	270869.59	**M25**	4328790.81	271066.81
L40	4329659.17	270720.09	**L88A**	4329269.85	270865.20	**M26**	4328780.40	271083.15
L41	4329640.14	270738.88	**L89**	4329247.71	270851.19	**M27**	4328770.64	271096.99
L42	4329628.54	270762.41	**L90**	4329227.92	270843.20	**M28**	4328758.65	271110.91
L43	4329629.02	270785.68	**L91**	4329205.90	270844.05	**M29**	4328760.12	271127.46
L44	4329606.07	270804.60	**L92**	4329200.36	270815.30	**M30**	4328754.67	271152.68
L45	4329614.89	270824.81	**L93**	4329173.93	270813.71	**N1**	4328883.55	271372.89
L46	4329604.58	270847.92	**L94**	4329144.38	270795.91	**N2**	4328906.02	271383.07
L47	4329612.47	270871.46	**L95**	4329128.00	270770.29	**N3**	4328926.19	271375.66
L48	4329632.76	270860.32	**L96**	4329129.97	270752.03	**N4**	4328941.00	271360.71
L49	4329644.30	270840.16	**L97**	4329126.04	270730.59	**N5**	4328957.30	271347.21
L50	4329669.78	270896.35	**L98**	4329101.90	270727.02	**N6**	4328961.88	271324.02
L50A	4329657.28	270865.46	**L99**	4329078.64	270740.84	**N7**	4328979.03	271317.08
L51	4329668.68	270918.83	**L100**	4329057.09	270741.22	**N8**	4328998.70	271314.90
L52	4329643.44	270912.16	**L101**	4329033.96	270756.29	**N9**	4329018.04	271312.24
L53	4329621.31	270901.26	**L102**	4329017.96	270729.03	**N10**	4329016.45	271292.41
L54	4329601.64	270880.57	**L103**	4329001.64	270709.10	**N11**	4329017.15	271275.17
L55	4329595.53	270870.38	**L104**	4328985.27	270708.06	**N12**	4329040.55	271258.62
L56	4329596.57	270855.98	**L105**	4328957.12	270717.19	**N13**	4329061.57	271273.53
L57	4329573.95	270850.40	**L106**	4328946.92	270698.06	**N14**	4329095.57	271302.66
L58	4329547.85	270828.82	**L107**	4328959.06	270666.99	**N15**	4329107.73	271282.28
L59	4329532.32	270796.62	**L108**	4328942.91	270688.62	**N16**	4329130.02	271283.75
L60	4329561.11	270802.39	**L109**	4328938.42	270666.31	**N17**	4329138.33	271283.02
L61	4329578.81	270786.84	**L110**	4328955.52	270638.39	**N18**	4329161.74	271304.70
L62	4329600.33	270770.26	**L111**	4328951.79	270603.57	**N19**	4329151.01	271324.15
L63	4329593.27	270748.28	**L112**	4328936.19	270565.66	**N19A**	4329131.73	271301.07
L64	4329579.73	270733.78	**M1**	4328931.43	270642.11	**N20**	4329171.91	271330.45
L65	4329555.10	270749.44	**M2**	4328920.15	270658.74	**N21**	4329186.72	271343.06
L66	4329527.46	270744.27	**M3**	4328919.74	270678.94	**N22**	4329204.96	271338.14
L67	4329509.05	270725.53	**M4**	4328927.10	270702.16	**N23**	4329224.59	271338.40
L68	4329497.23	270704.67	**M5**	4328927.56	270728.23	**N24**	4329237.06	271335.38
L69	4329473.63	270690.88	**M6**	4328939.21	270744.31	**N25**	4329246.89	271353.09
L70	4329447.28	270691.01	**M7**	4328960.05	270744.28	**N26**	4329263.96	271361.05
L71	4329433.60	270670.55	**M8**	4328982.09	270759.09	**N27**	4329282.22	271373.14
L72	4329416.67	270656.18	**M9**	4328978.49	270780.06	**N28**	4329269.62	271384.40
L73	4329395.55	270664.93	**M10**	4328974.39	270809.53	**N29**	4329281.56	271402.25
L74	4329375.69	270685.06	**M11**	4328980.54	270828.25	**N30**	4329288.84	271421.35
L75	4329367.49	270709.53	**M12**	4328970.28	270848.55	**N31**	4329298.55	271437.21
L76	4329356.41	270731.37	**M13**	4328953.61	270859.80	**N32**	4329309.27	271454.28

Table 3. Wetland Flag Numbers and Locations		
Pt	**NORTHING**	**EASTING**
N33	4329320.05	271468.29
N34	4329324.57	271485.01
N35	4329340.17	271497.79
N36	4329352.66	271514.28
N37	4329366.09	271530.14
N38	4329385.09	271535.60
N39	4329401.58	271547.88
N40	4329416.68	271559.09
N41	4329434.97	271564.80
N42	4329453.19	271564.78
N43	4329469.25	271573.46
N44	4329485.67	271576.24
N45	4329477.05	271592.36
N46	4329498.97	271598.15
N47	4329516.64	271598.82
L113	4328927.75	270554.03
L114	4328919.24	270521.17
L115	4328907.49	270505.84
MH10	4328940.35	270628.26
MH1	4328864.42	270495.46
MH2	4328876.68	270502.61
MH3	4328891.49	270507.89
MH4	4328905.79	270516.91
MH5	4328916.69	270534.79
MH6	4328919.24	270552.32
MH7	4328929.46	270569.69
MH8	4328935.42	270584.16
MH9	4328940.18	270605.79

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir		Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company		County Delta
Investigator WWE Brett Fletcher, Lonnie Renner		State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u> NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES <u>NO</u>	Transect ID A-5U TA-5U
Is the area a potential Problem Area? (If needed, explain on reverse)	YES <u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU	Fragaria virginiana	Herb	FacU
Pentaphylloides floribunda	Sap/shrub	FacW	Agropyron intermediam	Herb	FacU
Salix monticola	Sap/shrub	FacW	Castilleja occidentalis	Herb	FacU
Salix planifolia	Sap/shrub	Obl	Dactylis glomerada	Herb	FacU
Achillea millefolium	Herb	FacU			
Carex garberi	Herb	FacW			
Phleum alpinum	Herb	FacU			
Potentilla spp.	Herb	FacU			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)					
Remarks					

HYDROLOGY

☐ Recorded Data (Describe in Remarks)
- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	18 (in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? YES NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/3			Sandy Loam
6-12		10 Yr 3/2			Sandy Loam
12-18		10 Yr 3/1	5 Yr 4/4		Sandy Loam

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES NO	Is this Sampling Point Within a Wetland? YES NO
Wetland Hydrology Present?	YES NO	
Hydric Soils Present?	YES NO	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir		Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company		County Delta
Investigator WWE Brett Fletcher, Lonnie Renner		State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u> NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES <u>NO</u>	Transect ID TA-5W
Is the area a potential Problem Area? (If needed, explain on reverse)	YES <u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU	Caltha leptosepala	Herb	Obl
Salix planifolia	Sap/shrub	Obl			
Salix monticola	Sap/shrub	FacW			
Pentaphylloides floribunda	Sap/shrub	FacW			
Ribes aureum	Sap/shrub	FacW			
Lonicera involucrata	Sap/shrub	FacW			
Carex utricutalis	Herb	Obl			
Carex aquatilis	Herb	Obl			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)					
Remarks					

HYDROLOGY

☐ Recorded Data (Describe in Remarks)

- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	4 (in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:

- ☐ Inundated
- X Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):

- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? <u>YES</u> NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/4	GC2 4/10B		Sandy Loam
6-12		10 Yr 3/4	GC2 4/10B		Sandy Loam
12-18		10 Yr 3/4	GC2 4/10B		Sandy Loam

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- ☐ Histic Epipedon
- X Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:
Loamy gleyed matrix, difuse oxidation mottling 5Yr 4/4

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	<u>YES</u> NO	Is this Sampling Point Within a Wetland? <u>YES</u> NO
Wetland Hydrology Present?	<u>YES</u> NO	
Hydric Soils Present?	<u>YES</u> NO	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir			Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company			County Delta
Investigator WWE Brett Fletcher, Lonnie Renner			State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u>	NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES	<u>NO</u>	Transect ID A-5U TB-44U
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	<u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU	Fragaria virginiana	Herb	FacU
Pentaphylloides floribunda	Sap/shrub	FacW	Chamerion Augustifolium	Herb	FacU
Salix monticola	Sap/shrub	FacW	Hymenoxys hoopesii	Herb	FacU
Ribes aureum	Sap/shrub	FacW			
Achillea millefolium	Herb	FacU			
Carex garberi	Herb	FacW			
Alopecurus pratensis	Herb	FacW			
Potentilla spp.	Herb	FacU			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)					
Remarks					

HYDROLOGY

☐ Recorded Data (Describe in Remarks)
- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? YES NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 4/3			Sandy Loam
6-12		10 Yr 5/6			Sandy Loam
12-18		10 Yr 5/6			Sandy Loam

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES NO	Is this Sampling Point Within a Wetland? YES NO
Wetland Hydrology Present?	YES NO	
Hydric Soils Present?	YES NO	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir			Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company			County Delta
Investigator WWE Brett Fletcher, Lonnie Renner			State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u>	NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES	<u>NO</u>	Transect ID TB-44W
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	<u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Carex utricutalis	Herb	Obl			
Carex aquatilis	Herb	Obl			

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)

Remarks

HYDROLOGY

☐ Recorded Data (Describe in Remarks)
- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- X Water Marks
- ☐ Drift Lines
- X Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):
- X Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? YES NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/2			Silt Loam
6-12		10 Yr 3/2			Silt Loam
12-18		10 Yr 4/3			Silt Loam

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:
Light colored PM approx. 20% in first 8 inches was attributed to erosion and wave action of rapidly declining water levels. Oxidation was light within 12 inches of surface. Sandy Redox

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES NO	Is this Sampling Point Within a Wetland? YES NO
Wetland Hydrology Present?	YES NO	
Hydric Soils Present?	YES NO	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir			Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company			County Delta
Investigator WWE Brett Fletcher, Lonnie Renner			State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u>	NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES	<u>NO</u>	Transect ID A-5U TC-1U
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	<u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU	Carex garberi	Herb	FacW
Pentaphylloides floribunda	Sap/shrub	FacW	Alopecurus pratensis	Herb	FacW
Salix monticola	Sap/shrub	FacW	Potentilla spp.	Herb	FacU
Lonicera involucrata	Sap/shrub	Fac	Veratrum californicum	Herb	FacW
Ribes aureum	Sap/shrub	FacW	Achillea millefolium	Herb	FacU
Fragaria virginiana	Herb	FacU			
Chamerion Augustifolium	Herb	FacU			
Hymenoxys hoopesii	Herb	FacU			

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)

Remarks

HYDROLOGY

☐ Recorded Data (Describe in Remarks)

- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:

- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):

- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? <u>YES</u> NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/4			Sandy Loam
6-12		10 Yr 3/3	5 Yr 4/4	spotty	Sandy Loam
12-18		10 Yr 3/2	5 Yr 4/4		Sandy Loam
			GC2 3/10B		

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:
Consistently spotty below 12 inches, gleying at tip of auger at 18 inches. Close to wetland boundary line.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	<u>YES</u> NO	Is this Sampling Point Within a Wetland? YES <u>NO</u>
Wetland Hydrology Present?	YES <u>NO</u>	
Hydric Soils Present?	YES <u>NO</u>	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir			Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company			County Delta
Investigator WWE Brett Fletcher, Lonnie Renner			State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u>	NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES	<u>NO</u>	Transect ID TC-1W
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	<u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU			
Salix planifolia	Sap/shrub	Obl			
Salix monticula	Sap/shrub	FacW			
Salix geyeriana	Sap/shrub	FacW			
Carex utricutalis	Herb	Obl			
Carex aquatilis	Herb	Obl			
Caltha leptosepala	Herb	Obl			

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)

Remarks

HYDROLOGY

☐ Recorded Data (Describe in Remarks)
- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	10 (in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- ☐ Inundated
- X Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? <u>YES</u> NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/2	5 Yr 4/4		Fibric
6-12		10 Yr 3/2	GC2 4/10B		Loamy Sand
12-18		10 Yr 2/1	GC2 4/10B		Loamy Sand

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- **X** Histic Epipedon
- **X** Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- **X** Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	<u>YES</u> NO	Is this Sampling Point Within a Wetland? <u>YES</u> NO
Wetland Hydrology Present?	<u>YES</u> NO	
Hydric Soils Present?	<u>YES</u> NO	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir	Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company	County Delta
Investigator WWE Brett Fletcher, Lonnie Renner	State Colorado
Do Normal Circumstances exist on the site? <u>YES</u> NO	Community ID
Is the site significantly disturbed (Atypical Situation)? YES <u>NO</u>	Transect ID A-5U TF2-1U
Is the area a potential Problem Area? (If needed, explain on reverse) YES <u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU	Hymenoxys hoopesii	Herb	FacU
Pentaphylloides floribunda	Sap/shrub	FacW	Festuca arundinacea	Herb	FacW
Salix monticola	Sap/shrub	FacW	Chamerion Augustifolium	Herb	FacU
Salix planifolia	Sap/shrub	Obl	Casteilleja occidentalis	Herb	FacU
Vaccinium spp	Sap/shrub	FacU	Achillea millefolium	Herb	FacU
Dactylis glomerada	Herb	FacU			
Alopecurus pratensis	Herb	FacW			
Fragaria virginiana	Herb	FacU			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)					
Remarks					

HYDROLOGY

☐ Recorded Data (Describe in Remarks) ☐ Stream, Lake, or Tide Gauge X Aerial Photographs ☐ Other ☐ No Recorded Data Available	WETLAND HYDROLOGY INDICATORS Primary Indicators: ☐ Inundated ☐ Saturated in Upper 12 Inches ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns in Wetlands Secondary Indicators (2 or more Required): ☐ Oxidized Root Channels in Upper 12 Inches ☐ Water-Stained Leaves ☐ Local Soil Survey Data ☐ FAC-Neutral Test ☐ Other (Explain in Remarks)

FIELD OBSERVATIONS	
Depth of Surface Water	(in)
Depth to Free Water in Pit	(in)
Depth to Saturated Soil	(in)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? <u>YES</u> NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/3			Sandy Loam
6-12		10 Yr 3/4			Sandy Loam
12-18		10 Yr 3/4	5 Yr 4/4		Sandy Loam

HYDRIC SOIL INDICATORS:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:
Oxidation mottles at 16-18 inches

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES <u>NO</u>	Is this Sampling Point Within a Wetland? YES <u>NO</u>
Wetland Hydrology Present?	YES <u>NO</u>	
Hydric Soils Present?	YES <u>NO</u>	

Remarks

DATA FORM

ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site Overland Reservoir		Date 8-10-07
Applicant / Owner Overland Ditch and Reservoir Company		County Delta
Investigator WWE Brett Fletcher, Lonnie Renner		State Colorado
Do Normal Circumstances exist on the site?	<u>YES</u> NO	Community ID
Is the site significantly disturbed (Atypical Situation)?	YES <u>NO</u>	Transect ID TF2-1W
Is the area a potential Problem Area? (If needed, explain on reverse)	YES <u>NO</u>	Plot ID

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Picea engelmannii	Tree	FacU	Pedicularis groenlandica	Herb	Obl
Salix planifolia	Sap/shrub	Obl	Rumex aquaticus	Herb	Obl
Salix monticula	Sap/shrub	FacW	Polygonum bistortoides	Herb	Fac
Lonicera involucrata	Sap/shrub	Fac	Carex mycroptera	Herb	Fac
Ribes aureum	Sap/shrub	FacW	Castilleja rexifolia	Herb	FacU
Carex utricutalis	Herb	Obl			
Carex aquatilis	Herb	Obl			
Caltha leptosepala	Herb	Obl			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-)					
Remarks					

HYDROLOGY

☐ Recorded Data (Describe in Remarks)

- ☐ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ☐ Other

☐ No Recorded Data Available

FIELD OBSERVATIONS	
Depth of Surface Water	2 (in)
Depth to Free Water in Pit	2 (in)
Depth to Saturated Soil	0 (in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:

- X Inundated
- X Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required):

- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

SOILS

Map Unit Name (Series and Phase): 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex	Drainage Class:
Taxonomy (Subgroup)	Field Observations Confirm Mapped Type? YES NO

PROFILE DESCRIPTION

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6		10 Yr 3/2	GC2 3/10B		Fibric
6-12		10 Yr 3/1	GC2 3/10B		Hemic
12-18		10 Yr 3/1	GC2 3/10B		Hemic

HYDRIC SOIL INDICATORS:

- X Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:
Black histic and then mucky below 6 inches

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES NO	Is this Sampling Point Within a Wetland? YES NO
Wetland Hydrology Present?	YES NO	
Hydric Soils Present?	YES NO	

Remarks

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION
A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

C. PROJECT LOCATION AND BACKGROUND INFORMATION: The proposed Overland Reservoir Enlargement Project, in the Grand Mesa National Forest, Delta County, Colorado. Overland Reservoir is located 20 miles north of Hwy 139 out of Paonia, CO. and 7 miles west on Forest Service Road 705 (Figure 1). Overland Ditch and Reservoir Company (ODRC) currently holds 6200 acre-feet of absolute and 970 acre-feet of conditional water rights. The existing reservoir has a capacity of 6200 acre-feet with an inundated area of approximately 254 surface acres. The proposed project would increase the capacity of the reservoir 970 acre-feet for a total storage capacity of 7170 acre-feet and a footprint of 268 surface acres, an increase of 14 acres. The additional storage could satisfy requirements to adjudicate 970 acre-feet of conditional storage to absolute. Overland Reservoir's storage is used for irrigation and once the head gate has been opened water levels in the reservoir decrease rapidly. The capacity of the ditch that carries Overland's discharge is approximately 60cfs. Average daily flows in the ditch during irrigation season are 58cfs, which equates to an average elevation drop in the reservoir of 6 inches per day from existing Ordinary High Water Mark (OHWM). This JD will be used to avoid, minimize, and mitigate project related impacts in the project design. ODRC will submit an appropriate COE permit application following completion of project design and project coordination with United States Forest Service (USFS).

State:CO County/parish/borough: Delta City: Paonia

Center coordinates of site (lat/long in degree decimal format): Lat. 39.0922° **N**, Long. -107.645° **E**.

Universal Transverse Mercator:

Name of nearest waterbody: Overland Reservoir

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Colorado River

Name of watershed or Hydrologic Unit Code (HUC): 14020004

☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.

☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:

☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☐ Waters subject to the ebb and flow of the tide.

☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]

☐ TNWs, including territorial seas

☐ Wetlands adjacent to TNWs

☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs

☐ Non-RPWs that flow directly or indirectly into TNWs

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.

[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).

- ☒ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
- ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
- ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
- ☒ Impoundments of jurisdictional waters
- ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:
Non-wetland waters: linear feet: width (ft) and/or 82 acres.
Wetlands: 75.47 acres.

c. Limits (boundaries) of jurisdiction based on: **1987 Delineation Manual**
Elevation of established OHWM (if known):9896.5 feet MSL.

2. Non-regulated waters/wetlands (check if applicable):[3]

☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain: .

[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW
Identify TNW: .

Summarize rationale supporting determination: .

2. Wetland adjacent to TNW
Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: Drainage area:
Average annual rainfall: inches
Average annual snowfall: inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☐ Tributary flows through **Pick List** tributaries before entering TNW.

Project waters are **Pick List** river miles from TNW.
Project waters are **Pick List** river miles from RPW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Project waters are **Pick List** aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain: .

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

Identify flow route to TNW[5]: .
Tribulary stream order, if known: .

(b) General Tributary Characteristics (check all that apply):

Tributary is:
- ☐ Natural
- ☐ Artificial (man-made). Explain: .
- ☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):

☐ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☐ Muck
☐ Bedrock	☐ Vegetation. Type/% cover:	
☐ Other. Explain: .		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: .
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Pick List.** Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☐ the presence of litter and debris
☐ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☐ sediment deposition	☐ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community

☐ other (list):
☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;

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[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.
[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

☐ physical markings/characteristics ☐ vegetation lines/changes in vegetation types.
☐ tidal gauges
☐ other (list):

(iii) Chemical Characteristics:

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.). Explain: .

Identify specific pollutants, if known: .

(iv) Biological Characteristics. Channel supports (check all that apply):

☐ Riparian corridor. Characteristics (type, average width): .
☐ Wetland fringe. Characteristics: .
☐ Habitat for:
  ☐ Federally Listed species. Explain findings: .
  ☐ Fish/spawn areas. Explain findings: .
  ☐ Other environmentally-sensitive species. Explain findings: .
  ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:
Properties:
Wetland size: acres
Wetland type. Explain: .
Wetland quality. Explain: .
Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:
Flow is: **Pick List**. Explain: .

Surface flow is**: Pick List**
Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:
☐ Directly abutting
☐ Not directly abutting
  ☐ Discrete wetland hydrologic connection. Explain: .
  ☐ Ecological connection. Explain: .
  ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW
Project wetlands are **Pick List** river miles from TNW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Flow is from: **Pick List.**
Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .
Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

☐ Riparian buffer. Characteristics (type, average width): .
☐ Vegetation type/percent cover. Explain: .
☐ Habitat for:
  ☐ Federally Listed species. Explain findings: .
  ☐ Fish/spawn areas. Explain findings: .
  ☐ Other environmentally-sensitive species. Explain findings: .
  ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**
Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed: .

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   ☐ TNWs: linear feet width (ft), Or, acres.
   ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   ☒ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: Reservoir waters are seasonaly released June though Aug. and the reservoir

fills by RPW (Cow Creek) durning winter months.

☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: .

Provide estimates for jurisdictional waters in the review area (check all that apply):

☒ Tributary waters: **300** linear feet**10**width (ft).

☒ Other non-wetland waters: **82**acres.

Identify type(s) of waters: **Cow Creek at reservoir inlet and the surface area of water at the reservoirs lowest storage level** .

3. Non-RPWs[8] that flow directly or indirectly into TNWs.

☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):

☐ Tributary waters: linear feet width (ft).

☐ Other non-wetland waters: acres.

Identify type(s) of waters: **.**

4. Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.

☒ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.

☒ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale
indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is
directly abutting an RPW: **Wetlands surounding reservoir .**

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: **75.47**acres.

5. Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.

☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.

☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. Impoundments of jurisdictional waters.[9]

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.

☐ Demonstrate that impoundment was created from "waters of the U.S.," or

☒ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or

☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

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[8]See Footnote # 3.

[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]

☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: **.**
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: **.**
☐ Other: (explain, if not covered above): **.**

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
☐ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .

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[10] Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.*

☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
  ☐ USGS NHD data.
  ☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name:1:24000. Chalk Mountain.
☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
☐ National wetlands inventory map(s). Cite name: .
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date):NAIP.2005.
  or ☐ Other (Name & Date): .
☐ Previous determination(s). File no. and date of response letter: .
☐ Applicable/supporting case law: .
☐ Applicable/supporting scientific literature: .
☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir | City/County: Delta | Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company | State: CO | Sampling Point: TA5U

Investigator(s): WWE: Brett Fletcher, Lonnie Renner | Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): Hillslope | Local relief (concave, convex, none): Concave | Slope (%):

Subregion (LRR): E - RM Forests & Rangeland | Lat: 39.0922° | Long: 107.645° | Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex | NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	( )	(●)
Hydric Soil Present?	( )	(●)
Wetland Hydrology Present?	( )	(●)

Is the Sampled Area within a Wetland? **Yes** ( ) **No** (●)

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	15	Yes	FACU
2.			
3.			
4.			
	15 %		
Sapling/Shrub Stratum			
1. *Pentaphylloides floribunda*	10	Yes	FACW
2. *Salix monticola*	5	Yes	FACW
3. *Salix planifolia*	5	Yes	OBL
4.			
5.			
Total Cover:	20 %		
Herb Stratum			
1. *Achillea millefolium*	5	Yes	FACU
2. *Carex garberi*	5	Yes	FACW
3. *Phleum alpinum*	5	Yes	FAC
4. *Potentilla spp.*	5	Yes	FACU
5. *Fragaria virginiana*	5	Yes	FACU
6. *Agropyron intermediam*	5	Yes	FACU
7. *Castilleja occidentalis*	5	Yes	FACU
8. *Dactylis glomerada*	5	Yes	FACU
Total Cover:	40 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % | % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 12 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 41.7 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ( ) **No** (●)

Remarks:

SOIL

Sampling Point: TA5U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/3	99					Sandy Loam	
6-12	10 Yr 3/2	99					Sandy Loam	
12-18	10 Yr 3/1	95	5 Yr 4/4	3	C	PL	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ◉ No ○ Depth (inches): 18

Wetland Hydrology Present? Yes ○ **No** ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir City/County: Delta Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company State: CO Sampling Point: TA5W

Investigator(s): WWE: Brett Fletcher, Lonnie Renner Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 2%

Subregion (LRR): E - RM Forests & Rangeland Lat: 39.0922° Long: 107.645° Datum: NAD 83

Soil Map Unit Name: Broad Canyon, warm-Bullbasin- Cryaquolls complex NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◉ No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉	No ○
Hydric Soil Present?	Yes ◉	No ○
Wetland Hydrology Present?	Yes ◉	No ○

Is the Sampled Area within a Wetland? **Yes** ◉ **No** ○

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	5	Yes	FACU
2.			
3.			
4.			
	5 %		
Sapling/Shrub Stratum			
1. *Salix planifolia*	10	Yes	OBL
2. *Salix monticola*	5	Yes	FACW
3. *Pentaphylloides floribunda*	5	Yes	FACW
4. *Ribes aureum*	5	Yes	FACW
5. *Lonicera involucrata*	5	Yes	FACW
Total Cover:	30 %		
Herb Stratum			
1. *Carex utricutalis*	40	Yes	OBL
2. *Carex aquatilis*	25	Yes	OBL
3. *Caltha leptosepala*	20	Yes	OBL
4. *Pedicularis groenlandica*	5		OBL
5. *Carex mycroptera*	5		FAC
6. *Oxypolis fendleri*	5		OBL
7. *Castilleja rexifolia*	5		FACU
8. *Deschampsia caespitosa*	5		FACW
Total Cover:	110 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ % % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 9 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88.9 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ◉ **No** ○

Remarks:

SOIL

Sampling Point: TA5W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/4	40	GC2 4/10B	35	RM	M	Sandy Loam	
			5 Yr 4/4	15	C	RC		
6-12	10 Yr 3/4	20	GC2 4/10B	40	RM	M	Sandy Loam	
			5 Yr 4/4	25	C	PL		
12-18	10 Yr 3/4	15	GC2 4/10B	60	RM	M	Sandy Loam	
			5 Yr 4/4	25	C	PL		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [x] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5) (**LRR C**)
- [ ] 1 cm Muck (A9) (**LRR D**)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [x] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- [ ] 1 cm Muck (A9) (**LRR C**)
- [ ] 2 cm Muck (A10) (**LRR B**)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? **Yes** (●) **No** ( )

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1) (**Nonriverine**)
- [ ] Sediment Deposits (B2) (**Nonriverine**)
- [ ] Drift Deposits (B3) (**Nonriverine**)
- [ ] Surface Soil Cracks (B6)
- [x] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Biotic Crust (B12)
- [ ] Aquatic Invertebrates (B13)
- [x] Hydrogen Sulfide Odor (C1)
- [x] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Plowed Soils (C6)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water Marks (B1) (**Riverine**)
- [ ] Sediment Deposits (B2) (**Riverine**)
- [ ] Drift Deposits (B3) (**Riverine**)
- [ ] Drainage Patterns (B10)
- [ ] Dry-Season Water Table (C2)
- [ ] Thin Muck Surface (C7)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ( )	No (●)	Depth (inches):
Water Table Present?	Yes ( )	No (●)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes (●)	No ( )	Depth (inches): 4"

Wetland Hydrology Present? **Yes** (●) **No** ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir | City/County: Delta | Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company | State: CO | Sampling Point: TB44U

Investigator(s): WWE: Brett Fletcher, Lonnie Renner | Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): Sloping Bank | Local relief (concave, convex, none): convex | Slope (%): 1%

Subregion (LRR): E - RM Forests & Rangeland | Lat: 39.0834° | Long: 107.64° | Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex | NWI classification: not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	( )	(●)
Hydric Soil Present?	( )	(●)
Wetland Hydrology Present?	( )	(●)

Is the Sampled Area within a Wetland? Yes ( ) No (●)

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	10	Yes	FACU
2.			
3.			
4.			
	10 %		
Sapling/Shrub Stratum			
1. *Pentaphylloides floribunda*	15	Yes	FACW
2. *Salix monticola*	10	Yes	FACW
3. *Ribes aureum*	5	Yes	FACW
4.			
5.			
Total Cover:	30 %		
Herb Stratum			
1. *Fragaria virginiana*	5	Yes	FACU
2. *Hymenoxys hoopesii*	5	Yes	FACU
3. *Chamerion Augustifolium*	5	Yes	FACU
4. *Potentilla spp.*	5	Yes	FACU
5. *Achillea millefolium*	5	Yes	FACU
6. *Carex garberi*	5	Yes	FACW
7. *Alopecurus pratensis*	5	Yes	FACW
8.			
Total Cover:	35 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ % | % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 11 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 45.5 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ( ) No (●)

Remarks:

SOIL

Sampling Point: TB44U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 4/3	70					Sandy loam	
6-12	10 Yr 5/6	60					Sandy loam	
12-18	10 Yr 5/6	80					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ **No** ◉

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir City/County: Delta Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company State: CO Sampling Point: TB44W

Investigator(s): WWE: Brett Fletcher, Lonnie Renner Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): Sloping Bank Local relief (concave, convex, none): convex Slope (%): 1%

Subregion (LRR): E - RM Forests & Rangeland Lat: 39.0834° Long: 107.64° Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex NWI classification: not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●)	No ( )
Hydric Soil Present?	Yes (●)	No ( )
Wetland Hydrology Present?	Yes (●)	No ( )

Is the Sampled Area within a Wetland? **Yes** (●) **No** ( )

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Carex utricutalis*	45	Yes	OBL
2. *Carex aquatilis*	35	Yes	OBL
3. *Eleocharis palustris*	10		OBL
4.			
5.			
6.			
7.			
8.			
Total Cover:	90 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ % % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** (●) **No** ( )

Remarks:

SOIL

Sampling Point: TB44W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/2	70			C	M	Silt Loam	2-4 % oxidation on PL and R
6-12	10 Yr 3/2	80			C	M	Silt Loam	2-4 % oxidation on PL and R
12-18	10 Yr 4/3	80			C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☒ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? **Yes** ◉ **No** ○

Remarks: Light colored PM approx. 20% in first 8 inches was attributed to erosion and wave action of rapidly declining water levels. Oxidation was light within 12 inches of surface.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☒ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☒ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☒ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):
Water Table Present? Yes ○ No ◉ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ◉ **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir City/County: Delta Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company State: CO Sampling Point: TC1U

Investigator(s): WWE: Brett Fletcher, Lonnie Renner Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): concave Slope (%): 1%

Subregion (LRR): E - RM Forests & Rangeland Lat: 39.0844° Long: 107.64° Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	(●)	( )
Hydric Soil Present?	( )	(●)
Wetland Hydrology Present?	( )	(●)

Is the Sampled Area within a Wetland? Yes ( ) No (●)

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	10	Yes	FACU
2.			
3.			
4.			
	10 %		
Sapling/Shrub Stratum			
1. *Pentaphylloides floribunda*	15	Yes	FACW
2. *Salix monticola*	10	Yes	FACW
3. *Lonicera involucrata*	5	Yes	FAC
4. *Ribes aureum*	5	Yes	FACW
5.			
Total Cover:	35 %		
Herb Stratum			
1. *Fragaria virginiana*	5	Yes	FACU
2. *Hymenoxys hoopesii*	5	Yes	FACU
3. *Chamerion Augustifolium*	5	Yes	FACU
4. *Potentilla spp.*	5	Yes	FACU
5. *Achillea millefolium*	5	Yes	FACU
6. *Carex garberi*	5	Yes	FACW
7. *Veratrum californicum*	5	Yes	FACW
8. *Alopecurus pratensis*	5	Yes	FACW
Total Cover:	40 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ % % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 13 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 53.8 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

☒ Dominance Test is >50%

Prevalence Index is ≤3.0[1]

☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks:

SOIL

Sampling Point: TC1U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/4	95					Sandy loam	
6-12	10 Yr 3/3	90	5Yr 4/4	3	C		Sandy loam	spotty near ~12 inches
12-18	10 Yr 3/2	80	5Yr 4/4	15	C	M	Sandy loam	consistently spotty
			GC2 3/10B		C	M		at tip of auger ~18 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks: Oxidation was light and spotty within 12 of surface, close to wetland delineation boundary line.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ● Depth (inches):
Water Table Present? Yes ○ No ● Depth (inches):
Saturation Present? (includes capillary fringe) Yes ○ No ● Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir | City/County: Delta | Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company | State: CO | Sampling Point: TC1W

Investigator(s): WWE: Brett Fletcher, Lonnie Renner | Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): terrace | Local relief (concave, convex, none): concave | Slope (%): 1%

Subregion (LRR): E - RM Forests & Rangeland | Lat: 39.0844° | Long: 107.64° | Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex | NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	(●)	( )
Hydric Soil Present?	(●)	( )
Wetland Hydrology Present?	(●)	( )

Is the Sampled Area within a Wetland? **Yes** (●) **No** ( )

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	5	Yes	FACU
2.			
3.			
4.			
	5 %		
Sapling/Shrub Stratum			
1. *Salix planifolia*	20	Yes	OBL
2. *Salix monticula*	10	Yes	FACW
3. *Salix geyeriana*	5	Yes	FACW
4.			
5.			
Total Cover:	35 %		
Herb Stratum			
1. *Carex utricutalis*	60	Yes	OBL
2. *Carex aquatilis*	20	Yes	OBL
3. *Caltha leptosepala*	20	Yes	OBL
4. *Pedicularis groenlandica*	5		OBL
5. *Eleocharis palustris*	5		OBL
6. *Rumex aquaticus*	5		OBL
7. *Carex mycroptera*	5		FAC
8. *Castilleja rexifolia*	5		FACU
Total Cover:	125 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % | % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 85.7 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** (●) **No** ( )

Remarks:

SOIL

Sampling Point: TC1W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/2	90	5 Yr 4/4	5	C	M	Fibric	Histic Epipedon
6-12	10 Yr 3/2	35	GC2 4/10B	60	C	M	Loamy Sand	
12-18	10 Yr 2/1	20	GC2 4/10B	75	C	M	Laomy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [x] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [x] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5) (**LRR C**)
- [ ] 1 cm Muck (A9) (**LRR D**)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [x] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- [ ] 1 cm Muck (A9) (**LRR C**)
- [ ] 2 cm Muck (A10) (**LRR B**)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** (●) **No** ( )

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1) (**Nonriverine**)
- [ ] Sediment Deposits (B2) (**Nonriverine**)
- [ ] Drift Deposits (B3) (**Nonriverine**)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Biotic Crust (B12)
- [ ] Aquatic Invertebrates (B13)
- [x] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Plowed Soils (C6)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water Marks (B1) (**Riverine**)
- [ ] Sediment Deposits (B2) (**Riverine**)
- [ ] Drift Deposits (B3) (**Riverine**)
- [ ] Drainage Patterns (B10)
- [ ] Dry-Season Water Table (C2)
- [ ] Thin Muck Surface (C7)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ( )	No ( )	Depth (inches):
Water Table Present?	Yes ( )	No ( )	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes (●)	No ( )	Depth (inches): 10"

Wetland Hydrology Present? **Yes** (●) **No** ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir | City/County: Delta | Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company | State: CO | Sampling Point: TF2-1U

Investigator(s): WWE: Brett Fletcher, Lonnie Renner | Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): terrace | Local relief (concave, convex, none): concave | Slope (%): 1%

Subregion (LRR): E - RM Forests & Rangeland | Lat: 39.0807° | Long: 107.643° | Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex | NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	( )	(●)
Hydric Soil Present?	( )	(●)
Wetland Hydrology Present?	( )	(●)

Is the Sampled Area within a Wetland? **Yes** ( ) **No** (●)

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	15	Yes	FACU
2.			
3.			
4.			
	15 %		
Sapling/Shrub Stratum			
1. *Pentaphylloides floribunda*	10	Yes	FACW
2. *Salix monticola*	5	Yes	FACW
3. *Vaccinium spp*	5	Yes	FACU
4. *Salix planifolia*	3	Yes	OBL
5.			
Total Cover:	23 %		
Herb Stratum			
1. *Dactylis glomerada*	5	Yes	FACU
2. *Alopecurus pratensis*	5	Yes	FACW
3. *Fragaria virginiana*	5	Yes	FACU
4. *Hymenoxys hoopesii*	5	Yes	FACU
5. *Festuca arundinacea*	5	Yes	FACW
6. *Chamerion Augustifolium*	5	Yes	FACU
7. *Casteilleja occidentalis*	5	Yes	FACU
8. *Achillea millefolium*	5	Yes	FACU
Total Cover:	40 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % | % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 13 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 38.5 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ( ) **No** (●)

Remarks:

SOIL

Sampling Point: TF2-1U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/3	95					Sandy loam	
6-12	10 Yr 3/4	95					Sandy loam	
12-18	10 Yr 3/4	90	5 Yr 4/4	3	C	M	Sandy loam	oxidation mottles at 16-18 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ **No** ◉

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ **No** ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys and Coast Region

Project/Site: Overland Reservoir City/County: Delta Sampling Date: 8-10-07

Applicant/Owner: Overland Ditch and Reservoir Company State: CO Sampling Point: TF2-1W

Investigator(s): WWE: Brett Fletcher, Lonnie Renner Section, Township, Range: Sections 22 & 23 T 11S, R 92W

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): concave Slope (%): 1%

Subregion (LRR): E - RM Forests & Rangeland Lat: 39.0807° Long: 107.643° Datum: NAD 83

Soil Map Unit Name: 110 - Broad Canyon, warm-Bullbasin-Cryaquolls complex NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◉ No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉	No ○
Hydric Soil Present?	Yes ◉	No ○
Wetland Hydrology Present?	Yes ◉	No ○

Is the Sampled Area within a Wetland? **Yes** ◉ **No** ○

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea engelmannii*	25	Yes	FACU
2.			
3.			
4.			
	25 %		
Sapling/Shrub Stratum			
1. *Salix planifolia*	35	Yes	OBL
2. *Salix monticula*	10	Yes	FACW
3. *Lonicera involucrata*	5	Yes	FAC
4. *Ribes aureum*	5	Yes	FACW
5.			
Total Cover:	55 %		
Herb Stratum			
1. *Carex utricutalis*	20	Yes	OBL
2. *Caltha leptosepala*	10	Yes	OBL
3. *Carex aquatilis*	10	Yes	OBL
4. *Pedicularis groenlandica*	5	Yes	OBL
5. *Rumex aquaticus*	5	Yes	OBL
6. *Polygonum bistortoides*	5	Yes	FAC
7. *Carex mycroptera*	5	Yes	FAC
8. *Castilleja rexifolia*	5	Yes	FACU
Total Cover:	65 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ % % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 11 (A)

Total Number of Dominant Species Across All Strata: 13 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 84.6 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** ◉ **No** ○

Remarks:

SOIL

Sampling Point: TF2-1W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-6	10 Yr 3/2	75	GC2 3/10B	20			Fibric	
6-12	10 Yr 3/1	60	GC2 3/10B	30			Hemic	mucky
12-18	10 Yr 3/1	60	GC2 3/10B	40			Hemic	mucky

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [x] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [x] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5) (**LRR C**)
- [ ] 1 cm Muck (A9) (**LRR D**)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- [ ] 1 cm Muck (A9) (**LRR C**)
- [ ] 2 cm Muck (A10) (**LRR B**)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) **No** ( )

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1) (**Nonriverine**)
- [ ] Sediment Deposits (B2) (**Nonriverine**)
- [ ] Drift Deposits (B3) (**Nonriverine**)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Biotic Crust (B12)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Plowed Soils (C6)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water Marks (B1) (**Riverine**)
- [ ] Sediment Deposits (B2) (**Riverine**)
- [ ] Drift Deposits (B3) (**Riverine**)
- [ ] Drainage Patterns (B10)
- [ ] Dry-Season Water Table (C2)
- [ ] Thin Muck Surface (C7)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes (●)	No ( )	Depth (inches): 2"
Water Table Present?	Yes (●)	No ( )	Depth (inches): 2"
Saturation Present? (includes capillary fringe)	Yes (●)	No ( )	Depth (inches): 0"

Wetland Hydrology Present? Yes (●) **No** ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

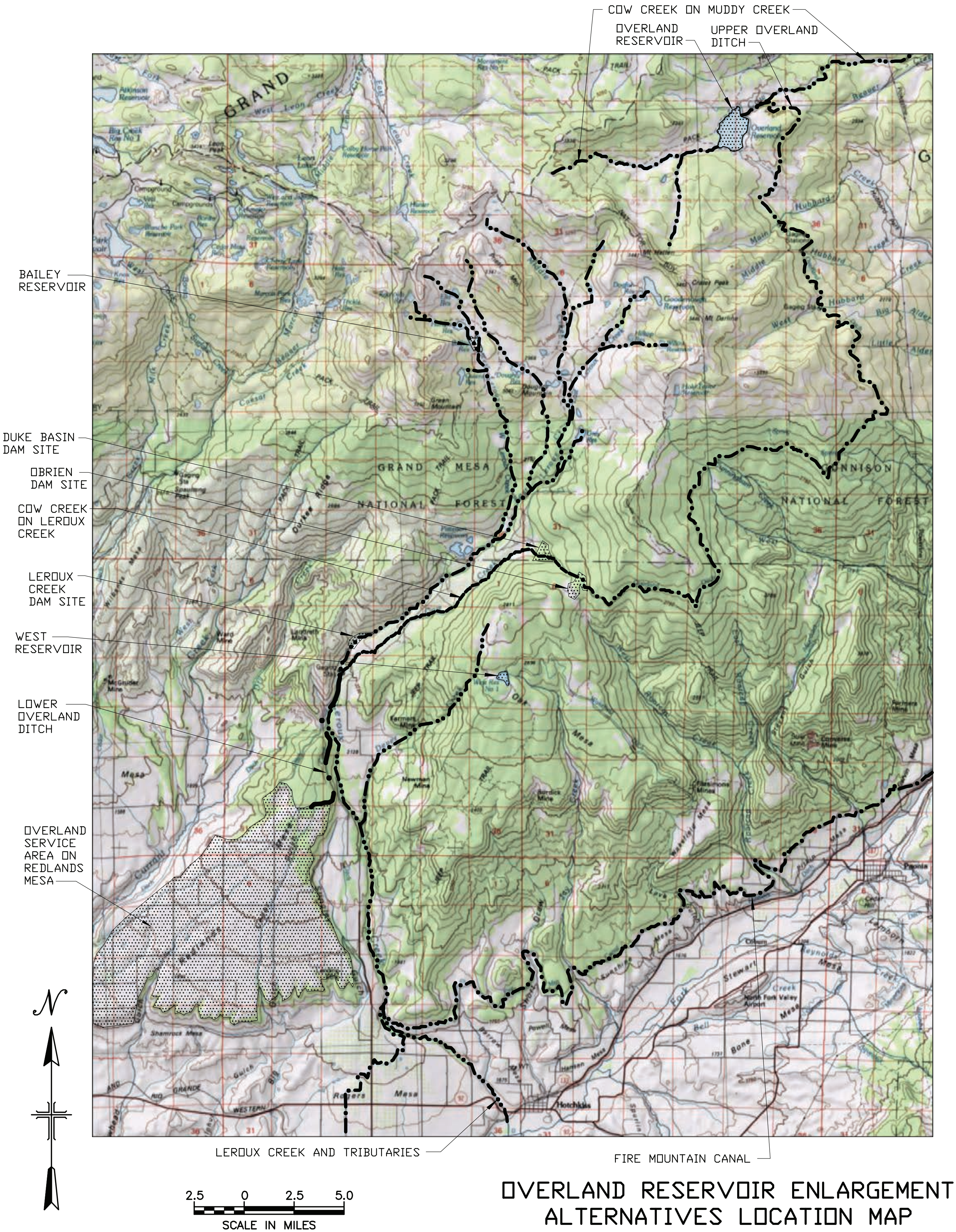
OVERLAND RESERVOIR SUMMARY OF ALTERNATIVES
SECOND DRAFT 9/20/2011

ALTERNATIVE DESCRIPTION	SUMMARY OF ALTERNATIVE EVALUATION
1. Overland Reservoir Enlargement	**PREFERRED ALTERNATIVE**
Located at 107° 38' 33" W Longitude, 39° 05' 19" N Latitude. This alternative consists of increasing the capacity of the existing Overland Reservoir by raising the existing main dam and an auxiliary dam on a secondary drainage.	1. No enlargement of Overland Ditch will be required. 2. There is an existing conditional water right at this site for the proposed increased storage amount with a 1954 priority date. 3. Previous modifications (1987) were made to accommodate the proposed enlargement in a manner that woud minimize additional disturbance. 4. The enlargement will inundate an additional 3.2 acres of wetlands including .1 acre of fen. 5. The majority of construction materials will come from previously disturbed areas. 6. Reservoir is on National Forest land.
2. West Reservoir	
2a. West Reservoir Enlargement	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 44' 00" W Longitude, 38° 55' 46" N Latitude. This alternative consists of increasing the capacity of the existing West Reservoir from 450 ac-ft to 1460 ac-ft by raising the existing dam height from 38 feet to 63 feet and constructing two auxiliary dams on secondary drainages. It would involve transfer of the existing Overland water storage right to the West Reservoir site.	1. Existing dam is in a conservation easement. The governing land trust will oppose enlargement. 2. Requires enlargement of the Upper Overland Ditch to 160 percent of existing flow capacity by modifying the ditch cross-section. No increase in the length of Overland Ditch will be required. 3. Requires enlargement of 3.5 miles of feeder ditch from the Upper Overland Ditch to the reservoir site. 4. Overland Ditch enlargement will disturb 96 additional acres of public land, much of which appears to be jurisdictional wetlands. 5. Based on interpretation of aerial photos, the enlargement will encroach on approximately 3.9 acres of additional jurisdictional wetlands. 6. Objections to water right transfer out of basin of origin will have to be overcome. 7. Several safety concerns raised by the Colorado Dam Safety Engineer regarding the existing dam will have to be addressed. 8. Estimated cost (including enlargement of Overland Ditch and feeder ditch) is 6.5 times greater than the preferred alternative.
2b. West Reservoir Reconstruction	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 44' 00" W Longitude, 38° 55' 46" N Latitude. This alternative consists of breaching the existing West Reservoir dam and constructing a new dam located 550 feet downstream from the current dam. The new dam will contain an enlarged reservoir . An auxiliary dam on a secondary drainage would also be required at this site. It would involve transfer of the existing Overland water storage right to the West Reservoir site.	1. Existing dam and proposed new dam site are both in a conservation easement. The governing land trust will oppose reconstruction. 2. Requires enlargement of the Upper Overland Ditch to 160 percent of existing flow capacity by modifying the ditch cross-section. No increase in the length of Overland Ditch will be required. 3. Requires enlargement of 3.5 miles of feeder ditch from the Upper Overland Ditch to the reservoir site. 4. Overland Ditch enlargement will disturb 96 additional acres of public land, much of which appears to be jurisdictional wetlands. 5. Based on interpretation of aerial photos, the reservoir will encroach on approximately 5.6 acres of additional jurisdictional wetlands. 5. Objections to water right transfer out of basin of origin will have to be overcome. 6. Estimated cost (including enlargement of Overland Ditch and feeder ditch) is 6.5 times greater than the preferred alternative.
3. Bailey Reservoir Enlargement	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 45' 31" W Longitude, 39° 02' 07" N Latitude. This alternative consists of increasing the capacity of the existing Bailey Reservoir from 330 ac-ft to 1,330 ac-ft by raising the existing dam height from 29 to 48 feet and constructing an auxiliary dam on a secondary drainage. This would involve filing for a new storage water right on West Leroux Creek.	1. New water right with a 2012 priority date or later will be subordinate to all earlier water rights in the drainage basin. Development of existing conditional water rights will reduce the yield of the new right. 2. Water yield may be less than for preferred alternative. 3. Dam is owned by Leroux Creek Water Users Association (LCWUA). LCWUA will require compensation for expansion of their dam by committing a portion of the resulting storage to LCWUA. This compensatory storage will increase enlargement costs and impacts. 4. Based on interpretation of aerial photos, the enlargement will encroach on approximately 10.4 acres of additional jurisdictional wetlands. 5. The enlargement will inundate existing camp sites and boat ramp impacting existing recreational uses. 6. Estimated cost is 5.0 times greater than the preferred alternative (not including the cost for compensatory storage to LCWUA). 7. Reservoir is on National Forest land.

ALTERNATIVE DESCRIPTION	SUMMARY OF ALTERNATIVE EVALUATION
4. O'Brien Reservoir Construction	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 42' 54" W Longitude, 38° 57' 01" N Latitude. This would involve transfer of the existing Overland water storage right to the O'Brien Reservoir site. The proposed reservoir requires construction of three new dams.	1. Requires enlargement of the Upper Overland Ditch to 160 percent of existing flow capacity by modifying the ditch cross-section. No increase in the length of Overland Ditch will be required. 2. Overland Ditch enlargement will disturb 96 additional acres of public land, much of which appears to be jurisdictional wetlands. 3. Objections to water right transfer out of basin of origin will have to be overcome. 4. Estimated cost (including enlargement of Overland Ditch) is 7.0 times greater than the preferred alternative.
5. Leroux Creek Reservoir Construction	
5a. Leroux Creek Reservoir Construction With Transfer of Existing Conditional Water Right	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 47' 26" W Longitude, 38° 55' 66" N Latitude. This would involve transfer of the existing Overland water storage right to the Leroux Creek Reservoir site. This alternative involves constructing a single new dam 112 feet in height.	1. Requires enlargement of the Upper Overland Ditch to 160 percent of existing flow capacity by modifying the ditch cross-section if existing water right is transfered. No increase in the length of Overland Ditch will be required. 2. Overland Ditch enlargement will disturb 96 additional acres, much of which appears to be jurisdictional wetlands. 3. Requires construction of 0.5 mile of new feeder ditch. 4. Objections to water right transfer out of basin of origin will have to be overcome. 5. Estimated cost (including enlargement of Overland Ditch and construction of feeder ditch) is 7.5 times greater than the preferred alternative. 6. Based on interpretation of aerial photos, the enlargement will encroach on approximately 13.2 acres of additional wetlands. 7. Moderate geologic hazards to overcome due to historic and potential landslides in the reservoir basin. 8. Increased ditch flows will result in greater erosion in the portion of Cow Creek which is used as part of the Overland Ditch water conveyance system.
5b. Leroux Creek Reservoir Construction With Filing for New Water Right	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 47' 26" W Longitude, 38° 55' 66" N Latitude. This would involve filing for a new storage water right on Leroux Creek. This alternative entails constructing a single new dam 112 feet in height.	1. Requires construction of 0.5 mile of new feeder ditch. 2. Estimated cost is 7.5 times greater than the preferred alternative. 3. New water right with a priority date of 2012 or later will be subordinate to all earlier water rights in the drainage basin. Development of existing conditional water rights held by others will reduce the yield of the new right. 4. Based on interpretation of aerial photos, the enlargement will encroach on approximately 13.2 acres of additional wetlands. 5. Moderate geologic hazards to overcome due to historic and potential landslides in the reservoir basin. 6 . Increased ditch flows will result in greater erosion in the portion of Cow Creek which is used as part of the Overland Ditch water conveyance system.
6. Duke Basin Reservoir Construction	**REASONS ALTERNATIVE NOT SELECTED**
Located at 107° 43' 27" W Longitude, 38° 57' 54" N Latitude. This would involve transfer of the existing Overland water storage right to the Duke Basin Reservoir site. This alternative involves constructing a single new dam 66 feet in height.	1. Requires enlargement of the Upper Overland Ditch to 160 percent of existing flow capacity by modifying the ditch cross-section. No increase in the length of Overland Ditch will be required. 2. Overland Ditch enlargement will disturb 96 additional acres of public land, much of which appears to be Jurisdictional wetlands. 3. Objections to water right transfer will have to be overcome. 4. Based on interpretation of aerial photos, the reservoir will encroach on approximately 9.0 acres of additional jurisdictional wetlands. 5. Estimated cost (including Overland Ditch enlargement) is 5.5 times greater than Overland enlargement. 6. Reservoir is on National Forest land. 7. Severe geologic hazards to overcome due to active, historic and potential landslides at the dam site and in the reservoir basin. 8. Increased ditch flows will result in greater erosion in the portion of Cow Creek which is used as part of the Overland Ditch water conveyance system.

OVERLAND RESERVOIR SUMMARY OF ALTERNATIVES
SECOND DRAFT 9/20/2011

ALTERNATIVE DESCRIPTION	SUMMARY OF ALTERNATIVE EVALUATION
7. Hydraulic Dredging of Overland Reservoir	**REASONS ALTERNATIVE NOT SELECTED**
This would involve removal of 1,600,000 cubic yards of soil from the Overland reservoir basin using a barge mounted dredge. Dredged slurry will be piped to a disposal site. Total quantity of dredged slurry would be 200,000,000 cubic feet including 3,500 ac-ft of water which will be pumped from the reservoir to the disposal site.	1. Recreational and other impacts to the area with equipment operating 24 hours/day, 7 days/week during summer months for 3 years. 2. Disturbance to 22 acres of National Forest land for 12 mile long discharge pipeline corridor. 3. Disturbance to 60 acres of public or National Forest land for disposal site. 4. Possible impact to existing wetlands within the reservoir basin. 5. Impact to wetlands along discharge pipeline corridor and at disposal site. 6. Water quality concerns to include Increased reservoir water turbidity during dredging activities and quality of water discharged from disposal site to streams. Water quality monitoring will be required at both locations. 7. Loss of 3,500 ac-ft of water pumped from the reservoir to the disposal site. 8. Potential impacts to fishery resulting from fish entrainment in dredged slurry. 9. Estimated cost is 9.5 times greater than the preferred alternative.
8. Mechanical Dredging of Overland Reservoir	**REASONS ALTERNATIVE NOT SELECTED**
This would involve removal of 1,600,000 cubic yards of soil from the Overland reservoir basin using conventional excavating equipment. Excavated spoil would be removed to a local disposal site.	1. Recreational and other impacts to the area with equipment operating 7 days/week during summer months for 4 years. 2. Disturbance to 70 acres of National Forest land for disposal site. 3. Potential impact to existing wetlands within the reservoir basin. 4. Impact to heavily used haul roads. 5. Loss of reservoir storage water for 4 years during dredging. 6. Estimated cost is 7.5 times greater than the preferred alternative.
9. Purchase Water From Other Entities	**REASONS ALTERNATIVE NOT SELECTED**
This would involve purchasing water from other water supply companies in the area. To satisfy the timing requirement, the purchased water would be from storage. The only local companies supplying significant storage water to the area are Fire Mountain Canal Company (FMCC) and Leroux Creek Water Users Association (LCWUA).	1. There is no surplus water available for sale. 2. Purchasing water from another entity would create a greater irrigation deficit for other irrigated lands in the area. 3. Obtaining water from FMCC would require pumping to the Overland service area. 4. The value of existing stored water supplies is based on replacement cost which is 5 to 10 times greater than the cost of water from the preferred alternative.



OVERLAND RESERVOIR ENLARGEMENT ALTERNATIVES LOCATION MAP

8/29/2011

OVERLAND DITCH AND RESERVOIR
DETAILED COST ESTIMATES FOR ALTERNATIVES
November 8, 2011
CONFIDENTIAL (FOR CORPS OF ENGINEERS EYES ONLY)

Cost estimates are included herein for the Overland Reservoir Dam enlargement and the following alternatives to Overland Reservoir Dam enlargement:

- West Reservoir Enlargement
- West Reservoir Relocation
- Obrien Reservoirs Construction
- Duke Basin Reservoir Construction
- Leroux Creek Reservoir Construction
- Bailey Reservoir Enlargement
- Overland Reservoir Basin Hydraulic Dredging
- Overland Reservoir Basin Mechanical Dredging

The Leroux Creek Reservoir Construction includes two separate alternatives – one in which the source of water is transfer of the current Overland Reservoir water storage right to the Leroux Creek site and the other based on filing for a new water storage right.

The cost estimate for the Overland Dam enlargement is based on quantities determined from the preliminary designs. This cost estimate has been updated annually since 2005.

The basis for the cost estimates for the first six projects listed above is work which was done in 2002 and 2003 for the North Fork Water Conservancy District to evaluate potential water storage projects in the Leroux Creek drainage basin. These costs estimates have been modified as follows:

1. For most of the projects, the reservoir sizes which were examined for the 2002 and 2003 studies were different than needed to provide an equivalent alternative. Therefore, the quantities for the detailed cost estimates were adjusted to reflect the size of reservoir which would provide a similar comparison to the proposed Overland enlargement.

2. In 2008, the cost for enlarging the Upper Overland Ditch to provide sufficient capacity to physically transfer the existing Overland water storage right to a downstream storage site was estimated. These costs were applicable to the projects which depend on that transfer (two projects do not rely on the transfer – Leroux Creek Dam with a new water right and Bailey enlargement).

3. All estimated costs were normalized to 2011 dollars by use of the U.S. Bureau of Reclamation's construction cost index data.

It should be noted that, for the two projects which rely on filing for a new water storage right it was assumed that storage of an equivalent volume of water would provide an equivalent alternative. That very well may not be the case if the new water rights do not produce comparable hydrologic yields. If that turned out to be the case, the storage volume for these alternatives would have to be increased accordingly resulting in a greater cost estimates. The comparable yield could only be determined based on detailed hydrologic investigations which are not justified at this point.

It is also important to recognize that the existing Bailey Dam is owned by an entity other than Overland Ditch and Reservoir Company (Leroux Creek Water Users Association). For the purposes of this cost estimate, it was assumed that the storage volume would have to be increased by 25 percent over that required to provide an equivalent amount in order to compensate the LCWUA for use and modification of their facility.

In 2008, cost estimates were prepared for both mechanical and hydraulic dredging of Overland reservoir as an alternative to enlargement of the dams. Those estimates were updated for inclusion herein.

There is one alternative for which a detailed cost estimate is not included herein – purchase of water from other entities. The reason for that is that the minimum cost for that option is the replacement cost for the water which would be based on at least the minimum alternative cost.

The itemized cost estimates are presented as follows:

OVERLAND ENLARGEMENT

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$147,772.36	$147,772
Clearing	10	Acre	$2,978.49	$29,785
Stripping	3,200	Cubic Yard	$4.10	$13,131
Embankment Excavation	87,500	Cubic Yard	$3.98	$347,923
Embankment Placement and Compaction	70,000	Cubic Yard	$4.88	$341,949
Furnish and Place Filter Drain Material	1,700	Cubic Yard	$79.36	$134,918
Furnish and Place Drain Pipe	4,000	Lin Foot	$24.59	$98,366
Furnish and Place Rip Rap	4,500	Cubic Yard	$55.89	$251,503
Spillway Reconstruction	75	Cubic Yard	$881.47	$66,111
Wetlands Mitigation	1	Lump Sum	$50,000.00	$50,000
SUBTOTAL				$1,481,458
15 Percent Contingency				$222,219
SUBTOTAL				$1,703,677
20 Percent Engineering and Permitting				$340,735
10 Percent Inspection				$170,368
TOTAL ESTIMATED COST				$2,214,780

WEST RESERVOIR ENLARGEMENT

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,631,473.05	$1,631,473
Clearing	22.4	Acre	$2,978.49	$66,718
Stripping	40,700	Cubic Yard	$4.10	$167,012
Embankment Excavation	306,250	Cubic Yard	$3.29	$1,007,474
Embankment Placement and Compaction	245,000	Cubic Yard	$3.40	$832,452
Cutoff Trench Excavation	18,800	Cubic Yard	$6.89	$129,485
Foundation Grouting	6,200	Linear Foot	$102.25	$633,975
Furnish and Place Filter Drain Material	12,700	Cubic Yard	$44.34	$563,131
Furnish and Place Rip Rap and Bedding	23,400	Cubic Yard	$58.59	$1,371,111
Outlet Works	1	Lump Sum	$253,811	$253,811
Spillway	74	Cubic Yard	$679.50	$50,283
Inlet Canal Enlargement	19,000	Linear Foot	$3.68	$69,825
Outlet Canal Construction	17,000	Linear Foot	$5.15	$87,465
Outlet Canal Pipeline	4,500	Linear Foot	$183.75	$826,875
Revegetation	22.4	Acre	$5,686.12	$127,369
Wetlands Mitigation	1	Lump Sum	$25,000.00	$25,000
Upper Overland Canal Enlargement	113,500	Linear Foot	$75.00	$8,512,500
SUBTOTAL				$16,355,959
15 Percent Contingency				$2,453,394
SUBTOTAL				$18,809,353
20 Percent Engineering and Permitting				$3,761,871
10 Percent Inspection				$1,880,935
TOTAL ESTIMATED COST				$24,452,159

WEST RESERVOIR DAM RELOCATION

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,659,066.73	$1,659,067
Clearing	11.6	Acre	$2,978.49	$34,550
Stripping	78,500	Cubic Yard	$4.10	$322,125
Embankment Excavation	406,250	Cubic Yard	$3.15	$1,280,513
Embankment Placement and Compaction	325,000	Cubic Yard	$3.13	$1,017,450
Cutoff Trench Excavation	37,500	Cubic Yard	$6.89	$258,281
Foundation Grouting	5,146	Linear Foot	$102.25	$526,199
Furnish and Place Filter Drain Material	13,750	Cubic Yard	$44.34	$609,689
Furnish and Place Rip Rap and Bedding	18,263	Cubic Yard	$58.59	$1,070,111
Outlet Works	1	Lump Sum	$216,702	$216,702
Spillway	74	Cubic Yard	$679.50	$50,283
Inlet Canal Enlargement	19,000	Linear Foot	$3.68	$69,825
Outlet Canal Construction	17,000	Linear Foot	$5.15	$87,465
Outlet Canal Pipeline	4,500	Linear Foot	$183.75	$826,875
Revegetation	11.6	Acre	$5,686.12	$65,959
Wetlands Mitigation	1	Lump Sum	$25,000.00	$25,000
Upper Overland Canal Enlargement	113,500	Linear Foot	$75.00	$8,512,500
SUBTOTAL				$16,632,593
15 Percent Contingency				$2,494,889
SUBTOTAL				$19,127,482
20 Percent Engineering and Permitting				$3,825,496
10 Percent Inspection				$1,912,748
TOTAL ESTIMATED COST				$24,865,727

OBRIEN DAMS

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,757,780.70	$1,757,781
Clearing	41.1	Acre	$2,978.49	$122,416
Stripping	113,400	Cubic Yard	$4.10	$465,337
Embankment Excavation	587,500	Cubic Yard	$2.98	$1,751,289
Embankment Placement and Compaction	470,000	Cubic Yard	$2.81	$1,322,200
Cutoff Trench Excavation	42,600	Cubic Yard	$6.89	$293,408
Foundation Grouting	4,778	Linear Foot	$102.25	$488,570
Furnish and Place Filter Drain Material	18,700	Cubic Yard	$44.34	$829,177
Furnish and Place Rip Rap and Bedding	23,800	Cubic Yard	$58.59	$1,394,549
Outlet Works	1	Lump Sum	$368,302	$368,302
Spillway	74	Cubic Yard	$679.50	$50,283
Inlet Canal Enlargement	1,500	Linear Foot	$5.15	$7,718
Revegetation	41.1	Acre	$5,686.12	$233,699
Wetlands Mitigation	1	Lump Sum	$25,000.00	$25,000
Upper Overland Canal Enlargement	113,500	Linear Foot	$75.00	$8,512,500
SUBTOTAL				$17,622,227
15 Percent Contingency				$2,643,334
SUBTOTAL				$20,265,562
20 Percent Engineering and Permitting				$4,053,112
10 Percent Inspection				$2,026,556
TOTAL ESTIMATED COST				$26,345,230

DUKE BASIN DAM

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,625,441.90	$1,625,442
Clearing	28.4	Acre	$2,978.49	$84,589
Stripping	45,900	Cubic Yard	$4.10	$188,351
Embankment Excavation	317,500	Cubic Yard	$3.27	$1,038,797
Embankment Placement and Compaction	254,000	Cubic Yard	$3.36	$854,056
Cutoff Trench Excavation	34,860	Cubic Yard	$6.89	$240,098
Foundation Grouting	7,280	Linear Foot	$102.25	$744,409
Furnish and Place Filter Drain Material	13,300	Cubic Yard	$44.34	$589,735
Furnish and Place Rip Rap and Bedding	19,700	Cubic Yard	$58.59	$1,154,312
Outlet Works	1	Lump Sum	$255,235	$255,235
Spillway	930	Cubic Yard	$679.50	$631,935
Abutment Stabilization	1	Lump Sum	$114,550.00	$114,550
Revegetation	28.4	Acre	$5,686.12	$161,486
Wetlands Mitigation	1	Lump Sum	$100,000.00	$100,000
Upper Overland Canal Enlargement	113,500	Linear Foot	$75.00	$8,512,500
SUBTOTAL				$16,295,495
15 Percent Contingency				$2,444,324
SUBTOTAL				$18,739,819
20 Percent Engineering and Permitting				$3,747,964
10 Percent Inspection				$1,873,982
TOTAL ESTIMATED COST				$24,361,765

LEROUX CREEK DAM (OVERLAND WATER RIGHT TRANSFER)

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,643,631.29	$1,643,631
Clearing	31.8	Acre	$2,978.49	$94,716
Stripping	51,380	Cubic Yard	$4.10	$210,838
Embankment Excavation	421,250	Cubic Yard	$3.13	$1,320,529
Embankment Placement and Compaction	337,000	Cubic Yard	$3.10	$1,043,989
Cutoff Trench Excavation	37,900	Cubic Yard	$6.89	$261,036
Foundation Grouting	6,060	Linear Foot	$102.25	$619,659
Furnish and Place Filter Drain Material	11,000	Cubic Yard	$44.34	$487,751
Furnish and Place Rip Rap and Bedding	15,000	Cubic Yard	$58.59	$878,918
Outlet Works	1	Lump Sum	$302,075	$302,075
Spillway	925	Cubic Yard	$679.50	$628,538
Abutment Stabilization	1	Lump Sum	$192,850.00	$192,850
Revegetation	31.8	Acre	$5,686.12	$180,819
Wetlands Mitigation	1	Lump Sum	$100,000.00	$100,000
Upper Overland Canal Enlargement	113,500	Linear Foot	$75.00	$8,512,500
SUBTOTAL				$16,477,849
15 Percent Contingency				$2,471,677
SUBTOTAL				$18,949,526
20 Percent Engineering and Permitting				$3,789,905
10 Percent Inspection				$1,894,953
TOTAL ESTIMATED COST				$24,634,384

LEROUX CREEK DAM (NEW WATER RIGHT ON LEROUX CREEK)

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$700,446.29	$700,446
Clearing	31.8	Acre	$2,978.49	$94,716
Stripping	51,380	Cubic Yard	$4.10	$210,838
Embankment Excavation	421,250	Cubic Yard	$3.13	$1,320,529
Embankment Placement and Compaction	337,000	Cubic Yard	$3.10	$1,043,989
Cutoff Trench Excavation	37,900	Cubic Yard	$6.89	$261,036
Foundation Grouting	6,060	Linear Foot	$102.25	$619,659
Furnish and Place Filter Drain Material	11,000	Cubic Yard	$44.34	$487,751
Furnish and Place Rip Rap and Bedding	15,000	Cubic Yard	$58.59	$878,918
Outlet Works	1	Lump Sum	$302,075	$302,075
Spillway	925	Cubic Yard	$679.50	$628,538
Abutment Stabilization	1	Lump Sum	$192,850.00	$192,850
Revegetation	31.8	Acre	$5,686.12	$180,819
Wetlands Mitigation	1	Lump Sum	$100,000.00	$100,000
SUBTOTAL				$7,022,164
15 Percent Contingency				$1,053,325
SUBTOTAL				$8,075,488
20 Percent Engineering and Permitting				$1,615,098
10 Percent Inspection				$807,549
TOTAL ESTIMATED COST				$10,498,135

BAILEY DAM ENLARGEMENT

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$707,421.23	$707,421
Clearing	35.2	Acre	$2,978.49	$104,843
Stripping	56,900	Cubic Yard	$4.10	$233,489
Embankment Excavation	423,750	Cubic Yard	$3.13	$1,327,177
Embankment Placement and Compaction	339,000	Cubic Yard	$3.09	$1,048,386
Cutoff Trench Excavation	38,000	Cubic Yard	$6.89	$261,725
Foundation Grouting	6,060	Linear Foot	$102.25	$619,659
Furnish and Place Filter Drain Material	17,300	Cubic Yard	$44.34	$767,099
Furnish and Place Rip Rap and Bedding	18,400	Cubic Yard	$58.59	$1,078,139
Outlet Works	1	Lump Sum	$222,709	$222,709
Spillway	620	Cubic Yard	$679.50	$421,290
Revegetation	35.2	Acre	$5,686.12	$200,151
Wetlands Mitigation	1	Lump Sum	$100,000.00	$100,000
SUBTOTAL				$7,092,089
15 Percent Contingency				$1,063,813
SUBTOTAL				$8,155,903
20 Percent Engineering and Permitting				$1,631,181
10 Percent Inspection				$815,590
TOTAL ESTIMATED COST				$10,602,674

OVERLAND RESERVOIR HYDRAULIC DREDGING

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,926,255.52	$1,926,256
Clearing	60.5	Acre	$2,978.49	$180,199
Stripping	98,000	Cubic Yard	$4.10	$402,143
Embankment Excavation	375,000	Cubic Yard	$3.19	$1,196,413
Disposal Pond Embankment Placement and Compaction	300,000	Cubic Yard	$3.20	$961,225
Cutoff Trench Excavation	20,500	Cubic Yard	$6.89	$141,194
Discharge Pipe Installation	62,000	Linear Foot	$32.10	$1,990,200
Sediment Dredging	1,627,000	Cubic Yard	$6.42	$10,445,340
Disposal Pond Regrading	230,000	Cubic Yard	$5.35	$1,230,500
Discharge Pipeline Removal	62,000	Linear Foot	$5.35	$331,700
Revegetation	89	Acre	$5,686.12	$506,064
SUBTOTAL				$19,311,233
15 Percent Contingency				$2,896,685
SUBTOTAL				$22,207,918
20 Percent Engineering and Permitting				$4,441,584
10 Percent Inspection				$2,220,792
TOTAL ESTIMATED COST				$28,870,294

OVERLAND RESERVOIR MECHANICAL DREDGING

Item	Quantity	Unit	Unit Price	Total Amt
Mobilization and Demobilization	1	Lump Sum	$1,219,367.46	$1,219,367
Stripping	121,000	Cubic Yard	$4.10	$496,524
Haul Road Construction	16,000	Linear Foot	$55.64	$890,240
Ecxavation and Transportation to Disposal	1,627,000	Cubic Yard	$5.65	$9,191,899
Revegetation	75	Acre	$5,686.12	$426,459
SUBTOTAL				$12,224,489
15 Percent Contingency				$1,833,673
SUBTOTAL				$14,058,162
20 Percent Engineering and Permitting				$2,811,632
10 Percent Inspection				$1,405,816
TOTAL ESTIMATED COST				$18,275,611

PLAN OF DEVELOPMENT (POD)
ENLARGEMENT OF OVERLAND RESERVOIR
GMUG National Forest, Paonia, Colorado, Ranger District

Project Proponent: Overland Ditch and Reservoir Company, Hotchkiss, CO
POD Author: Western Engineers, Inc.

Project Description:

The Overland Ditch and Reservoir Company (ODRC) proposes to enlarge the Overland Reservoir in order to supply supplemental irrigation water to the 20 sq. mi. service area, which generally includes the Redlands Mesa area near Lazear, Colorado. The Overland Reservoir is located in sections 22 and 23, T. 11S., R.92 W., 6th P.M., approximately 15 air miles north of Paonia, in Delta County, Colorado. The enlargement will store a conditional water right in the amount of 971 acre-feet currently held by ODRC.

Proposed Action:

The anticipated efforts will include work necessary to increase the normal reservoir level by 3.8 feet and will involve the following:

1. Raise the main dam and auxiliary dam crest elevations by about 2 feet and add rip rap needed to protect the embankment below the completed normal water surface.

2. Upgrade the auxiliary dam and a portion of the main dam to include internal and toe drainage, increase the crest width, add rip rap as necessary to protect the embankment below the completed normal water surface and add embankment to the downstream slope to flatten in to a more stable slope.

3. Raise the spillway crest level by 3.8 feet to allow for storage of the additional water. This will be accomplished by increasing the height of the existing concrete weir wall as well as the training and retaining walls.

4. Add emergency spillway capacity if necessary.

5. Remove timber from around the perimeter of the reservoir.

Work is anticipated to be completed in a single summer, beginning in May or June, weather permitting, with an anticipated completion time on or before November 30. Work is expected to take place during daylight hours only (typically 7 am to 7 pm) with a crew of 10-14 workers, including a supervisor, equipment operators, support staff, construction management, quality control and inspection staff, and periodic inspections by State and USFS personnel. At the contractor's discretion, a man camp may be used. If a man camp is used, it will be placed in the same area as the construction staging area – in the existing turn-around area north of the spillway structure. The staging area and camp will be confined to previously disturbed areas. The previously disturbed area at this location is estimated to be in excess of 0.5 acre. The staging area and camp is expected to occupy an area of about 0.5 acre or less. The staging area will include parking for construction equipment and vehicles, equipment service trailer, generator, fuel storage (as applicable), field office, field laboratory, mobile housing and temporary storage for materials and tools.

Following is a list of anticipated construction equipment needed for the work (note that not all equipment will necessarily be on-site at one time):

2 scrapers
2 track excavators
1 water truck
2 dozers
1 loader
3 rock trucks
1 compactor
1 log skidder
1 log loader
Miscellaneous pickups and ATV support vehicles
Electric Power Generator
Welder/Cutting Torch

In addition to the above equipment on site, supplies and materials will be hauled to the project using semi tractor/trailers and personnel and minor materials will be transported by pickup and passenger vehicles. For daily construction traffic, it is anticipated that approximately 4 daily pickup round-trips will be needed if a man camp is not used for the project. If a man camp is used, the number of daily vehicles trips may be reduced. A sand filter drain system is required to be installed in the auxiliary dam and a portion of the main dam. The purpose of the drain is to minimize potentially unsafe pore water pressures within the embankment and foundation or the dam. Based on engineering and geotechnical evaluations, approximately 1,700 cubic yards (3,100 tons) of sand will need to be transported to the dam. No sand is available on site within the reservoir basin. Due to more difficult access from the staging area to the auxiliary dam, at the Contractor's option, the sand may be temporarily stockpiled at a transfer point. The transfer point will be located either within the staging area or, if insufficient area remains in the staging area, within a previously disturbed area nearby the staging area. Tandem dump trucks can drive to the transfer point and discharge their loads at this location. If the contractor so chooses, they will be allowed to haul the sand directly to the auxiliary dam without stockpiling at the transfer point. However, if the sand is stockpiled at the transfer point, it will be reloaded into construction haul vehicles and transported to the auxiliary dam. It is anticipated that the transfer point stockpile will be limited to less than 5,000 sq ft (0.11 acre). The total trips to the site are estimated as follows:

Sand and Gravel Hauling – 120 trips
Timber Removal – 20 trips
Fuel and Miscellaneous – 30 trips
Pickup and Passenger vehicles – 520 trips

Geotechnical investigations have indicated the presence of sufficient suitable material in two previously used borrow areas which will be used for completion of the necessary embankment improvements. Material will be excavated from the borrow areas and placed in loose lifts and then compacted to required specifications. Rip rap will be obtained from areas within and adjacent to the final reservoir perimeter. The Company will obtain a Mineral Materials Contract from the Forest Service for use of the borrow material and riprap. Borrowed materials will be placed and compacted per engineering standards approved by the Colorado State Engineer's Office SEO. At all times standard Best Management Practices (BMPs) will be used, such as sediment control downstream of the project site to assist in maintaining clean, sediment-free water in streams below the project. All work will be performed by a licensed contractor.

Access Needs:

There are two potential access routes from main highways to the reservoir site as shown on Figure 1:

1. From Interstate 70 – 10.1 miles east on state highway 65 toward Mesa/Collbran. 17.5 miles east on county road 330 through Collbran to the fork to Vega Reservoir. 7.6 miles east on county road 330E to the turn toward Buzzard Divide. 3.6 miles southeast on county road 73.4 to the Gunnison National Forest boundary. 15.2 miles southeast on primary National Forest System Road (NFSR) 265 to Dike Creek Campground. 2.4 miles southwest on primary NFSR 701 (Stevens Gulch Road) to the Overland Road. 4.4 miles west on secondary NFSR 705 (Overland Road) to Overland Reservoir.

2. From state Highway 133 near Paonia – 7.7 miles north on country road 40.10 (Stevens Gulch Road) to the Gunnison National Forest boundary where Stevens Gulch Road transitions to primary NFSR 265. 14.0 miles north on primary NFSR 265 to the Overland Road. 4.4 miles west on secondary NFSR 705 (Overland Road) to Overland Reservoir.

NFSRs 265 and 705 are designated for use by full-sized vehicles. It is anticipated that most of the heavy equipment to be used at the dam site will make one trip in at the beginning of construction work and one trip out following completion of construction. Unforeseen circumstances, such as equipment repairs that cannot be conducted on site, or the need to demobilize and remobilize for an additional construction season, may require additional trips. The maximum width of equipment is anticipated to be 11'.

In 2007, 3.9 miles of the 4.4 mile long Overland Road (NFSR 705) were improved to accommodate heavy vehicle traffic related to a timber sale. As part of the Overland Reservoir enlargement work, the final 0.5 miles of this road will be improved by the ODRC to similar conditions as applied to the lower 3.9 miles of road for the timber sale. Road improvements will be done primarily in advance of construction work commencing on the dam and will be done to Forest Service specifications and in accordance with the Road Use Permit issued by the Forest Service. If road conditions allow, and as approved by the Forest Service, some equipment mobilization may start prior to completion of the road improvements. If necessary, due to the conditions of the road, equipment will be unloaded at the end of the existing improvements and roaded the final 0.5 miles. After completion of this road improvement work, the access roads will be sufficient to accommodate mobilization and demobilization of the required equipment as well as other pertinent traffic, subject to certain restrictions:

1. All repetitive traffic such as sand, gravel and timber hauling will use the Stevens Gulch Road access.

2. Heavy traffic loads will not be hauled on the Stevens Gulch Road in the spring until the roadbed has sufficiently dried and stabilized from snowmelt as determined by the Forest Service, generally early to mid June.

3. For repetitive traffic, ODRC will conduct periodic grading maintenance to control washboarding and rutting, depending on traffic volumes and weather conditions.

4. ODRC will contribute to routine maintenance and gravel surfacing replacement costs in accordance with a formula agreed to between the Forest Service and ODRC in advance of construction.

Wetlands:

The proposed construction will result in possible impact on wetlands in the following areas:

1. A short section of the main dam embankment may be extended downstream. All of the new embankment will be placed outside of wetlands areas. However, construction may result in disturbance of areas beyond the limits of permanent features and perimeter of 20 feet beyond these limits will encroach on a maximum of 670 ft^2 (0.015 acre) of wetlands. This includes the area which will be disturbed during installation of a new subsurface filter drain. This area will be mitigated in place and is considered a temporary impact.

2. The auxiliary dam embankment will be extended downstream, encroaching on a maximum wetlands area of 12,026 ft^2 (0.276 acres). Of this area, 4,620 ft^2 (0.106 acres), represents the area which will be disturbed during installation of the new subsurface filter drain and a perimeter area (20 feet beyond the limits of permanent construction features) which may be disturbed by construction activities, both of which will be mitigated in place and are considered temporary impacts.

3. The access road to the auxiliary dam will be improved for construction traffic which will include increasing the width of a short section which crosses a wetlands area. This will result in disturbance of 210 ft^2 (0.005 acre) of wetlands.

4. A temporary road to one of the borrow areas will cross a drain ditch which has been categorized as wetlands and will result in disturbance of 200 ft^2 (0.005 acre) of wetlands. This area will be restored but may be part of the emergency spillway and is, therefore, considered to be a permanent impact.

5. An emergency spillway channel may be constructed on the right end (looking downstream) of the main dam which will disturb 2,500 ft^2 (0.057 acre) of wetlands. It is likely that most of this area can be mitigated in place, but it has been assumed that it will consist of a permanent impact.

It must be noted that final designs have not been completed and the above figures represent maximum potential wetlands disturbance. For example, the main dam embankment may not be extended downstream, the auxiliary dam embankment may not be extended as far downstream as indicated, and the emergency spillway may not be needed.

It is anticipated that none of the existing wetlands areas will be adversely impacted by the increased reservoir level. The basis for this conclusion is presented in Appendix A to this Plan.

An estimate of the expected increase in fringe wetlands was made assuming that, wherever wetlands currently exist near the existing reservoir perimeter or extend to, or past, the existing reservoir perimeter, the fringe wetlands will expand past the existing boundary of the wetlands to a line 1.5 feet in elevation above the proposed final high water level. Examination of the existing wetlands areas suggests that it is common for wetlands to exist on slopes up to 25 percent. Therefore, no new fringe wetlands were assumed to develop in areas with ground slopes in excess of 25 percent. The resulting increase in fringe wetlands area was estimated to be 328,520 ft^2 (7.542 acres).

Table 1
Wetlands Impact and Mitigation Calculations
Total Temporary and Permanent Impacts and
Net Gain of Wetlands

Item Description	Area (ft) [acres]	Temporary Impact (Acres)	Permanent Impact (acres)
Existing Wetlands to be Impacted by Main Dam Construction	670 [0.015]	0.015	0.00
Existing Wetlands to be Impacted by Auxiliary Dam Construction	12,026 [0.276]	0.106	0.170
Existing Wetlands to be Impacted by Auxiliary Dam Access Road Improvements	210 [0.005]	0.00	0.005
Existing Wetlands to be Impacted by Temporary Borrow Area Haul Road	200 [0.005]	0.00	0.005
Existing Wetlands to be Impacted by Emergency Spillway Channel	2,500 [0.057]	0.00	0.057
Mitigation: New Fringe Wetlands Created by the Enlarged Reservoir Perimeter	328,520 [7.542]	0.00	7.542
Net Gain (Loss) of Wetlands	312,914 [7.184]	0.121	7.305

Note: Temporary impacts are not included in the calculation because they will be re-established in place.

Appropriate permitting and mitigation planning will be completed with the U.S. Army Corps of Engineers for these minor impacts. With the expansion of the reservoir perimeter, the result will be a net gain of at least 7.305 acres of wetlands (Table 1).

Design Criteria:

The following list presents the design features by resource category. This section includes both measures required by law and regulation and those agreed to between the ODRC and the FS to minimize the environmental impacts of the Proposed Action:

Air:

1. Air quality will be maintained by permitting of all regulated air pollution sources through the Colorado Department of Public Health and Environment (CDPHE), Air

Pollution Control Division, assuring compliance with all federal and state standards. Federal and, hence, State law requires that fugitive dust be controlled on contiguous construction sites where more than 25 acres of ground are disturbed and the project is longer than six (6) months in duration. The Overland Enlargement Project site will not have more than 25 acres of disturbance at any given time or in totality, and the duration of construction is not anticipated to last more than 6 months. Therefore, no Air Pollution Emissions Notice will be required[1].

2. Such additional methods and devices as are reasonable to prevent, control and otherwise minimize atmospheric emissions or discharges of air contaminants will be used, including:

   a. No burning of combustible construction materials and rubbish. Burning of slash may be allowed, pending USFS approval, provided the risk of fire spreading is extremely low, and any USFS and appropriate local burn permits are obtained.

   b. A dust-preventative treatment or water may periodically be applied to access and haul roads as needed to minimize dust.

<u>Noise</u>:

1. Noise pollution will be minimized by compliance with applicable laws and regulations regarding the prevention, control and abatement of harmful noise levels.

<u>Historical and Archaeological Resources and Paleontology</u>:

1. All employees of the Company, its contractors, subcontractors, consultants or other parties associated with the project will be instructed that, upon discovering evidence of possible prehistorical, historical or archeological objects, work will cease immediately at that location and the Company's engineer or his representative will be notified, and provided with the location and nature of the findings. The FS will be notified as soon as practicable. Care will be exercised so as not to disturb or damage artifacts or fossils uncovered during excavation operations.

2. Equipment operators will be informed that the removal, injury, defacement or alteration of any object of archaeological or historic interest is a federal crime and may be punishable by fine and/or imprisonment.

3. During project implementation, in the unlikely event of an inadvertent encounter of Native American remains or grave objects, the Native American Graves Protection and Repatriation Act (NAGPRA) requires that all activities must cease in their discovery area, that a reasonable effort be made to protect the items found or unearthed, and that immediate notification be made to the FS Authorized Officers as well as appropriate Native American group(s). Notice of such a discovery may be followed by a 30-day construction delay (NAGPRA Section 3(d)). Further actions may also require

[1] From the Colorado Department of Public Health and Environment, http:/www.cdphe.state.co.us/ap/down/landdevelop.pdf

compliance under provisions of the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act.

Water/Hydrology:

1. Implementation of Best Management Practices as described in the soils section below would minimize effects, such as sedimentation, on Cow Creek from construction activities.

Soils:

1. A Stormwater Management Plan (SWMP) will be incorporated into the design drawings. The final, approved design drawings will be submitted to the Forest Service upon approval by the SEO, and at least 30 days prior to the anticipated start of construction. The plan will describe how wastewater from general construction activities, such as drain water collection, drilling, grouting or surface runoff from disturbed areas or other construction operations will not enter flowing or dry watercourses without the use of approved turbidity control or containment methods. Approved turbidity control methods for surface runoff include Best Management Practices such as drainage swales and ditches, detention basins, straw or coconut fiber wattles placed in swales, weed free hay bales placed to trap sediment, and guard or drainage trenches surrounding disturbed areas when suitable to the topography of the land. No discharge is anticipated from drilling operations. The only geotechnical drilling that will be required may be installation of piezometers in the embankment and in the foundation of the dam after construction of the embankment is complete. This will not require any discharge of free flowing water. Grouting is not anticipated.

2. Sediment and erosion control Best Management Practices will be employed to the extent practicable prior to work involving site clearing, stripping, grubbing and stockpiling topsoil, excavation and earthwork. The sediment and erosion controls shall be maintained in functional condition and repaired as needed during the course of construction.

3. A Spill Prevention, Containment and Countermeasure Plan (SPCC plan) will be prepared and submitted to the Forest Service for approval at least 30 days prior to the anticipated start of construction. The SPCC shall state that refueling or lubricating and storage of hazardous materials, chemicals, fuels, etc., will only take place in designated locations that are more than 100 feet from wetlands and other water bodies or drainages. Secondary containment will only be required if tanks are non-mobile. Mobile lubricating and fuel units will not require secondary containment. The SPCC plan shall outline what actions and BMPs should be taken in case of a fuel or lubricant or other hazardous material spill.

4. Excavated materials or other construction materials will not be stockpiled or wasted near or on stream banks, lake shorelines or other watercourse perimeters where they

can be washed away by high water or storm runoff, or can in any way encroach upon the watercourse itself.

5. Soil disturbing actions will be avoided during long periods of heavy rain or wet soils to prevent excessive rutting and mobilization of sediment during runoff events. Rutting in the project area is acceptable to the extent that it is not contradictory to obtaining compaction standards required by the SEO.

6. During construction activities, initial clearing operations will fully contain material on-site and not allow material to move into wetlands or into the riparian zone. Excess excavated material and construction debris developed along roads near streams will be disposed of in an area outside of the riparian and wetland areas.

7. Upon completion of construction, the Company will re-grade, prepare a seed bed and reseed temporary road improvements that are intended to be abandoned.

8. No mobilization of equipment or use of equipment will be allowed when it will cause undue damage to existing roads and trails. Undue damage done to roads must be repaired by the Contractor per USFS requirements.

Reclamation:

A comprehensive reclamation plan will be included in the Contract Specifications. The Specifications will be submitted to and approved by the FS prior to construction.

1. Seed

   a. Grass seed will be from the same or previous year's crop. When available, certified weed-free seed will be provided. All seed will be free of prohibited noxious weeds (as defined by the State), and will contain no greater than 1 % other weeds.

   b. All sites will be seeded with the following mixture as required by the USFS:

Table 2 Revegetation Seed Mix

Species	Lbs/acre PLS	% of Mixture
Mountain Bromegrass	5	26
Slender Wheatgrass	3	16
Thickspike Wheatgrass	3	16
Canby Bluegrass	3	16
Blue Wildrye	5	26
Total	19	100

Temporary Revegetation

Species	Lbs/acre PLS
Tall Wheatgrass/Winter Wheatgrass (Regreen (brand name)	20 lbs/acre

c. Seed will be furnished and delivered premixed in the indicated proportions. Seed bag tags, or the equivalent, shall be provided for each delivery of seed. Tags shall show the guaranteed percentages of purity, weed content, germination, net weight, date of seed testing and date of shipment.

2. Seedbed Preparation

a. If possible, a minimum of 6 inches of topsoil, borrowed on-site, will be placed over all areas disturbed during construction, with exception of borrow areas within the reservoir basin, which shall be smoothed over, but not reseeded. The seeding will be limited to those areas of disturbance above the normal final pool elevation.

b. Topsoil will not be placed in water or while frozen or muddy conditions exist.

c. Topsoil shall be track compacted to approximately 80 to 90 percent standard Proctor Density, ASTM D-698, to an appropriate tilth, density, consistency and friability to provide a suitable growth medium for sprouting and seedling survival.

d. All areas will be graded to drain. The maximum slope steepness will be 2.5 H:1 V unless otherwise shown on the project drawings or approved in writing by the Company's engineer.

e. The final surface of the topsoil will be graded to a relatively smooth surface using mechanical or hand raked methods. Localized low spots shall be regraded to allow water to drain.

3. Seed Application

a. Seeding will typically be accomplished between September 1st and October 30th. No seeding will take place when soils are frozen or excessively wet or dry.

4. Monitoring and Completion of Reclamation

a. All seeded areas shall be maintained in good condition, reseeded and mulched if and when necessary, until a good, healthy, uniform growth is established over the entire area seeded and until vegetation is established.

b. On slopes, washouts and rills deeper than three (3) inches deep shall be re-graded and reseeded and the reseeded area maintained until vegetation is established.

c. An area will be considered to be satisfactorily reclaimed when: a) soil erosion resulting from the operation has been stabilized and b) a vegetative cover at least equal to that present prior to disturbance and a plant species composition at least as desirable as that present prior to disturbance has been established.

d. Areas not demonstrating satisfactory reclamation as outlined above, will be renovated, reseeded and maintained meeting all requirements as specified above.

Vegetation:

1. Preventative actions will include the cleaning of vehicles and equipment prior to bringing them into the project area. This will include washing of transport tractors and trailers and all equipment prior to entering all USFS lands. Inspection of washed equipment will be required by the FS, at least initially.

2. Certified weed-free seed mixtures shall be used for all reclamation, as described above.

3. Treatments will be developed using integrated weed management principles for each species and situation. Treatments may include hand pulling, grubbing, mowing, mulching, seeding, burning, herbicide application and soil management.

4. Monitoring of noxious weeds will be conducted on a scheduled basis to detect new infestations, evaluate prevention and/or treatment success, and identify the need for retreatment.

Wildlife (including Aquatic Wildlife and Special Status Species):

1. Pre-construction surveys have been conducted. If any special status species or habitat is found to be present, the Company will coordinate with the FS to determine the most effective means of mitigating or precluding impacts. No special status species have been located.

2. For the Colorado River fishes, construction practices which maintain existing stream flows and minimize siltation and pollution will protect these species. Best Management Practices described above for soil and water will meet this objective.

Hazardous Materials and Emergency Response:

l. The Company will prepare and submit to the FS for approval, a Spill Prevention, Containment and Countermeasure Plan (SPCC plan) to satisfy applicable Federal and State requirements.

2. A Fire/Emergency Response/Health and Safety Plan that addresses the potential for accidents and injuries, and other emergencies will be prepared and submitted to the FS for approval and kept onsite. This plan will be made available to the FS prior to construction and kept on all active locations.

Solid and Sanitary Waste:

1. All solid wastes (trash) that result from construction activities shall be contained in a metal bear-proof trash cage. All material in the trash cage shall be removed from the location and deposited in an approved sanitary landfill.

2. Portable toilets will be provided for construction workers at the construction site and the work camp. These will be maintained and removed by the Company or their designated Contractor as appropriate.

Travel Management and Roads:

l. The Company will obtain a Forest Service Road Use Permit in advance and approved in writing a minimum of 30 days before construction begins.

2. Project-related vehicular traffic will be restricted to approved locations. Operational equipment will be restricted to the road prism and construction site at all times.

3. Mobilization and demobilization of heavy equipment will be scheduled during the week and not on weekends or Federal holidays to avoid high public traffic periods.

4. Management of surface water run-off, soil stabilization and limiting travel to a single, recognized route will be priorities. All stream crossings and soft areas shall be armored and permanently stabilized unless otherwise directed by the USFS.

5. Road Maintenance: NFSRs and NFSTs will be maintained according to Forest Service road management objectives. Existing NFSRs currently open for use will also receive pre-haul maintenance depending upon their condition and the needs of the project. Pre-haul maintenance will not include road reconstruction or repairs of an extraordinary nature, but may include maintenance of drainage structures, grading the road surface, corrections to cut/fill failures, spot rock applications and rolling dips,

etc. The Company will consult with the FS on the degree and manner of preconstruction maintenance, road reconstruction, and ongoing maintenance that will be required. The details of intended road improvements are contained within this document (above).

6. No berms of material will be left on the sides of the roadway during maintenance activities that will impede surface drainage.

7. Maintenance and reconstruction of roads will be done in a manner so as to minimize sediment discharge into streams, lakes and wetlands.

8. The Company's contractor will sign the project area roads in accordance with the "Manual on Uniform Traffic Control Devices" (MUTCD), latest edition, to notify the public to expect occasional construction traffic.

9. The Company will consult with the FS on the removal of road improvements and the eventual degradation of the roads to their pre-construction condition.

APPENDIX A

Analysis of the Impact of Periodic Inundation on Wetlands and Fens
Western Engineers, Inc.

Historical Reservoir Level Elevation versus Fill/Drawdown Time

In order to evaluate the time increments during which wetlands and fen areas have historically been inundated by the reservoir, fill/drawdown data was collected for the period since 1987. This data was obtained from: 1) Official storage records maintained by the Colorado Division of Water Resources; 2) Instrument monitoring records from the files of the ODRC and the Colorado Division of Water Resources, Dam Safety Department; 3) Official ditch diversion records from the Colorado Division of Water Resources; 4) Personal records of the local water commissioner of Colorado Division of Water Resources); and 5) First-hand observations of ODRC and Western Engineers.

The historical records provide nineteen (19) years of water level history data (from 1988 through 2007) for Overland Reservoir (no records were available for the year 1991). Because the measurements are periodic, the exact dates for fill and start of drawdown are not generally identified. These dates were interpolated using a combination of the following methods:

- The fill and drawdown Reservoir Level Elevation (RLE) vs. time (month/day) slopes were extended to full stage (Figure A-1) as appropriate.

- It was possible to compare the interpolated fill RLE vs. time slopes with the range of typical slopes to judge their reasonableness. This was possible because of the consistency in fill RLE vs. time slopes between known data points (Figure A-1).

- Time brackets were estimated when drawdown would have likely started. This estimation was made from the records of ditch diversions (both diversion initiation date and quantity). The rate of ditch diversions also provided a means to check the RLE vs. time slope during the early stages of drawdown.

- The magnitude of spills provided a means to estimate time brackets for both fill date and date of drawdown initiation. This estimate was made possible by records maintained by the local water commissioner of spill flows since 2004.

It should be noted that there was generally sufficient data so that the actual date for either fill or start of drawdown would not deviate from the estimated date based on the interpolation by more than a few days.

The resulting historic RLE vs. time patterns are shown on Figure A-1. The lowest point of the historically inundated wetlands and fens experiences the greatest inundation time of the wetland/fen areas. In other words, these points have historically been and will continue to be subject to longest submergence. The lowest point for historically inundated wetlands is delineation point N11 (refer to the JD request, WestWater Engineering 2007) at an elevation of 9,876.04 feet. The lowest point for historically inundated fen is delineation point F6-9 at an elevation of 9,886.73 feet. The wetland and fen delineation elevation is shown in Figures A-1 through A-6 for comparison.

Estimate of Wetland (Including Fen) Inundation Duration

In order to visualize the range of historic wetlands inundation time intervals, the RLE vs. time data was normalized so that each year is centered at its maximum fill point (Figure A-2). This was done by shifting the time reference for each year's data so that a zero date occurs either at the point of maximum storage or at the middle of the full stage time period. This also allowed for determination of a median RLE vs. time relationship. It should be noted that there was no individual year which closely matched the median of the daily data, so the median RLE vs. time curve was determined based on connection of daily median values rather than selection of a single year's data to represent the median. The normalized data are shown on Figure A-2. The zero date shown was determined as described above with the negative date values representing the fill part of the cycle and the positive date values being the drawdown portion of the cycle. The following conclusions can be drawn from the data:

- The reservoir did not fill for four (4) of the 19 years evaluated (1988, 1990, 2000 and 2002). This means that during these 4 years the upper-most portion of the historically inundated wetlands and fen areas were not submerged. In 2002, the driest year during this period of record, the reservoir filled to only about half of its capacity and the maximum reservoir level elevation was 9,882.58 ft, significantly below the lowest elevation point in the fen areas. Therefore, in 2002 none of the fen areas were submerged and the lowest wetland point was submerged by a maximum of about 6.5 feet.

- Excluding the year 2002, the year which exhibited the shortest duration of wetland/fen inundation was 1990 (Figure A-3).

- The year during which the greatest duration of wetland/fen inundation occurred was 2005 (Figure A-3).

- The median curve, determined as described above, is also shown on Figure A-3.

Summary of Historical Overland Reservoir Wetland and Fen Inundation

Tables 2 and 3, below, tabulate a summary of the range of wetlands inundation periods at the current OHWL (9,896.5 feet), at the proposed future OHWL (9,900.3 feet), at the minimum historically inundated wetland elevation (9,886.73 feet) and at the minimum historically inundated fen elevation (9,876.04 feet) for both the historic data at the current OHWL and the projected values at the future proposed OHWL. The wetlands growing season was estimated to extend from June 2 through September 19 (see report entitled "Periodic Inundation Of Wetlands At Overland Reservoir Technical Report, December, 2008" prepared by Western Engineers and WestWater Engineering). Tables 4 and 5 present the portion of the growing season during which the wetlands and fens were exposed to the atmosphere at the four reference elevations listed above.

Table 2. Inundation Period of Wetland/Fen at Current and Proposed OHWL

Ordinary High Water Level Condition	Inundation Period (Days) At Original OHWL (Elevation = 9,896.5 feet)	Inundation Period (Days) At Future OHWL (Elevation = 9,900.3 feet)
Minimum Year (1990) Current OHWL	**0** (did not fill)	Not Applicable*
Maximum Year (2005) Current OHWL	**60** (5/17 through 7/16, 2005)	Not Applicable*
Median, Current OHWL	**17**	Not Applicable*
Minimum Year (1990) Proposed OHWL	**0** (would not fill)	**0** (would not fill)
Maximum Year (2005) Proposed OHWL	**71** (5/17 through 7/27, 2005)	**52** (5/25 through 7/16, 2005)
Median, Proposed OHWL	**26**	**4**

*The inundation period for wetland/fen located at elevation 9,900.3 with reservoir operation under the current OHWL (elevation 9,896.5) is not applicable because the reservoir level never reaches elevation 9,900.3.

Table 3. Inundation Period (days) of Wetland/Fen at Minimum Elevations

Ordinary High Water Level Condition	Inundation Period (Days) at Minimum Wetland Elevation (9876.04 feet)	Inundation Period (Days) at Minimum Fen Elevation (9886.73 feet)
Minimum Year (1990) Current OHWL	**79** (5/16 through 8/3, 1990)	**37** (6/4 through 7/11, 1990)
Maximum Year (2005) Current OHWL	**134** (4/12 through 8/24, 2005)	**99** (4/30 through 8/7, 2005)
Median, Current OHWL	**93**	**56**
Minimum Year (1990) Future OHWL	**79** (5/16 through 8/3, 1990)	**37** (6/4 through 7/11, 1990)
Maximum Year (2005) Proposed OHWL	**144** (4/12 through 9/3, 2005)	**106** (4/30 through 8/14, 2005)
Median, Future OHWL	**99**	**64**

Table 4. Exposure Period (days and percent of growing season) During the Growing Season of Wetland/Fen at Current and Proposed OHWL

Ordinary High Water Level Condition	Exposure Period (days) At Elevation 9,896.5 feet (Current OHWL)	Exposure Period (days) At Elevation 9,900.3 feet (Proposed OHWL)
Minimum Year (1990) Current OHWL	**6/2-9/19=109 days (100%)** (did not fill)	Not Applicable*
Maximum Year (2005) Current OHWL	**7/16-9/19=65 days (60%)**	Not Applicable*
Median, Current OHWL	**6/21-9/19=90 days (83%)**	Not Applicable*
Minimum Year (1990) Proposed OHWL	**6/2-9/19=109 days (100%)** (would not fill)	**6/11-9/19=109 days (100%)** (would not fill)
Maximum Year (2005) Proposed OHWL	**7/27-9/19=54 days (50%)**	**7/16-9/19=65 days (60%)**
Median, Proposed OHWL	**6/30-9/1=81 days (74%)**	**6/17-9/19=94 days (86%)**

*The inundation period for wetland/fen located at elevation 9,900.3 with reservoir operation under the current OHWL (elevation 9,896.5) is not applicable because the reservoir level never reaches elevation 9,900.3.

Table 5. Exposure Period (days and percent of growing season) During the Growing Season of Wetland/Fen at Minimum Elevations

Ordinary High Water Level Condition	Inundation Period (Days) at Elevation 9,876.04 feet (Minimum Wetland Elevation)	Inundation Period (Days) at Elevation 9,886.73 feet (Minimum Fen Elevation)
Minimum Year (1990) Current OHWL	**8/3-9/19=47 days (43%)**	**7/11-9/19=70 days (64%)**
Maximum Year (2005) Current OHWL	**8/24-9/19=26 days (24%)**	**8/6-9/19=44 days (40%)**
Median, Current OHWL	**8/6-9/19=44 days (40%)**	**7/18-9/19=63 days (58%)**
Minimum Year (1990) Proposed OHWL	**8/3-9/19=47 days (43%)**	**7/11-9/19=70 days (64%)**
Maximum Year (2005) Proposed OHWL	**9/4-9/19= 15 days (14%)**	**8/14-9/19=36 days (33%)**
Median, Proposed OHWL	**8/10-9/19=40 days (37%)**	**7/20-9/19=61 days (56%)**

Comparison of Historically Inundated Wetlands and Fens with Wetlands and Fens Not Subject to Historical Annual Submergence

In a report entitled "Periodic Inundation Of Wetlands At Overland Reservoir Technical Report, December, 2008" prepared by Western Engineers and WestWater Engineering, technical data from ongoing operations at Overland Reservoir was presented and evaluated that demonstrated effects of periodic inundation on wetlands, including fen. The report highlighted the persistence of wetland (including fen) during annual periodic episodes of inundation by Overland Reservoir operation. Close to twenty years of operating records were examined showing when wetlands and fen have been submerged (under water) by annual reservoir filling events. Based on observations made during the wetlands delineation, it was found that there were both similarities and differences between the inundated fens, and those not inundated. The delineation of the historically inundated wetland (including fen) areas suggest that these wetlands have remained functional and differences are relatively minimal compared to areas not previously inundated. In a letter dated March 25, 2008, the Corps of Engineers confirmed the boundaries of the wetland delineation, and therefore is aware of the existence of historically inundated wetland (including fen) which remain functional. The referenced report included the following observations and conclusions:

1. Historically, wetland submergence duration has varied up to 134 days, with a median duration of 93 days and fen submergence duration has ranged up to 99 days, typically lasting 56 days based on the median inundation period. The historically inundated wetlands and fens have persisted for nearly twenty (20) years throughout these periods of inundation. This is likely due to the fact that although submerged periodically, the wetlands are sufficiently exposed during the growing season.

2. The year during which the maximum submergence period occurred (2005) is critical. That is because, during the year with the longest inundation period, the portion of the growing season during which existing wetlands are exposed to the atmosphere is at its minimum.

3. A significant portion of the inundation period occurs prior to the growing season. The lowest elevation wetlands generally start to become inundated in late March and early April.

4. Wetlands currently persist in the reservoir basin at an elevation where exposure during the growing season is as short as 26 days (24 percent of the growing season) in the year with the shortest exposure during the growing season (2005). At this elevation (9876.04), the median period during which the wetlands are exposed during the growing season has historically been 44 days (40% of the total growing season).

5. Fens currently survive in the reservoir basin at an elevation where exposure during the growing season is as short as 44 days (40 percent of the total growing season) in the year with the shortest exposure during the growing season (2005). At this elevation (9886.73), the median period during which the wetlands are exposed during the growing season has historically been 63 days (58 percent of the total growing season).

6. The historical inundation evidence encountered at the Overland reservoir site suggests that the periodic inundation of these wetlands and fens may not have resulted in significant change and definitely has not resulted in a cease in function.

7. In respect to the wetlands delineation, there were relatively minimal noted differences between wetlands and fens that had been inundated by ongoing reservoir operations and those that had not.

Proposed Future Reservoir Level Data

In order to anticipate the effect of the proposed reservoir enlargement on the duration of wetlands (including fen) inundation time intervals, the RLE vs. fill time (for the 19 years of historic records which were considered) was projected to the proposed new maximum reservoir capacity. This was accomplished using the following considerations:

- The rate of fill (or, generally, the RLE vs. time curve slope) immediately prior to the reservoir reaching the full stage in each year can be used as a guide to establish the initial volumetric fill rate above the current OHWL.

- The volumetric fill rate above the current OHWL was estimated from the spill records maintained by the water commissioner (2004 through 2007).

- For the years in which no spill records are available, the volumetric fill rate for reservoir levels higher than the current OHWL was estimated. The rate of final volumetric fill prior to the reservoir level reaching the current OHWL varied from 71 to 292 acre-feet/day, averaging 181 acre-feet/day. For the lower final fill rates, it can be assumed that the daily fill rates would likely be declining. The RLE vs. time patterns prior to the peak storage levels for years in which the reservoir did not fill combined with the few years for which there were spill records can be used as templates for typical volumetric fill patterns. For the higher final fill rates, it is reasonable to assume that the daily volumetric fill rates were either increasing or would remain roughly constant for a short period of time before decreasing. It is possible to match the final volumetric fill rate patterns for each year evaluated with similar patterns exhibited by 1) years with more complete fill records such as years during which the reservoir did not fill; and 2) years for which spill records exist. In order to estimate this, the similar patterns in other years are used as models to estimate volumetric fill rates for each year evaluated.

The resulting proposed RLE vs. time patterns are shown on Figure A-4. The elevation of the lowest point of the historically inundated wetlands and fens are again shown on Figures A-4 through A-6.

Again, the RLE vs. time data was normalized in the same manner as the historical fill/drawdown data. This was accomplished in using the same procedure previously described. Each year's time reference was shifted so that a zero date occurs either at the point of maximum storage, or at the middle of the full stage time period (see Figure A-5).

For the 4 years (1988, 1990, 2000 and 2002) that the reservoir did not fill to the current OHWL, none of the wetlands or the small fen area located above the current OHWL would have been submerged. The data also reveals that the reservoir would not have filled to the future proposed OHWL for 6 of the 19 years (1989, 1992, 1998, 1999, 2001 and 2007). This means that about half the time some, or all, of the wetlands and the small area of fen between the current OHWL and the future proposed OHWL would have not been inundated at all (Figures A-5 and A-6).

The proposed future RLE vs. time curves for the minimum submergence duration year (1990), for the maximum submergence duration year (2005) and the median curve determined as described above, are shown on Figure A-6.

Projections Regarding Wetlands and Fens Which Will be Submerged Due to the Proposed Increase in OHWL

Tables 2 and 3 in this Appendix, tabulate a summary of the range of wetlands inundation periods at the current OHWL (9,896.5 feet), at the proposed future OHWL (9,900.3 feet), at the minimum historically inundated wetland elevation (9,886.73 feet) and at the minimum historically inundated fen elevation (9,876.04 feet) for both the historic data at the current OHWL and the projected values at the future proposed OHWL. These values were determined as previously described. A 3.11 acre area of wetlands between the current OHWL and the proposed final OHWL will be newly inundated. This includes 0.07 acre area of fens (a combination of portions of fens F-2 and F-6) predicted to be inundated as a result of the reservoir expansion.

The following discussion projects effects of the increase in OHWL:

1. In order to contrast the impact of the future OHWL from the proposed reservoir enlargement on the historically inundated wetlands and fens, the year during which the maximum submergence period occurred (2005) is critical. Additionally, the comparison must consider the lowest historical elevation of the inundated wetland or fen. This is because, after increasing the OHWL to the proposed future elevation, the total inundation period for all other years and at all other elevations at which historically inundated wetlands and fens were identified will be shorter than it would have been in 2005. The data for the year 2005 shows that an increase in OHWL from the current elevation to the future proposed elevation will result in a maximum increased submergence time increment for the lowest historically inundated wetland of 10 days (from 134 days to 144 days of inundation) and a maximum increased submergence time increment of 7 days (from 99 days to 106 days of inundation) for the lowest historically inundated fen. This is an increase of only 7% in inundation time duration for both the lowest historically inundated wetland and fen. This evaluation strongly suggests that wetlands and fen at Overland Reservoir will persist with future increases in inundation

2. The same rationale may be used to evaluate the potential effects that the increased OHWL will have on the area of newly inundated wetlands and fens. Again, 2005 is the critical year for comparative purposes. Additionally, the critical evaluation elevation is where the lowest newly inundated wetland or fen would occur, or the current OHWL. The data for the year 2005 shows that the increase in OHWL from the current elevation to the future proposed elevation would have resulted in a submergence time increment for the wetland and fen area at the current OHWL of 71 days, lasting only 26 days during a normal year based on the median inundation period. In 2005, the newly inundated wetland and fen areas at the proposed future OHWL would have experienced 52 days of inundation effects, with these effects lasting only 4 days during a normal year based on the median inundation period. This means that the average inundation period for the

wetland and fen areas which will be newly impacted by the increased OHWL will only be about 16 or 27 percent of the historical time increment found by observing the lowest elevation at which wetlands and fens (respectively) have been subjected to submergence in the past. Since the historically inundated wetlands (including fens) have survived with no significant observed deleterious effects it seems very likely that the wetland and fen areas which will be newly inundated by raising the OHWL to the proposed final elevation will be substantially less impacted than wetland and fen areas which have been historically inundated for longer periods of time. Therefore, it can be expected that the wetland and fen areas which will be newly inundated by raising the OHWL to the proposed future elevation will persist in the same manner as the wetland and fen areas that have been historically inundated for varying periods of time.

3. The proposed increase in OHWL will reduce the wetland exposure period for historically submerged wetlands during the normal growing season by 0 to 10 percent (with a median reduction of 6 percent) and will reduce the fen exposure period (percent of the growing season) by 0 to 7 percentage points (with a median reduction of 2 points).

4. At the minimum elevation at which the wetlands delineation identified wetlands (9876.04), the proposed increase in OHWL will decrease the median wetland exposure period during the normal growing season from 44 days (40% of the total growing season) by only 4 days.

5. At the minimum elevation at which the wetlands delineation encountered fens (9886.73), the proposed increase in OHWL will reduce the median fen exposure period during the growing season from 63 days (58 percent of the total growing season) by only 2 days.

6. The wetlands (including fens) which will be newly inundated as a result of the proposed increase in OHWL will be exposed for 81 to 94 days (74 to 86 percent) of the growing season during a median year. This compares with a range of 44 to 90 days(40 to 83 percent) of the growing season for wetlands in general and 63 to 90 days (58 to 83 percent) of the growing season for fens with the exposure experienced under the existing operating conditions during a median year with the current OHWL. In other words, the newly inundated wetlands and fens will be exposed for significantly longer percentages of the growing season compared with periods that wetlands and fens are currently exposed for. It is, therefore, reasonable to expect that the newly inundated wetlands and fens will be no more greatly impacted than the historically inundated fens and wetlands have been which appear to have persisted with little change based on observations made to date.

Although the wetlands delineation has been the only assessment to date, the observations made suggest that the effects of historic inundation have been relatively minimal and the water level and inundation duration data presented herein indicate that the increase in inundation duration for historically inundated fens and wetlands will be relatively minor. This data also suggests that the period of inundation for fens and wetlands which will be newly submerged as a result of the increase in OHWL will be substantially less than the historically inundated fens and wetlands have experienced.

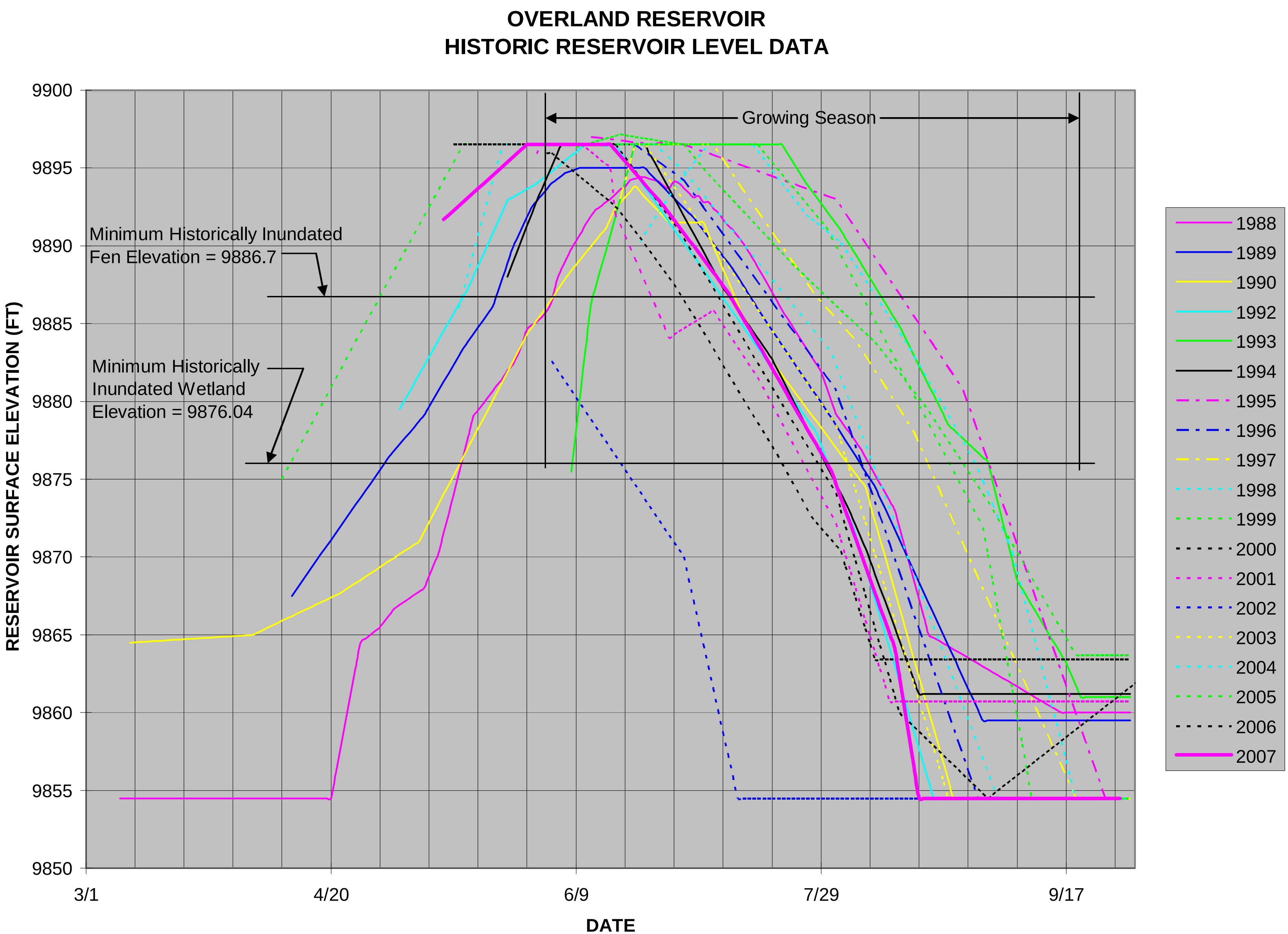
Wind and Wave Action

The potential effects of wave action on the wetlands and fens which will be newly inundated were considered. The erosive effects of wave action are dependent on a number of factors including:

- Wave velocity, which is a function of wind velocity and duration.
- Wave height, which is a function of a combination of reservoir fetch, wind velocity and wind duration. Fetch is defined as the distance over which the wind can act on a body of water and is generally defined as the normal distance from the windward shore to the area being considered.
- The slope of the ground against which the waves impinge. Steeper slopes are more subject to wave generated erosion because the wave energy is absorbed by a smaller area.

The maximum wind velocity and duration will not change with the proposed increase in OHWL. The reservoir fetch relative to the fen area, which will be inundated as a result of the increased OHWL will change from 2,851 feet to 2,967 feet, an increase of 4 percent. Generally accepted relationships between the parameters mentioned above indicate that, with a wind velocity of 100 miles/hr and fetch less than one mile, wave height increases by 0.15 percent per percent of fetch increase. Therefore, the increase in wave height and resultant wave impact energy as a result of the increase in OHWL is insignificant. For example, if the wave height impinging on the subject fen area at the current OHWL is 3.0 feet, the increased wave height due to the raise in OHWL to the future proposed elevation would be 3.005 feet, an increase of about 1/16 of an inch.

The entire wetland and fen area below the existing OHWL has historically been subject to wave erosion as the reservoir level cycles between the future annual low elevation and the current OHWL. These previously inundated wetlands and fens have persisted in spite of this wave activity. However, the greatest potential for wave erosion is at the elevation of the OHWL because of the greater time increment during which the reservoir surface remains at that level. Historically, the time duration during which the reservoir level remains at the current OHWL has ranged from 0 to 60 days, averaging 17 days. The average ground slope for the fens at this elevation is 14 percent. After raising the OHWL to the proposed future elevation, the time increment during which the reservoir level will remain at the new higher OHWL will vary from 0 to 53 days, averaging 11 days. The average ground slope for the fens at the elevation of the future proposed OHWL is 13 percent. Wave action appears to only affect steep slopes on NW side of Reservoir. Because the time duration during which reservoir level remains at the OHWL will be less with the raised OHWL than it is with the current OHWL, and since the ground slope in the fen areas is less at the elevation of the future proposed OHWL than at the elevation of the current OHWL, the wave erosion potential at the reservoir margin near the newly inundated fens will be significantly less than it has been for the historically inundated fens, and the effects are not expected to be significant related to function of either wetlands or fens.


OVERLAND RESERVOIR
HISTORIC RESERVOIR LEVEL DATA
Growing Season
Minimum Historically Inundated
Fen Elevation = 9886.7
Minimum Historically
Inundated Wetland
Elevation = 9876.04
RESERVOIR SURFACE ELEVATION (FT)
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
3/1
4/20
6/9
7/29
9/17
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2004
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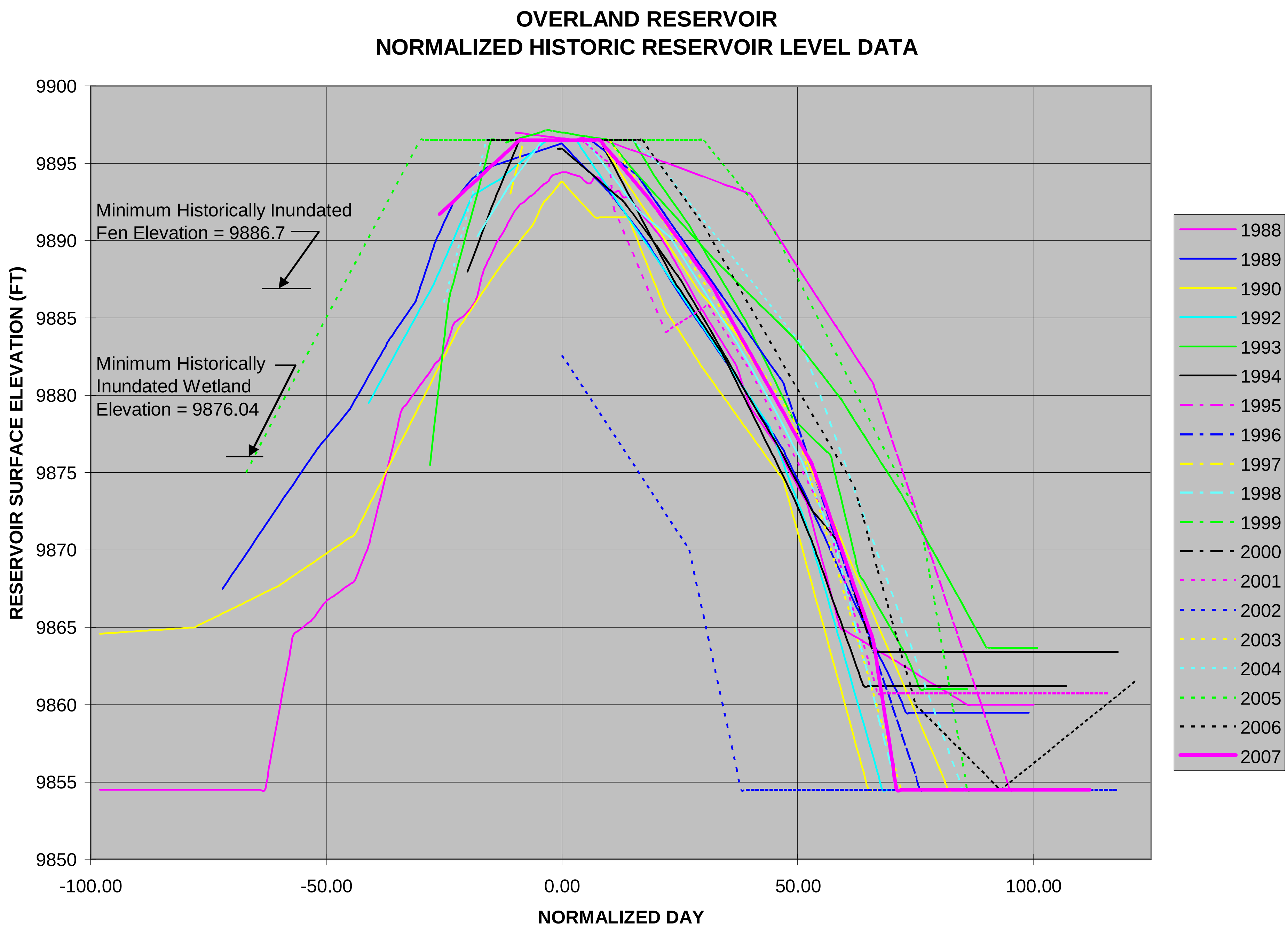
2006
2007



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9880
9875
9870
9865
9860
9855
9850
-100.00
-50.00
0.00
50.00
100.00
Minimum Historically Inundated
Fen Elevation = 9886.7
Minimum Historically
Inundated Wetland
Elevation = 9876.04
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2006
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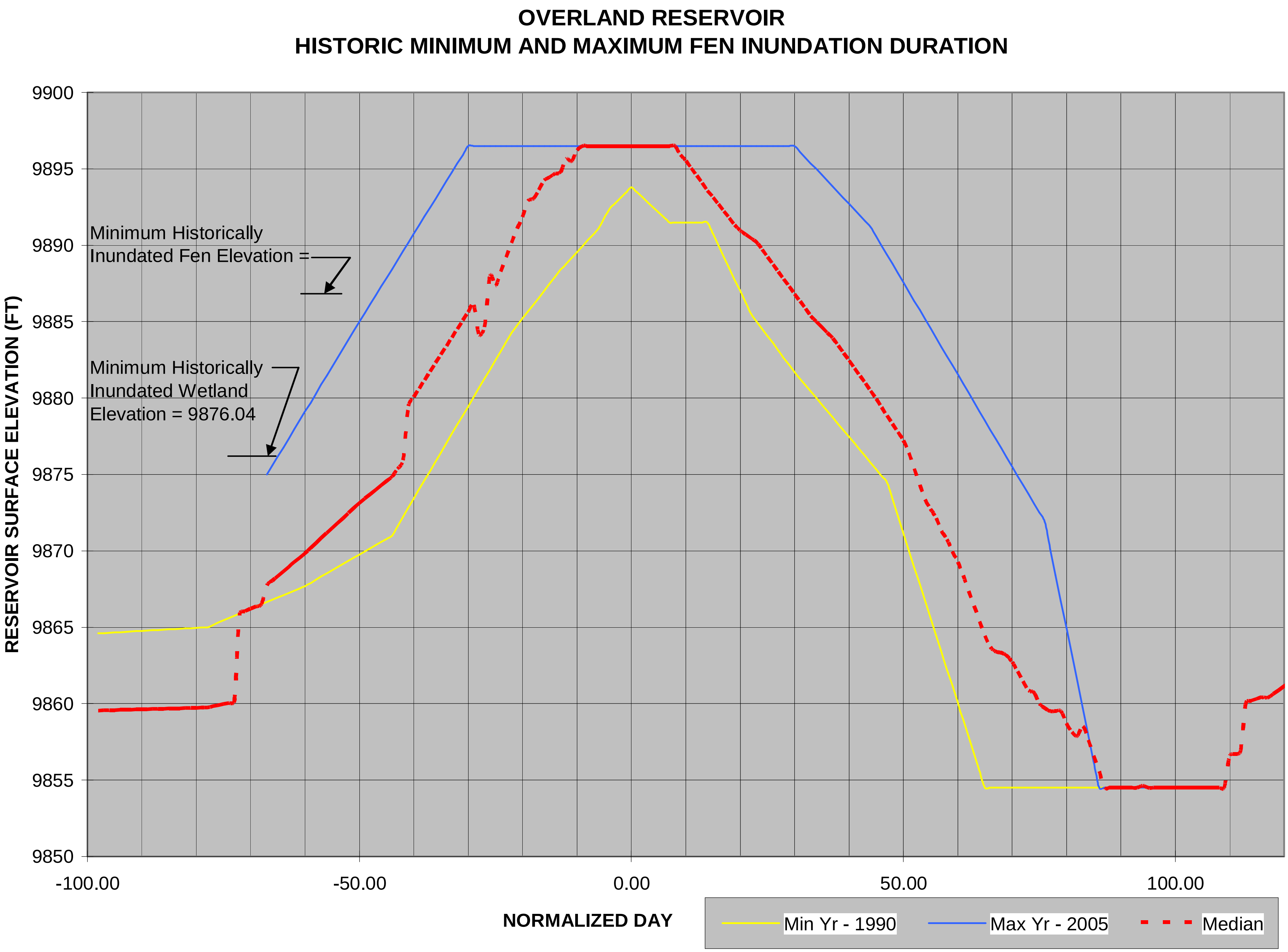
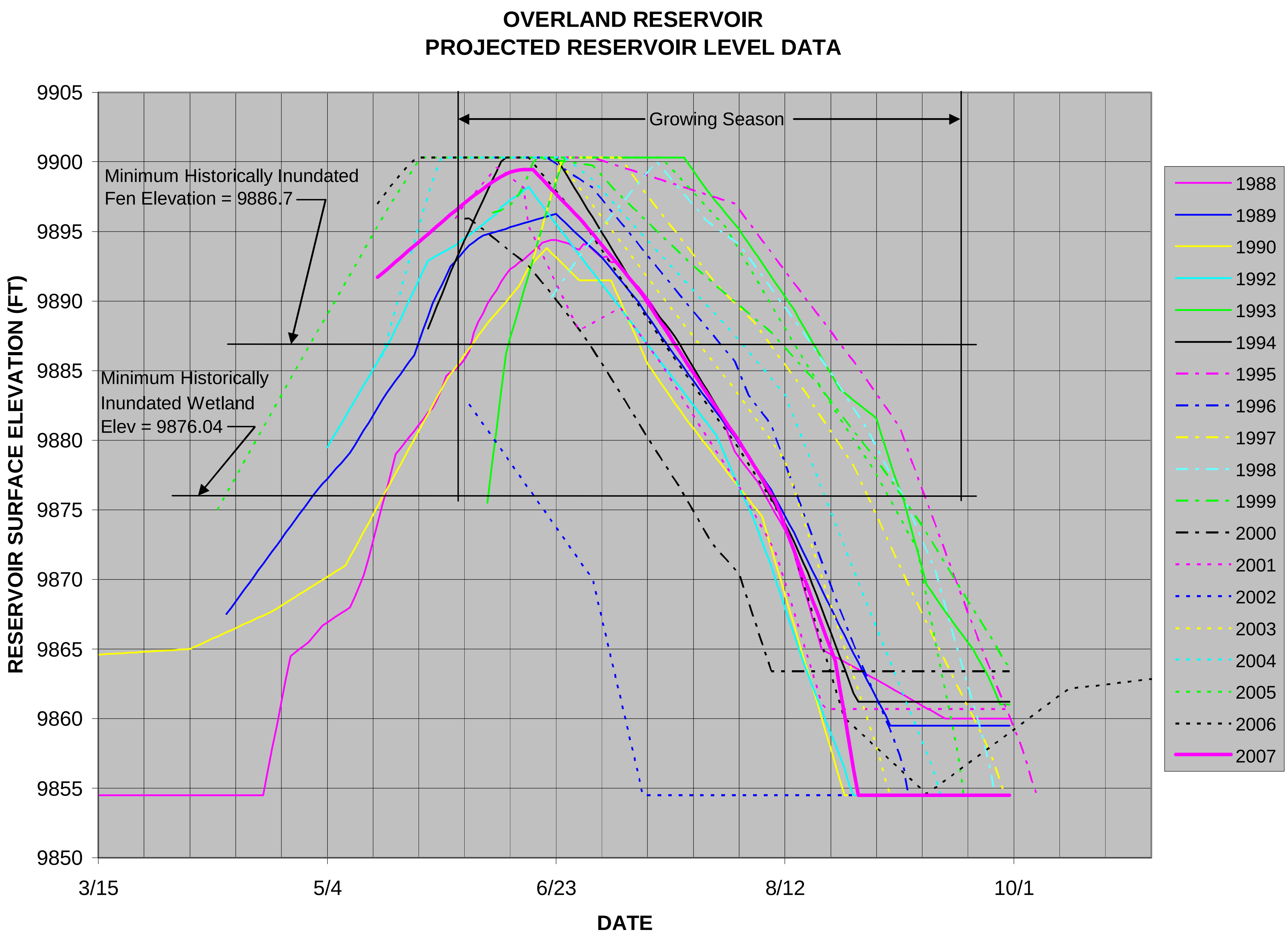


OVERLAND RESERVOIR
HISTORIC MINIMUM AND MAXIMUM FEN INUNDATION DURATION
Minimum Historically Inundated Fen Elevation =
Minimum Historically Inundated Wetland Elevation = 9876.04
RESERVOIR SURFACE ELEVATION (FT)
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
-100.00
-50.00
0.00
50.00
100.00
NORMALIZED DAY
Min Yr - 1990
Max Yr - 2005
Median


OVERLAND RESERVOIR
PROJECTED RESERVOIR LEVEL DATA
RESERVOIR SURFACE ELEVATION (FT)
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9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
3/15
5/4
6/23
8/12
10/1
DATE
Growing Season
Minimum Historically Inundated
Fen Elevation = 9886.7
Minimum Historically
Inundated Wetland
Elev = 9876.04
1988
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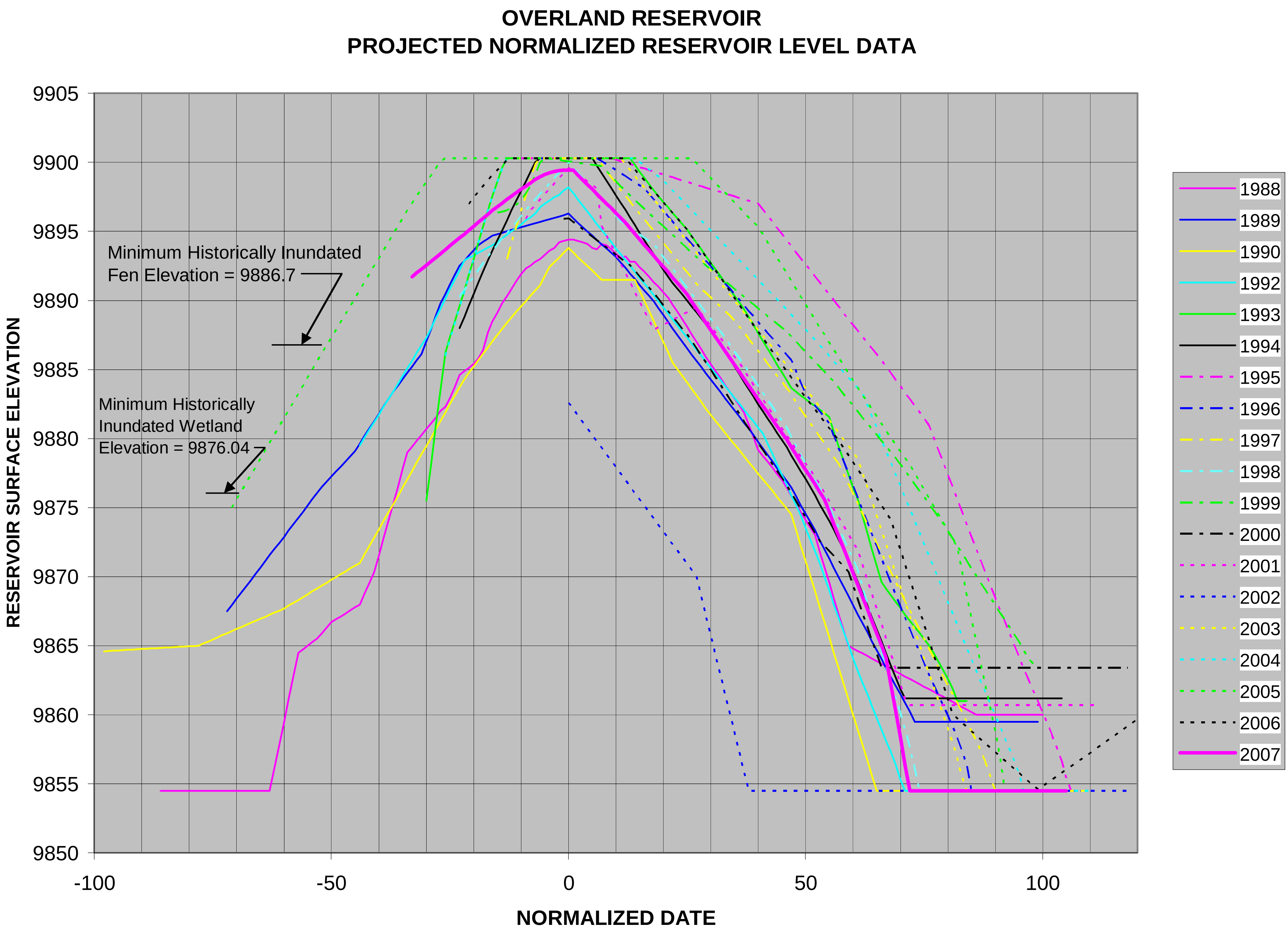

OVERLAND RESERVOIR
PROJECTED NORMALIZED RESERVOIR LEVEL DATA
RESERVOIR SURFACE ELEVATION
NORMALIZED DATE
9905
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
-100
-50
0
50
100
Minimum Historically Inundated Fen Elevation = 9886.7
Minimum Historically Inundated Wetland Elevation = 9876.04
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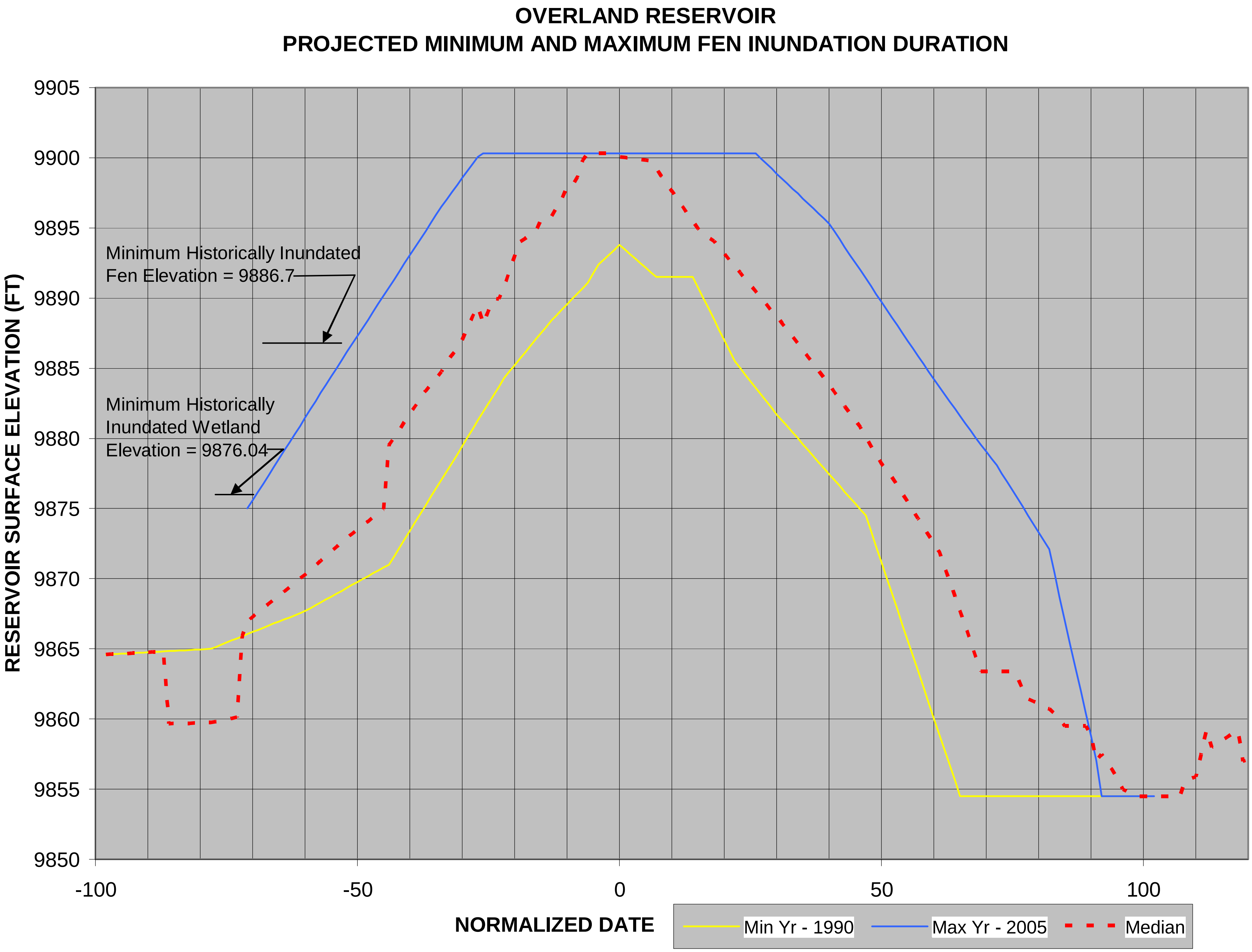
2006
2007


OVERLAND RESERVOIR
PROJECTED MINIMUM AND MAXIMUM FEN INUNDATION DURATION
RESERVOIR SURFACE ELEVATION (FT)
9905
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
Minimum Historically Inundated
Fen Elevation = 9886.7
Minimum Historically
Inundated Wetland
Elevation = 9876.04
-100
-50
0
50
100
NORMALIZED DATE
Min Yr - 1990
Max Yr - 2005
Median

PERIODIC INUNDATION OF WETLANDS AT OVERLAND RESERVOIR TECHNICAL REPORT DECEMBER, 2008 REVISED JANUARY, 2010

Prepared for:

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1.0 INTRODUCTION

Overland Reservoir is located 20 miles north of Highway 139 from Paonia, Colorado, and 7 miles west on Forest Service Road 705 (Figure 1). The reservoir was built in 1905 by the Overland Ditch and Reservoir Company (ODRC) to provide agricultural water to farmers and ranchers in the Redlands Mesa Area near Hotchkiss, Colorado. ODRC currently hold 6,200 acre-feet of absolute water rights and 971 acre-feet of conditional water rights. The existing reservoir has an active capacity of 6,163 acre-feet with an inundated area of approximately 254 surface acres. ODRC is proposing to enlarge the capacity of the reservoir to a total active storage capacity of 7,171 acre-feet. The reservoir footprint would increase by 14 acres to a total of 268 surface acres. The water level of the reservoir would be increased by approximately 3.8 feet. The additional storage would satisfy requirements to adjudicate existing conditional water rights to absolute water rights. Overland Reservoir's storage is used for irrigation and its water level decreases rapidly each year once water is released from storage in order to satisfy irrigation demands.

The Department of the Army, acting through the U.S. Army Corps of Engineers (COE), has authority to permit the discharge of dredged or fill material in waters of the United States under Section 404 of the Clean Water Act (CWA), and permit work and the placement of structures in navigable waters of the United States under Sections 9 and 10 of the Rivers and Harbors Act of 1899 (RHA).

In November of 2007, WestWater Engineering (WWE) submitted the Jurisdictional Determination (JD) Request to the COE for the proposed Overland Reservoir Enlargement Project (WWE 2007). Wetland areas were identified in accordance with the January 1987 Corps of Engineers Wetlands Delineation Manual and related supplements. The purpose of the JD is to identify and locate waters (including wetlands) in the project design which are jurisdictional under Section 404. The JD request identified wetlands (including fen) present in the vicinity of the reservoir. The delineation also identified wetlands located below the current Ordinary High Water Level (OHWL) as shown in Figure 2.

Fen is an ongoing topic of study by the Forest Service (FS) and others. The FS has an ongoing fen committee and working group to further define and monitor fen in Grand Mesa Uncompahgre and Gunnison National Forest (GMUG) (FS 2008). Fen is defined as wetlands with organic soils dependent on direct contact with mineral enriched groundwater for nutrients and consistent moisture. Fens in the Rocky Mountains have extremely slow rates of peat accumulation (approximately 1 to 2 inches/100 years) due to a cold dry climate.

2.0 OBJECTIVE

The objective of this report is to present technical data from ongoing operations at Overland Reservoir that demonstrate effects of periodic inundation on wetlands, including fen. The intention of this report is to bring attention to the persistence of wetland (including fen) during periodic episodes of inundation by reservoirs. Overland Reservoir has close to twenty years of operating records showing when wetlands and fen have been submerged (under water) by annual reservoir filling events. This report also identifies the portion of the inundation period which has occurred outside the window of the growth period.

3.0 RESERVOIR HISTORY

The Overland Ditch and Reservoir Company was established in 1895 with the purpose of completing ditch construction and building two reservoirs. Ditch construction was initiated in 1893, which is the appropriation date, and continued through 1905. The reservoir has an "1891" easement because it was constructed under an easement issued by the General Land Office, pursuant to the Act of March 3, 1981. The original dam, at the site of the existing Overland Dam, was started in 1903 and completed in 1905, with a capacity of about 2,500 acre-feet for irrigation water. Dam construction continued and, in the 1950s the reservoir was enlarged to a total active capacity of 5,960 acre-feet. The dam's original features degraded throughout the years in spite of the many improvements made. A detailed history of these efforts is provided in Appendix A. In 1984, Western Engineers, Inc. performed feasibility studies that led to rehabilitation of the dam in 1986-1987, including new improvements and enlargement of the spillway to conform to Colorado dam safety regulations. Progress in the 1980s and 90s led to further construction and improvements, resulting in the conditional storage right for a total volume of 6,186 acre-feet (6,163 acre-feet active of storage). The construction to allow that additional storage was completed in 1991.

The ODRC provides irrigation water to an area that encompasses about 20 square miles and is physically located such that it can provide water to a much larger area of about 450 square miles which extends from Paonia Reservoir on the east to Orchard City on the west, north of the North Fork of the Gunnison River. Irrigated acreage within the service area is primarily used to raise pasture, and crops such as hay, grains, corn and fruit. The ODRC system provides water to a total of over 6,000 irrigated acres. There are a total of 122 water users irrigating farm areas varying from 1 to 700 acres, averaging about 70 acres.

4.0 ENVIRONMENTAL SETTING

Overland Reservoir is located on the Grand Mesa, a large flat plateau, within National Forest Service (NFS) lands (Figure 1), east of Grand Junction, Colorado. The Grand Mesa lies in the northeastern corner of the Colorado Plateau and encompasses over 1,000 square miles. The Colorado Plateau is a desert region covering portions of the four-corner states defined by large plateaus, buttes, mountains, steeply incised canyons, and is dissected by the Colorado and Green Rivers. Grand Mesa and Battlement Mesa to the northeast are bisected by Plateau Creek, a tributary of the Colorado River, forming steep side slopes and narrow canyons. Due to the elevation and the geographic position (Yeend 1969); the Grand Mesa is classified as a forested mountain and alpine ecosystem. Grand Mesa rises above the surrounding valleys by about 5,000 feet with a maximum elevation of 11,086 feet above sea level (ASL). Much of the NFS lands within the Grand Mesa are at the higher elevations (9,000 to 11,000 feet elevations) and are relatively flat. Overland Reservoir is located at approximately 10,000 feet ASL.

Figure 1. Project Location Map

Weathering and movement of the bedrock, basalt flows, and glacial till have resulted in the present topography of the Grand Mesa. Topographic features include: incised valleys, steep talus slopes of basalt boulders, and gentle slopes of colluviums and valley fill deposits. Glaciated terrain has a natural tendency to have slumps and depressions that fill up with water and result in the many lakes and reservoirs present in the area. The lakes deposit sediment and create a favorable condition for moss growth and peat accumulation (Johnston et al. 2007). Thus, Grand Mesa wetlands have the characteristics of peat-forming wetlands, which are called fen. Fen is wetlands with organic soils dependent on direct contact with mineral enriched groundwater for nutrients and consistent moisture. Fens in the Rocky Mountains have extremely slow rates of peat accumulation (ranging from 240 to 540 mm/1000 years, or .94 to 2.12 inches/100 years) due to a cold dry climate (GSA 2002).

The distinctive climate on the Grand Mesa is created by its geographic position between two large valleys. Depending upon the season, moisture-laden storm systems move across the Grand Mesa from three different directions. There is no well-defined wet season on the Grand Mesa, but the maximum precipitation occurs (generally in the form of snow) in March, April, and into May. A secondary spike in precipitation occurs in August and September as a result of summer thunderstorms fed by moisture-laden air coming up from the Gulf of Mexico.

Based on generalized U.S. Geological Survey maps of mean annual precipitation for the Upper Colorado River Basin, the Grand Mesa receives 19 to 39 inches per year, averaging 28 inches per year (NOAA 2008). The cool Pacific storm fronts that come in from the west during the winter provide considerable snow pack on the Grand Mesa with the greatest snow depth readings occurring in April. The average minimum temperatures for the higher elevations can be expected to range from 0 to 20˚ F in the winter, while the lower elevation valley bottoms to the east and west have average minimum temperatures from 15 to 30˚ F in the winter months. The maximum summer temperatures on the Grand Mesa can be expected to average from 65 to 85˚ F at the higher elevations, while the surrounding valley bottoms average 85 to 95˚ F.

5.0 WETLAND DELINEATION FINDINGS

The delineation (WWE 2007) identified 19 wetland areas, representing four wetland types: fringe wetland, forested wetland, wet meadows, and fens (Figure 2). Table 1 summarizes these wetland types. Note that the delineation included areas below and adjacent to the current OHWL as well as other areas distant from the reservoir perimeter which might possibly be impacted by reservoir construction and operation (See Figure 2). Table 1 includes only those areas located below and adjacent to the current OHWL. Methods used in the delineation are described in WWE 2007 and are from the COE Wetlands Delineation Manual. Appendix B provides photographs of the delineation effort and the wetland areas. Appendix C provides an estimation of the growing season at Overland Reservoir.

Table 1. Wetlands Identified during Overland Reservoir Wetland Delineation

Wetland Type	Total Area Below and Adjacent to Current OHWL (acres)	Area Below Current OHWL (acres)	Area Above Current OHWL (acres)
Fringe and Forested Wetland	49.18	49.18	5.91
Fen	1.21	0.96	0.25

Figure 2. Overland Reservoir Wetlands

5.1 Growing season

Growing season at Overland is estimated to be from June 2 to September 19. Appendix C provides details on the derivation of this range. The significance of the growing season is paramount to this study because the wetlands, including fen, have generally been exposed to the atmosphere during much of the growing season in spite of their periodic inundation. This is detailed in later paragraphs.

5.2 Fringe and Forested Wetlands

Fringe and Forested wetlands around the reservoir represent the largest wetland wetland area in the project area. These wetland types are depicted on Figure 2 (see Fringe wetlands L, M, and N and Forested wetlands A, B and H). Fringe wetlands are also associated with the ditch below the south dam; seepage from under the dam maintains a flow of water through the creek to wetland O, which is 0.75 acres. Fringe wetland soils showed light oxidation in pore linings and rhizospheres, 2-4% within the first 6 inches. During initial site visits Fringe wetlands were inundated below current OHWL and vegetation appeared to be emergent littoral. Rapid decline in reservoir water levels continually exposed wetland vegetation throughout the growing season. Figure 2 shows wetlands L, M and N within the boundary of the current OHWL (or Ordinary High Water Line). Dominant species in annually inundated wetlands were *Carex utriculata, C. aquatilis.* Soils in Forested wetlands showed a loamy gleyed matrix and oxidation within the first 6 inches, along with exhibiting a strong hydrogen sulfide odor. Dominant species associated with the reservoir fringe were *Picea engelmannii, Salix planifolia, Salix monticule, Carex utriculata, C. aquatilis* and *Caltha leptosepala.*

5.3 Wet Meadow Wetlands

Wet meadow wetlands occurred beyond the footprint and perimeter of the reservoir which totaled 9.14 acres. The soils in wetland C (Figure 2), which were typical of all wet meadow wetlands, showed a histic epipedon above dark low chroma and gleyed soil. Dominant species *include, Salix planifolia, Salix monticule, Salix geyeriana, Carex utriculata, C. aquatilis, Caltha leptosepala, and Pedicularis groenlandica.*

Figure 2

5.4 Fens

Fens were surrounded by other wetland types within the project area and total 1.21 acres below or adjacent to the current OHWL (Figure 2 and Table 1). Table 2 shows the results of laboratory tests performed on undisturbed samples from the fen locations (Figure 2). The area of F-6 was expanded to the edge of F-2 after soil test results indicated that this area has organic soils. Fens F-6 and F-2 abut (Figure 2), but have differences in vegetative composition, structure, and topography. The total acreage of fens that exist at or below the current OHWL is 0.96 acres. The forested portion of wetland B contained one fen (F-2), with an area of 0.17 acres. F-1, F-2 and F-3 are located above the current OHWL. Soil tests revealed properties of histosols, organic soils, in all suspected fen areas. Dominant species within fens were *Carex utriculata*, *C. aquatilis,* and 2 species of moss *Tomentypnum nitens* and *Dreplanocladus adunces.*

Table 2. Fen Soils TOC, Texture Test Results and Sample Locations

Sample ID	TOC	Mineral Texture	% Sand	% Silt	%Clay	Easting	Northing
F-6	24.83	Sandy Loam	76	12	12	271383	4329087
F-2	32.34	Sandy Loam	66	26	8	271401	4329075
F-3.1	36.73	Sandy Loam	78	8	14	271375	4328619
F-3.2.1	22.19	Sandy Loam	76	8	16	271445	4328714
F-3.2.2	37.30	Sandy Loam	76	8	16	271445	4328714
F-4 3	30.05	Sandy Loam	74	10	16	270790	4329780
F-5.1	30.95	Loamy Sand	82	8	10	271324	4328630
F-5.2	35.29	Sandy Loam	76	12	12	271324	4328630
F-6	32.61	Sandy Loam	76	12	12	271350	4329090
F-7.1	17.49	Sandy Loam	74	10	16	271163	4330124
F-7.2	39.04	Sandy Loam	74	10	16	271163	4330124

6.0 SUMMARY OF WATER LEVEL DATA

Appendix A includes a detailed description of the historical water levels, along with statistical comparisons. Graphs are provided to display this data in Figures A-1 through A-3. Observations, tests and evaluations are provided in Appendix A and summarized below. Appendix A also includes a comprehensive analysis of the inundation time increments and durations that Overland wetland (including fen) areas have endured historically.

The analysis of water levels in Appendix A is summarized in the following table (Table 3). The following noteworthy observations can be drawn from the information in Appendix A and summarized in Table 3, and Figure 3:

1. Historically, wetland submergence duration has varied up to 134 days, with a median duration of 93 days and fen submergence duration has ranged up to 99 days, typically lasting 56 days based on the median inundation period. The historically inundated wetlands and fens have persisted for nearly twenty (20) years throughout these periods of inundation. This is likely due to the fact that although submerged periodically, the wetlands are sufficiently exposed during a portion of each growing season as discussed in following paragraphs.

2. The year during which the maximum submergence period occurred (2005) is critical (refer to Appendix A). That is because, during the year with the longest inundation period, the portion of the growing season during which existing wetlands are exposed to the atmosphere is at its minimum.

6.1 Wetland and Fen Exposure During the Growing Season

It is instructive to note the percentage of the wetlands growing season during which the Overland Reservoir wetlands (including fens) are not inundated (exposed to the atmosphere). Exposure during the growing season is obviously a significant factor in the on-going survivability and viability of existing wetlands. The wetlands growing season was estimated as described in Appendix C. The period during which the wetlands growing season and wetlands exposure coincide is summarized in Table 4. The following noteworthy observations are made regarding the growing season tabulations and chart (Table 4 and Figure 3):

- A significant portion of the inundation period occurs prior to the growing season. The lowest elevation wetlands generally start to become inundated in late March and early April.

- Wetlands currently persist in the reservoir basin at an elevation where exposure during the growing season is as short as 26 days (24 percent of the growing season) in the year with the shortest exposure during the growing season (2005). At this elevation (9876.04), the median period during which the wetlands are exposed during the growing season has historically been 44 days (40% of the total growing season).

- Fens currently survive in the reservoir basin at an elevation where exposure during the growing season is as short as 44 days (40 percent of the total growing season) in the year with the shortest exposure during the growing season (2005). At this elevation (9886.73), the median period during which the wetlands are exposed during the growing season has historically been 63 days (58 percent of the total growing season).

Table 3. Inundation Period (days) of Wetland/Fen at Minimum and Maximum Elevations

Reservoir Operation Year	Inundation Period (Days) At Elevation 9,896.5 feet (Current OHWL)	Inundation Period (Days) at Elevation 9,886.73 feet (Minimum Fen Elevation)	Inundation Period (Days) at Elevation 9,876.04 feet (Minimum Wetland Elevation)
Minimum Year (1990)	**0** (did not fill)	**37** (6/4 through 7/11, 1990)	**79** (5/16 through 8/3, 1990)
Maximum Year (2005)	**60** (5/17 through 7/16, 2005)	**99** (4/30 through 8/7, 2005)	**134** (4/12 through 8/24, 2005)
Median	**17**	**56**	**93**

Table 4. Exposure Period (days and percent of growing season) During Growing Season of Wetland/Fen at Minimum and Maximum Elevations

Reservoir Operation Year	Exposure Period (Days) At Elevation 9,896.5 feet (Current OHWL)	Exposure Period (Days) at Elevation 9,886.73 feet (Minimum Fen Elevation)	Exposure Period (Days) at Elevation 9,876.04 feet (Minimum Wetland Elevation)
Minimum Year (1990)	**6/2-9/19=109 days (100%)** (did not fill)	**7/11-9/19=70 days (64%)**	**8/3-9/19=47 days (43%)**
Maximum Year (2005)	**7/16-9/19=65 days (60%)**	**8/6-9/19=44 days (40%)**	**8/24-9/19=26 days (24%)**
Median	**6/21-9/19=90 days (83%)**	**7/18-9/19=63 days (58%)**	**8/6-9/19=44days (40%)**

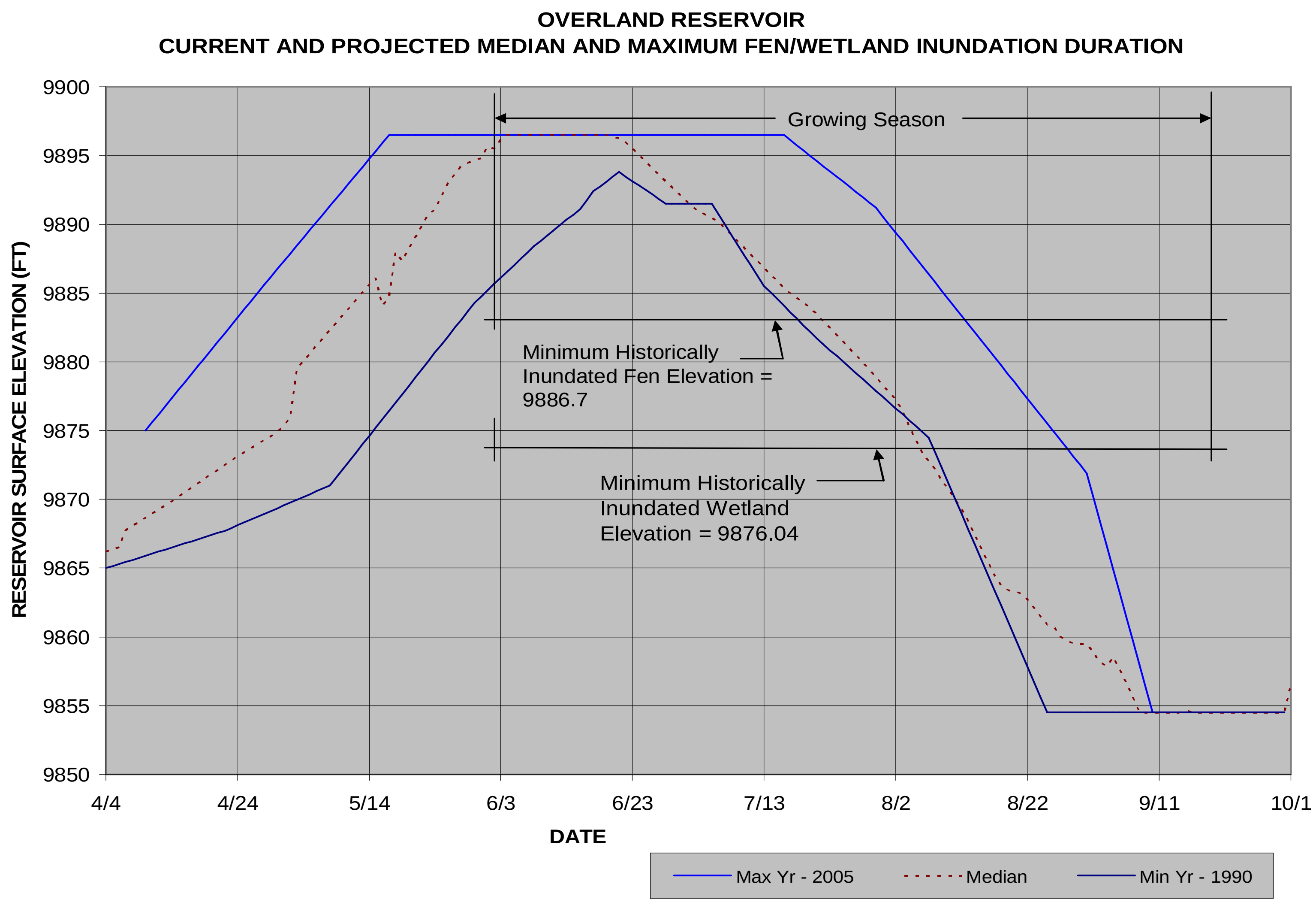

Figure 3. Fen/Wetland Inundation Duration

7.0 DISCUSSION

The delineation of the historically inundated wetland (including fen) areas (WWE 2007) suggest that these areas have remained functional and differences are relatively minimal compared to areas not previously inundated. In a letter dated March 25, 2008, the COE confirmed the boundaries of the wetland delineation, and therefore is aware of the historically inundated wetland (including fen) areas. The historical inundation evidence encountered at the Overland reservoir site suggests that the periodic inundation of these wetlands and fens may not have resulted in significant changes. Other researchers (Hill, Keddy & Wisheu, 1998; Keddy, 1983; Keddy & Reznicek, 1986; Keddy, 2000; Keddy & Fraser, 2000; Nilsson & Keddy, 1988; Obot, 1989; Wilcox & Meeker, 1991) have found that, while the richness and diversity of vegetation species may be affected by fluctuating water levels and periodic inundation, wetlands (including fen) can persist under such conditions.

There were both similarities and differences between the inundated wetlands and fens, and those not inundated. Again, the delineation indicated that fens F-4, F-7, and part of F-6 are lower than the current OHWL, and have been historically inundated (Figure 2). The fens, which have been historically inundated, have similar densities of Carex aqualtilils, Carex utriculata and mosses to those fens which have not been inundated (see photographs in Appendix B). Also, the organic content is similar between the fens that were inundated and the non-inundated fens. All fens appear to be accumulating more peat with each growing season. The differences between the inundated and non-inundated fens are 1) none of the inundated fens had willows (Salix) present, but willows are present in some of the non-inundated fens and 2) some non-inundated fens had a more diverse species assemblage (i.e. more mosses). Although the wetlands delineation has been the only assessment to date, the observations made suggest that the effects of historic inundation may have been relatively minimal.

In respect to the wetlands delineation (WWE 2007), there were relatively minimal noted differences between wetlands that had been inundated by ongoing reservoir operations and those that had not. However, it should be noted that there are no previous wetlands delineations with associated soil sampling for comparison.

In conclusion, the observations provided in this report are intended to be used for future decision making regarding the inundation of wetlands and fens. It should be noted that any projections made at this time must be extrapolated from a combination of historical hydrology data and present-day comparisons between previously inundated areas and similar, adjacent areas which have not been subjected to inundation. Following are some additional considerations:

1. It is recognized that the observations made in this report do not constitute rigorous research regarding the impact of historic inundation on existing wetlands and fens in the Overland Reservoir. However, sufficient observations have been made to suggest that historically inundated wetlands and fens in the Overland Reservoir basin continue to remain functional.

2. Many of the wetlands identified below the current OHWL probably would not exist without the reservoir operation because the reservoir provides at least a portion of the wetland hydrologic regime for the existing wetlands.

3. Potentially, there may be other wetlands and fens found within similar irrigation reservoirs (reservoirs with annually fluctuating reservoir levels) at other locations in the Grand Mesa area which continue to function in a similar manner to those examined at the Overland Reservoir site.

8.0 SUMMARY

- Wetlands (including fens) located at lower elevations than the current OHWL continue to exist while experiencing annual transient inundation.

- Based on initial observations, the temporarily submerged wetlands and fens appear to exhibit characteristics and plant communities similar to adjacent and nearby wetlands and fens.

- The average wetlands growing season at Overland Reservoir was estimated using four data sets (see Appendix C). The first data set included a combination of NRCS WETS station in surrounding counties and high elevation WETS stations from around the state of Colorado. The growing season estimated by using the WETS station data was validated based on records from two nearby climatological stations located on the Grand Mesa at approximately the same elevation as Overland Reservoir. Data from Bonham Reservoir produced the exact same growing season length as the WETS stations analysis. The growing season length based on data from Mesa Lakes was 15 days (19 percent) longer than that resulting from the WETS stations data. The fourth data set was from a SNOTEL (Snowpack Telemetry) station located very near Overland Reservoir. The length of growing season resulting from the SNOTEL data analysis was 28 days (35 percent) longer than that resulting from the WETS stations data. Because the SNOTEL station is located practically at Overland Reservoir and there is a long period of record, it was judged that it best represented the local conditions and was used as the basis for the growing season interval presented in this report. In spite of the variation in growing season length from the various data sets, they all lie well within the 95 percent prediction intervals produced by analysis of the WETS station data. Therefore, there is a relatively high degree of confidence in the estimated normal wetlands growing season, from June 2 to September 19.

- Depending on the year and the elevation of specific wetlands, delineated wetlands are exposed to the atmosphere (not submerged) for a range of time from 24 percent of the normal growing season up to 100 percent of the growing season. Similarly, delineated fens are exposed between 40 and 100 percent of the growing season.

- Considering inundation periods for an average year, wetlands continue to survive with exposure duration of 40 percent of the normal growing season. However, a more detailed examination of wetlands areas during drawdown might reveal the existence of wetlands at lower elevations than identified during the delineation which would further reduce the percent of average-year growing season exposure for existing wetlands.

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APPENDIX A

Analysis of Historical Water Levels
Western Engineers, Inc.

Historical Information

The Overland Ditch and Reservoir Company was established on July 1, 1895, with the purpose of completing ditch construction and building two reservoirs identified as Overland Reservoir No. 1 and Overland Reservoir No. 2. Ditch construction was initiated in 1893, which is the appropriation date, and continued through 1905. The reservoir has an "1891" easement because it was constructed under an easement issued by the General Land Office, pursuant to the Act of March 3, 1981. Overland Dam No. 1 (the original dam at the site of the existing Overland Dam) was started in 1903 and completed in 1905, with a capacity of about 2,500 acre-feet of irrigation water. Two dams were constructed to form the reservoir, the main dam across Cow Creek and Auxiliary Dam No. 1, crossing Hubbard Creek. During 1950 the reservoir was enlarged to a total active capacity of 5,960 acre-feet by enlarging the main dam and Auxiliary Dam No. 1 and adding a small Auxiliary Dam No. 2, located in a saddle just to the left of the main dam. The main dam and Auxiliary Dam No. 2 were connected as part of this project. Construction in 1950 included replacing the old wood stave outlet pipe and construction of a new spillway. An attempt was also made to install a second outlet pipe in the Auxiliary Dam No. 1. However, due to difficult and unstable excavation conditions, efforts to install this second outlet were abandoned. The presently existing ditch downstream from the current Auxiliary Dam is a remnant from this attempt. Approximately seven years after the enlargement and during the first complete filling, a settlement of four feet occurred on the crest near the right side of the outlet works. The State Engineer's Office restricted the maximum storage to gage height 40 (5,690 acre-feet). This restriction was in effect from 1957 to 1963. In 1963, a new wooden spillway was constructed near the left abutment to limit the filling to 5,690 acre-feet, or five feet below the reservoir capacity after the 1950 enlargement. The reservoir storage level was further restricted to gauge height 35 in 1982 after surficial cracking was observed in the right embankment and abutment. This reduced the allowable storage capacity to about 4,517 acre-feet. Since 1957, several studies have been conducted involving either construction of a new dam or rehabilitation of the existing dam. Since 1966, it was determined that the cost to repair the existing dam would be greater than construction of a new dam, approximately one-quarter (0.25) mile downstream. In 1976, McDermith and Schuster, Consulting Engineers, prepared a report entitled "Small Reclamation Project Application and Report and Feasibility Study for the Overland Ditch and Reservoir Company." The purpose of this study was to secure funding for a new dam. Plans and Specifications were prepared in 1982 for the new dam. It was subsequently determined that the cost of the new dam would result in annual costs greater than the repayment capabilities of the Overland Ditch and Reservoir Company and, subsequently, the plans to construct a new dam were abandoned. Western Engineers, Inc., was retained in early 1984 to perform an investigation of the existing Overland Dam to determine the feasibility of rehabilitating the structure and to identify the potential soils. This investigation led to construction work in 1986 and 1987, during which the main dam was rehabilitated and the spillway was rebuilt and enlarged in conformance with Colorado dame safety regulations. The storage capacity of the reservoir after rehabilitation was 5,811 acre-feet (5,788 acre-feet of active storage). This left 292 acre-feet of the previous absolute storage decree un-restored as well as an additional conditional decree of about 1,051 acre-feet that could not be stored. The rehabilitation design included provisions to accommodate future restoration projects that would allow storage of the full complement of water rights. However, funds were not available at that time to allow for the needed additional construction work. In 1987, the ODRC was able to buy out the USBR Small Projects loan at a significantly discounted amount. This was made possible by a second loan from CWCB. A secondary benefit of doing so was that dam safety jurisdiction was transferred from the USBR to the Colorado State Engineer. The effect was that minimum flood surcharge requirements were reduced, which allowed increasing of the normal water storage level by 1.5 feet and provided for storing the remaining 292 acre-feet of the absolute storage right along with 83 acre-feet of the conditional storage right for a total volume of 6,186 acre-feet (6,163 acre-feet of storage). The construction to allow that additional storage was completed in 1991.

The ODRC provides irrigation water to an area that encompasses about 20 sq miles and is physically located such that it can provide water to a much larger area of about 450 sq miles, which extends from Paonia Reservoir on the east to Orchard City on the west, north of the North Fork of the Gunnison River. Irrigated acreage within the service area is primarily used to raise pasture and crops such as hay, grains, corn and fruit. The ODRC system provides water to a total of over 6,000 irrigated acres. There are a total of 122 water users irrigating farm areas varying from 1 to 700 acres, averaging about 70 acres.

Historical Reservoir Level Elevation versus Fill/Drawdown Time

In order to evaluate the time increments during which wetlands and fen areas have historically been inundated by the reservoir, fill/drawdown data was collected for the period since 1987. This data was obtained from: 1) Official storage records maintained by the Colorado Division of Water Resources; 2) Instrument monitoring records from the files of the ODRC and the Colorado Division of Water Resources, Dam Safety Department; 3) Official ditch diversion records from the Colorado Division of Water Resources; 4) Personal records of the local water commissioner of Colorado Division of Water Resources) (CDWR 2007); and 5) First-hand observations of ODRC and Western Engineers.

The historical records provide nineteen (19) years of water level history data (from 1988 through 2007) for Overland Reservoir (no records were available for the year 1991). Because the measurements are periodic, the exact dates for fill and start of drawdown are not generally identified. These dates were interpolated using a combination of the following methods:

- The fill and drawdown Reservoir Level Elevation (RLE) vs. time (month/day) slopes were extended to full stage (Figure A1, in Appendix) as appropriate.

- It was possible to compare the interpolated fill RLE vs. time slopes with the range of typical slopes to judge their reasonableness. This was possible because of the consistency in fill RLE vs. time slopes between known data points (Figure A1).

- Time brackets were estimated when drawdown would have likely started. This estimation was made from the records of ditch diversions (both diversion initiation date and quantity). The rate of ditch diversions also provided a means to check the RLE vs. time slope during the early stages of drawdown.

- The magnitude of spills provided a means to estimate time brackets for both fill date and date of drawdown initiation. This estimate was made possible by records maintained by the local water commissioner (CDWR 2007) of spill flows since 2004.

It should be noted that there was generally sufficient data so that the actual date for either fill or start of drawdown would not deviate from the estimated date based on the interpolation by more than a few days.

The resulting historic RLE vs. time patterns are shown on Figure A1. The lowest point of the historically inundated wetlands and fens experiences the greatest inundation time of the wetland/fen areas. In other words, these points have historically been and will continue to be subject to longest submergence. The lowest point for historically inundated wetlands is delineation point N11 (refer to the JD request, WWE 2007) at an elevation of 9,876.04 feet. The lowest point for historically inundated fen is delineation point F6-9 (WWE 2007) at an elevation of 9,886.73 feet. The wetland and fen delineation elevation is shown in Figures A1-A3 for comparison.

Estimate of Wetland (Including Fen) Inundation Duration

In order to visualize the range of historic wetlands inundation time intervals, the RLE vs. time data was normalized so that each year is centered at its maximum fill point (Figure A2). This was done by shifting the time reference for each year's data so that a zero date occurs either at the point of maximum storage or at the middle of the full stage time period. This also allowed for determination of a median RLE vs. time relationship. It should be noted that there were no individual years which closely matched the median of the daily data, so the median RLE vs. time curve was determined based on connection of daily median values rather than selection of a single year's data to represent the median. The normalized data are shown on Figure A2. The zero date shown was determined as described above with the negative date values representing the fill part of the cycle and the positive date values being the drawdown portion of the cycle. The following conclusions can be drawn from the data:

- The reservoir did not fill for four (4) of the 19 years evaluated (1988, 1990, 2000 and 2002). This means that during these 4 years the upper-most portion of the historically inundated wetlands and fen areas were not submerged. In 2002, the driest year during this period of record, the reservoir filled to only about half of its capacity and the maximum reservoir level elevation was 9,882.58 ft, significantly below the lowest elevation point in the fen areas. Therefore, in 2002 none of the fen areas were submerged.

- Excluding the year 2002, the year which exhibited the shortest duration of wetland/fen inundation was 1990 (Figure A3).

- The year during which the greatest duration of wetland/fen inundation occurred was 2005 (Figure A3).

- The median curve, determined as described above, is also shown on Figure A3.

Summary of Historical Overland Reservoir Wetland/Fen Inundation

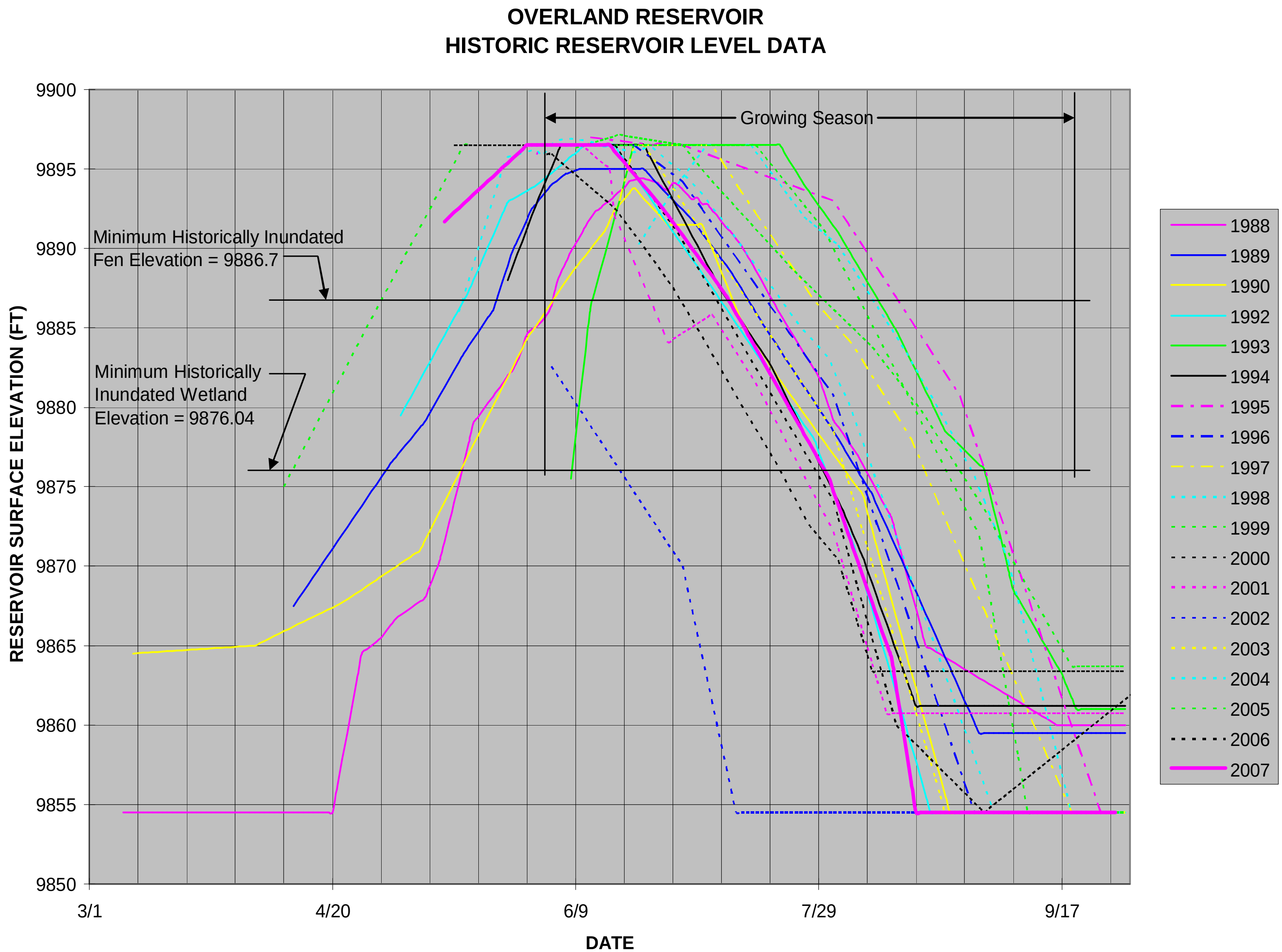
Table 2, below, tabulates a summary of the range of wetlands inundation periods at the current OHWL elevation (9,896.5 feet), at the minimum historically inundated wetland elevation (9,886.73 feet) and at the minimum historically inundated fen elevation (9,876.04 feet) for the historic data at the current OHWL.

Table 2. Inundation Period (days) of Wetland/Fen at Minimum and Maximum Elevations

Reservoir Operation Year	Inundation Period (Days) At Elevation 9,896.5 feet (Current OHWL)	Inundation Period (Days) at Elevation 9,886.73 feet (Minimum Fen Elevation)	Inundation Period (Days) at Elevation 9,876.04 feet (Minimum Wetland Elevation)
Minimum Year (1990)	**0** (did not fill)	**37** (6/4 through 7/11, 1990)	**79** (5/16 through 8/3, 1990)
Maximum Year (2005)	**60** (5/17 through 7/16, 2005)	**99** (4/30 through 8/7, 2005)	**134** (4/12 through 8/24, 2005)
Median	**17**	**56**	**93**

Conclusions

Historically, wetland submergence duration has varied up to 134 days, with a median duration of 93 days and fen submergence duration has ranged up to 99 days, typically lasting 56 days based on the median inundation period. The historically inundated wetlands and fens have persisted for nearly twenty (20) years throughout these periods of inundation.


OVERLAND RESERVOIR
HISTORIC RESERVOIR LEVEL DATA
Growing Season
Minimum Historically Inundated Fen Elevation = 9886.7
Minimum Historically Inundated Wetland Elevation = 9876.04
RESERVOIR SURFACE ELEVATION (FT)
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
3/1
4/20
6/9
7/29
9/17
DATE
1988
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1993
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2001
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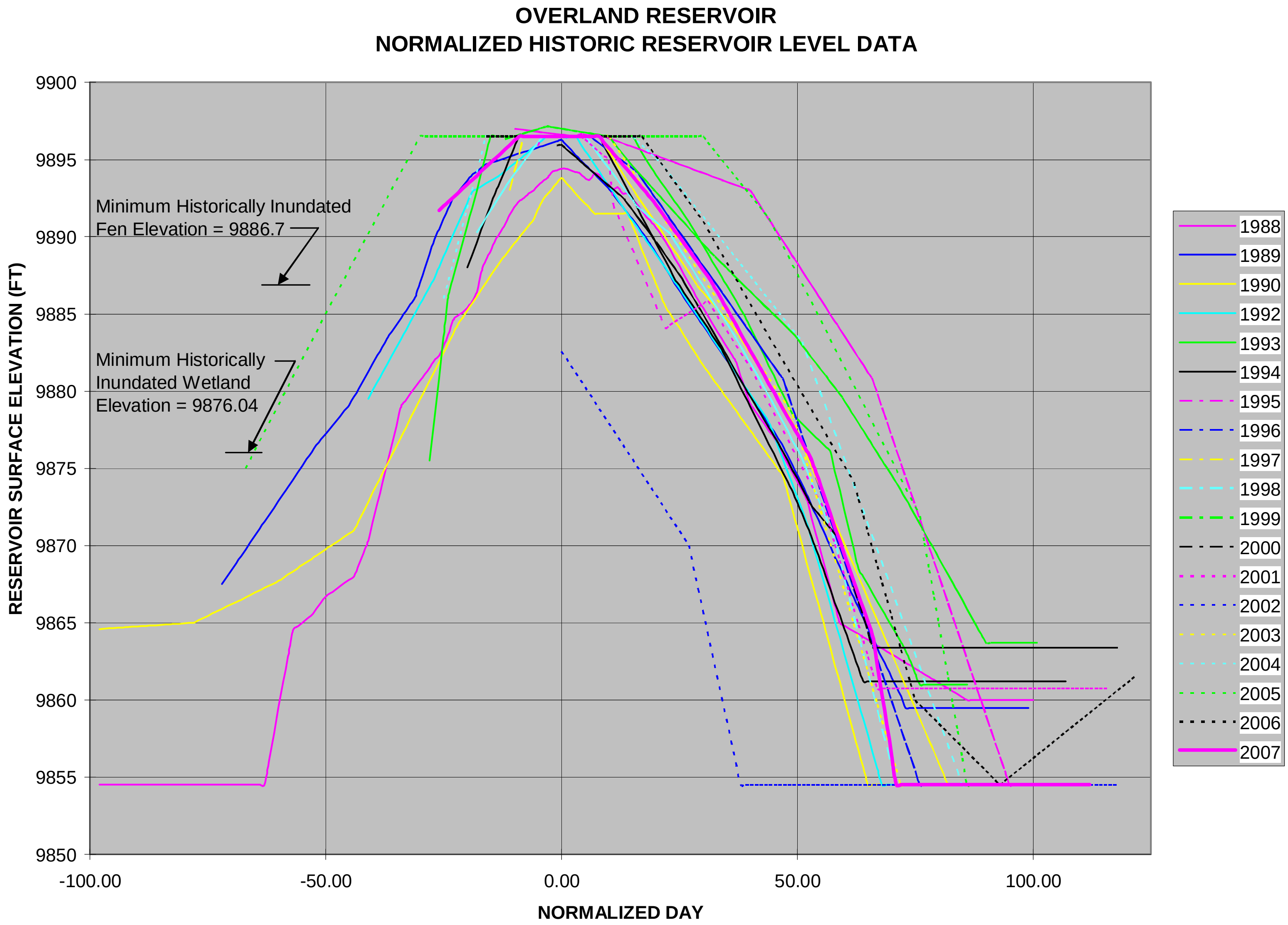
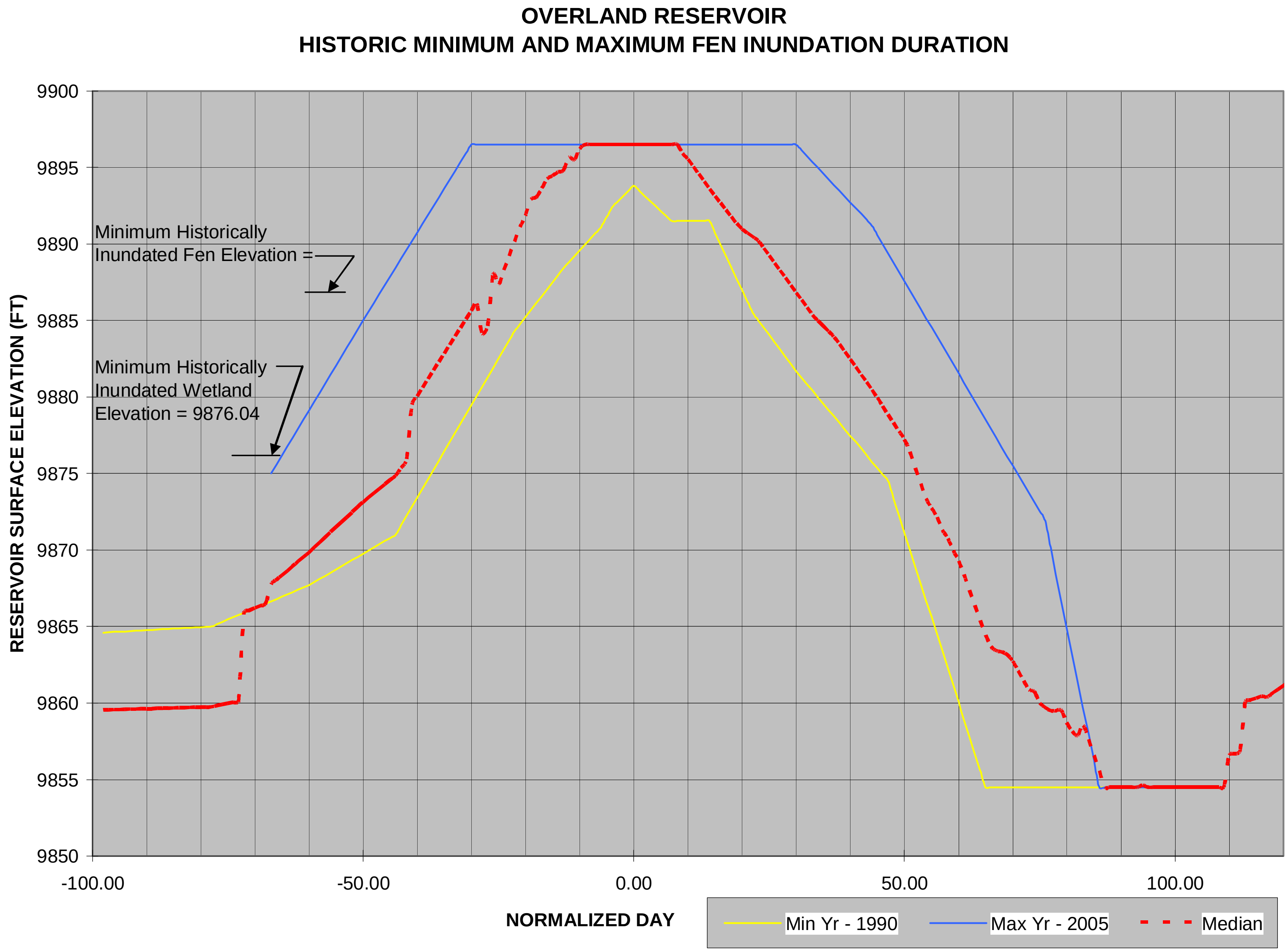
2003
2004
2005
2006
2007


OVERLAND RESERVOIR
NORMALIZED HISTORIC RESERVOIR LEVEL DATA
RESERVOIR SURFACE ELEVATION (FT)
NORMALIZED DAY
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
-100.00
-50.00
0.00
50.00
100.00
Minimum Historically Inundated Fen Elevation = 9886.7
Minimum Historically Inundated Wetland Elevation = 9876.04
1988
1989
1990
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007



OVERLAND RESERVOIR
HISTORIC MINIMUM AND MAXIMUM FEN INUNDATION DURATION
RESERVOIR SURFACE ELEVATION (FT)
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
Minimum Historically Inundated Fen Elevation =
Minimum Historically Inundated Wetland Elevation = 9876.04
-100.00
-50.00
0.00
50.00
100.00
NORMALIZED DAY
Min Yr - 1990
Max Yr - 2005
Median

APPENDIX B - PHOTOGRAPHS OF OVERLAND RESERVOIR WETLAND

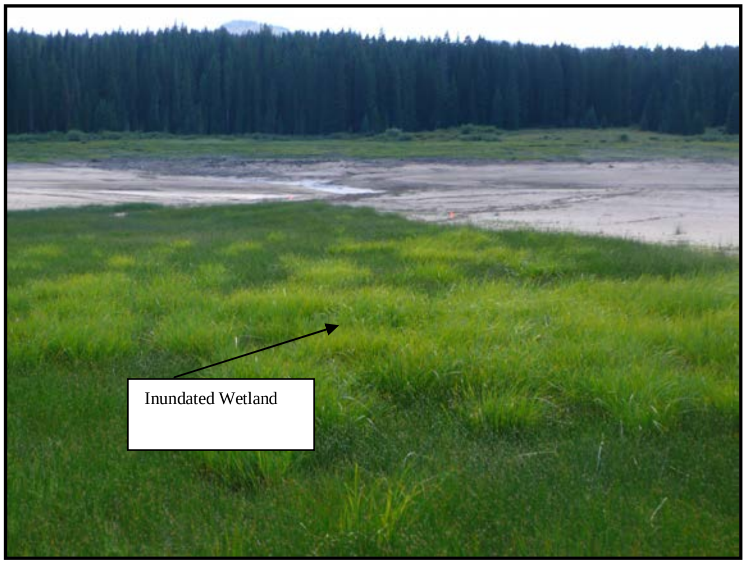
Carex in Fen 7

Carex in Fen 7 – Exposed to Growing Season

Carex in Fen 7

Sampling Soils in Fen 2

Sampling Soils in Fen 6



Looking west below Fen 6
Nearby lowest fen elevation

APPENDIX C

Estimation of Growing Season

Western Engineers, Inc.

General

For the purpose of this report, the wetlands growing season is defined as recommended by the Corps of Engineers (COE 1992):

> "Growing season starting and ending dates will generally be determined based on the '28 degrees F or lower' temperature threshold at a frequency of '5 years in 10'."

Since no U.S. National Resource Conservation Service WETS (Wetland Determination) station is located near the Overland Reservoir, it was necessary to estimate the growing season indirectly. This was accomplished by comparing the results of three methods which are described in the following paragraphs.

Correlation Using Applicable WETS Stations

The data was obtained for all of the WETS stations in the local county (Delta) and the immediate adjacent counties (Garfield, Gunnison, Mesa, Montrose and Pitkin). The growing season was correlated against station elevation. Correlations were produced for each of the WETS growing season probabilities (50% - average, 70% - likely) and index temperatures (24, 28 and 32 degrees F). Following is the list of WETS stations within this local county area:

Delta County:
- Delta
- Paonia 1 SW

Garfield County:
- Altenbern
- Glenwood Springs # 2
- Rifle
- Shoshone

Gunnison County:
- Blue Mesa Lake
- Cimarron
- Cochetopa Creek
- Crested Butte
- Gunnison 1 N
- Taylor Park

Mesa County:
- Collbran
- Colorado National Monument
- Fruita 1 W
- Gateway 1 SE
- Grand Junction WSO
- Grand Junction 6 ESE
- Palisade

Montrose County:
- Montrose 2
- Uravan

Pitkin County:
- Aspen 1 SW

The 21 WETS stations listed above included only one station above the 9,200 ft elevation – Taylor Park in Gunnison County. The reference elevation used for Overland wetlands is 9,890. Therefore, the data from the WETS stations in the six local and adjacent counties did not include sufficient information to satisfactorily extend the correlation to elevations at and above that for Overland Reservoir. Therefore, the data set was expanded by including all other WETS stations in Colorado near and above elevation 8,000. This added the 28 stations listed below:

Alamosa County:
- Great Sand Dunes, Elev 8120

Boulder County:
- Gross Reservoir, Elev 7,920

Chaffee County:
- Buena Vista, Elev 7,930

Clear Creek County:
- Cabin Creek, Elev 10,020

Custer County:
- Westcliffe, Elev 7,860

Dolores County:
- Rico, Elev 8,780

Eagle County:
- Meredith, Elev 7,830

El Paso County:
- Ruxton Park, Elev 9,050

Fremont County:
- Guffey, Elev 8,200

Grand County:
- Grand Lake 1 NW, Elev 8,720
- Grand Lake 6 SSW, Elev 8,290

Hinsdale County:
- Lake City, Elev 8,670
- Rio Grande Reservoir, Elev 9,460

Jackson County:
- Spicer, Elev 8,340
- Walden, Elev 8,120

Lake County:
- Climax, Elev 11,350
- Leadville, Elev 9,940
- Sugarloaf Reservoir, Elev 9,740
- Twin Lakes Reservoir, Elev 9,200

Mineral County:
- Hermit, Elev 9,000
- Wolf Creek Pass, Elev 10,640

Park County:
- Antero Reservoir, Elev 8,920
- Grant, Elev 8,670
- Lake George, Elev 8,520

Rio Grande County:
- Del Norte, Elev 7,880

Routt County:
- Pyramid, Elev 8,010
- Yampa, Elev 7,890

Saguache County:
- Sargents, Elev 8,470

San Juan County:
- Silverton, Elev 9,270

San Miguel County:
- Telluride, Elev 8,800

Summit County:
- Breckenridge, Elev 9,580
- Dillon, Elev 9,060

The Winter Park WETS station (Grand County) was not included in the data set even though it is at elevation 9,060 because it clearly falls well outside a trend established by the data from stations listed above. Polynomial regression curves were calculated for this set of data. The 95% and 50% confidence intervals were also determined for the regression curves. The confidence intervals represent statistical ranges of the growing season start and end dates which possess the specified probability that the values would continue to lie within the range with either the addition of data or a different data set from the same region. Additionally, calculations were made for the 95% prediction interval, which represents the range within which there is a 95% probability that all data points from unrepresented locations (locations not included in the data set) within the region would lie. The resulting data points, regression curves and statistical intervals are shown on Figures C-1 through C-6. Tables 1 and 2 below summarize the resulting growing season dates along with the calculated statistical parameters at the Overland wetlands reference elevation (9,890):

Table 1. Estimate of Growing Season Based on Regression

Index Temperature (ºF)	Probability that the Growing Season Will Fall Within the Dates (%)	Growing Season Limit	Date of Growing Season Limit	Regression Curve Correlation Coefficient (R^2)
24	50	Begin	5/31	0.83
24	50	End	9/18	0.71
28	50	Begin	6/18	0.83
28	50	End	9/7	0.73
32	50	Begin	7/4	0.78
32	50	End	8/23	0.73
24	70	Begin	5/25	0.83
24	70	End	9/24	0.79
28	70	Begin	6/12	0.83
28	70	End	9/12	0.75
32	70	Begin	6/12	0.79
32	70	End	9/12	0.73

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Table 2. Growing Season Regression Statistical Parameters

Index Temperature (ºF)	Probability that the Growing Season Will Fall Within the Dates (%)	Growing Season Limit	95% Confidence Interval (Days Prior to or After Regression Date)	50% Confidence Interval (Days Prior to or After Regression Date)	95% Prediction Interval (Days Prior to or After Regression Date)
24	50	Begin	5.5	2.5	20
24	50	End	4.5	2	17.5
28	50	Begin	5.5	2.5	22
28	50	End	5.5	2.5	20.5
32	50	Begin	6.5	3	25
32	50	End	5.5	2.5	22
24	70	Begin	5.5	2.5	20
24	70	End	4.5	2	17.5
28	70	Begin	5.5	3	21
28	70	End	5	2	19
32	70	Begin	6	3	24.5
32	70	End	5.5	3	21.5

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Correlation Using Nearby Climatological Stations

It is seen from the previous paragraph that, even though the confidence intervals using data from the WETS stations listed are quite narrow, the prediction intervals are relatively wide. This means that, although the addition of data from other locations would not be expected to result in substantial changes in the regression curves, the actual growing season dates for Overland Reservoir could vary within a fairly wide range. There are two climatological stations that are close to Overland Reservoir and at about the same elevation, but are not included within the WETS system because their periods of record are shorter than the minimum 30 years required for the WETS system. One of these stations is Bonham Reservoir located about 14 miles west of Overland Reservoir at elevation 9,915 with a useable period of record from March, 1970 through May, 1971 and September, 2003 through July, 2008. The second nearby station is Mesa Lakes, approximately 24 miles west of Overland Reservoir at an elevation of 9,806 with a useable period of record from September, 1971 through March, 1979. Daily minimum and maximum temperature records are available for these stations from the National Oceanic and Atmospheric Administration (NOAA), National Climate Data Center (NCDC). The growing season was calculated from the data for these two stations using the NRCS WETS procedure as follows:

> The growing season is defined as the period for each year during which the temperature has not fallen below the index value. The beginning of the growing season is the last occurrence of the index temperature on, or prior to, July 31. The end of the growing season is the first occurrence of the index temperature on, or after, August 1.

In order to determine the 50% and 70% probability for each of the index temperatures, a normal distribution curve was best-fit to the frequency/date histogram for each individual index temperature. The 70%, 50% and 30% percentile values were then determined from the normal distribution of the data.

Because the temperature data records for these two stations do not overlap, it was possible to combine the two data sets and effectively extend the combined period of record. Combining the data from the two stations seemed appropriate for the following reasons:

- The two stations are generally within the same meteorological regime.
- The two stations are within 110 feet in elevation and bracket the Overland wetlands reference elevation.

Therefore, the growing season dates were also determined for this combined data set in a similar manner to that described above for the separated data.

The results of the growing season data analysis for Bohnam Reservoir, Mesa Lakes and the combined data are shown on Figures C-1 through C-6 and are summarized in Table 3 below and compared with the result of the WETS station regression evaluation:

Table 3. Comparison of Growing Season Characteristics Resulting From Various Evaluation Methods

Index Temperature (ºF)	Probability that the Growing Season Will Fall Within the Dates (%)	Growing Season Limit	Date of Growing Season Limit From WETS Station Regression	Date of Growing Season Limit From Bonham Reservoir Data	Date of Growing Season Limit From Mesa Lakes Data	Date of Growing Season Limit From Combined Data
24	50	Begin	5/31	5/28	6/5	6/1
24	50	End	9/18	9/14	9/30	9/23
28	50	Begin	6/18	6/14	6/9	6/11
28	50	End	9/7	9/3	9/13	9/8
32	50	Begin	7/4	7/2	6/30	7/1
32	50	End	8/23	8/29	9/1	8/31
24	70	Begin	5/25	5/20	5/30	5/25
24	70	End	9/24	9/21	10/3	9/30
28	70	Begin	6/12	6/7	6/2	6/5
28	70	End	9/12	9/8	9/22	9/16
32	70	Begin	6/12	6/19	6/18	6/19
32	70	End	9/12	9/6	9/11	9/8

It is seen that the results of the regression analysis performed on data from the Colorado WETS stations compare closely (within a few days) with the growing season values calculated from the Bonham Reservoir and Mesa Lakes data. Therefore, the WETS regression analysis and Bonham Reservoir/Mesa Lakes evaluation are mutually validating. In general, the Bonham Reservoir/Mesa Lakes data produces either essentially no change or an increase in growing season length. Only the data for the 70% probability that the growing season will fall within the indicated time period for the 32 degree index temperature exhibits a slight decrease in growing season length.

Data From The Overland Reservoir SNOTEL Station

The U.S. National Resource and Conservation Service (NRCS) operates Snowpack Telemetry (SNOTEL) stations which collect continuous climatological data including snow depth, snow water equivalent, precipitation, and temperature. There is a SNOTEL station very close (less than a mile) from Overland Reservoir and at about the same elevation (elevation = 9840 – 50 feet below the reference elevation used for Overland wetlands of 9,890). SNOTEL data is not included in the WETS system. The Overland Reservoir SNOTEL data includes a useable period of record from October, 1989 through the present. The SNOTEL temperature sensors were inoperable for the period from the last half of 2006 through the middle of 2007 resulting in a useful period of record of 18 years. Daily minimum and maximum temperature records are available for this station from the NRCS, National Water and Climate Center (NWCC). The growing season was calculated from the data for these two stations using the NRCS WETS procedure as previously described.

In order to determine the 50% and 70% probability for each of the index temperatures, a normal distribution curve was best-fit to the frequency/date histogram for each individual index temperature. The 70%, 50% and 30% percentile values were then determined from the normal distribution of the data.

The results of the growing season data analysis for the Overland Reservoir SNOTEL station are shown on Figures C-1 through C-6 and are summarized in Table 4 below and compared with the result of the WETS station regression evaluation as well as the analysis of data from the Mesa Lakes and Bonham Reservoir climatological stations:

Table 4. Comparison of Growing Season Characteristics Resulting From Various Evaluation Methods

Index Temperature (°F)	Probability that the Growing Season Will Fall Within the Dates (%)	Growing Season Limit	Date of Growing Season Limit From WETS Station Regression	Date of Growing Season Limit From Bonham Reservoir Data	Date of Growing Season Limit From Mesa Lakes Data	Date of Growing Season Limit From Overland Reservoir SNOTEL Data
24	50	Begin	5/31	5/28	6/5	5/21
24	50	End	9/18	9/14	9/30	9/27
28	50	Begin	6/18	6/14	6/9	6/2
28	50	End	9/7	9/3	9/13	9/19
32	50	Begin	7/4	7/2	6/30	6/30
32	50	End	8/23	8/29	9/1	9/11
24	70	Begin	5/25	5/20	5/30	5/15
24	70	End	9/24	9/21	10/3	10/4
28	70	Begin	6/12	6/7	6/2	5/24
28	70	End	9/12	9/8	9/22	9/25
32	70	Begin	6/12	6/19	6/18	6/13
32	70	End	9/12	9/6	9/11	9/17

The above tabulation shows that the results of the Overland Reservoir SNOTEL data analysis indicated a growing season consistently longer than the results from evaluation of the other data sets. For example, the growing season for the pertinent wetlands index temperature and frequency (28 degrees F or lower temperature threshold at a frequency of 5 years in 10) based on the Overland SNOTEL data is longer than that determined using the other data sets by a range of 13 to 28 days (longer by 14 to 34 percent). However, it should also be noted that the growing season based on the Overland SNOTEL data falls well within the 95 percent prediction intervals which resulted from analysis of the applicable WETS stations throughout Colorado as previously described (See figures C-1 through C-6). There could be a number of reasons for the differences between the Overland SNOTEL data and the Mesa Lakes/Bonham Reservoir data. Even though all three stations are located in the Grand Mesa vicinity and are at about the same elevation, Mesa lakes and Bonham Reservoir are located on the northern flank of the Mesa while Overland Reservoir is on the eastern (downwind) end. It would, therefore, not be unexpected for the climatological regimes to vary significantly. The combined data for the Mesa Lakes and Bonham Reservoir stations encompassed 11 years. Only four of those years overlapped with the 18 year useable period of record from the Overland SNOTEL station. Consequently, the Overland SNOTEL period of record not only extended to a much longer time range, but practically represented a different time interval. The regression analysis from the WETS station data compares closely (16 days difference or less) with the growing season lengths calculated from the Bonham Reservoir and Mesa Lakes data. The results of the data analyses from the Overland SNOTEL station are used for the estimate of the growing season for Overland Reservoir as presented in this report for the following reasons:

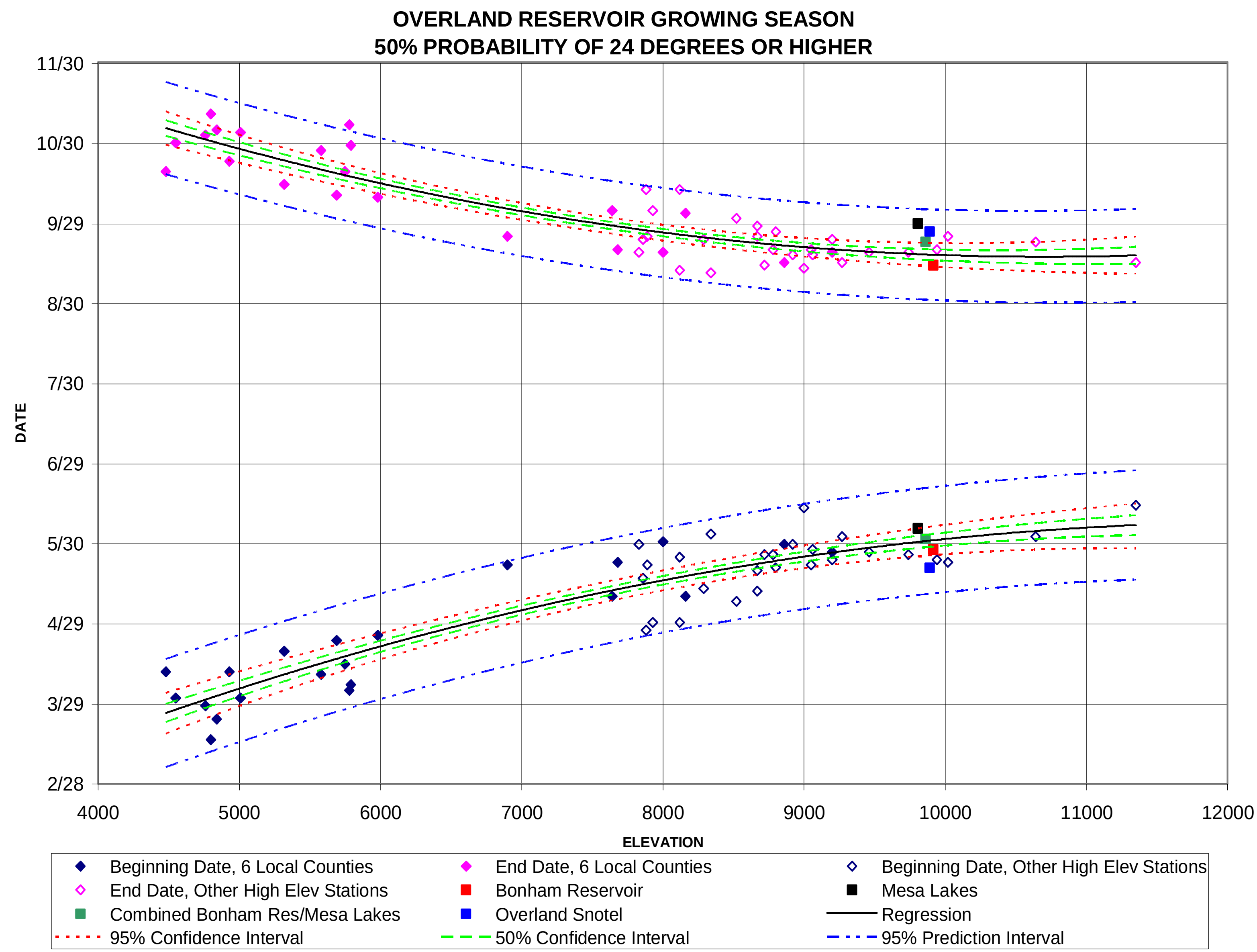
- The data from the Overland SNOTEL station represents the longest period of record of the Grand Mesa stations evaluated (Bonham Reservoir, Mesa Lakes and Overland SNOTEL).

- The Overland SNOTEL station is very near the Overland Reservoir and likely provides the best representation of the climatological conditions at Overland.

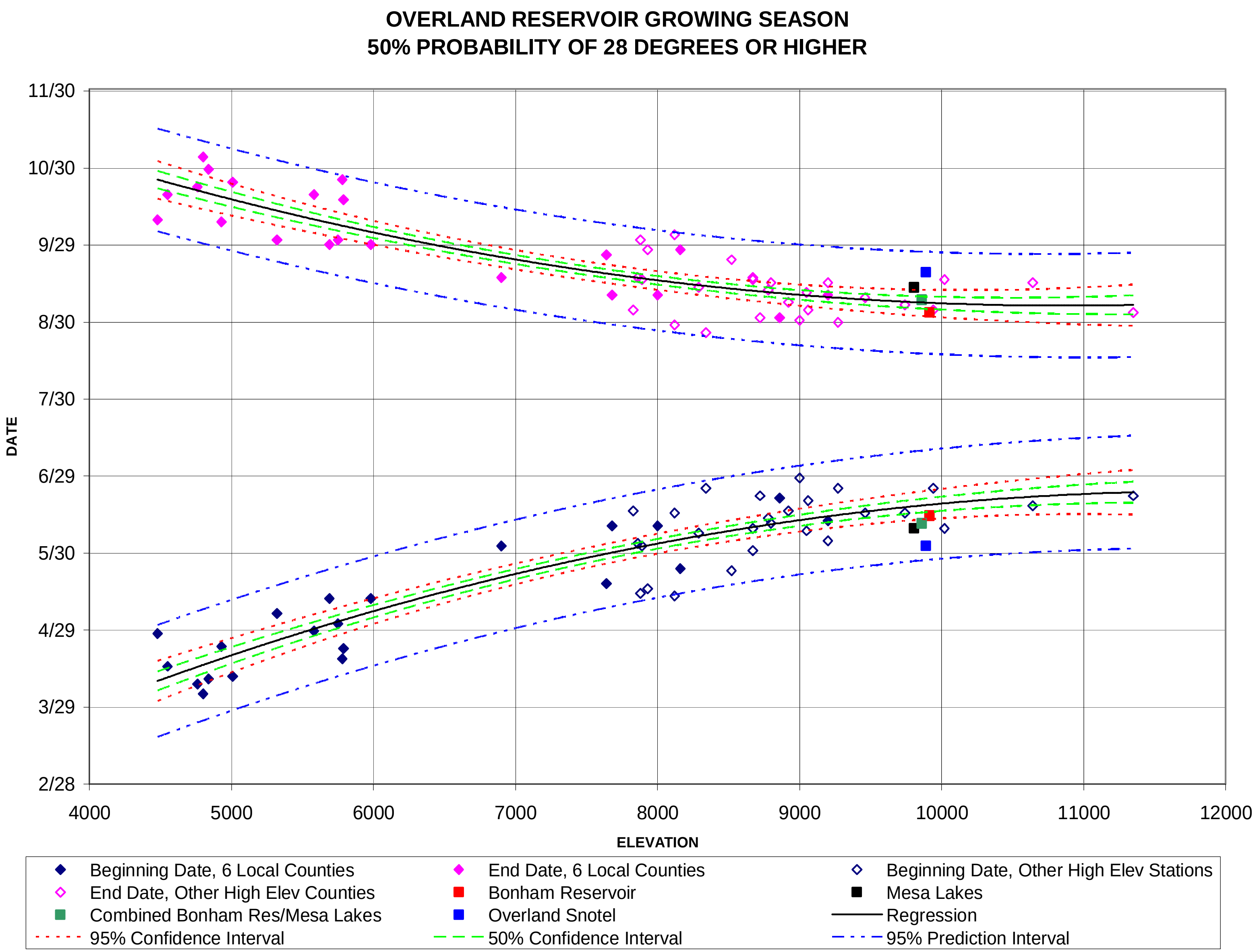
- There is a relatively long useable period of record (18 years) for the Overland SNOTEL station.

- The results of the growing season analysis performed on the data from the Overland SNOTEL station produced beginning and ending dates that were well within the 95 percent prediction intervals resulting from growing season analyses of applicable Colorado WETS stations.

It is interesting to not that all three of the Grand Mesa stations which were evaluated (Bonham Reservoir, Mesa Lakes and Overland SNOTEL) produced growing season lengths which were exactly the same, or longer than the growing season intervals resulting from analyses of the applicable Colorado WETS stations. This suggests a possibility that the Grand Mesa climate for elevations near 10,000 ft MSL produces growing season intervals longer than typical for areas at the same elevation in other locations of Colorado.



OVERLAND RESERVOIR GROWING SEASON
50% PROBABILITY OF 24 DEGREES OR HIGHER
11/30
10/30
9/29
8/30
7/30
6/29
5/30
4/29
3/29
2/28
DATE
4000
5000
6000
7000
8000
9000
10000
11000
12000
ELEVATION
Beginning Date, 6 Local Counties
End Date, 6 Local Counties
Beginning Date, Other High Elev Stations
End Date, Other High Elev Stations
Bonham Reservoir
Mesa Lakes
Combined Bonham Res/Mesa Lakes
Overland Snotel
Regression
95% Confidence Interval
50% Confidence Interval
95% Prediction Interval


OVERLAND RESERVOIR GROWING SEASON
50% PROBABILITY OF 28 DEGREES OR HIGHER
DATE
11/30
10/30
9/29
8/30
7/30
6/29
5/30
4/29
3/29
2/28
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9000
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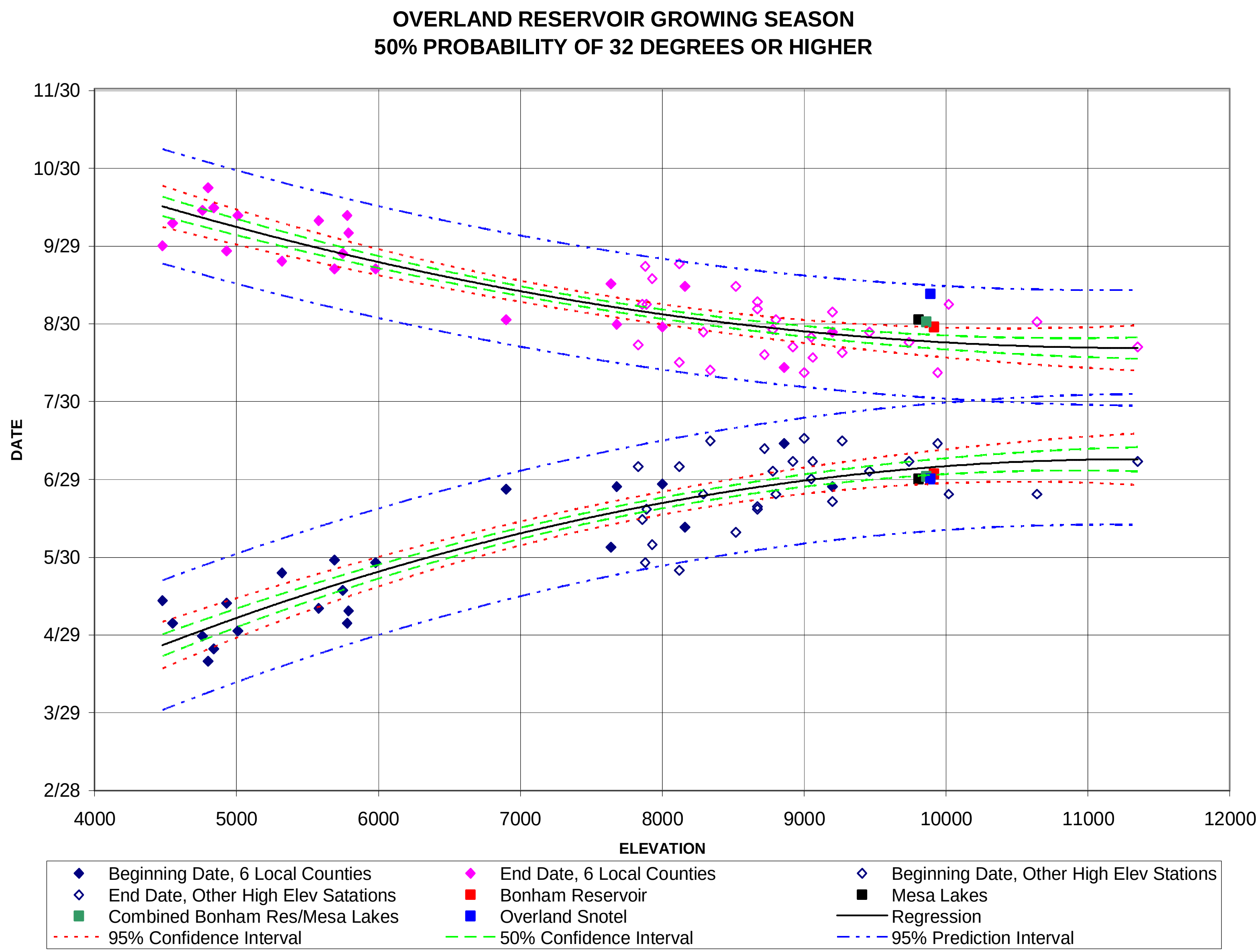
11000
12000
ELEVATION
Beginning Date, 6 Local Counties
End Date, 6 Local Counties
Beginning Date, Other High Elev Stations
End Date, Other High Elev Counties
Bonham Reservoir
Mesa Lakes
Combined Bonham Res/Mesa Lakes
Overland Snotel
Regression
95% Confidence Interval
50% Confidence Interval
95% Prediction Interval


OVERLAND RESERVOIR GROWING SEASON
50% PROBABILITY OF 32 DEGREES OR HIGHER
DATE
11/30
10/30
9/29
8/30
7/30
6/29
5/30
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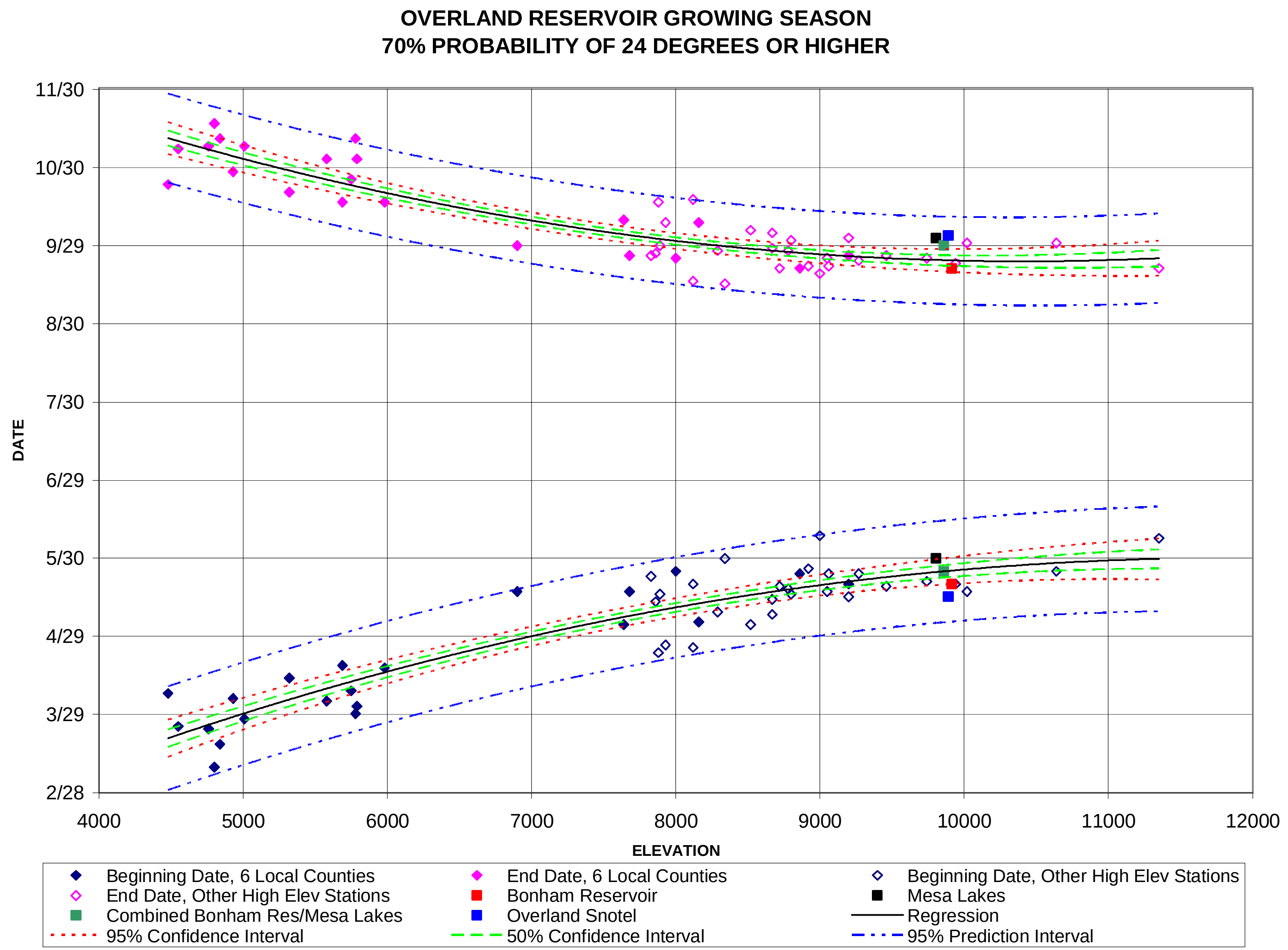
12000
ELEVATION
Beginning Date, 6 Local Counties
End Date, 6 Local Counties
Beginning Date, Other High Elev Stations
End Date, Other High Elev Satations
Bonham Reservoir
Mesa Lakes
Combined Bonham Res/Mesa Lakes
Overland Snotel
Regression
95% Confidence Interval
50% Confidence Interval
95% Prediction Interval



OVERLAND RESERVOIR GROWING SEASON
70% PROBABILITY OF 24 DEGREES OR HIGHER
DATE
11/30
10/30
9/29
8/30
7/30
6/29
5/30
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2/28
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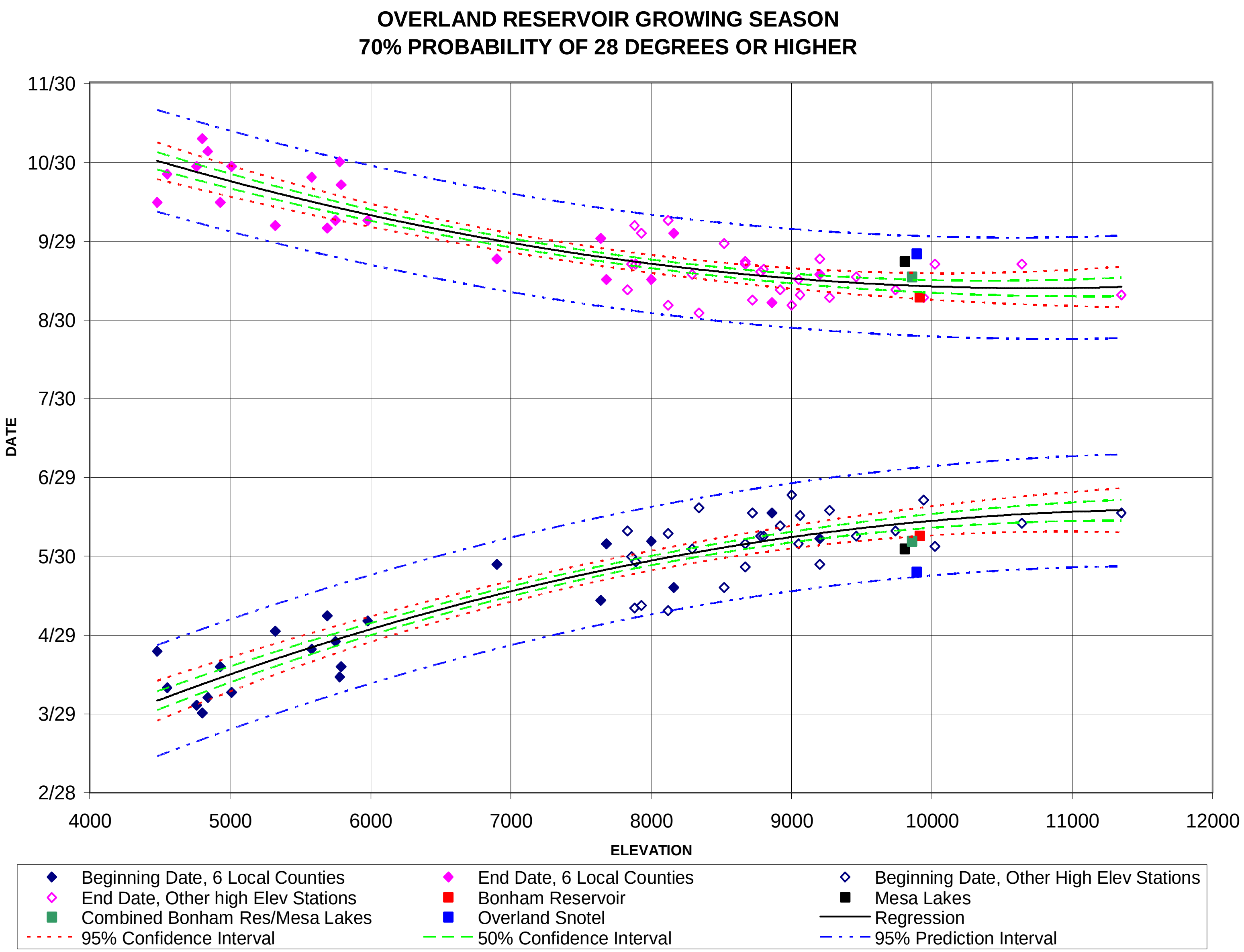
11000
12000
ELEVATION
Beginning Date, 6 Local Counties
End Date, 6 Local Counties
Beginning Date, Other High Elev Stations
End Date, Other High Elev Stations
Bonham Reservoir
Mesa Lakes
Combined Bonham Res/Mesa Lakes
Overland Snotel
Regression
95% Confidence Interval
50% Confidence Interval
95% Prediction Interval



OVERLAND RESERVOIR GROWING SEASON
70% PROBABILITY OF 28 DEGREES OR HIGHER
11/30
10/30
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DATE
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ELEVATION
Beginning Date, 6 Local Counties
End Date, 6 Local Counties
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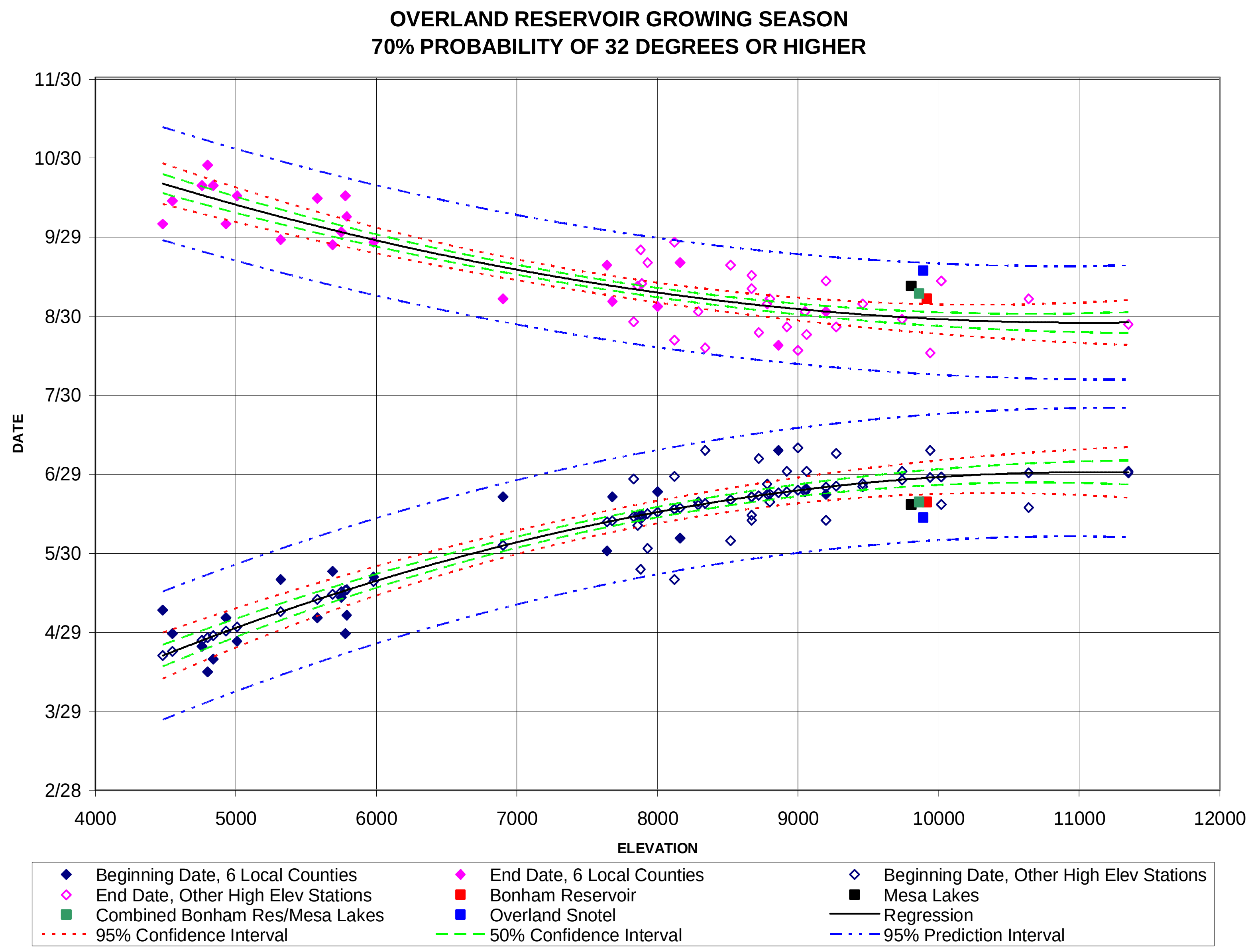
Bonham Reservoir
Mesa Lakes
Combined Bonham Res/Mesa Lakes
Overland Snotel
Regression
95% Confidence Interval
50% Confidence Interval
95% Prediction Interval


OVERLAND RESERVOIR GROWING SEASON
70% PROBABILITY OF 32 DEGREES OR HIGHER
DATE
11/30
10/30
9/29
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7/30
6/29
5/30
4/29
3/29
2/28
ELEVATION
4000
5000
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9000
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11000
12000
Beginning Date, 6 Local Counties
End Date, 6 Local Counties
Beginning Date, Other High Elev Stations
End Date, Other High Elev Stations
Bonham Reservoir
Mesa Lakes
Combined Bonham Res/Mesa Lakes
Overland Snotel
Regression
95% Confidence Interval
50% Confidence Interval
95% Prediction Interval

OVERLAND RESERVOIR

HYDROLOGIC YIELD ANALYSIS

Delta County, Colorado
September, 2012

Prepared for:

Overland Ditch and Reservoir Company
28444 Redlands Mesa Road
Hotchkiss, CO 81419

Prepared by:
Western Engineers, Inc.
2150 Highway 6 & 50
Grand Junction, CO 81505

[W.O. #3628-02-Y]

Table of Contents

INTRODUCTION

The purpose of this study is to determine the potential water available for storage at the existing Overland reservoir, the water from which is exclusively used for irrigation. The analyses provide estimates of the hydrologic yield statistics for the existing reservoir capacity (6,163 acre-feet of active storage), a currently proposed enlargement (7,171 acre-feet of active storage) and two larger sizes (7,500 and 8,000 acre-feet of active capacity). For the enlargement scenarios, the data includes yield values for both the total storage and the enlargement storage increments. The runoff from the Overland reservoir basin was estimated for the period between 1918 and 2011. While monthly data was used for the majority of the water availability determination, estimates of daily flows can be made by correlation with nearby stream gauging stations. The accuracy of daily flow estimates varies depending on the quality of the relationship between the Overland basin and the correlation basin, but would be useful for performing detailed reservoir operation simulations. Preparation of daily flow estimates for the full analysis period was beyond the scope of this investigation.

This study presents the result of the estimated runoff data and average yield. The data gathered and the results of the analyses are summarized in Tables 4, 6 and 7 and Figure 8.

DISCLAIMER

This report has been prepared exclusively for Overland Ditch and Reservoir Company. The analyses presented herein are applicable only to the referenced site. Neither Western Engineers, Inc. nor the Overland Ditch and Reservoir Company are responsible for misuse or misapplication of the information in this report. The contents of this report shall not be used for purposes other than reference without the prior written approval of the Overland Ditch and Reservoir Company and Western Engineers.

RESERVOIR OPERATION HISTORY AND RULES

History

Construction on the Overland ditch began in 1893. The original ditch and reservoir were completed in 1905. The initial capacity of the reservoir was about 2,500 acre-feet of irrigation water. During 1950 the reservoir was enlarged to a total active capacity of 6,290 acre-feet. Approximately 7 years after the enlargement and during the first complete filling, a settlement of 4 feet occurred on the crest near the right side of the outlet works, and so the State Engineer's Office restricted the maximum storage to gage height 40 (5,791 acre-feet of active storage). This restriction was in effect from 1957 to 1963. In 1963 a new wooden spillway was constructed near the left abutment of the main dam to limit the filling to 5,791 acre-feet of active storage, or

2.5 feet in elevation below the reservoir capacity after the 1950 enlargement. The reservoir storage level was further restricted to gauge height 35 in 1982 after surficial cracking was observed in the right embankment and abutment, reducing the allowable storage to about 4,517 acre-feet of active capacity. Work was performed in 1986 and 1987 to rehabilitate the main dam and rebuild and enlarge the spillway in conformance with dam safety regulations. The storage capacity of the reservoir after rehabilitation was 5,811 acre-feet (5788 acre-feet of active storage). In 1991, the storage capacity of the reservoir was increased to a total volume of 6,186 acre-feet (6,163 acre-feet of active storage).

Historic Operating Rules

Current operations involve closing the outlet gates to begin storage at the beginning of the storage year (November 1 through October 31). During the winter months (generally November through March) some water is stored, the amount of which varies depending on a combination of the previous year's runoff and the current year's precipitation and snowpack. The amount of water which has been stored during the winter has historically varied from about 50 to 1,020 acre-feet, averaging approximately 590 acre-feet. During spring runoff (generally April through June) the reservoir fills to its maximum storage level for the year. The date at which maximum storage is first achieved has historically varied from May 17 to August 2, averaging June 18. The date at which reservoir storage releases are initiated is dependent on when the Overland ditch is cleared of snow and ready to transport water to the service area. This has historically varied from May 22 to August 2, averaging June 22, and has become somewhat earlier over the years as means and efforts to clear the ditch as soon as possible have increased. Generally, direct diversions from Cow Creek to Overland ditch coincide with or start shortly prior to storage releases.

Between 1957 and 1985, the reservoir was under storage restrictions which varied as previously described. During the time period from 1957 through 1977, in order to facilitate maintaining the reservoir level below the restricted elevation, the outlet remained fully open until late winter or early spring, at which time it was fully closed to begin storage. The date for outlet closure varied depending on the level of winter snowpack through March or April. As runoff progressed, outlet releases would periodically be made to keep the reservoir level below the restriction elevation while still achieving maximum allowable storage. In order to achieve maximum allowable storage, it is likely that, in most years, releases would be made just prior to start of drawdown. During this period of time, it was possible to divert direct flow out of Cow Creek prior to initiating releases from reservoir storage. The year 1977 was the driest year of record for this area, and under the above operating rules, critical storage was lost during the winter months. Therefore, after 1977, the outlet gate was closed at the beginning of the storage year and outlet releases were exclusively relied on to maintain conformance with restrictions. These operating rules (during restricted storage) were identified based on examination of the records of the Cow Creek gauging station (station 13110, Figure 1 and Table 1) as will be discussed in subsequent paragraphs.

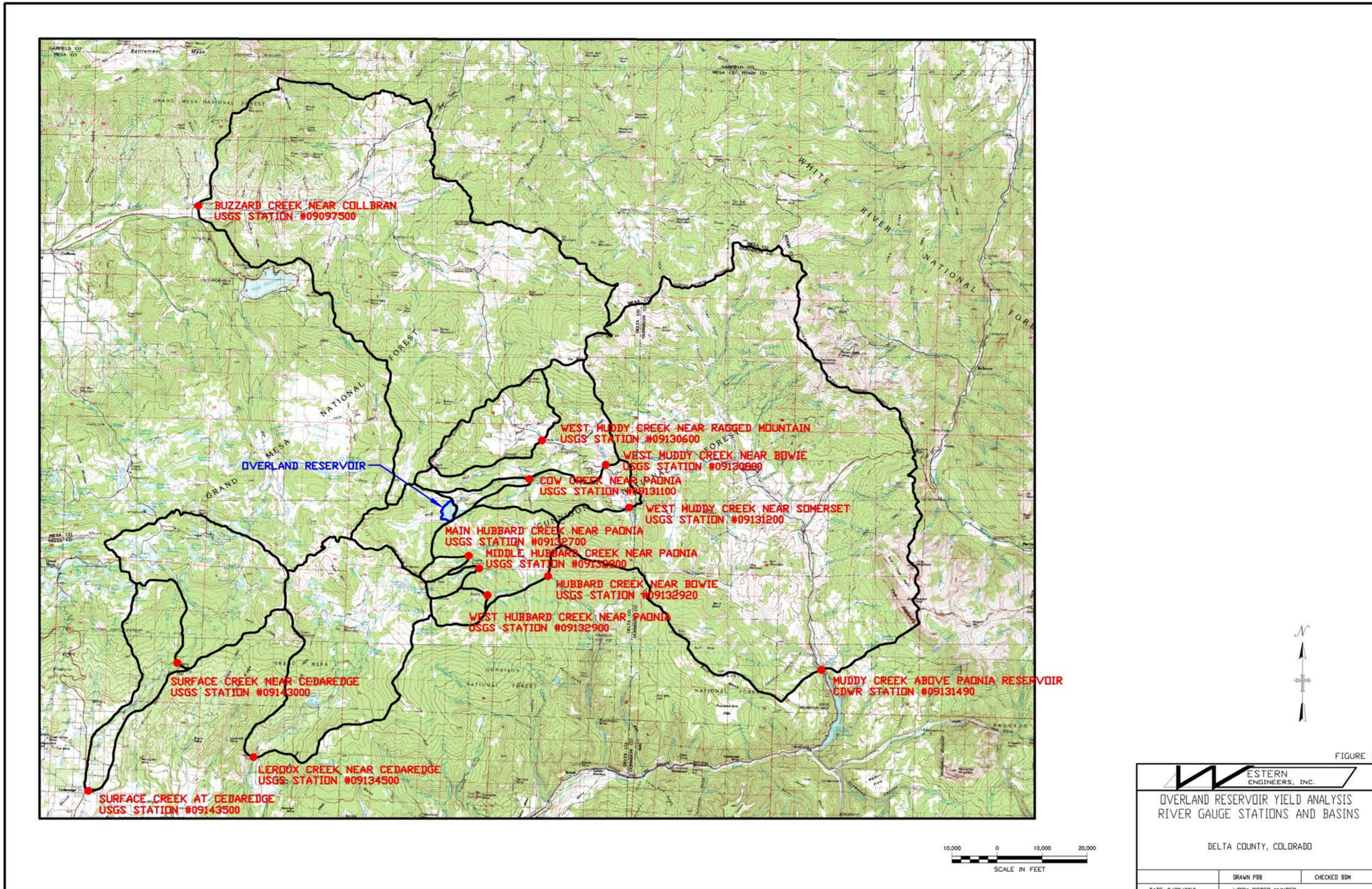

BUZZARD CREEK NEAR COLLBRAN
USGS STATION #09097500
WEST MUDDY CREEK NEAR RAGGED MOUNTAIN
USGS STATION #09130600
WEST MUDDY CREEK NEAR BOWIE
USGS STATION #09130800
OVERLAND RESERVOIR
COW CREEK NEAR PAONIA
USGS STATION #09131100
WEST MUDDY CREEK NEAR SOMERSET
USGS STATION #09131200
MAIN HUBBARD CREEK NEAR PAONIA
USGS STATION #09132700
MIDDLE HUBBARD CREEK NEAR PAONIA
USGS STATION #09132800
HUBBARD CREEK NEAR BOWIE
USGS STATION #09132920
WEST HUBBARD CREEK NEAR PAONIA
USGS STATION #09132900
SURFACE CREEK NEAR CEDAREDGE
USGS STATION #09143000
MUDDY CREEK ABOVE PAONIA RESERVOIR
CDWR STATION #09131490
LEROUX CREEK NEAR CEDAREDGE
USGS STATION #09134500
SURFACE CREEK AT CEDAREDGE
USGS STATION #09143500
N
10,000 0 10,000 20,000
SCALE IN FEET
FIGURE 1
WESTERN ENGINEERS, INC.
OVERLAND RESERVOIR YIELD ANALYSIS
RIVER GAUGE STATIONS AND BASINS
DELTA COUNTY, COLORADO
DRAWN PBB
CHECKED BDM
DATE: 9/28/2012
WORK ORDER NUMBER

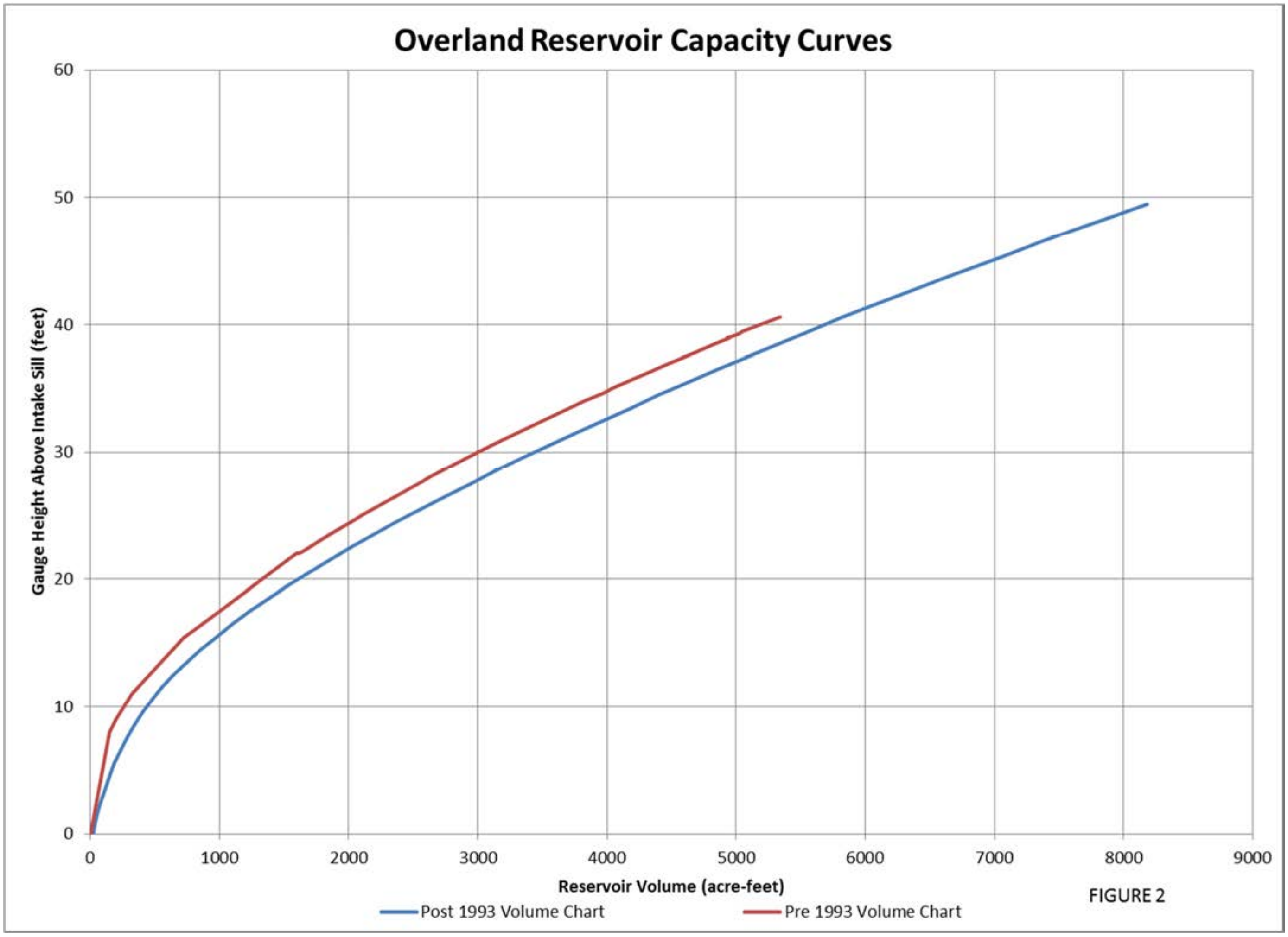
Table 1: Stream Gauging Stations Near Overland Reservoir

STATION NAME	FULL ID #	TRUNC. ID #	BASIN AREA (SQ MI)	ELEV. MIN (FT)	ELEV. MAX (FT)	PERIOD OF RECORD (YEARS)		MISSING/ INCOMPLETE YEARS
Buzzard Creek Below Owens Creek Near Heiberger	09096800	09680	49.7	8206	11146	1955	1970	Unknown
Buzzard Creek Near Colbran	09097500	09750	143.0	6955	11146	1921	1980	1921
Cow Creek Near Paonia	09131100	13110	12.0	9060	11310	1969	1982	
Hubbard Creek Near Bowie	09132920	13292	20.7	8440	11327	1968	1974	Unknown
Leroux Creek at Hotchkiss	09135900	13590	66.7	5315	11327	1976	1996	Unknown
Leroux Creek Near Cedaredge	09134500	13450	34.5	7255	11327	1936	1969	1936, 1957-1960
Leroux Creek Near Lazear	09135000	13500	51.8	6480	11327	1918	1926	Unknown
Main Hubbard Creek Near Paonia	09132700	13270	1.33	9710	11327	1960	1968	Unknown
Middle Hubbard Creek Near Paonia	09132800	13280	1.36	9650	11327	1960	1968	Unknown
Muddy Creek Above Paonia Reservoir	09131490	13149	237.5	6465	12720	1974	2012	1974, 1980, 1986-1988
Surface Creek at Cedaredge	09143500	14350	38.5	6220	11247	1917	2011	1917, 2000-2011
Surface Creek Near Cedaredge	09143000	14300	27.4	8261	11247	1939	2011	1939, 2000-2011
West Muddy Creek Near Bowie	09130800	13080	27.7	8240	11146	1968	1974	1968
West Hubbard Creek Near Paonia	09132900	13290	2.34	9640	11306	1960	1973	1960
West Muddy Creek Near Ragged Mountain	09130600	13060	7.42	8658	11146	1955	1965	1955
West Muddy Creek Near Somerset	09131200	13120	49.9	8020	11146	1961	1973	1961

OVERLAND BASIN HYDROLOGY

Drainage Area

Overland Reservoir is located in Western Colorado, in northern Delta County, approximately 40 miles east of Grand Junction and 10 miles north of Paonia as shown on Figure 1. The reservoir is contained by two homogeneous earth filled structures first built in 1905, enlarged twice since original construction, and rehabilitated in 1987. The main dam is on Cow Creek, which eventually drains into Muddy Creek, Paonia Reservoir and finally into the North Fork of the Gunnison River. The Overland drainage basin generally faces easterly, and most of the runoff occurs as a result of snowmelt. The basin area is 9.4 square miles and the elevation of the drainage area varies from 9,855 to 11,310 feet above mean sea level.



Stream Flow Data

Direct Records

There were no records available for direct flow into the Overland reservoir. At one time there was a gauging station located immediately upstream from the reservoir. However, the period of operation is unknown. We understand that the U.S. Forest Service may have these records, but we were unable to obtain them.

Reservoir storage records are available from the Colorado Division of Water Resources (CDWR) since 1970 (1981 and 1986 are missing). It should be noted that the storage records are based on two significantly different storage rating curves, one which was used prior to 1993 and one which was used for measurements in 1993 and later. The two curves are shown on Figure 2. The later curve is the more accurate of the two and, therefore, the CDWR data prior to 1993 was adjusted to match this later curve. Records of direct flow diversions out of Cow Creek into the Overland Ditch are also available for the period since 1975 (1976, 1977, 1981, 1986 and 2004 are missing). For years after 1987 during which the reservoir did not fill and for which there are complete records for both storage and direct diversions out of Cow Creek, the sum of storage and direct diversions represents practically the full year's basin runoff (not including water diverted to downstream senior water rights holders). That is because, after 1987, the outlet was closed at the beginning of the storage year (so that all winter flow was captured) and, if the reservoir did not fill, there are no spills which are unaccounted for. It should be noted, though, that the Cow Creek diversion records include a small amount of water which originates outside of the Overland reservoir drainage basin (the water commissioner estimates that this is less than about 5 to 10 percent of the total), and these combined records do not account for water diverted to satisfy late season calls by downstream senior water right holders (however, this is also a relatively small percentage of the total annual flow). Since these two missing portions of the record are minor and tend to offset, it was assumed that the effect on the overall annual yield volume is insignificant. These criteria apply to years 1991 and 2002.

There was a stream flow gauging station in operation on Cow Creek (station 13110, Figure 1 and Table 1) located about 4 stream miles downstream from Overland dam, between 1960 and 1973, a time period during which the Overland reservoir was under a storage restriction. This gauge would have measured all the flow originating in the Overland reservoir drainage basin less what was diverted into the Overland ditch (water stored in the reservoir and direct flow water which was diverted), plus runoff generated by the incremental drainage basin area tributary to the segment of stream channel between the dam and the gauging station. This incremental drainage basin area was relatively small (less than 20% of the total basin). Examination of the daily data for this station revealed several operational characteristics for the reservoir:

1. The date on which the outlet gate was closed for storage was apparent as a sudden substantial drop in flow rates during the winter period. That was the basis for the conclusion that, prior to 1977, the outlet remained open during the winter and was subsequently closed some time near the beginning of spring runoff, based on snowpack accumulation. It was also apparent that, after 1977, the outlet was closed in November. Prior to 1977 the winter flow at the Cow Creek station averaged substantially greater than after 1977.

2. The periodic outlet releases which were made in order maintain the storage restrictions are also apparent. They appear as sudden substantial upward spikes in flow that would last for a specific increment of time.

3. Reservoir spills, if any, also show as upward spikes in flow, but occur at the end of the filling cycle.

4. The date on which the reservoir was filled (in years during which filling occurred) coincides with the end of the final outlet or spill release.

5. Prior to 1977, winter flow through the reservoir is reflected in the gauging station records for at least a portion of the winter.

If there was a second stream flow gauging station that would provide high quality correlation with the Cow Creek station, it would be possible to combine the two in such a manner to provide a reasonably accurate calculation of the flow in Cow Creek at the reservoir. Such a station should meet the following criteria:

1. A drainage basin of approximately the same size and range of elevation as the Cow Creek station basin.

2. Close geographic proximity and similar geologic setting as the Cow Creek basin.

3. A period of record with a significant overlap with the Cow Creek station.

The West Hubbard station (13290, Figure 1 and Table 1) generally meets these criteria except for the basin size. There is an overlapping period of five years (1969 through 1973). The process of determining total annual flow into the reservoir using these records was as follows:

1. The start and end of storage dates were determined as described above.

2. The amount of water stored in Overland reservoir during a specific fill cycle was based on a combination of the storage records (adjusted as previously described) and the restriction capacity. If the record storage amount was close to the restriction value, it was assumed that the reservoir was filled to the restriction level.

3. The two hydrographs (Cow Creek and West Hubbard Creek) were overlaid and the West Hubbard hydrograph was scaled up so that the volume difference between the two hydrographs during the storage period equaled the storage amount for that year.

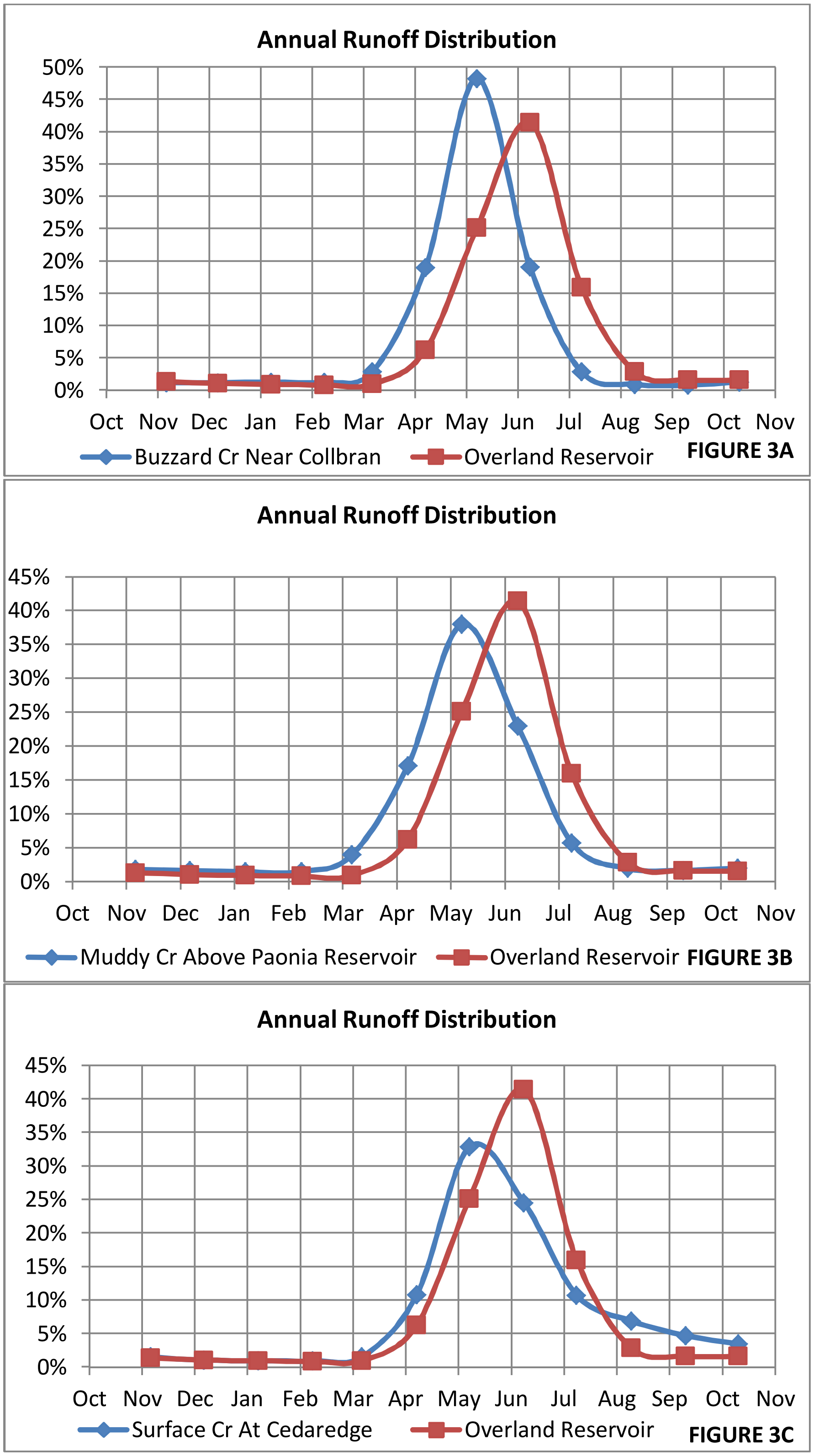
4. If the correlation is high quality, the scaled West Hubbard hydrograph should fairly accurately represent the total flow hydrograph at the Cow Creek gauging station. There are two ways to judge the quality of the scaling:

    a. The scaling factor required to match the storage volume should be fairly close to the ratio of the drainage basin area tributary to the Cow Creek station (11.7 square miles) to the drainage basin area above the West Hubbard station (2.34 square miles). The basin area ratio is 5.0 while the scaling factor varied from 3.9 to 5.3, averaging 4.6. The scaling factor would be expected to vary somewhat from the area ratio both on an annual basis as well as on a long-term average due to areal variations in precipitation, minor variations in geology, the difference in basin areas, a slight difference in basin orientation and other factors. However, the area ratio and average scaling factor are within 15% of each other which indicates a very high quality correlation.

    b. A good correlation should produce nearly the same flows from both sources during periods when the reservoir outlet gate is open and no storage or direct flow diversions from the stream are occurring. This can be best judged by comparing the winter Cow Creek flows with the scaled West Hubbard Creek flows. Visual examination of the overlaid hydrographs indicated that, for the majority of the time, the winter flows were close. The ratio of winter flow determined from West Hubbard Creek to that calculated from the Cow Creek data was found to vary from .74 to 1.23, averaging 1.00. The relatively closeness of the two winter flow estimates again indicates a high quality correlation.

During the remaining period of record for the Cow Creek station (1974 through 1982), there were no alternate stations which also included these years and satisfied most of the criteria described above for high quality correlation (see Table 1). The next closest to meeting the criteria (after West Hubbard Creek) was West Muddy Creek Near Bowie (station 13080, Figure 1 and Table 1), but its average basin elevation is significantly lower than the Overland basin (the minimum elevation for the West Muddy basin is about 1,600 feet lower than the Overland dam). Nevertheless, it would be desirable to extend the period of record for the flow which could be attributed to the Overland drainage basin beyond the 7 years described above. Therefore, the process described above for scaling the West Hubbard Creek hydrographs and using them as templates for the Overland flows was repeated for the West Muddy Creek data for the same period of years (1969 through 1973). This provided a means to compare the calculated annual flows produced by using the two different gauging stations as a basis. In order to do this, the temporal shift in runoff had to be accounted for. Because the West Muddy basin is lower in elevation than the Overland basin, the West Muddy snowmelt runoff is shifted earlier in the year (see Figure 3F and Table 2). Calculation of the centroids for the snowmelt runoff hydrographs (West Hubbard Creek vs. West Muddy Creek) suggested that the centroid shift varies by year from 5 to 35 days, averaging 24 days. The process therefore included shifting the West Muddy Creek snowmelt runoff earlier relative to the Cow Creek data.

Figure 3: Annual Runoff Distribution



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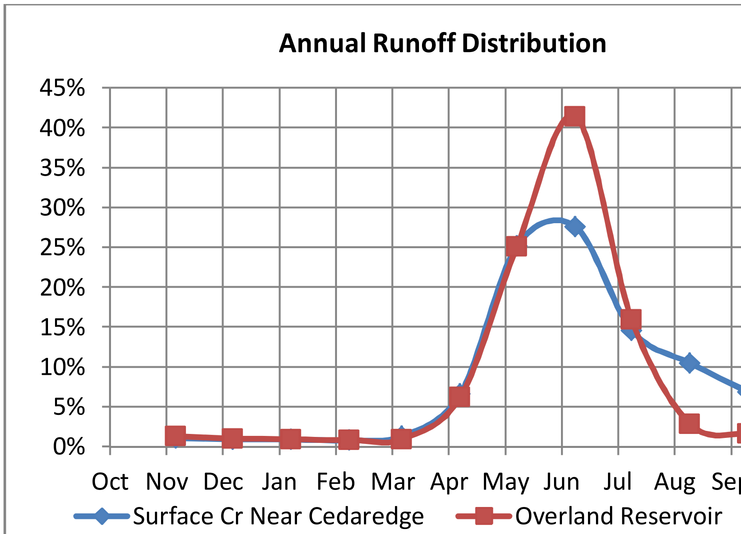

FIGURE 3D

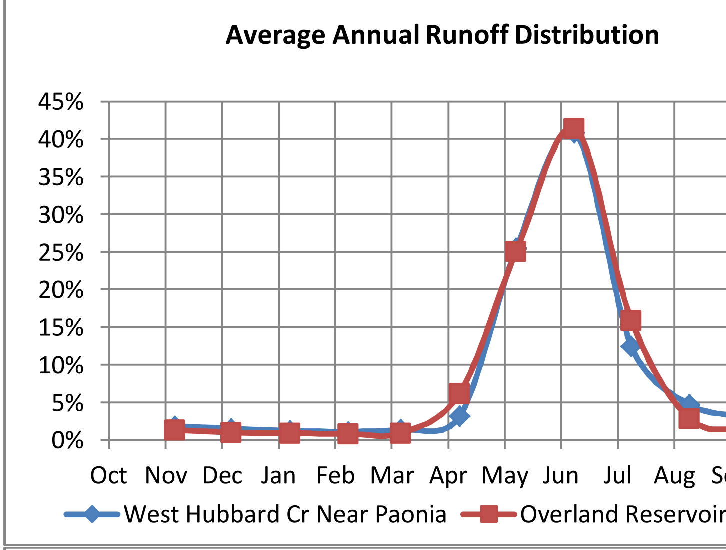

FIGURE 3E

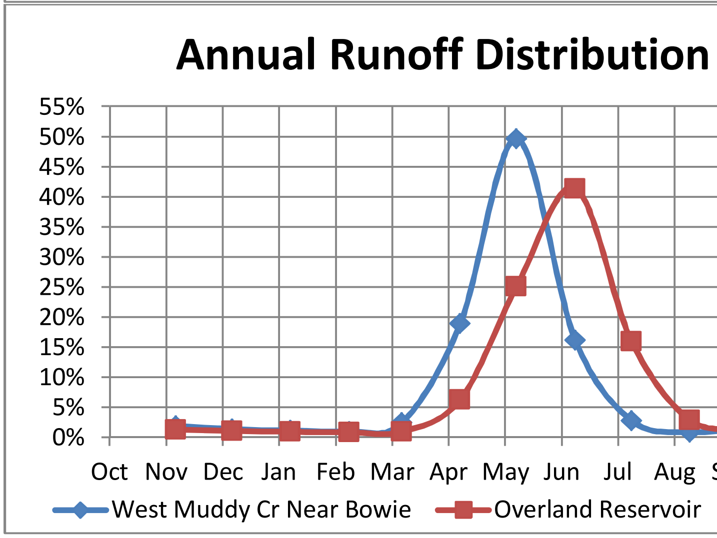

FIGURE 3F

Table 2: Monthly Runoff

SURFACE CREEK AT CEDAREDGE (GUAGE 14350) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	301.96	205.86	193.67	184.38	305.74	2163.14	6599.71	4925.61	2152.91	1386.39	942.90	699.32	20061.59
%Total	1.5%	1.0%	1.0%	0.9%	1.5%	10.8%	32.9%	24.6%	10.7%	6.9%	4.7%	3.5%	1.00
Std Dev	235.98	136.70	117.40	102.99	231.14	1133.42	3351.20	3260.47	1028.97	472.74	393.58	420.89	8101.33
Coef Var	0.78	0.66	0.61	0.56	0.76	0.52	0.51	0.66	0.48	0.34	0.42	0.60	0.40

BUZZARD CREEK NEAR COLLBRAN (GUAGE 09750) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	406.63	401.93	425.80	421.81	978.09	6423.73	16298.19	6437.79	966.28	306.58	261.91	440.59	33769.33
%Total	1.2%	1.2%	1.3%	1.2%	2.9%	19.0%	48.3%	19.1%	2.9%	0.9%	0.8%	1.3%	1.00
Std Dev	285.45	305.21	358.13	322.85	644.11	3675.37	9157.44	5113.89	1447.60	385.16	360.04	421.74	16815.11
Coef Var	0.70	0.76	0.84	0.77	0.66	0.57	0.56	0.79	1.50	1.26	1.37	0.96	0.50

LEROUX CREEK NEAR CEDAREDGE (GUAGE 13450) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	527.68	381.29	342.78	321.16	461.05	3215.76	14644.71	8408.68	2439.39	1714.42	1164.28	878.65	34499.85
%Total	1.5%	1.1%	1.0%	0.9%	1.3%	9.3%	42.4%	24.4%	7.1%	5.0%	3.4%	2.5%	1.00
Std Dev	251.30	86.31	75.32	62.90	107.64	1916.94	4416.99	4920.14	734.94	428.77	414.98	686.17	15347.93
Coef Var	0.48	0.23	0.22	0.20	0.23	0.60	0.30	0.59	0.30	0.25	0.36	0.78	0.44

SURFACE CREEK NEAR CEDAREDGE (GUAGE 14300) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	326.55	275.93	264.71	244.01	407.86	2140.34	8099.56	8882.15	4699.89	3368.14	2209.19	1107.29	32025.64
%Total	1.0%	0.9%	0.8%	0.8%	1.3%	6.7%	25.3%	27.7%	14.7%	10.5%	6.9%	3.5%	1.00
Std Dev	282.06	170.12	142.82	122.19	216.17	1080.56	3098.52	4381.70	1971.80	1006.98	731.42	471.80	10617.41
Coef Var	0.86	0.62	0.54	0.50	0.53	0.50	0.38	0.49	0.42	0.30	0.33	0.43	0.33

WEST HUBBARD CREEK NEAR PAONIA (GUAGE 13290) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	46.52	37.78	31.05	28.52	36.59	80.23	635.74	1019.14	312.38	118.17	80.49	65.66	2492.27
%Total	1.9%	1.5%	1.2%	1.1%	1.5%	3.2%	25.5%	40.9%	12.5%	4.7%	3.2%	2.6%	1.00
Std Dev	19.89	15.38	11.52	6.90	10.86	49.38	242.72	482.20	280.95	64.28	54.59	40.42	972.37
Coef Var	0.43	0.41	0.37	0.24	0.30	0.62	0.38	0.47	0.90	0.54	0.68	0.62	0.39

WEST MUDDY CREEK NEAR BOWIE (GUAGE 13080) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	271.36	192.37	163.39	144.04	342.62	2667.11	6998.01	2282.51	392.90	123.39	224.99	284.37	14087.06
%Total	1.9%	1.4%	1.2%	1.0%	2.4%	18.9%	49.7%	16.2%	2.8%	0.9%	1.6%	2.0%	1.00
Std Dev	163.06	112.75	120.35	92.84	311.85	2527.55	2915.89	1011.72	270.15	84.82	185.45	159.76	6486.94
Coef Var	0.60	0.59	0.74	0.64	0.91	0.95	0.42	0.44	0.69	0.69	0.82	0.56	0.46

MUDDY CREEK ABOVE PAONIA RESERVOIR (GUAGE 13149) IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	2155.59	1963.35	1763.37	1770.51	4703.34	20098.27	44567.92	26938.17	6696.05	2300.42	1970.53	2341.80	117269.32
%Total	1.8%	1.7%	1.5%	1.5%	4.0%	17.1%	38.0%	23.0%	5.7%	2.0%	1.7%	2.0%	1.00
Std Dev	1129.94	871.34	684.13	844.68	2744.91	9236.24	33417.51	32762.91	9391.19	1625.31	1081.47	1477.47	83279.72
Coef Var	0.52	0.44	0.39	0.48	0.58	0.46	0.75	1.22	1.40	0.71	0.55	0.63	0.71

OVERLAND DRAINAGE BASIN IN AC-FT													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Ave	130.90	101.10	90.50	82.12	93.33	606.96	2438.65	4019.57	1547.69	278.47	157.63	155.34	9702.25
%Total	1.3%	1.0%	0.9%	0.8%	1.0%	6.3%	25.1%	41.4%	16.0%	2.9%	1.6%	1.6%	1.00
Std Dev	88.93	64.25	59.60	46.15	38.42	1158.09	952.96	2621.44	1361.98	222.71	229.94	183.33	3733.14
Coef Var	0.68	0.64	0.66	0.56	0.41	1.91	0.39	0.65	0.88	0.80	1.46	1.18	0.38

The calculated snowmelt centroid shifts were used as an initial guide for the magnitude of the temporal shift. In most cases, this proved to result in reasonable relative hydrograph patterns, however, for two of the years (1969 and 1970), this amount of shift produced incompatible hydrographs. For example, the beginning of runoff wouldn't match or the Cow Creek data would indicate outlet releases occurring at a time which would be unrealistic compared to the West

Muddy flow. In these two cases, the amount of shift was adjusted to provide visually compatible hydrographs within the range of calculated centroid shifts. The final shifts varied from 10 to 35 days and averaged 23 days. The result was that the estimated annual flow using the West Muddy Creek data varied from 86% to 103% of that calculated using the West Hubbard Creek data (averaging 96%). Because of the differences in basin characteristics between the Cow Creek basin and the West Muddy basin, it was not feasible to judge the quality of the correlation by comparing the resulting scaling factors with the basin area ratio. The area ratio is 2.4 while the scaling factor varied from 0.97 to 1.57, averaging 1.27. Because of the lower elevation of the West Muddy basin it should be expected that the scaling factors would be significantly less than the area ratio. Even though the scaling factors differed significantly from the area ratio, it is important to note that they varied within a relatively small range. This suggests that the scaling process produced somewhat consistent ratios of overall basin characteristics. However, the winter flows estimated using the West Muddy Creek data as a template were still relatively close to the Cow Creek data, and did not exhibit a significantly greater deviation from values estimated based on the West Hubbard Creek data. The ratios of winter flow determined from West Muddy Creek to that calculated from Cow Creek were found to vary from 0.69 to 1.26, averaging 0.92. The winter flow correlations were slightly worse for the West Muddy Creek data than for West Hubbard Creek, but still close enough to suggest a relatively high quality correlation. Combining this with the fact that the annual calculated runoff values were very close using the two different gauging stations for templates, it was judged that use of the West Muddy Creek data as described above would produce a reasonably accurate determination of the flow at The Cow Creek station as well as at the reservoir site. Temporal shifts were primarily selected based on the apparent best-fit overlay of the two daily hydrographs, but any uncertainty was resolved by choosing the shift that produced a scaling factor closest to the average. Using the West Muddy Creek data as a template only added one year (1974) to the Cow Creek/Overland period of trusted data. The scaling factor for this year was 1.33.

The next closest station (after West Hubbard Creek and West Muddy Creek) to meeting the criteria for high quality correlation is Surface Creek Near Cedaredge (station 14300, Figure 1 and Table 1). Its basin characteristics are similar to those of West Muddy Creek, but the annual runoff distribution pattern differs significantly from that of the Overland drainage basin (see Table 2 and Figure 3D). The process described above for scaling and shifting the West Hubbard Creek and West Muddy Creek hydrographs and using them as templates for the Overland flows was repeated for the Surface Creek near Cedaredge data for the same period of years (1969 through 1973). Comparing the results using the Surface Creek data with the results using the West Hubbard Creek and West Muddy Creek data revealed that the estimates based on the Surface Creek data deviated substantially from the Overland annual runoff determinations derived from the other two stations and was therefore determined to be non-representative.

A final attempt to find a stream gauging station which would provide a compatible template to match with the remaining period of record for the Cow Creek station (1975 through 1982) was made using the Buzzard Creek Near Collbran station (09750, Figure 1 and Table 1). Its basin characteristics are significantly different than the Cow Creek or Overland basins, but the annual runoff distribution pattern is generally similar (see Table 2 and Figure 3A). The process described above for scaling and shifting the West Hubbard Creek and West Muddy Creek hydrographs and using them as templates for the Overland flows was repeated for the Buzzard Creek Near Collbran data for the same period of years (1969 through 1973). This provided a means to compare the calculated annual flows produced by using the two different gauging stations as a basis (West Hubbard Creek and Buzzard Creek). In order to accomplish this, the temporal shift in runoff was accounted for—because the Buzzard Creek basin is lower in elevation than the Overland basin, the Buzzard Creek snowmelt runoff is shifted earlier in the year (see Figure 3A).

Calculation of the relative centroids for the snowmelt runoff hydrographs (West Hubbard Creek vs. West Muddy Buzzard Creek) suggested that the centroid shift varies from 7 to 32 days, averaging 22 days. The process therefore included shifting the Buzzard Creek snowmelt runoff earlier relative to the Cow Creek data. The calculated snowmelt centroid shifts were used as an initial guide for the magnitude of the temporal shift. If this amount of shift proved to result in unrealistic relative hydrograph patterns, the amount of shift was adjusted to provide visually compatible hydrographs within the range of calculated centroid shifts. The final shifts varied from 16 to 28 days and averaged 22 days. The result was that the estimated annual flow using the Buzzard Creek data varied from 90% to 122% of that calculated using the West Hubbard Creek data (averaging 101%). However, 1972 was something of an outlier and excluding that year, the variation was 90% to 103%, averaging 96%.

Because of the differences in basin characteristics, between the Cow Creek basin and the Buzzard Creek basin, it was not feasible to judge the quality of the correlation by comparing the resulting scaling factors with the basin area ratio. The area ratio is 12.2 while the scaling factor varied from 2.10 to 4.20, averaging 3.35. Due to the lower elevation of the Buzzard Creek basin, it should be expected that the scaling factors would be significantly less than the area ratio. Similarly, the winter flows estimated using the Buzzard Creek data as a template were significantly different than the Cow Creek data. The ratio of winter flow determined from Buzzard Creek to that calculated from Cow Creek was found to vary from 0.60 to 1.94, averaging 1.02. However, because the annual calculated runoff values were very close using the two different gauging stations for templates, it was judged that use of the Buzzard Creek data as described above would produce a reasonably accurate determination of the flow at the Cow Creek station as well as at the reservoir site. Temporal shifts were selected based on the apparent best-fit overlay of the hydrographs, but any uncertainty was resolved by choosing the shift that produced a scaling factor closest to the average. Using the Buzzard Creek data as a template added six years (1975-1980) to the Cow Creek/Overland period of trusted data. The scaling factor for these years varied from 1.46 to 3.08, averaging 2.42 and the time shift for the Buzzard Creek data ranged from 25 to 30 days, averaging 28 days.

All of the annual runoff data determined by using the three template gauging stations as described in previous paragraphs (West Hubbard Creek, West Muddy Creek and Buzzard Creek) represent flows at the Cow Creek station. Therefore, the flow produced by the incremental portion of the Cow Creek basin which drains into the segment of the stream located between the dam and the Cow Creek station must be estimated and subtracted out in order to determine the runoff into the Overland reservoir. This incremental portion of the basin represents 20% of the total area. During winter months prior to spring snowmelt runoff, when there is significant snowpack (generally December through March), the temperature at the base of the snowpack remains near (or slightly above) freezing and the winter snowmelt runoff is primarily dependent on basin area rather than the snowpack or precipitation depths. Therefore, during these months, it was assumed that the incremental portion of the basin produces 20% of the total runoff. However, during the remaining months, including spring runoff and summer/fall months, the higher elevation portion of the basin would be expected to produce a greater percentage of the runoff since both snowpack depth and precipitation generally increases with increased elevation. Therefore, during the non-winter months, it was assumed that the incremental portion of the basin produces 10% of the total runoff. The runoff data estimated this way represents the total runoff into the reservoir.

The year 1988 was the first year that the reservoir was filled after completion of the rehabilitation work and so the dam was closely monitored during filling. Filling initiated on April 20 and the reservoir did not fill (or spill). There are records for direct flow diversions into the ditch for 1988. Therefore, the primary missing flow data for this year is the winter runoff from November 1 through April 19. As discussed in previous paragraphs, the winter flow data (November through March) from the Cow Creek gauging station for the years 1969 through 1976 consists primarily of water produced by the Overland reservoir drainage basin. Therefore, for the most part, it is possible to calculate the winter flows into the reservoir by applying the basin-area reduction factor directly to this data. In 1970, the outlet gates were closed prior to April 1, so it was necessary to adjust the data accordingly. In some cases other apparent necessary adjustments were made (such as accounting for release of prior year's holdover storage). These winter flow values were correlated with the corresponding months and/or years for the two Surface Creek stream gauging stations and the Buzzard Creek Near Collbran station, which all have overlapping periods of record with the Cow Creek station. The correlations were checked for both winter flow only (winter flow months at both Overland and the correlating gauge) and winter vs. total annual flow (winter flow months at Overland vs. corresponding annual flow at the correlating gauge). It was found that the best fit was with the total annual flow for the Buzzard Creek gauge and the relatively high correlation coefficient indicated a good quality correlation. The two Surface Creek gauging stations also produced relatively good correlations (although not nearly as good as Buzzard Creek) when comparing exclusively winter flow. Therefore, for future reference, it is noteworthy that it would be possible to estimate winter inflow into Overland reservoir with relative confidence for the full analysis period with further refinement of the data. These correlations along with correlation coefficients and regression equations are shown on Figure 4. This winter flow correlation made it possible to practically complete the 1988 runoff record (excluding any late season calls by senior water rights holders). Because the Buzzard Creek gauge period of record did not include 1988, it was necessary to use the Surface Creek Near Cedaredge correlation to determine the 1988 winter flow. Also, since the winter flow correlations were based on the months of November through March, it was necessary to add in the estimated reservoir inflow between April 1 and April 19. This estimate was based on the frequent reservoir level readings taken during the early filling in 1988.

Figure 4: Winter Flow Correlation

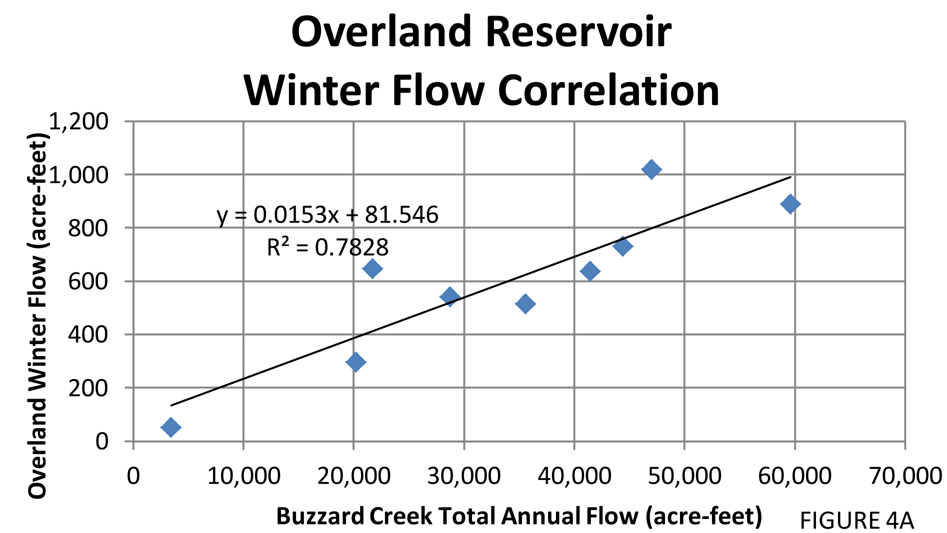

FIGURE 4A

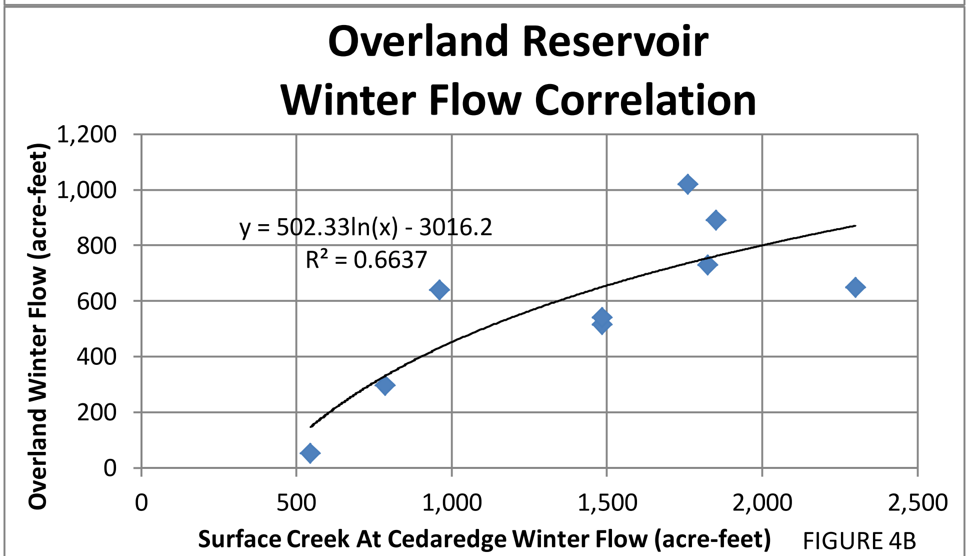

FIGURE 4B

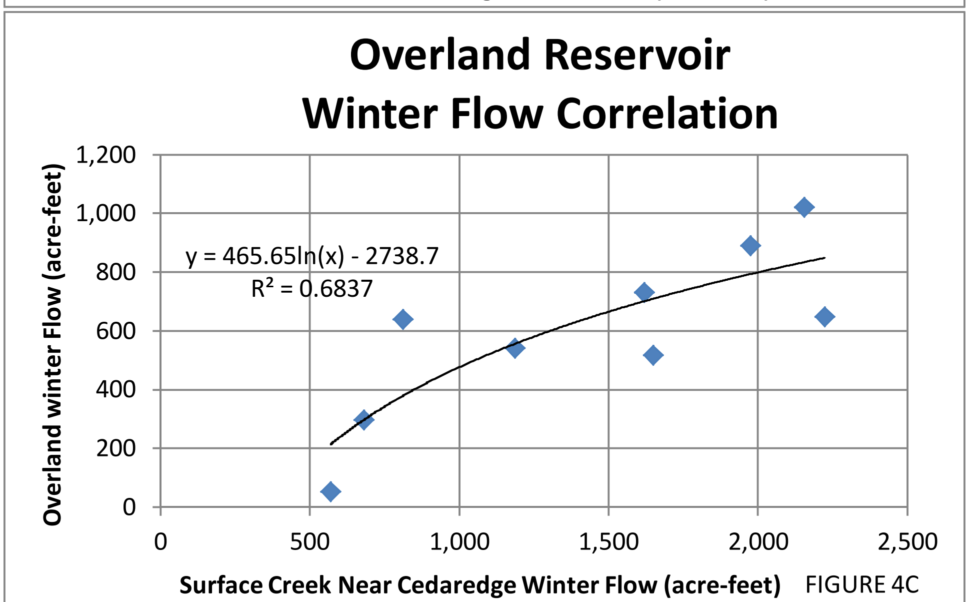

FIGURE 4C

Correlations For Missing Data

The level of effort described in the previous section was necessary to establish a period of years for which the flow into Overland reservoir was determined with a relatively high degree of confidence. This allowed for estimating other years' runoff based on stream flow correlations relative to gauging stations with longer and/or complementary periods of record. The nearby gauging stations which could possibly be used for these correlations are shown on Figure 1 and listed on Table 1

The following stations were excluded from consideration for correlation based on the reasons described:

1. Data from the station Cow Creek Near Paonia is severely distorted due to its location shortly downstream from Overland reservoir (about 4 stream miles downstream) – it is reduced by the amount of water diverted into the reservoir and Overland ditch. Also, it was fully used to determine runoff values into Overland reservoir. The station West Muddy Creek Near Somerset is located immediately downstream from the confluence of West Muddy Creek and Cow Creek. Even though it is not as distorted by Overland diversions, it is only about 9 miles downstream from the reservoir and it was, therefore, judged to be less reliable for correlation.

2. The stations Main Hubbard Creek Near Paonia, Middle Hubbard Creek Near Paonia, Hubbard Creek Near Bowie and West Muddy Creek Near Bowie would not extend the analysis period because their periods of record are fully within the time frame for which reservoir runoff has been established.

3. The stations Leroux Creek Near Cedaredge, West Muddy Creek Near Ragged Mountain, Buzzard Creek Below Owens Creek (not shown on Figure 1) and Leroux Creek Near Lazear (also not shown on Figure 1) have either insufficient or no overlap with the years for which Overland reservoir runoff was determined.

4. The Leroux Creek at Hotchkiss station was excluded due to its low elevation.

5. Even though the records for the station Muddy Creek Above Paonia reservoir includes data extending back to 1974, prior to 1989, the quality of data is very poor with lots of missing and erratic data points. Without the questionable years, there is no overlap with the Overland reservoir runoff years

The remaining stations which can be used for correlation are:

- Buzzard Creek Near Collbran
- Surface Creek At Cedaredge
- Surface Creek Near Cedaredge
- West Hubbard Creek Near Paonia

The quality of correlation with specific stream gauging stations can be judged based on several factors:

1. Similarity of drainage basin characteristics to the Overland basin. This includes such things as proximity to the Overland basin, elevation, orientation, geology and size.

2. Similarity in the annual pattern of runoff with that of the Overland basin as shown in Table 2 and on Figure 3. Table 2 presents the monthly runoff distribution statistics for the gauging stations considered for correlation as well as for the Overland drainage basin.

The average runoff distribution patterns for each of the potential correlation gauging stations were also compared with the Overland basin runoff as shown on Figure 3 and Table 2. May, June and July produce a combined 82 percent of the total runoff into Overland reservoir, with proportions of runoff for these three months being 25, 41 and 16 percent, respectively. Based on qualitative visual evaluation of the pattern comparisons, the order of the quality was judged to be as follows, in order from best to worst:

- West Hubbard Creek Near Paonia
- Buzzard Creek Near Collbran
- Surface Creek At Cedaredge
- Surface Creek Near Cedaredge

3. Regression analysis between the two sets of runoff records (Overland basin versus the correlation station). Even though the total number of years for which total flow into the Overland reservoir has been determined is small (fifteen years) relative to the total combined period of record represented by potential correlation gauging stations (94 years from 1918 through 2011), these fifteen years cover a substantial portion of the range of flows over the 94 years. They include 1977 which was the driest year in the combined period of record, as well 1980, the 12th wettest year within this period. In other words, even though the number of years for which Overland runoff has been determined is only 16 percent of the total number of years within the combined period of record, these years cover a range of flows encompassing 88 percent of the total period. This significantly increases the quality of the statistical correlations. The regression correlations including the coefficient of correlation (R^2) and the regression equation are shown on Figure 5. The correlation coefficients are a measure of the quality of the fit and they are listed below in order from best to worst:

- Surface Creek At Cedaredge, R^2 = 0.881
- Surface Creek Near Cedaredge, R^2 = 0.836
- Buzzard Creek Near Collbran, R^2 = 0.780
- West Hubbard Creek Near Paonia, R^2 = 0.729

Figure 5: Total Annual Flow Correlations

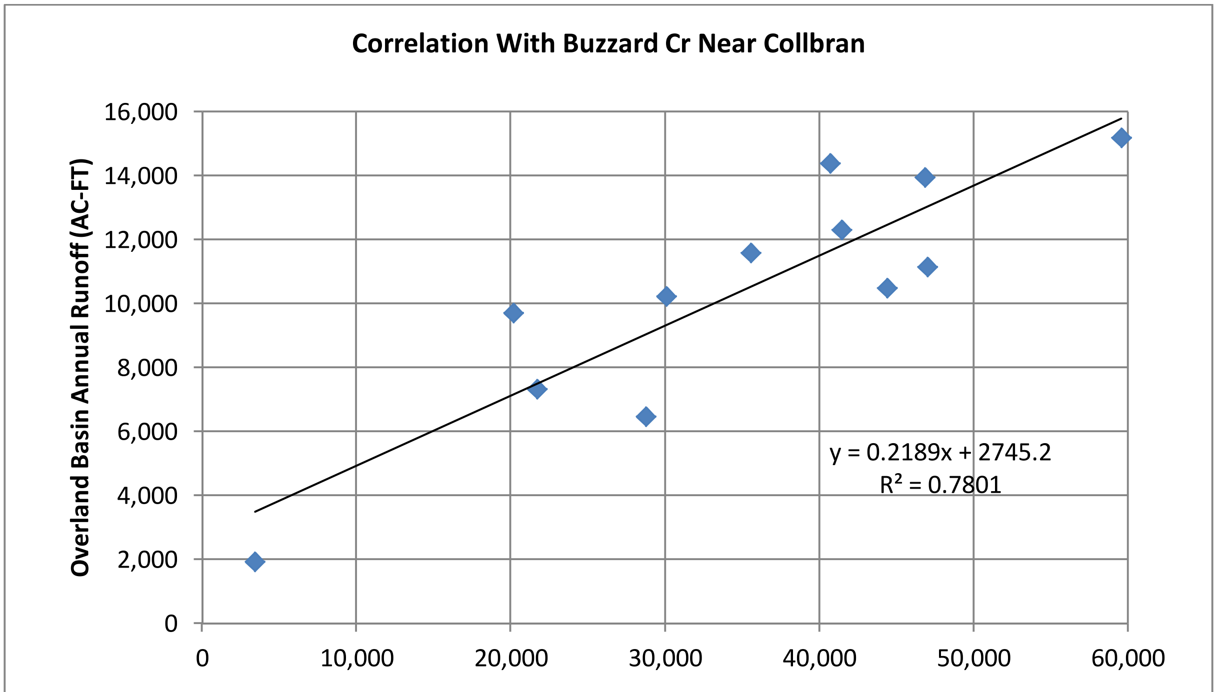

FIGURE 5A

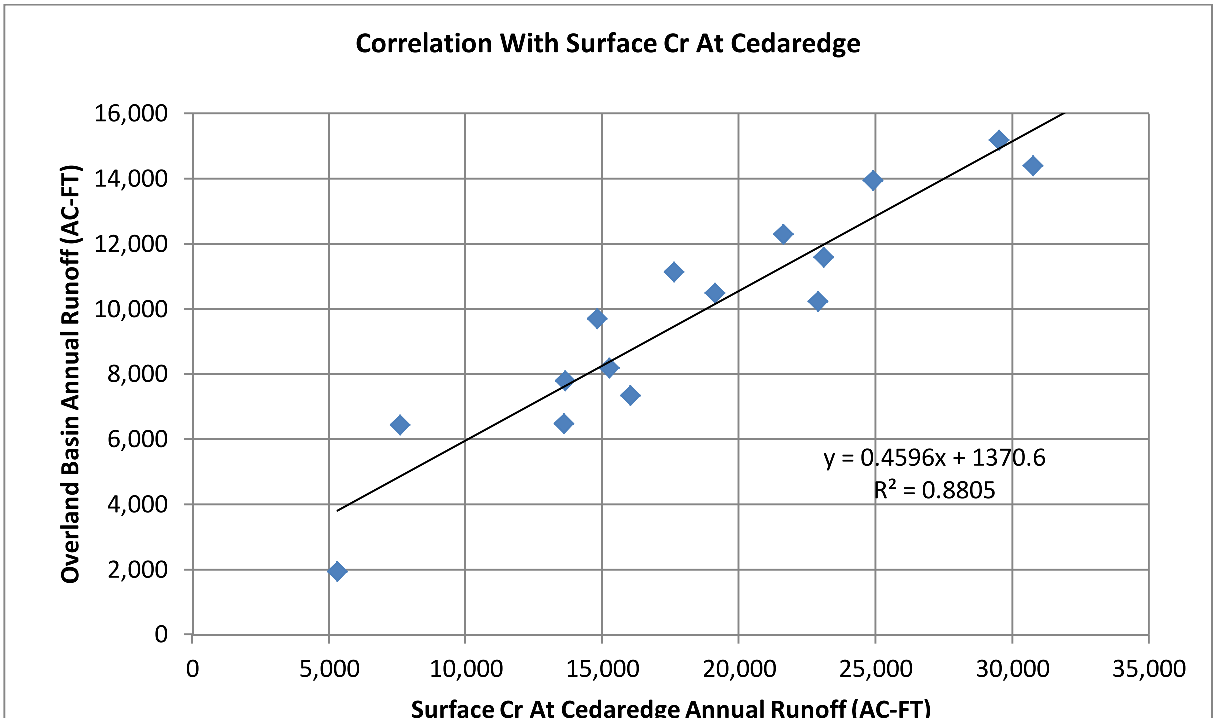

FIGURE 5B

(continued on next page)

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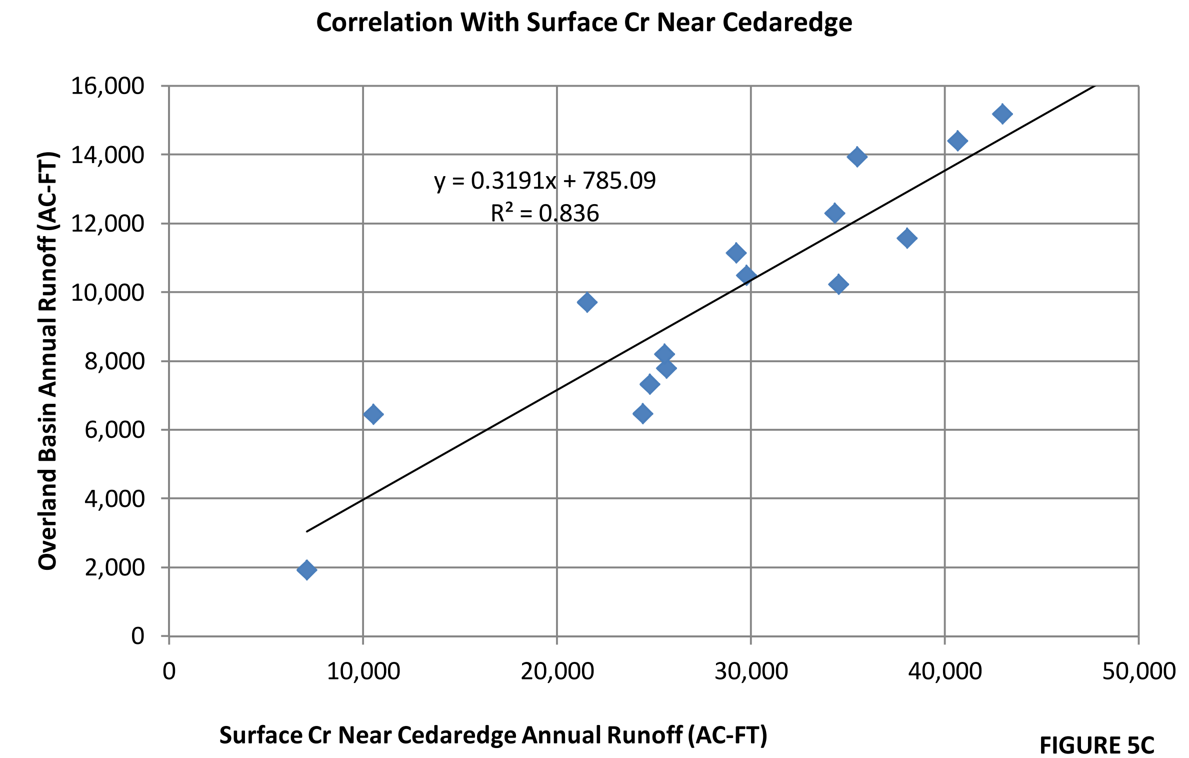


FIGURE 5C

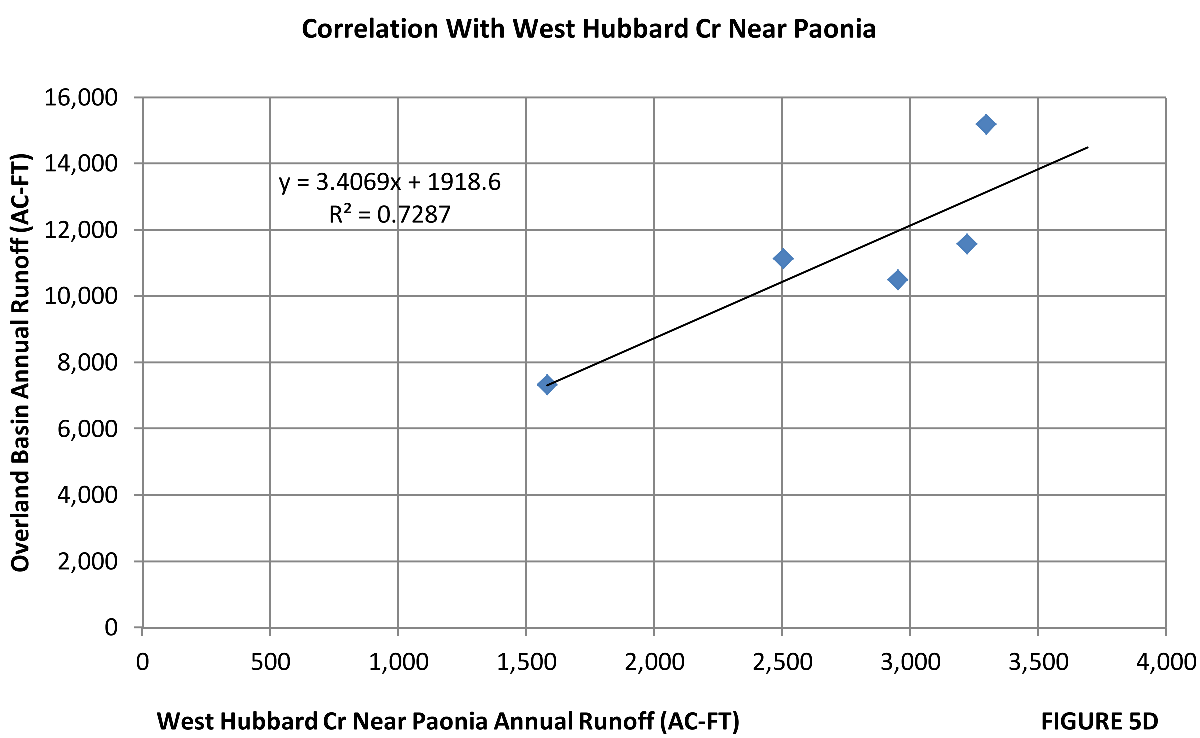


FIGURE 5D

Selection of the order of preference for correlation gauging stations was as follows:

1. Even though it exhibited the lowest correlation coefficient of all the stations considered, the West Hubbard Creek station was selected as the first priority station. This was based on the following considerations:

a. As described in previous sections, this station was used as a template for determining the Overland basin runoff values for a number of years and the results appeared to be quite high quality.

b. The runoff pattern is almost identical to that of the Overland basin (see Figure 3E)

c. The West Hubbard Creek basin is in close proximity to the Overland basin, is in the same geologic domain, is oriented approximately the same, is at nearly the same elevation and is closer in size when compared with the other possible correlation drainage basins.

2. The stations Surface Creek At Cedaredge and Surface Creek Near Cedaredge were selected as the second and third priority stations, respectively, primarily because of their high correlation coefficient and long period of record. However, the fact that there are few basin similarities with the Overland basin and that they exhibit poorer runoff pattern distribution comparisons indicates that the results of these correlations must be reviewed carefully and calibrated as much as possible.

The records for the station Buzzard Creek Near Collbran would not add any years beyond the correlations made with the stations listed above.

As indicated on Table 1, the records are incomplete for the two Surface Creek gauging stations during the years of 2000 through 2011. For 2007 and 2008, only records for Dec, Jan and Feb are missing. For the remaining years records for Nov through March are missing. In 2011, October is also missing. However, on average, these months only represent 3 to 6 percent of the total annual runoff. Therefore, in order to complete the analysis record through 2011 for these two gauging stations, it is reasonable to fill in the missing months using the average percent of the total annual runoff for those months.

The process of estimating total runoff and runoff distribution consisted of determining total annual runoff into the Overland reservoir by correlation with the applicable gauging station and then using the average annual distribution pattern for the Overland basin to estimate monthly runoff values.

The resulting annual and monthly runoff values based on correlations with these gauging stations are listed on Table 4. Statistics which indicate the quality of these correlations relative to those 15 years during which the runoff was more directly determined, are shown in Table 3:

Table 3: Annual Runoff Calibration Statistics

Correlation Station Name	Minimum % of Overland Total Runoff	Maximum % of Overland Total Runoff	Average % of Overland Total Runoff	Standard Deviation	Coefficient of Variation
Surface Creek at Cedaredge	82%	180%	105%	24%	23%
Surface Creek Near Cedaredge	77%	135%	105%	17%	16%
W Hubbard Cr Near Paonia	87%	113%	98%	11%	11%

In general, these statistics indicate good correlations. The West Hubbard Near Paonia station clearly provides the best results – a coefficient of variation less than 15% indicates a very good match. Even though the average for the two Surface Creek stations is slightly high, the coefficient of variation is moderately low. Figures 5B and 5C indicate that the correlation coefficient is better for the Surface Creek at Cedaredge station, but the above statistics suggest that the data from the Surface Creek Near Cedaredge station provides a better match, with a significant lower coefficient of variation. Therefore, the correlation priorities of the two gauging stations were reversed from that previously indicated, with the Surface Creek Near Cedaredge station used as the second priority.

The data in Table 4 has been modified as necessary to match the runoff values determined for the 15 years during which the runoff was more directly determined.

Table 4: Overland Reservoir Drainage Basin Annual Runoff Estimates (Acre-Feet)

Year	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual
1918	127	98	88	79	90	587	2,358	3,887	1,497	269	161	181	9,421
1919	95	73	65	59	67	438	1,761	2,903	1,118	201	120	135	7,037
1920	237	183	164	149	169	1,098	4,413	7,274	2,801	504	301	339	17,631
1921	222	171	153	139	158	1,029	4,134	6,815	2,624	472	282	317	16,517
1922	221	170	153	138	157	1,023	4,112	6,778	2,610	470	280	316	16,428
1923	152	118	105	95	108	706	2,835	4,673	1,799	324	193	218	11,326
1924	112	86	77	70	80	518	2,081	3,430	1,321	238	142	160	8,315
1925	121	94	84	76	86	561	2,256	3,718	1,432	258	154	173	9,012
1926	186	143	128	116	132	861	3,458	5,699	2,194	395	236	265	13,814
1927	165	127	114	103	118	764	3,071	5,063	1,949	351	209	236	12,271
1928	147	114	102	92	105	683	2,743	4,521	1,741	313	187	211	10,958
1929	202	156	140	127	144	938	3,769	6,212	2,392	430	257	289	15,056
1930	136	105	94	85	97	630	2,533	4,175	1,608	289	173	194	10,119
1931	96	74	67	60	69	446	1,793	2,955	1,138	205	122	138	7,162
1932	169	130	117	106	120	782	3,141	5,178	1,994	359	214	241	12,550
1933	100	77	69	63	71	464	1,863	3,070	1,182	213	127	143	7,441
1934	65	50	45	41	46	302	1,215	2,002	771	139	83	93	4,854
1935	119	92	82	75	85	552	2,219	3,658	1,409	253	151	170	8,867
1936	113	88	78	71	81	526	2,113	3,482	1,341	241	144	162	8,441
1937	154	119	106	97	110	714	2,868	4,727	1,820	327	195	220	11,457
1938	189	146	130	118	134	874	3,513	5,790	2,229	401	239	270	14,033
1939	96	74	66	60	68	444	1,785	2,942	1,133	204	122	137	7,130
1940	119	78	70	64	72	471	1,891	3,117	1,200	216	129	145	7,555
1941	196	152	136	123	140	911	3,659	6,031	2,322	418	249	281	14,617
1942	185	143	128	116	132	859	3,450	5,686	2,190	394	235	265	13,783
1943	125	96	86	78	89	578	2,321	3,826	1,473	265	158	178	9,273
1944	172	133	119	108	123	799	3,210	5,290	2,037	367	219	246	12,823
1945	162	125	112	102	116	751	3,019	4,976	1,916	345	206	232	12,060
1946	107	83	74	67	76	497	1,997	3,291	1,267	228	136	153	7,977
1947	170	131	117	107	121	788	3,164	5,215	2,008	361	216	243	12,641
1948	150	116	104	94	107	697	2,801	4,617	1,778	320	191	215	11,191
1949	148	115	103	93	106	688	2,764	4,555	1,754	316	188	212	11,042
1950	138	107	95	87	98	640	2,570	4,235	1,631	293	175	197	10,266
1951	109	84	75	68	77	503	2,022	3,332	1,283	231	138	155	8,077
1952	225	173	155	141	160	1,041	4,184	6,896	2,655	478	285	321	16,715
1953	107	83	74	67	76	496	1,992	3,284	1,265	228	136	153	7,960
1954	95	74	66	60	68	441	1,773	2,923	1,125	202	121	136	7,085
1955	132	102	91	83	94	611	2,455	4,046	1,558	280	167	188	9,806
1956	101	78	70	63	72	469	1,883	3,103	1,195	215	128	145	7,521
1957	195	151	135	123	139	906	3,639	5,998	2,309	416	248	279	14,538
1958	190	147	131	119	135	880	3,535	5,827	2,244	404	241	271	14,125
1959	91	70	63	57	65	422	1,697	2,797	1,077	194	116	130	6,781
1960	112	87	77	70	80	520	2,088	3,442	1,325	238	142	160	8,343
1961	99	76	68	62	70	457	1,836	3,025	1,165	210	125	141	7,333
1962	161	124	111	101	115	747	3,002	4,948	1,905	343	205	230	11,993
1963	85	65	59	53	60	392	1,577	2,599	1,001	180	107	121	6,300
1964	104	80	72	65	74	482	1,937	3,192	1,229	221	132	149	7,737

Table 4 (cont'd): Overland Reservoir Drainage Basin Annual Runoff Estimates (acre-feet)

Year	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual
1965	152	117	105	95	108	704	2,828	4,661	1,795	323	193	217	11,298
1966	129	99	89	81	92	597	2,399	3,954	1,523	274	163	184	9,585
1967	124	96	86	78	88	575	2,312	3,810	1,467	264	158	177	9,235
1968	128	99	89	80	91	594	2,387	3,934	1,515	273	163	183	9,535
1969	144	96	88	86	103	4,284	3,834	1,795	476	134	145	399	11,586
1970	245	156	129	105	97	644	3,956	2,936	656	329	845	398	10,497
1971	307	209	196	161	149	382	1,426	5,969	1,407	457	220	264	11,146
1972	190	142	118	98	101	368	2,521	2,620	326	126	199	528	7,338
1973	232	203	182	140	135	168	1,877	8,305	2,725	653	280	292	15,192
1974	101	134	110	104	93	527	4,108	909	106	53	111	125	6,481
1975	154	123	119	106	137	130	1,905	6,147	2,958	368	54	103	12,306
1976	92	57	35	38	75	462	2,881	4,554	1,310	74	72	59	9,710
1977	28	11	4	4	7	179	1,274	218	53	94	49	14	1,934
1978	27	27	26	29	65	354	2,451	4,137	2,776	201	32	112	10,237
1979	76	59	48	65	117	84	2,297	6,671	3,735	705	58	36	13,949
1980	80	78	104	116	118	190	2,703	7,220	3,292	371	64	67	14,402
1981	89	69	62	56	64	415	1,666	2,746	1,057	190	114	128	6,656
1982	183	142	127	115	131	850	3,416	5,631	2,168	390	233	262	13,649
1983	241	186	167	151	172	1,120	4,498	7,414	2,855	514	307	345	17,970
1984	197	152	136	123	140	912	3,663	6,038	2,325	418	250	281	14,634
1985	188	145	130	118	134	871	3,500	5,769	2,221	400	239	269	13,983
1986	228	176	158	143	163	1,057	4,247	7,001	2,696	485	289	326	16,969
1987	187	145	130	118	134	869	3,491	5,754	2,215	399	238	268	13,946
1988	105	81	73	66	75	486	1,954	3,221	1,240	223	133	150	7,807
1989	108	83	74	68	77	499	2,005	3,305	1,272	229	137	154	8,010
1990	83	64	58	52	60	387	1,555	2,563	987	178	106	119	6,212
1991	120	93	83	75	86	557	2,237	3,687	1,420	255	152	172	8,937
1992	111	86	77	69	79	513	2,063	3,400	1,309	236	141	158	8,240
1993	205	159	142	129	146	952	3,825	6,304	2,427	437	261	294	15,281
1994	121	94	84	76	87	563	2,263	3,730	1,436	258	154	174	9,040
1995	217	168	150	136	155	1,007	4,046	6,669	2,568	462	276	311	16,164
1996	112	86	77	70	80	517	2,078	3,425	1,319	237	142	160	8,302
1997	203	157	140	127	144	940	3,776	6,223	2,396	431	257	290	15,084
1998	164	127	113	103	117	760	3,053	5,032	1,938	349	208	234	12,198
1999	116	89	80	73	82	536	2,155	3,552	1,368	246	147	165	8,608
2000	105	81	73	66	75	487	1,957	3,226	1,242	224	133	150	7,820
2001	87	67	60	55	62	403	1,619	2,668	1,027	185	110	124	6,467
2002	87	67	60	54	62	402	1,615	2,662	1,025	184	110	124	6,451
2003	104	80	72	65	74	480	1,929	3,180	1,224	220	131	148	7,708
2004	100	77	69	62	71	462	1,855	3,057	1,177	212	126	142	7,409
2005	243	188	168	153	174	1,128	4,534	7,473	2,877	518	309	348	18,113
2006	126	97	87	79	90	582	2,340	3,856	1,485	267	159	180	9,347
2007	104	80	72	65	74	482	1,938	3,195	1,230	221	132	149	7,744
2008	165	128	114	104	118	766	3,077	5,072	1,953	351	210	236	12,293
2009	147	114	102	92	105	683	2,742	4,520	1,740	313	187	211	10,956
2010	122	95	85	77	87	568	2,281	3,760	1,448	261	155	175	9,115
2011	168	130	116	106	120	780	3,136	5,169	1,990	358	214	241	12,528

Reservoir Yield Analysis and Correlation Calibration

The amount of runoff available annually for storage in Overland reservoir was estimated based on the current operational rules described in previous paragraphs -- outlet gates fully closed on November 1st and maximum storage in late May, June or July. Based on storage records available, the date at which maximum storage has occurred varies from May 17 to Aug 2, averaging June 18. Diversion of direct flow from Cow Creek into the Overland ditch rarely starts prior to the date of maximum storage. The governing senior downstream water right is the Fire Mountain Canal which almost never places a call on the Overland water rights prior to the date of maximum storage. Therefore, for purposes of estimating runoff available for storage based on correlation with records for other gauging stations, it is reasonable to assume that all runoff water prior to the date of maximum storage is available to be stored. The date at which maximum storage would occur each year (and, consequently, the exact storable runoff amount) for a particular storage reservoir capacity can only reasonably be determined by estimating daily hydrographs for each year and performing operation simulations year-by-year. Doing so is beyond the scope of this project. The following procedures and assumptions were applied to estimate the maximum storable runoff for each year:

1. There are eight years for which sufficient records exist to determine stored and storable runoff (1972, 1974, 1977, 1988, 1989, 1990, 1991, and 1992). These are all years during which the reservoir did not fill and there is sufficient information to estimate unstored, but available, winter runoff. It was, therefore, possible to compare the actual stored volume with the monthly runoff estimated by correlation in order to determine an average percent of June runoff (combined with November through May total runoff) which would need to be stored in order to provide a match (an average of estimated storable water equal to the average of actual storable water). The percent of June runoff necessary to provide the match along with the comparison statistics are shown in Table 5. These percentages were used to determine runoff in years during which the reservoir would not have (or did not) fill to its current capacity.

Table 5: Storable Yield Calibration Statistics

Correlation Station Name	% of June Runoff to Provide a Match	Minimum % of Overland Storable Runoff	Maximum % of Overland Storable Runoff	Average % of Overland Storable Runoff	Standard Deviation	Coefficient of Variation
Surface Creek at Cedaredge	84%	80%	137%	100%	21%	21%
Surface Creek Near Cedaredge	80%	91%	119%	100%	15%	15%
W Hubbard Cr Near Paonia	77%	100%	100%	100%	N/A	N/A

In general, these statistics indicate matches with relatively consistent percentages of June runoff and minimal variation. The West Hubbard Near Paonia station only had one matching year. The coefficient of variation is moderately low for the two Surface Creek stations and significantly lower for the Surface Creek Near Cedaredge station, again suggesting that the data from the Surface Creek Near Cedaredge station provides a better match and confirming that the Surface

Creek Near Cedaredge station should be used as the second priority for storable yield estimates. It is interesting to note that the percent of June runoff necessary to provide a match with historic records varies from 77 to 84 percent compared with an average maximum storage date of June 18 (60 percent of the month). Because the runoff is generally declining during June, most of the runoff volume is shifted toward the early part of the month and it is reasonable to think that roughly 80 percent of the June runoff could typically occur during the first 18 days.

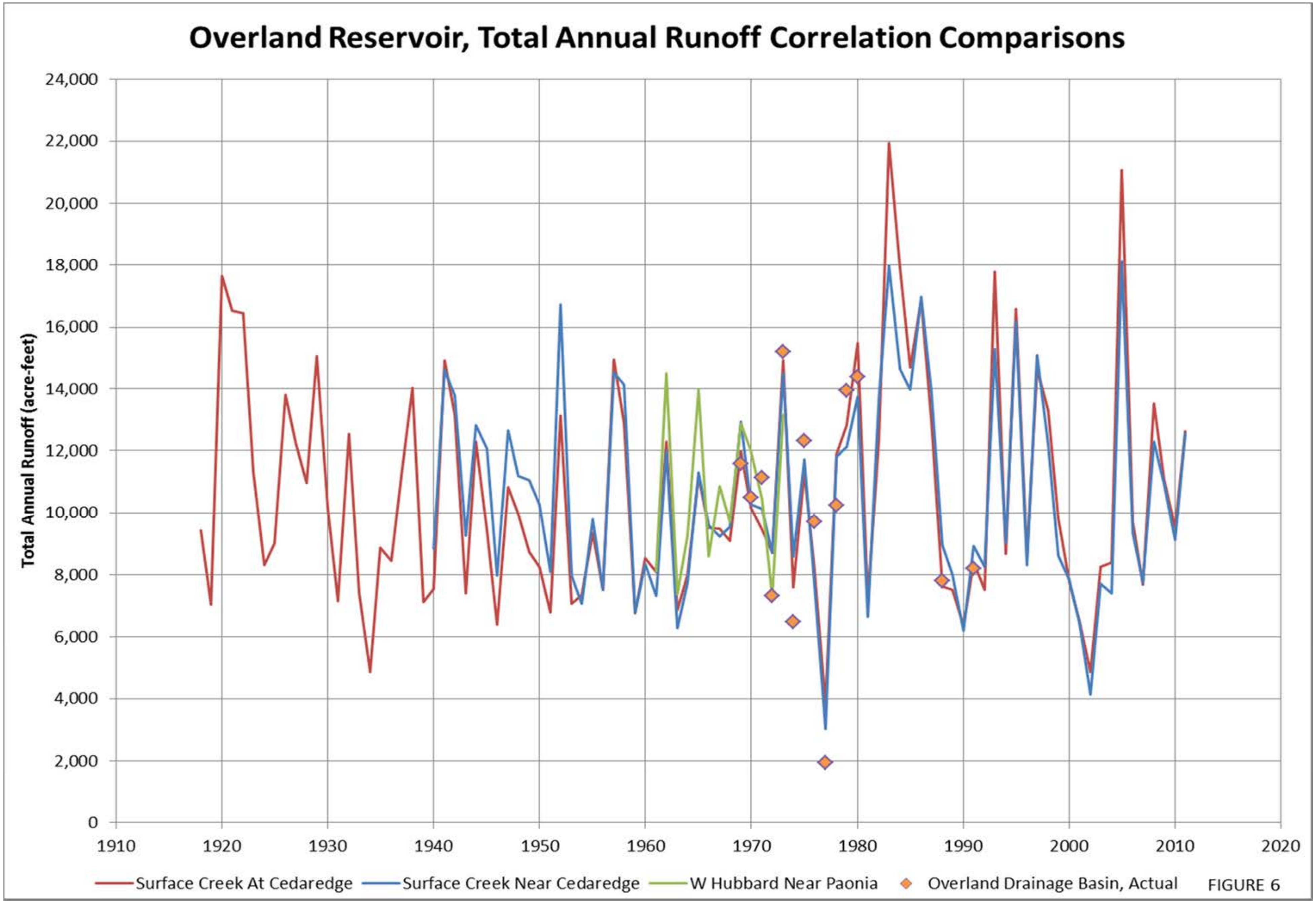
2. It is likely that, for years during which the reservoir would have filled and spilled at its current capacity, the maximum storable water would include a greater percentage of the June runoff. Therefore, for these years, it was assumed that the entire June runoff would have been available to be stored.

The Overland reservoir drainage basin yield estimates based on the above considerations are included on Table 6. The data in Table 6 has been modified as necessary to match the actual storable runoff values determined for the 8 years during which the storable amount was known.

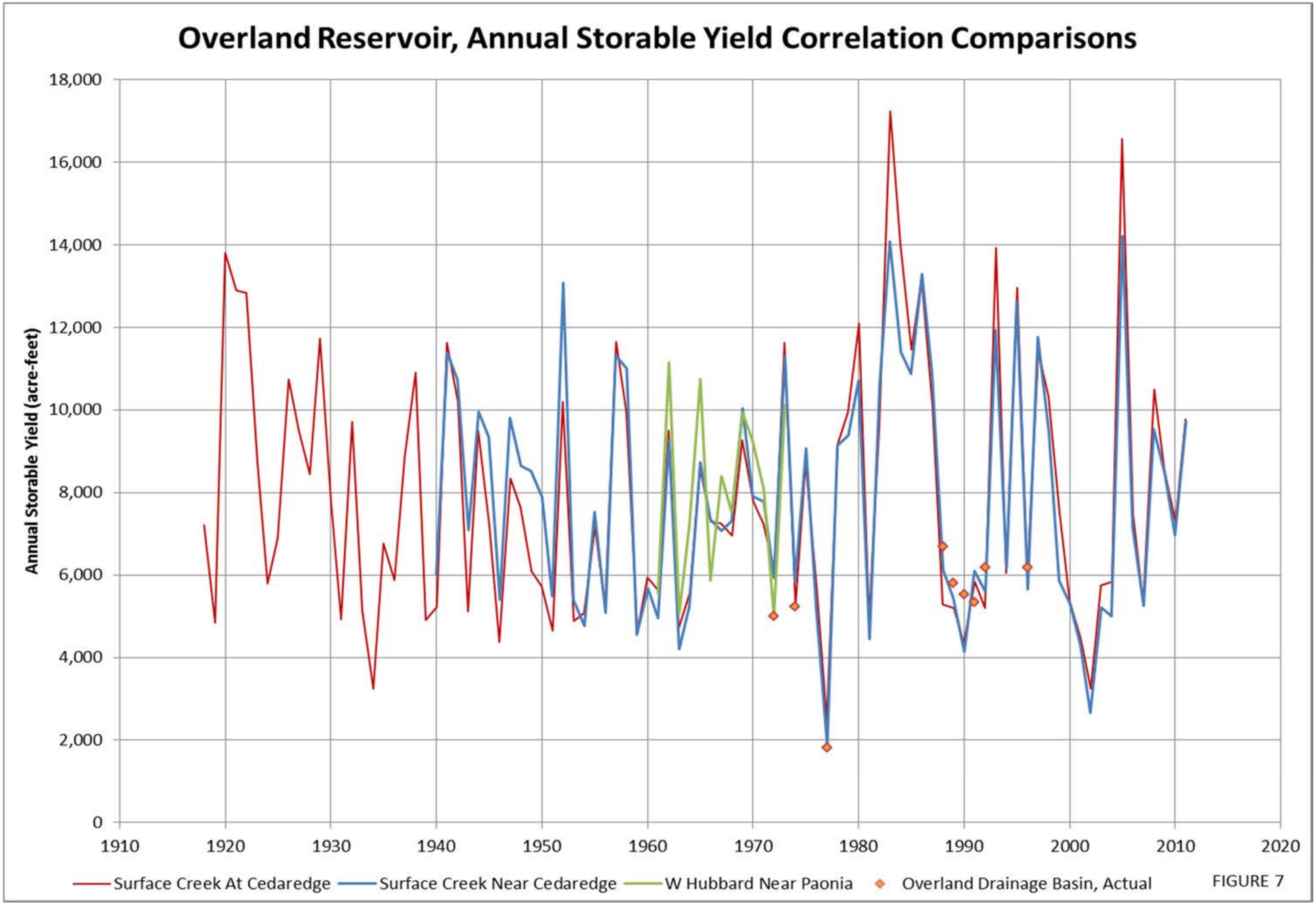
Table 6: Overland Reservoir Drainage Basin Annual Storable Yield Estimates (Acre-Feet)

Year	Storable Yield	Year	Storable Yield	Year	Storable Yield	Year	Storable Yield	Year	Storable Yield
1918	7,314	1937	8,894	1956	5,218	1975	9,107	1994	7,018
1919	4,998	1938	10,894	1957	11,286	1976	5,312	1995	12,548
1920	13,687	1939	5,064	1958	10,965	1977	1,829	1996	6,186
1921	12,822	1940	6,124	1959	4,704	1978	9,159	1997	11,709
1922	12,753	1941	11,347	1960	5,788	1979	9,398	1998	9,469
1923	8,792	1942	10,700	1961	5,527	1980	10,680	1999	5,972
1924	5,906	1943	7,198	1962	11,259	1981	4,618	2000	5,425
1925	6,996	1944	9,954	1963	5,036	1982	10,596	2001	4,487
1926	10,724	1945	9,362	1964	7,182	1983	13,950	2002	2,873
1927	9,526	1946	5,534	1965	10,843	1984	11,361	2003	5,347
1928	8,506	1947	9,813	1966	5,859	1985	10,855	2004	5,140
1929	11,688	1948	8,688	1967	8,436	1986	13,173	2005	14,061
1930	7,855	1949	8,572	1968	7,541	1987	10,826	2006	7,256
1931	5,087	1950	7,969	1969	10,005	1988	6,695	2007	5,373
1932	9,742	1951	5,604	1970	9,292	1989	5,811	2008	9,543
1933	5,285	1952	12,976	1971	8,109	1990	5,518	2009	8,505
1934	3,447	1953	5,522	1972	5,002	1991	5,347	2010	7,076
1935	6,883	1954	4,915	1973	10,206	1992	6,186	2011	9,725
1936	5,995	1955	7,612	1974	5,238	1993	11,862		

The Overland reservoir drainage basin total annual runoff and storable yield estimates over the period of analysis for each of the applicable correlation gauging stations are compared on Figures 6 and 7 along with the actual values for years in which they were known or determined. Figure 8 shows the recurrence (percent of years that the runoff or reservoir yield could be expected to equal or exceed the volumes shown) for both the total annual runoff and annual storable yield based on the analysis period.



Overland Reservoir, Total Annual Runoff Correlation Comparisons
Total Annual Runoff (acre-feet)
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Surface Creek At Cedaredge
Surface Creek Near Cedaredge
W Hubbard Near Paonia
Overland Drainage Basin, Actual
FIGURE 6



Overland Reservoir, Annual Storable Yield Correlation Comparisons
Annual Storable Yield (acre-feet)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Surface Creek At Cedaredge
Surface Creek Near Cedaredge
W Hubbard Near Paonia
Overland Drainage Basin, Actual

FIGURE 7

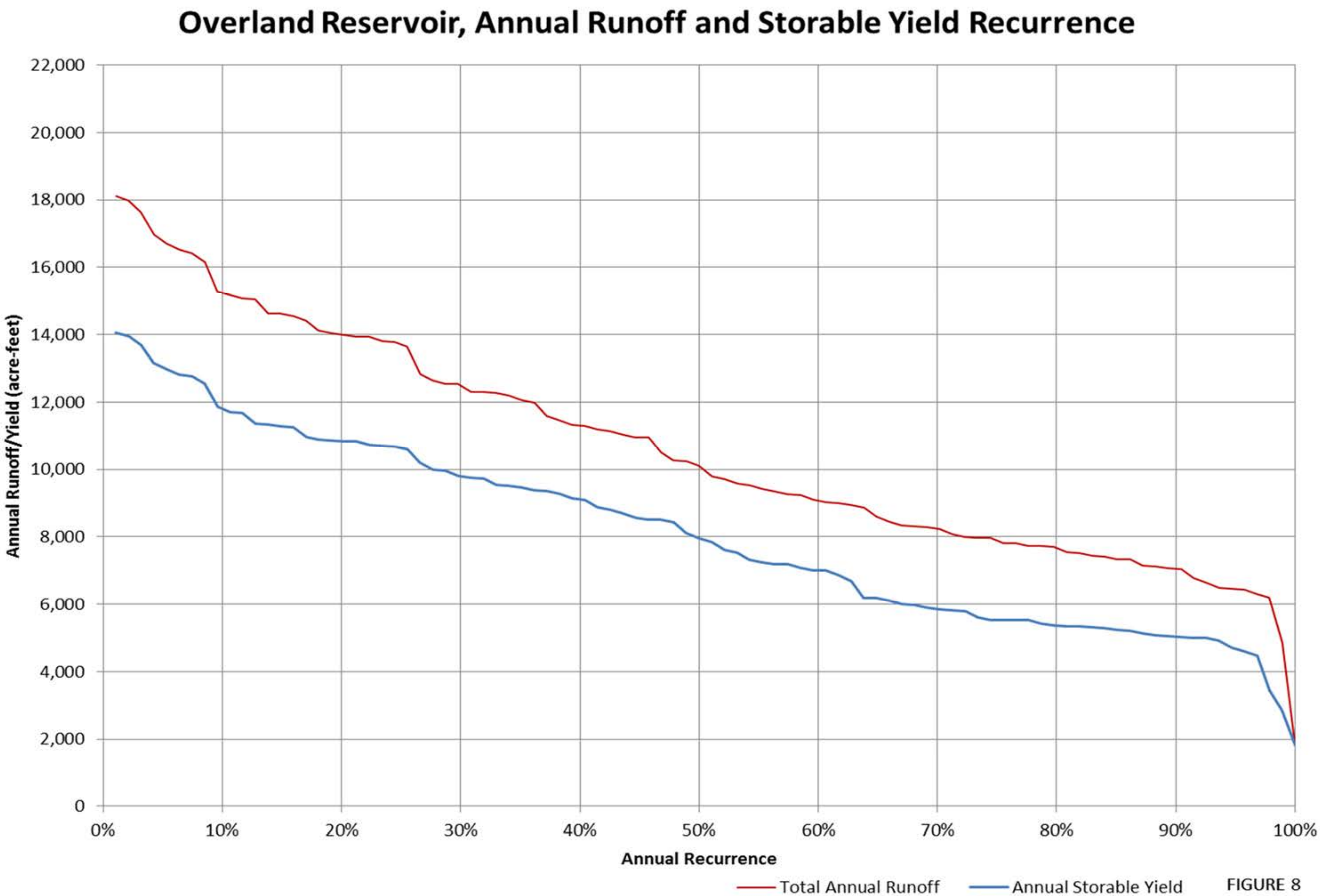

Overland Reservoir, Annual Runoff and Storable Yield Recurrence
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Annual Runoff/Yield (acre-feet)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Annual Recurrence
Total Annual Runoff
Annual Storable Yield

FIGURE 8

Table 7 presents the average annual storable yield for four sizes of reservoir: the current capacity (6,163 acre-feet of active storage), the proposed enlargement (7,171 acre-feet of active storage) and two larger sizes (7,500 and 8,000 acre-feet of active storage). The average annual storable yield for the incremental additional storage above the previous (next lower) capacity is also shown.

Table 7: Storable Yield Versus Reservoir Size

Total Active Reservoir Capacity (acre-feet)	Incremental Reservoir Capacity (acre-feet)	Total Capacity Yield (acre-feet/percent of active capacity)	Incremental Capacity Yield (acre-feet/percent of incremental capacity)
6,163	N/A	5,796/94%	N/A
7,171	1,008	6,417/89%	621/62%
7,500	329	6,595/88%	175/54%
8,000	500	6,850/86%	255/51%