



**US Army Corps
of Engineers®**

Portland District

Willamette Basin Review Feasibility Study

APPENDIX I

Reservoir-Related Boating Recreation Benefits Impact Analyses

June 2018

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Evaluation of Reservoir-Related Recreation Benefits

A reallocation of Willamette Valley Project (WVP) conservation storage to M&I water supply, Agricultural Irrigation, and Fish & Wildlife could change the existing water management and conservation plan for the WVP. In turn, this action would affect pool elevations and/or the timing of pool draw down. Reallocation of conservation storage could change existing reservoir pool elevations throughout the summer conservation use season. A multitude of recreation activities occur at Willamette Valley Project recreation facilities, but the only recreation activity that would be directly affected by changes in existing pool elevations would be recreational boating¹.

Boating opportunities in Oregon include 377,700 Federal recreation water acres according to the 2013 - 2017 Oregon SCORP². There are 783 boat ramp lanes statewide, including federal and non-federal facilities. In SCORP Planning Regions 1 and 2, which include the WVP, there are 66,650 Federal and non-Federal recreation water acres and 262 boat ramp lanes. The WVP supports 33 boat ramps³ - facilities also include three marinas and a yacht club operated under a lease agreement with the Corps.

1 Analytical Framework

1.1 Reservoir Pool Elevations

ResSim pool elevation output data for the No Action Alternative and the Agency Recommended Plan (ARP) were used to determine the relative impacts of the ARP on boating recreation. Daily data were analyzed for the period May 1 through September 30 over 80 ResSim simulation years. Daily pool elevations (i.e., 80 May 1 days, 80 May 2 days, 80 May 3 days, and continuing through to 80 September 30 days were analyzed) for each reservoir. Daily pool elevations were compared against each of the reservoir's boat launch facility elevations, and the days for which each boat launch facility was inaccessible (i.e., reservoir pool elevation lower than boat launch facility elevation) were recorded.

1.2 Ramp Elevations

Below is a listing of boat launch elevations at each of the WVP reservoirs. Each of the ramps was evaluated against daily reservoir pool elevation data as a means to identify impacts.

¹ It is important to note that recreational boating may include a sub-category of anglers who fish from a boat. Shoreline anglers would be less likely to be affected by changes from existing pool elevations because of opportunities to cast farther or to relocate to alternative shoreline locations where deeper water may be available, (e.g. move closer to the dam or walk out into the lake bed).

² Statewide Comprehensive Outdoor Recreation Plan 2013-2017, Oregon Parks and Recreation Department. Available at http://www.oregon.gov/oprd/PLANS/Pages/SCORP_overview.aspx#SCORP

³ Total does not include boat ramps at the Dexter or Foster re-regulating reservoirs

Blue River Reservoir:

1. Elevation 1295 NGVD: Saddle Dam Boat Launch; and
2. Elevation 1330 NGVD: Lookout Boat Launch.

Cottage Grove Reservoir:

1. Elevation 745 NGVD: Lakeside Park Boat Ramp; and
2. Elevation 779 NGVD: Wilson Creek Boat Ramp.

Cougar Reservoir:

1. Elevation 1635 feet NGVD: Slide Creek Boat Ramp; and
2. Elevation 1635 feet NGVD: Echo Park Boat Ramp.

Detroit Reservoir:

1. Elevation 1450 feet NGVD: Mongold Low Water Boat Ramp;
2. Elevation 1530 feet NGVD: Detroit Lake State Park Boat Ramp G;
3. Elevation 1534 feet NGVD: Mongold Main Boat Ramp;
4. Elevation 1540 feet NGVD: Mongold East Boat Ramp;
5. Elevation 1541 feet NGVD: Cove Creek Boat Ramp;
6. Elevation 1542 feet NGVD: South Shore Boat Ramp;
7. Elevation 1543 feet NGVD: Hoover Boat Ramp;
8. Elevation 1546 feet NGVD: Kane's Marina; and
9. Elevation 1556 feet NGVD: Detroit Lake State Park Boat Ramp D.

Dorena Reservoir:

1. Elevation 765 feet NGVD: Baker Bay Boat Ramp; and
2. Elevation 820 feet NGVD: Harms Park Boat Ramp.

Fall Creek Reservoir:

1. Elevation 689 feet NGVD: North Shore Boat Ramp;
2. Elevation 803 feet NGVD: Winberry Creek Park Boat Ramp; and
3. Elevation 822 feet NGVD: Cascara Campground Boat Ramp.

Fern Ridge Reservoir:

1. Elevation 364 feet NGVD: Orchard Point Park Boat Ramp;
2. Elevation 365 feet NGVD: Richardson Park Boat Ramp;
3. Elevation 367 feet NGVD: Fern Ridge Shores Boat Ramp; and
4. Elevation 368 feet NGVD: Perkins Peninsula Boat Ramp.

Green Peter Reservoir:

1. Elevation 919 feet NGVD: Thistle Creek Boat Ramp; and
2. Elevation 970 feet NGVD: Whitcomb Creek Boat Ramp.

Hills Creek Reservoir:

1. Elevation 1441 feet NGVD: Packard Creek Boat Ramp;
2. Elevation 1507 feet NGVD: CT Beach Park Boat Ramp; and
3. Elevation 1520 feet NGVD: Bingham Landing Boat Ramp.

Lookout Point Reservoir:

1. Elevation 821 feet NGVD: Signal Point Boat Ramp;
2. Elevation 900 feet NGVD: Black Canyon Boat Ramp;
3. Elevation 908 feet NGVD: Meridian Park Boat Ramp; and
4. Elevation 911 feet NGVD: Hampton Landing Boat Ramp.

1.3 Unit Day Value Points and Dollar Value Per Day of Boating

The unit day value (UDV) method for estimating recreation benefit impacts was used in this analysis to monetize the change in recreation benefits from conditions under the No Action Alternative to conditions under the ARP.

The UDV method relies on informed opinion and judgement to approximate the average willingness to pay of users of federally assisted recreation resources. Each year, the Corps distributes an Economic Guidance Memorandum (EGM) which assigns a range of values to categories of recreation⁴. The appropriate assignment of values combined with an estimation of recreation use (or visitation) yields an estimate of the recreational value of the resource in question. For this analysis, a UDV total point value of 87 out of 100 potential points for general recreation was estimated. The assessment was based on informed opinion regarding the recreation resource qualities noted below:

1. Recreation Experience (30 Potential Points). This criterion evaluates the degree of use and potential crowding at the facility. Given the vast size of the WVP reservoirs, and the degree to which parking is available for boaters, a total of 23 UDV points were assigned to the recreation experience. In order to assign a point value of more than 23, the recreation resource must show very low evidence of other users, and never be crowded.
2. Availability of Opportunity (18 Potential Points). This criterion evaluates whether or not similar recreation experiences can be traveled to within prescribed time limits. Travel time between any two WVP reservoirs was estimated to be one hour. If no similar facilities exist within a travel time of one hour, a maximum of 14 points can be assigned (and was selected for this criterion). In order to assign a point value of more than 14, no alternative facilities can be located within two hours of travel time.
3. Carrying Capacity (14 Potential Points). This criterion evaluates whether or not adequate facilities exist to conduct the activity without deterioration of the resource. In this sense, facilities relate to the existence of adequate parking facilities and boat ramps. The WVP boat ramps are well kept, and parking is ample and safe. The UDV points assigned to this criterion is 12 out of 14 potential points.
4. Accessibility (18 Potential Points). This criterion evaluates transportation access to and within the resource site. Travel to each WVP boat ramp showed good access, a high standard road to each site, and good access to the recreation resource within each site. For these reasons, a total of 18 points were assigned for the accessibility criterion.
5. Environmental Quality (20 Potential Points). This criterion evaluates aesthetic factors (e.g., air and water pollution, pests, poor climate, and unsightly adjacent areas). The

⁴ The most recent being EGM 18 -03, Unit Day Values for Recreation for Fiscal year 2018, dated 20 Nov 2017

beauty of the landscape surrounding the WVP reservoirs, the overall high aesthetic quality, and few (if any) factors existing to lower environmental quality, a total of 20 points were assigned to this criterion.

At a total of 87 points, the UDV for a day of boating recreation experience is \$ 11.42⁵ per boater, as valued by EGM-18-03.

Estimates of Year 2020 recreation visits for each reservoir were derived from current Corps Willamette Valley Project visitation estimates⁶, and Willamette Basin population growth estimated at 1.7 percent per year.

2 Boat Ramp Availability – No Action Alternative and ARP

Table 1 provides a summary of the boat ramps available under the No Action Alternative and under the ARP for each of the four water year types at Year 2070. The underlying basis of comparison in Table 1 is average monthly reservoir pool elevation. Average monthly pool elevation is a slightly less sensitive metric than the daily counts that will be used for the UDV analysis (which is based on a daily time step). As a result, fewer impacts are identified, but the overall pattern of impact is in line with the impacts identified in the UDV analysis later in this document. Impacts to the number of boat ramps available (i.e., fewer boat ramps available under the ARP than under the No Action Alternative) are highlighted in the table, and noted below.

Blue River:

- No change between the No Action Alternative and ARP in any water year types or months.

Cottage Grove:

- No change between the No Action Alternative and ARP in any water year types or months.

Cougar:

- No change between the No Action Alternative and ARP in any water year types or months.

Detroit:

- Reduction in the number of ramps available in September for abundant water year types. Six ramps would be available under the No Action Alternative, and five ramps would be available under the ARP. Reduction in the number of ramps available in June for insufficient water year types. Eight ramps would be available under the No Action

⁵ Note that the highest possible point value of 100 corresponds to a daily recreation experience EGM-18-03 value of \$ 12.15

⁶ Estimates of visitation at Corps of Engineers projects are based on the Corps Visitation Estimation and Reporting System (VERS), which includes vehicle meter counts and site specific surveys used to translate vehicle counts to numbers of visitors.

Alternative, and seven ramps would be available under the ARP. No change between the No Action Alternative and ARP in any other water year types or months.

Dorena:

- No change between the No Action Alternative and ARP in any water year types or months.

Fall Creek:

- No change between the No Action Alternative and ARP in any water year types or months.

Fern Ridge:

- No change between the No Action Alternative and ARP in any water year types or months.

Green Peter:

- Reduction in the number of ramps available in September for adequate water year types. Two ramps would be available under the No Action Alternative, and one ramp would be available under the ARP. No change between the No Action Alternative and ARP in any other water year types or months.

Hills Creek:

- No change between the No Action Alternative and ARP in any water year types or months.

Lookout Point:

- Reduction in the number of ramps available in August for adequate water year types. Four ramps would be available under the No Action Alternative, and three ramps would be available under the ARP. No change between the No Action Alternative and ARP in any other water year types or months.

**Table 1
Boat Ramps Available at Monthly Average Reservoir Pool Elevations – Yr 2070**

		Abundant Years (n=44)		Adequate Years (n=14)		Insufficient Years (n=11)		Deficit Years (n=11)	
		NA 2070	ARP 2070	NA 2070	ARP 2070	NA 2070	ARP 2070	NA 2070	ARP 2070
Blue River	May	2	2	1	1	1	1	0	0
	June	2	2	1	1	0	0	0	0
	July	2	2	1	1	0	0	0	0
	Aug	2	2	1	1	0	0	0	0
	Sep	1	1	0	0	0	0	0	0
Cottage Grove	May	2	2	2	2	1	1	1	1
	June	2	2	2	2	1	1	1	1
	July	2	2	2	2	1	1	1	1
	Aug	2	2	1	1	1	1	1	1
	Sep	2	2	1	1	1	1	1	1
Cougar	May	2	2	2	2	2	2	0	0
	June	2	2	2	2	2	2	0	0
	July	2	2	2	2	2	2	0	0
	Aug	2	2	2	2	0	0	0	0
	Sep	2	2	0	0	0	0	0	0
Detroit	May	9	9	9	9	5	5	1	1
	June	9	9	9	9	8	7	1	1
	July	9	9	9	9	4	4	1	1
	Aug	8	8	8	8	1	1	1	1
	Sep	6	5	3	3	1	1	1	1
Dorena	May	2	2	2	2	2	2	1	1
	June	2	2	2	2	1	1	1	1
	July	2	2	2	2	1	1	1	1
	Aug	2	2	1	1	1	1	1	1
	Sep	1	1	1	1	1	1	1	1
Fall Creek	May	3	3	1	1	1	1	1	1
	June	2	2	1	1	1	1	1	1
	July	2	2	1	1	1	1	1	1
	Aug	2	2	1	1	1	1	1	1
	Sep	1	1	1	1	1	1	1	1
Fern Ridge	May	4	4	4	4	4	4	4	4
	June	4	4	4	4	4	4	4	4
	July	4	4	4	4	4	4	3	3
	Aug	4	4	4	4	4	4	1	1
	Sep	3	3	2	2	2	2	0	0
Green Peter	May	2	2	2	2	2	2	2	2
	June	2	2	2	2	2	2	2	2
	July	2	2	2	2	2	2	2	2
	Aug	2	2	2	2	2	2	1	1
	Sep	2	2	2	1	1	1	1	1
Hills Creek	May	3	3	3	3	2	2	1	1
	June	3	3	3	3	1	1	1	1
	July	3	3	3	3	1	1	1	1
	Aug	3	3	2	2	1	1	1	1
	Sep	2	2	1	1	1	1	1	1
Lookout Point	May	4	4	4	4	3	3	1	1
	June	4	4	4	4	4	4	1	1
	July	4	4	4	4	2	2	1	1
	Aug	4	4	4	3	1	1	1	1
	Sep	2	2	1	1	1	1	1	1

Figures 1 through 10 provide graphic representations of average pool elevations by month and water year type for the No Action Alternative and the ARP at each of the WWP reservoirs for the year 2070. Average monthly elevations are plotted against boat ramp elevations (represented by solid horizontal lines on the figures) so that the impact of the ARP relative to the No Action Alternative across all water year types can be visualized.

Figure 1: Blue River Reservoir Pool Elevation Comparison

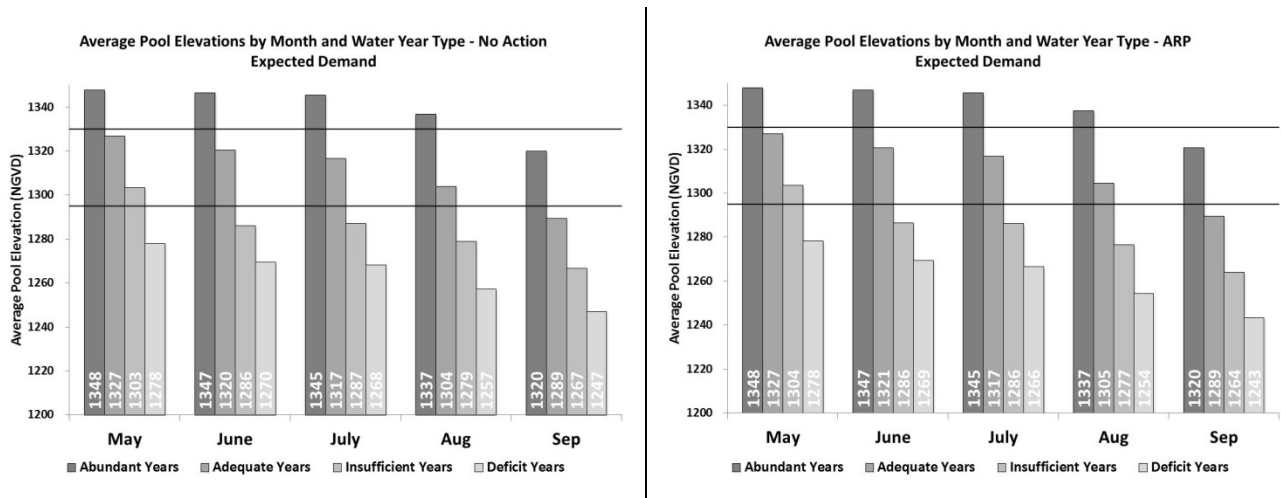


Figure 2: Cottage Grove Reservoir Pool Elevation Comparison

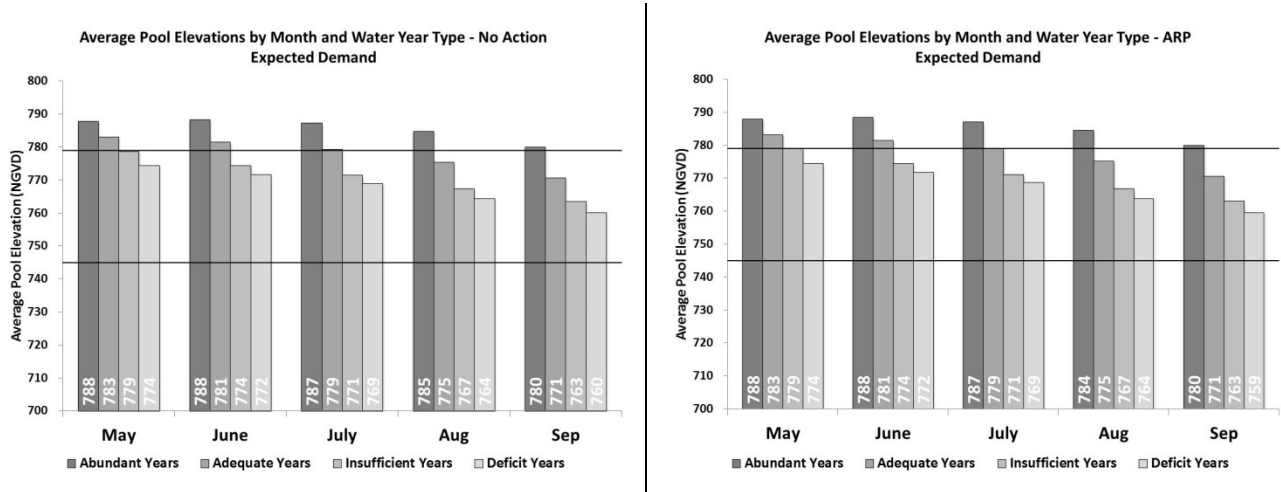


Figure 3: Cougar Reservoir Pool Elevation Comparison

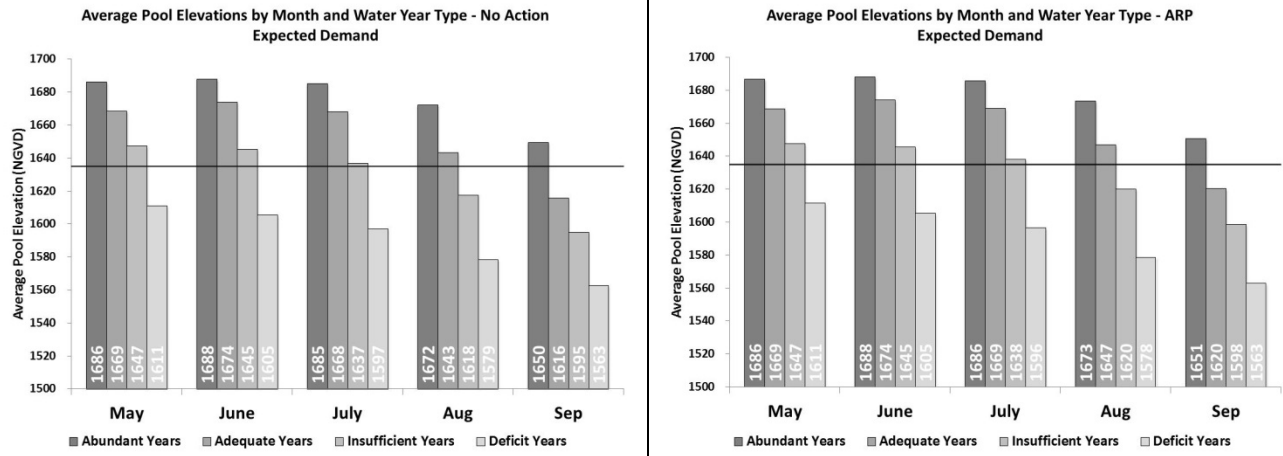


Figure 4: Detroit Reservoir Pool Elevation Comparison

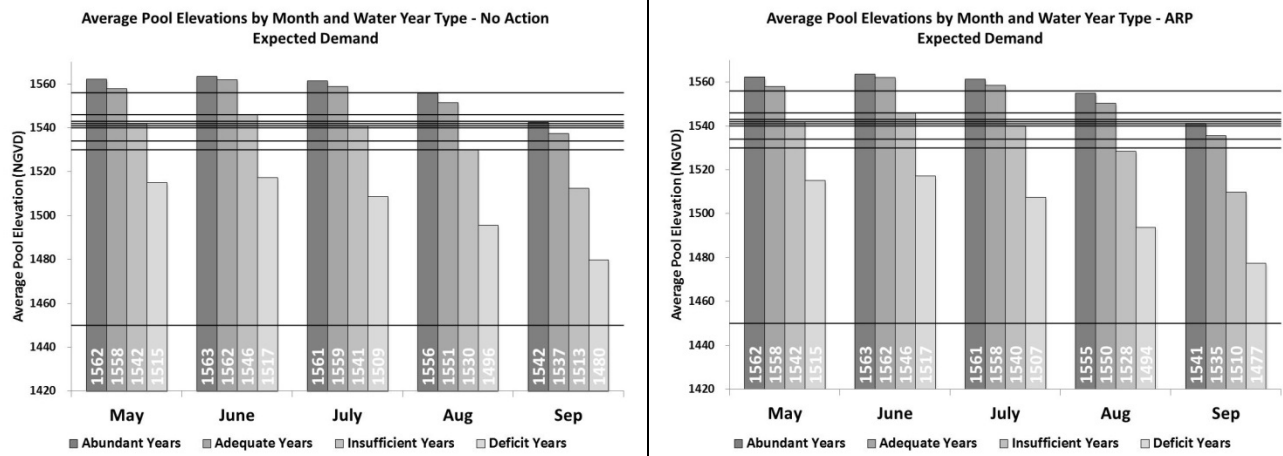


Figure 5: Dorena Reservoir Pool Elevation Comparison

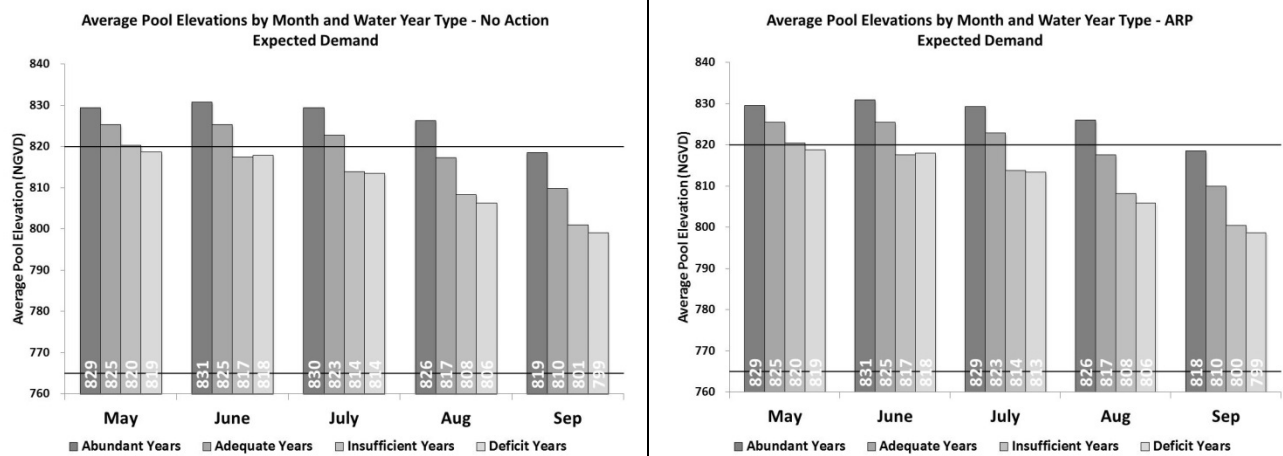


Figure 6: Fall Creek Reservoir Pool Elevation Comparison

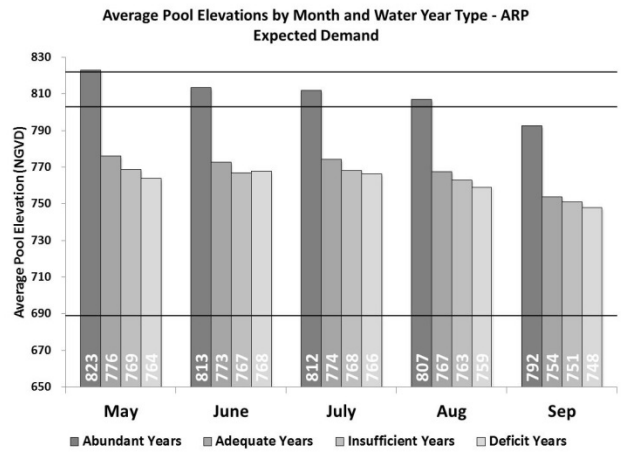
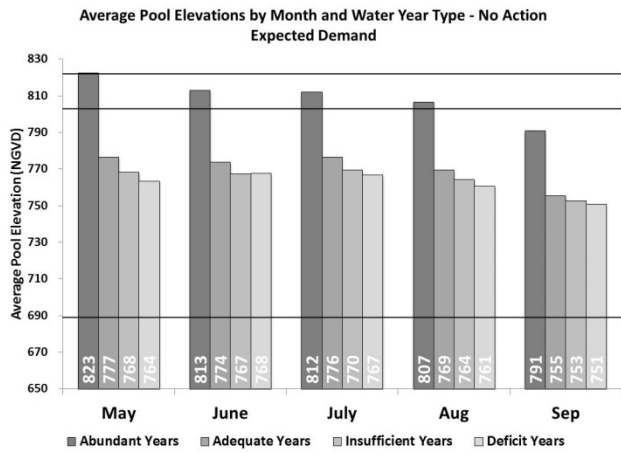


Figure 7: Fern Ridge Reservoir Pool Elevation Comparison

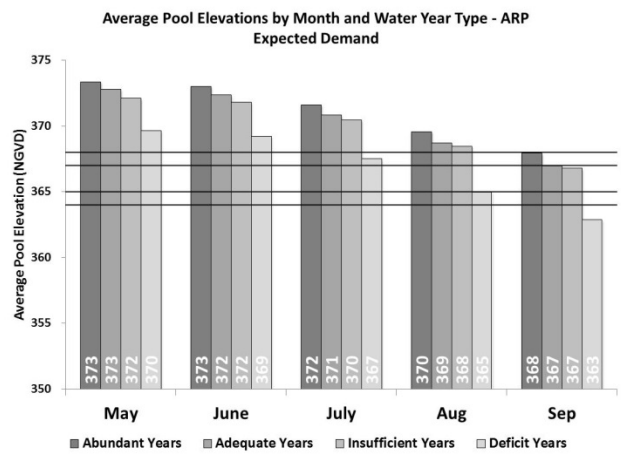
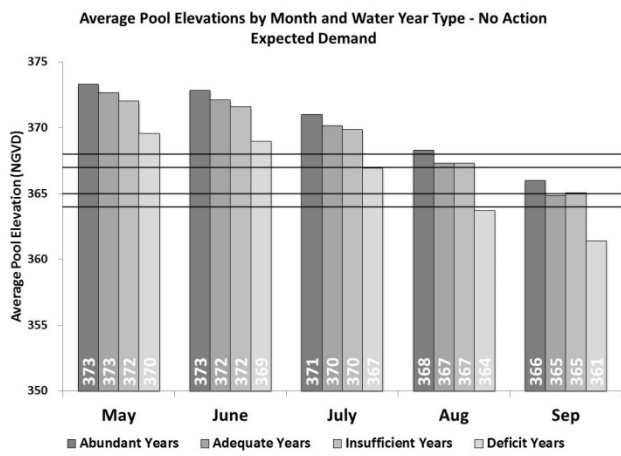


Figure 8: Green Peter Reservoir Pool Elevation Comparison

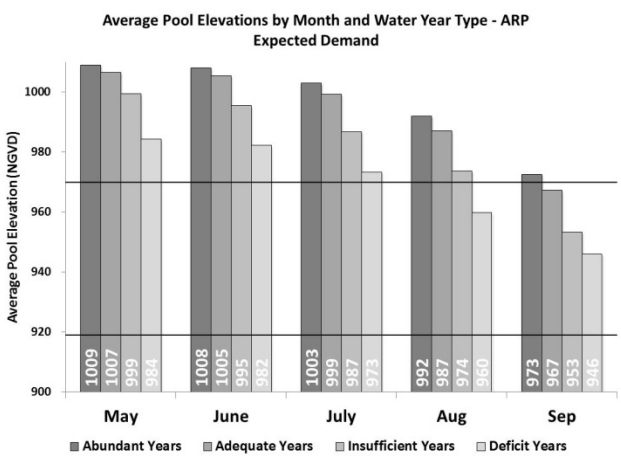
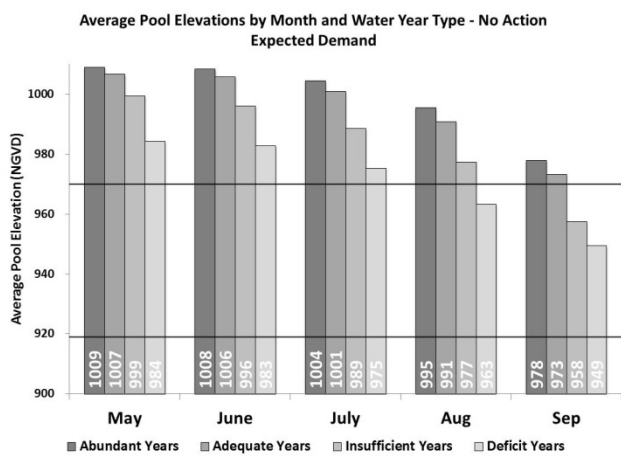


Figure 9: Hills Creek Reservoir Pool Elevation Comparison

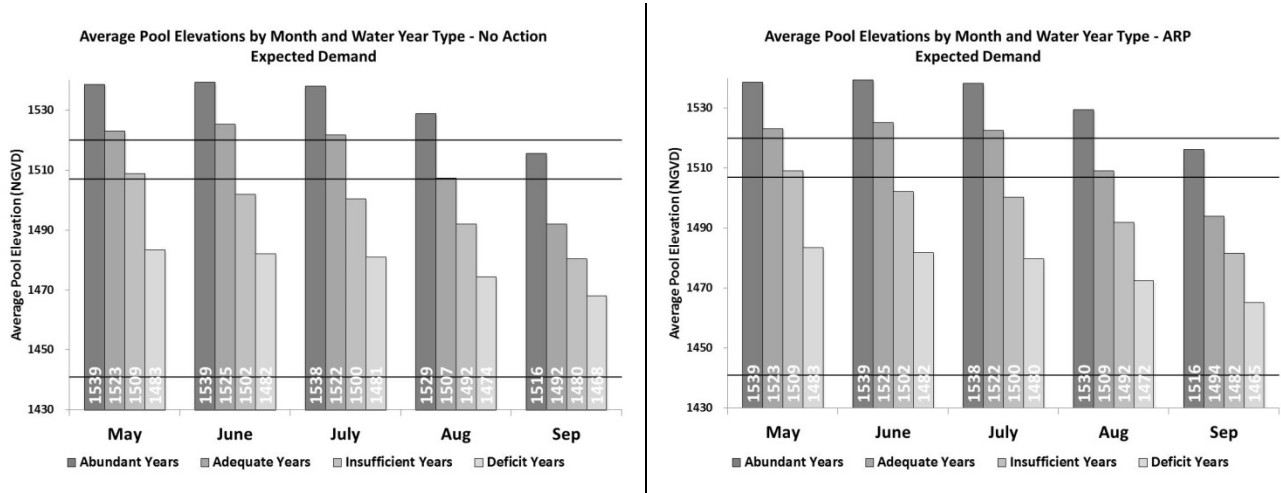
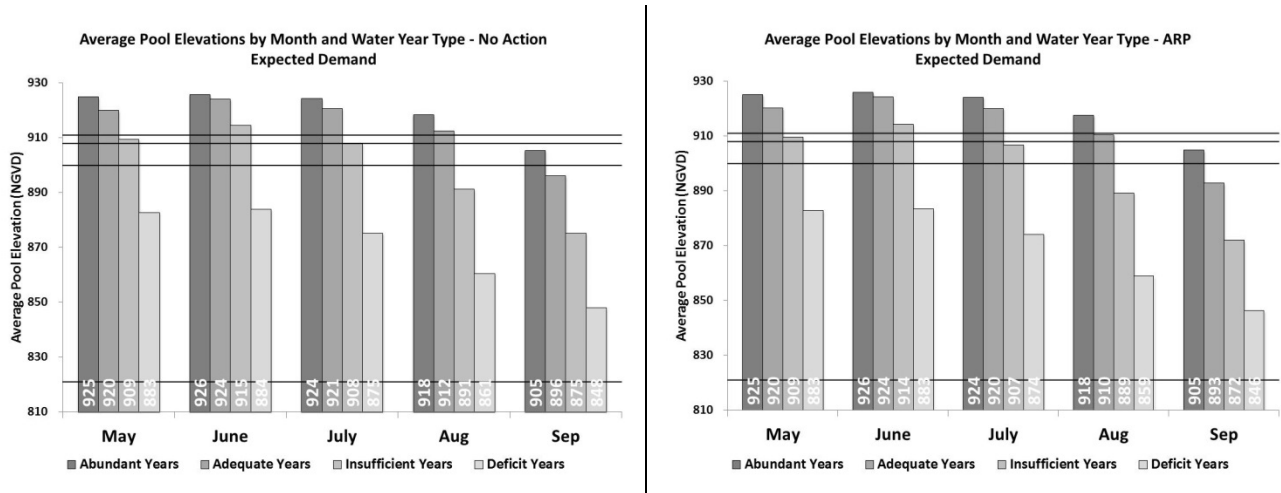


Figure 10: Lookout Point Reservoir Pool Elevation Comparison



3 NED Recreational Boating Impacts

The analysis of recreational boating impacts began with the official 2012⁷ Portland District estimates of recreation visitation, as shown below in Table 2⁸. The 2012 visitation estimates were projected out to the base year of 2020 by applying an annual 1.14 percent population growth factor calculated from the Oregon Department of Administrative Services – Economic Analysis Branch population estimates for 2012 and 2020. Visitation estimates for the year 2070

⁷ Estimates are not available past FY12 because the Portland District is in the process of altering the method used to convert vehicle counts to visitation estimates.

⁸ The re-regulating reservoir projects (Big Cliff, Dexter, and Foster) are not included in this analysis, and are omitted from all totals.

were projected forward by applying an annual 0.92 percent population growth factor using this source, as well.

Monthly visitation data for each of the reservoir projects were also provided by the Portland District for several years, which were used to develop a ratio of summer season (May 1 through August 31) visitors to total annual visitors. The ratios are also provided on Table 2, along with the result of applying the summer season ratio to projected years 2020 and 2070 visits for each reservoir project.

Table 2: WVP Visitation Summary and Projections

WVP Reservoir	2012 Visitors	Projected 2020 Visitors	Projected 2070 Visitors	Peak Season Use Pct	Projected 2020 Peak Season Visitors	Projected 2070 Peak Season Visitors
Blue River	55,300	60,500	95,600	50%	30,300	47,800
Cottage Grove	405,700	444,200	702,100	71%	315,400	498,500
Cougar	101,300	111,000	175,500	47%	52,200	82,500
Detroit	271,300	297,100	469,600	53%	157,500	248,900
Dorena	276,500	302,800	478,600	67%	202,900	320,700
Fall Creek	238,200	260,800	412,300	77%	200,800	317,500
Fern Ridge	860,700	942,400	1,489,700	56%	527,700	834,200
Green Peter	288,700	316,100	499,600	70%	221,300	349,700
Hills Creek	44,200	48,400	76,500	46%	22,300	35,200
Lookout Point	101,200	110,800	175,100	52%	57,600	91,100
Total	2,643,100	2,894,100	4,574,600	62%	1,788,000	2,826,100

Monthly load factors (which represent the portion of park visitors participating in various activities) were taken from NWP facility surveys for all surveyed locations within each project reservoir recreation areas. The percent of watercraft use was selected from each Load Factor Summary Report, and a percent of watercraft use visitors was developed for each project reservoir. Peak season visitors in the years 2020 and 2070 were then multiplied by the reservoir specific watercraft use percentage values to obtain an estimate of the number of watercraft users for the years 2020 and 2070. The Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP) provides information that was used to develop a ratio of motorized watercraft users to all watercraft users, which is 63 percent. The estimated number of Year 2020 and Year 2070 watercraft users for each project reservoir was multiplied by this factor to arrive at an estimated number of motorized watercraft visitors projected to use each project reservoir in the years 2020 and 2070. Table 3 below provides Projected 2020 Peak Season Visits (repeated from Table 2 above), the percent of visitors using watercraft, projected 2020 watercraft users, and projected 2020 motorized watercraft users. Table 4 provides these figures for the year 2070.

Table 3: WVP Motorized Watercraft Projections – Year 2020

WVP Reservoir	Projected 2020 Peak Season Visitors	Percent of Watercraft Visitors	Projected 2020 Watercraft Visitors	Projected 2020 Motorized Watercraft Visitors
Blue River	30,300	61%	18,500	11,700
Cottage Grove	315,400	30%	94,600	59,600
Cougar	52,200	30%	15,700	9,900
Detroit	157,500	30%	47,300	29,800
Dorena	202,900	39%	79,100	49,800
Fall Creek	200,800	34%	68,300	43,000
Fern Ridge	527,700	32%	168,900	106,400
Green Peter	221,300	30%	66,400	41,800
Hills Creek	22,300	30%	6,700	4,200
Lookout Point	57,600	57%	32,800	20,700
Total	1,788,000	33%	598,300	376,900

Table 4: WVP Motorized Watercraft Projections – Year 2070

WVP Reservoir	Projected 2070 Peak Season Visitors	Percent of Watercraft Visitors	Projected 2070 Watercraft Visitors	Projected 2070 Motorized Watercraft Visitors
Blue River	47,800	61%	29,200	18,400
Cottage Grove	498,500	30%	149,600	94,200
Cougar	82,500	30%	24,800	15,600
Detroit	248,900	30%	74,700	47,100
Dorena	320,700	39%	125,100	78,800
Fall Creek	317,500	34%	108,000	68,000
Fern Ridge	834,200	32%	266,900	168,100
Green Peter	349,700	30%	104,900	66,100
Hills Creek	35,200	30%	10,600	6,700
Lookout Point	91,100	57%	51,900	32,700
Total	2,826,100	33%	945,700	595,700

Table 5 shows the impacts to motorized boating recreation benefits at each of the Willamette Valley Project reservoirs for the year 2070. For the No Action Alternative and the ARP, the table shows numbers of motorized boating visitors, ramp days available, and the UDV valuation. Also shown are the differences between the No Action Alternative and the ARP for these three metrics.

Table 5
Summary Visits, Ramp Days Available, and UDV Comparison

Reservoir	2070 Peak Season Visitors	Metric	No Action Alternative	ARP	Reduction
Blue River	47,800	Mot. Watercraft Visitors	18,400	18,400	0
		Ramp Days Available	179	179	0
		UDV Valuation (\$)	121,710	121,710	0
Cottage Grove	498,500	Mot. Watercraft Visitors	94,200	94,200	0
		Ramp Days Available	253	253	0
		UDV Valuation (\$)	890,713	890,713	0
Cougar	82,500	Mot. Watercraft Visitors	15,600	15,600	0
		Ramp Days Available	236	236	0
		UDV Valuation (\$)	137,741	137,741	0
Detroit	248,900	Mot. Watercraft Visitors	47,100	46,420	680
		Ramp Days Available	996	976	20
		UDV Valuation (\$)	386,476	378,433	8,044
Dorena	320,700	Mot. Watercraft Visitors	78,800	78,800	0
		Ramp Days Available	241	241	0
		UDV Valuation (\$)	710,158	710,158	0
Fall Creek	317,500	Mot. Watercraft Visitors	68,000	68,000	0
		Ramp Days Available	238	238	0
		UDV Valuation (\$)	401,765	401,765	0
Fern Ridge	834,200	Mot. Watercraft Visitors	168,100	168,100	0
		Ramp Days Available	543	543	0
		UDV Valuation (\$)	1,705,876	1,705,876	0
Green Peter	349,700	Mot. Watercraft Visitors	66,100	65,020	1,080
		Ramp Days Available	294	289	5
		UDV Valuation (\$)	723,845	710,895	12,950
Hills Creek	35,200	Mot. Watercraft Visitors	6,700	6,700	0
		Ramp Days Available	348	348	0
		UDV Valuation (\$)	59,284	59,284	0
Lookout Point	91,100	Mot. Watercraft Visitors	32,700	32,435	265
		Ramp Days Available	463	458	5
		UDV Valuation (\$)	279,855	276,565	3,290
TOTALS	2,826,100	Mot. Watercraft Visitors	595,700	593,675	2,025
		Ramp Days Available	3,791	3,761	30
		UDV Valuation (\$)	5,417,400	5,393,100	24,300

The table shows a total Year 2070 UDV valuation of \$5,417,400 for motorized boating recreation under the No Action Alternative, and \$5,393,100 for motorized boating recreation under the ARP. The difference between UDV benefits under the No Action Alternative and the ARP is expected to be a decrease of \$24,300 in the year 2070. Also shown in the table is a total

decrease in 30 ramp days under the ARP, which precipitates the decrease of 2,025 motorized watercraft visitors across all of the WVP projects.

While there is a UDV recreation benefit reduction of \$24,300 in the year 2070, it is important to note that this is NOT the UDV benefit impact that would be seen in the base year of 2020. Impacts of the ARP in the base year 2020 are \$0, because the releases of WVP stored water to serve M&I peak season demands (WVP releases of stored water to serve M&I peak season demands are included in the ARP, but not the No Action Alternative) begin at zero in the year 2020. As such, the average annual UDV recreation benefit loss from ARP implementation is the average of the 2070 impact, and the 2020 impact, or \$12,150.

Monetization of recreation benefits using the UDV method relates to the value of the recreation experience only. This is because Corps analyses require the evaluation of benefits from a National Economic Development (NED) perspective. In this case, the evaluation of boating recreation impacts seeks to quantify the NED cost of implementation of the ARP. If the boating recreation resources provided by the WVP show damage from implementation of the ARP, there is a loss to the national economy resulting from a diminished potential use of the recreation resource.