

# RECLAMATION

*Managing Water in the West*

## Reservoir Recreation Economics Technical Report

For the Secretarial Determination on Whether to Remove  
Four Dams on the Klamath River in California and Oregon



U.S. Department of the Interior  
Bureau of Reclamation  
Technical Service Center  
Denver, Colorado

July 2012

## **Mission Statements**

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

# **Reservoir Recreation Economics Technical Report**

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# Acronyms and Abbreviations

BCA	benefit cost analysis
NED	National Economic Development
P&Gs	<i>Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies</i>
Reclamation	Bureau of Reclamation
RED	Regional Economic Development
VAOT	vehicles at one time



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## **1.1 INTRODUCTION**

This analysis measures potential changes in recreation visitation, recreation economic value, and recreation expenditures at the Klamath River dams and reservoirs proposed for removal. Changes in reservoir recreation economic value associated with the proposed dam removal alternatives as compared to the No Action Alternative reflect the reservoir recreation benefit measure used in the national economic development (NED) benefit-cost analysis. Changes in reservoir recreation expenditures are used to generate the reservoir recreation economic impacts displayed in the regional economic development (RED) impact analysis. Both the NED and RED analyses presented in the Economics and Tribal Summary Technical Report for the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon (Reclamation, 2011).

Of the four dams proposed for removal, significant reservoir recreation activity occurs at only three: J.C. Boyle, Copco 1, and Iron Gate. Copco Reservoir #2 is small (only 40 surface acres), does not have any recreation facilities, does not provide adequate recreation access and as a result, does not generate significant recreation activity. Therefore, the reservoir recreation analysis focuses exclusively on J.C. Boyle, Copco 1, and Iron Gate reservoirs.

## **2.1 RESERVOIR RECREATION BENEFITS USED IN THE NATIONAL ECONOMIC DEVELOPMENT (NED) BENEFIT COST ANALYSIS (BCA)**

This section describes the estimation of reservoir recreation benefits used within the NED BCA.

### **2.1.1 Methodology and Assumptions**

Reservoir recreation benefits associated with the dam removal alternatives are based on the difference in reservoir recreation economic value between the No Action Alternative and the dam removal alternatives. To develop estimates of the change in reservoir recreation economic value due to the removal of the reservoirs, annual estimates of the change in recreation visitation at each reservoir between the No Action Alternative and the dam removal alternatives were applied to estimates of recreation economic value per visit at each reservoir. The changes in annual reservoir recreation economic value were discounted and aggregated to provide an estimate of reservoir recreation benefits associated with each dam removal alternative.

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While the study period begins in year 2012 with the onset of the Klamath Basin Restoration Agreement, dam removal is not scheduled until year 2020. The assumption is made that recreation activity at these reservoirs would change between the No Action Alternative and the dam removal alternatives from the point where dam removal begins. Therefore, changes in recreation activity at these reservoirs would be expected from year 2020 through the end of the 50-year period of analysis (year 2061). As noted above, since these changes in reservoir recreation visitation between the No Action Alternative and the dam removal alternatives drive the reservoir recreation benefits associated with the dam removal alternatives, the reservoir recreation analysis focuses on years 2020-2061. Since the overall study period actually begins in 2012, the annual changes in reservoir recreation economic value (benefits) were discounted back to 2012 using the current 2011 Federal water project planning rate of 4.125 percent.

### **2.1.1.1 Reservoir Recreation Visitation Projection**

Background information used to develop the visitation estimates relies heavily upon a recreation report developed for these reservoirs as part of the FERC relicensing effort (PacifiCorp, 2004).

The recreation visitation analysis required several steps. The first step involved estimating “current” visitation at the three dam removal reservoirs with recreation activity. The 2004 PacifiCorp recreation report included results of a survey and visitor counts at each of the dam removal reservoirs. This information was used to generate visitation estimates for each reservoir for year 2002. The 2002 recreation day visitation method involved multiplying survey based data on average vehicles at one time (VAOT) by average number of people per vehicle by average daily turnover rate by number of days in the recreation season.

The second step involved projecting visitation into the future. The PacifiCorp recreation report projected recreation visitation at each reservoir in 10-year increments (2010, 2020, 2030, and 2040) taking into account projected population growth and trends in the demand for recreation activities within the region (for details of the recreation visitation method see PacifiCorp, 2004). Starting from year 2002 and using high/medium/low annual growth rates (1.2%, 0.7%, and 0.3%) based on growth trends assigned to different recreation activities, visitation projections were developed annually for each reservoir through the end of the period of analysis in year 2061.

The third and final step in the recreation visitation analysis attempted to account for potential reservoir recreation site substitution. With removal of the dams and

reservoirs, a portion of the change in recreation activity at the removed reservoirs might substitute to other reservoirs. Initially, the idea was to try and evaluate the degree of excess carrying capacity within the general vicinity of the lost reservoirs. Unfortunately, data does not exist as to the amount of current (or future) excess carrying capacity at other reservoirs within the area. However, the recreation survey described in the PacifiCorp report provides information on potential substitute sites in the area. Given the number of potential substitute sites in the area, it was deemed important to address site substitution in some fashion. Section 2.1.1.1.1 below describes in detail the approach used for estimating reservoir recreation site substitution. It is also possible that some recreation activity may substitute from reservoir to river after dam removal, however attempting to estimate the degree of such substitution may be even more speculative than reservoir substitution.

**2.1.1.1.1 Reservoir Recreation Substitution**

While recreation use of the reservoirs associated with the removed dams would change, the potential for substitution to other reservoirs and rivers either inside or outside of the “primary recreation market area” of the dams to be removed implies that the change in recreation activity may be less than otherwise expected.

The primary reservoir recreation market area was defined by the top five neighboring counties (Klamath OR, Jackson OR, Josephine OR, Siskiyou CA, and Shasta CA) in terms of percentage of visitation at each reservoir. As shown below in table 2.1-1, the weighted average percent of visitation stemming from this five-county primary market area across all three dam removal reservoirs was estimated at 78.2 percent (PacifiCorp, 2004). The percentages associated with each reservoir vary with 88.1 percent of visits at J.C. Boyle Reservoir, 63.3 percent of visits at Copco 1, and 74 percent of visits at Iron Gate coming from the five-county market area.

Given the number of potential substitute sites in the southern Oregon/northern California market area, it seems reasonable to assume that a significant portion of market area residents would substitute to other sites within the area. Since approximately 21.8% of visitors across all three reservoirs come from outside the primary market area, those visitors might substitute to sites outside the area after the dams have been removed. Given the complexities associated with trying to evaluate the level of substitution to reservoirs outside the area, the analysis focuses exclusively on substitution within the primary market area. By focusing only on site substitution within the primary market area, the analysis may somewhat understate the full degree of site substitution and therefore overstate the magnitude of the impact.

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**Table 2.1-1.—Visitation percentages by reservoir based on 2002 visitation by county**

State/neighboring county	Percent by State/county for each reservoir			
	J.C. Boyle	Copco 1	Iron Gate	
Oregon	0.858	0.067	0.536	
Klamath	0.784	0.067	0.039	
Jackson	0.06	0	0.286	
Josephine	0	0	0.141	
Lake	0.007	0	0.007	
California	0.09	0.833	0.441	
Siskiyou	0.03	0.533	0.211	
Del Norte	0	0	0.02	
Shasta	0.007	0.033	0.063	
Washington	0.022	0	0.01	
Other States	0.028	0.1	0.013	
<b>I. Primary Market Area: (Counties: Klamath, Jackson, Josephine, Siskiyou, Shasta)</b>				
Primary market area percent	0.881	0.633	0.74	
2002 percent visits by site	0.365	0.093	0.542	Wtd avg.
Weighted % visits from within primary market area	0.322	0.059	0.401	0.782
Outside primary market area percent	.119	.367	.26	
2002 percent visits by site	0.365	0.093	0.542	
Weighted % visits from outside primary market area	0.043	0.034	0.141	0.218
<b>II. Economic Region: (Counties: Klamath, Siskiyou)</b>				
Economic region (local) percent	0.814	0.6	0.25	
2002 percent visits by site	0.365	0.093	0.542	Wtd avg.
Weighted % visits from within economic region	0.297	0.056	0.136	0.488
Outside economic region (non-local) percent	0.186	0.4	0.75	
2002 percent visits by site	0.365	0.093	0.542	Wtd avg.
Weighted % visits from outside economic region	0.068	0.037	0.407	0.512

As shown in table 2.1-2, the three dams/reservoirs with recreation activity planned for removal provide about 2,364 acres of reservoir surface. There are many potential substitute reservoirs within the general area surrounding the proposed dam removal sites. While not an exhaustive list, the reservoirs listed in table 2.1-2 reflect those considered in the recreation analysis conducted for the ongoing FERC relicensing effort (PacifiCorp, 2004). The potential substitute reservoirs listed in table 2.1-2 combine to provide in excess of 241,000 acres of reservoir surface within the primary market area. If one limits substitution to smaller reservoirs in the area under the assumption that those reservoirs might provide a more similar recreation experience, those “smaller” reservoirs (reservoirs with less than 10,000 surface acres) still provide over 22,300 acres of reservoir surface. Even this reduced focus on smaller reservoirs provides nearly ten times the amount of surface acres associated with the dam removal sites.

As noted above, this is not an exhaustive list and focuses only on selected reservoirs within the five-county southern Oregon/northern California market area. Inclusion of other counties in the general vicinity, such as Lake County OR and Modoc County CA, would add significantly more reservoir surface acreage. At first glance, there appears to be ample opportunity for substitution from the proposed reservoirs for removal to other existing reservoirs in the area.

While multiple substitute reservoirs exist, there are a number of issues which might limit the amount of reservoir substitution within the region. The dam removal reservoirs are located among several different mountain ranges and are therefore somewhat unique within the region. According to the PacifiCorp (2004) recreation analysis, only Upper Klamath Lake and Agency Lake have a “similar physical setting.” In addition to somewhat dissimilar physical settings, table 2.1-2 also presents differences between the reservoirs in terms of recreation facilities, water temperatures, and reservoir/boating speed restrictions, all of which may imply a different range of recreation activities between the potential substitute reservoirs and the dam removal reservoirs. As a result, not all substitute reservoirs provide a similar recreation experience.

The dam removal reservoirs have similar visitation use patterns (i.e., similar peak seasons, similar weekend/holiday peaks) as the other regional reservoirs. Usage at several of the potential substitute reservoirs (e.g., Lake of the Woods, Emigrant Lake, Whiskeytown Lake, Shasta Lake) is already high and at or approaching capacity during peak season weekends and holidays suggesting a limited capacity to absorb lost visitation from the dam removal sites during those times. As populations continue to grow in Oregon and California especially in the proposed

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dam removal primary market area counties,<sup>1</sup> use of these popular reservoirs as well as the other reservoirs in the area would likely increase thereby resulting in additional carrying capacity/site substitution limitations. While recreation facilities could be added or expanded over time to meet increasing demand, some of the carrying capacity constraints relate to the size of the reservoir (e.g., the number of boats per surface acre), a factor which cannot be easily increased.

Finally, based on the survey conducted as part of the PacifiCorp recreation analysis, 28 percent of the respondents indicated Iron Gate Reservoir and 5 percent indicated J.C. Boyle Reservoir to be their favorite water-based recreation site in the region. As a result, it is possible that some recreators at these sites may choose not to substitute to other sites inside or outside of the region.

Using information presented above, substitution percentages were estimated for each dam removal reservoir. Two primary assumptions were used to develop an estimate for each dam removal reservoir reflecting the percentage of visits which would **not** substitute to other sites within the five-county primary market area. First, it was assumed that visits made by recreators from outside the five-county market area would not substitute to other sites within the area. These recreators are coming from further distances, by limiting their choices by reducing the number of reservoir options, the area becomes somewhat less attractive to reservoir recreators. Second, it was assumed that the percent of recreators at J.C. Boyle (5%) and Iron Gate (28%) that indicated these reservoirs to be their favorite could be applied to recreators from within the market area and that these percentages indicate the percent of market area visitors who would not substitute to other sites. While technically, these favorite site percentages were obtained from the entire sample, applying them to the within market area sample allows for estimation of a non-substituting percentage for market area residents. As shown in table 2.1-3, combining the non-substituting percentages for recreators from outside the market area with non-substituting percentages for recreators from

Oregon Counties						California Counties			
Year	Jackson	Josephine	Klamath	OR area	OR State	Shasta	Siskiyou	CA area	CA State
2000	182.2	76.1	63.9	322.2	3,436.8	164.8	44.6	209.4	34,105.4
2010	208.4	84.2	67.0	359.6	3,843.9	191.7	47.1	238.8	39,135.7
2020	238.9	94.4	70.6	403.9	4,359.3	224.4	51.3	275.7	44,135.9
2030	268.4	105.6	74.9	448.9	4,891.2	260.2	55.7	315.9	49,240.9
2040	297.5	117.2	80.2	494.9	5,425.4	295.3	60.7	356.0	54,226.1
Percent growth from 2000 to 2040	63.3	54.0	25.5	53.6	57.9	79.2	36.1	70.0	59.0

**Table 2.1-2.—Reservoir substitution**

Reservoir name	State, county, closest town	Rank	Surface acres	Facilities	Use of facilities	Restrictions/other issues	Primary activities	Market area
Source:		2001-2 Recreation Survey: Rank of % Visited Past 12 Months, Table 3.7-9)						
Dam removal sites:								
J.C. Boyle	OR, Klamath, Keno?	n/a	420	16 campsites, 2 boat launches, 4 day use picnic areas	5% of survey respondents said this was their favorite site in study area Low use		Sightseeing/relaxing, swimming/sunbathing, fishing, picnicking, camping	88.1% from local primary market area counties
Copco 1	CA, Siskiyou, Copco?	n/a	1,000	2 boat launches, 2 day use picnic areas	Low use		Fishing, sightseeing/relaxing, camping, picnicking, swimming/sunbathing	63.3% from local primary market area counties
Iron Gate	CA, Siskiyou, Copco	n/a	944	37 campsites, 3 boat launches, 6 day use picnic areas	28% of survey respondents said this was their favorite site in study area Moderate use		Powerboating, water/jetskiing, swimming/sunbathing, sightseeing/relaxing, fishing	76.7% from local primary market area counties
Possible substitutes:		Total:	2,364					
Lake of the Woods	OR, Klamath, Klamath Falls	1	1,113	3 campgrounds (190 sites), marina, 3 boat ramps, 3 swimming areas, day use area	All facilities reach capacity during peak season (Memorial Day to Labor Day), high use 100K visits/year	None	Water/jetskiing	
Crater Lake	OR, Klamath, Fort Klamath	2	13,069	No public boat ramps, 2 developed campgrounds, 6 day use areas	Facility use high reaching full capacity on many weekends & holidays 2000: > 1 million visits	No private boats		Majority of visitors are international
Howard Prairie Lake	OR, Jackson, Ashland	3	2,000	6 campgrounds (303 sites), 4 boat ramps, marina, day use picnic area	Moderate use	No speed restriction but water/jetskiing is limited due to cold water	Boating, sailing, fishing	

**Table 2.1-2.—Reservoir substitution**

Reservoir name	State, county, closest town	Rank	Surface acres	Facilities	Use of facilities	Restrictions/other issues	Primary activities	Market area
Upper Klamath Lake/Agency Lake	OR, Klamath, Klamath Falls	3	90620; UK: 85120 Agency: 5500	Agency Lake: 5 boat launches, 5 campgrounds (43 sites) UK: 6 boat launches, a few (?) marinas, several (?) campgrounds (269 sites), day use area	Agency: Low use UK: Moderate use	UK: WL maintained between 4136 and 4146', algae limits recreation use in some areas, water/jetskiing is limited	Fishing, wildlife viewing, motorboating, dispersed camping	
Lake Ewauna/Keno Reservoir	OR, Klamath, Keno	4	2,475	26 campsites, 3 boat launches, 2 day use picnic areas	Low use			
Emigrant Reservoir	OR, Jackson, Ashland	6	806	2 campgrounds (110 sites), 2 boat ramps, 2 swimming areas, 2 day use picnic areas, waterslide	Popular, use of facilities during the summer peak season is moderate, although use levels reach capacity on weekends		Water/jetskiing, hiking, boating, canoe/kayak, fishing	
Willow Lake	OR, ?	7	?	Campgrounds and a boat launch			Boating, fishing, waterskiing	
Hyatt Reservoir	OR, Jackson, Ashland	8	1,250	4 campgrounds (172 sites), swimming area, 2 boat launches, day use picnic area	Popular, moderate use	10 mph boating speed restriction – no water/jetskiing	Fishing is primary, also camping, hiking, boating	
Gerber Reservoir	OR, Klamath, Lorella	10	3,830	5 campgrounds (50 sites), 2 boat launches, 1 day use area, dispersed camping at 6 sites	Use is low to moderate even during peak season weekends (Memorial- Labor Day) 6-10K visits	10 mph boating speed restriction – no water/jetskiing	Camping and fishing	Majority of visitors are locals
Applegate Reservoir	OR, Jackson, Applegate	-	988	10 campgrounds (66 sites), 3 boat ramps, hiking trail, day use area	Moderate use on weekends & holidays during peak season (early May – mid-Sept), low use on weekdays	10 mph boating speed restriction – no water/jetskiing	Fishing	
Fourmile Lake	OR, Klamath, Klamath Lake	-	740	1 boat ramp, 1 campground (25 sites)	Low use 18K visits/year	No speed restriction but water/jetskiing is limited due to cold water		





**Table 2.1-3.—Reservoir recreation non-substituting percentages**

	J.C. Boyle	Copco 1	Iron Gate
Percent of visits from five-county primary market area	.881	.633	.74
Favorite site percentages	.05	0	.28
Market area non-substituting percentages (residents and non-residents)			
1) Market area non-residents	.119 (1-.881)	.367 (1-.633)	.26 (1-.74)
2) Market area residents	.044 (.881*.05)	0	.207 (.74*.28)
3) Total non-substituting percentage (1+2)	<b>.163</b>	<b>.367</b>	<b>.467</b>
Market area substitution percentage	.837 (1-.163)	.633 (1-.367)	.533 (1-.467)

within the market area results in an overall non-substituting percentage for each dam removal reservoir. As can be seen from the table, the non-substituting percentage for each reservoir was estimated as follows: J.C. Boyle = 16.3 percent, Copco 1 = 36.7 percent, and Iron Gate = 46.7 percent. These percentages measure the portion of the change in visitation due to the removal of the dams which would not substitute within the primary market area. These percentages were applied to the total visitation estimates at each site to measure the change in visitation with substitution.

**2.1.1.2 Reservoir Recreation Economic Values per Visit**

Recreation economic values per day at each reservoir were based on information obtained from a nationwide meta analysis study of recreation values (Loomis, 2005). Values per recreation day by activity representing the Pacific Coast region (WA, OR, CA) as measured in 2004 dollars from Loomis (2005) were first indexed up to current (November 2010) dollars using the Western States Consumer Price Index (CPI). With the beginning of the period of analysis in year 2012, attempts were made to measure all benefits and costs in 2012 dollars/price levels. A 5-year average annual growth rate in the Western States CPI from 11/2005 to 11/2010 (11/2005: 201.4 to 11/2010: 221.671 = 1.9365% average annual growth rate) was used to project recreation values to 2012 price levels. This average annual CPI growth rate was applied for two years (2011 and 2012) to estimate recreation economic values in 2012 dollars.

It should be noted that the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&Gs) (U. S. Water Resources Council, 1983) indicate that the prices of goods

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and services used for evaluation should reflect the real exchange values expected to prevail over the period of analysis. The P&Gs also state that the relative price relationships of outputs and inputs prevailing during or immediately preceding the period of planning generally represent the real price relationships over the life of the plan unless specific considerations indicate real prices are expected to change (P&Gs, p. 5, section 1.4.10 Prices). Bottom line, the reservoir recreation analysis found no reason to expect real reservoir recreation values to change over the period of analysis and therefore assumed that the current recreation values per trip could be used across the entire period of analysis without escalation.

Weighted average recreation economic values per day in 2012 dollars were estimated for each reservoir based on estimates of the percent of visitation by activity at each reservoir multiplied by the 2012 recreation economic values per activity. The recreation survey conducted as part of the PacifiCorp recreation report gathered information on the activities pursued at each reservoir as well as the number of survey respondents participating in each activity at each reservoir. This information was used to estimate the percent of visitation by activity at each reservoir. Note that the PacifiCorp recreation survey provided a more detailed range of recreation activities as compared to the Loomis (2005) valuation study. As a result, several of the recreation activities from the PacifiCorp survey were combined (e.g., tent camping and RV camping were combined into “Camping”; bank and boat fishing were combined into “Fishing”; tubing, whitewater boating, and canoeing/kayaking were combined into “Float/Raft/Canoe”). Percentages associated with the top seven activities at each reservoir were reweighted (to sum to 100%) and then applied to the 2012 recreation economic values by activity to estimate a weighted average recreation economic value per visit for each reservoir (J.C. Boyle: \$47.10, Copco 1: \$57.37, and Iron Gate: \$52.44). Table 2.1-4 displays the calculations for the recreation economic values associated with each reservoir. The recreation economic values for each reservoir were multiplied by the annual estimates of lost recreation activity at each reservoir to develop estimates of the total change in recreation economic value for use in the benefit-cost analysis.

### 2.1.2 Reservoir Recreation Economic Value

Changes in reservoir recreation economic value for the proposed dam removal alternatives as compared to the No Action Alternative provide estimates of reservoir recreation benefits for the dam removal alternatives. The reservoir recreation benefits are used in the NED benefit cost analysis presented in the Secretarial Determination Economic and Tribal Summary Report (Reclamation, 2011).

Table 2.1-4: Recreation Values by Site

Recreation Activity	PacifiCorp (2004) (*)				PacifiCorp (2004) (*)				PacifiCorp (2004) (*)				Loomis (2005) (**)			
	# of Survey Respondents Participating in J. C. Boyle Reservoir		J. C. Boyle Reservoir 2012 \$ Weighted Average Value based on Top 7 Activities		Top 7 Activities Re-weighted Reservoir Percentage Rank		Copro Reservoir 2012 \$ Weighted Average Value based on Top 7 Activities		Top 7 Activities Re-weighted Reservoir Percentage Rank		Iron Gate Reservoir 2012 \$ Weighted Average Value based on Top 7 Activities		Top 7 Activities Re-weighted Reservoir Percentage Rank		Pacific Coast Values per Day (2012 \$)	
	Reservoir	Percentage	Rank	Percentage	Rank	Percentage	Rank	Percentage	Rank	Percentage	Rank	Percentage	Rank	Percentage	Rank	Values per Day (2010 \$)
Swimming/Sunbathing	90	0.1754	2	0.2278	7.42	0.0501	5	0.0535	1.74	93	0.1490	2	0.1792	27.29	31.34	32.57
Sightseeing/Relaxing	99	0.1930	1	0.2506	6.06	0.2026	2	0.2163	5.23	91	0.1458	3	0.1753	20.27	23.28	24.19
Picnicking	45	0.0877	4	0.1139	8.73	0.0806	4	0.0860	6.59	36	0.0577	6	0.0694	64.22	73.76	76.64
Tent Camping	23									40						
RV Camping	17									45						
Camping	40	0.0780	5	0.1013	12.61	0.1460	3	0.1558	19.41	85	0.1362	4	0.1638	104.35	119.85	124.54
Fishing - bank	31									37						
Fishing - boat	21									46						
Fishing	52	0.1014	3	0.1316	6.97	0.2832	1	0.3023	16.01	83	0.1330	5	0.1599	44.36	50.95	52.94
Hiking	28	0.0546	7	0.0709	1.97	0.0370	7	0.0395	1.10	19	0.0304	9	0.0324	23.24	26.69	27.74
Wildlife Viewing	21	0.0409	9			0.0436	6	0.0465	4.02	27	0.0433	8	0.0448	72.48	83.25	86.5
Powerboating/Waterskiing/Jetskiing	41	0.0799	6	0.1038	3.34	0.0436	6	0.0465	1.50	96	0.1538	1	0.1850	26.94	30.94	32.15
Tubing	20									28						
Whitewater boating	2									2						
Canoeing/kayaking	4									5						
Float/Raft/Canoe	26	0.0507	8			0.0501	5	0.0535	1.78	35	0.0561	7	0.0674	27.84	31.98	33.23
Mountain Biking/Biking	18	0.0351	10			0.0065	10			15	0.0240	15		49.68	57.06	59.29
ORV	13	0.0253				0.0218	9			11	0.0176			40.37	46.37	48.18
Target Shooting	17	0.0331				0.0000	10			7	0.0112			?	?	?
Hunting	6	0.0117				0.0065	10			6	0.0096			45.49	52.25	54.29
Horseback Riding	4	0.0078				0.0000				4	0.0064			?	?	?
Other	13	0.0253				0.0283	8			16	0.0256			?	?	?
<b>Total:</b>	<b>513</b>	<b>1.0000</b>		<b>1.0000</b>	<b>47.10</b>	<b>1.0000</b>	<b>8</b>	<b>1.0000</b>	<b>57.37</b>	<b>624</b>	<b>1.0000</b>	<b>10</b>	<b>1.0000</b>	<b>52.44</b>		
	<b>Top 5 Percentage:</b>			<b>0.8126</b>		<b>0.7179</b>		<b>0.8317</b>		<b>Top 5 Percentage:</b>			<b>0.9311</b>			
	<b>Top 7 Percentage:</b>			<b>0.9368</b>		<b>0.8317</b>		<b>0.9311</b>		<b>Top 7 Percentage:</b>			<b>0.9311</b>			
	<b>Top 10 Percentage:</b>			<b>1.0000</b>		<b>1.0000</b>		<b>1.0000</b>		<b>Top 10 Percentage:</b>			<b>1.0000</b>			

Data Sources:

(\*) PacifiCorp. February 2004. Final Technical Report, Klamath Hydroelectric Project, Recreation Resources. FERC Project No. 2082. Table 3.7-11, page 3-17.

(\*\*) Loomis. J. 2005. Updated outdoor recreation use values on national forests and other public lands. Gen. Tech. Rep. PNW-GTR-658. Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station. 26 p. Table 2, page 6

Indexing Information:

Western CPI (Annual 2004)	193.000	# years	5
Western CPI (11/2010)	221.671	Western CPI (11/2005)	201.400
Index (2004 to 2010)	1.149	Western CPI (11/2010)	221.671
		5 Year Average Annual Growth (11/2005 - 11/2010)	0.019365



### 2.1.2.1 No Action Alternative

As shown in table 2.1-5, total visitation in year 2002 (year of the PacifiCorp recreation survey) at the three reservoirs (J.C. Boyle, Copco 1, and Iron Gate) was estimated in the PacifiCorp recreation report at 95,470 recreation days. Projecting into the future using PacifiCorp's annual activity specific growth rates, results in an estimated 112,900 days in 2020 and 167,500 days in 2061 across the three reservoirs. Aggregating visitation across all three reservoirs for years 2020 to 2061 totals over 5.8 million recreation days.

Applying the weighted average recreation economic values per visit for each reservoir to the estimates of recreation visitation at each reservoir and discounting the annual value estimates back to year 2012 results in a total reservoir recreation economic value of \$99.5 million across all three reservoirs under the No Action Alternative.

In recent years, water quality problems related to the existence of blue-green algae within Copco 1 and Iron Gate reservoirs have necessitated the issuance of health advisories. These advisories recommend avoiding ingestion of or contact with water containing visible algae blooms, avoiding use of water for cooking or washing dishes, and limiting or avoiding consumption of fish from these reservoirs. The advisories also suggest that children and pets are at greatest risk. Recreational exposure to toxic blue-green algae can cause eye irritation, allergic skin rash, mouth ulcer, vomiting, diarrhea, cold and flu-like symptoms, tingling, headaches, numbness and shaking. Liver failure, nerve damage and death have occurred in rare situations where large amounts of contaminated water were directly ingested (U.S. EPA, et al., 2009). To date, health advisories have not been issued for J.C. Boyle reservoir. This may be because this reservoir is relatively small and water flushes through rapidly.

Algae blooms occur during the summer months when the majority of water based recreation occurs at Copco 1 and Iron Gate Reservoirs. While these advisories have been in place for several years, no data exist as to their impact on recreation visitation primarily due to the lack of recreational data collection at these sites. Should these algae problems continue across the 50-year period of analysis for this study, a significant percentage of visitation at Copco 1 and Iron Gate Reservoirs may be lost. This could significantly reduce the baseline level of recreation visitation and value under the No Action Alternative at these reservoirs. However, the algae problem is unlikely to expand into J.C. Boyle Reservoir due to the manner in which water flushes through the reservoir. At this point, the impact of the blue-green algae problem on visitation is unknown, so attempting to provide algae adjusted visitation estimates could be considered speculative. For purposes of the reservoir recreation benefits analysis, the No Action Alternative includes projections of recreation visitation and value at all three reservoirs – J. C. Boyle, Copco 1, and Iron Gate.

### **2.1.2.2 Full Facilities Removal of Four Dams**

The reservoir recreation analysis reflects a “with versus without” reservoir analysis. The No Action Alternative assumes the reservoirs would remain in place. The Full Facilities Removal Alternative assumes the dams would be dismantled and the reservoirs would be lost. As a result, pursuing the Full Facilities Removal Alternative would imply a loss in reservoir recreation visitation and value as compared to the No Action Alternative.

Losses in reservoir recreation economic value due to dam removal reflect a forgone benefit in the NED benefit-cost analysis. As shown in table 2.1-5, after adjusting for site substitution, whereby a significant portion of potentially lost recreation visitation at J. C. Boyle, Copco 1, and Iron Gate Reservoirs would substitute to other lakes and reservoirs in the area (see section 2.1.1.1.1), total with substitution reservoir recreation losses for the Full Facilities Removal Alternative measured as a change from the No Action Alternative were estimated at 2.03 million recreation days and \$35.4 million in discounted recreation economic value across the 2020-2061 post dam removal period.

### **2.1.2.3 Partial Facilities Removal of Four Dams**

With partial removal of all four dams, the assumption was made that the reservoirs would be lost. As a result, the losses in reservoir recreation visitation and value for the Partial Facilities Removal of Four Dams Alternative as compared to the No Action Alternative would be the same as under the Full Facilities Removal of Four Dams Alternative.

## **3.1 RESERVOIR RECREATION EXPENDITURES USED IN THE REGIONAL ECONOMIC DEVELOPMENT (RED) IMPACT ANALYSIS**

This section describes the estimation of reservoir recreation expenditures used to estimate economic impacts within the regional economic impact analysis.

### **3.1.1 Economic Region**

The “region” used in the reservoir recreation regional economic impact analysis is based on the location of the impacted reservoirs and is therefore defined as Klamath County (OR) and Siskiyou County (CA). As a result, the economic



5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59

Year 2020 and continue to the end of the period of analysis in year 2060.

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
13,458	13,499	13,539	13,580	13,621	13,661	13,702	13,744	13,785	13,826	13,868	13,909	13,951	13,993	14,035	14,077	14,119	14,161	14,204	14,247	14,289	14,332	14,375	14,418	14,462	14,505	14,548	14,592	14,636	14,680	14,724	14,768	14,812	14,857	14,901	14,946	14,991	15,036	15,081	15,126	15,171	15,216	15,261	15,306	15,351	15,396	15,441	15,486	15,531	15,576	15,621	15,666	15,711	15,756	15,801	15,846	15,891	15,936	15,981	16,026	16,071	16,116	16,161	16,206	16,251	16,296	16,341	16,386	16,431	16,476	16,521	16,566	16,611	16,656	16,701	16,746	16,791	16,836	16,881	16,926	16,971	17,016	17,061	17,106	17,151	17,196	17,241	17,286	17,331	17,376	17,421	17,466	17,511	17,556	17,601	17,646	17,691	17,736	17,781	17,826	17,871	17,916	17,961	18,006	18,051	18,096	18,141	18,186	18,231	18,276	18,321	18,366	18,411	18,456	18,501	18,546	18,591	18,636	18,681	18,726	18,771	18,816	18,861	18,906	18,951	18,996	19,041	19,086	19,131	19,176	19,221	19,266	19,311	19,356	19,401	19,446	19,491	19,536	19,581	19,626	19,671	19,716	19,761	19,806	19,851	19,896	19,941	19,986	20,031	20,076	20,121	20,166	20,211	20,256	20,301	20,346	20,391	20,436	20,481	20,526	20,571	20,616	20,661	20,706	20,751	20,796	20,841	20,886	20,931	20,976	21,021	21,066	21,111	21,156	21,201	21,246	21,291	21,336	21,381	21,426	21,471	21,516	21,561	21,606	21,651	21,696	21,741	21,786	21,831	21,876	21,921	21,966	22,011	22,056	22,101	22,146	22,191	22,236	22,281	22,326	22,371	22,416	22,461	22,506	22,551	22,596	22,641	22,686	22,731	22,776	22,821	22,866	22,911	22,956	23,001	23,046	23,091	23,136	23,181	23,226	23,271	23,316	23,361	23,406	23,451	23,496	23,541	23,586	23,631	23,676	23,721	23,766	23,811	23,856	23,901	23,946	23,991	24,036	24,081	24,126	24,171	24,216	24,261	24,306	24,351	24,396	24,441	24,486	24,531	24,576	24,621	24,666	24,711	24,756	24,801	24,846	24,891	24,936	24,981	25,026	25,071	25,116	25,161	25,206	25,251	25,296	25,341	25,386	25,431	25,476	25,521	25,566	25,611	25,656	25,701	25,746	25,791	25,836	25,881	25,926	25,971	26,016	26,061	26,106	26,151	26,196	26,241	26,286	26,331	26,376	26,421	26,466	26,511	26,556	26,601	26,646	26,691	26,736	26,781	26,826	26,871	26,916	26,961	27,006	27,051	27,096	27,141	27,186	27,231	27,276	27,321	27,366	27,411	27,456	27,501	27,546	27,591	27,636	27,681	27,726	27,771	27,816	27,861	27,906	27,951	27,996	28,041	28,086	28,131	28,176	28,221	28,266	28,311	28,356	28,401	28,446	28,491	28,536	28,581	28,626	28,671	28,716	28,761	28,806	28,851	28,896	28,941	28,986	29,031	29,076	29,121	29,166	29,211	29,256	29,301	29,346	29,391	29,436	29,481	29,526	29,571	29,616	29,661	29,706	29,751	29,796	29,841	29,886	29,931	29,976	30,021	30,066	30,111	30,156	30,201	30,246	30,291	30,336	30,381	30,426	30,471	30,516	30,561	30,606	30,651	30,696	30,741	30,786	30,831	30,876	30,921	30,966	31,011	31,056	31,101	31,146	31,191	31,236	31,281	31,326	31,371	31,416	31,461	31,506	31,551	31,596	31,641	31,686	31,731	31,776	31,821	31,866	31,911	31,956	32,001	32,046	32,091	32,136	32,181	32,226	32,271	32,316	32,361	32,406	32,451	32,496	32,541	32,586	32,631	32,676	32,721	32,766	32,811	32,856	32,901	32,946	32,991	33,036	33,081	33,126	33,171	33,216	33,261	33,306	33,351	33,396	33,441	33,486	33,531	33,576	33,621	33,666	33,711	33,756	33,801	33,846	33,891	33,936	33,981	34,026	34,071	34,116	34,161	34,206	34,251	34,296	34,341	34,386	34,431	34,476	34,521	34,566	34,611	34,656	34,701	34,746	34,791	34,836	34,881	34,926	34,971	35,016	35,061	35,106	35,151	35,196	35,241	35,286	35,331	35,376	35,421	35,466	35,511	35,556	35,601	35,646	35,691	35,736	35,781	35,826	35,871	35,916	35,961	36,006	36,051	36,096	36,141	36,186	36,231	36,276	36,321	36,366	36,411	36,456	36,501	36,546	36,591	36,636	36,681	36,726	36,771	36,816	36,861	36,906	36,951	36,996	37,041	37,086	37,131	37,176	37,221	37,266	37,311	37,356	37,401	37,446	37,491	37,536	37,581	37,626	37,671	37,716	37,761	37,806	37,851	37,896	37,941	37,986	38,031	38,076	38,121	38,166	38,211	38,256	38,301	38,346	38,391	38,436	38,481	38,526	38,571	38,616	38,661	38,706	38,751	38,796	38,841	38,886	38,931	38,976	39,021	39,066	39,111	39,156	39,201	39,246	39,291	39,336	39,381	39,426	39,471	39,516	39,561	39,606	39,651	39,696	39,741	39,786	39,831	39,876	39,921	39,966	40,011	40,056	40,101	40,146	40,191	40,236	40,281	40,326	40,371	40,416	40,461	40,506	40,551	40,596	40,641	40,686	40,731	40,776	40,821	40,866	40,911	40,956	41,001	41,046	41,091	41,136	41,181	41,226	41,271	41,316	41,361	41,406	41,451	41,496	41,541	41,586	41,631	41,676	41,721	41,766	41,811	41,856	41,901	41,946	41,991	42,036	42,081	42,126	42,171	42,216	42,261	42,306	42,351	42,396	42,441	42,486	42,531	42,576	42,621	42,666	42,711	42,756	42,801	42,846	42,891	42,936	42,981	43,026	43,071	43,116	43,161	43,206	43,251	43,296	43,341	43,386	43,431	43,476	43,521	43,566	43,611	43,656	43,701	43,746	43,791	43,836	43,881	43,926	43,971	44,016	44,061	44,106	44,151	44,196	44,241	44,286	44,331	44,376	44,421	44,466	44,511	44,556	44,601	44,646	44,691	44,736	44,781	44,826	44,871	44,916	44,961	45,006	45,051	45,096	45,141	45,186	45,231	45,276	45,321	45,366	45,411	45,456	45,501	45,546	45,591	45,636	45,681	45,726	45,771	45,816	45,861	45,906	45,951	45,996	46,041	46,086	46,131	46,176	46,221	46,266	46,311	46,356	46,401	46,446	46,491	46,536	46,581	46,626	46,671	46,716	46,761	46,806	46,851	46,896	46,941	46,986	47,031	47,076	47,121	47,166	47,211	47,256	47,301	47,346	47,391	47,436	47,481	47,526	47,571	47,616	47,661	47,706	47,751	47,796	47,841	47,886	47,931	47,976	48,021	48,066	48,111	48,156	48,201	48,246	48,291	48,336	48,381	48,426	48,471	48,516	48,561	48,606	48,651	48,696	48,741	48,786	48,831	48,876	48,921	48,966	49,011	49,056	49,101	49,146	49,191	49,236	49,281	49,326	49,371	49,416	49,461	49,506	49,551	49,596	49,641	49,686	49,731	49,776	49,821	49,866	49,911	49,956	50,001	50,046	50,091	50,136	50,181	50,226	50,271	50,316	50,361	50,406	50,451	50,496	50,541	50,586	50,631	50,676	50,721	50,766	50,811	50,856	50,901	50,946	50,991	51,036	51,081	51,126	51,171	51,216	51,261	51,306	51,351	51,396	51,441	51,486	51,531	51,576	51,621	51,666	51,711	51,756	51,801	51,846	51,891	51,936	51,981	52,026	52,071	52,116	52,161	52,206	52,251	52,296	52,341	52,386	52,431	52,476	52,521	52,566	52,611	52,656	52,701	52,746	52,791	52,836	52,881	52,926	52,971	53,016	53,061	53,106	53,151	53,196	53,241	53,286	53,331	53,376	53,421	53,466	53,511	53,556	53,601	53,646	53,691	53,736	53,781	53,826	53,871	53,916	53,961	54,006	54,051	54,096	54,141	54,186	54,231	54,276	54,321	54,366	54,411	54,456	54,501	54,546	54,591	54,636	54,681	54,726	54,771	54,816	54,861	54,906	54,951	54,996	55,041	55,086	55,131	55,176	55,221	55,266	55,311	55,356	55,401	55,446	55,491	55,536	55,581	55,626	55,671	55,716	55,761	55,806	55,851	55,896	55,941	55,986	56,031	56,076	56,121	56,166	56,211	56,256	56,301	56,346	56,391	56,436

region used in the reservoir recreation regional economic impact analysis is not the same as the primary recreation market area described above under the reservoir recreation benefit analysis.

### **3.1.2 Methodology and Assumptions**

Changes in reservoir recreation expenditures due to dam removal are used to generate economic impacts within the RED economic impact analysis. To develop estimates of the annual change in reservoir recreation expenditures, annual estimates of changes in non-local recreator visitation across all three reservoirs were applied to estimates of within region recreation expenditures per visit.

Non-local recreators are determined based on the definition of the economic region. Therefore, visitation to the proposed dam removal reservoirs from recreators residing outside the economic region reflect non-local visitation. Similarly, expenditures made within the region by recreators residing outside the region reflect non-local expenditures. Changes in recreation visitation and expenditures within the region by local recreators are typically not included in the regional economic impact analyses. This exclusion is made under the assumption that changes in within region recreation expenditures made by local residents would not significantly affect regional economic activity. The basis for this assumption is that changes in recreational expenditures by locals would simply shift spending within the region. For example, if a local recreator reduces his/her recreational spending within the region due to the loss of the proposed dam removal reservoirs, chances are that the recreator will spend that money within the region on other goods and services. While the level of regional economic activity is also a function of how the dollars are spent (e.g., which economic sectors are affected), the implication of the insignificant impact assumption is that the shift in expenditures between sectors within the region by local residents would not significantly affect regional economic activity. Bottomline, the focus of the reservoir recreation regional economic impact analysis is on changes in regional recreation expenditures made by non-local residents of the two county economic region.

#### **3.1.2.1 Non-local Recreation Visitation**

The methodology for estimating changes in total recreation visitation is discussed above in section 2.1.1.1. To estimate changes in recreation visitation by non-locals of the economic region (recreators from outside Klamath & Siskiyou counties), a non-local visitation percentage was applied to the total visitation estimates at each reservoir. As shown in table 2.1-1, the PacifiCorp recreation survey gathered data on the percent of visitation by county (PacifiCorp (2004)

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report - Table 3.7-4, page 3-11). Using this data, non-local visitation percentages were developed for each reservoir (J.C. Boyle = 18.6%, Copco 1 = 40%, and Iron Gate = 75%) based on the two county economic region.

The non-local percentages were applied to the total without site substitution visitation estimates for each reservoir and year. The annual estimates of non-local without substitution visitation at each reservoir were aggregated across reservoirs and averaged to provide a total average annual without substitution loss in visitation estimate.

A separate visitation analysis provided annual visitation estimates under the assumption that a portion of the lost visits by non-local recreators at each reservoir would substitute to other sites within the two county economic region. As shown in table 3.1-1, the logic associated with developing non-substituting percentages by reservoir based on the economic region was similar to that used for the primary market area.

**Table 3.1-1.—Reservoir recreation non-substituting percentages**

	J.C. Boyle	Copco 1	Iron Gate
Percent of visits from five-county primary market area	.881	.633	.74
Favorite site percentages (percent not substituting)	.05	0	.28
Percent of visits from two-county economic region	.814	.6	.25
Percent of visits from outside economic region	.186	.4	.75
Economic region non-substituting percentages (non-residents only)			
1) Market area Non-residents (outside five-county market area)	.119 (1-.881)	.367 (1-.633)	.26 (1-.74)
2) Economic region non-residents, but market area residents (residents of Jackson, Josephine, Shasta counties)	.0034 (.186-.119 =.067*.05)	0	.1372 (.75-.26=.49*.28)
3) Total economic region non-resident non-substituting percentage (1+2)	<b>.1224</b>	<b>.367</b>	<b>.3972</b>

Since the two-county economic region falls within the five-county primary market area, the economic region substitution analysis began by separating the non-local area into two subregions: 1) outside and the primary market area (and economic region) and 2) outside the economic region but still within the primary market area (i.e., Jackson, Josephine, Shasta counties).

For the outside the primary market area subregion, the same assumption used in the market area substitution analysis was again applied – that visitors from outside the primary market area would not substitute within the economic region. Therefore, the percentages of visits from outside the primary market area (11.9% for J.C. Boyle, 36.7% for Copco 1, and 26% for Iron Gate) would not substitute.

For those visitors residing outside the economic region, but still within the market area (i.e., residents of Jackson, Josephine, Shasta counties - 6.7% at J.C. Boyle, 3.3% at Copco 1, and 49% at Iron Gate), the assumption was made that the favorite site percentages (5% for J.C. Boyle, 0% for Copco 1, and 28% for Iron Gate) would reflect the portion of visits not substituting. This implies that 95%, 100%, and 72% of J.C. Boyle, Copco 1, and Iron Gate visitors respectively from Jackson, Josephine, Shasta counties would substitute within the economic region. Given the primary market area is larger than the economic region, it would seem logical that perhaps these site substitution percentages might be somewhat smaller for the economic region as compared to the larger primary market area. However, it turns out that of the 241.0K of surface acreage at potential substitute sites within the five-county primary market area, that 203.3K (84.3%) occur within Klamath and Siskiyou counties. Given this situation, the decision was made that the primary market area substitution percentages were also reasonable for the smaller economic region.

Combining the non-substituting percentages for both subregions equals 12.24% for J.C. Boyle, 36.7% for Copco 1, and 39.72% for Iron Gate. These percentages measure the portion of total recreator visitation which would reflect recreation activity by non-residents who would not substitute within the economic region. These percentages were applied to the total visitation estimates at each site to measure the changes in non-local visitation with substitution.

### **3.1.2.2 Non-local Recreator Within Region Recreation Expenditures per Visit**

The PacifiCorp (2004) recreation survey also gathered information on recreational expenditures incurred within the local area. Average expenditures per group trip were reported by expenditure category (accommodations, food, gas/fuel, supplies, guide fees, and other [mostly beverage purchases]).

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Several adjustments to the average expenditure estimate had to be made before it could be applied to the non-local visitation estimates. Since the survey gathered data on expenditures per group trip, the expenditure estimate had to be converted to expenditures per day since the visitation numbers are in recreation days. This adjustment involved two steps: 1) convert from group trip to individual trip, and 2) convert from trip to day. To convert from group trip to individual trip, the expenditure estimate was divided by the median group size (PacifiCorp survey estimated the median group size at 4 recreators). To convert individual expenditures from trip to day, the expenditure estimate had to be divided by the average number of days per trip. While information on the average on-site days per trip was not gathered via the survey, information was collected on the number of nights per trip (PacifiCorp report Table 3.7-7 (page 3-13)). The assumption was made that the numbers of nights per trip provide a reasonable estimate of the number of days on-site. Sixty percent of visitors stayed overnight in the area averaging 3.6 nights (or days) per visit. Assuming the remaining 40% of visitors were on single day trips, this results in an average of 2.56 days per trip  $((.6 * 3.6) + (.4 * 1))$ . Finally, since the expenditures were measured in 2002 dollars, they were first indexed up to 2009 dollars (the year of the IMPLAN input-output model underlying data) using the average annual CPI for the Western States (average annual 2002 value: 184.7, average annual 2009 value: 218.822, index: 1.185). Subsequently, the decision was made to measure the expenditures in 2012 dollars so a further adjustment was made escalating costs from 2009 dollars to 2012 dollars, again using the CPI for the Western States (used an annual growth of 1.9365% which reflects the 5-year average annual growth from 11/2005 to 11/2010). As shown in table 3.1-2, after all of these adjustments, the expenditure estimate drops from \$125.23 per group trip in 2002 dollars to \$15.35 per recreator day in 2012 dollars.

**Table 3.1-2.—Reservoir recreation expenditures per day**

Source: PacifiCorp (2004) recreation report

<b>Expenditure category</b>	<b>2002 expenditures per group trip</b>	<b>2012 expenditures per recreation day</b>
Accommodations	13.25	1.62
Food	49.3	6.05
Gas/fuel	35.45	4.34
Supplies	19.71	2.43
Guide fees	3	0.36
Other (beverages)	4.52	0.55
Total	125.23	15.35

It should be noted that these estimates reflect within region expenditures by both local and non-local recreators. Since the focus of the regional analysis is on

non-local recreator expenditures, and non-local recreators typically incur higher within region expenditures per trip compared to local recreators (due to lodging costs among other things), by including local recreator expenditures with the average expenditure per trip, the resulting estimate may understate the average non-local expenditure. On the other hand, according to the PacifiCorp survey, of those staying overnight in the study area, 77% reported using a campground and 20% stayed at a private residence. Since camping costs are generally very low as compared to hotels/motels and staying at a private residence may imply little to no cost, this explains the low costs for accommodations as shown in table 3.1-2. With low accommodation costs associated with non-local recreators, the difference between expenditures by non-locals and locals tightens.

### **3.1.3 Reservoir Recreation Expenditures**

Changes in within region reservoir recreation expenditures by non-local recreators for the proposed dam removal alternatives as compared to the No Action Alternative provide input to the estimation of regional economic impacts for the dam removal alternatives. The reservoir recreation regional economic impacts are presented in the Economics and Tribal Summary Technical Report (Reclamation, 2011) and the Economics and Tribal Technical Report (Reclamation, 2011).

#### **3.1.3.1 No Action Alternative**

As noted above under the NED benefit No Action Alternative discussion (section 2.2.1), a significant blue green algae problem exists at Copco 1 and Iron Gate Reservoirs. Health advisories have been posted at these reservoirs for the past several years. Due to the lack of recreation data collection at these sites since the initiation of the health advisories, the impact of the blue-green algae problem on visitation is unknown, so attempting to provide algae adjusted visitation estimates could be considered speculative. For purposes of the reservoir recreation regional analysis, the No Action Alternative includes projections of recreation visitation and expenditures at all three reservoirs – J. C. Boyle, Copco 1, and Iron Gate.

As shown in table 3.1-3, average annual recreation visitation across the 2020-2061 period under the No Action Alternative was estimated at 71,584 recreation days across all three reservoirs. Applying the \$15.35 expenditure per day estimate to the average number of recreation days annually results in an average annual recreation expenditure estimate of \$1,098,821.

As discussed in the Economics and Tribal Technical Report (Reclamation, 2011), regional economic development impact analysis section, the \$1,098.8K of average

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annual non-local recreation expenditures across all three reservoirs was run through the IMPLAN input output model to estimate regional economic impacts for the No Action Alternative. The average annual impacts stemming from these lost within region recreation expenditures was estimated at 6.8 jobs, 0.22 million of labor income, and 0.54 million of output.

### **3.1.3.2 Full Facilities Removal of Four Dams Alternative**

The reservoir recreation analysis reflects a “with versus without” reservoir analysis. The No Action Alternative assumes the reservoirs would remain in place. The Full Facilities Removal Alternative assumes the reservoirs would be lost. As a result, pursuing the Full Facilities Removal Alternative would imply a loss in reservoir recreation visitation and expenditures as compared to the No Action Alternative.

The estimates of expenditures per day in 2012 dollars by expenditure category were multiplied by the number of with substitution recreation days lost annually by non-local recreators across all three reservoirs to provide estimates of the loss in total annual recreation expenditures for non-local recreators within the two-county economic impact region.

As shown in table 3.1-3, after accounting for site substitution, estimates of lost recreation visitation ranged from 33,308 days in year 2020 to 49,636 days in year 2061. Lost recreation expenditures ranged from \$511.3K in year 2020 to \$761.9K in year 2061. Averaging the with substitution visitation and expenditure losses across all years results in an average annual loss of 40,901 days and \$627.8K.

As discussed in the Economics and Tribal Technical Report (Reclamation, 2011), regional economic development impact analysis section, the \$627.8K of lost average annual non-local recreation expenditures across all three reservoirs was run through the IMPLAN input output model to estimate regional economic impacts for the Full Facilities Removal of Four Dams Alternative. The average annual impacts stemming from these reduced within region recreation expenditures were estimated to generate losses of 3.9 jobs, 0.13 million of labor income, and 0.31 million of output.

### **3.1.3.3 Partial Facilities Removal of Four Dams Alternative**

With partial removal of all four dams, the assumption was made that the reservoirs would be lost. As a result, the losses in average annual reservoir recreation visitation, expenditures, and impacts for the Partial Facilities Removal of Four Dams Alternative as compared to the No Action Alternative would be the same as under the Full Facilities Removal of Four Dams Alternative.



4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

effits start in year 2020 and continue to the end of the period of analysis in year 2060.

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061		
13,418	13,458	13,499	13,539	13,580	13,621	13,661	13,702	13,744	13,785	13,826	13,868	13,909	13,951	13,993	14,035	14,077	14,119	14,161	14,204	14,247	14,289	14,332	14,375	14,418	14,462	14,505	14,548	14,592	14,636	14,680	14,724	14,768	14,812	14,857	14,901	14,946	14,991	15,036			
21,428	21,685	21,946	22,209	22,475	22,745	23,018	23,294	23,574	23,857	24,143	24,433	24,726	25,023	25,323	25,627	25,934	26,246	26,560	26,879	27,202	27,529	27,861	28,198	28,540	28,887	29,239	29,596	29,957	30,322	30,692	31,066	31,444	31,826	32,212	32,602	32,995	33,392	33,792	34,195		
7,181	7,267	7,355	7,443	7,532	7,623	7,714	7,807	7,900	7,995	8,091	8,188	8,286	8,386	8,487	8,588	8,691	8,796	8,901	9,008	9,116	9,226	9,336	9,448	9,562	9,677	9,793	9,910	10,029	10,149	10,271	10,394	10,519	10,645	10,773	10,902	11,033	11,166	11,300	11,434	11,568	
42,027	42,410	42,800	43,191	43,584	43,980	44,381	44,787	45,198	45,614	46,035	46,461	46,892	47,328	47,769	48,216	48,669	49,127	49,591	50,060	50,534	51,013	51,497	51,986	52,480	52,979	53,483	53,992	54,506	55,025	55,549	56,078	56,612	57,151	57,695	58,244	58,798	59,357	59,921	60,490		
7,817	7,888	7,961	8,034	8,107	8,182	8,257	8,333	8,411	8,488	8,567	8,647	8,727	8,809	8,891	8,975	9,059	9,144	9,230	9,317	9,405	9,494	9,584	9,675	9,767	9,860	9,954	10,049	10,146	10,243	10,341	10,441	10,542	10,643	10,746	10,850	10,956	11,062	11,170	11,279	11,389	
8,798	8,859	8,921	8,984	9,047	9,110	9,174	9,238	9,303	9,368	9,433	9,499	9,566	9,633	9,700	9,768	9,837	9,905	9,975	10,045	10,115	10,186	10,257	10,329	10,401	10,474	10,547	10,621	10,695	10,770	10,846	10,922	10,998	11,075	11,153	11,231	11,309	11,388	11,468	11,548		
1,440	1,450	1,460	1,471	1,481	1,491	1,502	1,512	1,523	1,534	1,544	1,555	1,566	1,577	1,588	1,599	1,610	1,622	1,633	1,644	1,656	1,667	1,679	1,691	1,703	1,715	1,727	1,739	1,751	1,763	1,776	1,788	1,800	1,813	1,826	1,839	1,851	1,864	1,877	1,890	1,903	
10,238	10,309	10,381	10,455	10,528	10,601	10,676	10,750	10,826	10,902	10,977	11,054	11,132	11,210	11,288	11,367	11,447	11,527	11,608	11,689	11,771	11,853	11,936	12,020	12,104	12,189	12,274	12,360	12,446	12,533	12,622	12,710	12,798	12,888	12,979	13,070	13,160	13,252	13,345	13,438	13,531	
4,095	4,124	4,152	4,182	4,211	4,240	4,270	4,300	4,330	4,361	4,391	4,422	4,453	4,484	4,515	4,547	4,579	4,611	4,643	4,676	4,708	4,741	4,774	4,808	4,842	4,876	4,910	4,944	4,978	5,013	5,049	5,084	5,119	5,155	5,192	5,228	5,264	5,301	5,338	5,375		
3,757	3,783	3,810	3,837	3,864	3,891	3,918	3,945	3,973	4,001	4,029	4,057	4,085	4,114	4,143	4,172	4,201	4,230	4,260	4,290	4,320	4,350	4,381	4,411	4,442	4,473	4,505	4,536	4,568	4,600	4,632	4,665	4,697	4,730	4,763	4,797	4,830	4,863	4,898	4,931		
4,476	4,529	4,584	4,639	4,695	4,751	4,808	4,866	4,924	4,983	5,043	5,103	5,165	5,227	5,289	5,353	5,417	5,482	5,548	5,614	5,682	5,750	5,819	5,889	5,959	6,031	6,103	6,177	6,251	6,326	6,402	6,478	6,556	6,635	6,714	6,795	6,876	6,959	7,043	7,127	7,211	
4,739	4,796	4,854	4,912	4,971	5,030	5,091	5,152	5,214	5,276	5,340	5,404	5,468	5,534	5,600	5,668	5,736	5,805	5,874	5,945	6,016	6,088	6,161	6,235	6,310	6,386	6,462	6,540	6,618	6,698	6,778	6,860	6,942	7,025	7,109	7,195	7,281	7,368	7,457	7,545		
5,331	5,395	5,460	5,526	5,592	5,659	5,727	5,796	5,865	5,936	6,007	6,079	6,152	6,226	6,300	6,376	6,452	6,530	6,608	6,688	6,768	6,849	6,931	7,014	7,099	7,184	7,270	7,357	7,445	7,535	7,625	7,717	7,809	7,903	7,998	8,094	8,191	8,289	8,389	8,489		
17,669	17,792	17,917	18,042	18,169	18,296	18,424	18,553	18,683	18,813	18,943	19,073	19,203	19,333	19,463	19,593	19,723	19,853	19,983	20,113	20,243	20,373	20,503	20,633	20,763	20,893	21,023	21,153	21,283	21,413	21,543	21,673	21,803	21,933	22,063	22,193	22,323	22,453	22,583	22,713	22,843	22,973
6,064	6,136	6,210	6,285	6,360	6,436	6,514	6,592	6,671	6,751	6,832	6,914	6,997	7,081	7,166	7,252	7,339	7,427	7,516	7,606	7,697	7,790	7,883	7,978	8,074	8,171	8,268	8,368	8,468	8,570	8,673	8,777	8,882	8,989	9,096	9,206	9,316	9,428	9,541	9,654	9,768	
14,305	14,476	14,650	14,826	15,004	15,184	15,366	15,551	15,737	15,926	16,117	16,310	16,506	16,704	16,905	17,108	17,313	17,521	17,731	17,944	18,159	18,377	18,597	18,821	19,046	19,275	19,506	19,740	19,977	20,217	20,460	20,707	20,959	21,215	21,474	21,737	22,004	22,274	22,548	22,828	23,108	
2,431	2,460	2,489	2,519	2,549	2,580	2,611	2,642	2,674	2,706	2,739	2,771	2,805	2,838	2,872	2,907	2,942	2,977	3,013	3,049	3,085	3,123	3,160	3,198	3,236	3,275	3,314	3,354	3,394	3,435	3,476	3,518	3,560	3,603	3,646	3,690	3,734	3,779	3,824	3,870	3,915	
6,047	6,089	6,132	6,175	6,218	6,262	6,306	6,350	6,394	6,439	6,484	6,529	6,575	6,621	6,667	6,714	6,761	6,808	6,856	6,904	6,952	7,001	7,050	7,099	7,149	7,199	7,249	7,300	7,351	7,403	7,455	7,507	7,559	7,612	7,666	7,719	7,773	7,828	7,882	7,937		
2,830	2,864	2,898	2,933	2,968	3,004	3,040	3,077	3,114	3,151	3,189	3,227	3,266	3,305	3,345	3,385	3,425	3,466	3,508	3,550	3,593	3,636	3,679	3,724	3,768	3,813	3,859	3,906	3,952	4,000	4,048	4,096	4,146	4,195	4,246	4,297	4,348	4,400	4,453	4,506		
63,892	64,537	65,194	65,857	66,526	67,202	67,886	68,579	69,276	69,981	70,686	71,415	72,145	72,882	73,625	74,381	75,140	75,909	76,686	77,473	78,266	79,070	79,879	80,701	81,530	82,368	83,213	84,072	84,936	85,814	86,698	87,592	88,495	89,409	90,332	91,268	92,209	93,163	94,128	95,098		
47,919	48,403	48,896	49,393	49,895	50,402	50,915	51,434	51,957	52,486	53,022	53,561	54,109	54,662	55,219	55,786	56,355	56,932	57,515	58,105	58,700	59,303	59,909	60,526	61,148	61,776	62,410	63,054	63,702	64,361	65,024	65,694	66,371	67,057	67,749	68,451	69,157	69,872	70,596	71,328		
25,378	25,634	25,895	26,158	26,424	26,693	26,964	27,240	27,516	27,796	28,080	28,366	28,656	28,949	29,244	29,544	29,846	30,151	30,460	30,772	31,087	31,407	31,728	32,054	32,384	32,717	33,052	33,393	33,737	34,085	34,436	34,792	35,150	35,513	35,880	36,252	36,625	37,004	37,388	37,772		
116,157	117,256	118,375	119,503	120,641	121,792	122,955	124,132	125,320	126,520	127,733	128,958	130,198	131,452	132,716	133,998	135,289	136,597	137,916	139,253	140,602	141,966	143,342	144,737	146,145	147,569	149,005	150,461	151,928	153,417	154,919	156,436	157,968	159,519	161,087	162,673	164,270	165,889	167,526	169,180		
59,831	60,415	61,009	61,609	62,213	62,824	63,442	64,067	64,698	65,335	65,980	66,630	67,289	67,955	68,625	69,308	69,993	70,687	71,388	72,098	72,813	73,538	74,267	75,009	75,757	76,512	77,274	78,047	78,826	79,617	80,414	81,219	82,032	82,855	83,687	84,529	85,377	86,235	87,104	87,980		
34,279	34,608	34,944	35,282	35,623	35,968	36,316	36,669	37,024	37,383	37,747	38,113	38,484	38,860	39,238	39,622	40,008	40,398	40,794	41,193																						

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