CHAPTER 6.0 EFFECTS OF THE PROPOSED ACTION

6.1 INTRODUCTION

"Effects of the action" refers to the direct and indirect effects of a proposed action on listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects (Chapter 7) to determine the overall effects on the species (50 CFR § 402.02).

In accordance with the provisions of the ESA implementing regulations and the USFWS and NMFS Section 7 Handbook (USFWS and NMFS 1998), Reclamation used the following definitions to make its effects determinations for each listed species:

No effect: The conclusion if the action agency determines its proposed action will not affect listed species or critical habitat.

May affect: The conclusion if the action agency determines its proposed action may pose effects on listed species or designated critical habitat. The action agency must also determine whether the effects constitute an adverse effect as defined below.

> ***Not likely to adversely affect***: Effects on listed species are expected to be discountable, insignificant, or completely beneficial. "Beneficial effects" are contemporaneous positive effects without any adverse effects to the species. "Insignificant effects" relate to the size of the impact and should never reach the scale where take occurs. "Discountable effects" are those extremely unlikely to occur. Based on best judgment, a person would not: 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur.
>
> ***Likely to adversely affect***: Any adverse effect to listed species that may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial. In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made.

Reclamation has provided this BA to analyze the effects of its proposed action and to assist USFWS and NMFS in preparing a coordinated BiOp. Section 6.2 describes the hydrologic model that was developed to determine the hydrologic effects associated with the proposed action. Analysis of the effects on each listed species is presented individually in Sections 6.3 through 6.7.

6.2 HYDROLOGIC EFFECTS ANALYSIS

Reclamation used the MODSIM model to simulate Reclamation's project operations. Modeled output was used to evaluate the hydrologic effects of the proposed action on ESA-listed species. The computer model's development and assumptions are described in Appendix C. Modeled output is available on CD ROM "*MODSIM Simulation of Deschutes River Basin Projects Operations Modeling Results"* (Stillwater 2003) and is available from Reclamation's Pacific Northwest Regional Office, PN-6200, 1150 N. Curtis Road, Suite 100, Boise, Idaho, 83706. Modeled system inflows were developed from measured flows and reservoir contents from water years 1962 through 1999.

6.2.1 Description of Modeled Scenarios

Reclamation developed a hydrologic baseline representing the hydrology component of the environmental baseline. The hydrologic baseline provides an analytical tool to isolate flow effects of Reclamation's proposed action.

Two scenarios were modeled and are described in detail below. One scenario simulates all current and ongoing operations in the Deschutes River basin, including Reclamation's proposed action. The second scenario simulates hydrologic conditions if Reclamation's ongoing operations were removed -- without the proposed action. The "with Reclamation" scenario can be compared to the "without Reclamation" scenario to determine the hydrologic effects of the proposed action.

Hydrologic Baseline including the Proposed Action (with Reclamation)

This computer simulation, hereafter referred to as "with Reclamation," represents current facilities and ongoing operational practices within the Deschutes, Crooked River, and White River subbasins. The proposed action is a continuation of current Reclamation operations. Operational practices reflect the proposed action, interrelated and interdependent actions, and other actions such as private irrigation and hydropower operations. Table 6-1 summarizes major facilities operating in this scenario.

Hydrologic Baseline with Proposed Action Removed (without Reclamation)

This computer simulation, hereafter referred to as "without Reclamation," represents the hydrology without Reclamation facilities operating. Changes to interrelated and interdependent actions that result from the absence of Reclamation operations are reflected in the modeled results. The "without Reclamation" simulation differs from the "with Reclamation" simulation in that:

- The effects of operating Crane Prairie, Wickiup, Haystack, Prineville, and Wasco Reservoirs and Dams are removed;
- The North Unit Main Canal and Crooked River Feed Canal do not divert flow, including natural flows;
- NUID's Crooked River Pumping Plant does not divert from the Crooked River.

In the "without Reclamation" scenario, non-Reclamation actions continuing to occur include storage and other operations at Ochoco and Crescent Lake Dams and Reservoirs; diversions into Walker Canal, Arnold Canal, Central Oregon Canal, Bend Feed Canal, North Canal (Pilot Butte), and diversions by Tumalo, Lone Pine, and Swalley Irrigation Districts, and operations at the Pelton-Round Butte hydropower complex.

Removing the operations of Reclamation dams in the "without Reclamation" scenario means that reservoirs become run-of-the-river. In addition, water bypasses the North Unit Main Canal, the Crooked River Feed Canal, and NUID's Crooked River Pumping Plant. Since the modeled systems are dynamic, non-Reclamation facilities respond to these changes in operations. For example, Ochoco Reservoir is drawn on more heavily in the "without Reclamation" scenario because supplemental water is not available from Prineville Reservoir. Run-of-the-river operations dictate that Reclamation reservoirs forego their right to fill, so the natural flow that would have been stored is made available for distribution to other water rights holders in priority. Natural flows that would have been diverted by North Unit Main Canal, the Crooked River Feed Canal, and the Crooked River Pumping Plant also are made available for distribution to other water rights holders.

Table 6-1 summarizes the major facilities that continue to operate in the "without Reclamation" scenarios.

Table 6-1. Summary of Major Facilities and Actions Included in Each Modeled Scenario

	Scenario 1: With Reclamation	Scenario 2: Without Reclamation
Deschutes Project		
Crane Prairie Dam and Reservoir	✔ storage and release	✔ passes natural inflow
Wickiup Dam and Reservoir	✔ storage and release	✔ passes natural inflow
Crescent Lake Dam and Reservoir	✔ storage and release	✔ storage and release
Walker Canal	✔ diverts natural flow	✔ diverts natural flow
Arnold Diversion Dam and Canal	✔ diverts Crane Prairie Reservoir storage and natural flow	✔ diverts natural flow only
Central Oregon Headworks and Canal	✔ diverts Crane Prairie Reservoir storage and natural flow	✔ diverts natural flow only
Bend Feed Canal	✔ diverts Crescent Lake storage and natural flows	✔ diverts Crescent Lake storage and natural flows
North Unit Headworks and Main Canal	✔ diverts Wickiup Reservoir storage and natural flow	✔ no diversions
North Canal (Pilot Butte)	✔ diverts Crane Prairie Reservoir storage and natural flow	✔ diverts natural flow only
Lone Pine Canal	✔ diverts Crane Prairie Reservoir storage and natural flow	✔ diverts natural flow only
Swalley Canal	✔ diverts natural flow	✔ diverts natural flow
Diversions from Tumalo and Squaw creeks	✔ diverts natural flow	✔ diverts natural flow
Haystack Dam and Reservoir	✔ storage and release	✔ no operation
Crooked River Pumping Plant	✔ diverts Crooked River natural flow	✔ no operation
Crooked River Project		
Bowman Dam and Prineville Reservoir	✔ storage and release	✔ passes natural inflow
Crooked River Diversion Dam & Feed Canal	✔ diverts Prineville Reservoir storage and natural flow	✔ no diversion
Crooked River Distribution Canal	✔ delivery of Prineville Reservoir storage and conveyance of natural flow	✔ no operation
Barnes Butte Pumping Plant and Ochoco Re-lift Plant	✔ delivery of Prineville Reservoir storage and conveyance of natural flow	✔ no operation
9 small pumping plants	✔ delivery of Prineville Reservoir storage and conveyance of natural flow	✔ no operation
Ochoco Dam and Reservoir	✔ storage and release	✔ storage and release
Ochoco Main Canal, Rye Grass, and other distribution canals	✔ diverts Ochoco Reservoir storage and natural flow; conveys Prineville Reservoir storage and Crooked River natural flow	✔ diverts Ochoco Reservoir storage and natural flow only (no Crooked River water)
Rice Baldwin Ditch	✔ diverts Prineville Reservoir storage and natural flow	✔ diverts natural flow only
People's Ditch	✔ diverts Prineville Reservoir storage and natural flow	✔ diverts natural flow only

	Scenario 1: With Reclamation	Scenario 2: Without Reclamation
Central Ditch	✔ diverts Prineville Reservoir storage and natural flow	✔ diverts natural flow only
Lowline Ditch	✔ diverts Prineville Reservoir storage and natural flow	✔ diverts natural flow only
Wapinitia Project		
Wasco Dam and Clear Lake	✔ storage and release	✔ passes natural inflow
Other		
Pelton-Round Butte Hydro Complex	✔ hydropower operations	✔ hydropower operations

6.2.2 Determination of Flow Effects

Modeled output for the computer simulations can be viewed using *Pisces,* and is available on the CD ROM "*MODSIM Simulation of Deschutes River Basin Projects Operations Modeling Results.*" Modeled output is provided for reservoir elevations and river flows as time series; typical wet, dry, and normal years; and exceedance curves. Modeled end-of-the-month reservoir elevations are provided for Crane Prairie, Wickiup, Crescent Lake, Prineville, and Ochoco Reservoirs. Modeled river flows are provided for the Deschutes River below Wickiup Reservoir, below Bend, near Culver, near Madras (below Lake Billy Chinook), and at Moody, and for the Crooked River below Bowman Dam, and near Terrebonne (below Crooked River Pumping Plant).

The effects of the proposed action on streamflows in the middle and lower Deschutes can be evaluated by comparing the modeled average monthly flows for the "with Reclamation" to the "without Reclamation" flows at the 10, 50, and 90 percent exceedance levels. Table 6-2 shows modeled average monthly flows at these exceedance levels for the two scenarios at three locations on the Deschutes River.

- Deschutes River Near Culver (14076500)
- Deschutes River Near Madras (14092500)
- Deschutes River at Moody (14103000)

Figure 3-1 (Chapter 3) shows the relative location of these stream gages.

An exceedance level is the probability that the value is equaled or exceeded. For example, in Table 6-2 at the Deschutes River Near Culver for the “with Reclamation” scenario, there is a 10 percent probability that average monthly October flows will equal or exceed 1,603 cfs. There is a 50 percent probability that average monthly October flows will equal or exceed 774 cfs. There is a 90 percent probability that average monthly October flows will equal or exceed 687 cfs.

The flow effects due to the proposed action are determined by subtracting the “without Reclamation” scenario flows from the “with Reclamation” scenario flows. Although this approach does not distinguish flow differences on a year by year basis, it can be used to evaluate the magnitude and trends of the proposed action effects. Comparing “without Reclamation” to “with Reclamation” flows listed in Table 6-2, demonstrates the following general trends in the Deschutes River Near Culver and downstream.

- Reclamation activities decrease spring and summer flows when Reclamation diverters rely on natural flows versus storage water; because releases from storage are not being made;

- Reclamation activities maintain or increase summer flows when Reclamation diverters rely on stored water;

- Reclamation activities reduce winter flows (with some exceptions) by storing in Reclamation reservoirs; and

- River flows are increased from year-round gains attributed to recharge from irrigators using project water. See Appendix C for discussion of groundwater gains.

TABLE 6-2. MODELED FLOWS IN THE DESCHUTES RIVER

	Deschutes River Near Culver			Deschutes River Near Madras			Deschutes River at Moody		
Percent Exceedance (%)	**With Reclamation (cfs)**	**Without Reclamation (cfs)**	**Flow Effects due to Proposed Action (cfs)**	**With Reclamation (cfs)**	**Without Reclamation (cfs)**	**Flow Effects due to Proposed Action (cfs)**	**With Reclamation (cfs)**	**Without Reclamation (cfs)**	**Flow Effects due to Proposed Action (cfs)**
	October			**October**			**October**		
10	1603	1944	-341	4928	5337	-409	5648	5839	-191
50	774	1396	-622	4201	4593	-392	4742	5155	-413
90	687	1157	-470	3719	4098	-379	4127	4465	-338
	November			**November**			**November**		
10	1618	2138	-520	5420	6133	-713	6494	7240	-746
50	1116	1751	-635	4635	5208	-573	5454	5904	-450
90	931	1465	-534	4268	4701	-433	4799	5293	-494
	December			**December**			**December**		
10	2058	2243	-185	6372	6956	-584	9507	10409	-902
50	1252	1721	-469	5144	5526	-382	5987	6421	-434
90	926	1379	-453	4156	4620	-464	4962	5224	-262
	January			**January**			**January**		
10	1956	2156	-200	6883	7356	-473	9319	9936	-617
50	1254	1633	-379	5395	5652	-257	6586	6996	-410
90	927	1305	-378	4171	4559	-388	5034	5414	-380
	February			**February**			**February**		
10	2004	2214	-210	7816	8292	-476	11610	11993	-383
50	1555	1732	-177	5548	6001	-453	7557	7769	-212
90	945	1306	-361	4174	4415	-241	4733	5045	-312
	March			**March**			**March**		
10	2017	2323	-306	7873	8636	-763	10144	11060	-916
50	1312	1612	-300	5170	5931	-761	6734	7491	-757
90	969	1330	-361	4061	4748	-687	5063	5647	-584
	April			**April**			**April**		
10	1459	1910	-451	6956	7583	-627	9378	9737	-359
50	774	1206	-432	5090	5822	-732	6894	7408	-514
90	564	799	-235	3900	4260	-360	4652	5031	-379
	May			**May**			**May**		
10	766	1337	-571	5631	6213	-582	7511	8021	-510
50	549	810	-261	4399	4734	-335	5954	6120	-166
90	488	418	70	3707	3835	-128	4299	4439	-140
	June			**June**			**June**		
10	868	1603	-735	5199	5759	-560	6809	7395	-586
50	571	762	-191	4181	4231	-50	5091	5148	-57
90	486	385	101	3749	3615	134	4282	4142	140
	July			**July**			**July**		
10	669	1123	-454	4863	5110	-247	5560	5990	-430
50	525	574	-49	4212	4119	93	4745	4714	31
90	474	352	122	3861	3716	145	4247	4103	144
	August			**August**			**August**		
10	682	1087	-405	4649	4778	-129	5190	5348	-158
50	516	592	-76	4074	3963	111	4506	4362	144
90	474	361	113	3653	3474	179	4034	3874	160
	September			**September**			**September**		
10	870	1259	-389	4623	4755	-132	5185	5315	-130
50	568	774	-206	4007	3999	8	4465	4518	-53
90	496	480	16	3522	3432	90	3833	3826	7

6.2.2.1 Diversions Above the Deschutes River Below Bend Gage (DEBO)

Although other diversions occur in the model, diversions from the Deschutes River above DEBO (RM 164.4) have the greatest influence on groundwater gains to the Lake Billy Chinook region.

The median (50 percent exceedance) "with Reclamation" total diversion above DEBO is more than 2,260 cfs at the peak of the irrigation season. The proposed action comprises less than 650 cfs of the total diversion. Modeled diversions above DEBO by month are shown in Table 6-3. Reclamation's proposed action comprises about 19 to 34 percent of the total diversions during the period from March to October.

Table 6-3. Modeled Total Diversions from the Deschutes River above the "Deschutes River below Bend" Gage.

(Values shown are the median –50% exceedance – of average monthly flows)

	With Reclamation	Without Reclamation	Diversions due to Proposed Action (With Reclamation minus Without Reclamation)
Oct	718	473	245
Nov	132	126	6
Dec	83	80	3
Jan	82	82	0
Feb	98	98	0
Mar	137	111	26
Apr	889	605	284
May	1898	1375	523
Jun	2201	1582	619
Jul	2263	1622	641
Aug	2057	1583	474
Sep	1701	1300	401

6.2.2.2 Deschutes River Near Culver

The Deschutes River Near Culver gage is located directly upstream from Lake Billy Chinook and downstream from Squaw Creek at RM 120.1. Modeled flows at this location are shown in Table 6-2. Median "without Reclamation" flows range from about 570 cfs in July to 1,750 cfs in November. The proposed action decreases median flows (at the 50 percent exceedance level) by 9 to 45 percent. Reductions to flow tend to be greatest from September through January and again in early spring (April and May).

April through October

Median “without Reclamation” flows range from about 570 to 810 cfs during May through September. The proposed action reduces median flows by less than 265 cfs in May, June, and September and insignificantly in July and August. The proposed action increases low flows (at the 90 percentile level) by about 70 to 120 cfs during May through August. These effects reflect the diverters' reliance on stored flows. This is reasonable, because even though Reclamation diversions above DEBO were about 640 cfs during the peak of the irrigation season (see the Section 6.2.2.1 “Diversions Above the Deschutes River Below Bend Gage”), most Reclamation diversions during that period are from stored water. The effects of groundwater gains from Reclamation diversions above DEBO increase the low flows near Culver.

Median “without Reclamation” flows are about 1,200 cfs in April. The proposed action reduces April median flows by about 430 cfs due to the diversion and storage of natural flow. Similar conditions exist in October when median “without Reclamation” flows are about 1,400 cfs and the proposed action reduces those flows by about 620 cfs.

November through March

Median “without Reclamation” flows for November through March are about 1,610 to 1,750 cfs. The proposed action reduces these median flows by about 180 to 640 cfs, due to the storage of flows in Crane Prairie and Wickiup Reservoirs. These flow reductions include any groundwater gains from the Reclamation diversions above DEBO.

6.2.2.3 Deschutes River Near Madras

The Deschutes River Near Madras gage is located directly downstream from Lakes Billy Chinook and Simtustus at RM 100.1. Flows at this location include contributions from the Metolius and Crooked Rivers. Modeled flows at this location are shown in Table 6-2. Median “without Reclamation” flows range from about 3,960 cfs in August to 6,000 cfs in Februrary. In general the proposed action decreases median flows (at the 50 percent exceedance level) by 5 to 13 percent during the October through May period. Insignificant decreases or increases in flow occur during the remaining months.

April through October

The median “without Reclamation” flows in April are about 5,820 cfs. The proposed action reduces these flows by about 730 cfs. The median “without Reclamation” flows in May are about 4,730 cfs. The proposed action reduces median May flows by about 340 cfs. Median “without Reclamation” flows June through September are about 3,960 to 4,230 cfs. The proposed action reduces median flows by about 50 cfs in June, increases median flows by about 90 to 110 cfs in July and August, and increases median flows insignificantly in September. The proposed action increases low flows (at the 90 percentile level) by about 90 to 180 cfs in June through September.

The Deschutes River Near Madras gage reflects the regulation that was observed at the Deschutes River Near Culver location upstream. In addition, Prineville Reservoir often fills through April and sometimes May, reducing the contributions from the Crooked River. NUID's Crooked River pumps also contribute to flow reductions in April through June. The June through September effects indicate Reclamation diverters' reliance on stored water, in addition to the flow-increasing effects of groundwater gains from the Reclamation diversions above DEBO.

Median “without Reclamation” October flows are about 4,590 cfs. The proposed action reduces these flows by about 390 cfs due to natural flow diversions and storage in Prineville Reservoir.

November through March

Median “without Reclamation” flows from November through March are about 5,200 to 6,000 cfs. The proposed action reduces these flows by about 260 to 760 cfs due to the combined effects of storing flows in Crane Prairie, Wickiup, and Prineville Reservoirs. These flow reductions also reflect any groundwater gains from the Reclamation diversions above DEBO.

6.2.2.4 Deschutes River at Moody

The Deschutes River at Moody gage is located at RM 1.4, at the mouth of the Deschutes River where it enters the Columbia River. Modeled flows at this location are shown in Table 6-2. Median “without Reclamation” flows range from about 4,360 cfs in August to 7,770 cfs in February. In general, the proposed action decreases median flows (at the 50 percent exceedance level) by 10 percent or less most months, with a short increase in flows in July and August.

April through October

Median “without Reclamation” flows in April, May, and October are about 5,160 to 7,400 cfs. The proposed action reduces these median flows by about 170 to 510 cfs. Median “without Reclamation” flows from June through September are about 4,360 to 5,150 cfs. The proposed action reduces median flows in June and September by about 55 cfs, and increases median flows in July and August by about 30 to 140 cfs. The proposed action increases low flows (at the 90 percentile level) by about 140 to 160 cfs in June through August. In addition to effects from Crane Prairie, Wickiup, and Prineville Reservoirs, Reclamation’s effects at Moody reflect the activities of the Wapinitia Project in the White River subbasin.

November through March

Median “without Reclamation” flows for November through March are about 5,900 to 7,770 cfs. The proposed action reduces these flows by about 210 to 760 cfs. These flow effects are due to filling Crane Prairie, Wickiup, and Prineville Reservoirs and also reflect the flow-increasing effects of groundwater gains from the Reclamation diversions above DEBO.

6.2.3 Summary

Computer simulations were performed to evaluate the hydrologic effects of the proposed action. The results of these modeling studies for the Deschutes River Near Culver, Near Madras, and at Moody are summarized in Table 6-2. Additional hydrologic effect data is available in the *MODSIM Simulation of Deschutes River Basin Projects Operations – Modeling Results* CD ROM (Stillwater 2003).

Modeling studies indicate that the greatest effect of the proposed action occurs during the irrigation season (April through October) at the Deschutes River Near Culver. Median “without Reclamation” flows for this period range from about 575 to 1,400 cfs. The proposed action reduces median “without Reclamation” flows by 9 percent to 45 percent. However in low flow years (90 percent exceedance level), the proposed action results in an increase of 17 to 35 percent, contributing about 70 to 122 cfs in the May through August period.

Downstream at the Deschutes River Near Madras, April through October median "without Reclamation" flows range from about 3,960 to 5,820 cfs. The proposed action reduces these median flows in April and October by less than 13 percent and alters May through September median flows insignificantly. "Without Reclamation" June through September low flows (at the 90 percent exceedance level) at the Deschutes River Near Madras range from about 3,430 to 3,720 cfs. The proposed action increases these low flows insignificantly. At the Deschutes River at Moody, April through October median "without Reclamation" flows range from about 4,360 to 7,410 cfs. The proposed action alters these median flows insignificantly. "Without Reclamtion" April through October low flows (at the 90 percent exceedance level) at this location range from about 3,830 to 5,030 cfs. The proposed action alters these low flows insignificantly.

November through March median "without Reclamation" flows at the Deschutes River Near Culver range from about 1,610 to 1,750 cfs. The proposed action reduces these median flows by 10 percent to 36 percent due to reservoir storage.

Downstream November through March median "without Reclamation" flows range from about 5,210 to 6,000 cfs at the Deschutes River Near Madras and from about 5,900 to 7,770 at the Deschutes River at Moody. The proposed action reduces these median flows by less than 13 percent, reflecting the influence of groundwater gains.

6.3 BALD EAGLE EFFECTS ANALYSIS

Reclamation analyzed possible effects of the annual operation and maintenance of Reclamation dams and reservoirs on both nesting and wintering bald eagles-- principally their primary prey base of fish and, to a lesser extent, waterfowl. Seasonal fluctuations in reservoir levels and alterations in streamflows below Reclamation dams were analyzed to evaluate the quantity and quality of prey population habitat, influence on prey health and abundance, and the ability of bald eagles to exploit available prey species, especially fish prey (by making prey more or less vulnerable to predation.)

There are several overriding principles which should be kept in mind while assessing the effects of continued operation and maintenance activities at project reservoirs.

1. Currently, the bald eagle population that inhabits these areas has been attracted to and has, at least in part, adapted to the conditions which have been and will continue to be present, i.e., fluctuating water levels which affect abundance and availability of prey.

2. Annual fish stocking programs at project reservoirs have helped ameliorate the effects of reservoir fluctuations on fish prey.

3. The bald eagle population in the Deschutes River basin and at project reservoirs has been a growing population over the last 30 years. This increase has occurred in spite of changes in annual and seasonal operation scenarios, responding to differing hydrologic conditions.

4. The establishment of breeding areas at project reservoirs may be at or nearing carrying capacity due to territorial conflicts, paucity of suitable nesting trees, and/or other environmental factors (see baseline discussion in Chapter 5).

The following analysis focuses on the potential effects from the "proposed action" which is continued operation and maintenance at Reclamation facilities in the Deschutes River basin. Since the growing bald eagle population has experienced and adapted to the existence of project reservoirs in the basin for the last 30 years, it is reasonable to establish the existence of reservoirs, i.e., historic and ongoing operations, as the baseline for the bald eagle. Evaluation was made of "proposed action" reservoir contents and streamflows in order to assess whether or not eagle foraging habitat and habitat conditions for prey populations change from baseline conditions as described in Chapter 5. Indirect effects are also discussed, as applicable.

Analysis of hydrologic effects used modeled end-of-month reservoir elevations simulated in the "with Reclamation" scenario described earlier in this section. The model used historic water supply data for water years 1962 through 1999, but applied current operational criteria, including current irrigation demands. Although graphs contained in this chapter reference past water years, they do not represent the actual operations for those years, but rather an indication of potential reservoir operations for water supply situations similar to past water years. This approach simulates the range of end-of-month reservoir elevations that may occur in the future.

6.3.1 Upper Deschutes Subbasin Effects Analysis

Reservoir storage under the proposed action would continue to vary considerably from year-to-year and season-to-season, depending on the water supply and demand for irrigation withdrawals.

6.3.1.1 Crane Prairie and Wickiup Reservoirs

Crane Praire Reservoir

The environmental baseline discussion assumed that the average 23,000 acre-feet end-of-October carryover may be a critical level for sustaining a productive reservoir fishery. Figure 6-1, illustrating the modeled reservoir storage elevations under the proposed action, indicates that the reservoir may be drawn down to or below this volume about 66 percent of the years. Figure 6-2, an exceedance curve for end-of-October reservoir elevations, indicates the reservoir would be at or above 23,000 acre-feet by the end of the irrigation season about 46 percent of the time. However, the reservoir would be at or above 22,000 acre-feet about 70 percent of the time.

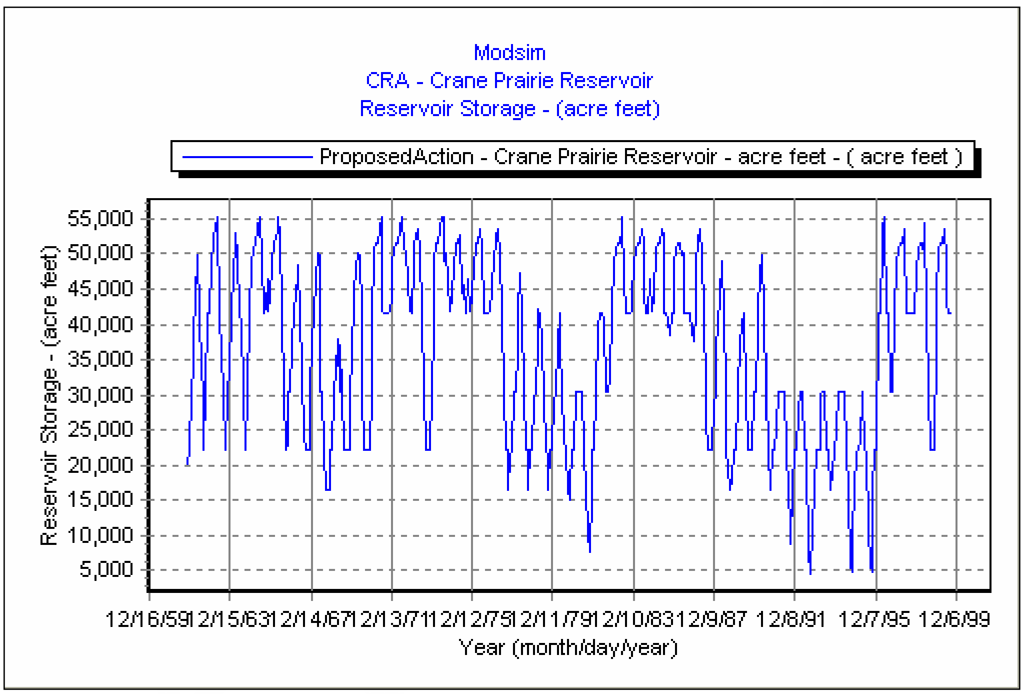

Figure 6-1. Crane Prairie Reservoir End-of-Month Storage – Proposed Action

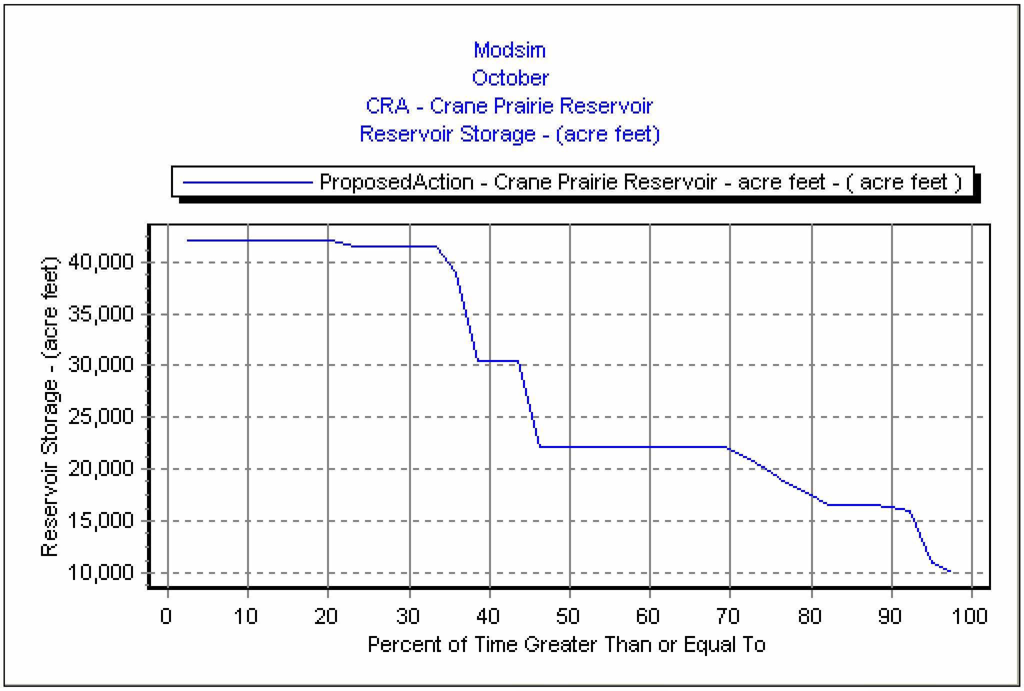

Figure 6-2. Crane Prairie Reservoir Storage End-of-October – Proposed Action Exceedance Curves

Wickiup Reservoir

As described in the environmental baseline discussion, when Wickiup Reservoir storage drops below 40,000 acre-feet, fish become concentrated in the Deschutes River channel of the reservoir and fish loss through the outlet increases (Fies et al. 1996a). Figure 6-3 indicates the reservoir would be drawn down to or below 40,000 acre-feet 32 percent of the years. However, end-of-October storage under the proposed action would be at or above 40,000 acre-feet about 81 percent of the time at the end of the irrigation season (Figure 6-4). At the 50 percent exceedance level, Wickiup Reservoir storage would be at or above 100,000 acre-feet at the end of October.

Effects on Foraging Habitat and Prey Base - The preceding analysis shows that the Crane Prairie and Wickiup Reservoirs content would continue to fluctuate seasonally and annually dependent on the water supply and demand, as has been the case historically.

As described in Chapter 3, Crane Prairie Reservoir levels and content have been substantially improved since Reclamation's rehabilitation of the dam in 1940. It has also operated with less variability and at higher minimum elevations since the coordinated operation with Wickiup Reservoir began in 1949. After 1970, annual fluctuations of Wickiup Reservoir have been more uniform and generally not drawn down as low as compared to pre-1970 data. These operational changes have improved the quality of the aquatic habitat for the reservoir fish populations, both resident and stocked, and have reduced the entrainment through Wickiup Dam.

Overall, continued operations at the reservoirs would not significantly change the habitat conditions for fish and waterfowl prey populations at the reservoirs from the environmental baseline. Continued fish stocking programs at the reservoirs would continue to help ameliorate the effects of reduced reservoir levels during low water years. Maintenance of the fish prey population, in particular, in the reservoirs would result in continued foraging success for bald eagles; although, there would continue to be fluctuations in the quantity and quality of aquatic habitat and dependent prey populations. Competition between eagles and other piscivorous birds (i.e., cormorants and ospreys) for fish prey, would continue.

Effects on Nesting Bald Eagles – The increasing year-round bald eagle use in close proximity to Crane Prairie and Wickiup Reservoirs (i.e., increased from 5 known breeding areas to 17 over a 30-year period in addition to occasional wintering birds) is an indication that a suitable prey base and other habitat requirements have been met historically at the reservoirs, and is not expected to change significantly.

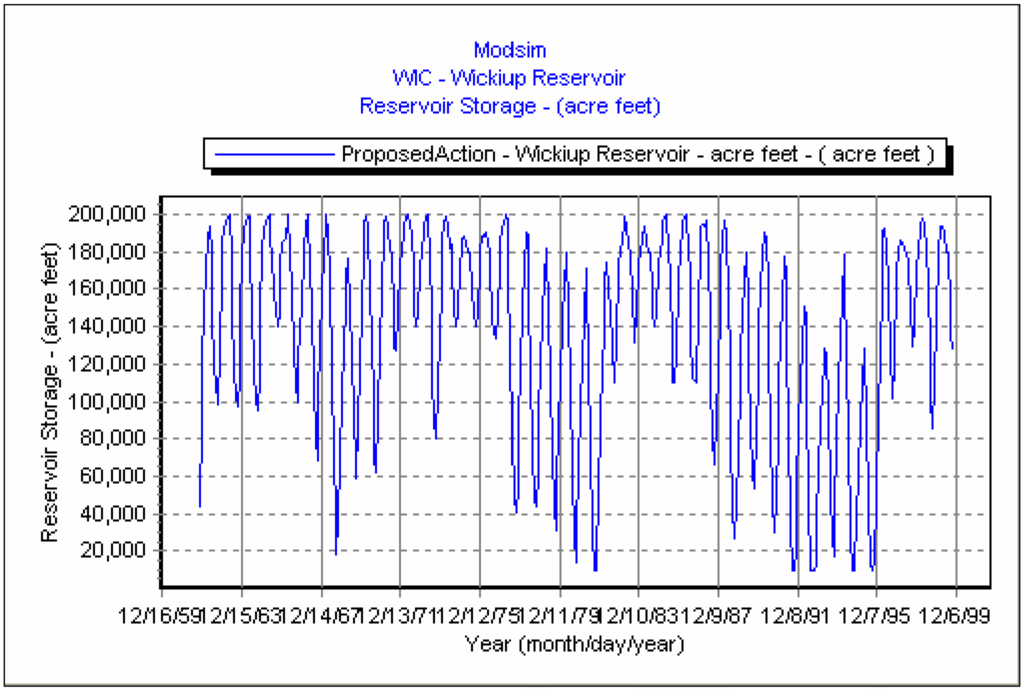

Figure 6-3. Wickiup Reservoir End-of-Month Storage – Proposed Action

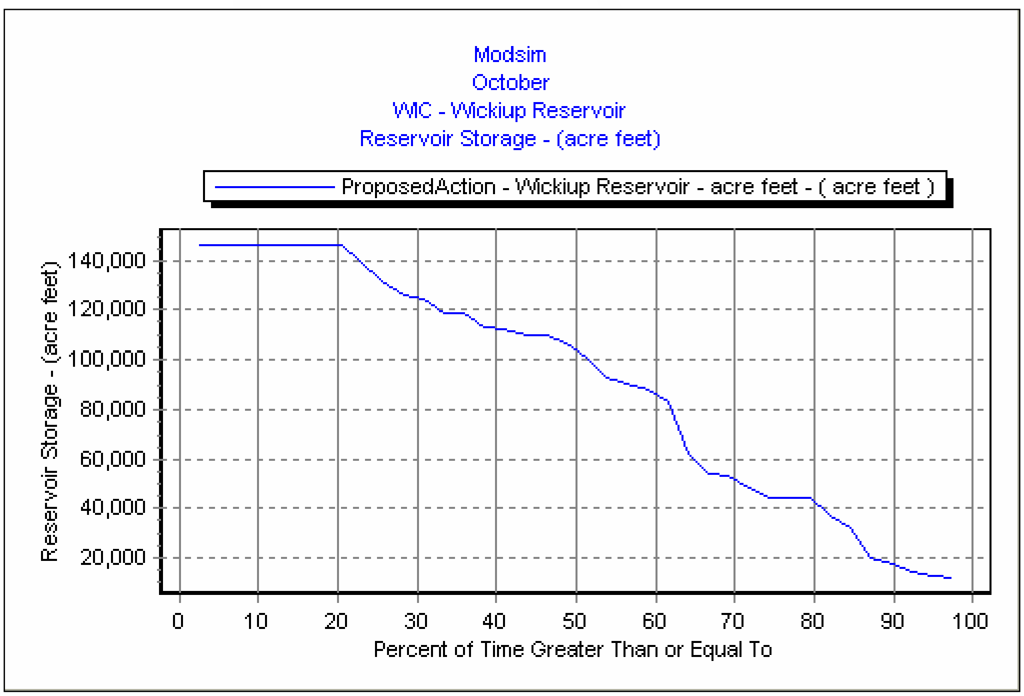

Figure 6-4. Wickiup Reservoir End-of-October Storage – Proposed Action Exceedance Curves

The potential relationship of project reservoir operations to bald eagle nesting success can be evaluated by examining the hydrologic conditions at Crane Prairie and Wickiup Reservoirs and the corresponding bald eagle nesting success of the last 30 years. The general trend has been an increase in breeding pairs with a corresponding increase in the production of young. However, there has been a great deal of fluctuation in these numbers (Table 5.1 and Figure 5.2) which cannot necessarily be explained in relationship to reservoir hydrologic cycles, with possibly one exception:

> *During the 1979-1981 historic period, Crane Prairie and Wickiup Reservoirs levels were drawn down to very low levels for three years in a row (Figures 3-2 and 3-7). The apparent result was an abrupt drop in the number of young eagles produced during the subsequent two nesting periods (1982 & 1983--See Table 5.1 & Fig. 5.2). This occurred even though the number of occupied breeding areas remained fairly constant. The effect was most apparent at Crane Prairie Reservoir, where there were no young produced during the two-year period following the 1979-81 drawdown years. Examination of climatic conditions (precipitation and temperature) for the 1982 breeding and nesting seasons indicated that there was above average precipitation during the May through July period, but that temperatures were near average. The question here would be whether or not these or other environmental factors also had an effect on the production of young. However, looking at the State of Oregon nesting record for 1982, it shows a general decrease in the average productivity of nesting pairs per occupied site--possibly indicating a general decline responding to widespread drought conditions in previous years (Isaacs and Anthony 2002).*

The number of breeding pairs which occupy nesting territories in the vicinity of Crane Prairie and Wickiup Reservoirs would be expected to continue to fluctuate annually with the proposed action, as under past operations. There may be some increases in numbers, depending on the suitability of environmental factors in addition to continued reservoir operations. Any possible increase in the number of occupied breeding territories under the proposed action would also depend on a number of factors, i.e., varying environmental conditions, competition for space, and availability of suitable nesting trees. Review of nesting data (Table 5-1) over the last 9 years indicate that the opportunity for establishing new breeding areas (nesting territories) at the reservoirs may be reaching carrying capacity. At Crane Prairie Reservoir, seven breeding areas were recorded in 1994 and increased by only one by the year 2000. At Wickiup Reservoir, there were eight recorded breeding areas as early as 1981, increasing by only one breeding area by 2001.

While it is uncertain as to whether the number of breeding areas may or may not increase under the proposed action, the continued operation of the reservoirs–resulting in a sustained prey base–would be expected to maintain the historic success of breeding pairs. The result may be at sustained or even higher numbers of occupied breeding territories (again dependent on competitive factors and annual environmental conditions) and continued success in raising and fledging young.

Effects on Wintering Bald Eagles –During severe winter months, when the lakes are mostly iced over, it is unlikely that the proposed action would have any differing effects on bald eagle habitat or food supply. Eagles often reside at the reservoirs until well into, or through, the winter months, feeding on wintering concentrations of waterfowl.

Early in the spring and sometimes in mild winters (i.e., at Wickiup Reservoir), ice either does not form or begins to recede at stream inlets to the reservoirs leaving small areas of open water. Waterfowl concentrate at these open water areas creating a ready source of food for the eagles. During this time, the proposed action would have little change on foraging opportunities from historic conditions.

This area also contains suitable perching and roosting sites nearby with little or no significant human disturbance in winter. These conditions would not change under the proposed action.

Other Effects –Disturbances to nesting activities in summer, due to recreational use of the reservoirs and adjacent landscapes, will continue to be a management concern under the proposed action, as has been the case historically. The USFS has addressed these concerns, as the authorized land manager, by establishing Bald Eagle Management Plans for all but the most recently recorded breeding areas at the reservoirs. Possibly more could be done to reduce disturbance effects on nesting eagles if some bays were restricted from access during the eagle nesting period (Dillon 2002). However, this would have to be a USFS action. Reclamation has no jurisdiction over recreation management on the reservoirs.

Routine operation and maintenance activities at Crane Prairie and Wickiup Dams would not result in disturbance or alteration of nesting, perching, or roosting sites. All routine activities would be concentrated at the dam locations and should have no disturbing effects on nesting or foraging eagles. If extraordinary maintenance activities requiring significant amounts of construction are proposed in the future, each would have to be assessed separately to determine potential disturbing effects, especially on eagle breeding and nesting success at nearby nest location, e.g., the nest site immediately downstream of Wickiup Dam.[1]

[1] The 2002 nesting activity at this sight was apparently adversely affected by ongoing construction activities associated with the Safety of Dams program. These activities were the subject of a separate Section 7 ESA consultation.

6.3.1.2 Deschutes River Below Project Reservoirs

Under the proposed action, the flows of the Deschutes River below Wickiup Dam would continue to vary considerably from year-to-year and season-to-season depending on the water supply and demands for irrigation (Figure 3-8). Maximum and minimum releases and overall flow patterns would be similar to conditions in the most recent past.

Any proposed action effects on bald eagles would be due primarily to continued fluctuating flow patterns and their effect on Deschutes River fish populations. However, according to Marx (2002) there are few issues associated with these flows relative to the availability of a food source for wintering eagles, i.e., there appears to be a sustained prey base (fish and waterfowl) in most years. During ice-over conditions, wintering birds move to lower elevations in the basin to roost and feed.

The three breeding areas on the upper Deschutes River have been established since 1990. The breeding pairs which utilize these areas are possibly year-long residents and rely on the Deschutes River fish and waterfowl populations as a main source of food. During the bald eagle nesting season, the riverine environment plus surrounding prey habitat appear to have provided a relatively stable prey base for the nesting eagles in recent years and would continue to do so under the proposed action. Fluctuations in breeding and fledging success and in numbers of wintering eagles along the river would be expected to continue as in the past.

6.3.2 Middle Deschutes River Subbasin Effects Analysis

Bald eagles nesting and wintering in the middle Deschutes River area are not affected by Reclamation project O&M activities. They are mostly influenced by operation of the Pelton-Round Butte Project reservoirs (i.e., Lake Billy Chinook) which, along with westside tributaries, provide abundant food sources for nesting and wintering eagles as described in Chapter 5. Nesting opportunities would continue to be limited by the paucity of suitable nesting trees.

6.3.3 Crooked River Subbasin Effects Analysis

The reservoir storage content at Prineville and Ochoco Reservoirs under the proposed action would continue to vary considerably from year-to-year and season-to-season depending on the water supply and irrigation demands.

6.3.3.1 Prineville and Ochoco Reservoirs

Figure 6-5 depicts the simulated end-of-month Prineville Reservoir storage for the proposed action. As described in the environmental baseline discussion, the average end-of-October carryover storage in Prineville Reservoir has been about 83,000 acre-feet, dipping below this level in only extreme drought years. Under the proposed action, end-of-October storage (end of irrigation season) would be expected to be at or above 83,000 acre-feet about 68 percent of the time (Figure 6-6).

The hydrological analysis for Ochoco Reservoir is important to the bald eagle effects analysis as it relates to winter forage habitat provided by a facility that is operationally interrelated and interdependently with Reclamation operations. Figure 6-7 depicts the simulated end-of-month storage for the proposed action. Overall fluctuations in Ochoco Reservoir elevations and content would continue as in the past. Historically, Ochoco Reservoir's average end-of-October carryover storage is 14, 750 acre-feet. Under the proposed action, the reservoir would be at or above this historic average carryover, about 73 percent of the time (Figure 6-8). The overall winter condition of the reservoir would not change significantly from past operations. Ochoco Reservoir has been held at higher elevations since the construction of Bowman Dam, because of coordinated operations.

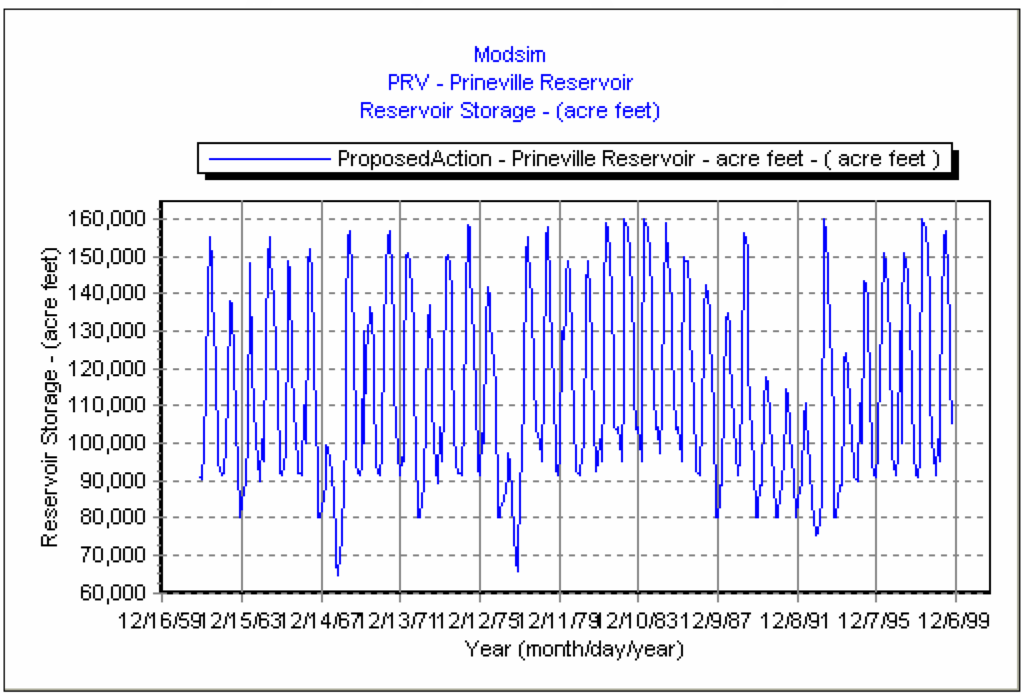

Figure 6-5. Prineville Reservoir End-of-Month Storage – Proposed Action

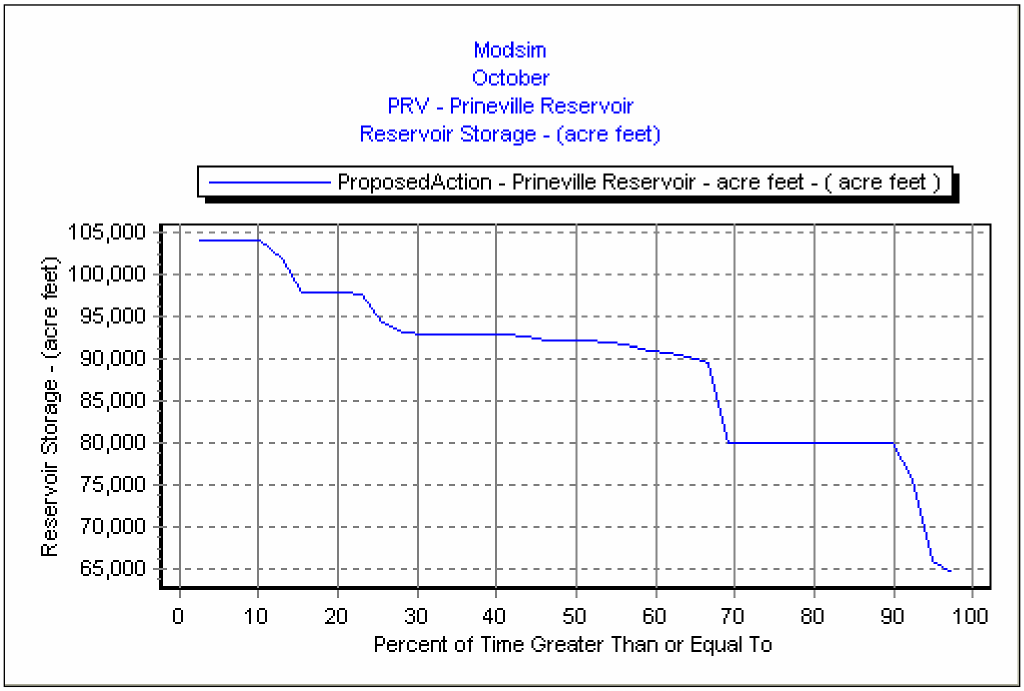

Figure 6-6. Prineville Reservoir End-of-October Storage – Proposed Action Exceedance Curve

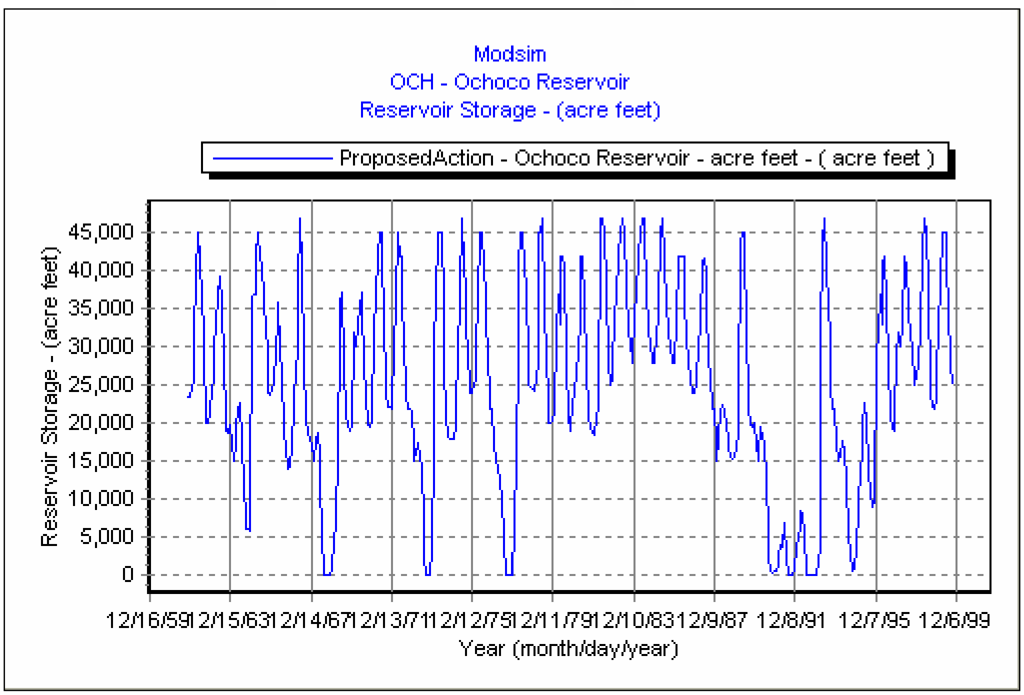

Figure 6-7. Ochoco Reservoir End-of-Month Storage – Proposed Action

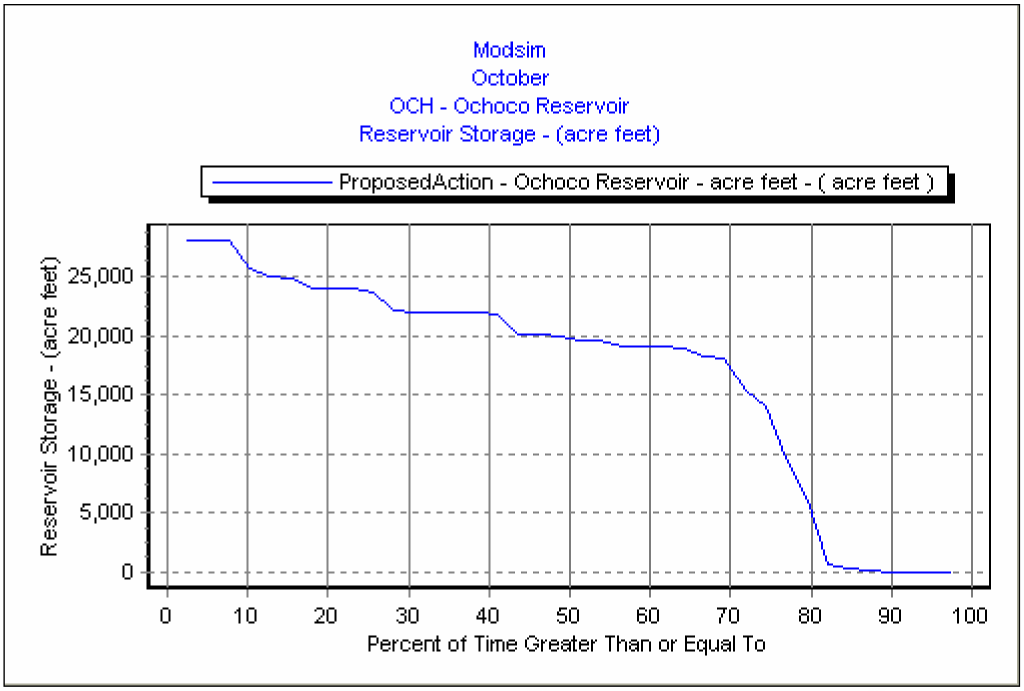

Figure 6-8. Ochoco Reservoir End-of-October Storage – Proposed Action Exceedance Curve

Effects on Foraging Habitat and Prey Base – The preceding analysis shows that under the proposed action there would remain a sizeable carryover content at Prineville Reservoir, as has been historically; and extreme drawdowns would be avoided. It is expected that the quality and quantity of the aquatic habitat for the reservoir fish populations, both resident and stocked, would be maintained at historical conditions. However, there would continue to be fluctuations in the quantity and quality of aquatic habitat and dependent prey populations.

Maintained conditions for fish prey population in the reservoir would probably have no significant change on the foraging success for the single resident breeding pair of bald eagles at Prineville Reservoir. Prey would remain readily available to these birds and to any new breeding pairs that may be able to find a suitable nesting site near the reservoir--although, as described under baseline conditions, suitable nesting trees are in short supply and the resident pair is extremely territorial.

Unchanged winter carryover conditions at Ochoco Reservoir would maintain the winter fishery and waterfowl prey base in the reservoir at current levels.

Effects on Nesting Eagles – Based on the foregoing, Prineville Reservoir would continue to be operated in a similar manner as it has been historically. Future bald eagle nesting success would respond to a continuation of similar environmental factors along with available prey.

Effects on Wintering Eagles – During severe winter months, when the reservoirs are mostly iced over, it is unlikely that the proposed action would have any effects on bald eagle habitat or food supply. But at these lower elevation reservoirs, eagles often reside well into, or through, the winter months, feeding on wintering concentrations of waterfowl and fish at the reservoirs and/or upland carrion on adjacent lands.

During this time, the proposed action would have little change on foraging opportunities from historic conditions, because reservoir fisheries and waterfowl, and their availability as exploitable prey, would not significantly change from historic conditions.

This area also contains suitable perching and roosting sites nearby with little or no significant human disturbance in winter. These conditions would not change under the proposed action.

Other Effects – Disturbances to nesting activities in summer, due to recreational use of the reservoirs and adjacent landscapes, has not been perceived as an issue at Prineville Reservoir in the past. Nesting sites are extremely limited by the availability of suitable nesting trees. If the resident pair or other eagles nest in closer proximity to the reservoir, as attempted in 2002, then conflicts with recreation use could occur. This could happen with or without implementation of the proposed action. Reclamation would continue to work with other agencies to minimize effects on recreation use on bald eagle breeding and nesting activities at Prineville Reservoir.

Routine operation and maintenance activities at Bowman Dam (Prineville Reservoir) and Ochoco Dam would not result in disturbance or alteration of nesting, perching, or roosting sites of breeding, nesting, or wintering bald eagles. All routine activities would be concentrated at the dam locations and should have no disturbing effects on nesting or foraging eagles. If extraordinary maintenance activities requiring significant amounts of construction are proposed in the future, each would have to be assessed separately to determine potential disturbing effects, especially on eagle foraging activities. At present there are no nest sites in the near vicinity of the dams.

6.3.3.2 Crooked River Below Bowman Dam

Under the proposed action, Crooked River flows below Bowman Dam would continue to vary considerably from year-to-year and season-to-season depending on the water year and on withdrawals for irrigation (Figure 3-25). Releases and overall flow patterns would not change significantly from recent past historic conditions. Minimum releases to sustain downstream fisheries (provided since 1990) would remain in effect.

Any effect of the proposed action on bald eagles would be due primarily to the continued fluctuating flow patterns and their effect on Crooked River fish populations. It is expected that continued release of minimum winter flows (as described in Chapter 2) would continue to sustain a healthy fishery below the dam during the nonirrigation season. This along with upland carrion sources would continue to provide a sustained foraging base for the bald eagles which winter along the river corridor.

6.3.4 Lower Deschutes River Subbasin Effects Analysis

6.3.4.1 Clear Lake

It is not known how operations at Clear Lake may affect the nesting success of the Clear Lake nesting territory. There is evidence that the eagles have been in the area for years, but monitoring of nesting activity began only about 6 years ago. Since then, there has been recorded nesting success in only the last 2 years. Fish resources are limited at Clear Lake, but there appears to be adequate foraging areas when considering all of the lake and stream fisheries in the general area. These conditions would not change with the proposed action. Clear Lake would continue to be operated in the same manner as it has been historically and future bald eagle nesting success would respond to a continuation of similar environmental factors.

6.3.4.2 Lower Deschutes River

This reach of the Deschutes River below Lake Billy Chinook would continue to support an abundance of waterfowl and fish prey. Bald eagle nesting would continue to be limited by the paucity of suitable nesting trees. Year-round bald eagle use (one nesting territory actually near the river and significant numbers of wintering eagles) of the lower Deschutes and tributaries is an indication that a sustained prey base (i.e., fish resources along with waterfowl and winter-killed big game) and other habitat features (i.e., suitable perching and roosting sites) are, and will continue to be, available. The bald eagle prey base in the lower river and tributaries is not likely to be adversely affected under the proposed action. Streamflows and dependent prey populations are generally adequate in the lower river and will remain so under the proposed action.

6.3.5 Summary of Effects

Based on the previous analysis and the fact that there has been and continues to be a growing bald eagle population in the Deschutes River basin, it is Reclamation’s conclusion that overall the proposed action “may affect, but is not likely to adversely affect” the breeding, nesting, or wintering success of bald eagles in the Deschutes and Crooked River subbasins.

6.3.5.1 Upper Deschutes River Subbasin

- The number of breeding pairs which occupy nesting territories in the vicinity of Crane Prairie and Wickiup Reservoirs would be expected to continue to fluctuate annually with the proposed action, as under past operations. There may be some changes in numbers, depending on the suitability of environmental factors in addition to reservoir level fluctuations. Such changes have been the case in the recent past with the growing eagle population. [May Affect, Not Likely to Adversely Affect]

- While the number of breeding areas may or may not increase under the proposed action, it is expected that breeding success would continue to fluctuate as in the past. [May Affect, Not Likely to Adversely Affect]

- Success of breeding pairs downstream of Wickiup Dam would be likely to remain about the same as historically. [No Effect]

- Conditions for winter eagles would probably not change significantly. [No Effect]

- Routine operation and maintenance activities at Crane Prairie and Wickiup Dams would not result in disturbance or alteration of nesting, perching, or roosting sites. [No Effect]

6.3.5.2 Middle Deschutes River Subbasin

- Bald eagles nesting and wintering in the middle Deschutes River area are not affected by Reclamation project O&M activities. [No Effect]

6.3.5.3 Crooked River Subbasin

- The proposed action would have little change on foraging opportunities from historic conditions at Prineville Reservoir because reservoir fisheries and their availability as exploitable prey will continue to be more than adequate for the resident breeding pair and wintering eagles. [No Effect]

- Routine operation and maintenance activities at Bowman Dam (Prineville Reservoir) and Ochoco Dam would not result in disturbance or alteration of nesting, perching, or roosting sites of breeding, nesting, or wintering bald eagles. [No Effect]

- It is expected that the commitment to providing minimum winter flows would continue to sustain a healthy fishery in the Crooked River below Bowman Dam during the nonirrigation season. This along with upland carrion sources would continue to provide a sustained foraging base for the bald eagles which winter along the river corridor. [No Effect]

- Winter carryover conditions at Ochoco Reservoir would remain unchanged. The winter fishery prey base in the reservoir would not change significantly. [No Effect]

6.3.5.4 Lower Deschutes River Subbasin

- Clear Lake would continue to be operated in the same manner as it has been historically and future bald eagle nesting success would respond to a continuation of similar environmental factors. [No Effect]

- The bald eagle prey base in the lower river and tributaries is not likely to be adversely affected under the proposed action. Streamflows and dependent prey populations are generally adequate in the lower river and will remain so under the proposed action. [May Affect, not Likely to Adversely Affect]

6.4 BULL TROUT

6.4.1 Upper Deschutes River Subbasin

6.4.1.1 Effects Analysis

Operation of project facilities at Crane Prairie Reservoir, Wickiup Reservoir, and diversion facilities downstream would have no effect on bull trout in the upper Deschutes subbasin since there are no longer any known bull trout populations in these reservoirs nor in the tributary streams above or immediately below the reservoirs.

6.4.2 Middle Deschutes River Subbasin

6.4.2.1 Effects Analysis

Effects of flow alterations resulting from the operation of Reclamation facilities of the Deschutes and Crooked River Projects and private facilities reduce inflows to the middle Deschutes River. Diversions related to the Deschutes Project and other private diversions have severely affected streamflow and water quality in the 33 stream miles from Bend downstream to Big Falls. Water quality and spatial habitat is severely depleted through this reach (Marx 2000). Downstream from Bend, large spring inflows (from irrigation groundwater recharge) restore or replace a significant amount of the water that is stored or diverted upstream.

Historic hydrologic analysis (Chapter 3) and hydrologic modeling of flows in the Deschutes River basin (Section 6.2) were conducted by Reclamation and described earlier. The hydrological model calculated daily mean streamflows on a monthly basis for two hydrologic scenarios (with Reclamation projects operating, and those expected if the proposed action were removed.) This provided the information to illustrate percent exceedance curves for the USGS streamflow gage near Culver, Oregon, just upstream from Lake Billy Chinook. Table 6-4 shows modeled 50 percent exceedances for each month for the Culver gage under the "with Reclamation" and "without Reclamation" conditions, and the percent difference in the streamflow for these two modeled simulations. Table 6-4 shows that there is a reduction in modeled downstream flow attributable to Reclamation operations for 12 months of the year at the Culver gage at the 50 percent exceedance level. Generally, these modeled flow changes reflect periods when Reclamation, under the proposed action, is storing or releasing water. These seasonal reductions in flow may contribute to reduced water quality conditions in the mainstem middle Deschutes River from the city of Bend downstream to Big Falls. Non-Federal water storage and diversion facilities similarly contribute to a net reduction in flows, due to the complex hydrology of the basin.

According to modeling results, storage of Reclamation project water along with any private storage have decreased winter streamflows. Diversion of natural flows has decreased flows during the irrigation season. Even so, spring inflows to the Deschutes River upstream from Lake Billy Chinook help ameliorate the effects of project caused flow reductions in the river and dilute potential nutrients and agricultural chemicals contained in irrigation return flows. Flows and water quality in this lower reach of the middle Deschutes River appear to be adequate, even during drought years, as evidenced by use of bull trout as far upstream as Big Falls, a natural barrier, and also provide bull trout access to lower Squaw Creek. The State of Oregon instream flow recommendations of 250 cfs year round are also met in this reach where bull trout occur (Marx 2003).

Table 6-4. Modeled Daily 50 Percent Exceedances for Streamflow in the Middle Deschutes River Near Culver, OR, (by month, in cfs)

Culver, OR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
With Reclamation	1254	1555	1312	774	549	571	525	516	568	774	1116	1252
Without Reclamation	1633	1732	1612	1206	810	762	574	592	774	1396	1751	1721
% Δ Q	-23.2	-10.2	-18.6	-35.8	-32.2	-25.1	-8.5	-12.8	-26.6	-44.6	-36.3	-27.3

Reclamation has been actively working with the DRC to fund and carry out several water conservation projects in Squaw Creek, Crooked River, and the Deschutes River to improve habitat and flows for bull trout, resident fish, and potentially for future reintroduction of anadromous fish. Other conservation projects have improved flows and water quality of Tumalo Creek and the middle reach of the Deschutes River.

Storage and diversion of flows on the Deschutes and Crooked Rivers do not significantly affect the levels of Lake Billy Chinook as this is a run-of-the-river operation. Operation of the Pelton-Round Butte Hydroelectric Project has the major influence on water quantity in Lake Billy Chinook and its tributary arms. Minor daily fluctuations help sustain lake levels to the benefit of bull trout by minimizing entrainment of kokanee and zooplankton. Even with the winter season drawdown of the lake for flood control, there appears to be adequate water surface and volume to provide for the increasing bull trout population in Lake Billy Chinook.

Return flows from irrigated project lands add nutrients, bacteria, and agricultural chemicals into Lake Billy Chinook via the Deschutes and Crooked River inflows. While these pollutants are diluted by large spring inflows, they do reduce the overall water quality of the lake, which is generally good, but which experiences seasonal algal blooms. However, there is no indication to date that water quality of Lake Billy Chinook is adversely affecting bull trout populations in the lake.

Overall, these project and nonproject influences, especially in the lower reaches of the middle Deschutes River basin, likely do not negatively influence adult and subadult bull trout.

6.4.2.2 Effects Conclusion

Reclamation project operations have no effect on the Metolius River subbasin spawning, rearing, and fluvial habitats of bull trout because there are no Reclamation facilities in the Metolius River nor its tributaries. Project operations may affect, but are not likely to adversely affect bull trout from Lake Billy Chinook upstream to Big Falls in the Deschutes River.

Reclamation does not anticipate any incidental take of bull trout in the middle Deschutes River associated with the continued operation of Reclamation facilities.

6.4.3 Lower Deschutes River Subbasin

6.4.3.1 Effects Analysis

Hydrologic modeling of flows in the Deschutes River basin was conducted by Reclamation and is described in Section 6.2. The model calculated a hydrologic baseline with Reclamation's proposed action and without its proposed action for daily mean flows on a monthly basis, and provided the information to illustrate percent exceedance curves for the USGS streamflow gage near Madras, Oregon just downstream from Pelton Reregulating Dam. Table 6-5 shows modeled 50 percent exceedances by month for "with Reclamation" and "without Reclamation" conditions and the percent difference in the streamflow near Madras.

Table 6-5. Modeled Daily 50 Percent Exceedances for Streamflow in the Lower Deschutes River Near Madras and at Moody, OR. (by month, in cfs)

Madras, OR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
With Reclamation	5395	5548	5070	5090	4399	4181	4212	4074	4007	4201	4635	5144
Without Reclamation	5652	6001	5931	5822	4734	4231	4119	3963	3999	4593	5208	5526
% Δ Q	-4.5	-7.5	-14.5	-12.6	-7.1	-1.2	+2.3	+2.8	+0.2	-8.5	-11.0	-6.9
Moody, OR												
With Reclamation	6586	7557	6734	6894	5954	5091	4745	4506	4465	4742	5454	5987
Without Reclamation	6996	7769	7491	7408	6120	5148	4714	4362	4518	5155	5904	6421
% Δ Q	-5.9	-2.7	-10.1	-6.9	-2.7	-1.1	+0.7	+3.3	-1.2	-8.0	-7.6	-6.8

The proposed action reduces modeled streamflows at the Madras gage for 9 months of the year, except for July, August, and September. During July, August, and September, the proposed action increases modeled streamflows slightly. At the 50 percent exceedance level, the decrease in modeled flows under the proposed action ranges from 1.2 to 14.5 percent for these 9 months, and is greater than 10 percent in November, March and April. The increase in modeled flow during these months ranges from 0.2 percent to 2.8 percent.

Generally, these modeled flow changes reflect periods when Reclamation, under the proposed action, is storing or releasing water. These seasonal reductions in flow coupled with increased air temperature and other variables, may contribute to reduced water quality conditions (e.g., increased water temperatures) in the mainstem lower Deschutes River. Non-Federal water storage and diversion facilities have similarly contributed to a net reduction in flows, due to the complex hydrology of the basin. Modeled results indicate storage of project water along with any private storage decrease winter streamflows. Diversion of natural flows decreases flows during the irrigation season. Even so, flows in the lower Deschutes River are remarkably uniform and stable (Fassnacht et al. 2002), and in most cases the modeled change in flow is within the general accepted accuracy range of streamflow gages, i.e., about 10 percent.

Project operation and maintenance activities have no effect on bull trout spawning tributaries in the lower Deschutes River subbasin mentioned above. Flows and water quality in the lower Deschutes River are primarily driven by the operation of the Pelton-Round Butte Complex and partially ameliorated by downstream surface and groundwater inflows. Natural warming of the river as it flows downstream is also a factor, especially in the summer months, when flows are somewhat reduced. Overall, these project and nonproject influences, especially warmer water temperatures in the lower Deschutes River downstream of Madras, may influence fluvial bull trout. However, the timing of these warmer water temperatures is typically when lower Deschutes River adult fluvial bull trout are in tributary streams that provide cooler water.

Therefore, the impacts, if any, would be minimal to adult bull trout. Impacts to subadult bull trout in the lower Deschutes River are unknown. However, any potential impacts are likely minimal based on an estimated increase in bull trout spawning populations for Shitike Creek and the Warm Springs River, plus the ability of bull trout to seek out suitable habitat.

Reclamation has been actively working with DRC to fund and carry out conservation projects in the Warm Springs River, Trout Creek, Mack's Canyon, and other subbasins of the lower Deschutes River to improve water quality, habitat, and flows for resident and anadromous fish.

Bull trout are not found in the White River subbasin (possibly because of the natural turbidity of the river caused from the suspension of glacial flour; natural barrier in the lower river; and warmer waters of the lower river); therefore, bull trout are not influenced by operation of Wasco Dam and Reservoir on Clear Creek, an upper tributary of the White River.

6.4.3.2 Effects Conclusion

Reclamation project operations may affect, but are not likely to adversely affect bull trout in the lower Deschutes River. Reclamation does not anticipate any incidental take of bull trout in the lower Deschutes River associated with the continued operation of Reclamation facilities.

6.4.4 Crooked River Subbasin

6.4.4.1 Effects Analysis

Operation of project facilities at Prineville and Ochoco Reservoirs would have no effect on existing bull trout populations; only the lower Crooked River below Opal Springs Dam supports wandering Metolius basin bull trout in the lower Crooked River subbasin. See the analysis in Section 6.4.2 "Middle Deschutes River Subbasin" for a description of effects on bull trout in the lower few miles of the Crooked River and in the Crooked River arm of Lake Billy Chinook. Unknown numbers of bull trout are found in the lower Crooked River, from Lake Billy Chinook to Opal Springs Dam that are a component of the Metolius River bull trout population. According to Gannett (2001), groundwater discharge of over 1,000 cfs occurs in this reach, providing suitable rearing habitat for Lake Billy Chinook bull trout. This groundwater discharge into the lower Crooked River results in instream flows that exceed State of Oregon instream flow recommendations from Opal Springs to Lake Billy Chinook.

Reclamation has partnered with DRC and National Fish and Wildlife Foundation to provide funding for conservation projects in the Crooked River subbasin to improve water quality and habitat, and has constructed new fish screen facilities at the Crooked River Project main diversion facility.

6.4.4.2 Effects Conclusion

Reclamation project operations may affect, but are not likely to adversely affect bull trout in the Crooked River.

Reclamation does not anticipate any incidental take of bull trout in the Crooked River associated with the continued operation of Reclamation facilities.

6.5 MIDDLE COLUMBIA RIVER STEELHEAD

6.5.1 Effects Analysis

Historic hydrologic conditions are described and hydrologic modeling of streamflows in the Deschutes River basin were conducted by Reclamation (see Chapter 3 and Section 6.2, respectively). The hydrologic model calculated daily mean streamflows on a monthly basis with Reclamation projects operating and without Reclamation. This information was used to produce percent exceedance curves for streamflow near Madras, Oregon, just downstream from Pelton Reregulating Dam, and at Moody, Oregon. Table 6-5 shows modeled 50 percent exceedances for each month near Madras and at Moody for the "with Reclamation" and the "without Reclamation" modeled scenarios, and the percent difference in the streamflow at those locations. Table 6-5 shows that Reclamation's proposed action reduces modeled downstream flow for 9 months of the year at the Madras gage and for 10 months of the year at Moody.

The proposed action reduces modeled streamflows near Madras for 9 months of the year, except for July, August, and September. At the 50 percent exceedance level, the proposed action decreases modeled flows near Madras ranging from 1.2 to 14.5 percent and are greater than 10 percent in November, March, and April, with an average 8.2 percent decrease for the 9-month period. During July, August, and September, the proposed action increases modeled streamflows slightly. Increased modeled flows near Madras range from 0.2 to 2.8 percent for these 3 months.

Generally, these modeled flow changes reflect periods when Reclamation, under the proposed action, is storing or releasing water. These seasonal reductions in flow may contribute to reduced water quality conditions in the mainstem lower Deschutes River, but the reductions generally occur during periods when ambient air temperatures are less likely to adversely affect water temperatures. However, as shown in Table 5-12, weekly water temperatures for a 17-year period are lower than the ODEQ water temperature criterion for salmonid fish rearing. Non-Federal water storage and diversion facilities similarly contribute to a net reduction in flows, which generally follow the same seasonal scenario of storing and releasing water.

Modeled hydrologic results indicate storage of Reclamation project water decreases winter streamflows. Diversion of natural flows decreases river flows during the irrigation season. Even so, flows in the lower Deschutes River are remarkably uniform and stable (Fassnacht et al. 2002), and in most cases the modeled change in flow is within the generally accepted accuracy range of streamflow gages, i.e., about 10 percent. Table 5-3 of historic flows shows that the average end-of-month streamflow for the period 1990-2001 meet or exceed the recommended instream flows. Table 6-5 depicting modeled streamflows under "with Reclamation" and "without Reclamation" conditions, indicates recommended instream flows are met or exceeded at the 50 percent exceedance levels.

Project operation and maintenance activities have no effect on the steelhead spawning tributaries in the lower Deschutes River subbasin mentioned above since no Reclamation projects occur there, with the possible exception of the White River. However, steelhead spawning and rearing in this short 2-mile reach of river below the 150-foot-high falls has not been documented by ODFW (Pribyl 2002). Flows and water quality in the lower Deschutes River are modified and controlled in large part by the operation of the Pelton-Round Butte Hydroelectric Project and are partially ameliorated by downstream surface and cooler groundwater inflows. Natural warming of the river as it flows downstream occurs, especially in the summer months when flows are somewhat reduced (Aney et al. 1967), but this is not a result of Reclamation operations.

The Wapinitia Project on Clear Creek, a tributary of the White River, utilizes Wasco Dam for storage of some irrigation water. The project has natural flow water rights that are supplemented by water from Clear Lake. During winter nonirrigation months, storage is accruing to Clear Lake and flows in the White River and to the Deschutes River are reduced by a maximum of 102 cfs in February. During the irrigation season, there is an average increase of 6 cfs to the Deschutes River flow (Appendix C).

Streamflow gages in the lower Deschutes River were installed only near Madras and at Moody. Modeled exceedance values near Madras and at Moody indicate flows are at least 3,100 cfs and 3,500 cfs, respectively. The calculated increase of 6 cfs to the Deschutes River from the White River is about 0.2 percent of the flow measured at Madras and is negligible. Change in flow in the lower Deschutes River attributable to the Wapinitia Project and storage in Wasco Dam is barely measurable, and within the range of accuracy of streamflow gages. Over time, return flows offset some of the water diverted upstream. However, the additional non-Federal upstream agricultural diversions could affect flows during the 1 May to 1 October irrigation season. Data are unavailable to determine the extent of any affect from non-Federal irrigation. But despite these unquantifiable effects on flow in the White River, there is still substantial flow in the lower Deschutes River as indicated by streamflow measurements at the USGS Moody gage (Table 5-3).

ODFW has not documented use of the lower 2-mile reach of the White River by steelhead. The water quality of this 2-mile reach of river is affected by the natural turbidity of the river caused by the suspension of glacial flour, some sediments carried into the river by agricultural return flows, and naturally warming conditions. The White River below Lower Falls is listed as exceeding the water temperature criterion of 64°F (17.8°C) for anadromous salmonids for 100, 58, and 72 days in 1992, 1993, and 1994, respectively. The White River at the National Forest boundary exceeded the 64°F (17.8°C) water temperature criterion for 45 and 3 days in 1992 and 1994, respectively. Clear Creek, at a USFS site at Road 42, exceeded the water temperature criterion for an unspecified length of time in 1995 (Oregon's Final 2002 303(d) List; http://www.deq.state.or.us/wq/WQLData/View303dList02.asp). Reclamation has been working with the JFDIC to improve irrigation efficiencies, reduce return flows, and improve water quality on Wapinitia Project lands. The trend toward sprinkler irrigation in the basin will improve efficiency and help reduce water quality effects of agricultural practices.

Reclamation has been actively working with the DRC to fund and implement conservation projects in the Warm Springs River, Trout Creek, Mack's Canyon, and other subbasins of the lower Deschutes to improve water quality, habitat, and flows for resident fish and wild steelhead. Cooperative projects are also being planned and carried out in the upper basin, e.g., Squaw Creek and Crooked River subbasins, to improve habitat conditions for resident fish and the potential reintroduction of anadromous fish.

The NMFS habitat matrix was used as a general guide to describe and discuss some habitat features as part of the environmental baseline for steelhead ESU in the lower Deschutes River. Table 6-6 summarizes these conditions where we had sufficient data and notes the effects of the proposed action. In general, operation of Reclamation's projects in the Deschutes River subbasin has no discernable effect on steelhead habitat in the lower Deschutes River.

Table 6-6. NMFS Matrix Checklist Documenting Environmental Baseline and General Effects of Reclamation's Operations on MCR Steelhead in the Lower Deschutes River.

PATHWAYS	ENVIRONMENTAL BASELINE			EFFECTS OF ACTIONS		
Indicators	Properly Functioning	At Risk	Not Properly Functioning	Restore	Maintain	Degrade
Water Quality Temperature		✔			✔	
Sediment/Turbidity		✔			✔	
Chem. Contaminants/ Nutrients		✔			✔	
Habitat Access Physical Barriers	✔				✔	
Habitat Elements Substrate		✔			✔	
Large Woody Debris		✔			✔	
Pool Frequency	UNK			UNK		
Pool Quality	UNK			UNK		
Off-channel Habitat	N/A			N/A		
Refugia	✔				✔	
Channel Conditions and Dynamics Width/Depth Ratio	✔				✔	
Streambank Condition		✔			✔	
Floodplain Connectivity	✔				✔	
Flow/Hydrology Change in Peak/Base Flows	✔				✔	
Increase in Drainage Network	N/A			N/A		
Watershed Conditions Road Density and Location	✔				✔	
Disturbance History		✔			✔	
Riparian Reserves	UNK			UNK		

UNK = unknown

N/A = not applicable

See narrative of indicators in Section 5.4.2.2.

6.5.2 Effects Conclusion

Reclamation projects in the Deschutes River basin have resulted in an average reduction of 8.2 percent in modeled 50 percent exceedance streamflows near Madras, just downstream from Pelton Reregulating Dam, for the period October through June. The reduction in modeled 50 percent exceedance streamflows during this 9-month period ranges from 1.2 to 14.5 percent (50 cfs in June to 861 cfs in March). Conversely, during July, August, and September, modeled 50 percent exceedance streamflows increase for the proposed action, ranging from 0.2 percent in September to 2.8 percent in August (Table 6-5). The 861 cfs (14.5 percent) reduction in modeled 50 percent exceedance streamflow in March reflects storage to project reservoirs, while the late summer increase in modeled streamflows reflects some return flows from springs in the area upstream from the Madras streamflow gage.

The overall effects of Reclamation's proposed action in the lower Deschutes River subbasin (i.e., annual altered modeled streamflows ranging from -14.5 to +2.8 percent, averaging -5.7 percent) on the Deschutes River component of the MCR steelhead ESU appear to be negligible. Much of the Deschutes River steelhead spawning habitat occurs in the numerous eastside and westside tributaries where adverse effects on the fish caused by passage at two mainstem Columbia River dams; the Pelton-Round Butte Hydroelectric Project dams that block access to historically occupied habitat upstream; the potential adverse effects of out-of-basin, out-of-ESU hatchery strays spawning with wild Deschutes River steelhead; and the potential adverse ecological interactions between wild and hatchery-origin steelhead have a greater impact than Reclamation's upper Deschutes River projects. A small portion of Deschutes River steelhead spawn in the upper reaches of the mainstem lower Deschutes River. Inasmuch as these factors and environmental conditions considered together have adverse effects on steelhead life stages, Reclamation's proposed action will slightly reduce modeled 50 percent exceedance streamflows for 9 months of the year, with an unquantifiable but likely insignificant effect on wild steelhead stocks in the lower Deschutes River.

Population abundance of both wild and hatchery Deschutes River steelhead has increased in recent years. Historic streamflows in the ESA-defined environmental baseline as well as the modeled 50 percent exceedance streamflows in the "with Reclamation" and "without Reclamation" scenarios exceed the annual recommended streamflows (Aney et al. 1967). Annual water temperatures meet the ODEQ water temperature criterion of 64°F (17.8°C) for anadromous salmonids except for a period in the summer as measured near the mouth of the river at the Moody gage. Any effect of Reclamation's proposed action on wild MCR steelhead in the lower Deschutes River is substantially outweighed by the numerous other factors listed above. It is Reclamation's determination that Reclamation's proposed action, the continued operation and maintenance of Reclamation projects in the Deschutes River basin, may affect, but is not likely to adversely affect, listed wild MCR steelhead stocks in the Deschutes River basin.

6.6 CANADA LYNX

6.6.1 Effects Analysis

Reclamation project O&M activities that could possibly have an effect on Canada lynx include reservoir drawdowns and clearing dam surfaces of vegetation that could be potential snowshoe hare habitat. However, reservoir fluctuations do not affect the surrounding habitat above the maximum high-water line where lynx and hare might occur, and dam surfaces are cleared on a routine basis and do not provide suitable habitat for hare.

Recreational opportunities created by reservoirs increase human activity within reservoir areas. Human presence and activity may limit the use of the reservoir shoreline and adjacent lands by lynx, if present. However, research into concerns that human activity negatively impacts resident lynx populations has shown that lynx tolerate some level of human disturbance (USFWS 2000a). As the USFS manages recreational activities in the Clear Lake, Crane Prairie and Wickiup areas, they are the agency responsible for consulting with USFWS on any potential recreational impacts.

6.6.2 Effects Conclusion

If Canada lynx are indeed present in the action area, there would be no impact to this species by Reclamation project O&M activities. Project O&M does not include alteration of any potential lynx habitat, and snowshoe hare and other small mammal species comprising lynx diet are not affected by project O&M. Therefore, the proposed action would have no effect on Canada lynx.

6.7 NORTHERN SPOTTED OWL

6.7.1 Effects Analysis

Reclamation project O&M activities that could possibly have an effect on northern spotted owls include reservoir drawdowns and removal of vegetation from dam surfaces and along reservoir shorelines and canals. However, reservoir fluctuations do not affect the surrounding habitat above the maximum high-water line where spotted owl nesting, roosting, and foraging territories are located. As northern spotted owls do not prey on aquatic species, reservoir drawdowns do not affect their prey base, nor are the owls attracted to reservoirs. In addition, northern spotted owls do not rely on habitat that is routinely cleared from the dam surfaces, reservoir shorelines, and canal margins.

Recreational opportunities created by reservoirs increase human activity within reservoir areas. No evidence exists to determine whether or not this increased activity negatively impacts the northern spotted owl. However, it has been found that despite being a secretive species, the northern spotted owl is relatively unafraid of human beings. Additionally, northern spotted owls are nocturnal, and recreational activity drops significantly at night (Federal Register 55:26114). The USFS biological assessments do mention the possibility of effects by human activity, stating that USFS actions within ¼-mile of northern spotted owl nesting, roosting, and foraging areas that exceed ambient (background) levels during the time period between March 1 and September 30 require USFWS consultation (Jeffries 2002). Further, as the USFS is the agency managing recreational activity on land surrounding Clear Lake, Crane Prairie, and Wickiup Reservoirs, they are the agency responsible for consulting on potential recreational impacts.

Reclamation project O&M activities have been ongoing and unchanged from the time the northern spotted owl was listed in 1990. The current existing northern spotted owl population status takes into account these ongoing actions, and it would appear there is no adverse effect (Jeffries 2002).

6.7.2 Effects Conclusion

Although numerous northern spotted owl nesting, roosting, and foraging territories occur near Reclamation projects within the Deschutes River basin, northern spotted owls do not forage on fish or other aquatic species that would attract them to Reclamation project reservoirs, nor is their prey base affected by project O&M activities. In addition, northern spotted owls do not depend on habitat provided by Reclamation project facilities, including dams and reservoirs. Therefore, Reclamation project O&M activities would have no effect on northern spotted owls.