Chapter 2

Existing Conditions

2.1 Natural Resources

2.1.1 Climate

Prineville Reservoir is located in the arid shrub-steppe region of central Oregon. The rainshadow of the Cascade Mountains exerts a strong influence on the climate of central Oregon, which is characterized by hot, dry summers and cold, moist winters. Precipitation in this semi-arid climate is about 12 inches of rain per year, most of which occurs during the winter. About 90% of precipitation occurs between November and February. Snow accumulation during the winter is not significant. Summer thunderstorms are generally infrequent but can be locally intense in the general vicinity.

While summer temperatures may exceed 100°F, winter temperatures frequently dip below 0°F. For the 33-year period ending in 1990, the maximum temperature was 105°F and the minimum -34°F. Average temperatures in July and January are 60°F and 32°F, respectively (Oregon Climatology Center 2001). The relatively short growing season of 50 to 90 days is characterized by frosts in early autumn and late spring. Chinook (warm, downslope) winds may occur during anytime of the year but are most noticeable during the winter and early spring with the contrasting cold air temperatures.

2.1.2 Topography

The reservoir is located in a shallow valley that is generally bordered by steep hillsides and rock outcrops (Photo 2-1). The general topography is rugged and has resulted from the erosion of soft beds into steep gullies leaving the more resistant beds along the ridges (Figure 2.1-1). While these steep slopes and rock outcrops limit access to the shoreline, scattered lower gradient slopes provide access to the reservoir. Because of the topography there is only one access road to the south side of the reservoir, which leads to Roberts Bay. Level areas adjacent to escarpments along the river are found on the south side of the reservoir in the SWA, which are accessible only by boat (Photo 2-2). Most of the north shore of

Photo 2-1. Main body of Prineville Reservoir surrounded by hills, bluffs, and plateaus.

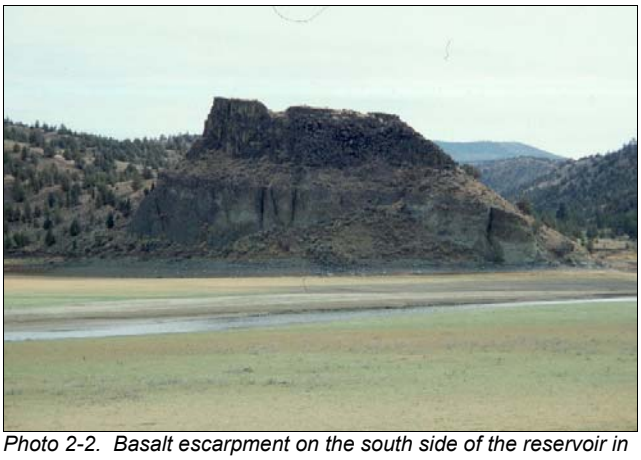

Photo 2-2. Basalt escarpment on the south side of the reservoir in the SWA.

the reservoir is dominated by moderate to steep slopes with some flat benches, stream corridors, and terraces. Thus, recreation tends to concentrate on areas of low to moderate slopes. Immediately downstream of the dam, the river flows through a canyon with rock walls over 150 feet high (Photo 2-3). The elevation of the study area ranges from 3,235 feet at the spillway to over 4,000 feet on adjacent ridges.

2.1.3 Geology

Prineville Reservoir is located in the western edge of the Blue Mountains Physiographic Province of eastern Oregon, which consists of several ranges of mountains separated by faulted valleys and synclinal basins. This portion of the Blue Mountains Physiographic Province is dominated by the Columbia River basalt, a thick formation that was extruded in many sheets during the Miocene epoch. Late Miocene and Pliocene formations of bedded tufts and silts are also present.

Geologic formations that consist of fine-grained volcanic tuff and dense andesite lava flows are present in the study area. The John Day formation dominates the north side of the reservoir, with combinations of the John Day and Clarno formations on the south side of the reservoir. Columbia River basalt flows lie on the John Day and Clarno formations. Most of the bedrock in the study area consists of fine-grained, light-colored tuff that easily weathers into a sticky clay that covers much of Prineville Reservoir lands.

The floor of the reservoir consists of a layer of fine sands and silt over a base of gravel and cobble. Alluvial outwash deposits are present at the terminus of drainages that enter into the reservoir. Landslide debris and talus slopes are scattered around the reservoir. There are no known large, active landslides associated with Prineville Reservoir. Historic slides are located in the Bear Creek vicinity where potential slide conditions persist. These slides likely occurred during the Pleistocene era when the climate was wetter and loosened the facing between the upper basalt layer and the underlying soft volcanic tuff (Reclamation 1992). A small, shallow, active landslide occurs on the north side of the reservoir about 4 miles upstream of the dam. The slide is about 200 feet long, 20 feet high, and 3-6 feet thick.

2.1.4 Hydrology

The Crooked River basin above Bowman Dam drains about 2,700 square miles. Annual runoff from the basin is about 270,000 af, but this is variable and has ranged from a high of 687,834 af in 1984 to a low of 38,853 af in 1961.

Photo 2-3. The Crooked River and Big Bend Campground downstream of Bowman Dam.

Figure 2.1-1

Back of Figure 2.1-1

Peak inflow has been recorded at 267,500 cfs. The highest recorded flow in the Crooked River was 8,410 cfs in March 1952. Flows are typically 200 to 250 cfs during the summer irrigation season and 30 to 75 cfs during the winter storage season (ODFW 1996).

Two primary tributaries flow into Prineville Reservoir—Bear Creek and Sanford Creek. Bear Creek is located on the south side of the reservoir and on the western end. Bear Creek originates above Antelope Flat Reservoir on the south side of the Maury Mountains. Bear Creek and its many tributaries drain about 260 square miles, or about 10% of the basin upstream of Prineville Reservoir. Eroded cutbanks are evident along much of the stream, which is characterized by high summer temperatures, low flows, and high turbidity. The ratio of sediment load to water volume is high for Bear Creek, which flows through highly erodible soils. Sanford Creek originates in the northwest corner of the Maury Mountains, and its basin consists of about 20 square miles. Most of Sanford Creek flows through sagebrush and juniper stands (ODFW 1996). Secondary tributaries to Prineville Reservoir include Alkali Creek, Deer Creek, Long Hollow Creek, Eagle Creek, and Antelope Creek.

Under the Congressional authorization for the Crooked River Project, Reclamation is required to release a minimum flow of 10 cfs from Bowman Dam. In February 1990, Reclamation administratively increased the minimum flow to 75 cfs in recognition of the regionally outstanding natural and recreational resources provided by the downstream reach of the Crooked River under the Federal Wild and Scenic River Act. The 75 cfs flow is dependent on water availability, but Reclamation's goal is to release at least 30 cfs even in low water years.

Groundwater is readily available along the reservoir margin, but on ridges and plateaus above the reservoir water wells must be drilled to between 200 and 800 feet to encounter the aquifer. A 400-foot deep well that was drilled in 1975 for the Jasper Point Recreation site yields 20 to 30 gallons per minute (Reclamation 1992).

2.1.5 Water Quality

Water quality is generally good and is suitable for all beneficial uses in Prineville Reservoir and in the Crooked River below Bowman Dam. The water quality of Prineville Reservoir and Crooked River downstream of Bowman Dam is suitable for the beneficial uses as defined by the State of Oregon's Department of Environmental Quality (ODEQ website 2001). Data collected by Reclamation, summarized in Table 2.1-1, indicate that the water quality standards and beneficial uses identified by ODEQ for the Deschutes River basin (which includes the Crooked River subbasin) are being met in most instances. The statewide standard for dissolved oxygen for warm water is 5.5 parts per million (ppm) (30-day mean minimum) and 126 units/ml for fecal coliform. Other specific standards for the Crooked River basin have not been developed.

Prineville Reservoir surface water temperatures during July and August often exceed the temperature standard for cold water aquatic life (17.8^{o}C). Profile data collected at Prineville Reservoir during July and August of 1985 and 1995 indicate that there are temperatures less than 17.8^{o}C in the bottom 50% of the reservoir. Dissolved oxygen levels in the reservoir decrease somewhat during July and August, but not to a level that would be indicative of eutrophication conditions.

Nutrients (nitrogen and phosphorus) were detected in sufficient quantities to support plant growth in the reservoir. Nutrient concentrations indicate a potential for algal blooms and eutrophic conditions. Because reservoir inflow and discharge into the Crooked River are turbid during most times of the year, it is suspected that the turbid conditions reduce light penetration to the extent that photosynthetic activity and plant

Table 2.1-1: Water quality (1973, 1978, 1979, 1984, 1991, and 1995) for Prineville Reservoir and Crooked River below Bowman Dam (mg/L except where noted).

Measured Parameter	Location								
	Prineville Reservoir[1]					Crooked River			
	July[2] (1984, 1995)	Aug (1984)	Sept (1979)	Oct (1979)	Nov (1978)	July[2] (1984, 1995)	Aug[2] (1984, 1991)	Sept (1973)	Nov (1978)
Temperature (°C)	23.2	20.9	17.8	17.2	6.4	10.7	11.7	---	5.6
Dissolved Oxygen	8.1	7.0	9.0	8.5	9.4	11.6	10.5	12.1	13.0
pH (Standard Units)	8.30	8.70	8.10	7.80	8.10	8.00	7.95	7.68	7.90
Total Phosphorus	0.031	0.018	0.022	0.055	0.050	0.076	0.091	0.12	0.057
Ortho Phosphorus	0.010	0.005	0.004	0.005	0.032	0.062	0.063	0.08	0.041
Nitrate + Nitrite as Nitrogen	<0.10	<0.10	0.06	0.04	0.10	<0.10	0.15	---	0.10
Fecal Coliform (Counts/100mL)	<2	<2	---	---	<2	4	<2	---	---
Turbidity (NTU)	2.0	3.0	2.0	1.0	3.0	12.5	12.5	9.0	4.0
Transparency Secchi (meters)	2.2	4.0	---	---	1.8	---	---	---	---
Chlorophyll A	0.002	---	---	---	---	---	---	---	---

Source: Reclamation (undated).
[1] Surface data used for reservoir.
[2] Average data presented for months with multiple years of data.

growth are limited. This is supported by the low concentrations of chlorophyll A and dissolved oxygen depletion in the lower levels of the reservoir during the summer months (ODFW 1996).

According to Section 303(d) of the Federal Clean Water Act (CWA), ODEQ lists water bodies where one or more water quality standards are not being met. This 303(d) list includes the mainstem Crooked River from its mouth to Baldwin Dam (about 8 miles upstream of Prineville Reservoir) due to flow modification and pH. The section of the Crooked River from Baldwin Dam to Prineville Reservoir is listed because of problems with total dissolved gas levels. The Lower Crooked River subbasin (which includes Prineville Reservoir) is listed as a Priority 2 watershed by ODEQ for development of Total Maximum Daily Load (TMDL) for water quality parameters, with Level 1 being the highest priority and Level 4 the lowest priority. The criteria for a Priority 2 water body applicable to the Lower Crooked River are candidate fish species and water contact recreation. Wild and Scenic River status is considered a second tier criterion when prioritizing water bodies. There is no current TMDL process for the Crooked River, but it is scheduled for 2004 to 2010 (ODEQ website 2002).

Turbidity is caused by suspended particles that block the passage of light. Turbidity is considered a negative visual effect due to its cloudy appearance. For recreational waters, appearance and clarity are often used by the general public to judge water quality. Soils, vegetation, geologic formations, reservoir fluctuation, and resource management practices influence the sediment loads and turbidity levels in Prineville Reservoir.

Prineville Reservoir is moderately nutrient rich in phosphorous and nitrogen, which can favor algal blooms. The turbidity of the reservoir limits sunlight penetration, however, which limits photosynthetic activity and reduces the likelihood of algal blooms. Orthophosphate phosphorous was measured at 0.047 mg/l in May 1982, and 0.025 mg/l in July 1982. These levels would usually indicate a eutrophic system, but corresponding chlorophyll A levels are low (an indicator of phytoplankton production), indicating an ultraoligotrophic, or unproductive, system.

High turbidity is the primary water quality problem in Prineville Reservoir and in the Crooked River below Bowman Dam. High turbidity in the reservoir is primarily a result of erosion that occurs along the mainstem Crooked River, Camp Creek, Eagle Creek, and Bear Creek, and from shoreline erosion along the reservoir edge from wind and boat-generated waves. The reservoir shoreline and adjacent and upstream watersheds are dominated by highly erodible soils, including montmorillonite clays. Upstream land use practices (including logging, road building, and heavy livestock grazing) have contributed to erosion in the watershed (Oregon State University [OSU] 1976). In addition, erosion from uncontrolled recreational use has contributed to sedimentation of the reservoir and related high levels of turbidity. When washed into the reservoir, the fine montmorillonite clay particles can stay in suspension for several years, increasing turbidity and blocking sunlight penetration in the water column (ODFW 1996).

The temperature cycle of Prineville Reservoir is representative of reservoirs in Oregon. During the spring, the reservoir has a relatively uniform vertical temperature profile. Warming of surface waters, combined with wave action, cause convective currents and a mixing of surface waters. The upper region of the reservoir is generally uniformly warm, turbulent, and well mixed. The lower region is cold and relatively undisturbed. The thermocline is the point where these two layers meet during the summer and early fall. As surface waters cool through the fall, the reservoir turns over, returning to a uniform temperature profile. The thermocline descends in response to drawdown.

2.1.6 Soils

Soils in the vicinity are derived from ancient lake-deposited sediments, with profiles consisting of a clay loam surface horizon over a clay-textured subsoil. These soils are notoriously slick and sticky when wet. Erosion-prone soils occur on more than 90% of the reservoir shoreline (BLM 1980) and, combined with the steep slopes surrounding the reservoir, pose an erosion potential if disturbed by excess human activity.

The dry climate of the Prineville area has led to the formation of poorly developed, loamy/stony sandy loam, erosion-prone soils. The ten soil types that occur in the vicinity of the Prineville Reservoir are shown in Table 2.1-2 and Figure 2.1-2.

Erodible soils are present along more than 90% of the reservoir shoreline (Reclamation 2002). The Stukel-Lorella soil association occurs over most of the study area. Stukel soils are shallow and well-drained with a slow permeability, rapid runoff, and a high erosion potential. The surface layer is a grayish brown loam about 7 inches deep. The Lorella series is a shallow, well-drained soil with a slow permeability, rapid runoff, and a moderate erosion potential. The soil is typified by grayish brown, very stony loam about 3 inches deep, with stones about 3 to 15 feet apart on the surface.

The soils of the Prineville Reservoir watershed area have formed from three basic kinds of parent material: (1) material from weathered bedrock and local movement on slopes; (2) pumice from geologically recent volcanic activity; and (3) alluvium deposited on floodplains, alluvial fans, and low benches. Bedrock in the vicinity is dominated by volcanic flows, tuffs, breccias, and tuffaceous sedimentary rock. Tuff is a rock consisting of cemented and hardened volcanic ash.

Potential soil erosion from lands surrounding Prineville Reservoir is a long-standing concern of land managers (BLM 1975; BLM 1980; OSU 1976) because of the predominance of erosion-prone soils in the watershed and continuing soil loss. Recent data indicate that the reservoir loses about 123 af in capacity per year from

Table 2.1-2: Soil types adjacent to Prineville Reservoir.

U.S. Soil Conservation Service Map Unit*	Soil Type	Slope	Depth to Bedrock	Erosion Hazard	Soil Characteristics
172E	Stukel-Lorella	3-30%	10-20 in	Moderate to high	Shallow, well-drained; moderate permeability; loam/stony sandy loam
151-172E	Stukel-Simas	3-30%	10-20 in	High	Shallow (Stukel) Deep (Simas) Well-drained; moderate to slow permeability; loam/sandy loam
46-48D	Choptie-Madeline	1-30%	10-20 in	Moderate	Shallow, well-drained, moderate to slow permeability; loam/stony sandy loam
133F	Redcliff-Rock Outcrop Complex	30-65%	20-40 in	High	Deep, well-drained; moderate permeability; stony/cobbley loam
118E	Redcliff Rock Outcrop Complex	5-30%	20-40 in	Moderate	Deep, well-drained; slow permeability; loam/clay/clay loam
151F	Simas Loan	30-70%	> 60 in	High	Deep, well-drained; moderate permeability; stony loam/very gravelly loam/gravelly clay loam
152F	Searless Stony Loam	30-65%	20-40 in	Moderate	Deep, well-drained; moderate permeability; stony loam/very gravelly loam/gravelly clay loam
175E	Willowdale	0-2%	> 74 in	Slight	Deep, well-drained; moderate permeability; loam; calcarious below 18 in.
151E	Simas Sandy Loam	5-30%	> 60 in	High	Deep, well-drained; slow permeability; sandy loam/clay/clay loam
33F	Fren Sandy Loam	30-60%	> 65 in	Moderate	Deep, well-drained; moderate permeability, sandy loam/gravelly loam/gravelly clay loam

Source: Reclamation 1992
* Original Soil Map Units

sedimentation from the contributing 2,700 square mile drainage area (Reclamation 1999).

Cryptobiotic crusts are soil crusts formed by living organisms and their byproducts, creating a crust of soil particles bound together by organic materials. Crusts are predominantly composed of cyanobacteria, green and brown algae, mosses, and lichens. These crusts affect processes that occur at the land surface or soil-air interface and include soil stability, nitrogen fixation, nutrient contributions to plants, infiltration, seedling germination, and plant growth (BLM et al. 2001). Soil crusts were once widespread in eastern Oregon deserts but have been disturbed by human use, off-road vehicles (ORV), and livestock. Much of Reclamation's lands around Prineville Reservoir have a long history of disturbance from a variety of factors and no longer include a high occurrence of soil crusts. Vegetation surveys indicate that areas in the downstream half of the reservoir where access is difficult have a high occurrence of soil crusts on Reclamation lands at Prineville Reservoir. It should be noted, however, that the occurrence of soil crusts was estimated from aerial photo interpretation and vegetation mapping with limited field verification.

2.1.7 Vegetation

2.1.7.1 Cover Types

Vegetation communities in the study area were characterized by W&H Pacific (2000) (Figure 2.1-3).

Figure 2.1-2

Soil Types at Prineville Reservoir

Back of Figure 2.1-2

Figure 2.1-3

Back of Figure 2.1-3

The following major vegetation cover types are found near Prineville Reservoir: (1) woodland communities, (2) shrub communities, (3) herbaceous communities, (4) rock outcrop and talus, (5) developed areas, and (6) wetland communities. The following sections describe the individual plant communities within each of the major groups.

Woodland Communities

Juniper woodland communities occupy 4,674 acres, or 79 percent of Reclamation's land (Table 2.1-3). Most of the forested vegetation cover types near Prineville Reservoir are dominated by western juniper (*Juniperus occidentalis*). Western juniper is the only native tree species near the reservoir, except for an occasional ponderosa pine (*Pinus ponderosa*) in sheltered areas. All of the juniper woodland areas are composed primarily of juniper/big sagebrush (*Artemisia tridentata*)/bluebunch wheatgrass (*Pseudoregeria spicata* ssp. *spicata*) but are further divided into communities based on soils, current conditions, and species composition (W&H Pacific 2000).

In addition to big sagebrush, other shrub species associated with juniper woodlands include gray and green rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*) and bitterbrush (*Purshia tridentata*). The two rabbitbrush species are most common in disturbed areas, while bitterbrush is limited to areas near the County boat ramp.

The juniper-dominated woodlands have varying herbaceous layers depending on the past level of grazing (Photo 2-4). Stands not heavily grazed are dominated by native bunchgrasses such as bluebunch wheatgrass, Sandberg's bluegrass (*Poa sandbergii*), Thurber's needlegrass (*Stipa thurberiana*), and bottlebrush squirreltail (*Sitanion hystrix*). On north slopes, Idaho fescue (*Festuca idahoensis*) is numerous. More well-drained soils support needle-and-thread grass (*Hesperostipa comata* ssp. *comata*) and Indian ricegrass (*Oryzopsis hymenoides*). Forbs include

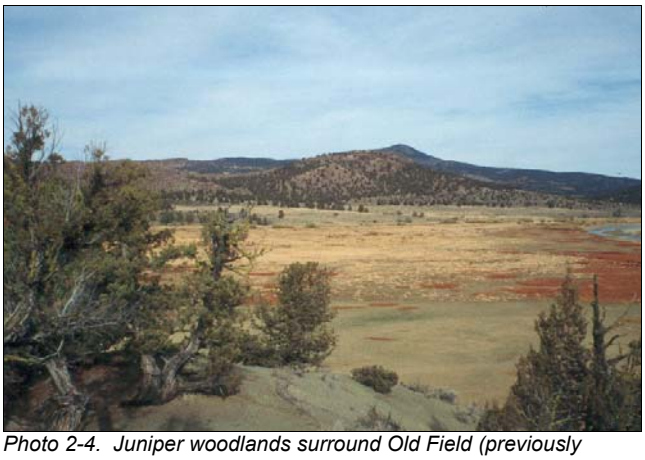

Photo 2-4. Juniper woodlands surround Old Field (previously farmed/grazed land) in the upper portion of the reservoir.

Douglas phlox (*Phlox douglasii*), gray groundsel (*Senecio canus*), and locoweed (*Astragalus* spp.). Undisturbed areas support well-developed cryptobiotic crusts. The coverage of non-native cheatgrass increases as the severity of grazing and/or recreational disturbance increases.

Within the study area, juniper reaches a density of 100 trees per acre (Reclamation 2002). Prior to European settlement, juniper was much less prevalent; however, suppression of the natural wildfires has resulted in substantial expansion in juniper coverage. The causes and effects of juniper expansion are variable (Bedell et al. 1993; Belsky 1996). The dense juniper coverage can result in high bare soil coverage and poor sagebrush and grass cover (Reclamation 2002). If not managed, western juniper is expected to substantially increase within the watershed.

Since the 1980s, BLM has conducted juniper removal on lands adjacent to Reclamation lands at Prineville Reservoir; however, no such management has occurred on the Reclamation lands. In some cases, juniper removal has been shown to increase herbaceous plant production and decrease bare soil coverage, but this does not always result in an improvement in range condition (Vaitkus and Eddleman 1987).

Table 2.1-3: Acreage of cover types in the Prineville Reservoir study area.

Cover Type	Acres	Percent
Western Juniper Woodlands		
Western juniper/big sagebrush/bluebunch wheatgrass woodland with dense understory	353.4	6.0
Western juniper/big sagebrush/bluebunch wheatgrass woodland with moderate to light understory	2,192.6	37.1
Western juniper/big sagebrush/bluebunch wheatgrass woodland with rock outcrops	61.0	1.0
Western juniper/big sagebrush/bluebunch wheatgrass woodland with stony red clay soils	182.9	3.1
Western juniper/big sagebrush/Thurber's needlegrass-bottlebrush squirreltail woodland with sandier substrate	176.5	3.0
Western juniper/big sagebrush/Thurber's needlegrass-bottlebrush squirreltail woodland with sandier substrate	86.7	1.5
Western juniper/big sagebrush/cheatgrass woodland	367.6	6.2
Western juniper/bluebunch wheatgrass savanna, with dense bunchgrass understory	306.9	5.2
Western juniper/bluebunch wheatgrass savanna, with light bunchgrass understory	778.9	13.2
Western juniper/bluebunch wheatgrass savanna, with light bunchgrass understory on red clay substrate	167.8	2.8
Western Juniper Woodland Total	**4,674.3**	**79.2**
Shrub-steppe Communities		
Big sagebrush/bluebunch wheatgrass shrub-steppe	93.0	1.6
Big sagebrush/bluebunch wheatgrass shrub-steppe, with red substrate	18.9	0.3
Big sagebrush/Thurber's needlegrass shrub-steppe	4.1	0.1
Big sagebrush/cheatgrass shrub-steppe, on stony silt-loam substrate	346.5	5.9
Big sagebrush/cheatgrass shrub-steppe, on red clay substrate	19.8	0.3
Shrub-steppe Communities Total	**482.4**	**8.2**
Grass-Forb Communities		
Native grass communities	4.3	0.1
Non-native grass/forb communities	87.6	1.5
Grass/Forb Communities Total	**91.8**	**1.6**
Rimrock and canyon shrubland, with sagebrush Total	**240.8**	**4.1**
Wetland and Riparian Communities		
Shoreline Palustrine Emergent Communities		
Matted muhly-Arctic rush-slenderbeak sedge-Douglas sedge	18.2	0.3
Creeping spike rush-matted muhly-Arctic rush-slenderbeak sedge-Douglas sedge	23.7	0.4
Quackgrass-saltgrass-meadow foxtail alkaline wet meadow	26.2	0.4
Shallow Water/Shoreline Palustrine/Shrub Community		
Water smartweed-Creeping spikerush-American water plantain/Pacific willow-coyote willow/matted muhly-Arctic rush	95.7	1.6
Riparian Shrub/Emergent Marsh Community		
Pacific willow/creeping spikerush/matted muhly	6.1	0.1
Sandbar Shrub Community		
Pacific willow-coyote willow/creeping spikerush-Arctic rush	42.3	0.7
Other Riparian Communities	26.2	0.4
Creek riparian willow community	11.1	0.2
Riverine gravel bar community	6.0	0.1
Wetland and Riparian Communities Total	**229.3**	**3.9**
Developed/Disturbed Cover Types		
Developed forested areas	73.8	1.3
Developed non-forested areas	19.7	0.3
Proximate disturbed areas	92.7	1.6
Developed/Disturbed Cover Total	**186.2**	**3.2**
Grand Total	**5,904.8**	**100.0**

Source: W&H Pacific (2000).

Note: The total acreage does not match Reclamation's estimate of the total acreage of their land at Prineville Reservoir (5,460 ac). The vegetation analysis was complete at a less than full pool level and includes habitats such as riverine gravel bar acreage.

Shrub Communities

Shrub communities are dominated by big sagebrush and either bluebunch wheatgrass, Thurber's needlegrass, or cheatgrass (*Bromus tectorum*). Together, the shrub communities occupy 482 acres, or 8% of the lands near the reservoir (Table 2.1-3). Other herbaceous plant species found in the shrub communities include Sandberg's bluegrass, bottlebrush squirreltail, needle-and-thread grass (*Stipa* spp.), Idaho fescue, yarrow (*Achillea millefolium*), buckwheat (*Eriogonum* spp.), and locoweed.

Herbaceous Communities

Upland communities that lack shrubs and juniper are limited to 92 acres, or less than 2%, mostly in sandy openings. These sites are dominated by Thurber's needlegrass and/or bottlebrush squirreltail. As disturbance level increases, the coverage of cheatgrass, Canadian thistle (*Cirsium arvense*), and spotted knapweed (*Centaurea maculosa*) increases. About half of the upland herbaceous communities are dominated by non-native species.

Rock Outcrop and Talus

Rimrock and canyon shrubland dominated by big sagebrush, mountain mahogany (*Cercocarpus* spp.), serviceberry (*Amelanchier alnifolia*), bitterbrush (*Purshia tridentata*), currant (*Ribes* spp.), and rose (*Rosa* spp.) occupy 241 acres (Table 2.1-3). Talus slopes occur below Bowman Dam.

Developed Areas

Developed areas include: (1) developed non-forested areas with buildings, parking lots, landscaped plantings, irrigated grass, paved and unpaved roads and parking pull-offs, and housing developments; (2) developed forest areas associated with developed campgrounds and primitive campsites; and (3) proximate disturbed areas that include the highly disturbed areas adjacent to roads, campsites, boat ramp facilities, and areas impacted by ORV use (W&H Pacific 2000). Combined, these areas cover 186 acres (Table 2.1-3). Although non-native plant species dominate most of the herbaceous vegetation, remnant patches of native vegetation also persist in some areas.

Wetland Communities

Five groups of wetland communities were mapped in the study area: (1) shoreline palustrine emergent communities, (2) shallow water/shoreline palustrine emergent/shrub community, (3) riparian shrub/emergent marsh community, (4) sandbar shrub community, and (5) riparian channels and gravel bars (W&H Pacific 2000). Together, these communities occupy 229 acres, or 4% of the study area (Table 2.1-3). The following sections discuss each of these communities.

Shoreline Palustrine Emergent Communities

The shoreline palustrine emergent communities occur below the normal high water line. Shorelines and inlets with gradual slopes support narrow zones of matted muhly (*Muhlenbergia richardsonis*)/arctic rush (*Juncus balticus* var. *balticus*)/slenderbeak sedge (*Carex athrostachya*)/ Douglas sedge (*C. douglasii*) emergent marsh. Other areas of the shoreline, particularly near Roberts Bay, Antelope Creek inlet, Jasper Point boat ramp, Powder House Cove, and Juniper Point inlet, support communities dominated by creeping spikerush (*Leaheries macrostachya*)/ matted muhly/arctic rush/slenderbeak sedge/ Douglas sedge. These two communities cover 18 and 24 acres, respectively (Table 2.1-3).

A Natural Resources Conservation Service (NRCS) Wetland Conservation Determination conducted in 1999 documented approximately 60 acres of wetland along the reservoir (NRCS 1999). The largest contiguous wetlands are located in the cutoff oxbow near Old Field and

along the lower portion of Bear Creek. The drawdown area at Roberts Bay is currently being managed for wetland restoration by prohibiting vehicular traffic off of designated roads. A reconnaissance of the area indicated a mixture of wetland and upland vegetation and a general lack of hydric soils. However, approximately 10% of the area likely meets the technical wetland criteria (pers. comm., A. Moore, 2000). These wetlands would be difficult to specifically identify as they are scattered in a mosaic pattern among upland areas. The lowermost portions of the drawdown zone are dominated by the non-native foxtail pricklegrass (*Crypsis alopecuroides* [*Heleochloa alopecuroides*]). There was evidence of past vehicular traffic creating extensive rutting in the drawdown area.

Shallow Water/Shoreline Palustrine Emergent/Shrub Community

The one community of this type was a water smartweed (*Polygonum amphibium*)/creeping spikerush/American water plantain (*Macaerocarpus californica*) /Pacific willow (*Salix exigua*)/coyote willow (*Salix exigua*)/ matted muhly/arctic rush. This community is located at the eastern portion of the reservoir near Old Field and occupies 96 acres (Table 2.1-3). Some of this community has been removed by recreational activity (angling and camping) along the river.

Riparian Shrub/Emergent Marsh Community

Areas near the mouth of Owl Creek, Juniper Bass campsite, and upstream on the north shore of the river support plant communities dominated by Pacific willow (*Salix lasiandra*)/creeping spikerush/matted muhly. Approximately 6 acres of this community were mapped in the study area (Table 2.1-3). In some of these areas, the willows extend into the water.

Sandbar Shrub Community

The Pacific willow/coyote willow/creeping spikerush/arctic rush shrub community occurs in 42 acres on several sandbars in the riverine section upstream of the reservoir (W&H Pacific 2000). Although willow dominates these areas, recently disturbed areas have many weeds.

Riparian vegetation represents a minor proportion of the overall study area acreage but is critical for biological biomass and species diversity (Reclamation 2002). Riparian habitats are characterized by willow, wheatgrass, alder (*Alnus rhomifolia*), dogwood (*Cornus stolonifera*), and scattered cottonwood (*Populus trichocarpa*) (Reclamation 2002). Riparian vegetation provides shade for water temperature control, hiding cover for fish, and bank stability through root systems. Riparian plants are especially important in holding soils and reducing bank erosion. Several of the streams in the study area are greatly affected by grazing and ORV activity. For example, the Bear Creek channel is incised 2 to 6 feet.

Other Riparian Communities

Creek riparian channels and gravel bars represent 11 and 6 acres, respectively (Table 2.1-3). The former community (which is dominated by willow, needle-leaf spikerush [*Eleocharis acicularis]*, and creeping spikerush) occurs along Eagle, Sanford, Deer, Black Canyon, and Antelope Creeks (W&H Pacific 2000). The latter community is limited to areas along the northwest side of Big Bend Recreation Site downstream of Bowman Dam.

2.1.7.2 Vegetation Management

Vegetation management issues at Prineville Reservoir include: (1) control of noxious weeds, (2) revegetation of disturbed areas, and (3) juniper management. The following sections discuss these issues.

Noxious Weeds

Department of Interior (DOI) directives 609 DM 1 (June 26, 1995), Secretarial Order No. 3190 (June 22, 1995), and Reclamation Manual Directive ENV 01-01 require development and approval of programs for the control of undesirable plants on DOI lands. Reclamation has developed a Draft Integrated Pest Management (IPM) Plan for controlling noxious weeds and unwanted non-native plant species (Reclamation 2002). This plan calls for noxious weed control primarily by application of chemical herbicides (pers. comm., B. Pieratt, April 11, 2001). In 1998, Reclamation began contracting with the U.S. Forest Service (USFS) and Crook County to conduct noxious weed management programs. These activities had significant impacts on the perennial pepperweed (*Lepidium latifolium*), spotted knapweed, Russian knapweed (*Centaurea repens*), and whitetop (*Cardaria draba*) populations.

Six noxious weed species recognized as "A" listed by the Oregon Department of Agriculture (ODA) have been documented at Prineville Reservoir (Table 2.1-4). Species that are "A" listed are weeds of known economic importance which occur in the state in small enough infestations to make eradication/containment possible; or are not known to occur, but the presence in neighboring states make future occurrence in Oregon seem imminent (ODA 2001). Intensive control is the recommended action for infestations. Russian knapweed (*Centaurea repens*) is by far the most common of these species. In addition to those species listed in Table 2.1-4, cheatgrass—a very widespread non-native annual grass that dominates disturbed areas and that is almost impossible to control—also occurs on Reclamation land.

Table 2.1-4: Noxious weeds documented at Prineville Reservoir.[1]

Species	Acres
Perennial pepperweed	20
Russian knapweed	200
Whitetop	20
Canada thistle	75
Puncture vine (*Tribulus terrestris*)	2
Spotted knapweed	2

Source: Draft Integrated Pest Management Plan for Prineville Reservoir – Crooked River Project – Oregon 2/19/2002.

[1] Species on the Draft Crook County Noxious Weed Control "A" list.

Disturbed Areas

The condition of the native vegetation varies greatly in the study area. Damage to native vegetation is often severe in locations where recreationists drive and camp along the shoreline (BLM 1980a).

There are several BLM grazing allotments that include Reclamation land. Evidence of grazing was noted near Roberts Bay during a 2000 site visit (compacted and grazed vegetation, cow tracks and scat in wetland).

ORV use on the lands surrounding Prineville Reservoir is a recreational activity that has occurred for more than 20 years. Extensive ORV traffic off of designated roadways has resulted in substantial damage to upland, riparian, and wetland vegetation communities. The relatively open terrain results in many unauthorized "jeep" trails. These trails increase erosion and do not easily revegetate. BLM generally considers areas with slopes >30% to be unacceptable for ORV use (BLM 1980b). OPRD, Reclamation, and BLM have been active in closing the unauthorized trails and attempting revegetation in selected areas near the reservoir on Reclamation and BLM administered lands.

Juniper Management

Historically, the uplands near the reservoir were dominated by big sagebrush, Idaho fescue, and bluebunch wheatgrass and supported only widely scattered juniper trees. However, during the last 50 years, a pattern of fire suppression and livestock grazing has resulted in a substantial

expansion of juniper woodland. A number of publications suggest that juniper encroachment has altered microclimates, water cycles, nutrient cycles, and plant and animal species (Bedell et al. 1993). The effect of juniper on soil, water, and grass and forbs is complex, however. Juniper control has been conducted on private and public land under the premise that it is an invading weed that dries up springs and streams, increases erosion, and reduces biodiversity and forage for wildlife and livestock (Bedell et al. 1993). Scientific evidence to support these claims is lacking (Belsky 1996). BLM documents (BLM 1993) indicate that juniper control would improve capture and storage of water, streamflow, forage and cover for big game, and fish habitat among other natural resources. An OSU Extension publication notes that "If not managed, western juniper would come to dominate a majority of eastern Oregon range sites" (Bedell et al 1993). But this assertion is contradicted by a USFS, BLM, and U.S. Fish and Wildlife Service (FWS) survey indicating that only 5% of eastern Oregon currently is or would potentially be affected by juniper encroachment (ODFW 1993).

There is a lack of data regarding the effects of juniper removal, no longitudinal studies measuring changes in ecosystem properties during succession of grasslands to woodlands, and only a few studies on the effects of juniper removal, often with conflicting results (Belsky 1996). While ranchers and range managers often claim that junipers dry up springs and streams, there is little substantial evidence to support this (Belsky 1996). These popular assumptions ignore the complexities of ecosystem interactions. An example is that in arid climates, most snow/rain water recharges the soil column and leaves little available for downslope movement into drainages (Hibbert 1983; West 1984). Thus, removing juniper often has no effect on stream recharge.

In addition, studies in eastern Oregon note that while herbaceous production can double after juniper removal, much of this increase comes from annual forbs such as fireweed (*Epilobium angustifolium*). This study concluded "...an increase in herbage production after tree removal does not necessarily result in an improvement in range condition" (Vaitkus and Eddleman 1987). Purported effects of juniper on water infiltration and erosion are fewer than the effects caused by livestock, which reduce cover and disturb soil with hooves (Wilcox 1994). And because much of the intermountain west has been significantly affected by grazing impacts, interactions of grazing and juniper encroachment are difficult to separate. Evans (1988) concludes that excessive rates of runoff and sediment in pinyon pine (*Pinus edulis*)-juniper woodlands were due to grazing and other human-related activities. Therefore, the effects of juniper control are not clear, often varied, and difficult to separate from grazing impacts. This does not mean that juniper control has no place in vegetation management, but that it should be done judiciously, with clear goals and objectives, and be based on a thorough scientific understanding of the complexities of site-specific conditions.

Currently, there are very few areas that do not have at least some juniper at Prineville Reservoir. The draft Prineville Reservoir IPM Plan (Reclamation 2002) indicates that there are 400 acres of land in the SWA with an 80% increase in juniper, but the time period of this increase is not identified. The IPM Plan says this increase "…is currently threatening the viability of the diverse grassland ecosystem." No data are cited for this assertion. BLM has been conducting manual juniper thinning on BLM land near Reclamation land, and BLM states that juniper thinning activities have been effective in stopping erosion and increasing sagebrush and perennial herbaceous vegetation cover (pers. comm., J. Swanson, BLM, 2002).

2.1.8 Fish and Wildlife

2.1.8.1 Fish

A number of fish species have historically occurred in the Lower Crooked River, including spring chinook (*Oncorhynchus tshawytscha*), summer steelhead (*O. mykiss*), redband trout (*O. mykiss*), cutthroat trout (*O. clarkii*), and mountain whitefish (*Prosopium williamsoni*). Nongame species included northern pikeminnow (*Ptychocheilus oregonensis*), chiselmouth (*Acrocheilus alutaceus*), longnose (*Rhinichtys cataractae*) and speckled dace (*R. falcatus*), redside shiner (*Richardsonius balteatus*), largescale (*Catostomus macrocheilus*) and bridgelip sucker (*C. columbianus*), and a variety of sculpin (*Cottus* spp.). Introduced hatchery rainbow trout (*O. mykiss*), smallmouth bass (*Micropterus dolomieri*), largemouth bass (*M. salmoides*), brown bullhead (*Ictalurus meles*), and black crappie (*Pomoxis nigromaculatus*) are gamefish present in the reservoir. The Crooked River and Prineville Reservoir are managed by ODFW under the 1996 Crooked River Basin Plan (ODFW 1996).

Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act (MSA), the Federal law that governs U.S. marine fish management, require heightened consideration of fish habitat in resource management decisions. EFH is defined in Section 3 of the MSA as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." EFH applies to anadromous and marine fish. The National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries, formerly the National Marine Fisheries Service [NMFS]) interprets EFH to include aquatic areas and their associated physical, chemical, and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem. The MSA and its implementing regulations at 50 CFR 600.92(j) require that before a Federal agency may authorize, fund, or carry out any action that may adversely affect EFH, it must consult with NOAA Fisheries and, if requested, the appropriate Regional Fishery Management Council. The purpose of consultation is to develop a conservation recommendation that addresses all reasonably foreseeable adverse effects to EFH. While no anadromous species reach Bowman Dam because of downstream barriers, the Crooked River could be considered potential EFH for anadromous species.

Reservoir

Hatchery rainbow trout are stocked in the reservoir in early to mid-May and are the primary game fish in the reservoir. These hatchery rainbow trout sometimes emigrate from the reservoir into the Crooked River below the dam. High emigration rates appear to correspond with severe drawdown of the reservoir or when the reservoir is high enough that water flows over the spillway (ODFW 1996). Rainbow trout may also migrate upriver during the spring and fall. It is unlikely that these fish are able to reproduce because of the poor habitat conditions in the river.

Several incidences of disease outbreaks have been reported in trout populations in the reservoir. During September 1984, 91% of rainbow trout and 96% of cutthroat trout from the upper reservoir were infected with Lernea, a parasitic copepod. About 68% of rainbow trout and 57% of cutthroat trout from the lower reservoir were infected. Strawberry disease, a rickettsial or bacterial disease that causes red sores, has been observed over the past 10 years (ODFW 1996).

Largemouth and smallmouth bass were stocked in the reservoir in 1960 and 1961 soon after completion of the project. Natural reproduction has sustained the population since these initial stockings. Largemouth bass are generally found in the upper half of the reservoir, while smallmouth bass are common throughout the reservoir. Largemouth bass prefer shallow

mudflats, creek mouths, natural coves with stumps, and other underwater structure (ODFW 1996). Winter survival of juvenile largemouth bass is highly dependent on conditions during the summer and early fall. Because weather conditions are variable there is a corresponding variation in juvenile bass survival and later cohort survival and spawning. Abundance of largemouth and smallmouth bass is relatively low compared to other Oregon water bodies (ODFW 1996); the slow growth and general poor condition of largemouth and smallmouth bass in the reservoir indicate an insufficient prey base. FWS has expressed a concern that bass production is likely limited by reservoir drawdowns in the early spring (pers. comm., Rasmussen, 2002).

Table 2.1-5: Estimated harvest of game fish at Prineville Reservoir from April through October 1994.

	Brown Bullhead	Largemouth Bass	Smallmouth Bass	Rainbow Trout	Black Crappie
April	1,038	0	0	3,881	0
May	4,713	20	159	4,701	278
June	6,250	26	53	2,295	868
July	7,371	109	267	1,790	3,553
August	8,258	0	812	1,942	1,248
September	4,475	87	394	2,414	1,221
October	17	0	3	627	16
Total	**32,122**	**242**	**1,688**	**17,650**	**7,184**

Source: ODFW 1996.

An abundant brown bullhead population occurs in the reservoir, with an average size of 8 to 10 inches and some examples up to 18 inches. While this species occurs throughout the reservoir, most of the population occurs in the shallow upper end of the reservoir and in the Bear Creek Arm. The population of brown bullhead appears to be overpopulated and stunted (ODFW 1996).

Black crappies were illegally introduced into the Prineville Reservoir in the late 1980s, and surveys indicate that they are successfully breeding. Black crappies grow slowly in the reservoir and rarely exceed 8 inches. Over 7,000 black crappies were harvested from the reservoir during 1994. Table 2.1-5 indicates the harvest of gamefish in Prineville Reservoir from April through October 1994.

Nongame species dominate the fish population in Prineville Reservoir. Gillnet sampling indicates that 90-95% of the population is nongame species. The numbers of nongame species are likely to exert a major influence on food resources and the viability of game species. Suckers and chiselmouth are the most abundant species, comprising over 70% of samples from 1962 through 1980 (ODFW 1996).

Zooplankton densities are relatively low in the reservoir due to the poor phytoplankton production. Zooplankton, which feed upon phytoplankton, are the major food item for juvenile fish, rainbow trout during the spring, and black crappie. Low levels of zooplankton in the reservoir suggest that there is intense competition for limited food by rainbow trout, black crappie, and juvenile bass. As the black crappie population increases, competition for food would likely increase (ODFW 1996). In 2001, ODFW noted a spring die-off of a wide size range of crappie that they attributed to Chronic Wasting Disease or starvation.

ODFW and Reclamation have cooperated on some projects to improve bass habitat in the reservoir, including the placement of about 225 juniper trees in the cove at Sanford Creek and along the shore upstream of the cove. Follow-up electroshock surveys indicated that crappie and bass used the site.

In recent years (1999-2002), ODFW and the Oregon Bass and Panfish Club have cooperated to capture and transport black crappie from Prineville Reservoir to Haystack Reservoir over the Memorial Day weekend. The result has been an average of about 4,000 5- to 8-inch crappie removed from Prineville Reservoir. ODFW monitors fish populations using gill nets in Prineville Reservoir about every 3 to 4 years, mostly to evaluate the trout stocking program. Electrofishing is used to sample the warmwater fishery more sporadically (pers. comm., B. Hodgson, 2002).

Downstream Crooked River

The cold water discharge from Bowman Dam has created a tailrace fishery through the Chimney Rock section (to river mile [RM] 57). Summer water temperatures in this section average 47°F to 50°F with a maximum 54°F while winter temperatures average 37°F to 40°F with a minimum of 32°F. Water released from the dam rarely exceeds 54°F (ODFW 1996). Cold water releases maintain good trout populations for a 12-mile reach below the dam to about the Crooked River Feed Canal diversion. Irrigation withdraws and increased water temperatures provide substantially less productive trout habitat from the Crooked River Feed Canal diversion (RM 57) to Highway 97 (RM 18). Because of high turbidity in the reservoir, the Crooked River below the dam is turbid until about RM 18 at Highway 97 where spring inflow contributes clearer water. High volume spill events can cause nitrogen supersaturation downstream of Bowman Dam. In April 1989, 85% of rainbow trout sampled between Bowman Dam to Prineville exhibited gas bubble disease. Nitrogen supersaturation below the dam was as high as 109%; one month later, saturation levels were still 108% at 0.5, 3, and 5 miles below Bowman Dam. ODFW testing and analysis in 1993 concluded that supersaturation was only a problem at flows above 3,000 cfs that extended for long periods. ODFW considers supersaturation below the dam to be an infrequent, localized, and short-term problem (pers. comm., B. Hodgson, 2001).

The Crooked River Chimney Rock section supports a mix of native redband trout, hatchery rainbow trout, and mountain whitefish. Hatchery fish have not been stocked below the dam since 1975, but they emigrate from the reservoir through an unscreened outlet. Small amounts of smallmouth and largemouth bass, brown bullhead, and nongame fish also occur in the river below the dam. Current angling regulations from Bowman Dam to Lake Billy Chinook are a 5 trout per day limit, 6-inch minimum with no more than one fish over 20 inches, with bait and barbed hooks allowed during the regular trout season from late April to the end of October. Since 1988, the lower Crooked River has been open to fishing in winter from November 1 to late April for catch-and-release only with barbless flies and no lures or bait.

Rainbow trout abundance has seen healthy increases since 1989. Abundance was estimated at 826 trout per mile in 1989, 2,289 trout per mile in 1993, 8,228 trout per mile in 1994, and 6,098 trout per mile in 1995. The increase may be a response to increased winter flows from 10 cfs in 1989 to flows from 30 to 75 cfs from 1989 to 1995 (ODFW 1996).

2.1.8.2 Wildlife

When Prineville Reservoir was established, wildlife habitat quality was considered poor due to overgrazing of the region (Reclamation 1992). Gamebird populations were at low to moderate levels and were comprised of a few migrating duck species, California and mountain quail (*Callipepla californica* and *Oreortyx pictus*), and a remnant population of Great Basin Canada geese (*Branta canadensis*). Duck and geese use Prineville Reservoir as a wintering site. Nongame birds included songbirds, shorebirds, and raptors, many of which still occur along the reservoir. Mule deer (*Odocoileus hemionus*)

populations were also small but increased slightly around the reservoir during winter months.

After the reservoir was built, Reclamation entered into an agreement in 1962 with ODFW for management of the upper reservoir area. ODFW manages this area as the Prineville Reservoir SWA. When the reservoir is full, the SWA spans 2,230 acres of terrestrial land and 930 acres of aquatic habitats.

The SWA is managed primarily for waterfowl, upland game, and big game populations (Reclamation 1992). Land management in this area has focused on increasing habitat for these game species. A few species introductions have been carried out under these management goals. Chukar (*Alectoris chukar*) and ring-necked pheasant (*Phasianus colchicus*) have been introduced with limited success due to marginal habitat quantity and quality (Reclamation 1992). Nesting and foraging habitat improvements for game species have been successful, as indicated by population increases for many game species (pers. comm., Ferry, 2001).

Birds

Waterfowl have benefited from the establishment of Prineville Reservoir through an increase in available aquatic habitat (Reclamation 1992). Ducks and geese use the reservoir and SWA for nesting, brooding, and feeding. The upper end of the SWA has become an important nesting area for local waterfowl (pers. comm., Ferry, 2000). Canada goose nesting platforms have been maintained by the ODFW and have led to an increase in nesting populations (Reclamation 1992). Juniper Bass, located along the northern shoreline, has become an important grazing area for geese (pers. comm., Ferry, 2001). Canada goose brood counts performed by ODFW estimated that 69 young were reared on Prineville Reservoir during the 2000 season. Crook County waterfowl surveys estimated over 5,700 birds in the county during the winter of 2001 (pers. comm., Ferry, 2001). Other waterfowl species observed or likely to occur include western grebe (*Aechmorphorus occidentalis*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), American wigeon (*Anas americana*), northern shoveler (*Anas clypeata*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), cinnamon teal (*Anas cyanoptera*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), ring-necked duck (*Aythya collaris*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), common merganser (*Mergus merganser*), hooded merganser (*Lophodytes cucullatus*), ruddy duck (*Oxyura jamaicensis*), and American coot (*Fulica americana*).

Shorebirds and wading birds are known to use the RMP study area, especially during migration periods. Due to concerns over declining shorebirds and available habitat, especially during migration, the FWS has recently developed an Intermountain West Regional Shorebird Management Plan (Oring et al. 2001). As throughout the Intermountain West, shorebird migration sites in eastern Oregon are becoming increasingly concentrated and important as habitat is lost or degraded. High quality, freshwater sites are identified in the plan as important and as a declining habitat type utilized by migrating shorebirds in this region (Oring et al. 2001). Shorebirds and wading birds known or likely to use the RMP study area include great blue heron (*Ardea herodias*), greater sandhill crane (*Grus canadensis tabida*), long-billed curlew (*Numenius americanus*), and killdeer (*Charadrius vociferus*).

Gamebird species are a priority for management in the SWA. Chukar, mourning dove (*Zenaida macroura)*, ring-necked pheasant, grouse (order *Galliformes*), and quail (order *Galliformes*) are among the species present in the RMP study area.

California quail, known locally as valley quail, have been observed in the RMP study area (pers.

comm., Soules, 2000). This species uses a variety of habitats including open sagebrush areas (Csuti et al. 1997). It is rarely found farther than 1,200 feet from a water source (Csuti et al. 1997). ODFW reports that California quail are common at the eastern end of Prineville Reservoir, especially in high quality riparian habitats (pers. comm., Ferry, 2001). Current populations of this species appear to be stable compared to 1990 population levels (pers. comm., Ferry, 2001).

Osprey (*Pandion haliaetus*) utilize the reservoir for foraging during the spring and summer (Reclamation 1992). This species is a fish eater and forages in the reservoir and Crooked River. ODFW expects that this species could be nesting in the area but have not confirmed any nest sites. Suitable nesting habitat may occur along the free-flowing sections of the Crooked River, where large trees are located in riparian areas and fish populations are higher.

Golden eagles (*Aquila chrysaetos*) and prairie falcons (*Falco mexicanus*) have been observed nesting around the reservoir (pers. comm., Ferry, 2000) (Figure 2.1-4). Golden eagles use open habitats for foraging and use cliff ledges for nesting (Csuti et al. 1997). Prey species are mostly small mammals, though eagles are also known to eat larger game animals, birds, and reptiles (Csuti et al. 1997). Golden eagles are granted special protection under the Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668d, 54 Stat. 250), under which they are protected from persecution and disturbances.

Many other types of birds utilize the RMP study area. The most likely common species are listed in Table 2.1-6.

Rare songbirds, such as tricolored blackbirds (*Agelaius tricolor*), willow flycatchers (*Empidonax trailii*), and loggerhead shrikes (*Lanius ludovicianus*), as well as woodpeckers (Family: *Picidae*), such as the Lewis's woodpecker (*Melanerpes lewis*), use the habitats of the RMP study area. Ravens also nest in the RMP study area (pers. comm., Ferry, 2001). The remaining rare songbirds are discussed under the rare and sensitive species section below.

Table 2.1-6: Common bird species in the RMP study area.

Common Name	Scientific Name
Belted kingfisher	*Ceryle alcyon*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*P. villosus*
Northern flicker	*Colaptes auratus*
Northern shrike	*Lanius excubitor*
Steller's jay	*Cyanocitta stelleri*
Western scrub-jay	*Aphelocoma californica*
Black-billed magpie	*Pica hudsonia*
Tree swallow	*Tachycineta bicolor*
Bank swallow	*Riparia riparia*
American crow	*Corvus brachyrhynchos*
Common raven	*C. corax*
Horned lark	*Eremophila alpestris*
Red-breasted nuthatch	*Sitta canadensis*
Canyon wren	*Catherpes mexicanus*
Mountain bluebird	*Sialia sialis*
American robin	*Turdus migratorius*
European starling	*Sturnus vulgaris*
Song sparrow	*Melospiza melodia*
White-crowned sparrow	*Zonotrichia leucophrys*
Dark-eyed junco	*Junco hyemalis*
Red-winged blackbird	*Agelaius phoeniceus*
Western meadowlark	*Sturnella neglecta*
Brewer's blackbird	*Euphagus cyanocephalus*
House finch	*Carpodacus mexicanus*
American goldfinch	*Carduelis tristis*
House sparrow	*Passer domesticus*

Migratory Birds

On January 10, 2001, President Bill Clinton signed an Executive Order mandating that all Federal agencies cooperate with the FWS to increase awareness and protection of the nation's migratory bird resources. Each agency is supposed to have developed a Memorandum of Understanding (MOU) with the FWS stating how it intends to cooperate. Reclamation has recently finalized an MOU with the FWS, which includes provisions for analyzing Reclamation's effect to migratory birds. Most birds in North America are considered migratory under the Federal Migratory Bird Treaty Act. The general bird species of the Prineville RMP study area are described in the above narrative.

Amphibians and Reptiles

Many amphibians and reptiles use the RMP study area, but the presence of these species has not been well documented. Species suspected to occur in the vicinity include the northern sagebrush lizard (*Sceloporus graciosus*) and western toad (*Bufo boreas*), which are discussed in the rare and sensitive species section , and the Oregon spotted frog (*Rana pretiosa*), which is treated in the Threatened and Endangered species section due to its Federal and State status. Common amphibians and reptiles found in the area include gopher snake (*Pituophis catenifer*), common garter snake (*Thamnophis sirtalis*), rattlesnake (*Crotalis viridis*), and fence lizard (*Sceloporus occidentalis)*.

Mammals

The RMP study area may provide habitat for a number of bat species: Townsend's big-eared bat *(Corynorhinus townsendi*), small-footed myotis (*Myotis cilolabrum*), long-eared myotis (*Myotis evotis*), yuma myotis (*Myotis yumanensis*), palid bat (*Antrozous pallidus pallidus*), and silver-haired bat (*Lasionycteris noctivagans*) (FWS 2000a). These species are discussed under rare and sensitive species in Section 2.1.8.3.

Deer population management is a priority for the SWA, especially during winter when deer concentrate in the area. Mule deer are mainly confined to open woodlands and isolated mountain ranges on the east side of the Cascades (Csuti et al. 1997). In the winter, mule deer descend to lower valleys, which are often occupied by human development. In the SWA, winter management includes closing the western end of the North Side Primitive Road from November 15 through April 15, and the eastern end from December 15 through March 15. This staggered road closure was established to allow for recreational access to the eastern end for a longer period and is not optimal for deer management, as this area gets heavy ORV use (pers. comm., Ferry, 2002).

Year-round management for deer incorporates maintaining fencing around the entire SWA, which aids in regulating hunting and grazing impacts, and habitat management, such as vegetation restoration and noxious weed control. Neighboring BLM land is managed for deer through juniper thinning, which increases winter forage (pers. comm., Ferry, 2000). The SWA is designated as critical deer winter range by the ODFW, with seasonal use increasing significantly depending on winter severity. Winter mule deer numbers for the SWA have increased from between 50 to 75 animals in the 1960s to between 300 and 500 animals in 1990 (Reclamation 1992). While deer population estimates are not currently estimated for the RMP study area directly, they are kept for the Maury and Ochoco Wildlife Management Units (WMUs), which lie to either side of the SWA. Both WMUs combined held over 24,000 deer in year 2000 (pers. comm., Ferry, 2000).

Within the RMP study area, the Bear Creek and Roberts Bay areas are important deer wintering sites that are outside of the SWA (pers. comm., Ferry, 2000). According to SWA biologists, population numbers for deer in the SWA are currently below their general expectations (pers. comm., Ferry, 2000). Deer numbers have increased, but seasonal use patterns remain similar to when the 1992 RMP was developed (pers. comm., Ferry, 2001). Development of the surrounding area has reduced forage and shelter for resident and migratory deer using the RMP study area (pers. comm., Ferry 2001). Livestock grazing has reduced the value of some mule deer winter habitat on lands outside the SWA (pers. comm., Rasmussen, 2002).

Elk (*Cervus elaphus*) are not a formal ODFW managed species at Prineville Reservoir, but their winter use of the RMP study area has been increasing (pers. comm., Ferry, 2000). It is

Figure 2.1-4

Wildlife and Plant Critical Habitat Features

Back of Figure

estimated that 100 to 300 elk use the SWA and adjacent lands, a steady increase since 1990 (pers. comm., Ferry, 2001). ODFW estimates that 6,500 elk use the Ochoco and Maury WMUs outside of the SWA. Prineville SWA herd numbers vary, with regular movement along and between the north and south sides of the reservoir (pers. comm., Ferry, 2001). Cross-reservoir movement does occur, primarily during late fall and winter when the reservoir waters are low (pers. comm., Ferry, 2001). Use of lands around the reservoir decreases during the spring and summer months, especially on the north side of the reservoir. Winter habitat use by elk is of primary concern because this is when they concentrate for foraging (Csuti et al. 1997). In addition, there is concern over habitat loss from development and recreation use in the area (pers. comm., Ferry, 2001). In cooperation with the BLM and in reaction to increased use of the SWA by elk, ODFW is in the process of designating the eastern portion of the SWA on both sides of the reservoir as an elk travel corridor and winter range.

Pronghorn antelope (*Antilocapra americana*) have been observed within the RMP study area by ODFW staff (pers. comm., Ferry, 2000). This species uses open to woodland habitats and tends to range within 5 miles of water (Csuti et al. 1997; Ingles 1965). Pronghorn forage includes sagebrush and a variety of grasses (Ingles 1965).

Cougar (*Felis concolor*) have been observed within the area by ODFW staff and others. Cougar reports in the area have increased over the last decade. Over the past 3 years, ODFW has had an increasing number of sighting reports by landowners along the south side of the reservoir, as well as along the north shore between the dam and the State Park Campground (pers. comm., Ferry, 2001). ODFW estimates that between two and eight cougars reside in the RMP study area, depending on season and reproductive status (pers. comm., Ferry, 2001). The cougar population likely fluctuates with deer and elk populations, with the largest number using the area in the winter when prey populations peak.

Nongame furbearers observed at Prineville Reservoir include bobcat (*Lynx rufus*), beaver (*Castor canadensis*), mink (*Mustela vison*), and coyote (*Canis latrans*) (Reclamation 1992; pers. comm., Ferry, 2001). These species are more commonly observed in the SWA in recent years than in the 1960s (Reclamation 1992). Additional nongame mammals observed in the RMP study area include badger (*Taxidea taxus*), muskrat (*Ondatra zibethica*), raccoon (*Procyon lotor*), porcupine (*Erethizon dorsatum*), striped and spotted skunk (*Mephitis mephitis* and *Spilogale gracilis*, respectively), weasel (*Mustela* sp.), and river otter (*Lutra canadensis*) (Reclamation 1992; pers. comm., Ferry, 2001). Pygmy rabbit (*Sylvilagus idahoensis*) and Canada lynx (*Lynx canadensis*) are, due to their Federal sensitive status rankings, described under threatened and endangered species.

2.1.8.3 Rare and Sensitive Species

There are a number of sensitive and rare species that potentially occur in the study area (see Table 2.1-7). Rare and sensitive species include those listed as Federal Species of Concern that also have Oregon State status or that have an Oregon Natural Heritage Program (ONHP) rank of 3 or 4. Species with Federal Status (i.e., Threatened, Endangered, or Sensitive), are discussed separately in Section 2.1.8.4.

Birds

Mountain bluebird is a species of open forests and woodlands. They are found in coniferous juniper woodlands, as well as along meadow edges, clearcuts, and recently burned areas in higher elevations (Csuti et al. 1997). This cavity-nesting species eats mostly insects and covers territories between 5 to 15 acres around nest sites (Csuti et al. 1997). Though there is a mix of estimates for this species across different regions and habitats, they are thought to be increasing in Oregon

Table 2.1-7: Rare and sensitive species occurring or potentially occurring in the Prineville Reservoir vicinity.

Species	FWS[1]	ODFW[2]	ONHP[3]
Birds (10)			
Mountain bluebird (*Sialia mexicana*)	--	SV	4
Mountain quail (*Oreotyx pictus*)	SoC	SU	4
Greater sandhill crane (*Grus canadensis tabida*)		SV	4
Western burrowing owl (*Athene cunicularia hypugea*)	SoC	SC	3
Ferruginous hawk (*Buteo regalis*)	SoC	SC	3
Swainson's hawk (*Buteo swainsoni*)	--	SV	4
Willow flycatcher (*Empidonax traillii adastus)*	SoC	SV	4
Long-billed curlew (*Numernius americanus*)	SoC	SV	4
Lewis's woodpecker (*Melanerpes lewis*)	SoC	SC	3
Loggerhead shrike (*Lanius boreas*)	--	SV	4
Amphibians and Reptiles (2)			
Western toad (*Bufo boreas*)	--	SV	3
Northern sagebrush lizard (*Scelopporus glaciosis glaciosus*)	SoC	--	4
Mammals (6)			
Townsend's big-eared bat (*Corynorhinus townsendii*)	SoC	--	3
Small-footed myotis (*Myotis ciliolabrum*)	SoC	--	3
Long-eared myotis (*Myotis evotis*)	SoC	SU	4
Yuma Myotis (*Myotis yumanensis*)	SoC	--	4
Pallid Bat (*Antrozous pallidus pallidus*)	--	SV	3
Silver-haired Bat (*Lasionycteris noctivagans*)	SoC	SU	4

Source: FWS 2000a; ODFW 2000; ONHP 2001.

Footnotes:

[1] FWS Classification: SoC= Federal species of concern.

[2] ODFW Status: E= endangered; T= threatened; SC= Sensitive Critical- species for which listing as threatened or endangered is not imminent and can be avoided through protective measures; SP/R= Sensitive Peripheral/Rare- species that are on the edge of their range or that are naturally rare; SU= Sensitive Undetermined- species for which status is unclear; SV= Sensitive Vulnerable- species not believed to be threatened or endangered and listing as such can be avoided by continued or expanded protective measures.

[3] ONHP Status: 1= taxa that are threatened with extinction or presumed to be extinct throughout their entire range; 2= taxa that are threatened with extirpation or presumed to be extirpated in the state of Oregon; 3= List 3- taxa for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range; 4= List 4- taxa which are of conservation concern but are not currently threatened or endangered.

(Sauer et al. 2001). This species has been observed in the Bear Creek drainage and in the SWA (pers. comm., Jennifer Seavey, Wildlife Biologist, EDAW Inc. October 17, 2000).

Mountain quail are generally found in open woodlands at high elevations (Csuti et al. 1997). This species has shown a decline in Oregon, especially in the eastern mountains (Csuti et al. 1997). Mountain quail are known to be present in the RMP study area, though the population status of this rare species at Prineville Reservoir is not well known (pers. comm., Ferry, 2001). This species has been sighted along Sanford Creek on the south side of Prineville Reservoir (pers. comm., Ferry, 2001); Owl Creek has been identified as potential habitat for this species (pers. comm., Ferry, 2001). It is possible that the elevation range of mountain quail extends low enough to utilize the shoreline of the reservoir (pers. comm., Ferry, 2001). ODFW estimates that mountain quail are likely found in low number on both sides of the reservoir (pers. comm., Ferry, 2001).

Sandhill cranes are thought to have declined by over 3 percent from 1966 to 1999 in Oregon (Sauer et al. 2001). This species breeds in wet meadows and drier grasslands throughout central and southeastern Oregon (Csuti et al. 1997; Gough et al. 1998). However, the species does not breed in agricultural lands in Oregon (FWS 2000b). Nesting territories in Oregon range from 3 to 168 acres (Csuti et al. 1997). Although

adequate habitat may exist, this species is not known to breed in the Prineville area.

The range for the western burrowing owl (*Athene cunicularia hypugea*) encompasses the RMP study area (Csuti et al. 1997). Burrowing owls are dependent on burrowing mammals, such as ground squirrels, for their nest sites. Many populations of these burrowing mammals are known to be declining (Partners in Flight, in press). Habitat preferences include areas of open grasslands and shrub-steppe habitat (Dechant et al. 1999a). Studies in north-central Oregon show that, while this species utilizes observation perches in habitats where vegetation is over 5 cm tall, it did not use habitats dominated by rabbitbrush or bunchgrass (Green and Anthony 1989 as cited in Dechant et al. 1999a). This species has been documented on the Crooked River National Grasslands, northwest of the town of Prineville (Marshall et al. 1996). There are no ONHP records for this species within the RMP study area.

Ferruginous hawks (*Buteo regalis*) potentially occur within the RMP study area, as their range overlaps with Prineville Reservoir (Csuti et al. 1997). However, there are no ONHP records for this species in the area. This species is known to be sensitive to prey abundance declines and nest site disturbances (Dechant et al. 1999b). The shrub-steppe and open juniper woodlands surrounding the reservoir offer suitable habitat for this species (Csuti et al. 1997). Generally, quality habitat consists of minimally grazed prairie or sagebrush shrublands with nesting shrubs and trees at least 1 meter high (Gilmer and Stewart 1983; Partners in Flight in press). Sagebrush has been highlighted by the Partners in Flight Landbird Conservation Plan as target habitat for the ferruginous hawk (Partners in Flight, in press).

According to the ONHP database, Swainson's hawks (*Buteo swainsoni*) may utilize the RMP study area. The occurrence of this species in the area has been confirmed by ODFW (pers. comm., Ferry, 2001). This species is closely associated with riparian systems in arid regions (Schlorff and Bloom 1984). Habitat management for this species includes providing open grasslands with tree patches for nesting and perching that are near cultivated areas (Dechant et al. 2001a). Prey species include insects and small mammals (Dechant et al. 2001a).

Long-billed curlew may potentially occur in the RMP study area, but Prineville Reservoir is on the edge of the range of this species (Dechant et al. 2001b). They breed in open grasslands and meadows, often with interspersed shrubs (Csuti et al. 1997). This species forages on insects and vegetation in grasslands and agricultural areas (Csuti et al 1997).

Willow flycatchers are fairly abundant in willows at the edge of wetlands and riparian areas (Csuti et al. 1997). Habitat requirements of this species in eastern Oregon are dense shrubby riparian areas interspersed with open areas (Partners in Flight, in press). This habitat exists at the upper end of the SWA, where Pacific willow dominates the riparian area (W&H Pacific 2000).

Lewis's woodpeckers are commonly found in oak and ponderosa pine woodlands (Csuti et al. 1997; Galen 1989). The RMP study area does not contain oak or pine woodlands, and published distribution maps show that this species does not occur in the Prineville area (W&H Pacific 2000; Csuti et al. 1997). However, this species is thought to breed in scattered locations in central Oregon (Marshall et al. 1996) and is occasionally observed around Prineville Reservoir (pers. comm., Ferry 2001). Therefore, it is uncertain if this species is breeding in the area or just foraging. This woodpecker species is very erratic and moves as forage opportunities change (Paige 1999a). Prey species consist of flying insects, fruits, and seeds (Paige 1999a).

Loggerhead shrikes are found throughout the late-seral sagebrush community, as large sagebrush is among its preferred nesting habitat (Poole 1992); it also nests in juniper habitat (Bartgis 1992). Both these habitats are available in the Prineville Reservoir area (W&H Pacific 2000). This shrike is present year round in the RMP study area (pers. comm., Ferry 2001). Loggerhead shrike prey species can include insects, reptiles, amphibians, and small birds (Dechant et al. 1998).

Amphibians and Reptiles

The western toad is a State-listed vulnerable species and a conservation concern species listed with the ONHP. The habitat requirements are broad for this species and include deserts, chaparral, grasslands, and woodlands (Csuti et al. 1997). This species has been disappearing in many areas for reasons not yet determined (Csuti et al. 1997). This species was observed in 1995 along Sanford Creek, a tributary to Prineville Reservoir (ONHP 2001). This was a breeding observation with one adult and one egg mass observed (ONHP 2001).

One reptile species of concern, the northern sagebrush lizard (*Sceloporus graciosus graciosus*), potentially occurs in the Prineville Reservoir area. This lizard is common in sagebrush habitat and juniper woodlands, such as those that surround the reservoir (Csuti et al. 1997). Therefore, although the presence of this species at Prineville Reservoir is currently unknown, they probably occur due to the presence of available habitat. This species is sensitive to the presence of western fence lizards and are not found where fence lizards have established populations (Storm and Leonard 1995). Sagebrush lizards are very wary, thus difficult to observe, so it is possible that this species occurs in areas around Prineville Reservoir where fence lizards are absent.

Mammals

The Townsend's big-eared bat, small-footed myotis, long-eared myotis, yuma myotis, pallid bat, and silver-haired bat are all species of concern that may be found in the RMP study area. Based on published distribution accounts, the long-eared myotis, small-footed myotis, and pallid bat are the three most likely bats to occur near Prineville Reservoir (Csuti et al. 1997). All of the above listed bats were observed near the Pelton Round Butte Hydroelectric Project northwest of Prineville (Perkins 1998). In addition, there are bat populations at Chimney Rock along the Crooked River below Prineville Reservoir (pers. comm., Soules, 2000). Based on the regional observances of these species, it is likely that they occur around Prineville Reservoir.

2.1.8.4 Threatened, Endangered, and Sensitive (TES) Species

There are several species of flora and fauna with Federal status designations occurring or potentially occurring within the region surrounding Prineville Reservoir (Table 2.1-8; Figure 2.1-4). Special status species included in this review are Federally endangered, threatened, candidate species, and those species with an ONHP ranking of 1 or 2. Species presence data from State and Federal sources, such as FWS, Reclamation, ODFW, ONHP, and OPRD, have been reviewed. In total, 12 TES species (eight wildlife, one fish, and three plant species) are known or likely to occur within the Prineville Reservoir area. Federal protection is afforded to those species listed or proposed as threatened or endangered by FWS under the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884). ESA-related correspondence is included in Appendix A.

Wildlife

Of the eight wildlife species, two are Federally listed as Threatened or Endangered (the bald eagle *[Haliaeetus leucocephalus]* and Canada

Table 2.1-8: Threatened, endangered, and sensitive species that are known to or potentially occur in the Prineville Reservoir vicinity.

Species	FWS[1]	ODFW[2]	ONHP[3]
Amphibians (1)			
Oregon spotted frog (*Rana luteiventris*)[4]	C	SC	3
Birds (4)			
Bald eagle (*Haliaeetus leucocephalus*)	T	T	1
Tricolored blackbird (*Agelaius tricolor*)	SoC	SP/R	2
Greater sage grouse (*Centrocercus urophasianus*)	SoC	--	2
Peregrine falcon (*Falco peregrinus anatum*)	--	E	1
Mammals (3)			
Canada lynx (*Felis lynx Canadensis*)	T	--	2
Pygmy rabbit (*Brachylagus idahoensis*)	SoC	SV	2
Spotted bat (*Euderma maculatum*)	SoC	--	2
Fish (1)			
Interior redband trout (*Oncorhynchus mykiss*)	SoC	SV	2
Plants (3)			
Estes' artemisia (*Artemisia ludoviciana* ssp. *estesii*)	SoC	--	1
Peck's Long-bearded mariposa-lily (*Calochortus longebarbatus* var. *peckii*)	SoC	--	1
Columbia Cress (*Rorippa columbiae*)	SoC	--	1

Source: FWS 2000a; ODFW 2000; ONHP 2001.

Footnotes:

[1] FWS Classification: E= Listed as Endangered; T= Listed as Threatened; P= Proposed for Federal listing; C= Candidate for Federal listing; SoC= Federal species of concern.

[2] ODFW Status: E= endangered; T= threatened; SC= Sensitive Critical- species for which listing as threatened or endangered is not imminent and can be avoided through protective measures; SP/R= Sensitive Peripheral/Rare- species that are on the edge of their range or that are naturally rare; SU= Sensitive Undetermined- species for which status is unclear; SV= State vulnerable- species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protection measures and monitoring.

[3] ONHP Status: 1= List 1- taxa threatened with extinction or presumed extinct throughout their range; 3= species for which information is needed before status can be determined but which may be threatened or endangered in Oregon or throughout their range; 4= List 2- taxa threatened with extirpation or presumed extinct from the state of Oregon.

[4] FWS lists the Oregon spotted frog as potentially occurring within Prineville Reservoir. The Oregon spotted frog, a Federal candidate species, was split into two species in 1996: the Oregon spotted frog (*R. pretiosa*) and the Columbia spotted frog (*R. luteiventris*) (Green et al. 1996). It is the Oregon spotted frog that could potentially occur near Prineville Reservoir (Csuti et al. 1997).

lynx); one species is a Federal Candidate species (Oregon spotted frog *[Rana luteiventris]*); one is State endangered; and the remaining species are Species of Concern (Table 2.1-8). Federal status, ONHP rank, and Oregon State status are presented in Table 2.1-8. ONHP ranks of 1 or 2 indicate that a species is threatened with extinction either throughout its entire range (rank 1) or within the state of Oregon only (rank 2). Candidate and Species of Concern with 1 and 2 ONHP rankings are included in this section due to the possibility of Federal listing of these species in the near future. Information on these species is presented below.

The lynx, a Federally Threatened species, is not likely to reside in the area due to a lack of appropriate boreal forest habitat. However, it may utilize the RMP study area as corridor habitat for travel between more appropriate habitats (pers. comm., Ferry, 2000). Habitat for this species in the Pacific Northwest is generally restricted to higher elevations of the Cascade Range (Koehler and Aubry 1994). Lynx require a mixture of forest types: early successional forest for foraging and late successional forest for dwelling. The FWS has concluded that a self-sustaining resident population does not exist in Oregon but that individual animals are present (63

Federal Register [FR] 36994-37013, July 8, 1998). Though recently rediscovered in the Northern Cascades of Oregon, the lynx is naturally a rare species in Oregon as this region is the southern extent of its distribution (Csuti et al. 1997; Roach 1999).

The ONHP database includes one observation of the Oregon spotted frog (1977) in Bear Creek, which is located at the southern tip of Prineville Reservoir (ONHP 2001). It is possible that this species does occur on other portions of Reclamation land at Prineville Reservoir, however. This species requires cool, permanent, quiet water, such as a spring, pond, lake, or slow stream with abundant associated vegetation and a bottom layer of decaying vegetation (Corkran and Thoms 1996; Leonard et al. 1993; Csuti et al. 1997). Spotted frogs do not occupy ponds with bullfrogs *(Rana catesbeiana*) or predatory fish, such as bass (*Micropterus* spp.) (Corkran and Thoms 1996). The presence of bass in Prineville Reservoir, especially near the mouths of tributaries (Reclamation 1992), would preclude the occurrence of spotted frogs in the reservoir itself; however, the frogs could exist farther up tributary creeks.

The bald eagle, a Federally threatened species, is the most easily observable TES wildlife species near Prineville Reservoir. The RMP study area supports resident, migrant, and wintering bald eagles. The bald eagle has met recovery goals in many areas and is currently proposed for delisting (64 Federal Register 36453-36464, July 6, 1999). ODFW conducts a mid-winter count of bald eagles at Prineville Reservoir, and OSU and OPRD staff cooperate to monitor an eagle nest on BLM property above Prineville Reservoir (discussed below) (pers. comm., Isaacs, 2002).

The bald eagle utilizes a variety of habitats over its life history stages, from fresh and saltwater shorelines to mature coniferous forest. Breeding habitat is predominately composed of mature coniferous forest, with an uneven vertical structure and old-growth characteristics (Rodrick and Milner 1996). These breeding areas are located near large bodies of water, used for foraging, and have low human disturbance levels (Rodrick and Milner 1996). Like many raptor species, bald eagles utilize the same nest site over many years (Ehrlich et al. 1988). A pair of resident eagles has been documented to maintain a nesting territory to the south-southwest of Juniper Point, on BLM property adjacent to Reclamation-owned lands (ONHP 2001). This nest site is known to be a successful breeding site (ONHP 2001). The presence of this one breeding territory at Prineville Reservoir fulfills the Pacific states' recovery goal of one territory for this area. Annual territory monitoring is identified as the current management need to ensure the persistence and success of this nest site (FWS 1986). A second bald eagle nest was located in 2002 on BLM property adjacent to the SWA. ODFW, BLM, and Reclamation are coordinating efforts to determine the status of the nest (i.e., is it an active nest?) and will develop a specific management plan as needed.

Winter roost sites represent another component of eagle habitat needs. During winter months, eagles concentrate in areas of high prey availability and low disturbance (Keister and Anthony 1983; Rodrick and Milner 1996). Winter nighttime roosts are composed of mature stands of trees, close to foraging sites (Keister and Anthony 1983). In the Prineville area, research has shown a strong preference for conifers that are isolated from human activities (Isaacs et al. 1993). Daytime roost sites are located along foraging areas in emergent trees and snags (Rodrick and Milner 1996). A large wintering population of bald eagles is located at the eastern edge of Prineville Reservoir (Isaacs et al. 1993). This wintering group, which extends from the eastern edge of Prineville Reservoir up the Crooked River to the Rager Ranger Station (a total of approximately 95 miles), has been estimated to be as large as 115 birds, a record

number of eagles utilizing eastern Oregon habitats (Isaacs et al. 1993).

Nesting and wintering eagle populations forage on a variety of prey items. Regional research has shown that eagles in eastern Oregon rely on mammals, birds, reptiles, and especially on fish species for forage (McShane et al. 1998). Local research has shown that the main prey items for the Crooked River wintering population are large mammal (deer and livestock) carcasses and ground squirrels (*Spermophilus* spp.) (Isaacs et al. 1993).

Twelve species designated as species of concern or candidate species by FWS or species with an ONHP rank of 1 or 2 may occur in the RMP study area. Three species also have Oregon State status. Brief descriptions of potential habitat and occurrence of species of concern are presented below by taxonomic group.

The tricolored blackbird, a migrant in central and northern Oregon, has a patchy and unpredictable distribution in the state (Csuti et al. 1997). This species uses wetland areas for breeding and foraging (Csuti et al. 1997). It is a highly colonial species, and populations can grow into the thousands in some locations. The RMP study area is located at the northern extent of the range for this species, though breeding groups have been observed as far north as Portland, Oregon (USGS 2000; Csuti et al. 1997). Habitat for this species may exist at the northern end of the reservoir in the tall grassy/sedge areas in the wetland and riparian habitats (W&H Pacific 2000).

Sage grouse (*Centrocercus urophasianus*) utilize sagebrush habitat, where big sagebrush covers 15 to 50% of the ground (Csuti et al. 1997). In addition to these densely vegetated areas, open habitat is used for leking behavior, which occurs in the early spring when male birds concentrate for breeding displays (Csuti et al. 1997). This habitat type is available around the reservoir (W&H Pacific 2000). This grouse species is known to occur in the upper Bear Creek basin, within 3 miles of the southern extent of the reservoir (pers. comm., Ferry, 2001). Local ODFW biologists believe that there are no lek sites in the RMP study area due to the high density of juniper woodlands (pers. comm., Ferry, 2000). Habitat loss and modification are blamed for the decline of sage grouse (Paige 1999b).

The peregrine falcon (*Falco peregrinus anatum*) was removed from the Federal list of endangered species in August 1999 (as published in the Federal Register, 64 FR 46541-46558) but remains listed as endangered in Oregon State. This is one of the world's most wide-ranging bird species, and thus would be expected to overlap with the RMP study area. Habitat limitations are most likely suitable nesting sites, which are commonly cliff sites within areas of open and abundant hunting opportunities (Csuti et al. 1997). Prey species are primarily small birds captured on the wing. Illegal collection of eggs and young for falconry trade is one of their greatest threats (Csuti et al. 1997). Peregrine falcons likely travel through the area but are not known to breed near Prineville Reservoir.

The pygmy rabbit is a mammalian Federal species of concern with an ONHP rank of 2 that potentially occurs at the RMP study site. There are no occurrence data for this species in the RMP study area, but the range and habitat requirements for the pygmy rabbit do overlap with the RMP study area (Csuti et al. 1997). Pygmy rabbits potentially exist in the area but have yet to be documented. Habitat for this species is generally dense areas of sagebrush in areas of deep, loose soils that are easily moved for burrows (Johnson and Cassidy 1997). Sagebrush is also a main staple of the diet of this species (Johnson and Cassidy 1997). The spotted bat (*Euderma maculatum*) is listed as a species of concern and has an ONHP ranking of 2 and is likely found in the vicinity of Prineville Reservoir.

Fish

Native redband trout occur in many headwater tributaries of the Crooked River, primarily on USFS land. Many of these headwater streams are intermittent or ephemeral and provide extremely limited or seasonal habitat for redband trout. Downstream, on private lands and in the mainstem Crooked River, flows decline significantly due to irrigation withdrawal and water temperature increases. Populations of redband trout are depressed compared to historical abundance because the Crooked River and its tributaries have poor riparian and instream conditions. Native redband trout are found in headwater tributaries of Bear Creek and were reported below the confluence of Little Bear Creek in 1978, and in Sanford Creek in 1977 at RM 8.0 (ODFW 1996). The Chimney Rock section of the Crooked River below Bowman Dam also provides habitat for redband trout. Prineville Reservoir does not provide habitat for native redband trout (ODFW 1996).

Plants

Based on information provided by the FWS and ONHP as well as surveys conducted by OPRD, three plant species considered Species of Concern with an ONHP rank potentially occur within the RMP study area. Estes' artemisia (*Artemisia ludoviciana* ssp. *estesii*) is typically found in sandy, gravelly, and moist riparian areas in central and south-central Oregon (W&H Pacific 2000; Massey undated). This plant requires open to partially shaded areas and is believed to do poorly in areas of dense shading or steep slopes (W&H Pacific 2000). This species was collected in 1949 along Bear Creek, which feeds into the reservoir on the southwestern shore (ONHP 2001). Four additional populations of this plant have been documented in the reservoir area (W&H Pacific 2000). These populations were noted at Jasper Point boat ramp, Big Bend recreation site, Juniper Bass campsite, and on a gravel bar along the Crooked River, upstream of the reservoir. All four populations are located near the normal full pool shoreline.

Photo 2-5. Prineville Reservoir and surrounding landscape.

Peck's long-bearded mariposa-lily (*Calochortus longebarbatus* var. *peckii*) is a species of seasonally wet meadows in regions of ponderosa pine forests (Massey undated). Soil types of preferred areas include cobble to stony clay loam soils, which are high in organic matter (Massey undated). This species is often associated with Artemisia species (W&H Pacific 2000). This species has not been documented in the RMP study area, but associated habitat may occur in the RMP study area (W&H Pacific 2000).

Columbia cress (*Rorippa columbiae*) is typically found in the wet soils of vernal pools, stream and lake margins, irrigation ditches, meadows, and in intermittent riparian areas (W&H Pacific 2000; Massey undated). This species has not been documented in the RMP study area, but associated habitat may occur in the drawdown zones of the reservoir (W&H Pacific 2000). This species is thought to have evolved with systems that experienced occasional flooding and scouring (TNC 1999).

2.2 Visual Resources

This section addresses visual resources within the RMP study area and in the general vicinity of Prineville Reservoir.

2.2.1 Summary of Visual Resource Conditions

The study area is located in the high rimrock dessert of central Oregon, a region dominated by open grasslands, juniper stands, basalt outcrops, and brown and reddish soils. The landscape surrounding the reservoir is dominated by steeply sloping hills with occasional peaks and buttes in the distance (Photo 2-5). Prineville Reservoir itself is a long, meandering water body formed by an earthen dam at its west end approximately 245 feet high on the Crooked River. The reservoir is approximately 14.6 miles long and between approximately 50 and 4,700 feet wide. In addition to their primary purpose of providing irrigation water, Bowman Dam and Prineville Reservoir are designed for flood control; thus, the surface of reservoir fluctuates seasonally as much as 97 vertical feet. At the higher operational range, the reservoir has 43 miles of shoreline that reduces to 6.4 miles at low pool.

The downstream portion of the reservoir lies within the Crooked River Canyon and is bounded on either shore by steeply sloping canyon walls (Photo 2-6). Near the dam, the canyon walls tower 800 feet above the reservoir at full pool, resulting in dramatic scenery. An 8-mile reach of the lower Crooked River between Bowman Dam and mile marker 12 of State Highway 27 (Chimney Rock segment) was designated by Congress in October 1988 as a National Wild and Scenic River and was classified as a recreational river area. Outstandingly remarkable values included scenic, recreation, and fishery values. This 8-mile reach was also designated as a component of the National Back Country Byway System in 1989 (BLM 1992). The Lower Crooked River Backcountry Byway covers 43 miles of paved and gravel roads from the City of Prineville south to the convergence with State Highway 20.

BLM administers most of the land adjacent to the Chimney Rock section and completed a Management Plan and Environmental Assessment for the Wild and Scenic portion of the river in 1992 (BLM 1992). BLM also designated this reach as an Area of Critical Environmental Concern (BLM 1988), and it is a State Scenic Highway.

Photo 2-6. Crooked River below Bowan Dam.

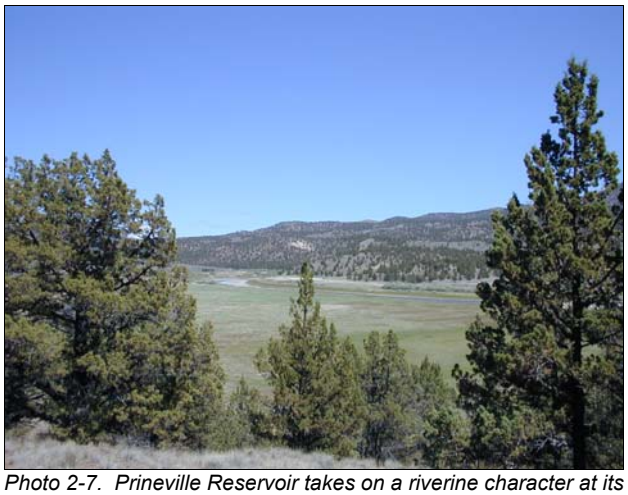

Photo 2-7. Prineville Reservoir takes on a riverine character at its upper end.

At the upstream end, the reservoir itself is more riverine in character, flowing through the center of a wide, gently sloping valley (Photo 2-7). Notable natural visual features include vertical basalt outcroppings, a rocky island, and several side canyons.

The study area north of the reservoir is within the John Day formation, while combinations of the John Day and Clarno formations are south of the reservoir. These formations consist of gently

Photo 2-8. Rugged tooth-like basalt ridgeline as seen from Antelope Creek Area.

Photo 2-9. A view of the State Park shoreline near the Antelope Creek area.

warped beds of fine-grained volcanic tuff and dense lava flows (Reclamation 1992). These features manifest as sloping bands of striated outcrops and escarpments of vertically fractured, columnar basalt. The most visually dramatic rock formations line the steep walls of the Crooked River canyon near the Big Bend Campground. Another visually prominent feature is a ridge of tooth-like outcrops (Photo 2-8) protruding from a ridge visible on both sides of the reservoir from Antelope Creek.

The shores of Prineville Reservoir are vegetated with a variety of plant types typical of central Oregon. These include woodlands, savanna, and shrub-steppe areas. Dominant plant species include western juniper and big sagebrush, interspersed with an understory of bluebunch wheatgrass, cheatgrass, and needlegrass-bottlebrush squirreltail. Plant cover is relatively uniform, except where disturbed by juniper management activities, rock outcroppings, talus slopes, roads, and recreational infrastructure. With the exception of old rectangular clearcuts on adjacent BLM land resulting from juniper management, the vegetation appears fairly natural.

Due to the lack of road access, viewing opportunities of Prineville Reservoir from public roads are limited. The only segment of State Highway with a view of the water is a short section of SR 27 between Bowman Dam and Powder House Cove. Portions along Juniper Canyon Road provide panoramic views of the reservoir between Antelope Creek and the Prineville Reservoir Resort (Photo 2-9), but the North Side Primitive Road is out of view of the water between Jasper Point and Cattle Guard; however, there are dramatic views of ridgetop rock formations to the north from this road. Other than the road to Roberts Bay and the recreation sites it accesses, there are no public views of the reservoir from the south shore. Views of the water from private property on the north side of the reservoir are generally limited to Bottero Park, Jasper Knolls, and Lakeview Cove Estates. On the south side of the reservoir, a few private residences have good views of the reservoir. Generally, the best viewing opportunities are from the surface of the reservoir itself.

The vast majority of the area surrounding the reservoir has a natural character that appears unaltered by human activity. In general, the only development visible from the reservoir includes the access points, recreation facilities, Bowman Dam, and a few private homes. With the exception of Prineville State Park and the Prineville Reservoir Resort, the recreation sites have a relatively undeveloped appearance characterized by gravel or unimproved road and

parking surfaces, portable toilets, and other minimal facilities. During the summer, these are most visually discernable from their surroundings due to the large numbers of recreation vehicles (RVs) parked between the juniper trees. By contrast, both the Prineville State Park and Prineville Reservoir Resort have large areas of irrigated and mowed lawn, paved roads and parking, and permanent buildings. In addition, the Resort also operates a small marina and store that are particularly visible from the reservoir due to the Resort's prominent location at the tip of Jasper Peninsula. The only notable concentrations of private development easily visible from the reservoir are Bottero Park and Jasper Knolls, both near the middle of the reservoir. Bottero Park is a small cluster of cottages and trailer pads on a small rise north of the Prineville Reservoir Resort. Due to the topography of the site, this subdivision is visible from most recreation sites on both shores of the reservoir (Photo 2-10). The dominant small scale of these homes is visually consistent with the nearby resort and appropriate to its rural, park-like surroundings. Jasper Knolls is sited on the plateau overlooking the reservoir, but it is so far from the reservoir that it does not intrude visually to a noticeable degree (Photo 2-11).

Photo 2-10. Bottero Park subdivision as seen from Roberts Bay.

Photo 2-11. Jasper Knolls subdivision as seen from Roberts Bay.

When the reservoir is drawn down during the late summer through spring, the high water mark on the shoreline surrounding the reservoir is clearly evident. This zone of former inundation varies in height from the water's surface, up to a maximum of 3,235 feet above sea level, according to the degree of drawdown. At low pool (3,114 feet above sea level), the former reservoir bottom is exposed, revealing mudflats in shallow areas, such as in the SWA (Photo 2-12) and Roberts Bay (Photo 2-13), and steep cobble benches in the lower reservoir such as Powder House Cove (Photo 2-14). In some locations, tree stumps become exposed at low pool.

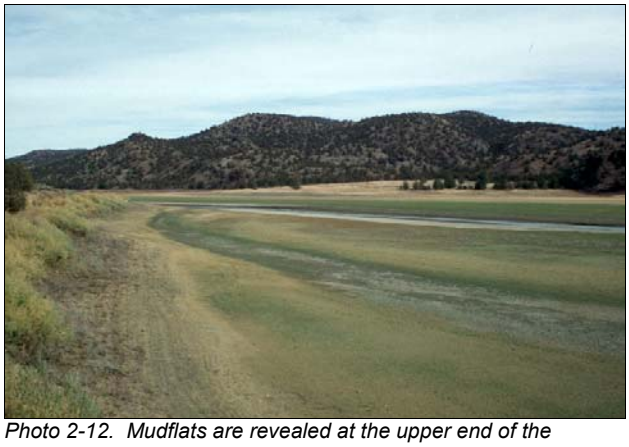

Photo 2-12. Mudflats are revealed at the upper end of the reservoir during low water periods.

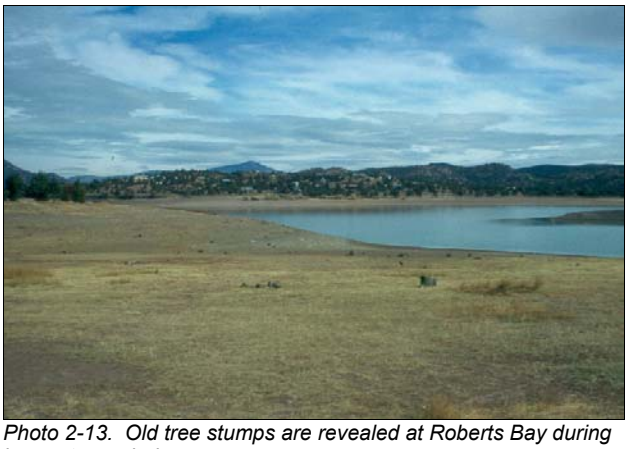

Photo 2-13. Old tree stumps are revealed at Roberts Bay during low water periods.

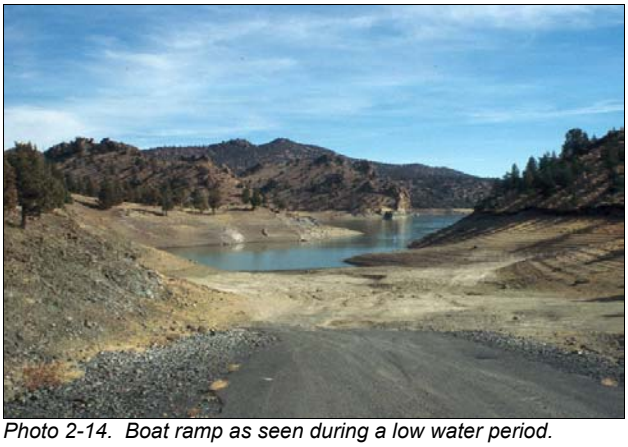

Photo 2-14. Boat ramp as seen during a low water period.

2.2.2 Changes in the Visual Environment Since the 1992 RMP

Because limited information is available on the visual resources at Prineville Reservoir at the time of the 1992 RMP, it is difficult to accurately assess subsequent changes. Changes to visual resources resulting from management practices and physical developments built since 1992 include the following.

2.2.2.1 Juniper Management

Many of the large, visually prominent juniper clearcuts in the vicinity of the Prineville Reservoir pre-date the 1992 RMP. This is because the BLM's juniper management practices changed in response to the BLM's 1989 Brothers/La Pine Resources Management Plan that elevated concerns over visual impacts to a required consideration by range managers. Specifically, Prineville Reservoir was included in the plan as an "area having high or sensitive visual quality." Several recreation sites and the reservoir's surface were classified as "key observation points" (KOPs) for monitoring of future changes to visual resources. BLM has implemented a number of practices to accomplish this objective, such as leaving more larger-diameter trees, making irregular cut boundaries, and leaving strips and patches of remaining forest. The overall intended result is a more naturalistic vegetation cover pattern and less viewer objection (pers. comm., Swanson, 2002).

2.2.2.2 Jasper Point

Jasper Point was used as a dispersed recreation site prior to the 1992 RMP. At the time of the 1992 RMP, rutting, gullying, and vehicular tracks were prominent landscape features. In response to heavy recreation demand combined with ongoing resource management problems, this site was subsequently developed as a medium density "fee-use" campground for a limited number of RVs and tents (Reclamation 1992). As a result of this action, the Jasper Point site has a far more orderly appearance, with the regrowth of some ground vegetation, clearly defined campsites, and new boat ramp, restroom, and other recreation facilities. The gullies, ruts, and vehicular tracks are no longer visually prominent.

2.2.2.3 ORV Trails

The 1992 RMP described notable scenic problems resulting from unauthorized ORV use: "heavy dispersed recreation and off-road vehicle trail use in undeveloped areas has resulted in visual scars that will be very difficult for nature to repair. Often the most scenic and accessible lands within the reservoir area are the most heavily disturbed. In many locations, the vegetation has been heavily damaged or destroyed and the soils loosened or compacted to the point that wind and water erosion is common. Some of the most

severe damage and abuse occur on the steepest slopes leading down to the reservoir. Off-road vehicle trails are a visible landscape feature due to the open nature of the juniper canopy and the preponderance of steeply sloped hillsides" (Reclamation 1992).

While unauthorized ORV use has continued at Prineville since the 1992 RMP, Reclamation and its partners (OPRD and ODFW) have had some success in reducing its extent and its impacts. As a result of more effective management and law enforcement practices, the most severe damage has moved from more accessible areas to less accessible areas, such as near the North Side Primitive Road and other dispersed recreation areas.

2.3 Noise

Noise can be defined as the intensity, duration, and character of sounds from any and all sources. In general, the rural character of Prineville Reservoir and the surrounding area is reflected by low ambient noise levels. Noise sources present are primarily from motorized recreational activities on the reservoir, visitors at the various recreation areas, and vehicular noise on nearby roadways. The noise levels associated with these sources vary significantly depending on location, season, and time of day.

Sensitive noise receptors in proximity to the park include residential dwellings directly adjacent to the park boundary. Of all the noise sources within the RMP study area, motorized recreational activities on the reservoir during the summer months and vehicular traffic on the interior road are the most prevalent. Noise from personal watercraft (PWC) and motorized boats is reflected off the water and, depending on wind and weather conditions, can be heard at locations far from their source. At the present time, however, none of the noise sources within the RMP study area are known to be significantly disruptive to visitors or wildlife. The North Side Primitive Road is closed during the winter in part to eliminate the disturbance to wildlife from recreation traffic.

2.4 Cultural Resources

Cultural resources include prehistoric sites, historic sites, and traditional cultural properties as discussed below.

2.4.1 Prehistoric and Historic Resources

To date, approximately 2,945 acres of land around Prineville Reservoir have been inventoried for archeological resources, and 126 archeological sites and one human burial have been recorded. The following discussions summarize cultural resource investigations and results through July 2002.

Archeological investigations first occurred in 1948, when the Smithsonian Institution's River Basin Survey (RBS) completed a reconnaissance survey of the reservoir basin prior to construction of the dam (Osborne 1948). The RBS team recorded nine archeological sites (35-CR-1 through CR-9) and the burial (35-CR-10). They noted, but did not record, two rock slab enclosures. They excavated the burial, which was later sent to the Smithsonian Institution. From surface evidence, the RBS team determined that the archeological sites were not historically important, and no data recovery occurred. No further cultural resource investigations occurred at the reservoir until the 1990s.

In 1992, Reclamation completed the Prineville Reservoir RMP. The RMP incorporated commitments to initiate systematic archeological investigations at the reservoir. The commitments focused on archeological site identification and preparation of a Cultural Resource Management Plan (CRMP). Consultation with the State Historic Preservation Officer (SHPO) was to occur to determine National Register of Historic

Places eligibility, where this could be accomplished using survey information. Reclamation anticipated that the surveys would be completed in 1993 and the CRMP would be written in 1994. Surveys did begin in 1993. However, a far greater number of sites were found than anticipated. The greater level of effort necessary to document these sites caused all available funding to be expended to survey and record sites in only a portion of the study area. Work resumed in 1998, when funding again became available. Since 1992, investigations have focused on conducting archeological surveys and test excavations in the areas with the highest probability for cultural resources and the greatest potential for impact from reservoir operations or land use.

The principal investigations completed since 1992 are as follows. In 1993 and 1999, Reclamation's contractors completed intensive archeological surveys of lands on the north shore upstream of the County boat ramp, much of the south shore upstream of Juniper Point, and at the Big Bend recreational use area below the dam. The surveyors relocated four of the nine sites recorded by the RBS team, and recorded 116 new archeological sites. The 1993 surveys are reported in Morgan et al. (1999) and the 1999 surveys in Oetting (2000). In 1998 and 2002, the Powder House Cove area was surveyed, encompassing locations that might be recommended under this RMP update. The surveys are reported in Regan and Crisson (1998) and via pers. comm. (A. Oetting, 2002).

No sites were found at Big Bend recreational area. One site was recorded upstream of Powder House Cove (pers. comm., A. Oetting, 2002). Sites were recorded throughout all other surveyed areas, even in locations where somewhat rougher terrain might have been expected to discourage frequent human use. Sites are present in or near all designated recreation areas around the reservoir except Owl Creek. They are present along much of the shoreline areas in the SWA, which are the focus of much of the dispersed boat-in or land-based camping and day use. Some are within the reservoir operational zone. The North Side Primitive Road passes through sites, as do other unauthorized roads and trails.

Of the 126 recorded archeological sites, nine are 20th century trash dumps; one is the foundation from a ranch/farmstead; one is a masonry structure that may have been the powder house used when constructing Bowman Dam; and two are rock overhangs with associated prehistoric archeological deposits. The remaining 113 sites are prehistoric archeological sites variously recorded as lithic scatters or artifact scatters. Diagnostic artifacts observed at the sites indicate they span the last 4,000 years. The prehistoric sites primarily consist of debitage from stone tool manufacture. Some sites also contain natural cobbles that exhibit wear from use as grinding implements. Two of those sites have boulders with ground surfaces indicating they were used as grinding platforms, and several have fragments of stones that appear to have been used as grinding platforms. Most formed tools found were projectile points or point fragments, scrapers, gravers, or bifacial fragments.

As of 2002, most lands with a high or moderate probability for site occurrence have been surveyed. Most of the unsurveyed lands are extremely steep, rocky areas with low site potential. Additional survey is needed in some areas, particularly portions of the south shore below Juniper Point and up Bear Creek. The two rock enclosures noted by the RBS also need to be relocated.

In 1998, Reclamation began archeological test excavations at recorded sites in areas most subject to impacts. Test excavations were completed at 20 of the recorded sites in the vicinity of the Roberts Bay recreation use area (Oetting 1999). The test excavations indicate that three of those sites contain subsurface deposits that appear to make them eligible for the National Register

under criterion d. Sites eligible under criterion d have the potential to contribute new information that will expand our understanding of past lifeways. The remaining 17 sites tested at Roberts Bay appear to fail to meet National Register criteria.

In 2001, preliminary test probing was completed at 44 of the recorded archeological sites on the north shore (Oetting 2001). The 44 probed sites are near the County boat ramp, within the State Park, near Jasper Point Campground, along the North Side Primitive Road, and between the North Side Primitive Road and the shoreline. The latter area encompassed recorded archeological sites in or near the primitive-designated recreation areas in the SWA. The probing indicated that 29 of the 44 sites seem to lack any subsurface materials and are unlikely to meet minimum National Register criteria. Fifteen of the probed sites required additional test excavation to determine their historic significance. All of these 15 sites are in locations that are commonly used for dispersed camping or day use. Some are where recreational development is proposed or where primitive-designated use is authorized. In 2002, more extensive test excavations were completed at four of those 15 sites. Two of the tested sites are at proposed recreation use sites within the State Park, and the other two are in the vicinity of the Old Field and Cattle Guard primitive-designated recreation areas. The additional test excavations confirmed that these four sites contain subsurface deposits, and at least three of the four appear eligible to the Register (pers. comm., A. Oetting, 2002). Consultation with the Oregon SHPO and with interested Indian tribes is needed before the final determination can be made about the historic significance of any of the sites discussed above.

Further investigations have been completed at the nine trash dump sites to assess their historic significance. The contractor has recommended that none of the nine dump sites be considered eligible to the National Register (Minor and Oetting 2002). No test excavations have yet occurred at the other archeological sites recorded at the reservoir to enable determination of their eligibility to the Register.

2.4.2 Traditional Cultural Properties

In 2001, Reclamation initiated tribal consultations to learn if traditional cultural properties (TCPs) or culturally important resources might be present at the reservoir. Prineville Reservoir is situated within the ceded lands of The Confederated Tribes of the Warm Springs Reservation of Oregon (Warm Springs Tribes). In January 2001, Reclamation management and staff met with staff from the Warm Springs Tribes' Natural Resources Department. They indicated that the Warm Springs Tribes' Cultural Committee would contact Reclamation if they felt it necessary to be involved in the RMP update. In July 2001, a member of the Cultural Committee contacted Reclamation and indicated that archeological sites, TCPs, and traditional subsistence plants were present near Prineville Reservoir, and they were concerned about their protection. In August 2001, Reclamation staff met at the reservoir with members of the Cultural Committee. The meeting focused on familiarizing Cultural Committee members with the RMP update process and goals, and with general discussions of land management issues and tribal concerns about resource management. The Cultural Committee indicated they would collect existing information about TCPs and provide it for Reclamation's use in preservation planning. They also requested that Reclamation complete an ethnographic study for the area. In March 2002, Reclamation contacted the Cultural Committee and learned they had talked with knowledgeable people in the tribe and identified several areas at the reservoir that have important plants and cultural sites. In April, it was agreed that the Cultural Committee would visit the reservoir to collect field data. At this time, Reclamation had not yet received further information about the location or characteristics of TCPs or culturally important resources.

Consultations with the Warm Springs Tribes about these resources will continue during the RMP implementation.

In 2001 Reclamation also notified the Burns Paiute Tribe and the Klamath Tribes of the RMP update and offered to meet to discuss cultural resource issues or concerns. No response was received from either of those tribes.

2.5 Indian Sacred Sites

Indian sacred sites are defined in Executive Order 13007 as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." Federal agencies are required, to the extent practicable, to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and seek to avoid adversely affecting the physical integrity of such sites.

No Indian sacred sites are known to exist within Reclamation's jurisdiction at Prineville Reservoir. Reclamation has contacted the Warm Springs Tribes, the Burns Paiute Tribe, and the Klamath Tribes and notified them about the RMP update. Reclamation requested that the tribes inform Reclamation if Indian sacred sites are present. No response has been received from the Burns Paiute Tribe or the Klamath Tribes. The Warm Springs Tribes have indicated that culturally important resources are present but have not indicated that sacred sites are present.

2.6 Indian Trust Assets

Reclamation has an established policy (October 3, 1993) to protect Indian Trust Assets (ITAs) from adverse impacts of its program and activities and to enable the Secretary of the Interior (Secretary) to fulfill responsibilities to Indian tribes. ITAs are legal interests in property held in trust by the United States for Indian tribes or individuals. The United States, with the Secretary as the trustee, holds many assets in trust for Indian tribes or Indian individuals. Examples of ITAs include lands, minerals, hunting and fishing rights, and water rights. While most ITAs are on-reservation, they may also be found off-reservation.

The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or by Indian individuals by treaties, statutes, and executive orders. These are sometimes further interpreted through court decisions and regulations.

2.6.1 Confederated Tribes of the Warm Springs Reservation

The Confederated Tribes of the Warm Springs Reservation (Warm Springs Tribes) include the Wasco, Warm Springs, and Northern Paiute Tribes. The Warm Springs Reservation was created by the Treaty with the Tribes of Middle Oregon in June 25, 1855 (Treaty of 1855) and covers an area of 640,000 acres in the Deschutes River basin within Central Oregon. The Warm Springs Tribal territory originally comprised more than 10 million acres. This territory was ceded to the United States in return for retaining and preserving the Warm Spring Tribes rights to self-govern, fish, hunt, graze livestock, and gather foods within those lands. The Warm Springs Tribes reserved ITAs are hunting, fishing, and gathering rights on ceded lands.

Prineville Reservoir and the area of Reclamation's proposed action is located within the Warm Springs Tribes ceded area. ITAs of potential concern to the Warm Springs Tribes include the rights to fish, hunt, graze livestock, and gather food. The resources that provide for

these rights to be exercised include fish, wildlife, and vegetation. The Warm Springs Tribes especially value the need to augment flows and restore historical fishing opportunities in the Deschutes River basin, particularly anadromous fish resources. Huckleberry (*Vaccinium membranaceum*) and other traditionally harvested vegetation and roots are also very important food resources for the Warm Springs Tribes.

A description of important Native American Indian Trust Assets in the Deschutes River Basin has been further documented by the Warm Springs Tribes in *Restoring Oregon's Deschutes River - Developing Partnerships and Economic Incentives to Improve Water Quality and Instream Flows* (Moore et al. 1995). The Warm Springs Tribes have identified that their paramount goal is to enhance Deschutes River tribal fisheries by increasing instream flows. The Warm Springs Tribes portfolio of trust assets and treaty rights – on- and off-reservation water resources – "all.....depend on a continuing supply of high-quality water" in the Deschutes River Basin (Moore et al. 1995).

Reclamation sent a letter, dated September 24, 2001 to the U.S. Bureau of Indian Affairs (BIA) requesting formal information on any ITAs held in trust by the United States in the proposed Federal action area. BIA's formal response is contained in Appendix A.

2.6.2 Klamath Tribes

The Klamath Tribes Natural Resource Department was contacted by letter on August 22, 2001 to determine if the tribes assert traditional hunting, fishing, and grazing rights in the study area. No response was received.

2.6.3 Burns Paiute

The Burns Paiute Tribe holds no off-reservation Treaty rights, and therefore no ITAs, in the study area. The Burns Paiute Tribe has been consulted by letter dated August 22, 2001 to determine if Indian sacred sites are present and are impacted by the Proposed Action. No response was received.

2.7 Paleontological Resources

Eastern Oregon is rich in vertebrate, invertebrate, and botanical paleontological materials. The John Day Basin is recognized to have some of America's more important Oligocene, Miocene, and Pliocene epoch deposits. These deposits have been the focus of scientific research since the late 1800s. The John Day Fossils Beds National Monument, located about 50 miles northeast of Prineville Reservoir, was created to foster continuing research and to interpret the fossil materials and paleo-environment of the area for the public.

Most area paleontological deposits are associated with specific geological formations. Oligocene deposits dating from 50 to 19 million years ago are found in the Clarno and John Day Formations. Fossil deposits have been documented in these geological formations extending through and south of the Prineville Reservoir area. Geological maps indicate outcrops of both the Clarno and John Day Formations on lands in the central section of Prineville Reservoir. One finding of botanical fossil materials has been reported from Reclamation lands, but only the approximate area of the find is known.

No inventories of paleontological deposits have been completed at the reservoir. However, as part of archeological surveys in 1993 and 1999, archeological crews were required to record any fossil materials or localities noted during their work. No such materials were found. However, no archeological survey has yet occurred in areas where Clarno or John Day Formations are exposed on the ground surface.

2.8 Socioeconomics

Prineville Reservoir is located in Crook County, Oregon. Crook County's economy and demographics are profiled below.

2.8.1 Economy and Employment

Manufacturing and trade (primarily wood products and tires) and agriculture (farming and ranching) are the principal employment sources for most families in Crook County. The area's best-known and largest employer is Les Schwab Tires, headquartered in Prineville. As shown in Table 2.8-1, all other large manufacturing sector employers produce wood products.

Table 2.8-1: Five largest employers, public and private, as of September 2000.

Employer—Product/Service	Number of Employees
Les Schwab Tire Co—Tires	833
Clear Pine Moldings, Inc.—Millwork, Wood Products	549
American Pine Products—Pine Moldings	425
Ochoco Lumber Company—Lumber Products	212
Pioneer Cust Stock—Millwork	120

Source: Oregon Economic and Community Development Department website; accessed 4/10/01

The principal irrigated crops are small grains, alfalfa, potatoes, and peppermint. Agricultural use of non-irrigated lands includes dryland wheat and livestock grazing. Approximately 48% of the County's land area is farm land (Prineville-Crook County Chamber of Commerce 2001).

Local economic health has been gradually rebounding after years of decline in the timber industry, with manufacturing and the service sectors playing an increasingly important role in the local economy. Leading economic indicators in Crook County are summarized in Table 2.8-2.

2.8.2 Population and Demographics

Crook County is a sparsely populated rural county of 2,991 square miles, with an average population density of 6 persons per square mile (Oregon Economic and Community Development Department website). Population growth (See Table 2.8-3) has increased slightly faster in the City of Prineville than Crook County as a whole, in part because Prineville's housing market is relatively affordable in comparison to other areas in the region. Crook County's population growth is expected to slow slightly in the future, with long-term growth at between 15 and 18% per decade until 2040, as shown in Table 2.8-4.

The City of Prineville has become increasingly attractive to retirees interested in central Oregon's climate and amenities, as well as to commuters employed in nearby Bend and Redmond (pers. comm., Moore, 2001). Overall, the central Oregon area around the City of Bend is the fastest growing area in the state. It continues to attract small, high-tech companies, the resort industry, and retirees (McMahon 2001). Among cities in Oregon with a population of greater than 10,000 in 1990, Bend was the fastest-growing area, increasing by 160% during the decade and reaching 53,000 in 2000. Ranked by the amount of population change during the decade, Bend ranked third (with 33,000) behind Portland and

Table 2.8-2: Crook County economic indicators.

Economic Indicators	2000
Population	19,182
Labor Force	8,010
Total Employment	7,340
Unemployment	640
Unemployment Rate	8.4
Non-Farm Payroll Employment	6,350
Total Covered Employment	6,336
Total Covered Payroll ($ thousands)	167,955
Average Annual Payroll Per Employee	26,508
Number of Business Units	391
Total Personal Income ($ millions)	20,225
Annual Per Capita Personal Income	16,899
Assessed Value of Property ($ millions)	1,038
Residential Construction	
Building Permits	205
Value ($ thousands)	24,926
Travel Expenditures ($ millions)	23,400
Travel-Related Employment	500

Sources: Center for Population Research & Census website; U.S. Census Bureau website; Bureau of Economic Analysis website; Oregon Tourism Commission website; Oregon Department of Revenue website; Oregon Economic and Community Development Department website.

Hillsboro. Deschutes County, where Bend is located, has also experienced extremely rapid population growth. In the period between 1990 and 2000, Deschutes County had the highest percent change in population (53.9%) in the entire state (Center for Population Research & Census website).

Racial diversity is relatively limited in Crook County (see Table 2.8-5). Approximately 93% of the population is white. Latinos are the only minority group comprising more than 5% of the population. Other than Latinos, which more than doubled in population since the last census, Crook County appears to be relatively stable in terms of racial demographics.

Table 2.8-3: Local and regional population growth.

	1970	1980	1990	1998	1999	2000	Change 1990-2000
City of Prineville	4,101	5,276	5,355	6,920	7,255	7,356	37.4%
Crook County	9,985	13,091	14,111	16,650	16,800	19,182	35.9%

Sources: U.S. Census Bureau website; Center for Population Research and Census website; Oregon Economic and Community Development Department website; Office of Economic Analysis website.

Table 2.8-4: Long-term Crook County population and non-agricultural employment forecast.

Crook County	2000	2010	2020	2030	2040	Change 2000-2040
Population	17,168	20,215	23,678	27,567	31,752	84.9%
Employment	6,834	8,160	9,266	10,634	12,264	79.5%

Source: Office of Economic Analysis website.

Table 2.8-5: 2000 Crook County population by race.

	1990		2000	
Race	Population	Percentage	Population	Percentage
White	13,637	97	17,830	92.9
African American	11	0.08	8	0.04
Indian/Alaska Native	221	1.6	250	1.3
Asian	47	0.3	82	0.4
Hawaiian/Pacific Islander	N/A	N/A	6	0.03
Other	195	1.4	731	3.81
Two or More Races	N/A	N/A	275	1.39
Latino	338	2.4	1,082	5.6

Source: 1990, 2000 Census

Note: The percentage totals are greater than 100% because Latinos (an ethnicity) are also counted as African American or White (races) depending on how they identify themselves.