Wildlife Impact Assessment

Four Reports:

Bonneville, McNary, The Dalles,
and John Day Projects

Annual Reports for 1989

October 1990

WILDLIFE IMPACT ASSESSMENT

BONNEVILLE PROJECT, OREGON AND WASHINGTON

Annual Report 1989

Prepared by

Larry Rasmussen
Patrick Wright

U.S. Fish and Wildlife Service
Portland Field Station

Prepared for

Joe DeHerrera, Project Manager
U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97208-3621

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Abstract

The Habitat Evaluation Procedures (HEP) were used to evaluate pre- and post-construction habitat conditions of the U.S. Army Corps of Engineers Bonneville project in Oregon and Washington. The project directly impacted 20,749 acres of wildlife habitat. Seven evaluation species were selected with losses and gains expressed in Habitat Units (HU's). One HU is equivalent to 1 acre of prime habitat. The evaluation estimated a gain of 2,671 HU's of lesser scaup wintering habitat. Losses of 4,300 HU's of great blue heron habitat, 2,443 HU's of Canada goose habitat, 2,767 HU's of spotted sandpiper habitat, 163 HU's of yellow warbler habitat, 1,022 HU's black-capped chickadee habitat, and 1,622 HU's of mink habitat occurred as a result of the project. This amounts to a total combined loss of 12,317 HU's.

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INTRODUCTION

This report presents an analysis of impacts on wildlife and wildlife habitat as a result of the construction and operation of the Corps of Engineers Bonneville Lock and Dam Project. The study was funded by the Bonneville Power Administration (BPA) under the authority of Measure 1004 (b)(2) and (3) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4(h) of the Northwest Electric Power Planning and Conservation Act of 1980. The objective of the study was to estimate the net effects to wildlife resulting from hydroelectric development and operation of the original Bonneville Project (First Powerhouse).

State, Fderal and tribal agencies worked cooperatively in the assessment process to accomplish these objectives. These agencies included the Oregon Department of Fish and Wiidlife, Washington Department of Wildlife, U.S. Forest Service, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and Yakima Indian Nation. Approximately six meetings and three on-site field trips were conducted by these agencies (from July 1987 to April 1988) to develop the impact analysis.

PROJECT DESCRIPTION

The Bonneville Lock and Dam Project is located 40 miles east of Portland, Oregon on the Columbia River at river mile (RM) 145 (Figure 1). The project

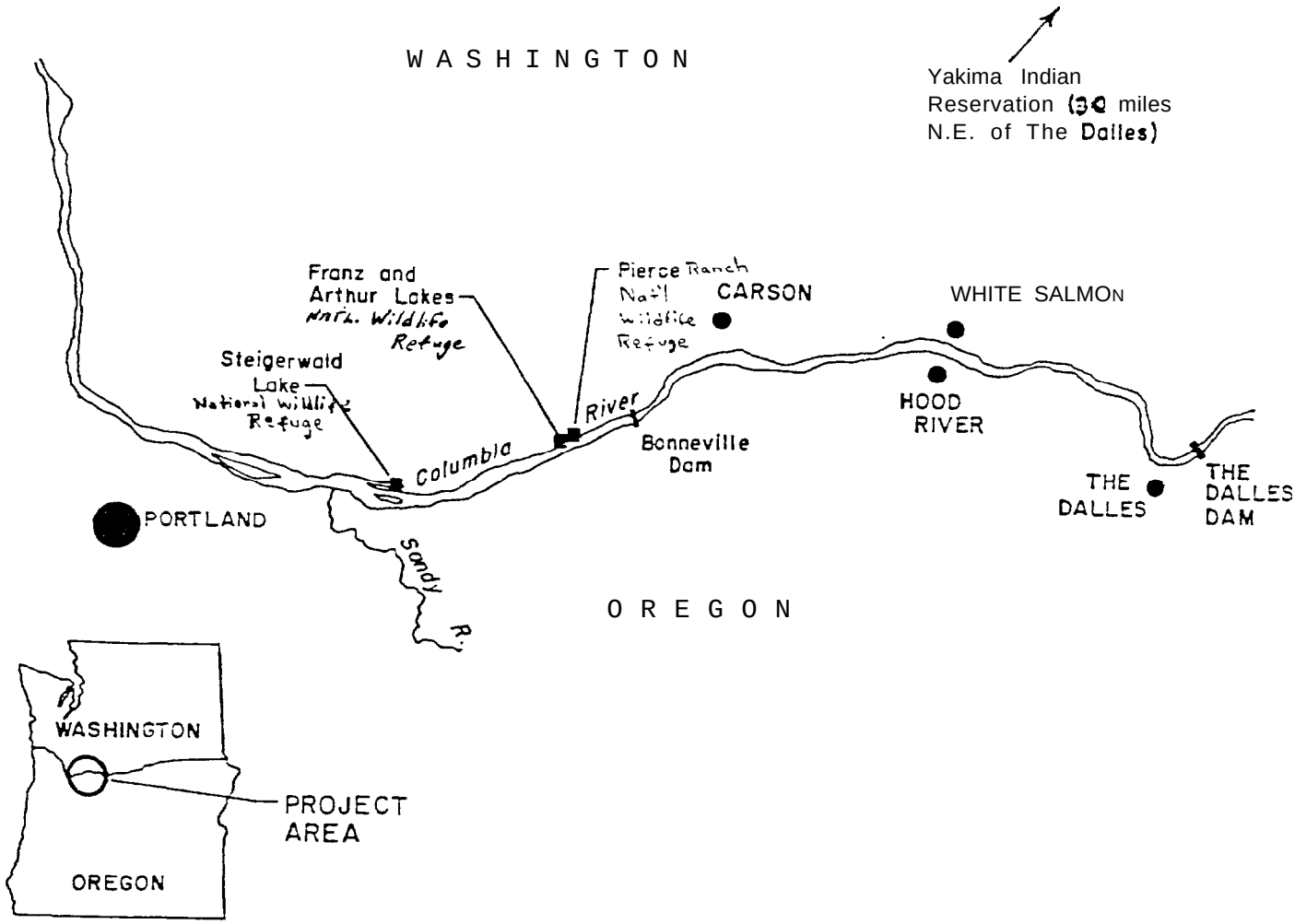
was built and operated by the Corps of Engineers, and first began operation in 1938. It was authorized for the purposes of power and navigation. The dam creates a 48-mile-long impoundment which extends upstream to The Dalles Dam (RM 192). The Bonneville Project is normally operated between elevations 70.0 and 74.0 feet msl (measured at the dam). Maximum flood pool elevation is 82.5 feet msl. The reservoir surface area measures about 20,400 acres.

The first powerhouse at Bonneville Dam contains 10 generators with a total capacity of 526,700 kilowatts (kw). In 1981, construction was completed on a second powerhouse containing 8 additional generator units which produce an additional 558,200 kw of power.

STUDY AREA

The impact area for the Bonneville Project is defined as that area from and including Bonneville Dam and support facilities upstream to The Dalles Dam. Adjoining backwaters and rivers which became inundated by the reservoir are considered part of the impact area. Although the two major highways and railroads along the north and south shorelines have impacted wildlife habitat, they are not considered a result of the project. The area included in the habitat analysis extended into the upland areas adjacent to the reservoir between the vertical slopes of the gorge. Some areas downstream of the dam were also evaluated to gain understanding of what pre-project habitats were like. These included the Pierce Ranch (RM 142) Franz and Arthur Lakes (RM 138), and Steigerwald Lake (RM 125-128) areas (Figure 1).

Figure 1.


WASHINGTON
Yakima Indian Reservation (30 miles N.E. of The Dalles)
Franz and Arthur Lakes Nat'l. Wildlife Refuge
Pierce Ranch Nat'l Wildlife Refuge
CARSON
WHITE SALMON
Steigerwald Lake National Wildlife Refuge
HOOD RIVER
River
Columbia
Bonneville Dam
THE DALLES
THE DALLES DAM
PORTLAND
Sandy R.
OREGON
WASHINGTON
PROJECT AREA
OREGON

MATERIALS AND METHODS

VEGETATIVE ANALYSIS

Preconstruction and recent vegetation cover types for the Bonneville Dam and Reservoir were mapped based on black and white aerial photographs. The photographs, which were provided by the Corps of Engineers, Portland District, were taken in 1930 for preconstruction status (scale 1:15,840), and in 1975 for recent status (scale 1:25,200). The 1975 photographs were used to avoid inclusion of the effects of the second powerhouse. Some 1939 photographs showing immediate postconstruction conditions were examined to identify direct project impacts. Recent vegetation cover types of the area from Bonneville Dam to the mouth of the Sandy River were mapped from 1973 aerial photographs.

Base maps were derived from 1:62,500 USGS quadrangle maps, enlarged to 1:24,000 and screened on mylar film. Mapping extended approximately 1/4 to 1/2 mile beyond the reservoir shoreline. Vegetation cover types were based in part on categories described by Hall et al. (1985) and are described below.

The aerial photographs were overlaid with mylar film and examined under a mirror stereoscope. Areas of discernibly different vegetation were outlined (polygons) and labeled with a symbol designating vegetation cover type. The polygons on the overlays were then transferred to the base map using known landmarks, slope, ridge and valley topography, and proportional dividers to locate each polygon accurately.

The recent maps were ground-truthed on July 30, 1987. Cover type categories designated on the maps were visually verified and, if necessary, changes were made on the maps. All maps were then finalized and traced onto mylar overlays to the base maps. A boundary including only the area directly affected by the project was determined from postconstruction aerial photographs. Where this boundary extended beyond the railroad tracks which run along either side of the reservoir, the extensions were shown by dashed lines.

Mapping was generalized in the uplands outside the affected area to avoid having many small polygons which would have been difficult to discern. Where two or more cover types were intermixed, the one with the greatest proportional coverage was used to designate that area. Where the proportion was approximately equal, the polygon was labeled with both cover type codes.

Acreages of map categories within the affected area boundary were calculated from blackline reproductions of the maps, using the known area of the reservoir (Howerton et al. 1984) as a basis for assigning acreages to polygons. The affected area was narrow and contained many small polygons; therefore a dot grid was used to calculate acreages. Dot counts between preconstruction and recent maps agreed within 3 percent, indicating that good accuracy had been obtained.

Fifteen vegetation cover type/map categories were identified in the Bonneville Project Area. Table 1 shows the acreages for each type impacted (lost) by the Bonneville Project.

Table I. Acreages of vegetation and other cover types impacted (lost) by the Bonneville Project.

VEGETATION COVER TYPE	ACRES
Mainland	
Conifer Forest, Open	151
Conifer - Hardwood Forest, Open	651
Conifer - Hardwood Forest, Closed	21
Shrub	216
Grassland	114
Agricultural Lands	615
Riparian Hardwoods	536
Riparian Shrub	312
Emergent Wetland	9
Sand/Gravel/Cobble/Mud	2947
Talus/Rock	335
Disturbed/Bare/Riprap	138
Open Water - Lakes & Ponds	328
Residential/Urban/Industrial	43
TOTAL MAINLAND	6416
Islands	
Conifer - Hardwood Forest, Open	24
Grassland	44
Shrubland	37
Riparian Shrub	13
Sand/Cobble/Gravel/Mud	427
Talus/Rock	62
Open Water - Lakes & Ponds	4
TOTAL ISLANDS	611
River	
Open Water - river	13722
TOTAL RIVER	13722
GRAND TOTAL	20749

Forest, shrub, and grass vegetation cover types change from mesic to xeric with increasing distance eastward from Bonneville Dam. Franklin and Dyrness (1973) show mean annual precipitation decreasing from about 40 inches per year at Bonneville Dam to about 16 per year in the vicinity of The Dalles. Within the area covered by the Bonneville Reservoir, the vegetation changes from forests typical of the Western Hemlock Vegetation Zone to that commonly seen in Columbia Basin shrub-steppe. Between the two extremes are found narrow bands of both the Grand fir-Douglas-fir and the Ponderosa Pine Vegetation Zones. The various plant communities of these zones intermingle in the Columbia Gorge, making it one of the most vegetationally complex areas in the Pacific Northwest. The climate of the area is unique (Franklin and Dyrness 1973), comprising as it does elements of both maritime and continental climates. Strong winds are common in all seasons. Ice storms occur when cold, dry continental air encounters moist marine storms in the winter. Summers are characterized by hot, dry winds blowing from interior valleys.

The minimum map unit within the affected area was on the order of 1 acre. This allowed depiction of the many small, narrow patches of vegetation along the highways and railroads which bordered the river and the reservoir. Outside the affected area the minimum map unit was closer to 5 acres, and when large areas were a mosaic of several vegetation cover types, the one comprising more than 50 percent of the area was used to designate that polygon. This occurred more often on south-facing slopes on the Washington shore and on hillsides above the river between Hood River and The Dalles on the Oregon shore. In the descriptions of cover types, the more common inclusions are noted.

Conifer Forest, Open: In the Bonneville Project area, open conifer forests are more abundant upland of the railroads and highways. Overstory crown closure was generally less than 50 percent. Open stands appeared to be the result of selective cutting at preconstruction; recent stands were often in areas of frequent human use. Few recent stands were seen which contained trees greater than 15 in dbh. Douglas-fir was the most abundant conifer, with western hemlock and western red cedar present in some stands. The latter was more frequently found in moist areas. The understory vegetation, when observed, was often weedy. Outside the affected area, ponderosa pine gradually replaced Douglas-fir on lower slopes with increasing distance east from Hood River.

Conifer Forest, Closed: Closed conifer tended to occur on higher slopes and seldom extended into the mapped area. Crown closure was greater than 50 percent. Stands varied from large pole-sized trees to (rarely) large sawtimber. The species composition of closed conifer forests was similar to that of open stands, but the understory often had a higher proportion of native shrubs and herbs. Deciduous hardwoods were common, but their cover did not exceed 30 percent overall.

Conifer-Hardwood Forest, Open: These stands were mixtures of conifers and hardwoods (e.g., red alder and bigleaf maple in the west end of the Project area, bigleaf maple or Oregon white oak in the east end.) The conifer component of mixed stands changed with distance east along the river. Douglas-fir, western hemlock, and, in more mesic areas, western red cedar was intermixed with ponderosa pine near Carson on the Washington shore and near Mosier on the Oregon shore. With greater distance east, ponderosa pine

achieved dominance among the conifers until, near The Dalles, it was generally the only conifer present. Similarly, Oregon white oak became more common with increasing distance east, although red alder and bigleaf maple continued to occur throughout the project area. Hardwoods comprised 30 percent to 70 percent of these stands. Most stands contained seedling and sapling conifers, indicating that they are probably seral communities. Mixed stands included patches of shrubland and of conifer forest throughout the project area. Rocky outcrops occurred occasionally. This cover type was particularly patchy below Bonneville Dam.

Conifer-Hardwood Forest, Closed: Closed conifer-hardwood forest stands were similar to open ones in species composition. Crown closure was greater than 50 percent. They appeared to be younger stands, with trees growing more densely and with less understory vegetation.

Shrubland: This vegetation cover type includes such diverse plant communities as blackberry thickets, shrubby clearcuts, xeric shrub thickets, and sagebrush-steppe. Shrub communities had greater than 40 percent woody crown cover, but woody vegetation was under 15 feet tall (Hall et al. 1985). Most of the shrubland cover type within the affected area was situated between the railroads and the shoreline. They were weedy and often showed signs of frequent or recent disturbance. Some of them were young trees growing densely together. Toward the east end of the project area, on the Washington shore, the shrubs included young Oregon white oak and ceanothus. Near The Dalles, big sagebrush and rabbitbrush became the most common shrubs, Shrublands, particularly in the eastern end of the project area, included scattered patches of mixed and conifer forest, grassland, and rocky talus slopes. For

instance, above Rowena there is a band of trees, too narrow to map, along the rimrock.

Grassland: Many of the areas mapped as grassland in the western end of the project area and downstream to the Sandy River were probably pastures which have not been cultivated for many years. Within the affected area, they were more commonly areas recovering from disturbance and therefore had a high proportion of weedy forbs and grasses. East of Hood River, the grasslands became drier and cheatgrass became more abundant until, near The Dalles, it achieved dominance. In that area, this map category includes scablands -- areas where basalt supports only a thin covering of grasses and forbs. Woody plant cover in grasslands was less than 40 percent, but some shrubs were often present. There were also dense shrub stands occupying too small an area to map, as well as small groves of trees of various species.

Agricultural Lands: These areas were represented by croplands, orchards, and pastures. Orchards were the most common use of agricultural lands near Hood River and to the east, while most of this cover type in the western end of the project area was used as pasture. Trees were common along the edges of many areas mapped as Agricultural Lands and sometimes, particularly below Bonneville Dam, riparian hardwoods grew in lines between fields and in swales within the fields.

Riparian Hardwoods: Black cottonwood was an important component of this cover type. It was sometimes accompanied by red alder, western red cedar, and Douglas-fir. Bigleaf maple was sometimes present, but more often along steeper streams outside the affected area than within it. Willows were abundant in some stands, but their lesser height often made them part of the

understory. Franklin and Dyrness (1975) stated that nearly pure stands of black cottonwood once lined the shores of the lower Columbia River (from the Gorge west) and remnants of this riparian community occurred in abundance below Bonneville Dam in 1930 and in 1975.

Riparian Shrub: This cover type represents young stands of riparian hardwoods as well as willow thickets on sandbars. The latter must be considered ephemeral, since high water could wash them away at any time. At least 70 percent of each of these mapped areas supported woody vegetation less than 15 feet tall. An occasional tree or snag was present and forbs and grasses varied from scattered and sparse to abundant. Many of the areas mapped as Riparian Hardwoods and Riparian Shrub were almost certainly wetlands.

Emergent Wetland: Characterized by wet soil supporting sedges, rushes, or cattails, these areas usually occurred where drainage from nearby slopes was interrupted by railroad or highway embankments or agricultural activities. Some of the areas mapped as agricultural lands (particularly pastures) included emergent wetlands, but they were too small to map. This situation was particularly evident in the vicinity of Arthur Lake, west of Bonneville Dam.

Open Water: Open water includes rivers, lakes, ponds, and Bonneville Reservoir. For purposes of calculating acreages, the reservoir and the rivers, including sloughs and embayments, were kept separate from other open water areas. Many of the ponds and lakes in the affected area contained emergent or submergent vegetation. Most of the sloughs and embayments did not, nor did the rivers and the reservoir.

Sand/Gravel/Cobble/Mud: Most of this cover type occurred along the rivers and was probably under water during periods of high water. It should be noted that both sets of aerial photographs were taken during periods of low water (preconstruction in January; recent in September), so it is probable that many of the areas in this cover type would have been flooded during part of the year. Some vegetation was present on many of the sandbars along the river. It usually consisted of seedling willows, scattered grasses and forbs, and an occasional shrubby willow or black cottonwood. It was never abundant. Some of the occurrences of this cover type had the potential to develop into riparian hardwood or riparian shrub cover types, given a sufficient period without washouts by the river. Across the river from The Dalles and for a short distance downriver, there were blowouts on the uplands, particularly in 1930. These areas are also mapped in this cover type. They were sparsely vegetated with upland species, mostiy grasses, forbs, and scattered shrubs.

Talus/Rock: This cover type included rocky cliffs, pinnacles, and talus slopes. Vegetation was present although usually quite sparse and included good-sized trees as well as shrubs and herbs. Many of the small islands in the river and the reservoir included this cover type.

Disturbed/Bare/Riprap: Areas where severe or continued disturbance or vegetation management preclude the natural re-establishment of vegetation are included in this map category. It occurred most commonly along railroad and highway rights-of-way, particularly where they bordered the river or reservoir. This map category frequently included narrow bands of sand along the reservoir's edge. It also intergraded with the Talus/Rock category in some instances. Vegetation was usually sparse and weedy.

Residential Urban Industrial: Cities, towns, major residential areas, and industrial developments were included in this map category. Individual houses usually occupied areas too small to map and farm buildings were included in the Agricultural Lands category.

HABITAT EVALUATION

Habitat Evaluation Procedures (HEP) were utilized to evaluate the quality of wildlife habitat prior to and after project construction. The HEP involved an interagency team of biologists who selected appropriate evaluation species and then analyzed habitat conditions based on models developed for each of those species. The species utilized in the evaluation (target species) were selected because their particular habitat requirements were indicative of certain vegetative cover types and they often represented a larger group of species with similar habitat requirements, or because they were of special significance in the study area from an economical, ecological, social, or environmental point of view. A list of all wildlife species present in the project area is provided in Appendix A.

A total of 26 species were proposed for consideration as target species. Table 2 identifies each agency's suggested target species. Eventually the interagency group selected seven target species for the HEP evaluation. These species and the rationale for their selection are identified in Table 3.

The lesser scaup, great blue heron, mink, yellow warbler, and black-capped chickadee HEP models have been published and are available from the USFWS (Mulholland 1985, Short 1985, Allen 1986, Schroeder 1982, Schroeder 1982). The spotted sandpiper model was developed from a literature review by Geoff

Tabie 2. List of target species initially proposed by the cooperating agencies.

Species	Agency					
	ODFW	USFS	COE	WDW	YIN	FWS
Peregrine falcon	X	X		X	x	X
Bald eagle	X	X			x	X
Osprey	X	X			x	X
Cooper's hawk					x	
Saw-whet owl					x	
Great blue heron	X	X	X	X	x	X
Canada goose	X	X	X	X	x	X
Lesser scaup			X			
wood duck	X		X			
Waterfowl		X				
Cavity nester (pileated woodpecker)		X				
Downy woodpecker			x			
Ruffed grouse				x	X	
Swallow	X		x	x		
Purple martin	X					
Spotted sandpiper			x			
Yellow warbler	X			x	X	X
Black-capped chickadee	X					
Beaver	X	X	X		X	X
Mink	X					X
River otter				X	X	X
Columbian white-tailed deer					X	
Black-tailed deer	X					
Seals	X				X	
Little brown myotis			X			
Western pond turtle				X		

Table 3. Target species selected for the Bonneville HEP and the rationale for their selection.

Species	Rationale
Spotted sandpiper (*Actitis macularia*)	A representative of migratory shorebirds which utilize the sparsely vegetated islands, mudflats, shorelines, and sand and gravel bars associated with the Bonneville Project area. Collectively these habitats comprised the largest loss of acreage resulting from the project.
Lesser scaup (*Aytha affinis*)	A migratory waterfowl species commonly observed utilizing open water habitat of Bonneville Reservoir during the winter. Representative of other diving waterfowl which may use the area. Existing HEP model available.
Canada goose (*Branta canadensis*)	A migratory bird of national significance sensitive to island nesting habitat and associated shoreline brooding areas. Cultural significance.
Great blue heron (*Ardea herodias*)	Carnivore which forages on a variety of vertebrates in shallow water, wetland, and shoreline habitats. Nests and roosts in mature riparian forest habitats. Represents wildlife species utilizing mature riparian forests. Existing HEP model available which is sensitive to changes in the aforementioned habitats. Cultural significance.
Yellow warbler (*Dendroica petechia*)	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. Existing HEP model which is sensitive to the targeted habitats - riparian shrub and adjacent wetlands.
Black-capped chickadee (*Parus atricopillus*)	Representative of species utilizing mature forest canopies and forest cavity nesters. HEP model available.
Mink (*Mustela vison*)	Carnivorous furbearer, feeds on a wide range of vertebrates. Utilizes shoreline and adjacent shallow water habitats. HEP model available. Cultural significance.

Dorsey, a member of the evaluation team. The model for Canada goose was based on a model developed by Dave Lockman, Mike Whitfield, Bob Jones, and Chuck Solomon for use in evaluating the Palisades project on the South Fork of the Snake River in Idaho. That model was modified by the evaluation team with the assistance of Jim Bottorff, to adapt to the Bonneville Project area. The latter two models are in Appendix B.

Each species model uses a number of measurable variables that are combined into a simple equation which results in a sample site Habitat Suitability Index (HSI). The average HSI from all sample sites is used as the HSI value for a given evaluation species in the study area. This overall HSI, which is a number between 0 and 1.0, is a quality index or a measure of the capacity of the project area to meet the life requisites of the evaluation species.

To evaluate changes in habitat quality associated with this project using the HEP, two scenarios had to be considered; baseline or pre-construction conditions and recent (post-construction) conditions. Upon review of available data, photographs, and field inspection, the evaluation team agreed that the habitat quality of vegetation communities presently in the project area are representative of the corresponding vegetation communities inundated by the project. Therefore, the same HSI value for each habitat type was applied to both pre- and post-project conditions.

The interagency team of biologists spent about 5 days in the project area measuring many different habitat variables for each of the evaluation species found in the various vegetative cover types. Some of the cover types identified in Table 1 were combined for the evaluation. Table 4 identifies the cover types that were evaluated for each species. A few variables were

Table 4. HSI scores and resultant changes in habitat units for target species in the Bonneville Project Area

	Cover Types and HSI Scores								
	Conifer/Hardwood Forest	Riparian Forest	Riparian Shrub	Shrub/Grassland/ Pasture	Sand/Gravel/ Cobble/Mud-Shoreline	Wetlands, Lakes and Ponds	Open Water Reservoir/River	Islands	Change In Habitat Units
Change In Acreage with Project"	-047	-536	-325	-1026	-3374	-341	+6678	1/	
Species									
Spotted Sandpiper					0.0	0.2			-2767
Lesser Scaup							0.4		+2671
Great Blue Heron		0.7		0.6	0.9	0.0	0.8 2/		-4300
Yellow Warbler			0.5						-163
Chickadee	0.7	0.0							-1022
Mink					0.4	0.0	0.4 2/		-1622
Change In Project 1/ with	-023	-536	-312	-945	-2947	-337	+6678	3/ -549	
Canada Goose				0.4	0.4	0.5		1.0 1/	-2443

Total Habitat Units Lost.....12,317
Total Habitat Units Gained.....2,671

1/ Acreage totals for all species except Canada goose include the acreages of each cover type impacted on both the mainland and islands. However, the cover type acreages for Canada goose do not individually include the acreages of each cover type which occured on islands. The island cover type acreages have been lumped for Canada goose because the Fish and Wildllfe Service assumed that islands provide the best nesting habitat for Canada geese in the Columbia River Gorge Area.

2/ Although open water acreage increased, the actual acreage of the open water cover type used by these species is represented by a narrow band adjacent to the shore1 ine which did not significantly change In size. Therefore the acreage and habitat unit value of open water to these species remained unchanged.

3/ 611 acres of island habitat impacted less the 63 acres of talus/rock which was not evaluated.

calculated utilizing navigation charts and/or the aforementioned aerial photographs. The variables devised from these measurements were used to develop an HSI value. Each HSI value was multiplied by the total number of acres of the associated habitat type directly impacted by the project to determine the number of habitat units for each evaluation species. The habitat units (HU's) for each evaluation species represents the losses or gains of habitat as a result of the project. Each species and its associated habitats variables that were measured in the field are described below.

Spotted Sandpiper – The evaluation team sampled eight sand/gravel/cobble/mud shoreline habitats. Measurements were taken at these sites to determine the value of cover, foraging habitat, and distance from water to nesting and foraging areas.

Lesser Scaup – Habitat variables measured for this species included percent of the the area supporting emergent vegetation, water depth during average winter conditions, human disturbance in the feeding area, and percent of the area supporting pelecypods. Since the percent of pelecypods present prior to the project is unknown and because we lacked time to determine its existing presence, it was assumed that the percentage has not changed and based upon the amount of pelecypod shells observed in the shallow water and shoreline areas the population was assumed to be average or slightly above average. Ten open-water sites in the field as well as their corresponding cross-sections on navigation charts (for depth) were evaluated to determine an HSI value for lesser scaup.

Canada Goose - HSI values for Canada geese were developed for shrub/grassland/pasture; sand/gravel/cobble/mud; wetlands/lakes/ponds; and island habitats. The first three cover types provided important foraging habitat for juvenile geese. The forage value was determined by considering: 1) the distance from the forage area to nesting areas; 2) the height of the forage; 3) the amount of forage zone to open water; and 5) the absence of obstructions or dense vegetation which could provide predator cover between open water and the forage area. Forage values for Canada geese were evaluated at 21 sample sites within the first three cover types.

Canada goose nesting habitat occurs almost exclusively on islands (as opposed to mainland) in the project area. Project construction resulted in a severe impact on goose production since 66 percent of the island habitat was destroyed. The HEP team concluded that because islands provided the best nesting habitat for Canada geese in the project area that all islands would be given an HSI of 1.0 for nesting.

Great Blue Heron - Thirty-six different sample sites in five habitat types (riparian forest; shrub/grassland/pasture; sand/gravel/cobble/mud; wetlands/lakes/ponds; and open water reservoir/river) were assessed by the interagency team of biologists. In each of these habitat types, up to five habitat variables were considered. These variables included: 1) the distance between a foraging area and heronry site, (2) the presence of a suitable prey population, (3) the presence of a disturbance free zone around the foraging area, (4) the presence of a disturbance free zone around the heronry site, and (5) the distance between a potential and active heronry.

Yellow warbler – The evaluation team looked at three habitat variables in six different riparian shrub areas. The variables measured were the percent deciduous crown cover, average height of deciduous shrub canopy, and percent of the deciduous shrub canopy which is hydrophytic.

Black-Capped Chickadee – Ten different areas were sampled in conifer, conifer/hardwood, and riparian hardwood habitats. Three habitat variables were assessed in each area. These variables included percent tree canopy closure, average height of overstory trees, and number of 4"-10" diameter snags per acre.

Mink – Habitat variables measured in the field included the percent of shoreline cover within 1 meter of the waters edge, the percent tree/shrub canopy within 100 meters of waters edge, and the percent of the year that water is present. These variables were analyzed at 23 samples sites in 3 different habitat types (sand/gravel/cobble/mud; wetlands/lakes/ponds; and open water reservoir/river).

RESULTS

The HSI scores and resultant changes in habitat units for each of the target species are discussed below and summarized in Table 4.

Spotted sandpiper

Spotted sandpiper utilize the sparsely vegetated mudflats, shoreline, and sand and gravel bars in the project area for foraging and nesting. These shoreline

habitats comprised the largest loss of acreage resulting from the project - 3,374 acres. This habitat had an HSI value of 0.8 for the sandpiper. In addition 341 acres of wetland/lake/pond habitat of a relative low value (HSI=0.2) to the spotted sandpiper were also lost as a result of the project. Collectively, the impacts resulted in a loss of 2,767 habitat units to the sandpiper.

Lesser scaup

During the winter, lesser scaup forage and rest in open water habitat in the project area. The project created 6,678 additional acres of open water habitat of moderate value to the scaup (HSI=0.4). This resulted in an increase of 2,671 habitat units for the scaup.

Canada goose

The Canada goose was adversely impacted by the loss of 549 acres of island habitat as a result of the project. Islands provide the best nesting habitat (HSI=1.0) for the geese in the project area. In addition, the project eliminated 945 acres of shrub, grassland, and pasture habitat important to the geese for foraging (HSI=.4), especially during the period immediately following the hatching of goslings. Further, 2,947 acres of shoreline habitat lost to the project also provided foraging and resting areas important to the geese (HSI=.4). Finally, 337 acres of wetlands, lakes, and ponds valuable to the geese (HSI=.5) were eliminated by the project. Collectively these impacts resulted in the loss of 2,443 habitat units to the Canada goose.

Great blue heron

The 536 acres of riparian forest habitat lost to the project was utilized by great blue heron for nesting and roosting and was generally high in value (HSI=.7). Further, the variety of heron feeding habitats lost to the project were quite valuable: 1,026 acres of shrub, grassland, and pasture (HSI=.6), 3,374 acres of shoreline (HSI=.9); and 341 acres of wetlands, lakes, and ponds (HSI=.8). Collectively, these impacts resulted in the loss of 4,300 habitat units to the heron.

Yellow warbler

The yellow warbler reproduces and feeds in riparian shrub habitat and also feeds in adjacent wetlands. The loss of 325 acres of riparian shrub habitat with and HSI value of 0.5 resulted in a loss of 163 habitat units to the warbler.

Black-capped chickadee

The chickadee utilizes forest habitats in the project area for both nesting and feeding. The project eliminated 847 acres of conifer/hardwood forest with an HSI value of 0.7 to the chickadee. In addition, 536 acres of riparian forest habitat with an HSI value of 0.8 to the chickadee were eliminated by the project. The combined losses of forested habitats resulted in a loss of 1,022 habitat units to the chickadee.

Mink

Mink utilize shoreline, wetland, and adjacent shallow water habitats in the project area. The 3,374 acres of shoreline habitat lost to the project were moderately valuable (HSI=.4) to the mink. However, the 341 acres of wetlands, lakes, and ponds eliminated by the project provided good mink habitat (HSI=0.8). Collectively the impacts resulted in a loss of 1,622 habitat units to the mink.

HYDROELECTRIC RESPONSIBILITY FOR LOSSES AND BENEFITS

The Power Act required that mitigation for wildlife losses be undertaken for "hydroelectric projects" having "various project purposes" (Section 4(h)(10)(C)). Congress stated that "monetary costs resulting from implementation of the (mitigation) program are to be allocated among projects, both Federal and non-Federal, in accordance with the relative impacts...".

The Northwest Power Planning Council subsequently determined that funding authority for wildlife mitigation would be limited to Federal projects only, and to just one part of those Federal projects – the power purpose. The also determined that the level of mitigation responsibility would be based on a yet-to-be determined financial accounting procedure.

In view of the above, we have assessed biological impacts caused by the overall multi-purpose hydroelectric project. The wildlife impacts identified in this report are attributable to the changes in wildlife habitat which occurred as a direct result of the construction of Bonneville Dam, Powerhouse,

support facilities, and the creation of Bonneville Reservoir. It is assumed the Power Council will establish the portion of the project to be mitigated under the Act and their program.

SUMMARY

Pre- and post-construction habitat conditions associated with the U.S. Army Corps of Engineers' Bonneville Hydroelectric project in Oregon and Washington were evaluated using the Fish and Wildlife Service's Habitat Evaluation Procedures (HEP). The project directly impacted 20,749 acres of wildlife habitat. This resulted in significant losses of several habitats which supported a diverse and significant wildlife resource. Seven evaluation species were selected to evaluate the impacts to wildlife. Losses and gains for each evaluation species are expressed in Habitat Units (HU's). One HU is equivalent to 1 acre of prime habitat. The evaluation estimated that losses of 4,300 HU's of great blue heron habitat, 2,443 HU's of Canada goose habitat, 2,767 HU's of spotted sandpiper habitat, 163 HU's of yellow warbler habitat, 1,022 HU's black-capped chickadee habitat, and 1,622 HU's of mink habitat occurred as a result of the project; for or a combined loss of 12,317 HU's. Conversely, Bonneville Reservoir created an additional 6,678 acres of open water habitat for lesser scaup. This provided an increase of 2,671 habitat units for the lesser scaup.

Planning efforts will proceed to compensate for the lost habitats and their associated wildlife resources.

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APPENDIX A

LIST OF WILDLIFE SPECIES FOUND IN THE GENERAL VICINITY OF THE BONNEVILLE PROJECT, MAINSTEM OF THE COLUMBIA RIVER

Mammals, birds, amphibians, and reptiles found in the vicinity of the Bonneville Project area.

MAMMALS

Vagrant shrew
Trowbridge shrew
Dusky shrew
Pacific water shrew
Shrew-mole
Pacific mole
Silver-haired bat
Western pipistrel
Big brown bat
Pallid bat
Western big-eared bat
Little brown myotis
California myotis
Small-footed myotis
Mountain cottontail
Showshoe hare
Brush rabbit
Townsend chipmunk
Yellowbellied marmot
California ground squirrel
Northern flying squirrel
Western gray squirrel
Eastern gray squirrel
Chickaree
Northern pocket gopher
Western pocket gopher
Norway rat
Beaver
Western harvest mouse
Deer mouse
Bushytail woodrat
Montane vole
Townsend vole
Muskrat
House mouse
Porcupine
Coyote
Red fox
American black bear
Raccoon
Long-tailed weasel
Short-tailed weasel
Mink
River otter
Spotted skunk
Striped skunk
Mountain lion
Bobcat
Mule Deer
Black-tailed deer
Rocky Mountain elk
Opossum

BIRDS

Common loon
Horned grebe
Eared grebe
Western grebe
Pied-billed grebe
Red-necked grebe
White pelican
Double-crested cormorant
Great blue heron
Black-crowned night heron
Green heron
American bittern
Whistling swan
Canada goose
Mallard
Gadwall
Pintail
Green-winged teal
Blue-winged teal
Cinnamon teal
American wigeon
Shoveler
wood duck
Redhead
Ring-necked duck
Canvasback
Lesser scaup
Bufflehead
Hooded merganser
Common merganser
Turkey vulture
Goswak
Sharp-skinned hawk
Cooper's hawk
Red-tailed hawk
Swainson's hawk
Rough-legged hawk
Ferruginous hawk
Golden eagle
Bald eagle
Harrier

Appendix A cont.

Osprey
Prairie falcon
Peregrine falcon
American kestrel
Blue grouse
Ruffed grouse
Turkey
Sora rail
American coot
Killdeer
Black-bellied plover
Common snipe
Whimbrel
Spotted sandpiper
Solitary sandpiper
Willet
Greater yellowlegs
Lesser yellowlegs
Least sandpiper
Western sandpiper
Pectoral sandpiper
California quail
Ring-necked pheasant
Sanderling
Long-billed dowitcher
American avocet
Wilson's phalarope
Northern phalarope
Herring gull
California gull
Ring-billed gull
Franklin's gull
Western gull
Forster's tern
Caspian tern
Mourning dove
Barn owl
Screech owl
Great horned owl
Long-eared owl
Short-eared owl
Saw-whet owl
Snowy owl
Pygmy owl
Poor will
Common nighthawk
Vaux's swift
Black-chinned hummingbird
Rufous hummingbird
Calliope hummingbird
Belted kingfisher
Bandtail pigeon

Pileated woodpecker
Lewis' woodpecker
Yellow-bellied sapsucker
Hairy woodpecker
Downy woodpecker
Eastern kingbird
Western kingbird
Ash-throated flycatcher
Say's phoebe
Western flycatcher
Olive-sided flycatcher
Western wood peewee
Horned lark
Violet-green swallow
Tree swallow
Bank swallow
Rough-winged swallow
Barn swallow
Cliff swallow
Purple martin
Scrub jay
Steller's jay
Black-billed magpie
Common raven
Common crow
Clark's nutcracker
Black-capped chickadee
Mountain chickadee
Chestnut-backed chickadee
Common bushtit
White-breasted nuthatch
Red-breasted nuthatch
Pygmy nuthatch
Brown creeper
Dipper
House wren
Winter wren
Bewick's wren
Long-billed marsh wren
Canon wren
Rock wren
Robin
Western bluebird
Swainson's thrush
Varied thrush
Golden-crowned kinglet
Water pipit
Bohemian waxwing
Cedar waxwing
Northern shrike
Loggerhead shrike
Solitary vireo

Appendix A cont.

Common flicker
Orange-crowned warbler
yellow warbler
Yellow-rumped warbler
Black-throated gray warbler
MacGillivary's warbler
Hermit warbler
Yellowthroat
yellow-breasted chat
Wilson's warbler
House sparrow
Northern oriole
Brown-headed grosbeak
Luzili bunting
Pine grosbeak
Evening grosbeak
Cassin's finch
House finch
Purple finch
Red crossbill
Pine siskin
American goldfinch
Rufous-sided towhee
Savannah sparrow
Grasshopper sparrow
Vesper sparrow
Chipping sparrow
White-crowned sparrow
Song sparrow
Fox sparrow
Lincoln's sparrow
Western meadowlark
Red-winged blackbird
Brewer's blackbird
Undifferentiated juncos
Starling
Warbling vireo

AMBHIBIANS

Long-toed salamander
Northwestern salamander
Western red-backed salamander
Olympic salamander
Larch mountain salamander
Pacific treefrog
Tailed frog
Red-legged frog
Spotted frog
Bullfrog
Rough-skinned newt
Ensatina

REPTILES

Western skink
Southern alligator lizard
Western fence lizard
Northern alligator lizard
Rubber boa
Mountain kingsnake
Western terristrial garter snake
Western rattlesnake
Pacific gopher snake
Great basin gopher snake
Northwestern garter snake
Sharp-tailed snake
Western yellow-bellied racer
Western painted turtle

APPENDIX B

Unpublished Evaluation Species Models
Used in Impact Assessment
For the Bonneville Project, Oregon and Washington

Canada Goose
Spotted Sandpiper

CANADA GOOSE MODEL

This model is a modification of the Canada goose model developed by Dave Lockman et. al. for the evaluation of Canada goose nesting and brooding habitat on the Snake River at Palisades Reservoir. This modification was developed by Patrick Wright, Larry Rasmussen, and Jim Bottorff of the Portland Field Office, Fish and Wildlife Service for use in describing the quality of nesting and brooding habitat in the vicinity of Bonneville Reservoir on the lower Columbia River.

Nesting Habitat

Islands (V1)	SI Value
Stable islands present; islands have relatively high shoreline/area ratio; cover indicative of stability; ground cover on portions of island 4"-8" high.	0.8-1.0
Stable islands present; relatively low shoreline/area ratio; cover on island <4" or >8".	0.5-0.7
No stable islands, or islands with limited or no cover.	0.0-0.4

Shorelines (V2)	SI Value
Portions of cover within 10 meters of water; ground cover 4"-8", wetland buffer within 50 meters of shoreline, may include sloughs of open water.	0.5
Portions of shoreline cover within 10 meters of water; ground cover <4"or >8";adjacent wetlands within 50M of shoreline (does not include open water, rather forested or emergent wetlands).	0.3-0.4
No shoreline cover, or shoreline cover taller than 10" and/or very dense; buffer >50 meters from shoreline to absent.	0.1-0.2

Brood Rearing Habitat

Foraging Area (V3)	SI Value
Distance from nesting areas to foraging zones ≤1/2 mile (preferably within site of the nesting area); forage ≤4" tall and ≥ one acre in size; foraging zones total ≥20 acres per mile of river; edge of foraging zone within 25 meters of open water (escape cover).	0.7-1.0
Distance from nesting areas to foraging zones >1/2 and ≤1 mile; forage ≤4" tall and ≥ one acre in size, foraging zones total 10 to 20 acres per mile of river; edge of foraging zone >25 meters and ≤50 meters from open water (escape cover).	0.4-0.6
As above except foraging zone >1 mile from nesting areas and	0.0-0.3

>50 meters from open water (escape cover).

Model Equation

$$HSI = \frac{(V1 \text{ or } V2) + V3}{2}$$

Spotted Sandpiper – Willamette Ecoregion

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed species, occurring on the margins of sandy ponds, sea shores, and rocks bordering streams.

Hays (1973) reported that spotted sandpiper nests were located in grassy upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used all the sparsely vegetated areas on an island as nest sites. Bent (1929) stated that nest sites were variable; high areas of sand island in high, rank sedge grass, on grassy, overgrown gravel bars, in driftwood piles, under extending tree branches, under rock ledges, and under decayed logs representing reported nest sites. Nest sites are close to water (Bent 1929). Oring and Knudson stated that spotted sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (1973) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) reported that spotted sandpipers nest just above the highwater mark on tree-lined shores. Stout (1967) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous cover 0.5 m in height and 30 m or less from the beach. Three nests were located in mixed deciduous woods 8-13 m high and 20-50 m from the beach. Miller and Miller (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 – 76.2 cm in height.

Hays (1973) stated that spotted sandpipers have a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial in winter.

Miller and Miller (1948) reported a colonial breeding situation, 38 pairs/5.46 ha. Kuenzel and Wiegert (1973) reported a territorial size of approximately 1.21 ha per bird. Heideman and Oring (1976) stated that 4-5 pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 active nests/l.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

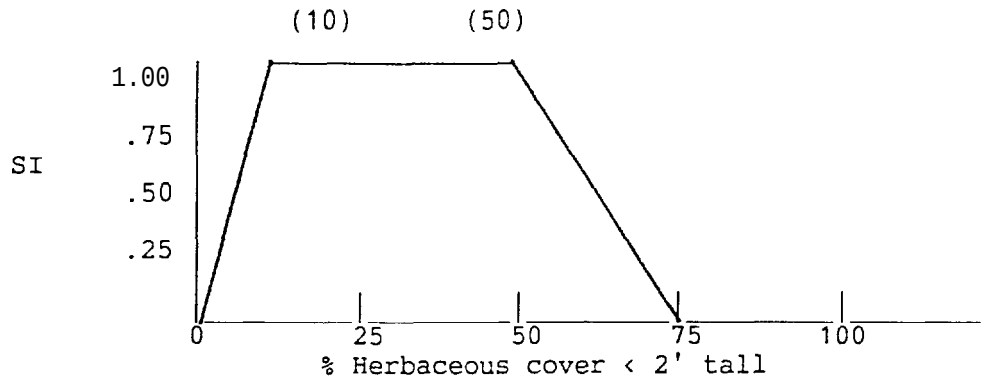
Spotted sandpipers feed primarily on insects, especially aquatic insects.

SPOTTED SANDPIPER SUITABILITY INDEX

Nesting Cover (V1)

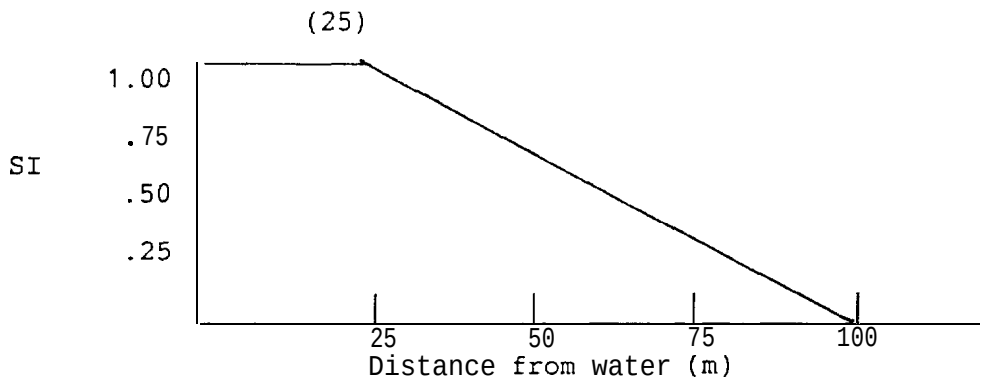
A mosaic of herbaceous ground cover with an overall density of less than 50% and less than 2' high (an overstory of deciduous trees can be present if the ground cover requirements are met).

Flooding probably not a significant problem as the sandpiper is quite capable of renesting if necessary.



Nesting distance from water (V2)

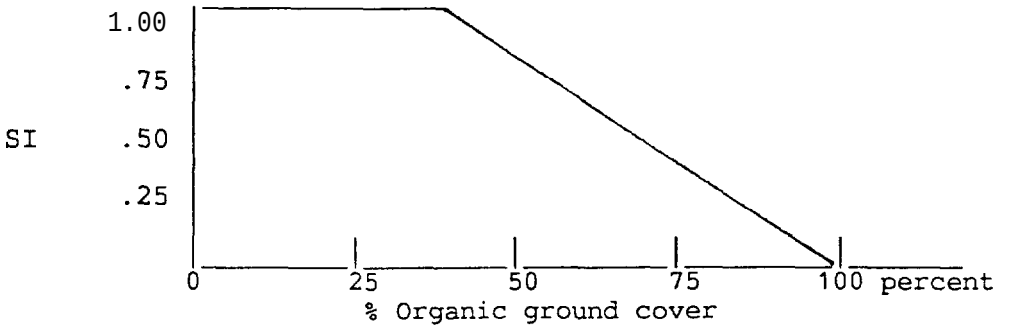
Nesting habitat is within 25m of water.



Foraging habitat (V3) -

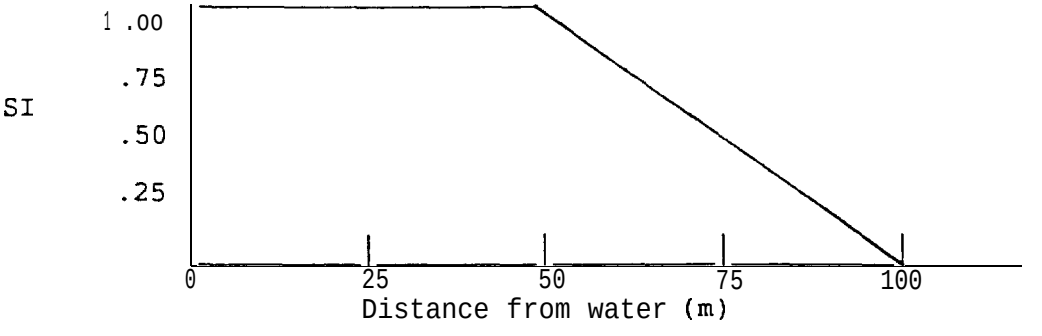
Open or partially vegetated shorelines (gravel, riprap, or sandy substrates) containing organic debris or drift

(50)



Foraging distance from water (V4)

Foraging area is within 50m of water.



Model Equation

$$HSI = \frac{V1 + V2 + V3 + V4}{4}$$

Spotted Sandpiper

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WILDLIFE IMPACT ASSESSMENT

MCNARY PROJECT, OREGON AND WASHINGTON

Annual Report 1989

Prepared by

Larry Rasmussen
Patrick Wright

U.S. Fish and Wildlife Service
Portland Field Station

Prepared for

Joe DeHerrera, Project Manager
U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97208-3621

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Abstract

The Habitat Evaluation Procedures (HEP) were used to evaluate pre- and post-construction habitat conditions of the U.S. Army Corps of Engineers McNary project in Oregon and Washington. The project directly impacted 15,502 acres of wildlife habitat. Eight evaluation species were selected with losses and gains expressed in Habitat Units (HU's). One HU is equivalent to 1 acre of prime habitat. The evaluation estimated a gain of 13,744 HU's of mallard aquatic habitat. However, losses of 6,959 HU's of mallard terrestrial habitat, 3,469 HU's of western meadowlark habitat, 3,484 HU's of Canada goose habitat, 1,363 HU's of spotted sandpiper habitat, 329 HU's of yellow warbler habitat, 377 HU's of downy woodpecker habitat, 1,250 HU's of mink habitat, and 6,314 HU's of California quail habitat occurred as a result of the project. This amounts to a total combined loss of 23,545 HU's.

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B. Unpublished Evaluation Species Models Used in Wildlife Impact Assessment for the McNary Project

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INTRODUCTION

This report presents an analysis of impacts on wildlife and wildlife habitat as a result of the construction and operation of the Corps of Engineers McNary Lock and Dam Project. The study was funded by the Bonneville Power Administration (BPA) under the authority of Measure 1004 (b) (2) and (3) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4(h) of the Northwest Electric Power Planning and Conservation Act of 1980. The objective of the study was to estimate the net effects to wildlife resulting from hydroelectric development and operation of the McNary Project.

State, Federal and tribal agencies worked cooperatively in the assessment process to accomplish the objective. These agencies included the Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and Yakima Indian Nation. Approximately four meetings and eight on-site field trips were conducted by these agencies (from November 1988 to August 1989) to develop the impact analysis.

PROJECT DESCRIPTION

The McNary Lock and Dam Project is located near Umatilla, Oregon on the Columbia River at river mile (RM) 292 (Figure 1). The project was built and operated by the Corps of Engineers, and began operation in 1953. It was authorized for the purposes of power, navigation and irrigation. The dam creates a 61-mile-long impoundment which extends upstream to RM 353. The McNary Project is normally operated between elevations 335 and 340 feet msl

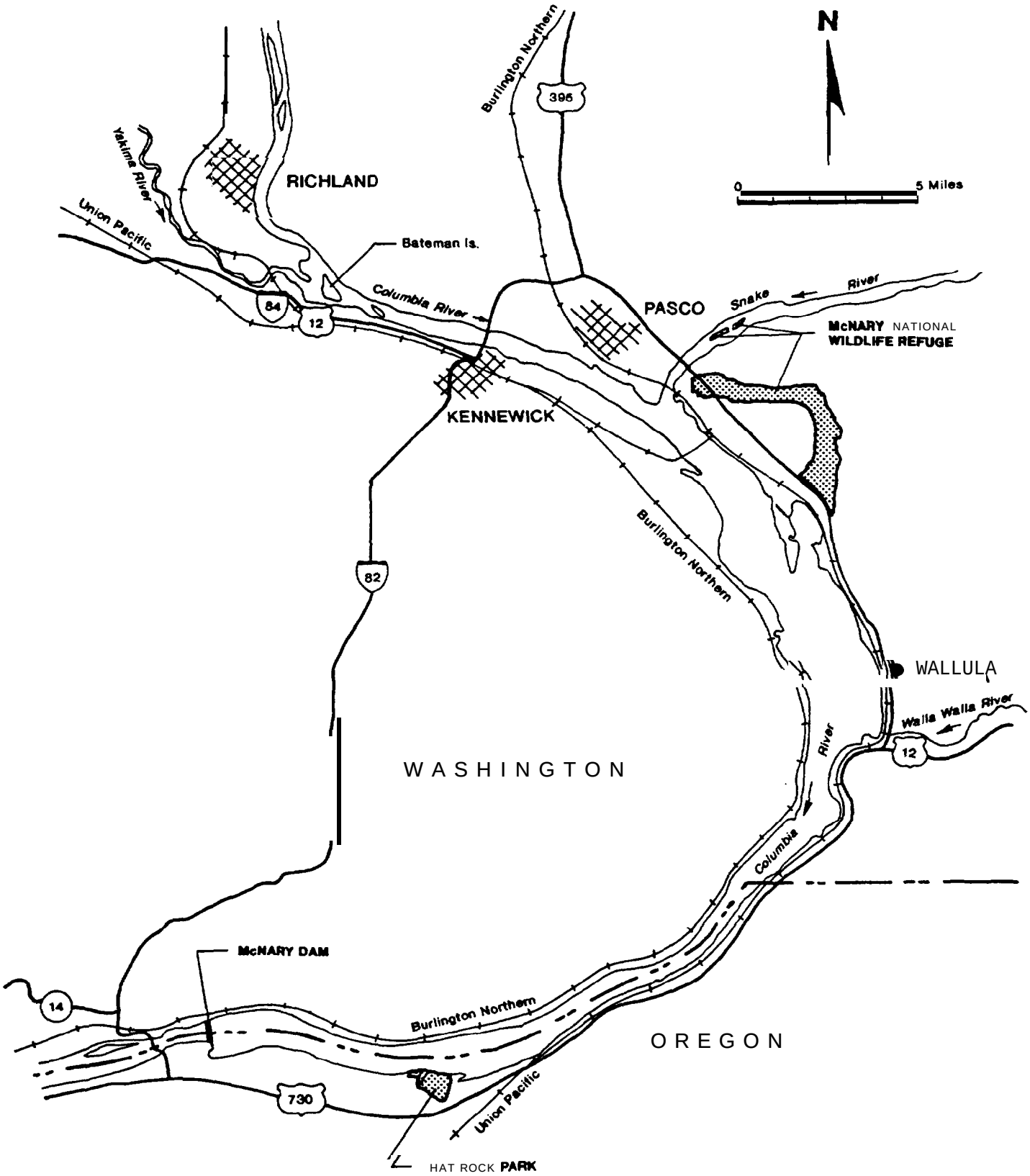


FIGURE 1. McNARY RESERVOIR

(measured at the dam). The reservoir surface area measures about 39,000 acres. The powerhouse contains 14 generators with a total power capacity of 980,000 kilowatts (kw).

STUDY AREA

The impact area for the McNary Project is defined as the reservoir area from, and including, the dam and support facilities upstream to about RM 338. Impact analysis upstream from this point was not possible because during the pre-project years the U.S. Atomic Energy Commission prohibited aerial photography in the Hanford area. Habitat losses in this area would have been minimal as the shorelines have a steep slope and water level increases this far from McNary Dam were small. Adjoining backwaters and rivers which became inundated by the reservoir area are considered part of the impact area. Although the highway and railroad along the shoreline have impacted wildlife habitat, they are not considered a result of the project. The area included in the habitat analysis extended into the low elevation uplands adjacent to the reservoir but within the confines of the nearby hillsides.

MATERIALS AND METHODS

VEGETATIVE ANALYSIS

Preconstruction vegetation cover types of the McNary Dam and Reservoir area were mapped based on 1952 black and white aerial photographs obtained from the Corps of Engineers in Walla Walla. The scale was 1:9,600. No earlier aerial photography was found of the dam area; some oblique aerial photography and

surface photographs were available for portions of the project area. Recent color aerial photography was flown in 1987 at a scale of 1:12,000.

Base maps were derived from 1:24,000 USGS quadrangle maps screened on mylar film. Mapping extended approximately 1/4 to 1/2 mile beyond the reservoir shoreline. Vegetation cover types were based in part on categories described by Hall et al. (1985) and were consistent with those used in 1987 for Bonneville, The Dalles, and John Day Reservoirs. They are described below.

The aerial photographs were examined under a mirror stereoscope. Areas of discernible different vegetation were noted and polygons corresponding to them were transferred to the base map and labeled with a symbol designating vegetation cover type. The polygons were located on the base map using known landmarks, slope, ridge and valley topography, and field observations. Proportional dividers were frequently used to determine relative sizes of landmarks, since the photographs and maps were of various scales.

Where aerial photography was lacking or, in the case of some areas associated with dam construction, taken after construction commenced, vegetation cover types were extrapolated based on surrounding vegetation. Some large disturbed areas were mapped as such on the preconstruction maps, because there was no way of determining whether they were directly associated with dam construction.

The recent maps were ground checked on December 7 and 8, 1988. Cover type categories designated on the maps were visually verified and, if necessary, changes were made on the maps. All maps were then finalized and traced onto

mylar overlays to the base maps. A boundary including only the area directly affected by the project was defined on the maps by a dashed line.

Mapping was generalized in the uplands outside the project area. Where two or more vegetation cover types interdigitated, the one with the greatest proportional coverage was used to designate that area.

Acreages of map categories within the affected area boundary were calculated from blackline reproductions of the maps, using the mean of the known area of two sections per map as a basis for assigning acreages to polygons. The project area was generally narrow and contained many small polygons; therefore a dot grid was used to calculate acreages. Dot counts between preconstruction and recent maps agreed within 3.01 percent for the entire project area and within 2.8 percent for the reservoir.

Franklin and Dyrness (1973) show mean annual precipitation to be about 8 inches per year in the McNary Reach of the Columbia River. Strong winds are common along the river in all seasons. Winters are cold and fairly dry. Summers are hot.

Although the natural vegetation along McNary Reservoir is usually considered to belong to the shrub-steppe (Franklin and Dyrness 1973), it is difficult to find even small areas free of alien species. Cheatgrass (Bromus tectorum L.) is the most common grass species over much of the area. Shrubs, particularly green and gray rabbitbrush (Chrysothamnus nauseosus [Pall.] Britt. and Chrvsothamnus viscidiflorus [Hook.] Nutt.), have often replaced big sagebrush (Artemisia tridentata Nut-t.). The latter is more sensitive to fire, a common occurrence in the dry grass and shrub communities of the area.

The minimum map unit within the project area was on the order of 1 acre. This allowed depiction of small, narrow patches of vegetation along the highways and railroads which bordered the river and the reservoir. Outside the project area the minimum map unit was closer to 5 acres and, when large areas were a mosaic of several vegetation cover types, the one comprising more than 50 percent of the area was used to designate that polygon. In the descriptions of cover types, the more common inclusions are noted.

Thirteen vegetation cover type/map categories were identified in the area mapped. Table 1 shows the acreages of each vegetative cover type flooded by the McNary project. Direct project impacts identified on 1952 aerial photographs were identified in the immediate vicinity of McNary Dam and at the mouth of the Walla Walla River. Most of the impacted areas were occupied by dam-associated facilities or industrial developments or were under water in 1987.

Missing or incomplete aerial photography required some creativity during the mapping process, as did the fact that the 1952 photography was flown after the coffer dam at McNary was in place and water was backing up behind it. The water level in 1952 photography was definitely higher than normal, but fortunately not enough so that low-lying islands could not be seen. Riparian shrub and tree communities were obviously inundated at the roots, but their crowns still retained leaves. Along Burbank Slough, aerial coverage was incomplete and some aerial photos were missing from the Peavine Island area. Oblique aerial and surface photography was used to complete mapping of those areas. Some portions of the Walla Walla delta were also mapped from oblique aerials, as was a portion of the western shoreline across from the mouth of

Table 1. Acreages of Vegetation and other Cover Types Impacted by the McNary Project.

VEGETATION COVER TYPE	ACRES
Mainland	
Agricultural Lands	1872
Grassland	3228
Shrubland	4188
Riparian Hardwoods	1028
Riparian Shrub	284
Riparian Herb	7
Emergent Wetland	248
Sand Dunes/Blowouts	977
Sand/Gravel/Cobble/Mud	577
Talus/Rock	0
Disturbed/Bare/Riprap	346
Open Water - Lakes & Ponds	6
Residential/Urban/Industrial	137
TOTAL MAINLAND	12898
Islands	
Agricultural Lands	157
Grassland	193
Shrubland	1063
Riparian Hardwoods	227
Riparian Shrub	81
Riparian Herb	7
Emergent Wetland	16
Sand Dunes/Blowouts	211
Sand/Cobble/Gravel/Mud	786
TOTAL ISLANDS	2741
TOTALS MAINLAND & ISLANDS	15639

the Snake River and thence downstream several miles. Finally, most of the Hanford Reach of the Columbia, as well as the upper 2 miles of the Yakima River, were impossible to map in 1952, since national security prevented aerial photography from being flown. Mapping was ended short of Ice Harbor Dam because the effects of that structure were evident upstream of the transmission line crossing.

It should be noted that the peninsula along the south shore of the Snake River was not considered an island. Bateman Island at the mouth of the Yakima River, however, was. In calculating preconstruction acreages, none of the area upstream of the new highway bridge over the Walla Walla River was considered to lie below the pool level; most of it was under water only a short time before sedimentation filled it.

Agricultural Lands: Croplands, both irrigated and dryland, and pastures were the primary agricultural uses of land within the McNary reach in both 1952 and 1987. A few orchards and vineyards were seen on aerial photographs, but nearly all of them were outside the project area. Those within were generally small and associated with farmhouses. No produce growing areas were noted, although some of the low-lying agricultural areas along the Yakima River in 1952 may have been used for that purpose. Some cleared areas near the mouth of what was to become Burbank Slough were noted on the 1952 photographs. They were mapped as agricultural. Agricultural lands accounted for about 13 percent (2,029 acres) of the terrestrial habitat inundated by the reservoir.

For the purpose of mapping, recreation areas and parks were included in this map category, although they were designated as "PARK." Some parks were developed along the shores of McNary Reservoir. These include those at the

mouth of the Walla Walla and Snake Rivers and along the shore between Richland and Kennewick. Wildlife management areas created by the filling of the reservoir or as later mitigation were not included in the PARK category. There were no parks within the project area in 1952, but in 1987 somewhat over 2 percent of the area was parkland.

Grasslands: This vegetation cover type dominated much of the uplands above the river in 1952 and was common in 1987. Some succession of grasslands to shrub communities was seen within the area mapped, primarily in areas where grazing probably takes place. Some of the change also probably resulted from increased human use and from fires. Woody plant cover in grasslands was less than 50 percent over most of the polygons, with considerable variation from practically no shrubs to dense patches scattered throughout the area mapped as a single polygon. Some areas near the mouth of the Yakima and Walla Walla Rivers, and in the Burbank Slough area, occupy moist sites resulting in somewhat different species composition than communities on drier sites. Grasslands comprised 22 percent (3,421 acres) of the terrestrial habitat flooded by the project.

Shrubland: Shrub communities had greater than 50 percent woody crown cover, but woody vegetation was under 15 ft. tall (Hall et al. 1985). Stands were weedy and often showed signs of frequent or recent disturbance. Big sagebrush (*Artemisia tridentata* Nutt.) and rabbitbrush were the most common shrubs and the latter seemed to be more abundant in easily accessible areas and those along railroads where fires may be more frequent. On sand blowouts and dunes (q.v.), bitterbrush (*Purshia tridentata* [Pursh] DC.) was often dominant, and those areas were mapped as shrublands where crown cover was 25 percent or greater. Much of the Burbank Coulee (preconstruction) area was this cover

type. Some shrubby areas along the edges of talus included mounds of virgin's-bower (Clematis sp.) or small groves of hackberry (Celtis reticulata Torr.). Sometimes, particularly around cities, shrublands were abandoned fields supporting dense stands of Russian thistle (Salsola kali L.) and other weedy species. The shrub covertype comprised 34 percent of the land area inundated by the reservoir. This was the largest single terrestrial habitat (5,251 acres) impacted by McNary Dam. Because the grassland and shrubland cover types are so intermingled and their associated wildlife species are common to both habitats, they have been combined for HEP into a "shrub/steppe/grass" category.

Riparian Hardwoods: Black cottonwood (Populus trichocarpa T. & G.) was the dominant component of this cover type. It was often accompanied by willow (Salix spp.), both shrubby species and fairly large trees. Russian olive (Eleagnus ansustifolia L.) was sporadically abundant along the river's edge -- more so in 1987 than in 1952, particularly around the mouth of the Walla Walla River. Alder (Alnus spp.) and hackberry (Celtis reticulata Torr.) appeared sporadically in riparian woodlands throughout the area. At Burbank Slough and upstream, near the mouth of the Snake River, the mosaic of riparian vegetation, emergent wetlands, and ponds, was extremely complex. Incomplete aerial coverage at the mouth of the Yakima River required some extrapolation; the vegetation there was all assumed to be Riparian Hardwoods. The reservoir flooded 1,255 acres of riparian tree habitat which represented about 8 percent of the terrestrial habitat loss.

Riparian Shrub: This cover type included young stands of riparian hardwoods, bands of shrubby vegetation along inlets and embayments, and willow thickets on sandbars. Riparian shrub lined much of the reservoir shoreline in 1987 and

probably was as ubiquitous in 1952. These narrow bands of ephemeral shrubs and herbs were too narrow to be seen on aerial photographs, but were noted during ground truthing. Willow thickets on sandbars must be considered ephemeral, since high water could wash them away at any time. False indigo (Amorpha fruticosa L.), an introduced shrub, was probably the most common species in this cover type in 1987 and seemed to be increasing in abundance. At least 70 percent of each of these mapped areas supported woody vegetation less than 15 feet tall. An occasional tree or snag was present and forbs and grasses varied from scattered and sparse to abundant. This category also included small stands of upland shrubs when they occurred in riparian situations, as well as the same shrubs intermixed with willows and cottonwoods. Many of the areas mapped as Riparian Hardwoods and Riparian Shrub were wetlands. A loss of 365 acres of riparian shrub resulted from the project. This was about 2 percent of the flooded land areas.

Riparian Herbs: This vegetation cover type comprised low-growing vegetation, chiefly herbaceous, on sandbars, mudflats, and other riparian substrates. It also included subirrigated pastures and grasslands where the substrate appeared sufficiently wet on aerial photographs that the vegetation would be expected to be influenced. Almost always weedy, it included shrubby willows and seedling cottonwoods as well as a variety of forbs and grasses. Mustards (Brassicaceae), docks (Rumex spp.), pigweeds (Chenooodium spp.) and Russian thistle (Salsola kali L.), and composites (Asteraceae) were typically dominant in these communities. Grasses present usually included species such as foxtails and squirreltails (Hordeum spp. and Sitanion spp.), cheatgrass, and reed canarygrass (Phalaris arundinacea L.). Total plant cover rarely exceeded 75 percent, but had to be at least 25 percent to distinguish this cover type from sand/gravel/cobble/mud. The major differences between areas mapped as

Riparian Herbs and those designated Emergent Wetland were topographic position and species composition. The emergent wetland usually occupied sites where flooding could be expected for part of the year and often could be distinguished to support typically wetland taxa (e.g., Carex spp., Juncus spp., Typha. Riparian herb communities accounted for less than 0.1 percent (14 acres) of the habitats lost with the project.

Emergent Wetland: This cover type represented less than 2 percent (264 acres) of the terrestrial habitat inundated by the reservoir. Characterized in the project area by wet soil supporting sedges, rushes, or cattails, these areas were common in the Burbank Slough area and at the mouths of the Walla Walla and Yakima Rivers. They also were found where runoff from agricultural areas or canals occurred. The "pothole" area just east of Umatilla (recent map) was a mosaic of emergent wetland, riparian herb, riparian shrub, and pasture insofar as there was aerial coverage. South of the highway, the potholes were drawn from the USGS quadrangle maps. In that area, some clearing of shrubs and trees was observed in December 1988 and May 1989.

Emergent wetlands tend to be longer lived than riparian herb communities. The latter often are ephemeral when on riverine sandbars or mudflats. Elsewhere they generally give way to shrub, then tree communities. The emergent wetlands are often found where flooding is of longer duration than along rivers.

Sand dunes/Blowouts: Several instances of this cover type occurred within the project area, although most were on higher slopes. Bitterbrush was growing on many dunes, and sometimes achieved such abundance that the area was mapped as

Shrubland rather than this category. This cover type comprised more than 1,100 acres of area inundated by the project.

The difference between this cover type and sand/gravel/cobble/mud was sometimes positional--if sandy areas occurred on low, level areas along the river or reservoir, they were mapped as the latter. This was done even if they were obviously part of a blowout or dune system, since they were, like all riverine sand bars, subject to flooding at high water.

Sand/Gravel/Cobble/Mud: Most of this cover type occurred along the rivers and was probably under water during periods of high water before McNary Dam was built. Some vegetation was present on may of the sandbars along the river. It usually consisted of seedling willows, scattered grasses and forbs, and an occasional shrubby willow or black cottonwood. It was never abundant. Some of the occurrences of this cover type had the potential to develop into riparian hardwood or riparian shrub cover types, given a sufficient period without washouts by the river. About 9 percent (1,118 acres) of the flooded habitats were represented by this cover type.

Talus/Rock: This cover type included rocky cliffs, pinnacles, and talus slopes. Vegetation was present although usually quite sparse and included shrubs and herbs. The cliffs were fairly heavily vegetated for brief periods in the spring when annual grasses and spring forbs were present; the rest of the year, crustose lichens and acrocarpus mosses were the most abundant vegetation. Only some of the areas mapped as talus/rock were talus; in the Wallula Gap there were numerous rocky cliffs with talus at their bases. An insignificant amount (less than 0.1 percent) of talus/rock was flooded by the project.

Disturbed/Bare/Riprap: Areas where severe or continued disturbance or vegetation management precluded the natural re-establishment of vegetation were included in this map category. It occurred most commonly along railroad and highway rights-of-way, particularly where they bordered the river or reservoir. The dike and the ditch behind it, in the Tri-Cities area, were mapped as disturbed/bare, as was the freeway in Kennewick, which was under construction in 1952. Large disturbed areas along the shoreline (e.g., Yellepit) in 1952 were indirectly associated with the reservoir; they were being recontoured to serve as wildlife/waterfowl habitat. They were mapped in this category, rather than being mapped as their probable preconstruction cover type. The major disturbance to vegetation caused by railroad and highway relocation was not, however, shown on the preconstruction maps, and they were indirectly attributable to the dam. Railroads and roads were often too narrow to map in the McNary Reservoir area. This was particularly true along the river between Cold Springs and Wallula. This map category frequently intergraded with the Talus/Rock category, as well as with sand/gravel/cobble/mud when along the river or reservoir shore. Vegetation was usually sparse and generally weedy. There were 346 acres of disturbed/bare/riprap areas impacted by McNary reservoir.

Open Water: Open water includes rivers, lakes, ponds, and the McNary Reservoir. For purposes of calculating acreages, the reservoir and the rivers, including sloughs and embayments, were kept separate from other open water areas. Ponds and lakes accounted for 6 acres of flooded habitat.

The Columbia and Snake Rivers and associated sloughs and embayments provided 15,685 acres of open water habitat prior to construction of McNary Dam. This

free flowing section of the Columbia River was replaced with 30,947 acres of reservoir when the dam was constructed.

Residential/Urban/Industrial: Cities, towns, major residential areas, and industrial developments were included in this map category. Individual houses usually occupied areas too small to map and farm buildings were included in the Agricultural Lands category. Some areas (e.g., the area between Kennewick and Richland occupied by numerous small acreages in 1987) were mapped as residential/urban/industrial even though there was considerable agriculture; the density of residences was the deciding factor. There were 137 acres of residential/urban/industrial areas flooded by the reservoir. This was not included as wildlife habitat lost with the project.

HABITAT EVALUATION

Habitat Evaluation Procedures (HEP) were utilized to evaluate the quality of wildlife habitat in the project area prior to and after construction. The HEP involved an interagency team of biologists who selected appropriate evaluation species and then analyzed habitat conditions based on models developed for each of those species. The species utilized in the evaluation (target species) were selected because their particular habitat requirements were indicative of major vegetative cover types that were impacted by the project. The target species often represented a larger group of species with similar habitat requirements, and were of special significance in the study area from an economical, ecological, social, or environmental standpoint. A list of all wildlife species present in the project area is provided in Appendix A. The interagency group selected eight target species for the HEP evaluation. These species and the rationale for their selection are identified in Table 2.

Table 2. Target species selected for the McNary HEP and the rationale for their selection.

Species	Rationale
Spotted sandpiper (*Actitis macularia*)	A representative of migratory shorebirds which utilize the sparsely vegetated islands, mudflats, shorelines, and sand and gravel bars associated with the McNary Project area.
Canada goose (*Branta canadensis*)	A migratory bird of national significance sensitive to island nesting habitat and associated shoreline brooding areas. Cultural significance.
Yellow warbler (*Dendroica petechia*)	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. There is an existing HEP model which is sensitive to the targeted habitats - riparian shrub and adjacent wetlands.
Mink (*Mustela vison*)	Carnivorous furbearer, feeds on a wide range of vertebrates. Utilizes shoreline and adjacent shallow water habitats. HEP model available. Cultural significance.
Western meadowlark (*Sturnella neslecta*)	A species common to shrub-steppe-grassland habitat, the largest terrestrial habitat type flooded by the McNary project. This bird, well known for its melodious song, feeds primarily on insects and seeds.
California quail (*Lophortyx californicus*	A species associated with brushy thickets, shrub-steppe-grassland, riparian shrub, and cropland habitats. This game animal feeds essentially on seeds and greens in somewhat open brushy and grassland areas.
Mallard (*Anas platyrhynchos*)	The mallard utilizes a broader range of cover types than any other target species. Shrub-steppe-grassland, riparian herb, and island habitats are all used to some degree for nesting. Open water and agricultural areas provide winter resting and feeding while emergent wetlands are necessary for brood rearing.
Downy woodpecker (*Picoides pubescens*)	This woodpecker represents a species which feeds and reproduces in a tree environment. The downy woodpecker HEP model was selected to measure the riparian tree cover type. Its diet is primarily insects with some seeds and fruits.

The mink, yellow warbler, and downy woodpecker HEP models have been published and are available from the USFWS (Allen, 1986, Schroeder 1982, Schroeder, 1983). The spotted sandpiper model was developed from a literature review by Geoff Dorsey, a member of the John Day project HEP team. The model for the Canada goose was based on a model developed by Dave Lockman, Mike Whitfield, Bob Jones, and Chuck Solomon for use in evaluating the Palisades project on the South Fork of the Snake River in Idaho. That model was modified by the evaluation team to adapt to the McNary Project area. The California quail model was taken from the Fish and Wildlife Service Draft Terrestrial Habitat Evaluation Criteria Handbook for Ecoregion 2410, June, 1978. The variables were reviewed and determined applicable to the project area by the interagency HEP team. The model for the mallard was jointly developed from several other models by the members of the HEP team. The spotted sandpiper, Canada goose, California quail, and mallard models are in Appendix B. The Western Meadowlark model was a modified form of the USFWS Eastern Meadowlark (Shroeder and Sousa 1982).

Each species model uses a number of measurable variables that are combined into a simple equation which results in a Habitat Suitability Index (HSI) value for each sample site. The average HSI from all sample sites in each cover type is used as the HSI value for a given evaluation species in the study area. This overall HSI, which is a number between 0 and 1.0, is a quality index or a measure of the capacity of the project area to meet the life requisites of the evaluation species.

To evaluate changes in habitat quality associated with this project using the HEP, two scenarios had to be considered; baseline or pre-construction conditions and recent (post-construction) conditions. Upon review of

available data, photographs, and field inspection, the evaluation team agreed that the habitat quality of vegetation communities presently in the project area are representative of the corresponding vegetation communities inundated by the project. Therefore, the same HSI value for each habitat type was applied to both pre- and post-project conditions.

The interagency team of biologists spent 8 days in the project area measuring many different habitat variables for each of the evaluation species found in the various vegetative cover types. Table 3 identifies the cover types that were evaluated for each species. A few variables were calculated utilizing navigation charts and/or the aforementioned aerial photographs. The variables devised from these measurements were used to develop an HSI value. Each HSI value was multiplied by the total number of acres of the associated habitat type directly impacted by the project to give the number of habitat units for each evaluation species. The habitat units (HU's) for each evaluation species represents the losses and/or gains of habitat as a result of the project.

Each species along with its associated habitat and variables that were measured in the field is described below.

Spotted Sandpiper – The evaluation team sampled four sand, gravel, cobble and mud shoreline habitats. Measurements were taken at these sites to determine the value of cover, foraging habitat, and distance from water to nesting and foraging areas.

Canada Goose – HSI values for Canada geese were developed for island, riparian herb, agricultural, shrub/steppe/grass, and sand/gravel/cobble/mud habitats.

Table 3. Summary of HSI Values and Changes in Habitat Units as a Result of the McNary Project. (The upper figure under each species heading is the HSI and the lower figure is Habitat Units.)

Cover Type/ Acres Flooded	C. Goose	M-lark	V-quail	Mallard	Sandpiper	Mink	Woodpecker	Warbler
Shrub/steppe/grass -8,672'	0.1 -742HU[3]	0.4 -3469HU	0.6 -5203HU	0.4 -2966HU[3]				
Islands -2,741'	0.8 -2193HU			0.7 -1919HU				
Agriculture -2,029'	0.2 -374HU[4]		0.4 -812HU	1.0 -1872HU[4]				
Sand/Gravel -1,363'	0.3 -173HU[5]				1.0 -1363HU	0.2 -273HU		
Rip. Tree -1,255'						.4 -502HU	0.3 -377	
Rip. Shrub -365'			0.8 -292HU			0.7 -256HU		0.9 -329HU
Emerg. Wetland -264'				0.8 -198HU[6]		0.8 -211HU		
Rip. Herb -14'	0.3 -2HU		0.5 -7HU	0.5 -4HU		0.6 -8HU		

Table 3 - cont.

Cover Type/ Acres Charmed	C. Goose	M-lark	V-quail	Mallard	Sandpiper	Mink	Woodpecker	Warbler
Open Water - River								
Backwater -1,348				0.8 -1078HU				
Main River -14,337				0.5 -7169HU				
Open Water - Reservoir								
Backwater +4,248				0.9 +3823HU				
Main River +24,963				0.7 +17,474HU				
Barge Channel +1,736				0.4 +694HU				
TOTAL HU'S	-3484	-3469	-6314	Terrest. -6959 Aquatic +13,744	-1363	-1250	-377	-329

Terrestrial Habitat Impact -- -23,545 H.U.
Aquatic Habitat Impact -- +13,744 H.U.

1/ Acreage includes islands.
2/ Acreage includes all cover types on islands.
3/ Based on 7,416 acres, excluding islands.
4/ Based on 1,872 acres, excluding islands.
5/ Based on 577 acres, excluding islands.
6/ Based on 248 acres, excluding islands.

Riparian herb and certain agricultural, shrub/steppe/grass, and sand/gravel/cobble/mud areas provide important foraging zones for juvenile geese. The forage value was determined by considering: 1) the distance from the forage area to nesting areas; 2) the height of the forage; 3) the amount of forage per mile of river; 4) the distance from the forage zone to open water; and 5) the absence of obstructions or dense vegetation which could provide predator cover between open water and the forage area. Forage values for Canada geese were developed at 10 riparian herb, 6 agricultural, 8 shrub/steppe/grass, and 4 sand/gravel/cobble/mud sample sites.

Canada goose nesting habitat occurs almost exclusively on islands (as opposed to mainland) in the project area. Project construction resulted in a severe impact on goose production since almost 90 percent of the islands were destroyed. HSI variables considered were island stability, shoreline/area ratio, vegetative canopy cover, and availability of other nesting areas (islands).

Yellow Warbler – The evaluation team looked at three habitat variables in six different riparian shrub areas. The variables measured were the percent deciduous crown cover, average height of deciduous shrub canopy, and percent of the deciduous shrub canopy which is hydrophytic.

California quail – Shrub/steppe/grass, agricultural, riparian shrub, and riparian herb habitat sample sites were measured to determine their value to California quail. Nine shrub/steppe/grass, six agricultural, six riparian shrub, and ten riparian herb sites throughout the project area were selected to sample this cover type. Five parameters were measured to develop an HSI

value at each sample site. These parameters included percent of ground vegetative cover consisting of herbs and grasses, average shrub height, distance to escape cover, average diameter of escape cover patches, and distance between escape cover patches.

Mallard – Mallard habitat was represented by the open water and agricultural (wintering), riparian herb, shrub/steppe/grass, and island (nesting), and emergent wetlands (brood rearing). Four variables were measured to determine an HSI value for mallard nesting. These were: 1) the distance between nesting cover and water with emergent vegetation (for broods); 2) height of the nesting cover; 3) percent canopy cover; and 4) the probable amount of disturbance by people and/or dogs. The brood rearing value of emergent wetlands was measured by determining the ratio of open water to water covered by emergent vegetation. Wintering habitat values were determined from agricultural crops (winter food) and velocities of open water areas (for resting). There were a total of 38 sites sampled in these habitats to develop an HSI value for the mallard.

Mink – Habitat variables measured in the field included the percent of shoreline cover within 1 meter of the waters edge, the percent tree/shrub canopy within 100 meters of waters edge, and the percent of the year that water is present. These variables were analyzed in riparian tree, riparian shrub, riparian herb, sand/gravel/cobble/mud, and emergent wetland habitat types which combined provided 33 sample sites.

Western meadowlark – Habitat variables in nine shrub/steppe/grass sample sites were measured by the evaluation team. Five variables were used to determine the HSI for each site. They included herbaceous canopy cover, percent

herbaceous canopy that is grass, average height of the herbaceous canopy, distance to nearest perch site, and percent shrub canopy cover.

Downy woodpecker – Six different sample sites were evaluated in the riparian tree cover type utilizing the downy woodpecker criteria. Two variables were measured: 1) basal area; and 2) number of snags per acre. These measurements were collected at six different sample sites in the project area.

RESULTS

The HSI scores and resultant changes in habitat units for each of the target species are discussed below and summarized in Table 3.

Spotted sandpiper

Spotted sandpiper utilize the sparsely vegetated mudflats, shoreline, and sand and gravel bars in the project area for foraging and nesting. These shoreline habitats comprised the fourth largest terrestrial habitat loss of acreage resulting from inundation by the project – 1,363 acres. This habitat had an HSI value of 1.0 for the spotted sandpiper. This impact resulted in a loss of 1,363 habitat units to the sandpiper.

Canada goose

The Canada goose was adversely impacted by the loss of 2,741 acres of island habitat as a result of the project. These islands which provided excellent goose nesting habitat prior to inundation by McNary Reservoir, were determined to have a high value (HSI = 0.8) by the evaluation team. Lower value juvenile

foraging habitat was also lost with the flooding of 14 acres of riparian herb, 1,872 acres of agricultural lands, 8,672 acres of shrub/steppe/grass, and 577 acres of sand/gravel/cobble/mud. These cover types were determined to have HSI values of 0.3, 0.2, 0.1, and 0.3 respectively. Project impacts to all habitats resulted in a combined loss of 3,484 habitat units.

Yellow warbler

The yellow warbler reproduces and feeds in riparian shrub habitat and also feeds in adjacent wetlands. The loss of 365 acres of riparian shrub habitat with an HSI value of 0.9 resulted in a loss of 329 habitat units to the warbler.

California quail

There were 8,672 acres of shrub-steppe-grass habitat flooded by the project, the largest terrestrial cover type impacted. This cover type, which provided an HSI value of 0.6 to California quail, lost 5,203 Habitat Units as a result of the project. Quail also utilize riparian shrub, riparian herb, and some agricultural habitats. These cover types were determined to have HSI values of 0.9, 0.5, and 0.4 respectively. Flooding of 365 acres of riparian shrub, 14 acres of riparian herb, and 2,029 acres of agricultural land resulted in a loss of 292, 7, and 812 habitat units respectively for quail.

Mallard

Mallard habitat losses resulted from the flooding of 8,672 acres of shrub/steppe/grass, 2,741 acres of islands, 2,029 acres of agriculture, 248

acres of emergent wetland, and 14 acres of riparian herb. These habitats had an HSI value of 0.4, 0.7, 1.0, 0.8, and 0.5 respectively. Together with, 15,685 acres of open water river habitat, these areas were replaced by 30,947 acres of new open water reservoir. A total combined loss of 6,959 habitat units to the mallard occurred with the McNary Project. However, the formation of McNary Reservoir caused a net gain of 13,744 Habitat Units of wintering habitat for the mallard.

Mink

Mink utilize riparian tree, riparian shrub, riparian herb, sand/gravel/cobble/mud, and emergent wetland habitats in the project area. The 1,255 acres of riparian tree habitat lost to the project had an HSI value of 0.4. The riparian shrub community lost 365 acres with an HSI value of 0.7. An HSI of 0.2 was found in the sand/gravel/cobble/mud which lost 1,363 acres. Riparian herb lost 14 acres with a moderate HSI value of 0.6. The 264 acres of emergent wetlands lost had the highest habitat value to mink (HSI = 0.8). Collectively, for all habitats, the mink lost 1,250 habitat units.

Western meadowlark

The Western meadowlark, common in the shrub/steppe/grass habitat, lost 8,672 acres of this habitat to the McNary Project. With an HSI value of 0.4, this resulted in a loss of 3,469 habitat units.

Downy woodpecker

The downy woodpecker lost 1,255 acres of riparian tree habitat with an HSI value of 0.3. This accounted for loss of 377 habitat units.

HYDROELECTRIC RESPONSIBILITY FOR LOSSES AND BENEFITS

The Power Act required that mitigation for wildlife losses be undertaken for "hydroelectric projects" having "various project purposes" (Section 4(h)(10)(C)). Congress stated that "monetary costs resulting from implementation of the (mitigation) program are to be allocated among projects, both Federal and non-Federal, in accordance with the relative impacts...". The Northwest Power Planning Council subsequently determined that funding authority for wildlife mitigation would be limited to Federal projects only, and to just one part of those Federal projects – the power purpose. They also determined that the level of mitigation responsibility would be based on a yet-to-be determined financial accounting procedure.

In view of the above, we have assessed biological impacts caused by the overall multi-purpose hydroelectric project. The wildlife impacts identified in this report are attributable to the changes in wildlife habitat which occurred as a direct result of the construction of the McNary Dam, Powerhouse, support facilities, and the creation of the McNary Reservoir. It is assumed the Power Council will establish the portion of the project to be mitigated under the Act and their program.

SUMMARY

Pre- and post-construction habitat conditions associated with the McNary Lock and Dam Project were evaluated by Habitat Evaluation Procedures (HEP). There

were 15,502 acres of terrestrial wildlife habitat flooded by the project. This resulted in significant habitat losses to shrub/steppe/grass, agriculture, sand/gravel/cobble/mud, and riparian tree cover types. In addition, 2,741 acres of island habitat was flooded. Impacts to habitat for Canada goose, western meadowlark, valley quail, mallard, spotted sandpiper, mink, downy woodpecker, and yellow warbler produced a combined loss of 19,397 habitat units. The increase of 15,262 acres of open water in the new reservoir created additional mallard wintering areas. This provided an increase of 13,744 aquatic habitat units for the mallard. Efforts will proceed to compensate the losses through enhancement of existing habitats and creation of new habitats. Compensation will be sought within the McNary Reservoir area, however offsite compensation opportunities will also be considered.

APPENDIX

A. Mammals, birds, amphibians, and reptiles found in the vicinity of the McNary Project Area

B. Unpublished Evaluation Species Models Used in Wildlife Impact Assessment for the McNary Project

1. Spotted sandpiper
2. Canada goose
3. California quail
4. Mallard

C. References

APPENDIX A

Mammals, birds, amphibians, and reptiles found in the vicinity of the McNary Project Area.

MAMMALS

Vagrant shrew
Whitetail jackrabbit
Blacktail jackrabbit
Mountain cottontail
Yellow-bellied marmot
California ground squirrel
Townsend ground squirrel
Northern pocket gopher
Great basin pocket
Ord kangaroo rat
Western harvest mouse
Deer mouse
Forest deer mouse
Montane vole
House mouse
Pika
Mink
River otter
Beaver
Muskrat
Raccoon
Badger
Striped skunk
Coyote
Bobcat
Porcupine
Mule deer
White-tailed deer
Rocky mountain elk

BIRDS

Common loon
Red-necked grebe
Horned grebe
Eared grebe
Western grebe
Pied-billed grebe
White pelican
Double-crested cormorant
Great blue heron
Black-crowned night heron
American bittern
Tundra swan
Canada goose
White-fronted goose
Snow goose
Mallard
Gadwall
Pintail
Green-winged teal
Blue-winged teal
Cinnamon teal
American widgeon
Shoveler
Wood duck
Redhead
Ring-necked duck
Canvasback
Lesser scaup
Undifferentiated scaup
Common goldeneye
Bufflehead
Ruddy duck
Hooded merganser
Common merganser
Turkey vulture
Goshawk
Sharp-skinned hawk
Cooper's hawk
Red-tailed hawk
Swainson's hawk
Peregrine falcon
Ferrigunous hawk
Rough-legged hawk
Golden eagle
Bald eagle
Marsh hawk
Osprey
Prairie falcon
American kestrel
Barn owl
Screech owl
Great horned owl
Snowy owl
Burrowing owl
Long-eared owl
Short-eared owl
Saw-whet owl
California quail
Ring-necked pheasantj
Chukar
Common snipe
Mourning dove
Hungarian partridge
Sandhill crane
Sora rail
Semipalmated plover
Killdeer
Common snipe
Long-billed curlew
Spotted sandpiper
Greater yellowlegs
Sanderling
American avocet
Wilson's phalarope
Herring gull
California gull

Ring-billed gull
Forster's tern
Common tern
Caspian tern
Common nighthawk
White-throated swift
Belted kingfisher
Common flicker
House finch
Pine siskin
American goldfinch
Rufous-sided towhee
Savannah sparrow
Lark sparrow
Dark-eyed junco
Chipping sparrow
White-crowned sparrow
Golden-crowned sparrow
Song sparrow
Varied thrush
Golden-crowned kinglet
Loggerhead
Starling
Solitary vireo
Yellow warbler
Yellow-rumped warbler
Sage sparrow
Vesper sparrow
Mountain bluebird
Yellowthroat
Yellow-breasted chat
House sparrow
Western meadowlark
Yellow-head blackbird
Red-winged blackbird
Northern oriole
Brewer's blackbird
Brown-headed cowbird
Luzili bunting
Evening grosbeak
Purple finch
Eastern kingbird
Western kingbird
Western wood peewee
Horned lark
Violet-green swallow
Tree swallow
Bank swallow
Rough-winged swallow
Barn swallow
Cliff swallow
Black-billed magpie
Common raven
Common crow
Black-capped chickadee
Winter wren
Bewick's wren
Long-billed marsh wren
Canon wren
Robin

REPTILES

Western yellow-bellied racer
Desert striped whipsnake
Great basin gopher snake
Wandering garter snake
Western rattlesnake
Western painted turtle
Western fence lizard
Sagebrush lizard
Wide-blotched lizard

AMPHIBIANS

Woodhouse's toad
Bullfrog

APPENDIX B

Unpublished Evaluation Species Models Used in Wildlife Assessment for the McNary Project.

1. Spotted Sandpiper
2. Canada Goose
3. California Quail
4. Mallard

Spotted Sandpiper

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed species, occurring on the margins of sandy ponds, sea shores, and rocks bordering streams.

Hays (1973) reported that spotted sandpiper nests were located in grassy upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used all the sparsely vegetated areas on an island as nest sites. Bent (1929) stated that nest sites were variable; high areas of sand island in high, rank sedge grass, on grassy, overgrown gravel bars, in driftwood piles, under extending tree branches, under rock ledges, and under decayed logs representing reported nest sites. Nest sites are close to water (Bent 1929). Oring and Knudson stated that spotted sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (1973) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) reported that spotted sandpipers nest just above the highwater mark on tree-lined shores. Stout (1967) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous cover 0.5 m in height and 30 m or less from the beach. Three nests were located in mixed deciduous woods 8-13 m high and 20-50 m from the beach. Miller and Miller (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 - 76.2 cm in height.

Hays (1973) stated that spotted sandpipers have a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial in winter.

Miller and Miller (1948) reported a colonial breeding situation, 38 pairs/5.46 ha. Kuenzel and Wiegert (1973) reported a territorial size of approximately 1.21 ha per bird. Heideman and Oring (1976) stated that 4-5 pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 active nests/l.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

Spotted sandpipers feed primarily on insects, especially aquatic insects.

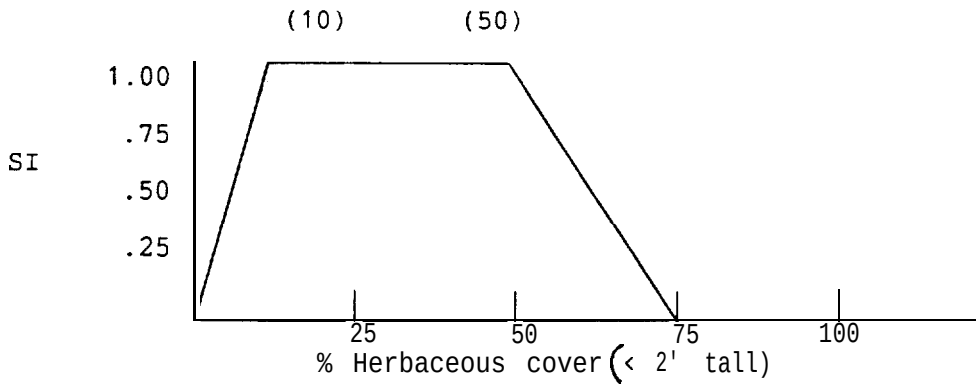
SPOTTED SANDPIPER SUITABILITY INDEX

Nesting Cover (V1)

A mosaic of herbaceous ground cover with an overall density of less than 50% and less than 2' high (an overstory of deciduous trees can be present if the ground cover requirements are met).

Flooding probably not a significant problem as the sandpiper is quite capable of renesting if necessary.

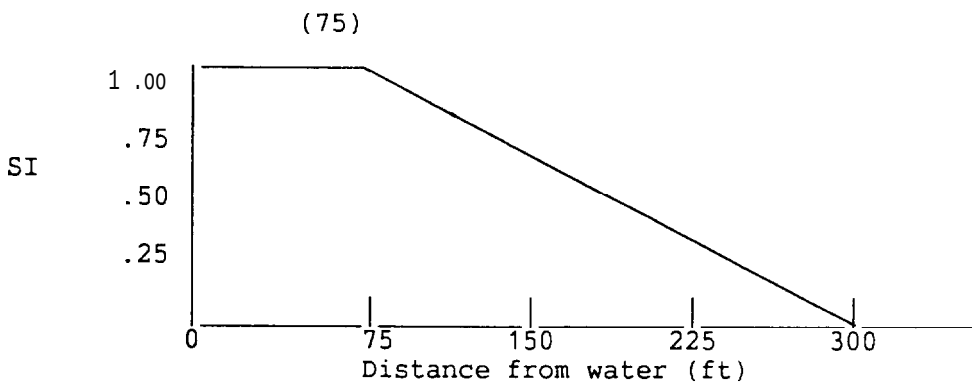
[150 ft. transect, 25 ft. intervals. Begin transect where V3 crosses daily high water mark and continue inland 150 ft.]



Nesting distance from water (V2)

Optimum Nesting habitat is within 75 ft. of water.

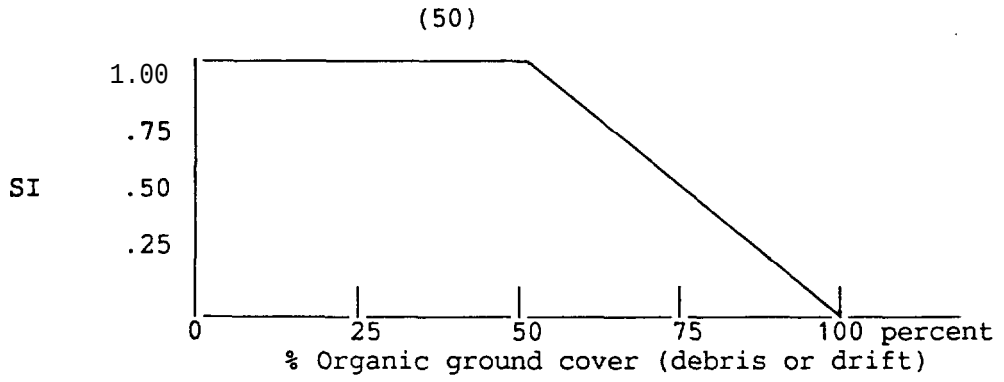
[measure minimum distance between nesting habitat and water]



Foraging habitat (V3) -

Open or sparsely vegetated shorelines (gravel, riprap, or sandy substrates) within 150 feet (45 m) of water (normal pool) which may contain some organic debris or drift.

[Begin transect at EOW and go inland 150 ft. with measurements every 25 ft.]



Model Equation

$$HSI = \frac{V1 + V2 + V3}{3}$$

Spotted Sandpiper

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CANADA GOOSE MODEL

This model is a modification of the Canada goose model developed by Dave Lockman et. al. for the evaluation of Canada goose nesting and brooding habitat on the Snake River at Palisades Reservoir. This modification was developed by Patrick Wright, Larry Rasmussen, and Jim Bottorff of the Portland Field Station, Fish and Wildlife Service and The Dalles, John Day, and McNary wildlife loss assessment HEP tram members for use in describing the quality of nesting and brooding habitat in the vicinity of these projects.

Nesting habitat

Islands (V1)	$1 Value
Stable islands present; islands have relatively high shoreline/area ratio; cover indicative of stability; ground cover on portions of island 4"-8" high.	0.8-l .0
Stable islands present; relatively low shoreline/area ratio; cover on island <4" or >8".	0.5-0.7
No stable islands, or islands with limited or no cover.	0.0-0.4

Brood Rearing Habitat

Late April - July

Foraging Area (V3)	SI Value
Distance from nesting areas to foraging zones ≤1 mile (preferably within site of the nesting area); forage ≤4" tall and ≥ one acre in size; foraging zones total ≥10 acres per mile of river; access to foraging zone within 25 meters of open water and not precluded by physical obstruction or dense vegetation (predator cover).	0.7-1.0
Distance from nesting areas to foraging zones ≥1 and ≤2 miles; forage ≤4" tall and ≥ one acre in size, foraging zones total 5 to 10 acres per mile of river; >25 meters but <50 meters from open water (escape cover).	0.4-0.6
As above except foraging zone >2 miles from nesting areas and >50 meters from open water (escape cover).	0.0-0.3

Model Equation

$$HSI = \frac{V1 + V3}{2}$$

CALIFORNIA QUAIL
Grassland/Agricultural Type

General

California quail (Lophortyx californicus) are year-around residents in this Ecoregion and are most abundant in the brush-grassland successional stage in areas where water is available (Crawford 1977). California quail habitats include brushy thickets, scattered low branched trees, grassland, dry and irrigated cropland, orchards, and vineyards (Sumner 1935; Emlen and Glading 1945; and Edminster 1954).

Food Requirements

Adult quail are essentially vegetarians (Edminster 1954). The California quail feeds in open areas with abundant annual herbaceous vegetation where ground cover is not dense enough to impede movement (Emlen and Glading 1945; Edminster 1954; and Crawford 1977). Highest densities in brush-grassland habitat types in Oregon were found in areas with bare ground percentages of 30% and 45% (Crawford 1977). Seeds comprise 60 to 75% of the year round diet, and greens account for 25 to 30% of the diet (Edminster 1954). Acorns and berries are sometimes eaten by quail in small quantities in late summer and fall. Legume seeds (and some leaves) comprised 25 to 35% of the annual diet. Grasses, including grains, account for 10 to 25% of the annual diet while annual weed seeds account for 20 to 60%. Woody plants account for only 3 to 5% of the diet. The berries of snowberries (Symphoricarpos sp.), brambles (Rubus spp.), and poison oak (Rhus diversiloba) make up a o f the summer and fall diet. The most important plant families in the diet of quail in California were legumes (Fabaceae), grasses (Poaceae), geraniums (Geraniaceae), and composites (Asteraceae) (Sumner 1935). Insects account for up to one-third of the diet of young quail during their first few weeks of life (Edminster 1954).

Water Requirements

Surface water is required by California quail throughout the year although succulent foods meet some of the water needs for quail within the humid Pacific coastal belt (Edminster 1954).

Cover Requirements

California quail require cover for feeding, roosting, escape, loafing, and nesting (Edminster 1954). Cover needs associated with reproduction are discussed under Reproductive Requirements.

The best food-producing cover types are open brushlands and non-brushy grasslands (Edminster 1954). The usefulness of cultivated fields, especially small grains and hay, as feeding areas depends on the proximity of the fields to escape cover. Areas where clean farming methods are used do not provide suitable feeding cover for quail. Dense stands of brush or grasses or closed canopy stands with little understory are deficient in food supplies or do not provide suitable feeding cover (Sumner 1935).

Dense low shrubs, trees, trailing vines, weed patches, dense grass, piles of debris, and even rockpiles serve as escape cover (Emlen

and Glading 1945; Edminster 1954). Crawford (1977) found that blackberry brambles were used almost exclusively for escape cover in the Willamette Valley. Escape cover is characteristically lower than good roosting cover and taller and denser than good nesting cover (Edminster 1954). Escape cover is also used as loafing cover. Optimal escape and loafing cover is provided by clumps of plants 10 to 20 feet (3-6 m) in diameter, and spaced not more than 200 feet (61 m) apart (Emlen and Glading 1945).

Quail roost in areas of dense foliage (either tall shrubs or scattered trees with low-growing, densely foliated branches) with suitable roost sites from 15 to 25 feet (4.5-7.6 m) above ground (Sumner 1935; Edminster 1954). In California, thickly branched trees and shrubs from 5 to 30 feet (1.5-9.1 m) tall provide suitable roosting cover with at least one roosting site per 30 to 40 acres (12.1-16.2 ha), or at 0.25 mile (0.4 km) intervals (Emlen and Glading 1945).

Reproductive Requirements

California quail require areas of low vegetation that provide concealment and shade for nest sites (Sumner 1935; Emlen and Glading 1945; and Edminster 1954). Nests are on the ground in a variety of locations and are frequently found in edge situations (Edminster 1954). Young quail require thick, brushy cover. Broods occupy areas of 10 to 30 acres (4-12 ha) by their eighth week. Broods combine to form coveys as the summer progresses.

Special Habitat Requirements

No special habitat requirements were found in the literature.

Interspersion Requirements

Quail require a mixture of cover types including open areas with abundant annual herbaceous vegetation, dense foliage from 5 to 30 feet (1.5-9.1 m) tall for roosting, clumps of low plants for escape and loafing, suitable ground sites for nesting, and sources of surface water. Optimal habitat conditions consist of a high degree of interspersion of herbaceous and woody cover and water sources within a small area. In California, a cruising radius of approximately 50 feet (15 m) has been observed (Sumner 1935). In Oregon, coveys of quail ranged up to 0.25 mile (0.4 km) from their evening roost site (Yadon 1954). Fall and winter range of coveys is limited by the amount of protective shrub cover (McMillan 1964). Covey size appears to be influenced more by food supply and adequacy and juxtaposition of shelter in relation to food supplies than by any other factor (Edminster 1954).

Special Considerations

Clean farming methods that reduce brushy fence rows, weedy patches, and similar brushy edges reduce the suitability of the habitat for California quail (Sumner 1935; Edminster 1954). Overgrazing may reduce brushy cover to the point that habitat becomes unsuitable for quail (Edminster 1954). Irrigated croplands provide both surface water and food but these areas often lack suitable shelter unless brushy cover is left.

June 1978

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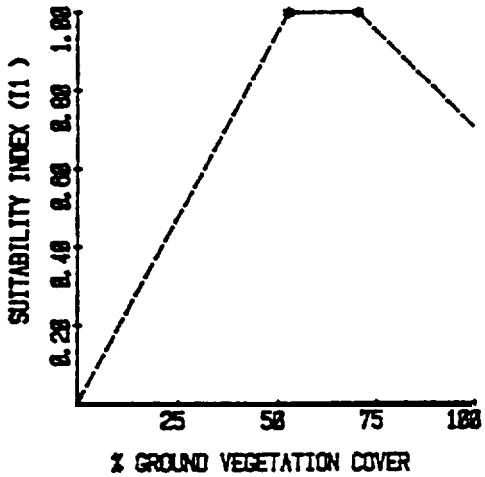
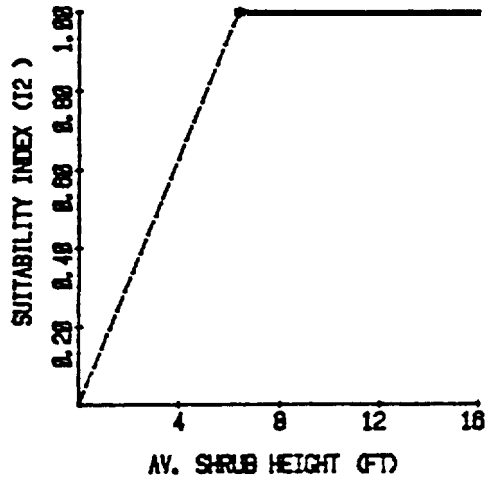
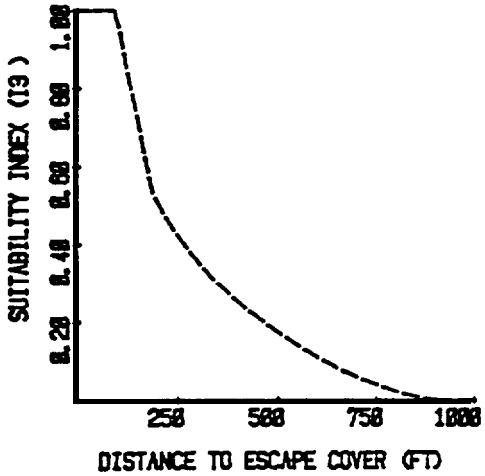
JUNE 1978

CALIFORNIA QUAIL

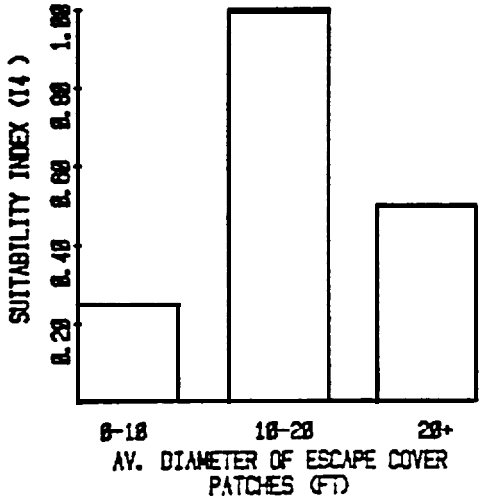
GRASSLAND/AGRICULTURAL

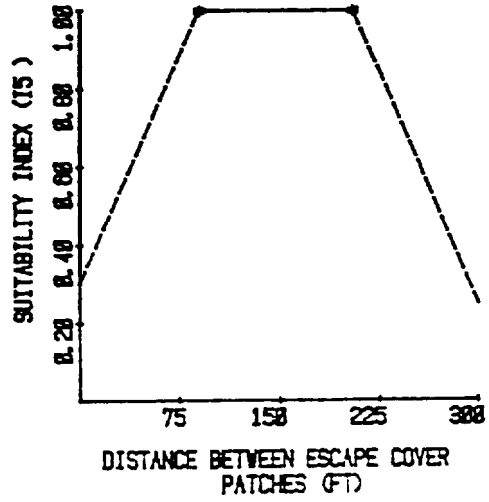






ESCAPE COVER=DENSE GROWTH OF SHRUBS, VINE TANGLES, OR DENSE TALL GRASSES OR FORBS GREATER THAN 8 INCHES TALL





June 1978

HABITAT SUITABILITY INDEX

California Quail in Grassland/Agricultural Type

Ecoregion 2410

$$\underline{\text{Cover Value}}\ (X_1) = \frac{II + I_2 + (I_3 \times I_4 \times I_5)^{1/3}}{3}$$

Where : I_1 = Suitability Index (SI) of percent ground vegetation cover.

I_2 = SI of average shrub height.

I_3 = SI of distance to escape cover.

I_4 = SI of average diameter of escape cover patches.

I_5 = SI of distance between escape cover patches.

The Habitat Suitability Index is XI.

MALLARD MODEL

This model was developed from information provided in several different models including: (1) the Draft Habitat Suitability Index model, Mallard (Breeding), U.S. Fish and Wildlife Service, Division of Ecological Services, Sacramento, California, July, 1985; (2) Draft Habitat Suitability Index Model, Mallard (Wintering), U.S. Fish and Wildlife Service, Division of Ecological Services, Sacramento, California, July, 1985; and (3) Habitat Suitability Index Models: Dabbling Ducks, by Patricia D. Rice, U.S. Fish and Wildlife Service, Great Basin Complex, Reno, Nevada, February, 1984. These models were modified for The Dalles, John Day, and McNary wildlife loss assessment by HEP team members according to information provided by the local, state, federal, and tribal biologists.

General

The mallard (*Anas platyrhynchos*) utilizes this portion of the Columbia basin for both nesting and wintering habitat. Typical mallard habitats include riparian herb, emergent wetlands, occasionally some agricultural lands (grain crops) and shrub/steppe areas, and open waters.

Wintering Habitat

Wintering populations of mallards are often congregated around the shallow water graveled areas associated with islands where they are protected from human disturbance and predators. Large numbers of mallards utilize backwater areas and slower velocity portions of reservoirs (especially John Day and McNary Reservoirs) and rivers for resting. The main reservoir area with higher velocities and barge traffic is only used occasionally. Daily flights to nearby agricultural crops (cereal grains and corn) provide much of the food requirements in the mid-Columbia basin area.

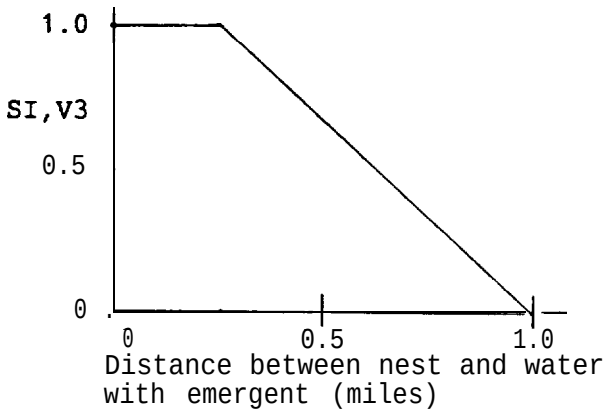
Nesting Habitat

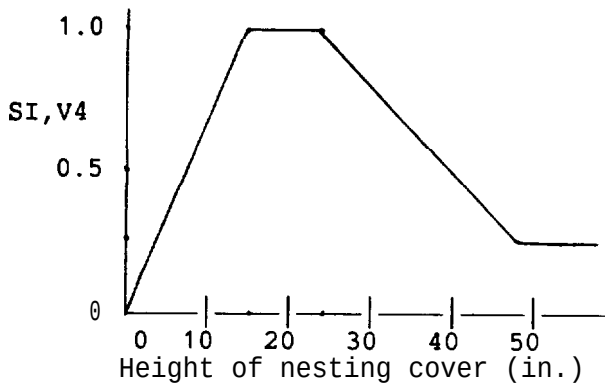
Nesting commonly occurs in a riparian herb cover type that is located in the vicinity of emergent wetlands. Herbaceous vegetation between 15 and 24 inches tall with at least a 75 percent canopy cover is preferred. Mallard nests are found in greater numbers and have a higher success rate if they are within 1/4 mile of water with emergent vegetation. The emergent vegetation provides cover and rearing area for the juvenile birds. Emergent wetlands with 40 to 60 percent vegetative cover (relative to open water) are preferred. The success of an otherwise optimum nesting area can be significantly reduced by disturbance from people and dogs.

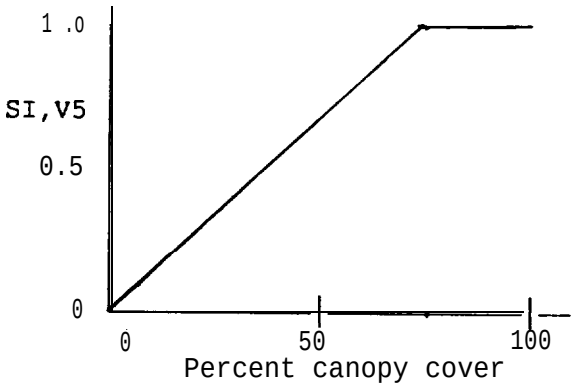
MALLARD HABITAT SUITABILITY INDEX

NESTING

Cover Types: Riparian Herb and Shrub/Steppe/Grassland







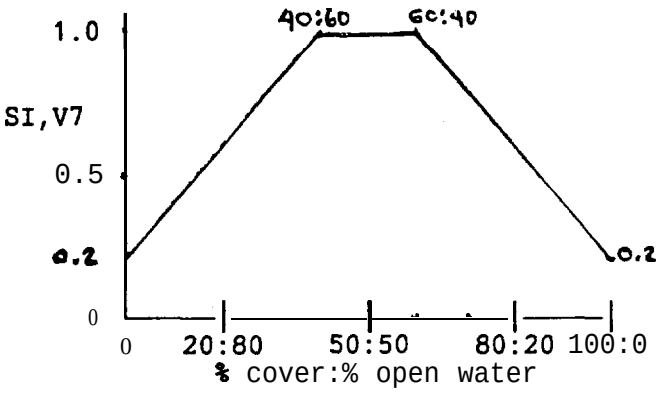
V6, Disturbance by people and dogs

	S.I.
Low	0.8-1.0
Medium	0.4-0.7
High	0.0-0.3

Model Equation

$$HSI = \frac{V3 + V4 + V5}{3} \times V6$$

Cover Type: Emergent wetland



Model equation

HSI = V7

WINTERING

Cover Type: Open Water

V-l, Velocity of open water

Preproject
main river SI = 0.5
backwater SI = 0.8

Postproject
main river SI = 0.7
backwater SI = 0.9
barge channel SI = 0.4

Cover Type: Agricultural (food crop)

V-2, crop management

For the mid-Columbia Basin projects the HEP study team assumed that both pre- and post-project crop management provided an adequate mallard food supply. Food supply is not a limiting factor.

Model equation for wintering mallard: HSI = V-l

APPENDIX C
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WILDLIFE IMPACT ASSESSMENT
THE DALLES PROJECT, OREGON AND WASHINGTON

Annual Report 1989

Prepared by

Larry Rasmussen
Patrick Wright

U.S. Fish and Wildlife Service
Portland Field Station

Prepared for

Joe DeHerrera, Project Manager
U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97208-3621

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Abstract

The Habitat Evaluation Procedures (HEP) were used to evaluate pre- and post-construction habitat conditions of the U.S. Army Corps of Engineers The Dalles Project in Oregon and Washington. The project directly impacted 9,138 acres of wildlife habitat. Eight evaluation species were selected with losses and gains expressed in Habitat Units (HU's). One HU is equivaient to 1 acre of prime habitat. The evaluation calculated a gain of 2,068 HU's of lesser scaup wintering habitat. Losses cf 427 HU's of great blue heron habitat, 439 HU's of Canada goose habitat, 534 HU's of spotted sandpiper habitat, 172 HU's of yellow warbler habitat, 183 HU's cf black-capped chickadee habitat, 330 HU's of mink habitat, and 247 HU's of meadowlark habitat occurred as a result of the project. This amounts to a combined loss of 2,330 HU's. Some wildlife measures may be implemented on project lands, however, collectively they will likely fall short of adequately mitigating the wildlife losses attributable to the project.

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INTRODUCTION

This report presents an analysis of impacts on wildlife and wildlife habitat as a result of the construction and operation of the Corps of Engineer's The Dalles Lock and Dam Project. The study was funded by the Bonneville Power Administration (BPA) under the authority of Measure 1004 (b)(2) and (3) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4(h) of the Northwest Electric Power Planning and Conservation Act of 1980. The primary objective of the study was to estimate the net effects to wildlife resulting from hydroelectric development and operation of The Dalles Project.

State, Federal and tribal agencies worked cooperatively in the assessment process to accomplish the objective. These agencies included the Cregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and Yakima Indian Nation. Approximately five meetings and four on-site field trips were conducted by these agencies (from November 1988 to September 1989) to develop the impact analysis.

PROJECT DESCRIPTION

The Dalles Lock and Dam Project is located at The Dalles, Oregon on the Columbia River at river mile (RM) 192 (Figure 1). The project was built by the Corps of Engineers and began operation in 1957. It was authorized for the purposes of power, navigation, and irrigation. The dam creates a 23-mile-long impoundment which extends upstream to John Day Dam (RM 215). The Dalles Project is normally operated between elevations 155 and 160 feet msl

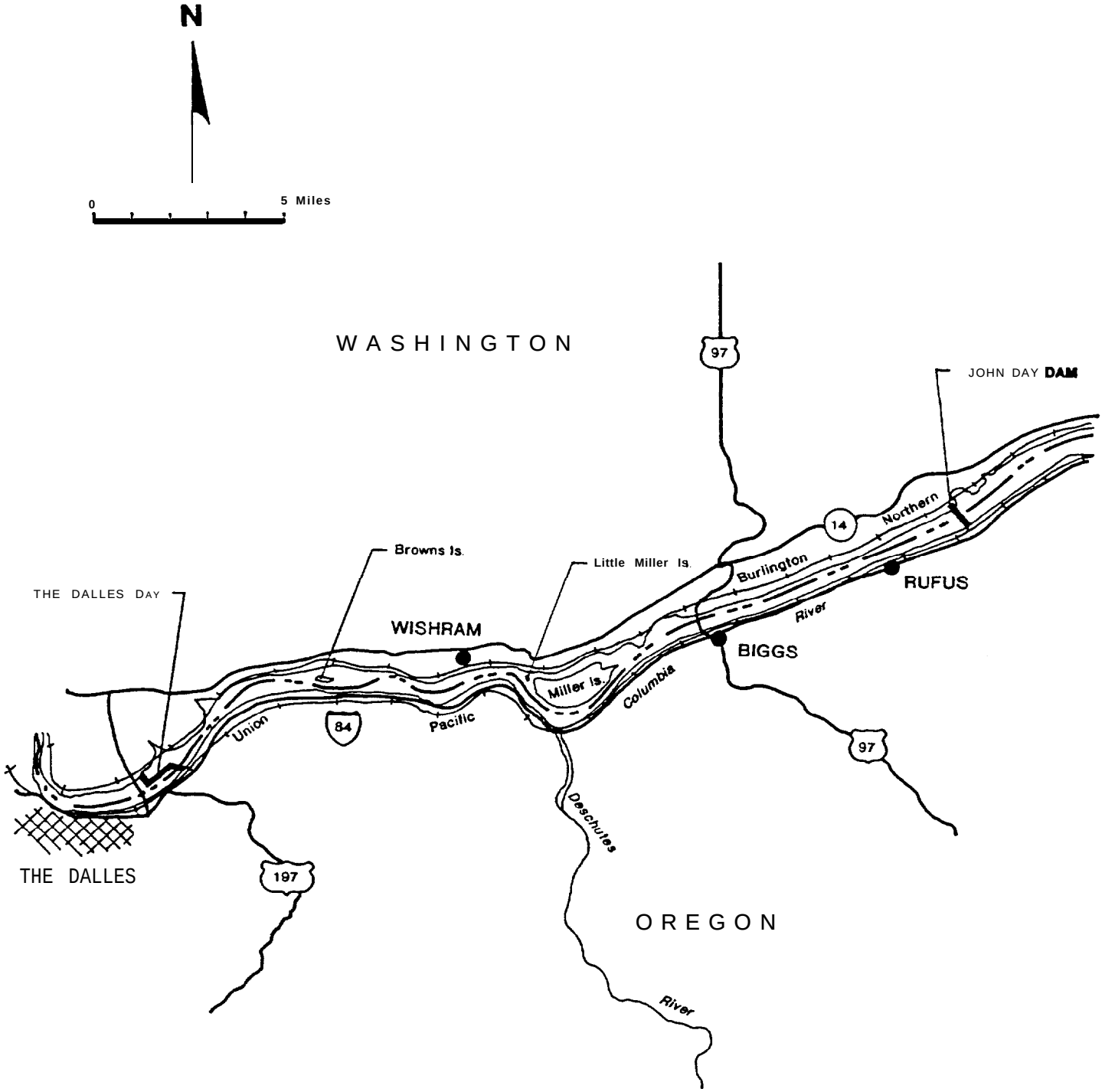


FIGURE 1. THE DALLES RESERVOIR

(measured at the dam). Maximum flood pool elevation is 176.5 feet msl. The reservoir surface area measures about 9,200 acres. The powerhouse contains 22 generators with a total capacity of 2,100,000 kilowatts (kw) of power.

STUDY AREA

The impact area for The Dalles Project is defined as the reservoir area from, and including, The Dalles Dam and support facilities upstream to John Day Dam. Adjoining backwaters and rivers which became inundated by the reservoir are considered part of the impact area. Although the two major highways and railroads along the north and south shorelines have impacted wildlife habitat, they are not considered a result of the project. The area included in the habitat analysis extended into the upland areas adjacent to the reservoir between the vertical slopes of the gorge.

MATERIALS AND METHODS

VEGETATIVE ANALYSIS

Preconstruction and recent vegetation cover types of The Dalles Dam and Reservoir area were mapped based on black and white aerial photographs obtained from USACE in Portland. Most preconstruction photographs were taken in 1954; the scale was 1:9,600. A few 1951 photographs of the dam area were used to determine the vegetation before construction began. Recent photography was flown in 1979 at a scale of 1:48,000.

Base maps were derived from 1:24,000 USGS quadrangle maps screened on mylar film. Mapping extended approximately 1/4 to 1/2 mile beyond the reservoir

shoreline. Vegetation cover types were based in part on categories described by Hall et al. (1985) and are described below.

The aerial photographs were examined under a mirror stereoscope. Areas of discernible different vegetation were noted and polygons corresponding to them were sketched on the base map and labeled with a symbol designating vegetation cover type. The polygons were located on the base map using known landmarks, slope, ridge and valley topography, and field observations. Proportional dividers were frequently used to determine relative sizes of landmarks, since the photographs and maps were of several scales.

The recent maps were ground checked on May 16 and 18, 1989. Cover type categories designated on the maps were visually verified and, if necessary, changes were made on the maps. All maps were then finalized and traced onto mylar overlays to the base maps. A boundary including only the area directly affected by the project was defined on the maps.

Mapping was generalized in uplands outside the affected area to avoid having many small polygons which would have been difficult to discern. Where two or more cover types were intermixed, the one with the greatest proportional coverage was used to designate that area. Where the proportion was approximately equal, the polygon was labeled with both cover type codes.

Acreages of map categories within the affected area boundary were calculated from blackline reproductions of the maps, using the known area of five sections per map as a basis for assigning acreages to polygons. The project area was narrow and contained many small polygons; therefore a dot grid was

used to calculate acres. Dot counts between preconstruction and recent maps agreed within 3 percent.

Franklin and Dyrness (1973) show mean annuai precipitation decreasing from about 16 inches per year at The Dalles to about 8 inches per year in the vicinity of John Day Dam. Strong winds are common along the river in all seasons. Winters are cold and fairly dry. Summers are characterized by hot, dry winds blowing from interior valleys.

Although the natural vegetation along The Dalles reach is usually considered to belong to the bluebunch wheatgrass-Sandberg's bluegrass (Agropyron spicatum-Poa sanbergii) zonal association (Franklin and Dyrness 1973), it is difficult to find even small areas free of alien species. Cheatgrass (Bromus tectorum L.) is the most common grass species over much of the area. Shrubs, particularly green and gray rabbitbrush (Chrvsothamnus nauseosus [Pall.] Britt. and Chrvsothamnus viscidiflorus [Hook.] Nutt.), have invaded what both Daubenmire (1970) and Franklin and Dyrness (1973) indicate were primarily grass communities.

The minimum map unit within the project was on the order of 1 acre. This allowed depiction of some, small, narrow patches of vegetation along the highways and railroads which bordered the river and the reservoir. Outside the project area the minimum map unit was closer to 5 acres and, when large areas were a mosaic of several vegetation cover types, the one comprising more than 50 percent of the area was used to designate that polygon. In the descriptions of cover types, the more common inclusions are noted.

Fourteen vegetation cover type/map categories were identified in the area mapped. Table 1 shows the acreages of extant vegetation cover types in 1954 within the now flooded area (i.e., below the new reservoir shoreline). Direct project construction impacts identified on 1951 and 1954 aerial photographs occurred in the immediate vicinity of The Dalles Dam. These construction activities impacted about 120 acres, most of which were the talus/rock cover type. Most of these areas were still occupied by dam-associated facilities or industrial developments in 1979.

Agricultural Lands: Croplands, orchards, pastures and parks were included in this category and accounted for 24 acres of land lost to the project. In 1979, about 4 percent of the project area was farmed. Orchards were common along the river in 1954, particularly at Maryhill; few remained in 1979. Most of the land suitable for agriculture within the project area was inundated by The Dalles Reservoir. Some parks were developed as a result of new embayments created by The Reservoir. These include those at Spearfish Lake, Horsethief Lake, Maryhill, and the mouth of the Deschutes River. The parks at Celilo and just below John Day Dam are also located on lands adjacent to The Dalles Reservoir. Parks accounted for almost half the areas mapped as agriculture in 1979.

Grasslands: This vegetation cover type dominated the uplands above the project area in 1954 and was common on low bluffs along the river. By 1979, shrubs had invaded most grasslands to the extent that they became dominant within the communities. This invasion was almost certainly unrelated to the reservoir -- it more likely resulted from increased human use and from fires. Woody plant cover in the remaining grasslands was generally less than 50

Table 1. Acreages of Vegetation and other Cover Types Impacted (lost) By The Dalles Project.

VEGETATION COVER TYPE	ACRES
Mainland	
Agricultural Lands	24
Grassland	228
Shrubland	157
Riparian Hardwoods	183
Riparian Shrub	161
Riparian Herb	81
Emergent Wetland	15
Sand Dunes/Blowouts	93
Sand/Gravel/Cobble/Mud	325
Talus/Rock	390
Disturbed/Bare/Riprap	176
Open Water - Lakes & Ponds	50
Residential/Urban/Industrial	40
Parks	0
TOTAL MAINLAND	1,923
Islands	
Agricultural Lands	0
Grassland	0
Shrubland	27
Riparian Hardwoods	46
Riparian Shrub	28
Riparian Herb	0
Emergent Wetland	0
Sand Dunes/Blowouts	24
Sand/Cobble/Gravel/Mud	209
Talus/Rock	152
Disturbed/Bare/Riprap	0
Open Water - Lakes & Ponds	1
Residential/Urban/Industrial	1
TOTAL ISLANDS	488
River	
Open Water - Celilo Canal	141
Open Water - River	6627
Open Water - Reservoir	0
TOTAL RIVER	6,768
TOTAL MAINLAND, RIVER, & ISLANDS	9,179

percent over most of the polygon, with considerable variation from practically no shrubs to dense patches scattered throughout the area mapped as a single polygon. The reservoir flooded 228 acres of grassland habitat.

Shrubland: Shrub communities were defined as having greater than 50 percent woody crown cover, with shrubs being under 15 ft. tall (Hall et al. 1985). Most of the shrubland cover type within the project area was situated on rocky bluffs between the railroads and the shorelines. Stands were weedy and often showed signs of frequent or recent disturbance. Big sagebrush (*Artemisia tridentata* Nutt.) and rabbitbrush were the most common shrubs. On sand blowouts and dunes (q.v.), bitterbrush (*Purshia tridentata* [Pursh] DC.) was often dominant. *Ceanothus* sp. occurred on higher slopes near The Dalles, but none was seen inside the project area. Some shrubby areas along the edges of talus on the Oregon side included blackberry thickets (*Rubus* spp.) and mounds of virgin's-bower (*Clematis* sp.). Construction of The Dalles Project resulted in the inundation of 184 acres of shrub habitat. Because the grassland and shrubland cover types are so intermingled and their associated wildlife species are common to both habitats, they have been combined for HEP into a "shrub/steppe/grassland" category.

Upland Hardwoods: These stands of nearly pure hardwoods (less than 30 percent conifer cover) occurred outside the project area, on the Washington side above Horsethief Lake. A few patches of tree-of-heaven (*Ailanthus altissima* Swingle) grew along I-84 and the railroad in the vicinity of the Deschutes River. They were shrubby in 1979 and were included in the riparian shrub category rather than in this category.

Riparian Hardwoods: Black cottonwood (Populus trichocarpa T. & G.) was the dominant component of this cover type. It was often accompanied by willow (Salix spp.), both shrubby species and fairly large trees. Russian olive (Eleagnus angustifolia L.) was sporadically abundant along the river's edge -- more so in 1979 than in 1954. Alder (Alnus spp.) occurred in the vicinity of The Dalles, and hackberry (Celtis reticulata Torr.) appeared sporadically in riparian woodlands throughout the area. A loss of 229 acres of riparian tree habitat resulted from the project.

Riparian Shrub: This cover type included young stands of riparian hardwoods, bands of shrubby vegetation along inlets and embayments, and willow thickets on sandbars. The latter must be considered ephemeral, since high water could wash them away at any time. False indigo (Amorpha fruticosa L.), an introduced shrub, was probably the most common species in this cover in 1979. Certainly it was abundant when the maps were ground truthed. Both it and Russian olive seem to be spreading downstream. At least 70 percent of each of these mapped areas supported woody vegetation less than 15 feet tall. An occasional tree or snag was present and forbs and grasses varied from scattered and sparse to abundant. Many of the areas mapped as Riparian Hardwoods and Riparian Shrub were wetlands. The project area contained 189 acres of riparian shrub that were flooded by the reservoir.

Riparian Herbs: This vegetation cover type comprised low-growing vegetation, chiefly herbaceous, on sand bars, mud flats, and other riparian substrates. Almost always weedy, it included shrubby willows and seedling cottonwoods as well as a variety of forbs and grasses. Mustards (Brassicaceae), docks (Rumex spp.), pigweeds (Chenopodium spp.) and Russian thistle (Salsola kali L.), and composites (Asteraceae) were typically dominant in these communities. Grasses

present usually included species such as foxtails and squirreltails (Hordeum spp. and Sitanion spp.), cheatgrass, and reed canarygrass (Phalaris arundinacea L.). Total plant cover rarely exceeded 75 percent, but had to be at least 25 percent to distinguish this cover type from sand/gravel; cobble/mud. A large area of this cover type occurred just west of Rufus in 1954. It was apparently composed of cobbles and well above normal high water. All that remained in 1979 was a series of sand and gravel bars. The reservoir covered 81 acres of riparian herb habitat.

Emergent Wetland: Characterized in the project area by wet soil supporting sedges, rushes, or cattails, these areas usually occurred where drainage from nearby slopes was interrupted by railroad or highway embankments or agricultural activities. Outside the project area, most emergent wetlands were caused by seepage or runoff form agricultural lands upslope. Few emergent wetlands were in the project area, resulting in only 15 acres being flooded.

Sand dunes/blowouts: Several instances of this cover type occurred within the project area, although most were on higher slopes. One large dune, just east of The Dalles Dam, was stabilized about 1985 and is no longer evident to the passerby. Rabbitbrush was noted on many dunes and blowouts during the ground checking in June 1989. The difference between this cover type and sand/gravel/cobble/mud was sometimes positional--if sandy areas occurred on low, level areas along the river or reservoir, they were mapped as the latter. This was done even if they were obviously part of a blowout or dune system, since they were, like all riverine sand bars, subject to flooding at high water.

Sand/Gravel/Cobble/Mud: There were 534 acres of sand/gravel/cobble/mud habitat lost with the project. This was the largest impact to any of the wildlife cover types and second largest of all cover types combined. Most of this cover type occurred along the rivers and was probably under water during periods of high water before The Dalles Dam was built. Some vegetation was present cn many of the sandbars along the river, although it was never abundant. It usually consisted of seedling willows, scattered grasses and forbs, and an occasional shrubby willow or black cottonwood. Some of the occurrences of this cover type had the potential to develop into riparian hardwood, riparian shrub, or riparian herb cover types, given a sufficient period without washouts by the river.

Talus/Rock: This cover type was one of the most extensive inundated by The Dalles Reservoir. It included scablands, rocky cliffs, pinnacles, and talus slopes. Vegetation was present although usually quite sparse and included shrubs and herbs. The scablands were fairly heavily vegetated for brief periods in the spring when annual grasses and spring forbs were present; the rest of the year, crustose lichens and acrocarpus mosses were the most abundant vegetation. The rocky islands that gave The Dalles its name are included in this cover type, as are most other islands within the project area. More than half of the talus/rock inundated was on islands. Most of the areas mapped as talus/rock were rock rather than talus; those which were not scablands were most often rocky basalt cliffs as typified by those above Celilo. The few talus slopes within the overall study area were outside the impact area. The old Celilo ship canal between The Dalles and Celilo was carved out of basalt scablands for most of its length. The Dalles Dam itself, and surrounding construction area, was almost entirely rocky habitat.

Disturbed/Bare/Riprap: Areas where severe or continued disturbance or vegetation management preclude the natural re-establishment of vegetation are included in this map category. It occurred most commonly along railroad and highway rights-of-way, particularly where they bordered the river or reservoir. This map category frequently included narrow bands of sand along the reservoir's edge. It also intergraded with the talus/rock category in some instances. Vegetation was usually sparse and generally weedy.

Open Water: Open water includes rivers, lakes, ponds, and The Dalles Reservoir. The reservoir and river acreages (including sloughs and embayments) were separated out from other open water areas. Many cf the ponds and lakes in the project area contained some emergent or submergent vegetation. However, this vegetation was rarely found in the rivers, sloughs, embayments or the reservoir.

The Columbia River and its associated sloughs and embayments comprised 6,768 acres of riverine habitat prior to the project. The Dalles Dam destroyed this riverine habitat and replaced it with 9,193 acres of reservoir. This includes the embayments behind the railroads and highways as well as river mouths flooded by the pool.

Residential/Urban/Industrial: Cities, towns, major residential areas, and industrial developments were included in this map category. Individual houses usually occupied areas too small to map and farm buildings were included in the Agricultural Lands category.

HABITAT EVALUATION

Habitat Evaluation Procedures (HEP) were utilized to evaluate the quality of wildlife habitat in the project area prior to and after construction. The HEP involved an interagency team of biologists who selected appropriate evaluation species and then analyzed habitat conditions based on models developed for each of those species. The species utilized in the evaluation (target species) were selected because their particular habitat requirements were indicative of major vegetative cover types that were impacted by the project. The target species often represented a larger group of species with similar habitat requirements, and were of special significance in the study area from an economical, ecological, social, or environmental standpoint. The interagency group selected eight target species for the HEP evaluation. These species and the rationale for their selection are identified in Table 2. A list of all wildlife species present in the project area is provided in Appendix A. Initially the mallard was also included as a target species. However, as HEP field data collection began, it became apparent that the mallard was not an appropriate species for evaluating islands or riparian herb. Mallards were initially selected to evaluate islands because large numbers of wintering mallards are often seen on the gravel and cobble peninsulas and islands like those near Rufus. However, this use seems to be associated with the shallow gravel bars and not because of the presence of islands. The islands on The Dalles pool (e.g. Miller and Browns Islands) do not have the large mallard concentrations. The study team agreed that the

Tabie 2. Target species selected fcr The Dalles HEP and the rationale for their selection.

Species	Rationale
Spotted sandpiper (*Actitis macularia*)	A representative of migratory shorebirds which utilize the sparsely vegetated islands, mudflats, shorelines, and sand and gravel bars associated with The Dalles Project area. Collectively these habitats comprised the largest terrestrial loss of acreage resulting from the project.
Lesser scaup (*Aythya affinis*)	A migratory waterfowl species commonly observed utilizing open water habitat of The Dalles Reservoir during the winter. Representative of other diving waterfowl which may use the area. Existing HEP model available.
Canada goose (*Branta canadensis*)	A migratory bird of national significance sensitive to island nesting habitat and associated shoreline brooding areas. Cultural significance.
Great blue heron (*Ardea herodias*)	Carnivore which forages on a variety of vertebrates in shallow water. The sand/gravel/cobble/mud shorelines of The Dalles Reservoir are commonly used as foraging areas. Existing HEP model available which is sensitive to changes in this habitat. Cultural significance.
Yellow warbler (*Dendroica petechia*)	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. Existing HEP model which is sensitive to the targeted habitats - riparian shrub and adjacent wetlands.
Black-capped chickadee (*Parus atricapillus*)	Representative of species utilizing mature forest canopies and forest cavity nesters. HEP model available.
Mink (*Mustela vison*)	Carnivorous furbearer, feeds on a wide range of vertebrates. Utilizes shoreline and adjacent shallow water habitats. HEP model available. Cultural significance.
Western meadowlark (*Sturnella neglecta*)	A species common to shrub/steppe/grassland habitat, the largest terrestrial habitat type flooded by the McNary project. This bird, well known for its melodious song, feeds primarily on insects and seeds.

gravel and cobble habitat (which the wintering mallards are attracted to) is adequately evaluated by two other target species (sandpiper and great blue heron). The mallard was also proposed to evaluate riparian herb habitat. Field inspection, however, revealed that practically no riparian herb is present. Less than 1 percent of the flooded habitat was riparian herb and only 47 acres were remaining in 1979. Furthermore, the remaining riparian herb consisted only of 1- to Z-inch-high vegetation in August; certainly an insufficient height to provide mallard nesting. The few "riparian herb" sites that are present would be considered "sand-gravel-cobble-mud" habitat a few months earlier. For these reasons, the riparian herb cover type was deleted along with its indicator species, the mallard.

The lesser scaup, great blue heron, mink, yellow warbler, and black-capped chickadee HEP models have been published and are available from the USFWS (Mulholland 1985, Short 1985, Allen, 1986, Shroeder 1982). The spotted sandpiper model was developed from a literature review by Geoff Dorsey, a member of the evaluation team. The model for Canada goose was based on a model developed by Dave Lockman, Mike Whitfield, Bob Jones, and Chuck Solomon for use in evaluating the Palisades project on the South Fork of the Snake River in Idaho. That model was modified by the evaluation team to adapt to The Dalles Project area. The latter two models are in Appendix B. The Western Meadowlark model was a modified form of the USFWS Eastern Meadowlark (Shroeder and Sousa 1982).

Each species model uses a number of measurable variables that are combined into a simple equation which results in a sample site Habitat Suitability Index (HSI). The average HSI from all sample sites in each cover type is used as the HSI value for a given evaluation species in the study area. This

overall HSI, which is a number between 0 and 1.0, is a quality index or a measure of the capacity of the project area to meet the life requisites of the evaluation species.

To evaluate changes in habitat quality associated with this project using the HEP, two scenarios had to be considered; baseline or pre-construction conditions and recent (post-construction) conditions. Upon review of available data, photographs, and field inspection, the evaluation team agreed that the habitat quality of vegetation communities presently in the project area are representative of the corresponding vegetation communities inundated by the project. Therefore, the same HSI value for each habitat type was applied to both pre- and post-project conditions.

The interagency team of biologists spent about 5 days in the project area measuring many different habitat variables for each of the evaluation species found in the various vegetative cover types. Some of the cover types identified in Table 1 were combined for the evaluation. Table 3 identifies the cover types that were evaluated for each species. A few variables were calculated utilizing navigation charts and/or the aforementioned aerial photographs. The variables devised from these measurements were used to develop an HSI value. Each HSI value was multiplied by the total number of acres of the associated habitat type directly impacted by the project to give the number of habitat units for each evaluation species. The habitat units (HU's) for each evaluation species represents the losses and/or gains of habitat as a result of the project. The various habitats and their variables that were measured in the field for each species are described below.

Table 3. Summary of HSI Vaiues and Changes in Habitat Units as a Result of The Dalles Project (the upper figure under each species heading is the HSI and the lower figure is Habitat Units.)

Cover type/ Acres Flooded	Sandpiper	Heron	Meadow-lark	Mink	Warbler	G o o	Chick-adee	Scaup
Sand/gravel -534'	1.0 -534	0.8 -427						
Shrub/steppe/grass -412'			0.6 -247					
Rip.tree -229'				0.7 -160			0.8 -183	
Rip.shrub -189'				0.9 -170	0.9 -170			
Islands -488[2]						0.9 -439		
Open water (new acres) +2,566								+578
Total HU's	-534	-427	-247	-330	-170	-439	-183	+578

1/ Acreage includes islands.
2/ Acreage includes all cover types on island.

Total Habitat Units Lost.....2,330
Total Habitat Units Gained.....578

Spotted Sandpiper – The evaiuation team sampled six sand/gravel/cobble/mud shoreline habitats. Measurements were taken at these sites to determine the value of cover, foraging habitat, and distance from water to nesting and foraging areas.

Lesser-Scaup – Habitat variables measured for this species included percent of the area supporting emergent vegetation, water depth during average winter conditions, human disturbance in the feeding area, and percent of the area supporting pelecypods. Since the percent of pelecypods present prior to the project is unknown and because the team lacked time to determine its existing presence, it was assumed that the percentage has not changed and based upon the amount of pelecypod shells observed in the shallow water and shoreline areas the population was assumed to be adequate and average. Twelve open-water sites in the reservoir area were evaluated for lesser scaup.

Canada Goose – Canada geese depend almost entirely on island habitat for nesting in the project area and Brown's and Miller Islands are the only two major islands remaining in The Dalles Reservoir. Both islands were examined to determine their value to the Canada goose.

Great Blue Heron – The interagency team of biologists assessed six different samples sites in the sand/gravel/cobble/mud habitat to determine the foraging value to great blue heron. At each of these sites, three habitat variables were considered. These variables included: 1) the distance between a foraging area and heronry site, 2) the presence of a suitable prey population, and 3) the presence of a human disturbance free zone around the foraging area.

Yellow Warbler – The evaluation team looked at three habitat variabies in six different riparian shrub areas. The variables measured were the percent deciduous crown cover, average height of deciduous shrub canopy, and percent of the deciduous shrub canopy which is hydrophytic.

Black-Capped Chickadee – Six different areas were sampled in the riparian tree cover type. Three habitat variables were assessed in each area. These variables included percent tree canopy closure, average height of overstory trees, and number of 4– to lo-inch-diameter snags per acre.

Mink – Habitat variables measured in the field included the percent of shoreline cover within 1 meter of the waters edge, the percent tree/shrub canopy within 100 meters of waters edge, and the percent of the year that water is present. These variables were analyzed in both riparian tree and riparian shrub habitat types which combined provided 12 sample sites.

Western Meadowlark – Habitat variables in six shrub/steppe/grassland sample sites were measured by the evaluation team. Five variables were used to determine the HSI for each site. They included herbaceous canopy cover, percent herbaceous canopy that is grass, average height of the herbaceous canopy, distance to nearest perch site, and percent shrub canopy cover.

RESULTS

The HSI scores and resultant changes in habitat units for each of the target species are discussed below and summarized in Table 3.

Spotted sandpiper

Spotted sandpiper utilize the sparsely vegetated mudflats, shoreline, and sand and gravel bars in the project area for foraging and nesting. These shoreline habitats comprised the largest loss of acreage resulting from inundation by the project – 534 acres. This habitat had an HSI value of 1.0 for the sandpiper. This impact resulted in a loss of 534 habitat units to the sandpiper.

Lesser scaup

During the winter, lesser scaup forage and rest in open water habitat in the project area. The existing reservoir provides 9,193 acres of open water habitat. However, only 2,566 acres of this is additional habitat because 6,627 acres were already present prior to The Dalles Dam. Of the new 2,566 acres, 924 acres are useable by scaup. Of this, 231 acres are of optimum value (HSI = 1.0) and 693 acres are of moderate value (HSI = 0.5). This resulted in an increase of 578 habitat units for the scaup. The remaining new reservoir area (1,129 acres) is too deep for use by scaup.

Canada goose

The Canada goose was adversely impacted by the loss of 488 acres of island habitat as a result of the project. These islands which provide excellent goose nesting habitat in The Dalles Reservoir, were determined to have optimum value (HSI = 0.9) by the evaluation team. Project impacts resulted in the loss of 439 habitat units to the Canada goose.

Great Blue Heron

The 534 acres of sand/gravel/cobble/mud habitat lost to the project was utilized by great blue heron for foraging and was generally high in value (HSI = 0.8). These impacts resulted in the loss of 427 habitat units to the heron.

Yellow warbler

The yellow warbler reproduces and feeds in riparian shrub habitat and also feeds in adjacent wetlands. The loss of 189 acres of riparian shrub habitat with an HSI value of 0.9 resulted in a loss of 170 habitat units tc the warbler.

Black-capped chickadee

The chickadee utilizes mature tree habitats in the project area for both nesting and feeding. The project eliminated 229 acres of riparian tree habitat with an HSI value of 0.8 to the chickadee. This reduction in riparian forested habitat resulted in a loss of 183 habitat units to the chickadee.

Mink

Mink utilize riparian tree and shrub habitats in the project area. The 229 acres of riparian tree habitat lost to the project were moderately valuable (HSI=0.7) to the mink. However, the 189 acres of riparian shrub eliminated by the project provided excellent mink habitat (HSI=0.9). Collectively the loss resulted in a loss of 330 habitat units to the mink.

Western meadowlark

The observation of western meadowlarks was common in the shrub/steppe/ grassland habitat during the HEP field work. The project flooded 412 acres of this particular habitat. The HSI value was determined to be 0.6 which resuits in a loss of 247 habitat units.

HYDROELECTRIC RESPONSIBILITY FOR LOSSES AND BENEFITS

The Power Act requires that mitigation fcr wildlife losses be underraken for "hydroelectric projects" having "various project purposes" (Section 4(h)(10)(C)). Congress stated that "monetary costs resulting from implementation of the (mitigation) program are to be allocated among projects, both Federal and non-Federal, in accordance with the relative impacts...". The Northwest Power Planning Council subsequently determined that funding authority for wildlife mitigation would be limited to Federal projects only, and to just one part of those Federal projects - the power purpose. They also determined that the level of mitigation responsibility would be based on a yet-to-be determined financial accounting procedure.

In view of the above, we have assessed biological impacts caused by the overall multi-purpose hydroelectric project. The wildlife impacts identified in this report are attributable to the changes in wildlife habitat which occurred as a direct result of the construction of The Dalles Dam, Powerhouse, support facilities, and the creation of The Dalles Reservoir. It is assumed the Power Council will establish the portion of the project to be mitigated under the Act and their program.

SUMMARY

Pre- and post-construetion habitat conditions associated with The Dalles Lock and Dam Project were evaiuated by the Habitat Evaluation Procedures (HEP). There were 1,923 acres of terrestrial habitat flooded by the project. This resulted in significant habi'tat losses to sand/gravel/cobble/mud, shrub/steppe/grassland, riparian tree, and riparian shrub cover types. In addition, and of major concern, is the loss of 488 acres of islands. Project impacts to Canada goose, spotted sandpiper, great blue heron, western meadowlark, mink, yellow warbler, black-capped chickadee, and lesser scaup habitat types resulted in a combined loss of 2,330 Habitat Units. The additional water surface area created by The Dalles Reservoir provided expanded wintering habitat for lesser scaup. This resulted in an increase of 578 Habitat Units for scaup. Efforts will proceed to compensate the losses through enhancement of existing habitats. Compensation will be sought within The Dalles Reservoir area, however offsite compensation opportunities will also be considered.

We recommend that the Bonneville Power Administration fund the agencies which cooperated in the development of this report to develop a Wildlife Protection, Mitigation and Enhancement Plan for The Dalles Project.

APPENDIX

A. Mammals, birds, amphibians, and reptiles found in the vicinity of The Dalles Project Area

B. Unpublished Evaluation Species Models Used in Wildlife Impact Assessment for the Dalles Project

1. Spotted sandpiper

2. Canada goose

C. References

APPENDIX A

Mammals, birds, amphibians, and reptiles found in the vicinity of The Dalles Project Area.

MAMMALS

Small-footed myotis
Western pipistrel
Big brown bat
Pallid bat
Whitetail jackrabbit
Mountain cottontail
Yellow-bellied marmot
California ground squirrel
Townsend ground squirrel
Northern pocket gopher
Grean basin pocket
Western harvest mouse
Deer mouse
Bushytail woodrat
Norway rat
House mouse
Mink
River otter
Beaver
Muskrat
Raccoon
Badger
Spotted skunk
Striped skunk
Coyote
Bobcat
Porcupine
Red fox
Black-tailed deer
Mule deer
White-tailed deer
Rocky Mountain Elki

BIRDS

Common loon
Red-necked grebe
Horned grebe
Eared grebe
Western grebe
Pied-billed greve
White pelican
Double-crested cormorant
Great blue heron
Black-crowned night heron
American bittern
Tundra swan
Canada goose
White-fronted goose
Snow goose
Mallard
Gadwall
Pintail
Green-winged teal
Blue-winged teal
Cinnamon teal
American widgeon
American widgeon
Shoveler
wood duck
Redhead
Canvasback
Lesser scaup
Common goldeneye
Barrow's goldeneye
Bufflehead
Ruddy duck
Hooded merganser
Common merganser
Turkey vulture
Goshawk
Sharp-skinned hawk
Cooper's hawk
Red-tailed hawk
Swainson's hawk
Peregrine falcon
Rough-legged hawk
Golden eagle
Bald eagle
Marsh hawk
Osprey
Prairie falcon
American kestrel
Barn owl
Screech owl
Great horned owl
Snowy owl
Burrowing owi
Short-eared owl
Saw-whet owl
California quail
Ring-necked pheasant
Chukar
Common snipe
Bandtail pigeon
Mourning dove
Hungarian partridge
Sandhill crane
Killdeer
Black-bellied plover
Common snipe
Long-billed curlew
Spotted sandpiper
Greater yellowlegs
Wilson's phalarope
Glaucous-winged gull

Western gull
Herring gull
California gull
Ring-billed gull
Bonaparte's gull
Forster's tern
Caspian tgern
Common nighthawk
White-throated swift
Rufous hummingbird
Belted kingfisher
Common flicker
Lewis' woodpecker
House finch
Pine siskin
American goldfinch
Rufous-sided towhee
Savannah sparrow
Lark sparrow
Dark-eyed junco
Chipping sparrow
Brewer's sparrow
White-crowned sparrow
Golden-crowned sparrow
Fox sparrow
Song sparrow
Varied thrush
Qestern bluebird
Townsend's solitaire
Golden-crowned kinglet
Cedar waxwing
Northern shrike
Loggerhead
Starling
Solitary vireo
Orange-crowned warbler
Yellow warbler
Yellow-rumped warbler
Vesper sparrow
Mountain bluebird
Bohemian waxwing
Yellowthroat
Yellow-breasted chat
Wilson's warbler
House sparrow
Western meadowlark
Red-winged blackbird
Northern oriole
Brewer's blackbird
Brown-head cowbird
Western tanager
Black-headed cowbird
Luzili bunting
Qvening grosbeak
Purple finch
Eastern kingbird
Western kingbird
Western wood peewee
Horned lark
Violet-green swallow
Tree swallow
Bank swallow
Rough-winged swallow
Barn swallow
Cliff swallow
Black-billed magpie
Common raven
Common crow
Black-capped chickadee
White-breasted nuthatch
Brown creeper
Winter wren
Bewick's wren
Long-billed marsh wren
Canon wren
Rock wren
Robin

REPTILES

Western yellow-bellied racer
Pacific gopher snake
Western rattlesnake
western fence lizard
Qide-blotched lizard
western skink
Southern alligator lizard

AMPHIBIANS

Pacific treefrog
Bullfrog
Long-toed salamander

APPENDIX B

Unpublished Evaluation Species Models Used in Wildlife Assessment for The Dalles Project.

1. Spotted Sandpiper
2. Canada Goose

Spotted Sandpiper

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed species, occurring on the margins of sandy ponds, sea shores, and rocks bordering streams.

Hays (1973) reported that spotted sandpiper nests were located in grassy upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used all the sparsely vegetated areas on an island as nest sites. Bent (1929) stated that nest sites were variable; high areas of sand island in high, rank sedge grass, on grassy, overgrown gravel bars, in driftwood piles, under extending tree branches, under rock ledges, and under decayed logs representing reported nest sites. Nest sites are close to water (Bent 1929). Oring and Knudson stated that spotted sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (1973) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) reported that spotted sandpipers nest just above the highwater mark on tree-lined shores. Stout (1967) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous 'cover 0.5 m in height and 30 m or less from the beach. Three nests were located in mixed deciduous woods 8-13 m high and 20-50 m from the beach. Miller and Miller (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 - 76.2 cm in height.

Hays (1973) stated that spotted sandpipers have a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial in winter.

Miller and Miller (1948) reported a colonial breeding situation, 38 pairs/5.46 ha. Kuenzel and Wiegert (1973) reported a territorial size of approximately 1.21 ha per bird. Heideman and Oring (1976) stated that 4-5 pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 active nests/l.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

Spotted sandpipers feed primarily on insects, especially aquatic insects.

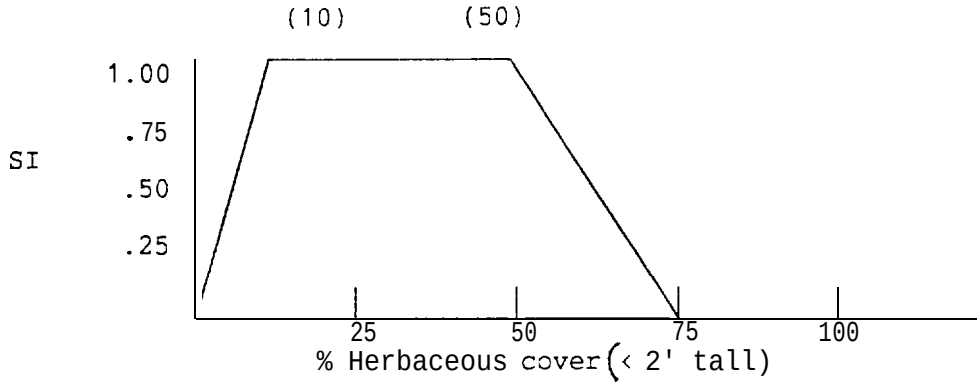
SPOTTED SANDPIPER SUITABILITY INDEX

Nesting Cover (V1)

A mosaic of herbaceous ground cover with an overall density of less than 50% and less than 2' high (an overstory of deciduous trees can be present if the ground cover requirements are met).

Flooding probably not a significant problem as the sandpiper is quite capable of renesting if necessary.

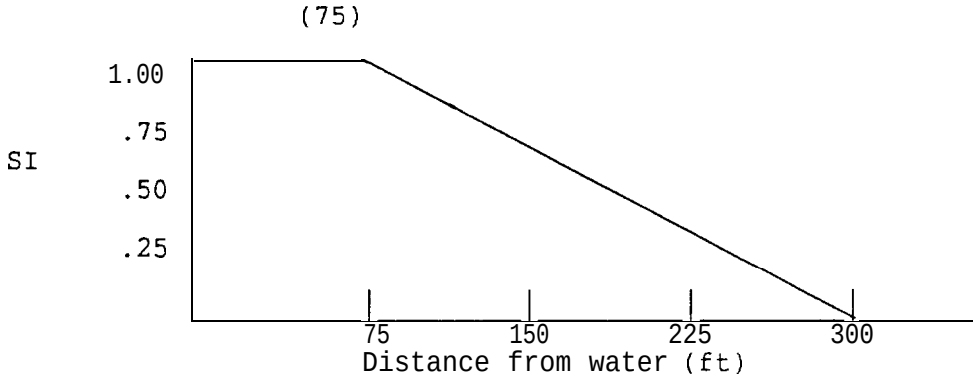
[150 ft. transect, 25 ft. intervals. Begin transect where V3 crosses daily high water mark and continue inland 150 ft.]



Nesting distance from water (V2)

Optimum Nesting habitat is within 75 ft. of water.

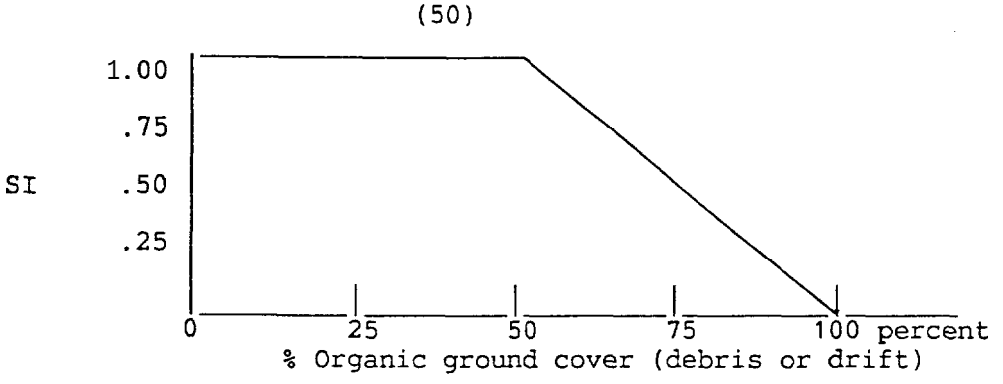
[measure minimum distance between nesting habitat and water]



Foraging habitat (V3) -

Open or sparsely vegetated shorelines (gravel, riprap, or sandy substrates) within 150 feet (45 m) of water (normal pool) which may contain some organic debris or drift.

[Begin transect at EOW and go inland 150 ft. with measurements every 25 ft.]



Model Equation

$$HSI = \frac{V1 + V2 + V3}{3}$$

Spotted Sandpiper

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CANADA GOOSE MODEL

This model is a modification of the Canada goose model developed by Dave Lockman et. al. for the evaluation of Canada goose nesting and brooding habitat on the Snake River at Palisades Reservoir. This modification was developed by Patrick Wright, Larry Rasmussen, and Jim Bottorff of the Portland Field Station, Fish and Wildlife Service and The Dalles, John Day, and McNary wildlife loss assessment HEP team members for use in describing the quality of nesting and brooding habitat in the vicinity of these projects.

Nesting Habitat

Islands (V1)	SI Value
Stable islands present; islands have relatively high shoreline/area ratio;. cover indicative of stability; ground cover on portions of island 4"-8" high.	0.8-1.0
Stable islands present; relatively low shoreline/area ratio; cover on island <4" or >8".	0.5-0.7
No stable islands, or islands with limited or no cover.	0.0-0.4

Brood Rearing Habitat

Late April - July

Foraging Area (V3)	SI Value
Distance from nesting areas to foraging zones ≤1 mile (preferably within site of the nesting area); forage ≤4" tall and ≥ one acre in size; foraging zones total ≥10 acres per mile of river; access to foraging zone within 25 meters of open water and not precluded by physical obstruction or dense vegetation (predator cover).	0.7-1.0
Distance from nesting areas to foraging zones ≥1 and ≤2 miles; forage ≤4" tall and ≥ one acre in size, foraging zones total 5 to 10 acres per mile of river; >25 meters but <50 meters from open water (escape cover).	0.4-0.6
As above except foraging zone >2 miles from nesting areas and >50 meters from open water (escape cover).	0.0-0.3

Model Equation

$$HSI = \frac{V1 + v3}{2}$$

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WILDLIFE IMPACT ASSESSMENT

JOHN DAY PROJECT, OREGON AND WASHINGTON

Annual Report 1989

Prepared by

Larry Rasmussen
Patrick Wright

U.S. Fish and Wildlife Service
Portland Field Station

Prepared for

Joe DeHerrera, Project Manager
U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97208-3621

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Abstract

The Habitat Evaluation Procedures (HEP) were used to evaluate pre- and post-construction habitat conditions of the U.S. Army Corps of Engineers John Day Project in Oregon and Washington. The project directly impacted 27,455 acres of wildlife habitat. Ten evaluation species were selected with losses and gains expressed in Habitat Units (HU's). One HU is equivalent to 1 acre of prime habitat. The evaluation estimated a gain of 14,398 HU's of lesser scaup wintering habitat. Losses of: 3,186 HU's of great blue heron habitat, 8,010 HU's of Canada goose habitat, 3,186 HU's of spotted sandpiper habitat, 1,085 HU's of yellow warbler habitat, 869 HU's of black-capped chickadee habitat, 1,437 HU's of mink habitat, 5,059 HU's of meadowlark habitat, 6,324 HU's of quail habitat, and 7,399 HU's of mallard habitat occurred as a result of the project. This amounts to a total combined loss of 36,555 HU's.

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INTRODUCTION

This report presents an analysis of impacts on wildlife and wildlife habitat as a result of the construction and operation of the Corps of Engineers John Day Lock and Dam Project. The study was funded by the Bonneville Power Administration (BPA) under the authority of Measure 1004 (b) (2) and (3) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4(h) of the Northwest Electric Power Planning and Conservation Act of 1980. The objective of the study was to estimate the net effects to wildlife resulting from hydroelectric development and operation of the John Day Project.

State, Federal and tribal agencies worked cooperatively in the assessment process to accomplish these objectives. These agencies included the Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and yakima Indian Nation. Approximately four meetings and five on-site field trips were conducted by these agencies (from November 1988 to February 1990) to develop the impact analysis.

PROJECT DESCRIPTION

The John Day Lock and Dam Project is located near Rufus, Oregon on the Columbia River at river mile (RM) 215 (Figure 1). The project was built and is operated by the Corps of Engineers, and began operation in 1968. It was authorized for the purposes of power, navigation, irrigation, and flood control. The dam creates a 76-mile-long impoundment which extends upstream to

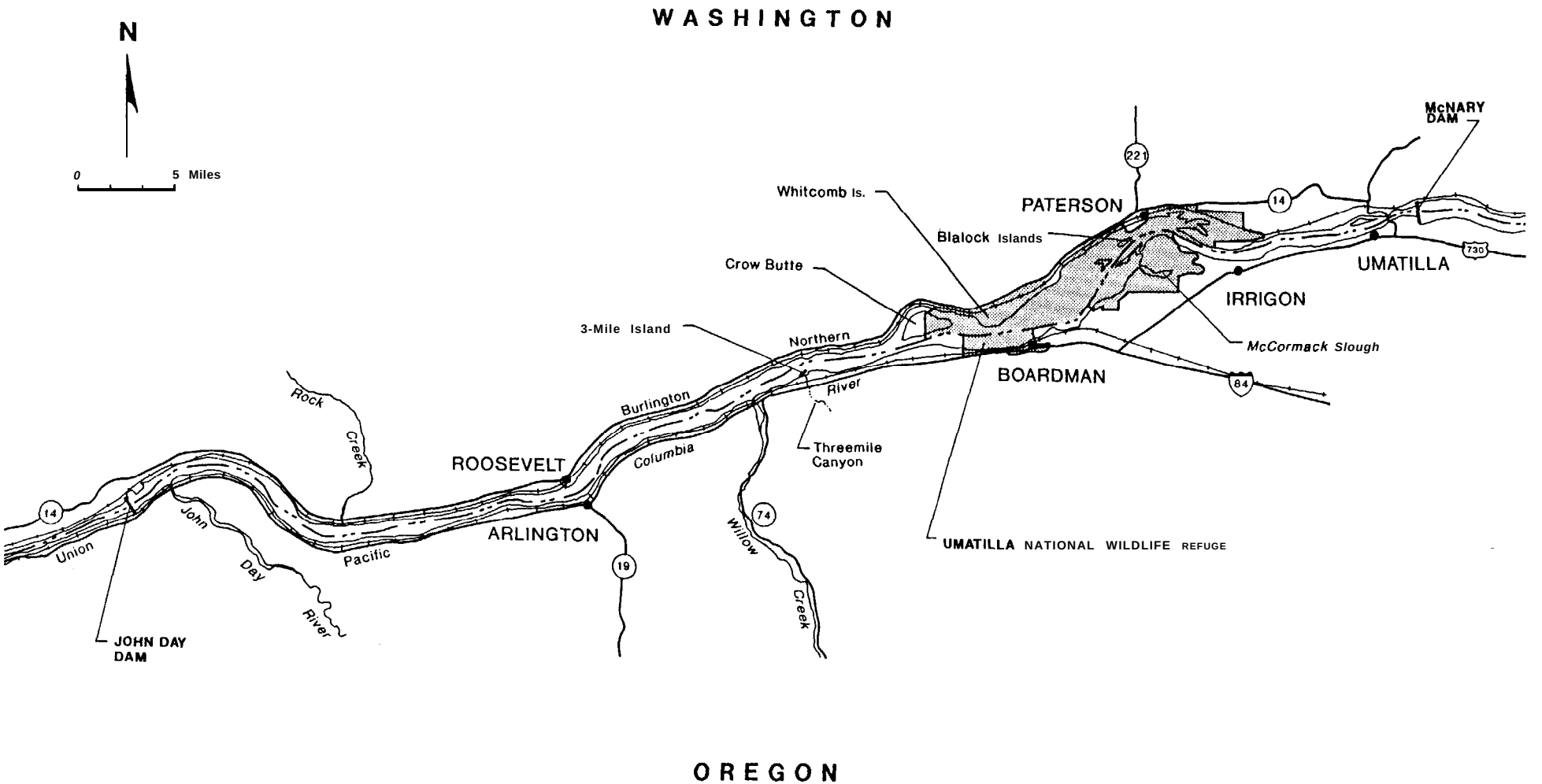


FIGURE 1. **JOHN DAY RESERVOIR**

McNary Dam (RM 291). The John Day Project is normally operated between elevations 257 and 268 feet msl (measured at the dam). The reservoir surface area measures about 48,000 acres. The powerhouse contains 20 generators with a total capacity of 3,105,000 kilowatts (kw).

STUDY AREA

The impact area for the John Day Project is defined as the reservoir area from, and including, the John Day Dam and support facilities upstream to McNary Dam. Adjoining backwaters and rivers which became inundated by the reservoir are considered part of the impact area. Although two major highways and railroads along the north and south shorelines have impacted wildlife habitat, they are not considered a result of the project. The area included in the habitat analysis extended into the upland areas adjacent to the reservoir but within the confines of the rocky cliffs and nearby hillsides.

MATERIALS AND METHODS

VEGETATIVE ANALYSIS

Preconstruction vegetation cover types of the John Day Dam and Reservoir area were mapped based on 1966 black and white aerial photographs obtained from USACE in Portland and Walla Walla. The scale was approximately 1:20,000. No earlier aerial photography was found of the reservoir upstream of the mouth of the John Day River. Recent color aerial photography was flown in 1979 at a scale of 1:48,000.

Base maps were derived from 1:24,000 USGS quadrangle maps screened on mylar film. Mapping extended approximately 1/4 to 1/2 mile beyond the reservoir shoreline. Vegetation cover types were based in part on categories described by Hall et al. (1985) and were consistent with those used in 1987 for the Bonneville Reservoir and earlier in 1989 for The Dalles and McNary Reservoirs. They are described below.

The aerial photographs were examined under a mirror stereoscope. Areas of discernible different vegetation were noted and polygons corresponding to them were sketched on the base map and labeled with a symbol designating vegetation cover type. The polygons were located on the base map using known landmarks, slope, ridge and valley topography, and field observations. Proportional dividers were frequently used to determine relative sizes of landmarks, since the photographs and maps were of several scales.

Where aerial photography was lacking or, in the case of some areas associated with dam construction, taken after construction commenced, vegetation cover types were extrapolated based on surrounding vegetation. Some large disturbed areas were mapped as such on the preconstruction maps, because there was no way of determining whether they were directly associated with dam construction. It should be noted that when the 1966 photography was flown, John Day Dam construction had begun.

The recent maps were ground checked on May 16 and 18, 1989. Cover type categories designated on the maps were visually verified and, if necessary, changes were made on the maps. All maps were then finalized and traced onto mylar overlays to the base maps. A boundary of the project area was drawn to include the entire reservoir as well as upland areas where the effects of the

reservoir were clearly to be seen (e.g., McCormick Slough). The boundary followed the relocated railroad tracks for much of the reservoir shoreline.

Acreages of map categories within the affected area boundary were calculated from blackline reproductions of the maps, using the mean of the known area of two sections per map as a basis for assigning acreages to polygons. The project area was narrow and contained many small polygons; therefore a dot grid was used to calculate acreages. Dot counts between preconstruction and recent maps agreed within 3 percent for the entire project area and within 2.3 percent for the reservoir.

Franklin and Dyrness (1973) show mean annual precipitation to range between about 12 inches per year at John Day Dam and 8 inches per year at McNary Dam. Strong winds are common along the river in all seasons. Winters are cold and fairly dry. Summers are hot and windy.

Although the natural vegetation along John Day Reservoir is usually considered to belong to the shrub-steppe (Franklin and Dyrness 1973), it is difficult to find even small areas free of alien species. Cheatgrass (Bromus tectorum L.) is the most common grass species over much of the area. Shrubs, particularly green and gray rabbitbrush (Chrysothamnus nauseosus [Pall.] Britt. and Chrysothamnus viscidiflorus [Hook.] Nutt.), have often replaced big sagebrush (Artemisia tridentata Nutt.). The latter is more sensitive to fire, a common occurrence in the dry grass and shrub communities of the area.

The minimum map unit within the project area was on the order of 1 acre. This allowed depiction of small, narrow patches of vegetation along the highways and railroads which bordered the river and the reservoir. Mapping

was generalized in the uplands outside the project area, where the minimum map unit was closer to 5 acres and, when large areas were a mosaic of several vegetation cover types, the one comprising more than 50 percent of the area was used to designate that polygon. In the descriptions of cover types, the more common inclusions are noted.

Twelve vegetation cover type/map categories were identified in the area mapped. Table 1 shows the acreages of extant vegetation types in 1966 within the now flooded area (i.e., below the new reservoir shoreline). Direct project construction impacts in the immediate vicinity of John Day Dam affected about 40 acres as determined from 1966 aerial photographs.

Agricultural Lands: Croplands, both irrigated and dryland, and pastures were the primary agricultural uses of land within the John Day Reach in both 1966 and 1979. A few orchards and vineyards were seen on aerial photographs, but nearly all of them were outside the project area. Those within were generally small and associated with farmhouses. Large areas were converted from grass/shrub to agriculture between 1966 and 1979, particularly in the Boardman and Irrigon areas. Agricultural lands accounted for about 7 percent (2,062 acres) of the terrestrial habitat inundated by the reservoir.

For the purpose of mapping, recreation areas and parks were included in this map category, although they were designated as "PARK." Some parks were developed along the shores of John Day Reservoir. These include those at the mouth of the John Day River and at Crow Butte. Wildlife management areas created after the filling of the reservoir or as later mitigation were not included in the PARK category; the cemetery at Irrigon was included.

Table 1. Acreages of Vegetation and other Cover Types Impacted (lost) By The John Day Project.

VEGETATION COVER TYPE	ACRES
Mainland	
Agricultural Lands	2012
Shrub/Steppe/Grass	10175
Riparian Hardwoods	960
Riparian Shrub	833
Riparian Herb	476
Emergent Wetland	511
Sand Dunes/Blowouts	1966
Sand/Gravel/Cobble/Mud	2439
Talus/Rock	830
Disturbed/Bare/Riprap	392
Open Water - Lakes & Ponds	182
Residential/Urban/Industrial	82
TOTAL MAINLAND	20858
Islands	
Agricultural Lands	50
Grass/Shrub	2472
Riparian Hardwoods	126
Riparian Shrub	252
Riparian Herb	702
Sand Dunes/Blowouts	1459
Sand/Cobble/Gravel/Mud	1544
Talus/Rock	64
Open Water - Lakes & Ponds	10
Residential/Urban/Industrial	29
TOTAL ISLANDS	6708
River	
Open Water - river	21103
TOTAL RIVER	21103

Shrub/Steppe/Grass: This vegetation cover type dominated much of the uplands above the river in 1966 and was common in 1979. Shrub cover in these communities varied from practically none to extremely dense. Stands were weedy and often showed signs of frequent or recent disturbance. Big sagebrush and rabbitbrush were the most common shrubs and the latter seemed to be more abundant in easily accessible areas and along railroads where fires may be more frequent. On sand blowouts and dunes (q.v.), bitterbrush (*Purshia tridentata* [Pursh] DC.) was often dominant, and those areas were mapped as this category. Sometimes, particularly around towns, shrub/steppe/grass communities occupied abandoned fields supporting dense stands of Russian thistle (*Salsola kali* L.) and other weeds. The shrub/steppe/grass cover type comprised 46 percent of the terrestrial habitat flooded by the project. This was the largest single habitat (12,647 acres) impacted by John Day Dam.

Riparian Hardwoods: Also described as "riparian tree," this cover type's dominant component was black cottonwood (*Populus trichocarpa* T. & G.). It was often accompanied by willow (*Salix* spp.), usually shrubby species. Russian olive (*Eleagnus angustifolia* L.) was sporadically abundant along the river's edge --more so in 1979 than in 1966, particularly around Boardman. Alder (*Alnus* spp.) and hackberry (*Celtis reticulata* Torr.) appeared sporadically in riparian woodlands throughout the area. At McCormick Slough, the mosaic of riparian vegetation, emergent wetlands, and ponds, was extremely complex. The reservoir flooded 1,086 acres of riparian tree habitat which represented about 4 percent of the loss to terrestrial habitat.

Riparian Shrub: This cover type included young stands of riparian hardwoods, bands of shrubby vegetation along inlets and embayments, and willow thickets

on sandbars. Wiilow thickets on sandbars must be considered ephemeral, since high water could wash them away at any time. False indigo (Amorpha fruticosa L.), an introduced shrub, was probably the most common species in this cover in 1979 and seemed to be increasing in abundance. At least 70 percent of each of these mapped areas supported woody vegetation less than 15 feet tall. An occasional tree or snag was present and forbs and grasses varied from scattered and sparse to abundant. This category also included small stands of upland shrubs when they occurred in riparian situations, as well as the same shrubs intermixed with willows and cottonwccds. Many of the areas mapped as Riparian Hardwoods and Riparian Shrub were wetlands. A loss of 1,085 acres of riparian shrub habitat resulted from the project. This was about 4 percent of the total terrestrial habitat loss.

Riwarian Herbs: This cover type represented about 4 percent (1,178 acres) of the terrestrial habitat loss from project inundation. Riparian herb consisted of low-growing vegetation, chiefly herbaceous, on sandbars, mudflats, and other riparian substrates. Almost always weedy, it included shrubby willows and seedling cottonwoods as well as a variety of forbs and grasses. Mustards (Brassicaceae), docks (Rumex spp.), pigweeds (Chenooodium spp.) and Russian thistle (Salsola kali L.), and composites (Asteraceae) were typically dominant in these communities. Grasses present usually included species such as foxtails and squirreltails (Hordeum spp. and Sitanion spp.), cheatgrass, and reed canarygrass (Phalaris arundinacea L.). Total plant cover rarely exceeded 75 percent, but had to be at least 25 percent to distinguish this cover type from sand/gravel/cobble/mud.

Emergent Wetland: The major differences between areas mapped as Riparian Herbs and those designated Emergent Wetland were topographic position and

species composition. The emergent wetland usually occupied sites where seepage from upslope or subirrigation maintained typically wetland taxa (e.g., Carex Juncus spp., Typha spp.). Fcr instance, many small we-lands occurred on benches above the Washington shore.

The area north of the Tower Road interchange, west of Boardman, supported areas best termed playas. Patches of saltgrass (Distichlis stricta [Torr.] Rydb.) and scattered to dense greasewood (Sarcobatus vermiculatus [Hook.] Torr.) occurred on saline/alkaline soils. The lowest and wettest of these areas were included in this category.

There were more areas supporting emergent vegetation at both Patterson and McCormick Sloughs in 1989 than were apparent on the 1979 aerial photographs. The numerous ponds appear to be undergoing natural succession through emergent wetland to uplands, probably primarily because of sedimentation.

Emergent wetlands tend to be longer lived than riparian herb communities. The latter often are ephemeral when on riverine sand bars or mud flats. Elsewhere they generally give way to shrub, then tree communities. The emergent wetlands are usually found where soil saturation is fairly dependable.

John Day Reservoir was responsible for the loss of 511 acres of emergent wetlands in the project area.

Sand dunes/blowouts: Blowouts occur when disturbance removes the plant cover from sandy soil, allowing the wind to continue the removal of protective vegetation. In a windy region, such as around Boardman and Irrigon, blowouts tend to be frequent. They appear as long, often narrow, sparsely vegetated

areas, oriented in the direction of prevailing winds. A few sand dunes occurred within or adjacent to blowouts within the John Day reach. Vegetation was generally sparse, although bitterbrush occasionally achieved fairly dense cover. There were 3,425 acres of sand dune/blowout type habitat flooded by the reservoir.

The difference between this cover type and sand/gravel/cobble/mud was sometimes positional--if sandy areas occurred on low, level areas along the river cr reservoir, they were mapped as the latter. This was done even if they were obviously part of a blowout or dune system, since they were, like all riverine sandbars, subject to flooding at high water.

Sand/Gravel/Cobble/Mud: John Day Reservoir inundated 3,983 acres of sand/gravel/cobble/mud habitat. This was 14 percent of the total terrestrial habitat flooded, the second largest habitat type lost. Most of this cover type occurred along the rivers and was probabiy under water during periods of high water before John Day Dam was built. Some vegetation was present on many of the sandbars along the river. It usually consisted of seedling willows, scattered grasses and forbs, and an occasional shrubby willow or black cottonwood. It was never abundant. Some of the occurrences of this cover type had the potential to develop into riparian hardwood or riparian shrub cover types, given a sufficient period without washouts by the river.

Many islands and peninsulas in this category in 1966 were apparently being excavated for fill, possibly for railroad and highway relocation. They were mapped as though they were undisturbed.

Talus/Rock: This cover type included scablands, rocky cliffs, and talus siopes. Vegetation was present although usually quite sparse and included shrubs and herbs. Typical scablands occurred around the aiuminum plant just upstream of John Day Dam. Cliffs were fairly heavily vegetated for brief periods in the spring when annual grasses and spring forbs were present; the rest of the year, crustose lichens and acrocarpus mosses were the most abundant vegetation. Some shrubby areas along the edges of talus included mounds of virgin's-bower (Clematis sp.) or small groves of hackberry (Celtis reticulata Torr.). Along the lower reach of the reservoir there were numerous rocky cliffs with talus at their bases. There were 894 acres of talus/rock covered by the project.

Disturbed/Bare/Riprap: Areas where severe or continued disturbance or vegetation management precluded the natural re-establishment of vegetation were included in this map category. It occurred most commonly along railroad and highway rights-of-way, particularly where they bordered the river or reservoir. The major disturbance to vegetation caused by railroad and highway relocation was not shown on the preconstruction maps. Railroads and roads were often too narrow to map in the John Day Reservoir area. This was particularly true along the Washington shore in 1966. This map category frequently intergraded with the Talus/Rock category, as well as with Sand/grave l/cobble/mud when along the river or reservoir shore. Vegetation was usually sparse and weedy. Disturbed/bare/riprapped areas accounted for 392 acres flooded by the project.

Open Water: This map category includes rivers, lakes, ponds, and the John Day Reservoir. For purposes of calculating acreages, the reservoir and the rivers, including sloughs and embayments, were kept separate from other open

water areas. John Day Dam resulted in the loss of 21,103 acres of free flowing river habitat. This was replaced by a 47,993-acre reservoir which includes backwaters behind railroad and highway fills as well as rivers and creeks flooded by the pool.

Residential/Urban/Industrial: Cities, towns, major residential areas, and industrial developments were included in this map category. There were 111 acres of this category that were impacted by the project. Individual houses usually occupied areas too small to map and farm buildings were included in the Agricultural Lands category.

HABITAT EVALUATION

The Fish and Wildlife Service's Habitat Evaluation Procedures (HEP) were utilized to evaluate the quality of wildlife habitat in the project area prior to and after construction. The HE? involved an interagency team of biologists who selected appropriate evaluation species and then analyzed habitat conditions based on models developed for each of those species. The species utilized in the evaluation (target species) were selected because their particular habitat requirements were indicative of major vegetative cover types that were impacted by the project. The target species often represented a larger group of species with similar habitat requirements, and were of special significance in the study area from an economical, ecological, social, or environmental standpoint. A list of all wildlife species present in the project area is provided in Appendix A. The interagency group selected 10 target species for the HEP evaluation. These species and the rationale for their selection are identified in Table 2.

Table 2. Target species selected for the John Day HEP and the rationale for their selection.

Species	Rationale
Spotted sandpiper (*Actitis macularia*)	A representative of migratory shorebirds which utiiize the sparsely vegetated islands, mudflats, shorelines, and sand and gravel bars associated with the John Day Project area. This habitat comprised the third largest loss of terrestrial acreage resulting from the project.
Lesser scaup (*Aytha affinis*)	A migratory waterfowl species commonly observed utilizing open water habitat of John Day Reservoir during the winter. Representative of other diving waterfowl which may use the area. Existing HEP model available.
Canada goose (*Branta canadensis*)	A migratory bird of national significance sensitive to island nesting habitat and associated shoreline brooding areas. Cultural significance.
Great blue heron (*Ardea herodias*)	Carnivore which forages on a variety of vertebrates in shallow water. The sand/gravel/cobble/mud shorelines of the John Day Reservoir are commonly used as foraging areas. Existing HEP model available which is sensitive to changes in this habitat. Cultural significance.
Yellow warbler (*Dendraica petechia*)	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. Existing HEP model which is sensitive to the targeted habitats - riparian shrub and adjacent wetlands.
Black-capped chickadee (*atricopillus*)	Representative of species utilizing mature forest canopies and forest cavity nesters HEP model available.
Mink (*Mustela vison*)	Carnivorous furbearer, feeds on a wide range of vertebrates. Utilizes shoreline and adjacent shallow water habitats. HE? model available. Cultural significance
Western meadowiark (*Sturnella neglecta*)	A species common to shrub/steppe/grassland habitat, the largest terrestrial habitat type flooded by the John Day project. This bird is well known for its melodious song, feeds primarily on insects and seeds.

California quail (*Lophortyx californicus*)	A species commonly associated with the shrub-steppe-grassland habitat. This game animal feeds essentially on seeds and greens in somewhat open brushy and grassland areas.
Mallard (*Anas platyrhynchos*)	The mallard utilizes a broad range of cover types. Riparian herb, emergent wetlands, and islands provide nesting, brcod rearing, and wintering habitat for the mallard. Recreational significance.

The lesser scaup, great blue heron, mink, yellow warbler, and black-capped chickadee HEP models have been published and are available from the USFWS (Mulhclland 1985, Short 1935, Allen, 1986, Shroeder 1982). The spotted sandpiper model was developed from a literature review by Geoff Dorsey, a member of the evaluation team. The model for Canada goose was based cn a model developed by Dave Lockman, Mike Whitfield, Bob Jones, and Chuck Solomon for use in evaluating the Palisades project on the South Fork of the Snake River in Idaho. That model was modified by the evaluation team to adapt to the John Day Project area. The California quail model was taken from the Fish and Wildlife Service Draft Terrestrial Habitat Evaluation Criteria Handbook for Ecoregion 2410, June, 1978. The variables were reviewed and determined applicable to the project area by the interagency HE? team. The model for the mallard was jointly developed from several other models by the members cf the HEP team. The spotted sandpiper, Canada goose, California quail, and mallard models are in Appendix B. The Western Meadowlark model was a modified form of the USFWS Eastern Meadowlark (Shroeder and Sousa 1982).

Each species model uses a number of measurable variables that are combined into a simple equation which results in a Habitat Suitability Index (HSI) value for each sample site. The average HSI from all sample sites in each cover type is used as the HSI value for a given evaluation species in the study area. This overall HSI, which is a number between 0 and 1.0, is a quality index or a measure of the capacity cf the project area to meet the life requisites of the evaluation species.

To evaluate changes in habitat quality associated with this project using the HEP, two scenarios had to be considered; baseline or pre-constructicn

conditions and recent (post-construction) conditions. Upon review of available data, photographs, and field inspection, the evaiuation team agreed that the habitat quality of vegetation communities presently in the project area are representative of the corresponding vegetation ccmaunities inundated by the project. Therefore, the same HSI value for each habitat type was applied to both pre- and post-project conditions.

The interagency team of biologists spent 5 days in the project area measuring many different habitat variables for each of the evaluation species found in the various vegetative cover types. Table 3 identifies the cover types that were evaluated for each species. A few variables were calculated utilizing navigation charts and/or the aforementioned aerial photographs. The variables devised from these measurements were used to develop an HSI value. Each HSI value was multiplied by the total number of acres of the associated habitat type directly impacted by the project to give the number of habitat units for each evaluation species. The habitat units (HU's) for each evaluation species represents the losses and/or gains of habitat as a result of the project. Each species along with its associated habitat and variables that were measured in the field is described below.

Spotted Sandpiper – The evaluation team sampled IO sand, gravel, cobble and mud shoreline habitats. Measurements were taken at these sites to determine the value of cover, foraging habitat, and distance from water to nesting and foraging areas.

Table 3. Summary of HSI Values and Changes in Habitat Units as a Result of the John Day Project. (The upper figure under each species heading is the HSI and the lower figure is Habitat Units.)

Cover type/ Acres Flooded	Scaup	Chickadee	Goose	Mallard	Warbler	Mink	Quail	M.Lark	Sparrow	Hopper
Sand/gravel -3,983'									.8 -3,186	.8 -3,186
Shrub/steppe/grass -12,647[1]							.5 -6,324	.4 --5,059		
Rip.tree -1,086'		.8 -869								
Rip.shrub -1,085'					1.0 -1,085	.9 -977				
Rip.herb -1,178'			.2 -95[4]	.7 -333[4]						
Islands -6,708~			1.0 -6,708	1.0 -6,708						
Open water (new acres) +47,993	.3 +14,398									
Emergent -5113				.7 -358[5]		.9 -460				
Agriculture -2062'			.6 1,207[6]							
Total HU's	+14,398	-869	-8,010	-7,399	-1,085	-1,437	-6,324	-5,059	-3,186	-3,186

1/ Acreage includes islands.
2/ Acreage includes all cover types on island.
3/ No emergent habitat on islands.
4/ Based on 476 acres, excluding islands.
5/ Based on 511 acres, excluding islands
6/ Based on 2,012 acres, excluding islands.

Total Habitat Units Lost.....36,555
Total Habitat Units Gained.....14,398

Lesser Scaup - Habitat variables measured for this species included percent of the area supporting emergent vegetation, water depth during average winter conditions, human disturbance in the feeding area, and percent of the area supporting pelecypods. Since the percent of pelecypods present prior to the project is unknown and because we lacked time to determine its existing percentage, it was assumed that the percentage has not changed and based upon the amount of pelecypod shells observed in the shallow water and shoreline areas the population was assumed to be adequate and average. Ten open-water sites in the field as well as 10 cross-sections on navigation charts (for depth) were evaluated to determine the HSI value for lesser scaup.

Canada Goose - HSI values for Canada geese were developed for riparian herb, agricultural, and island habitats. Riparian herb and certain agricultural areas are important foraging zones fcr juvenile geese. The forage value was determined by considering: 1) the distance from the forage area to nesting areas; 2) the height of the forage; 3) the amount of forage per mile of river; 4) the distance from the forage zone to open water; and 5) the absence of obstructions or dense vegetation which could provide predator cover between open water and the forage area. Forage values for Canada geese were developed at seven riparian herb and four agricultural sites.

Canada goose nesting habitat occurs almost exclusively on islands (as opposed to mainland) in the project area. Project construction resulted in a severe impact on goose production since 80 percent of the islands were destroyed. HSI variables considered were island stability, shoreline/area ratio, vegetative canopy cover, and availability of other nesting areas (islands).

Great Blue Heron - The interagency team of biologists assessed 10 different sample sites in the sand/gravel/cobble/mud habitat to determine the foraging value tc great blue heron. At each of these sites, three habitat variables were considered. These variables included: 1) the distance between a foraging area and heronry site, 2) the presence of a suitable prey population, and 3) the presence of a disturbance free zone (no human activity) around the foraging area.

Yellow Warbler - The evaluation team looked at three habitat variables in eight different riparian shrub areas. The variables measured were the percent deciduous crown cover, average height of deciduous shrub canopy, and percent of the deciduous shrub canopy which is hydrcphytic.

California quail - Shrub/steppe/grass habitat sample sites were measured to determine their value to California quail. Seven sites throughout the project area were selected to sample this cover type. Five parameters were measured to develop an HSI value at each sample site. These parameters included percent of ground vegetative cover consisting of herbs and grasses, average shrub height, distance to escape cover, average diameter of escape cover patches, and distance between escape cover patches.

Mallard - Important mallard habitat was represented by the sand-gravel-cobble-mud component of islands (wintering), riparian herb (nesting), and emergent wetlands (brood rearing). Based on the extensive winter use by mallards of the sand-gravel areas around islands, the evaluation team assigned the optimum value to that particular habitat. Four variables were measured to determine an HSI value for mallard nesting in the riparian herb cover type. These were: 1) the distance between riparian herb and water with emergent vegetation (for

broods); 2) height of the nesting cover; 3) percent canopy cover; and 4) the probable amount of disturbance by people and/or dogs. The brood rearing value of emergent wetlands was measured by determining the ratio of open water to water covered by emergent vegetation. There was a total of 14 riparian herb and emergent wetland habitats sampled in the field.

Black-Capped Chickadee – Seven different areas were sampled in the riparian tree covertype. Three habitat variables were assessed in each area. These variables included percent tree canopy closure, average height of overstory trees, and number of 4-inch to lo-inch diameter snags per acre.

Mink – Habitat variabies measured in the field included the percent cf shoreline cover within 1 meter of the waters edge, the percent tree/shrub canopy within 100 meters of waters edge, and the percent of the year that water is present. These variables were analyzed in both riparian shrub and emergent wetland habitat types which combined provided 15 sample sites.

Western meadowlark – Habitat variables in seven shrub-steppe-grass sample sites were measured by the evaluation team. Five variables were used to determine the HSI for each site. They included herbaceous canopy cover, percent herbaceous canopy that is grass, average height of the herbaceous canopy, distance to nearest perch site, and percent shrub canopy cover.

RESULTS

The HSI scores and resultant changes in habitat units for each of the target species are discussed below and summarized in Table 3.

Spotted sandpiper

Spotted sandpiper utilize the sparsely vegetated mudflats, shoreline, and sand and gravel bars in the project area for foraging and nesting. These shoreline habitats comprised the third largest terrestrial habitat loss of acreage resulting from inundation by the project – 3,983 acres. This habitat had an HSI value of 0.8 for the spotted sandpiper. This impact resulted in a loss of 3,186 habitat units to the sandpiper.

Lesser scaup

During the winter, lesser scaup forage and rest in open water habitat in the project area. The project created 21,117 acres of open water habitat useable by scaup, and 26,876 acres which are too deep for scaup use. This results in an overall HSI value for the entire reservoir (47,993 acres) of 0.3 and an increase of 14,398 scaup habitat units.

Canada goose

The Canada goose was adversely impacted by the loss of 6,708 acres of island habitat as a result of the project. These islands which provide excellent goose nesting habitat in the John Day Reservoir, were determined to have optimum value (HSI = 1.0) by the evaluation team. Juvenile foraging habitat was also lost with the flooding of 476 acres of riparian herb and 2,012 acres of agricultural lands. These two cover types were determined to have HSI values of 0.2 and 0.6 respectively. Project impacts to island, riparian herb, and agricultural habitats resulted in a combined loss of 8,010 habitat units.

Great blue heron

The 3,983 acres of sand/gravel/cobble/mud habitat lost to the project was utilized by great blue heron for foraging and was generaliy high in value (HSI = 0.8). These impacts resulted in the loss of 3,186 habitat units to the heron.

Yeliow warbler

The yellow warbler reproduces and feeds in riparian shrub habitat and also feeds in adjacent wetlands. The loss of 1,085 acres of riparian shrub habitat with an HSI value of 1.0 resulted in a loss of 1,085 habitat units to the warbler.

California quail

There were 12,647 acres of shrub-steppe-grass habitat flooded by the project. This cover type provided an HSI value of 0.5 to California quail, and 6,324 Habitat Units were lost as a result of the project.

Mallard

Mallard habitat losses resulted from the flooding of 476 acres of riparian herb, 511 acres of emergent wetlands, and 6,708 acres of islands. These habitats had an HSI value of 0.7, 0.7, and 1.0 respectively. A total combined loss of 7,399 Habitat Units to the mallard occurred with the John Day Project.

Black-capped chickadee

The chickadee utilizes mature tree habitats in the project area for both nesting and feeding. The project eliminated 1,086 acres of riparian tree habitat with an HSI value of 0.8 to the chickadee. This reduction in riparian forested habitat resulted in a loss of 869 habitat units to the chickadee.

Mink

Mink utilize riparian shrub and emergent wetland habitats in the project area. The 1,085 acres of riparian shrub habitat lost to the project were of high value (HSI=0.9) to the mink. The 511 acres of emergent wetlands eliminated by the project also provided excellent mink habitat (HSI=0.9). Collectively the loss resulted in a loss of 1,437 habitat units to the mink.

Western meadowlark

The Western meadowlark, common in the shrub/steppe/grasslands, lost 12,647 acres of this habitat to the John Day Project. With an HSI value of 0.4, this resulted in a loss of 5,059 habitat units.

HYDROELECTRIC RESPONSIBILITY FOR LOSSES AND BENEFITS

The Power Act required that mitigation for wildlife losses be undertaken for "hydroelectric projects" having "various project purposes" (Section 4(h)(10)(C)). Congress stated that "monetary costs resulting from implementation of the (mitigation) program are to be allocated among projects, both Federal and non-Federal, in accordance with the relative impacts...".

The Northwest Power Planning Council subsequently determined that funding authority for wildlife mitigation would be limited to Federal projects only, and to just one part of those Federal projects – the power purpose. They also determined that the level of mitigation responsibility would be based on a yet-to-be determined financial accounting procedure.

In view of the above, we have assessed biological impacts caused by the overall multi-purpose hydroelectric project. The wildlife impacts identified in this report are attributable to the changes in wildlife habitat which occurred as a direct result of the construction of the John Day Dam, Powerhouse, support facilities, and the creation of the John Day Reservoir. It is assumed the Power Council will establish the portion of the project to be mitigated under the Act and their program.

SUMMARY

Pre- and post-construction habitat conditions associated with the John Day Lock and Dam Project were evaluated by Habitat Evaluation Procedures (HEP). There were 27,455 acres of terrestrial wildlife habitat flooded by the project. This resulted in significant habitat losses to shrub/steppe/grassland, sand/gravel/cobble/mud, riparian tree, riparian shrub, and riparian herb cover types. In addition, and of notable concern, is the loss of 6,708 acres of island habitat. Collectively these habitats supported a diverse and significant wildlife resource which was assessed utilizing 10 target species. Project impacts to Canada goose, mallard, black-capped chickadee, yellow warbler, mink, California quail, western meadcwlark, great blue heron, and spotted sandpiper habitats resulted in a combined loss of

habitat units. The John Day Reservoir created additional open water acreage for lesser scaup habitat. This provided an increase of 14,398 habitat units for the lesser scaup. Efforts will proceed to compensate losses through enhancement of existing habitats and creation of new habitats. Compensation will be sought within the John Day Reservoir area, however offsite compensation opportunities will also be considered.

APPENDIX

A. Mammals, birds, amphibians, and reptiles found in the vicinity of the John Day Project Area

B. Unpublished Evaluation Species Models Used in Wiidlife Impact Assessment for the John Day Project

1. Spotted sandpiper
2. Canada goose
3. California quail
4. Mallard

C. References

APPENDIX A

Mammals, birds, amphibians, and reptiles found in the vicinity of the John Day Project Area.

MAMMALS

Opossum
Little brown myotis
Small-footed myotis
Big brown bat
Pallid bat
Whitetail jackrabbit
Blacktail jackrabbit
Mountain cottontail
Yellow-bellied marmot
California ground squirrel
Townsend ground squirrel
Northern pocket gopher
Great basin gopher
Ord kangaroo rat
Western harvest mouse
Deer mouse
Forest deer mouse
Bushytail woodrat
Montane vole
House mouse
Mink
River otter
Beaver
Muskrat
Raccoon
Shortail weasel
Badger
Spotted skunk
Striped skunk
Coyote
Bobcat
Porcupine
Mule deer
White-tailed deer
Antelope
Rocky Mountain elk

BIRDS

Common loon
Red-necked grebe
Horned grebe
Eared grebe
Western grebe
Pied-billed grebe
White pelican
Double-crested cormorant
Great blue heron
Black-crowned night heron
American bittern
Tundra swan
Canada goose
White-fronted goose
Snow goose
Mallard
Gadwall
Pintail
Green-winged teal
Blue-winged teal
Cinnamon teal
American'widgeon
Shoveler
wood duck
Redhead
Ring-necked duck
Canvasback
Lesser scaup
Common goldeneye
Barrow's goldeneye
Bufflehead
Ruddy duck
Hooded merganser
Common merganser
Turkey vulture
Goshawk
Sharp-skinned hawk
Cooper's hawk
Red-tailed hawk
Swainson's hawk
Peregrine falcon
Ferrigunous hawk
Rough-legged hawk
Golden eagle
Bald eagle
Marsh hawk
Osprey
Prairie falcon
American kestrel
Baron owl
Screech owl
Great horned owl
Snowy owl
Burrowing owl
Long-eared owl
Short-eared owl
Saw-whet owl
California quail
Ring-necked pheasant
Chukar
Common snipe
Mourning dove
Hungarian partridge
Sandhill crane
Virginia rail
Sora rail
Killdeer
Common snipe
Long-billed curlew

Whimbrel
Spotted sandpiper
Greater yellowlegs
Least sandpiper
Dunlin
Marbled gcdwit
Long-billed dowitcher
Western sandpiper
Sanderling
American avocet
Wilson's phalarcpe
Northern phalarope
Glaucous-winged gull
California gull
Ring-billed gull
Bonaparte's gull
Forster's tern
Caspian tern
Black tern
Common nighthawk
White-throated swift
Rufous hummingbird
Belted kingfisher
Common flicker
Lewis' woodpecker
Downy woodpecker
House finch
Pine siskin
American goldfinch
Rufous-sided towhee
Savannah sparrow
Lark sparrow
Dark-eyed junco
Tree sparrow
Chipping sparrow
Brewer's sparrow
White-crowned sparrow
Golden-crowner sparrow
Fox sparrow
Song sparrow
Varied thrush
Swainson's thrush
Western bluebird
Townsend's solitaire
Golden-crowned kinglet
Water pipit
Cedar waxwing
Northern shrike
Loggerhead
Starling
Solitary vireo
Warbling vireo
Orange-crowned warbler
Yellow warbler
Yellow-rumped warbler
Sage sparrow
Vesper sparrow
Mountain bluebird
Bohemian waxwing
Townsend's warbler
Yellowthroat
Yellow-breasted chat
Wilson's warbler
House sparrow
Western meadowlark
Yellow-head blackbird
Red-winged blackbird
Northern oriole
Brewer's blackbird
Brown-head cowbird
Western tanager
Black-headed grosbeak
Luzili bunting
Evening grosbeak
Purple finch
Eastern kingbird
Western kingbird
Western wood peewee
Horned lark
Violet-green swallow
Bank swallow
Rough-winged swallow
Barn swallow
Cliff swallow
Black-billed magpie
Common raven
Common crow
Black-capped chickadee
Mountain chickadee
Red-breasted nuthatch
Brown creeper
Winter wren
Bewick's wren
Long-billed marsh wren
Canon wren
Rock wren
Sage thrasher
Robin

REPTILES

Western yellow-bellied racer
Striped whipsnake
Pacific gopher snake
Wandering garter snake
Western rattlesnake
Western painted turtle
Western fence lizard
Sage brush lizard
Wide-blotched lizard
Short-horned lizard
Western skink

Southern alligator lizard

AMPHIBIANS

Woodhouse's toad
Pacific treefrog
Bullfrog
Long-toed salamander
Great basin spadefoot

APPENDIX B

Unpublished Evaluation Species Models Used in Wildlife Assessment for the John Day Project.

1. Spotted Sandpiper
2. Canada Goose
3. California Quaii
4. Mallard

Spotted Sandpiper

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed species, occurring on the margins of sandy ponds, sea shores, and rocks bordering streams.

Hays (1973) reported that spotted sandpiper nests were located in grassy upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used al.1 the sparsely vegetated areas on an island as nest sites. Bent (1929) stated that nest sites were variable; high areas of sand island in high, rank sedge grass, on grassy, overgrown gravel bars, in driftwood piles, under extending tree branches, under rock ledges, and under decayed logs representing reported nest sites. Nest sites are close to water (Bent 1929). Oring and Knudson stated that spotted sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (1973) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) reported that spotted sandpipers nest just above the highwater mark on tree-lined shores. Stout (1967) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous cover 0.5 m in height and 30 m or less from the beach. Three nests were located in mixed deciduous woods 8-13 m high and 20-50 m from the beach. Miller and Miller (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 - 76.2 cm in height.

Hays (1973) stated that spotted sandpipers have a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial in winter.

Miller and Miller (1948) reported a colonial breeding situation, 38 pairs/5.46 ha. Kuenzel and Wiegert (1973) reported a territorial size of approximately 1 .21 ha per bird. Heideman and Oring (1976) stated that 4-5 pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 active nests/l.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

Spotted sandpipers feed primarily on insects, especially aquatic insects.

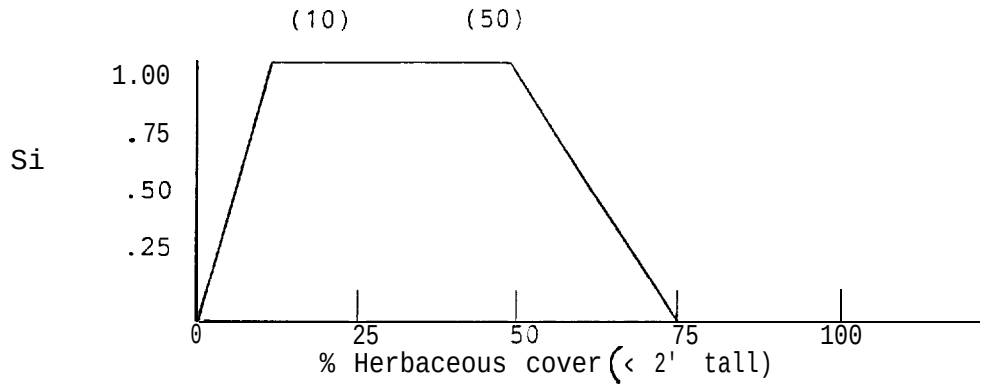
SPOTTED SANDPIPER SUITABILITY INDEX

Nesting Cover (V1)

A mosaic of herbaceous ground cover with an overall density of less than 50% and less than 2' high (an overstory of deciduous trees can be present if the ground cover requirements are met).

Flocding probably not a significant problem as the sandpiper is quite capable of renesting if necessary.

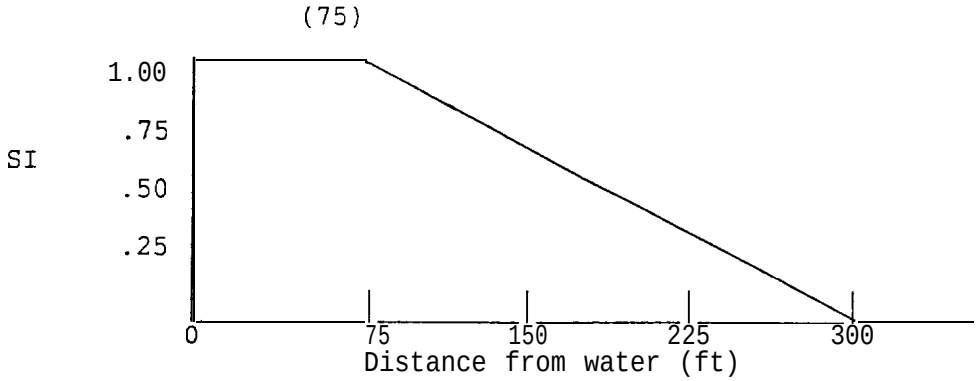
[150 ft. transect, 25 ft. intervals. Begin transect where V3 crosses daily high water mark and continue inland 150 ft.]



Nesting distance from water (V2)

Optimum Nesting habitat is within 75 ft. of water.

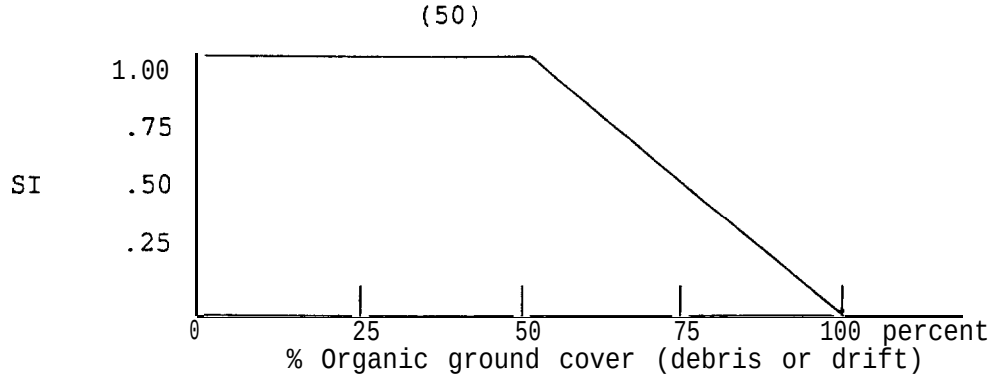
[measure minimum distance between nesting habitat and water]



Foraging habitat (V3) -

Open or sparsely vegetated shorelines (gravel, riprap, or sandy substrates) within 150 feet (45 m) of water (normal pool) which may contain some organic debris or drift.

[Begin transect at EOW and go inland 150 ft. with measurements every 25 ft.]



Model Equation

$$HSI = \frac{V1 + V2 + V3}{3}$$

Spotted Sandpiper

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CANADA GOOSE MODEL

This model is a modification of the Canada goose model developed by Dave Lockman et. al. for the evaluation of Canada goose nesting and brooding habitat on the Snake River at Palisades Reservoir. This modification was developed by Patrick Wright, Larry Rasmussen, and Jim Bottorff of the Portland Field Station, Fish and Wildlife Service and The Dalles, John Day, and McNary wildlife loss assessment HEP team members for use in describing the quality of nesting and brooding habitat in the vicinity of these projects.

Nesting Habitat

Islands (V1)	SI Value
Stable islands present; islands have relatively high shoreline/area ratio; cover indicative of stability; ground cover on portions of island 4"-8" high.	0-8-1.0
Stable islands present; relatively low shoreline/area ratio; cover on island <4" or >8".	o-5-0.7
No stable islands, or islands with limited or no cover.	o-o-o.4

Brood Rearina Habitat

Late April - July

Foraqinq Area (V3)	SI Value
Distance from nesting areas to foraging zones ≤1 mile (preferably within site of the nesting area); forage ≤4" tall and ≥ one acre in size; foraging zones total ≥10 acres per mile of river; access to foraging zone within 25 meters of open water and not precluded by physical obstruction or dense vegetation (predator cover).	0.7-1.0
Distance from nesting areas to foraging zones ≥1 and ≤2 miles; forage ≤4" tall and ≥ one acre in size, foraging zones total 5 to 10 acres per mile of river; >25 meters but <50 meters from open water (escape cover).	0.4-O-6
As above except foraging zone >2 miles from nesting areas and >50 meters from open water (escape cover).	0.0-0.3

Model Equation

$$HSI = \frac{V1 + V3}{2}$$

June 1978

CALIFORNIA QUAIL
Grassland/Agricultural Type

General

California quail (Lophortyx californicus) are year-around residents in this Ecoreqion and are most abundant in the brush-grassland successional stage in area; where water is available (Crawford 1977). California quail habitats include brushy thickets, scattered low branched trees, grassland, dry and irrigated cropland, orchards, and vineyards (Sumner 1935; Emlen and Glading 1945; and Edminster 1954).

Food Requirements

Adult quail are essentially vegetarians (Edminster 1954). The California quail feeds in open areas with abundant annual herbaceous vegetation where ground cover is not dense enough to impede movement (Emlen and Glading 1945; Edminster 1954; and Crawford 1977). Highest densities in brush-grassland habitat types in Oregon were found in areas with bare ground percentages of 30% and 45% (Crawford 1977). Seeds comprise 60 to 75% of the year round diet, and greens account for 25 to 30% of the diet (Edminster 1954). Acorns and berries are sometimes eaten by quail in small quantities in late summer and fall. Legume seeds (and some leaves) comprised 25 to 35% of the annual diet. Grasses, including grains, account for 10 to 25% of the annual diet while annual weed seeds account for 20 to 60%. Woody plants account for only 3 to 5% of the diet. The berries of snowberries (Symphoricarpos sp.), brambles (Rubus spp.), and poison oak (Rhus diversiloba) make up a small part of the summer and fall diet. The most important plant families in the diet of quail in California were legumes (Fabaceae), grasses (Poaceae), geraniums (Geraniaceae), and composites (Asteraceae) (Sumner 1935). Insects account for up to one-third of the diet of young quail during their first few weeks of life (Edminster 1954).

Water Requirements

Surface water is required by California quail throughout the year although succulent foods meet some of the water needs for quail within the humid Pacific coastal belt (Edminster 1954).

Cover Requirements

California quail require cover for feeding, roosting, escape, loafing, and nesting (Edminster 1954). Cover needs associated with reproduction are discussed under Reproductive Requirements.

The best food-producing cover types are open brushlands and non-brushy grasslands (Edminster 1954). The usefulness of cultivated fields, especially small grains and hay, as feeding areas depends on the proximity of the fields to escape cover. Areas where clean farming methods are used do not provide suitable feeding cover for quail. Dense stands of brush or grasses or closed canopy stands with little understory are deficient in food supplies or do not provide suitable feeding cover (Sumner 1935).

Dense low shrubs, trees, trailing vines, weed patches, dense grass, piles of debris, and even rockpiles serve as escape cover (Emlen

and Glading 1945; Edminster 1954). Crawford (1977) found that blackberry brambles were used almost exclusively for escape cover in the Willamette Valley. Escape cover is characteristically lower than good roosting cover and taller and denser than good nesting cover (Edminster 1954). Escape cover is also used as loafing cover. Optimal escape and loafing cover is provided by clumps of plants 10 to 20 feet (3-6 m) in diameter, and spaced not more than 200 feet (61 m) apart (Emlen and Glading 1945).

Quail roost in areas of dense foliage (either tall shrubs or scattered trees with low-growing, densely foliated branches) with suitable roost sites from 15 to 25 feet (4.5-7.6 m) above ground (Sumner 1935; Ecfminster 1954). In California, thickly branched trees and shrubs from 5 to 30 feet (1.5-9.1 m) tall provide suitable roosting cover with at least one roosting site per 30 to 40 acres (X.1-16.2 ha), or at 0.25 mile (0.4 km) intervals (Emlen and Glading 1945).

Reproductive Requirements

California quail require areas of low vegetation that provide concealment and shade for nest sites (Sumner 1935; Emlen and Glading 1945; and Edminster 1954). Nests are on the ground in a variety of locations and are frequently found in edge situations (Edminster 1954). Young quail require thick, brushy cover. Broods occupy areas of 10 to 30 acres (4-12 ha) by their eighth week. Broods combine to form coveys as the summer progresses.

Special Habitat Requirements

No special habitat requirements were found in the literature.

Interspersion Requirements

Quail require a mixture of cover types including open areas with abundant annual herbaceous vegetation, dense foliage from 5 to 30 feet (1.5-9.1 m) tall for roosting, clumps of low plants for escape and loafing, suitable ground sites for nesting, and sources of surface water. Optimal habitat conditions consist of a high degree of interspersion of herbaceous and woody cover and water sources within a small area. In California, a cruising radius of approximately 50 feet (15 m) has been observed (Sumner 1935). In Oregon, coveys of quail ranged up to 0.25 mile (0.4 km) from their evening roost site (Yadon 1954). Fall and winter range of coveys is limited by the amount of protective shrub cover (McMillan 1964). Covey size appears to be influenced more by food supply and adequacy and juxtaposition of shelter in relation to food supplies than by any other factor (Edminster 1954).

Special Considerations

Clean farming methods that reduce brushy fence rows, weedy patches, and similar brushy edges reduce the suitability of the habitat for California quail (Sumner 1935; Edminster 1954). Overgrazing may reduce brushy cover to the point that habitat becomes unsuitable for quail (Edminster 1954). Irrigated croplands provide both surface water and food but these areas often lack suitable shelter unless brushy cover is left.

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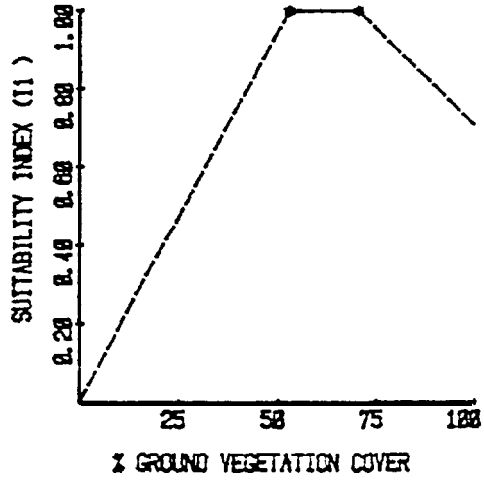
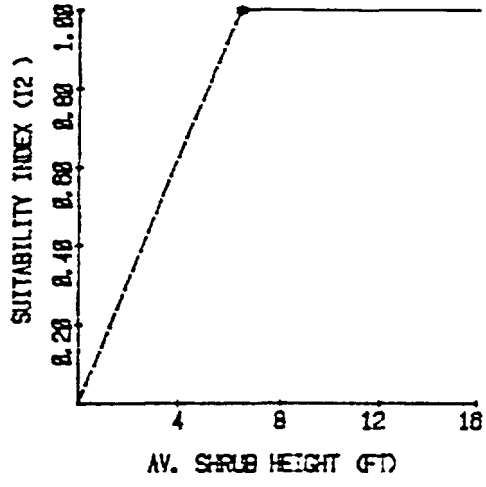
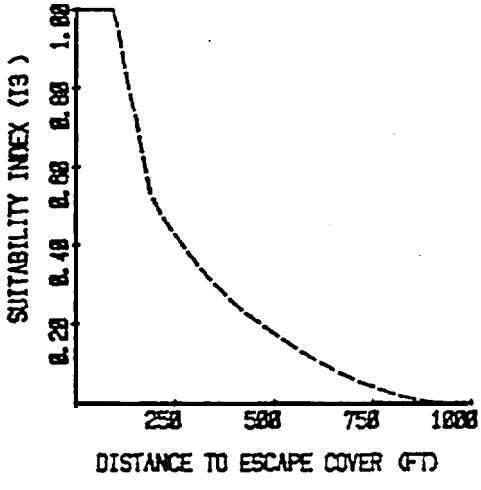
JUNE 1978

CALIFORNIA QUAIL

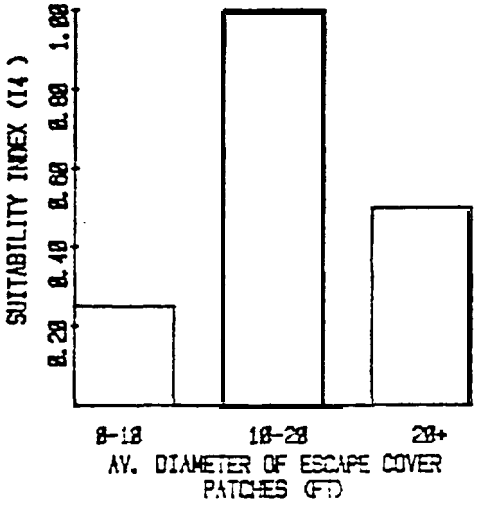
GRASSLAND/AGRICULTURAL

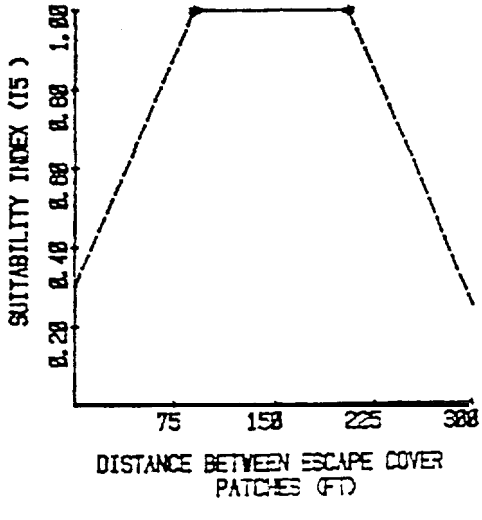






ESCAPE COVER=DENSE GROWTH OF SHRUBS, VINE TANGLES, OR DENSE TALL GRASSES OR FORBS GREATER THAN 8 INCHES TALL





June 1978

HABITAT SUITABILITY INDEX

Cal ifornia Quai 1 in Grassland/Agricultural Type

Ecoregion 2410

$$\underline{\text{Cover Value}}\ (\text{XI}) = \frac{I_1 + 12 + (I_3 \times I_4 \times I_5)^{1/3}}{3}$$

Where: I_1 = Suitability Index (SI) of percent ground vegetation cover.

I_2 = SI of average shrub height.

I_3 = SI of distance to escape cover.

I_4 = SI of average diameter of escape cover patches.

I_5 = SI of distance between escape cover patches.

The Habitat Suitability Index is XI.

MALLARD MODEL

This model was developed from information provided in several different models including: (1) the Draft Habitat Suitability Index model, Mallard (Breeding), U.S. Fish and Wildlife Service, Division of Ecological Services, Sacramento, California, July, 1985; (2) Draft Habitat Suitability Index Model, Mallard (Wintering), U.S. Fish and Wildlife Service, Division of Ecological Services, Sacramento, California, July, 1985; and (3) Habitat Suitability Index Models: Dabbling Ducks, by Patricia D. Rice, U.S. Fish and Wildlife Service, Great Basin Complex, Reno, Nevada, February, 1984. These models were modified for The Dalles, John Day, and McNary wildlife loss assessment by HEP team members according to information provided by the local, state, federal, and tribal biologists.

General

The mallard (*Anas platyrhvnchos*) utilizes this portion of the Columbia basin for both nesting and wintering habitat. Typical mallard habitats include riparian herb, emergent wetlands, occasionally some agricultural lands (grain crops) and shrub/steppe areas, and open waters.

Wintering Habitat

Wintering populations of mallards are often congregated around the shallow water graveled areas associated with islands where they are protected from human disturbance and predators. Large numbers of mallards utilize backwater areas and slower velocity portions of reservoirs (especially John Day and McNary Reservoirs) and rivers for resting. The main reservoir area with higher velocities and barge traffic is only used occasionally. Daily flights to nearby agricultural crops (cereal grains and corn) provide much of the food requirements in the mid-Columbia basin area.

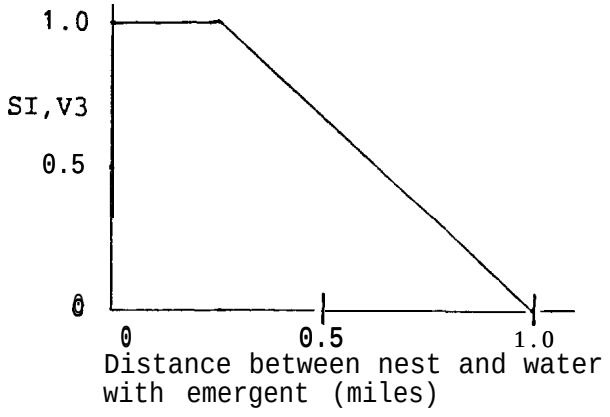
Nestina Habitat

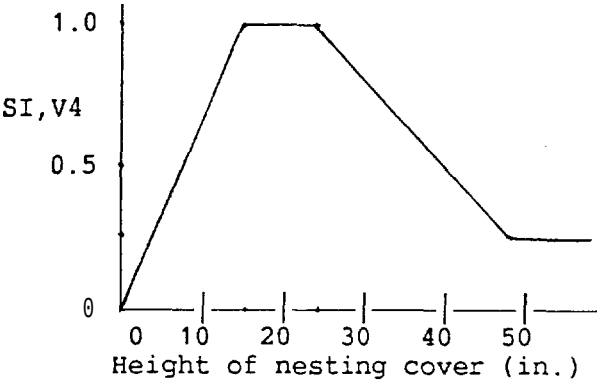
Nesting commonly occurs in a riparian herb cover type that is located in the vicinity of emergent wetlands. Herbaceous vegetation between 15 and 24 inches tall with at least a 75 percent canopy cover is preferred. Mallard nests are found in greater numbers and have a higher success rate if they are within 1/4 mile of water with emergent vegetation. The emergent vegetation provides cover and rearing area for the juvenile birds. Emergent wetlands with 40 to 60 percent vegetative cover (relative to open water) are preferred. The success of an otherwise optimum nesting area can be significantly reduced by disturbance from people and dogs.

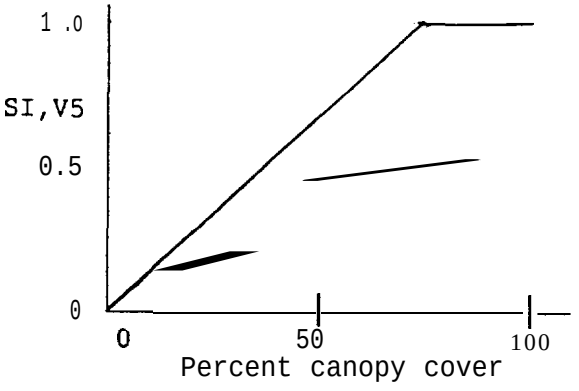
MALLARD HABITAT SUITABILITY INDEX

NESTING

Cover Types: Riparian Herb and Shrub/Steppe/Grassland







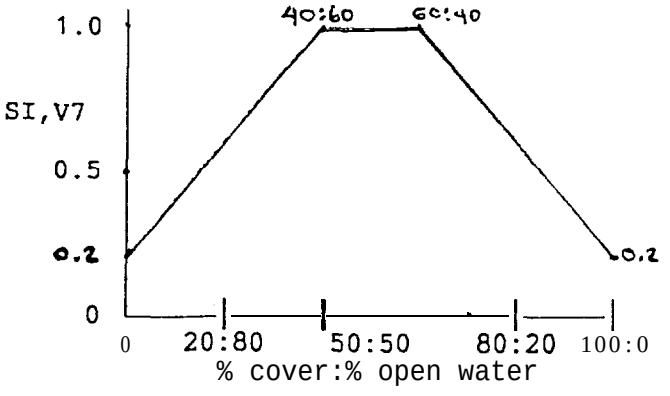
V6, Disturbance by people and dogs

	S.I.
Low	0.8-1.0
Medium	0.4-0.7
High	0.0-0.3

Model Equation

$$HSI = \frac{V3 + V4 + V5}{3} \times V6$$

Cover Type: Emergent wetland



Model equation

HSI = V7

WINTERING

Cover Type: Open Water

V-l, Velocity of open water

Preproject
main river SI = 0.5
backwater SI = 0.8

Postproject
main river SI = 0.7
backwater SI = 0.9
barge channel SI = 0.4

Cover Type: Agricultural (food crop)

V-2, crop management

For the mid-Columbia Basin projects the HEP study team assumed that both pre- and post-project crop management provided an adequate mallard food supply. Food supply is not a limiting factor.

Model equation for wintering mallard: HSI = V-1

APPENDIX C

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