IMPACTS OF THE SALEM PARKWAY UPON BIOTIC RESOURCES AND WATER QUALITY

by

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Dr. G. Matzke

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Both of my geographical roommates, Sharon and Judy Kelly, have been dear friends and good editors of this paper. Robert Morrow has offered criticism as a biologist and friend, and has supported and cheered me through its preparation and revision. To these special comrades, I offer my thanks.

Finally and foremost, I owe my thanks to Marion and Mary Lou Hobbs for their continuous and total support of me. Without their help it would have been impossible for me to begin, and at last complete this Research Paper, and this journey of education.

ABSTRACT. The proposed construction of a four lane road, the Salem Parkway, was evaluated regarding the potential environmental impacts its location would have upon biotic resources and water quality. Due to existing commitment of the study area to urbanization and agriculture, only limited environmental sensitivity was observed overall. It was found that most, if not all, of the expected detrimental environmental impacts could be confined to disturbance of riparian woodlands and wetlands. These sensitive areas constitute 2% of the entire study area.

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INTRODUCTION

The purpose of this report is to assess the probable impacts of the Salem Parkway and corollary projects upon biotic resources and water quality.

The proposed Salem Parkway involves the construction of a four-lane limited access arterial which is estimated to be 3.6 miles long and 68 feet wide. The corollary projects involve widening, extending or improving existing roads.

The Salem Parkway study area was designated, but the location of the road within this area was not known at the time of this study. The study area is approximately 13 square miles in extent. It is located within the Willamette River Valley, and includes a portion of northern Salem, and the City of Keizer.

It is not the goal of this report to generate original technical data regarding ecosystems or responses to road construction. Rather, it is the intent of this report to integrate all existing data (see Appendix A, List of Contacts) with field observations in order to identify areas of special concern and/or unusual environmental sensitivity. This report is intended for use and understanding by the public, as well as by the technical Environmental Impact Analysis team of which the researcher is a member.

Included within this report are surface and groundwater quality,

wetlands, flora, and fauna. Several maps have been generated to show the classification and distribution of these phenomena within the study area.

BACKGROUND

When Federal monies are used to finance major actions which have been determined to significantly affect the quality of the human enviornment (such as the Salem Parkway), it is required by the National Environmental Policy Act (NEPA) of 1969, that an Environmental Impact Statement (EIS) be filed. The EIS must address probable impacts upon the biotic environment, and propose measures to ameliorate these impacts. Secondary or indirect consequences of the action, as well as primary or direct impacts must be addressed. It is also required that alternatives to the action be developed and studied.

A large percentage of the funding for the Salem Parkway is being provided by the Federal Highway Administration. It is therefore required by law that an EIS in compliance with Federal guidelines be prepared.

The intent of this report is to precede the EIS, and to facilitate an informed and intelligent choice of alternative corridor locations, and provide guidelines for further and more complete analysis as specified by NEPA. This report is intended to aid the EIS writer, and at the same time, be understood by the layman public.

METHODS

The first step in determining the probable environmental impacts of the Salem Parkway was to survey the existing environmental conditions.

The first task in such a survey involved the preparation of a Vegetation Form Map. The purpose of classifying land into vegetation forms is to help determine, in a general way, the types of biological resources present.

A combination of aerial photographic analysis, examination of agricultural tax deferral maps, and site visitation were used in the compilation of this map.

Planimetric analysis was used to determine the proportions of each vegetation form category within the study area. This provided an important measurement used in determining the extent and distribution of biological resources, and estimating the degree of sensitivity present within the study area.

The Oregon Fish and Wildlife Service composed the comprehensive list of wildlife which exist around the Salem area. They also provided the services of a fisheries biologist, who sampled Claggett Creek, and offered information regarding the various water bodies within the study area.

The Audubon Society furnished the Christmas Bird Count for the Salem area, which identified and counted important migratory

waterfoul which frequent the area in late December.

Surface and ground water quality was assessed according to Department of Environmental Quality (DEQ) standards and samples. A Water Resources Department hydrogeologist provided technical guidance regarding the quantity and quality of ground water.

The Wetlands Areas Map was prepared following U.S. Fish and Wildlife criteria, and the partially completed Wetlands Inventory Map covering the USGS West Salem Mapping Unit. Aerial photographic analysis, Marion County Soil Survey Maps, and site visitation during periods of high water tables were important tools used to develop this map.

After existing environmental conditions had been determined, potential environmental impacts were addressed. The Oregon Department of Transportation (ODOT) Technical Library provided access to a large and useful collection of works regarding types of impacts associated with road construction and maintenance. Several ODOT biologists provided valuable guidance regarding special problems existing within the study area.

Potential mitigation measures were recommended by several expert sources. Conclusions represent the summation of established environmental sensitivity and probable environmental responses to project construction.

Citizen input has been a concern throughout the preparation of

this paper. Letters were sent to various citizen organizations (see Appendix A) and little response was received. The Salem Parkway Citizens Advisory Committee offered little opinion in their review of this report. However, at a meeting on June 21, 1979, the committee did vote acceptance of the report.

ENVIRONMENTAL INVENTORY

Vegetation

There are four distinct environments within the study area. These are largely the product of various land uses which give rise to different vegetation forms. The vegetation form categories are: 1) urban/committed lands, which compose 61% of the study area; 2) agricultural lands, which compose 31% of the study area; 3) grasslands, which compose 6% of the study area; and 4) woodlands, which account for 2%. An explanation as to their classification is shown in Appendix B, Vegetation Form Map.

The classification of land into vegetation forms helps to determine the distribution and presence of various types of biological resources within the study area. Each of the vegetation forms also represents a different intensity of land use. The most intense land use is the urban/committed category, followed by those in agriculture and grasslands. Woodlands represent the least disturbed ecosystem in the study area.

Urban/committed lands are lands that are either in direct urban use (roads, buildings, etc.) or are in close proximity to such uses. In these areas natural succession is no longer instrumental in determining the character of vegetation. Lawns and yards are the predominant vegetation form, and exotic species of flora are commonly cultivated.

Agricultural lands also constitute a major alteration to the natural vegetation. In these areas natural succession is maintained at an early stage by cyclic cultivation and/or mowing. Along field edge areas, bunch grasses are quite common.

Grasslands include pastureland and transitional grasslands. Natural succession in pastures is maintained at an early stage by grazing and/or mowing. In transitional grasslands natural succession is important in forming the existing brush/shrub communities. The dominant brush/shrub species include large thickets of blackberry (Rubus ursinus), and a lesser amount of woodrose (Rosa woodsii) and stinging nettle (Urtica dioica). Bunch grasses and reed canary grasses are also present.

In terrestrial and riparian woodland areas natural succession has been important in forming existing stands. In many of the riparian woodlands, willows (Salix spp.) are the most common tree species. Willows are well adapted to the wet conditions that prevail there. In drier locations Oregon ash (Fraxinus oregona) and black cottonwood (Populus trichicarpa) commonly form the upper canopy of the woodlands. The lower and middle canopies include young ash, mock orange (Philadelphus lewsii), hawthorn (Crategus spp.), willow (Salix spp.), and other non-native trees.

Two important plant species may exist in the study area.[1] These are Sidalcea campestris and Sidalcea nelsoniana, commonly

known as wild hollyhock. These species are suspected to occur in eleven Oregon counties including Marion County.[2] Both of these plants bloom during May and June and may be seen in meadows and along roadsides.

Both of these species have been classified as Proposed Endangered (Federal Register 41(117), June 16, 1976), which means the plants are to be treated as if they were endangered until the status can be more completely documented. Upon completion of additional field work, the plant will be either reclassified or removed from the list altogether.

A list has been compiled by the Endangered Species Office of the U. S. Fish and Wildlife Service, in which proposed endangered species in Oregon are prioritized. Sidalcea campestris has been given a low priority status, and after more field work it will probably be removed from the protected status list.

Sidalcea nelsoniana has been given an undetermined status by the Office of Endangered Species until more is learned about the existence of this species in Oregon.

Fish and Wildlife

The Oregon Department of Fish and Wildlife has prepared a list of wildlife to be found in the Salem vicinity (see Appendix C). This list is comprehensive and includes mammals, birds, reptiles and amphibians.

Probably only a small portion of the species listed actually occur in the study area. A Christmas bird count was compiled between 1968 and 1973 by the Salem chapter of the Audubon Society (see Appendix D). The totals represent one-day counts only, taken during the winter when waterfowl are most numerous.

Rather than set forth exact population numbers and locations of specific species of fish and wildlife, it is the purpose of this report to assure that no rare or endangered species exist in or adjacent to the study area. No such species are believed to exist. Any sensitive or rare wildlife species that might have occupied the study area were driven from the area long ago by urban encroachment.

A letter of intent has been filed with the U.S. Fish and Wildlife Service with regard to the Salem Parkway Project as required by law (NEPA, 1969). If a possibility exists of rare or endangered species being present in the study area, the Fish and Wildlife Service will provide further consultation and technical advice.

Fish populations in Claggett Creek were sampled using a seine net, and as expected no game or anadramous fish were discovered. The urban creek produced one small population of bream. It is not likely that Labish Ditch supports any fish populations other than bream. The log ponds within the study area probably support some warm water fish species. Although the log ponds are in private ownership, and entry is prohibited, fishing activities are known to occur.

Surface Water Quality

Within the study area Claggett Creek is a low gradient, sluggish drainage system. In general, the water quality can be classified as fair (see Table 1). Both the quality and quantity of water in Claggett Creek are a reflection of existing residential, industrial, and commercial development in the drainage area.

Physical water quality is determined in part by the concentration of suspended sediment. In Claggett Creek, turbidity varies from season to season with the flow regime. In areas where construction activities are ongoing, turbidity tends to be high and physical water quality may be temporarily degraded.

The bacteriological water quality of Claggett Creek is good, judging from several samples taken by the Oregon Department of Environmental Quality (DEQ, 1972). Some high measures of fecal coliform have been recorded along certain stream reaches. These can probably be attributed to the presence of livestock in riparian areas.

Chemical water quality has been sampled several times by DEQ (see Table 1), and appears to be within acceptable limits. Dissolved oxygen is high, and nutrient loading does not pose a threat to aquatic life. Roadway and street runoff is collected in a storm drain system that discharges mainly into the Willamette River. However, short segments of the system empty into Claggett Creek. Some chemical modification of water quality undoubtedly occurs from this urban runoff.

Table 1. Water Quality Sample of Claggett Creek.

	PH	Temp.	Flow	DO	Saturation	BOD
Dearborn St.	6.7	10°C	1 cfs	11.2	99%	5.8
McNary	7.1	10°C	1.5 cfs	8.6	76%	.7

DEQ, 11/21/72

A study of urban stormwater runoff in the Salem area in 1977 attempted to identify runoff problems in specific parts of the city.[3] The results however, were less than reliable because of the drought condition during the study period. A second stormwater study is scheduled for July 1979. An acceptable model for predicting pollutant loadings from transportation projects similar to the Salem Parkway does not presently exist.

Water quality data for Labish Ditch does not exist. It may be assumed however, that intensive agricultural land use adjacent to much of this small channelized ditch has adversely affected the water quality.

Presently the Chemawa Indian School sewage lagoon discharges into Labish Ditch, augmenting its small flow. However, the school will be serviced by the Salem Sewage Treatment Plant beginning in late summer 1979. This will eliminate the discharge into Labish Ditch.

Groundwater Quality

The quality of groundwater in the study area is generally good. Wells once were common throughout the study area, and well water was used domestically prior to urbanization. Due to the presence of near surface water tables at several points in the study area, and the ease by which groundwater contamination could occur at such points, most of the early wells have been capped.

The source of much groundwater recharge is precipitation, of which the study area receives approximately 43 inches annually. The rate of dispersion of groundwater in the study area is slow, and movement is toward the northwest, to points of discharge along the Willamette River.[4]

Wetlands

Because of the great diversity in wetland types (marshes, swamps, bogs, wet meadows, estuaries, etc.) there has been some confusion and contradiction regarding a definition of wetlands. The definition used by the U.S. Fish and Wildlife Service is quite broad:

> Wetlands exist where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes.[5] (At the present time the U.S. Fish and Wildlife Service is preparing a list of hydrophytes of the U.S. The U.S. Soil Conservation Service is also preparing a list of hydric soils for use in this classification system.)

The definition given by the Oregon Department of Transportation (ODOT) and the Federal Highway Administration (FHWA) (Executive Order 11990), is more restrictive and does not include waters of permanent streams, or shallow lakes or ponds without emergent vegetation. However, it is anticipated that ODOT and FHWA will adopt the wetlands definition and classification currently being developed by the U.S. Fish and Wildlife Service. Therefore, in this report the definition used by Fish and Wildlife will be adhered to.

Two wetland ecosystem types exist in the study area. These are palustrine (P) and riverine (R), and are found in:

(1) Claggett Creek (R) and riparian marshland (P);

(2) Labish Ditch drainage (R);

(3) Meander scar, located in the topographic depression on Keizer Road west of I-5 (P);

(4) Log ponds (P); and

(5) Willamette River shoreline (P).

It should be noted that Claggett Creek and Labish Ditch would not qualify as wetlands under the ODOT definition because they are considered to be permanent streams. It is also questionable whether the log ponds would qualify under this definition because of their lack of emergent vegetation.

The palustrine system includes marshland and shallow ponds (less than 2 meters deep at low water). In the palustrine ecosystem the water tables are at or near the ground surface. Flooding occurs

frequently and for long periods between the months of December and April. Vegetation classes in the study area included forested wetlands, scrub/shrub wetlands, emergent grasslands wetlands, and open water possessing unknown vegetation species along the bottom.

The riverine system includes all wetlands contained within a river or stream channel. Water is typically flowing within this lotic system. Water tables are at or near the ground surface, and flooding is common in most areas. Existing subsystems include lower perennial and intermittent flow regimes of water. In the lower perennial systems water is usually present and flowing slowly throughout the year. In the intermittent systems water flows only during the wet season. During dry periods water may be entirely absent or remain in isolated pools.

Both types of wetlands are commonly found throughout the Willamette River floodplain and along other alluvial floodplains. Typical features of fluvial denudation processes include low gradient, marshy streams, and meander cut-offs or scars. Wetlands not resulting from natural processes, such as old log ponds or gravel pits, are common along the Willamette River floodplain, especially near centers of present or past human populations.

The visual and aesthetic qualities of wetlands are a factor in their evaluation for enviornmental impact statements. Field observations were conducted on April 25 and 26, 1979 for the purpose of

assessing visual and aesthetic quality. (See Wetland Areas Map for location of observation points.)

1. Along the Claggett Creek and the associated wooded marshland (observed at Dietz Avenue N.E.) a small footpath provides access to the creek and to the wooded and scrub/shrub area. A series of riffles and pools dominates this reach of Claggett Creek. In the riffle areas the water is relatively fast flowing, shallow and clear. In the pool areas the water is deeper, dark grey, and the bottom is not visible. Water in the pools is slow moving, and some evidence of pollution exists. Surface oil is visible, as well as brown scum collecting along the pool edge. The shoreline has a thin strip of willows, and appears to be free of channelization efforts. The adjacent marshland (wooded and scrub/shrub) displays large deciduous trees and a thick brush understory and fringe. Standing water is present. A pheasant was observed, along with various song birds and snakes. There was little sign of human disturbance; no litter, no livestock, and few trails.

2. Labish Ditch (observed at Highway 99 East) shows very little flow. Aquatic plants dominate the water surface, and riparian trees are absent. The channel morphology was apparently determined by channelization.

3. The meander scar (observed at Hasbrook and Allendale Way) consists of a marshy area, considerably deeper than that found along Claggett Creek. The water is a blackish-red color, and moderate

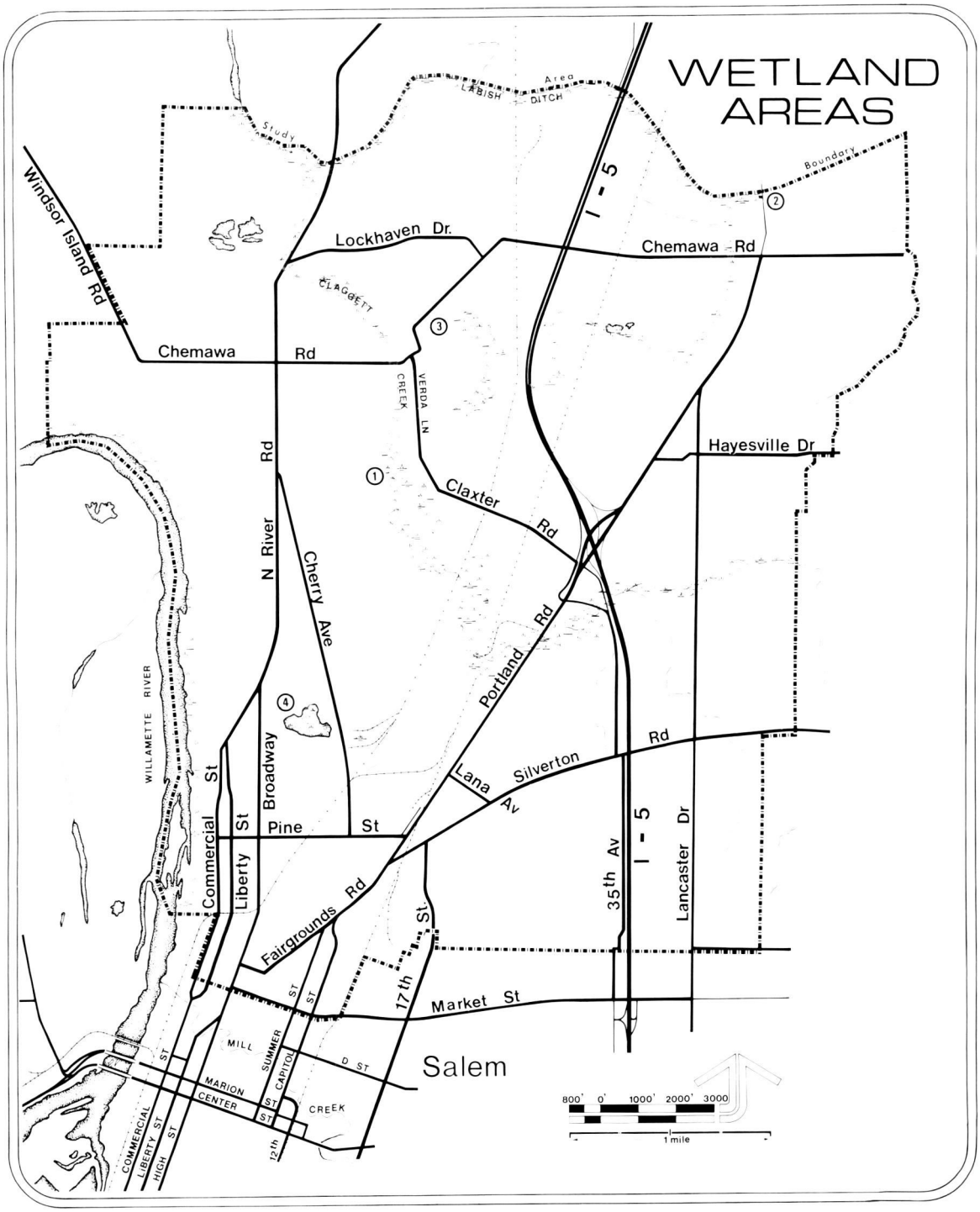


Figure 1. Wetland Areas Map

eutrophication is apparent. The water contains much floating and submerged material (lumber, tires, furniture). Emergent grasses and reeds exist despite the disturbance. Two mallards were seen swimming in this area.

4. The large log pond located behind Orchard Village Housing is fenced and posted as private property. Despite signs and two fences, holes are cut in the fences, making entry possible at several points. Trails leading around the log pond indicate heavy use. The water appears fairly clear, revealing a bottom heavily littered with concrete slabs, boards, and materials. The log pond shore is quite littered. A resident of Orchard Village (a low income housing project) expressed concern regarding the safety hazard the log pond poses. Although the pond is fenced, a large hole exists about 100 feet from a children's play area.

DISCUSSION: POTENTIAL ENVIRONMENTAL IMPACTS

Vegetation

The Salem Parkway and corollary projects will permanently and directly affect a small amount of existing vegetation by alteration of the ground surface. Most of the existing vegetation in the study area has previously been altered from its natural type by human use or activities. Therefore, impacts on natural vegetation will be minimal and localized. There should be no regional vegetation impacts resulting from this project. Areas of special concern are possible endangered plant species and riparian woodlands.

Two proposed endangered plant species may exist in the study area. When the Salem Parkway corridor alternatives have been developed, the area should be field-checked to determine the existence and location of these species.

In the study area riparian woodlands display the most diverse, mature, and sensitive vegetation. The removal of this woodland vegetation can usually be compensated in 50-100 years through secondary succession. However, if topsoil is removed, primary succession will take over 1,000 years to replace the original community. Therefore, construction in mature riparian areas should be avoided where possible, and construction techniques in these areas should be carefully chosen and strictly monitored.

Besides potential adverse impacts to existing vegetation, some beneficial effects may occur from the project. In highly urbanized areas a highway right-of-way sometimes provides the only open space and non-urban flora to be found. It is also possible that vegetation habitats suitable for displaced endangered species may be created along rights-of-way in drainage ditches. A knowledgeable botanist should consider and carefully plan for the wise use of right-of-way land.

Fish and Wildlife

The Salem Parkway will not cause significant regional impacts upon wildlife or fisheries. Local impacts will be more pronounced than the regional, yet they will also be slight.

Local wildlife will be affected by direct and indirect consequences of the Salem Parkway. Loss of habitat will result from paving the ground surface and maintaining the right-of-way. These direct impacts are usually considered irreversible. Another direct impact will be increased wildlife mortality due to traffic kill.

Indirect impacts include various changes to the biota, which in turn may affect certain sensitive species. Air and noise pollution are examples of indirect impacts. While some wildlife species are unaffected by such changes, others display extreme intolerance to them. Some waterfowl depend upon the configuration of wetlands in

breeding areas, and a mere change in form may render a previously acceptable wetland useless.

With exception of some migratory waterfowl, no species in the study area will be seriously threatened by the Salem Parkway. Most, if not all, vulnerable species have already been compromised or displaced by urbanization or agriculture.

The most sensitive wildlife zone in the study area is the riparian woodland. The diversity of wildlife is greatest in this zone.

Fisheries will be impacted initially during construction of the Salem Parkway Project. Physical water quality will be temporarily degraded by increased turbidity and sedimentation. Fish and macrobenthic organisms may be affected in several ways. Mortality due to smothering may occur as well as individual organism drift. However, once the source of siltation has been controlled, populations rapidly recover and/or repopulate the area. There are no sensitive fisheries present in the study area. Therefore, a return to existing conditions can be expected following completion of the construction phase.

Surface Water Quality

The Salem Parkway will have both temporary and long term effects on surface water quality. However, these impacts will be of minor significance considering present water uses and existing conditions.

Roadway construction will result in increased turbidity and sedimentation in surface waters, notably Claggett Creek. Considering the aquatic communities present in the study area, this disruption should not cause permanent or irreversible damage.

The long term effect of roadway construction will involve a slight degradation of chemical water quality. Increased street runoff and chemicals used for weed control within the right-of-way can be expected to add a small yet undetermined volume of contaminants to surface water bodies. However, even during periods of low flow this increased degradation should be too small to significantly alter the nature of existing ponds and streams.

Groundwater Quality

Near-surface water tables throughout the study area make it possible for contaminants to enter the groundwater body. Once groundwater contamination has occurred, it is difficult to purge the water of pollutants.

Considering the relatively small land area involved and the hydrologic characteristics of the study area, the increase in street runoff should not significantly alter the quality of groundwater.

It is possible, however, that chemical spills, especially from industrial traffic, could occur in sensitive areas of near-surface water tables. Such spills could contaminate the groundwater with a

highly concentrated pollutant which could cause serious and long-lasting problems. These spills cannot be predicted, but they should be considered a potential adverse impact of the project. Areas of near-surface water tables should therefore be viewed as environmentally sensitive areas.

Wetlands

Roadway construction will have primary and secondary impacts on complex wetland ecosystems. To properly assess such impacts, one must consider, besides the physical attributes of wetlands; the design of the roadway, the size and maintenance of the right-of-way, types and intensity of traffic use, and associated changes in land use.

No extensive literature addressing specific wetland responses to transportation projects similar to the Salem Parkway and corollary projects exist. However, certain responses and effects can be expected.

The construction of a roadway bisecting wetlands tends to impound the flow of surface and groundwaters. This can result in elevated water levels on the upstream side of the road structure, and a lowering of the water level on the downstream side.

These changes in water level can drastically alter the composition of wetland communities. Many wetland vegetation species are extremely intolerant to even minor changes in water level.

Wetlands are rich wildlife habitats, and are frequently used as corridors of migration and travel for many species. Roads can physically block such routes of travel and contribute to increased wetland wildlife mortality. In the instance of migratory waterfowl, the mere proximity of roads and the alteration of the shape of a wetland area can seriously limit the use of that area for some species.

Many plant and animal communities are dependent upon good water quality and a narrow range of substrate conditions. Road construction has an effect in both of these areas.

Turbidity refers to the ability of water to transmit light. High turbidity often results from the presence of suspended particulate matter. When this suspended matter settles out of the water, sedimentation occurs. During road construction both of these conditions present problems for benthic animals (substrate dwellers) and aquatic communities.

In summary, roadway construction in wetland areas alters the quantity and quality of surface and groundwater, reduces suitable terrestrial habitat, and may result in a variety of downstream effects. Many of these effects are secondary or long term and include changes in water supply, inability to convey flood flows, reduced fish and wildlife fertility, and reduced O_2 production.[6]

POTENTIAL MITIGATION MEASURES

The following measures are recommended to mitigate the adverse impacts of roadway construction on biotic communities in the Salem Parkway study area:

Pre-Construction Phase

1) Avoidance of encroachment on sensitive wetland and riparian areas where possible;
2) Avoidance of possible endangered plant species in the right-of-way.

Construction Phase

1) Adoption of careful erosion controls (return of topsoil, etc.);
2) Careful selection of borrow areas;
3) Use or disposal of all spoil material;
4) Design of facilities for heavy equipment parking and turning;
5) Use of culverts and/or other devices to preserve water quality;
6) Provisions along roadway corridors to facilitate animal migrations;
7) Possible creation of new wetland habitat in ditches, culverts, etc.;
8) Begin and end construction phase during the dry season to minimize site runoff.

Post Construction Phase

1) Minimal use of deicing salts and other chemicals;

2) Effective mowing practices and minimum use of herbicides;

3) Slope protection (stabilization, revegetation);

4) Careful selection of right-of-way vegetation.

CONCLUSION

This report has attempted to survey the biotic resources and water quality of the Salem Parkway study area. Areas of special concern and/or unusual environmental sensitivity have been highlighted and mitigation measures have been suggested. In a later addendum to this report specific biotic impacts of the various projects alternatives will be identified and compared and specific mitigation measures proposed.

The report has concluded that areas of special concern are:

1) Vegetation	*Possible Proposed Endangered Species (Sidalcea campestris and Sidalcea nelsoniana), location undetermined;
2) Fish and Wildlife	*Diverse wildlife habitats uncommon to urban areas, located in riparian woodlands and wetland areas;
3) Wetlands	*Protection of Wetlands, Federal Requirement, *Extreme sensitivity to water level fluctuations and other changes associated with road construction; *Diverse wildlife habitat uncommon to urban areas; *Presence of sensitive aquatic habitat;
4) Groundwater	*Vulnerable areas where near-surface water tables are found, located near wetland areas.

For the study area as a whole, environmental sensitivity is quite low. Yet, some areas deserving and in some cases requiring

protection do exist. These sensitive areas as specified above, are confined to riparian woodlands and wetlands which constitute only about 2% of the study area (see Wetlands Area Map).

Intensive land use has successfully reduced the size of native plant and animal communities within the study area. Although most of the remaining biotic communities are by no means rare or endangered, this is not to imply they are worthless or insignificant. For example, a small enclave of wetlands may assume increased value by virtue of its scarcity within the developed area.

FOOTNOTES

1. Jean Siddall, Field Checking Progress Report to Field Botanists on Provisional List of Rare, Threatened, and Endangered Plants in Oregon, Oregon Rare and Endangered Species Task Force (1977) pp. 26-30.

2. U. S. Dept. of Fish and Wildlife, Oregon County List of Threatened and Endangered Plant Species, (Endangered Species Office, Portland, Oregon, 1979).

3. Mid-Willamette Valley Council of Governments, Urban Stormwater Runoff Subplan, (Areawide Waste Treatment Management Plan, Marion, Polk, and Yamhill Counties, Oregon, 1977).

4. Robert Almy, Water Resources Department, (personal communication, May 10, 1979).

5. U. S. Dept. of Fish and Wildlife, Classification of Wetland and Deep Water Habitat, (Washington, D. C., 1977) pg. 11.

6. W. N. Shaw and G. C. Fredine, Wetlands of the U. S., Their Extent and Their Value to Waterfowl and Other Wildlife, (Circular 39, Fish and Wildlife Service) pg. 16.

APPENDIX A

LIST OF CONTACTS

Audubon Society - (letter sent to Mrs. Beverly Klock)

Department of Environmental Quality - Mr. Steve Downs, Water Quality Engineer

Marion County Health and Sanitation Department

Marion County Planning Department

Oregon Department of Transportation - Roger Powers, Biologist
Prusilla Harney, Water Quality

Oregon State University - Department of Geography - Dr. Frenkel
Dr. Matzke

Salem Public Works - Herb Arnold, Planning Engineer

Salem Rod and Gun Club - (letter sent to Richard Iltis)

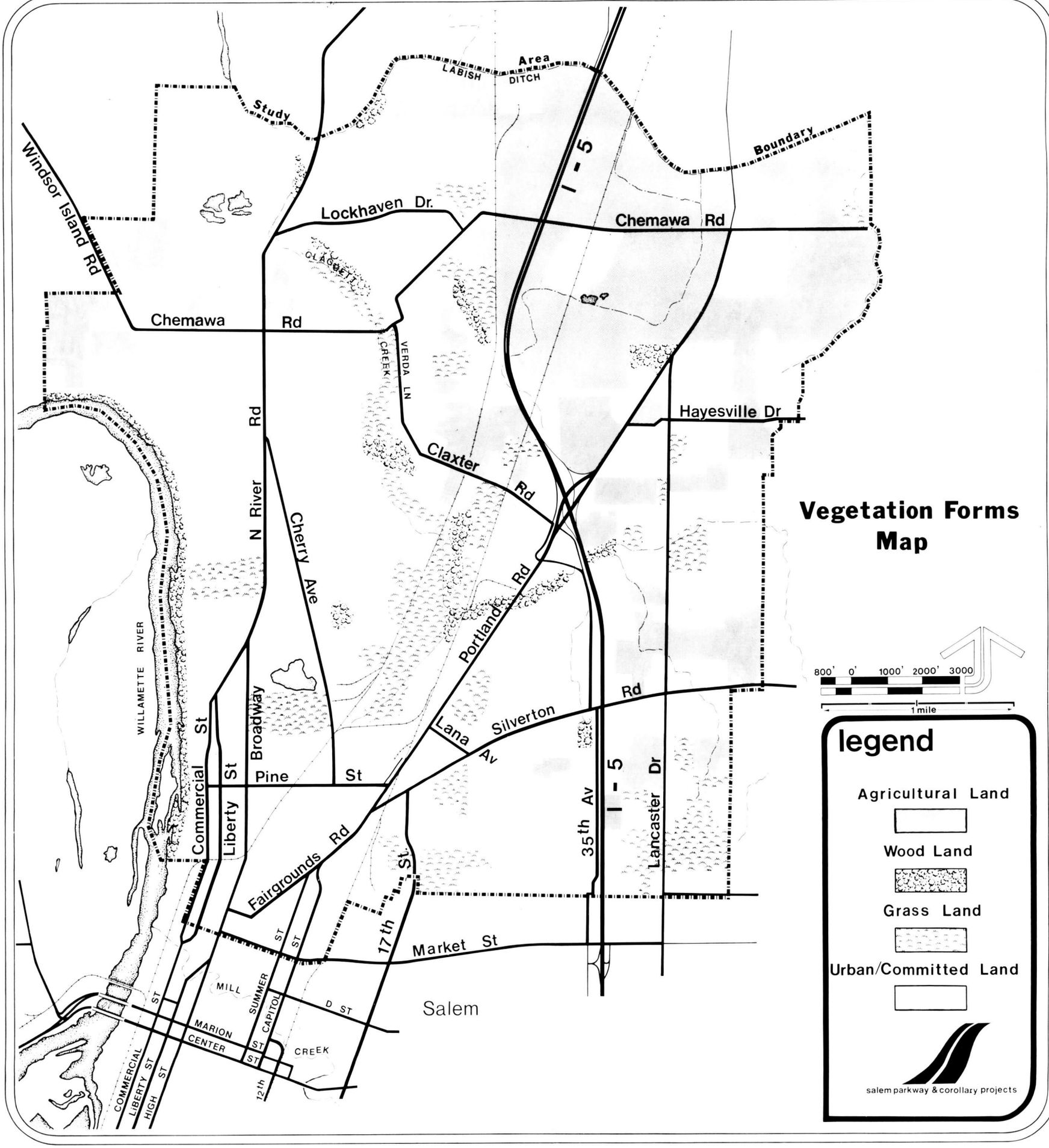
Soil Conservation Service - Mr. Doug Price

State Fish and Wildlife Service - Joe Weatherbee, Fisheries Biologist

U.S. Fish and Wildlife Service - Mr. Dennis Peters, Regional Director
National Wetlands Inventory Project
- Endangered Species Office

Isaak Walton League - (letter sent to Stan Kirk)

Water Resources Department - Mr. Don Buell, Water Rights Engineer
Mr. Robert Almy, Hydrogeologist


Study Area
LABISH DITCH
Boundary
I - 5
Windsor Island Rd
Lockhaven Dr.
Chemawa Rd
OLAGUET
Chemawa Rd
CREEK
VERDA LN
Hayesville Dr
Claxter Rd
N River Rd
Cherry Ave
Portland Rd
WILLAMETTE RIVER
Broadway St
Commercial St
Liberty St
Pine St
Lana Av
Silverton Rd
35th Av
I - 5
Lancaster Dr
Fairgrounds Rd
17th St.
Market St
MILL
SUMMER ST
CAPITOL ST
D ST
MARION ST
CENTER ST
CREEK
12th
COMMERCIAL ST
LIBERTY ST
HIGH ST
Salem
Vegetation Forms Map
800' 0' 1000' 2000' 3000
1 mile
legend
Agricultural Land
Wood Land
Grass Land
Urban/Committed Land
salem parkway & corollary projects

VEGETATION FORMS MAP

Although many small areas of agriculture and pasture/grasslands exist in the study area, unless they occur in eight acre blocks they are classified as urban/committed lands. Considering the importance and scarcity of relatively narrow riparian woodlands throughout the study area, an effort has been made to include all such areas in the woodland classification.

Categories

Committed/Urban Lands

(1) All impervious surfaces;

(2) Urban parks, golf course, yards, etc.;

(3) Any vegetation other than riparian woodland that occurs in less than eight acre blocks;

Agricultural Lands

(1) All cultivated land of eight acres or more; and

(2) All land receiving agricultural tax deferrals for orchards or row crops (may presently be fallow).

Grasslands

(1) Vacant grasslands and pasturelands that are in eight acre or larger tracts;

(2) Transitional grasslands (shrub/brush); and

(3) Pastureland having agricultural tax deferrals.

Woodlands

(1) Terrestrial woodlands (18 percent of all woodlands); and

(2) Riparian woodlands (82 percent of all woodlands).

APPENDIX C

WILDLIFE OF THE SALEM VICINITY
Prepared by: Oregon Fish and Wildlife Service

Mammals of Salem Vicinity

Opossum
Pacific Water Shrew
Trowbridge's Shrew
Vagrant Shrew
Shrew Mole
Townsend's Mole
Western Big Eared Bat
Bib Brown Bat
Little Brown Bat
Eastern Cottontail
Black-tailed Jackrabbit
Beaver
Nutria
Townsend's Chipmunk
Northern Flying Squirrel
Chickaree
Western Gray Squirrel
California Ground Squirrel
Camas Pocket Gopher
Muskrat
Deer Mouse
Oregon Vole
Dusky Tree Mouse
Townsend's Vole
House Mouse
Norway Rat
Pacific Jumping Mouse
Coyote
Gray Fox
Red Fox
Raccoon
Striped Skunk
Short-tailed Weasel
Long-tailed Weasel
Mink
River Otter
Black-tailed Deer

Birds of Salem Vicinity

Common Loon
Pied-billed Grebe
Western Grebe
Whistling Swan
Canada Goose
Snow Goose
Mallard
Pintail
Gadwall
American Widgeon
European Widgeon
Shoveler
Blue-Winged Teal
Cinnamon Teal
Green-Winged Teal
Wood Duck
Redhead
Canvasback
Ring-necked Duck
Lesser Scaup
Common Goldeneye
Barrow's Goldeneye
Bufflehead
Ruddy Duck
Common Merganser
Hooded Merganser
Turkey Vulture
Cooper's Hawk
Sharp-shinned Hawk
Marsh Hawk
Rough-legged Hawk
Red-tailed Hawk
Osprey
Pigeon Hawk
Kestrel
California Quail
Ring-necked Pheasant

Birds of Salem Vicinity

Common Egret
Great Blue Heron
Green Heron
American Bittern
American Coot
Killdeer
Dunlin
Wilson's Phalarope
Spotted Sandpiper
Greater Yellowlegs
Least Sandpiper
Western Sandpiper
Common Snipe
Herring Gull
California Gull
Ring-billed Gull
Band-tailed Pigeon
Rock Dove
Mourning Dove
Screech Owl
Great Horned Owl
Short-eared Owl
Barn Owl
Common Nighthawk
Vaux's Swift
Rufous Hummingbird
Belted Kingfisher
Red-Shafted Flicker
Acorn Woodpecker
Lewis Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Says Phoebe
Traill's Flycatcher
Western Flycatcher
Dusky Flycatcher
Olive-sided Flycatcher
Western Wood Pewee
Horned Lark
Barn Swallow
Violet-green Swallow
Cliff Swallow
Tree Swallow
Bank Swallow
Rough-winged Swallow
Purple Martin
Steelar's Jay
Scrub Jay
Common Crow
Black-capped Chickadee
Common Bushtit
White-Breasted Nuthatch
Red-Breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Bewick's Wren
Robin
Varied Thrush
Hermit Thrus
Swainson's Thrush
Townsend's Thrush
Western Bluebird
Golden-crowned Kinglet
Ruby-crowned Kinglet
Cedar Waxwing
Northern Shrike
Starling
Solitary Vireo
Hutton's Vireo
Warbling Vireo
Orange-crowned Warbler
MacGillivary's Warbler
Black-throated Gray Warbler
Yellow Warbler
Yellow-rumped Warbler
Townsend's Warbler
Yellowthroat
Yellow-Breasted Chat
Wilson's Warbler
House Sparrow
Western Meadowlark
Red-winged Blackbird
Brewer's Blackbird
Brown-headed Cowbird
Western Tanager
Black-headed Grosbeak

Birds of Salem Vicinity

Evening Grosbeak
Lazuli Bunting
Purple Finch
House Finch
Pine Siskin
American Goldfinch
Lesster Goldfinch
Rufous-sided Towhee
Savannah Sparrow
Vesper Sparrow
Oregon Junco
Chipping Sparrow
White-crowned Sparrow
Golden-crowned Sparrow
Fox Sparrow
Song Sparrow
Lincoln Sparrow

Reptiles of Salem Vicinity

Garter Snake
Gopher Snake
Racer
Ringneck Snake
Oregon Alligator Lizard
Pacific Pond Turtle
Western Painted Turtle

Amphibians of Salem Vicinity

Northwestern Salamander
Long-toed Salamander
Rough-skinned Newt
Bullfrog
Red-legged Frog
Pacific Treefrog

APPENDIX D

AUDUBON SOCIETY CHRISTMAS BIRD COUNTS
Historical Tally - Salem Circle

Species	12-28-68	12-27-69	1-1-71	12-26-71	12-30-72	12-29-73
Horned Grebe				1		
Western Grebe		2		1	1	2
Pied-billed Grebe	6	11	4		3	14
Great Blue Heron	30	31	28	17	33	27
Green Heron		1	1	2		
Great Egret						3
Whistling Swan	46	85	144	67	38	
Canada Goose	2193	859	914	1885	1151	5382
White Fronted Goose						1
Snow Goose				10		
Mallard	1348	860	790	480	849	1434
Pintail	1552	4220	555	5352	536	2152
Green-winged Teal	126	221	200	271	216	137
European Widgeon					1	
American Widgeon	4781	8146	3871	4355	1375	3623
Shoveler	12	4	2	11	6	10
Wood Duck	24	61	29	23	24	20
Ring-necked Duck	518	478	56	210	113	211
Canvasback	18	6		1		1
Greater Scaup			10			
Lesser Scaup	108	6	16	4	42	71
Common Goldeneye		6				1
Bufflehead	7	12	7	8		7
Ruddy Duck	67	9	40	22	12	11
Hood Merganser	17		2	54	11	25
Common Merganser		3	1		4	8
Coot	163	96	62	66	52	73
TOTAL	11,016	15,117	6,732	12,840	4,467	13,213