CITY OF MOSES LAKE

SHORELINE INVENTORY AND CHARACTERIZATION

FINAL DRAFT

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1. INTRODUCTION

In 2004, the City of Moses Lake obtained a grant from the Washington State Department of Ecology (DOE) to conduct a characterization of its shoreline jurisdiction as defined by the state's Shoreline Management Act (RCW 90.58). The purpose of this study is to conduct a baseline inventory of abiotic, biological and cultural conditions in the City of Moses Lake's shoreline jurisdiction to provide the basis for the City's Shoreline Master Program update. This characterization will help the City identify existing conditions, determine functions and values of shoreline resources, and explore opportunities for conservation and restoration of ecological functions within the shoreline jurisdiction. These findings will help provide a framework for future updates to the City's shoreline environment designations and shoreline management policies and regulations.

Methodology

Following DOE (2004) protocols, this shoreline inventory and analysis attempts to integrate findings in an accessible manner through narrative and associated maps to inform SMP planning decisions and to provide a baseline for adaptive management and cumulative impact assessment. The resulting shoreline characterization indicates management opportunities for protection of ecological functions, restoration of degraded habitat, improving public access, and supporting water-dependent use.

Using existing reports, the protocol begins with providing a regional context, including a vicinity map, which describes the regional setting, climate, topography and land uses, and indicates the extent of shorelines that are under SMA jurisdiction. This regional context sets the stage for the characterization of ecosystem-wide processes that are influencing the ecological functions within the shoreline jurisdiction, focusing on upland and adjacent land uses that affect the flow of water, sediment, nutrients and materials. This characterization uses existing regional plans, as well as data and information from existing, studies, data and technical information, to identify management issues and determine the relationship of ecosystem-wide processes to shoreline functions, the health of those functions, and measures to protect or restore healthy processes and functions. Management issues addressed include flooding, erosion and sedimentation, loss and fragmentation of habitat, water pollution, and exotic species.

Following the characterization of ecosystem-wide processes, the protocol requires the characterization of the shoreline jurisdiction's ecological functions, which first requires mapping preliminary reach boundaries and documenting the rationale used. By overlaying the lake shoreline, land use, and aerial photos, reach boundaries are created by considering changes in land use and zoning, vegetation cover, and/or geomorphic units (e.g. notable changes in slope, soils, fetch, shoreline geometry, surficial geology).

After determining reach boundaries, assessment of the ecological function of each reach begins with overlaying biological features and critical physical areas, including fish and conservation areas, wetlands, riparian and aquatic vegetation, frequently flooded areas, and geologically hazardous areas, such as areas of slope instability or erosion. Next,

possible impacts to ecological functions are determined by overlaying shoreline modifications, including structures (e.g. bulkheads, docks, storm drains), facilities cutting across the shoreline (e.g. roads and bridges), and land uses (e.g. agriculture, impervious surfaces). The results of these overlays are provided in a narrative summary and tables describing existing shoreline functions as evidenced by the mapped physical, biological and modification features.

The final step in the shoreline characterization is to overlay cultural and regulatory constraints to future use of the shoreline, and combine that analysis with the analysis of ecological functions to identify opportunities for shoreline protection and use. Cultural resources, public access, and regulatory designations that define and/or constrain future uses are mapped and summarized in both narrative and tables. These include archaeological and historic sites, public access, and zoning designations. Ecological protection and restoration opportunities are then identified through the physical, biological and cultural modification synthesis map overlays, while public access and cultural resource protection needs and opportunities are identified through the cultural jurisdiction synthesis maps. Preliminary shoreline environmental designation boundaries are also determined for each reach, based on existing use patterns and the biological and physical characteristics of the shoreline.

Principal Data Sources

A number of Grant County, State, and federal agency data sources, and technical reports were reviewed to characterize overall watershed conditions and to assess the ecological function of the City of Moses Lake's shorelines in this watershed context. Sources reviewed for this report include:

1) Reports and Maps:

Comprehensive Plan (City of Moses Lake 2000)

Park, Recreation, & Open Space Plan, Moses Lake, Washington (City of Moses Lake 2001).

Water System Plan for the Year 2000 (City of Moses Lake 2001).

Sewer System Plan (City of Moses Lake 1994).

Shoreline Management Master Plan (City of Moses Lake 1988)
Moses Lake Total Maximum Daily Load Groundwater Study. Washington Department of Ecology 2003)

Moses Lake Clean Lake Project. Irrigation Water Management Final Stage 3 Report (Moses Lake Irrigation and Rehabilitation District 1987).

Moses Lake Clean Lake Project. Irrigation Water Management Final Report (Moses Lake Irrigation and Rehabilitation District 1990).

Moses Lake Area: Water Quality Monitoring Report. (Moses Lake Irrigation and Rehabilitation District 1997).

Moses Lake Total Maximum Daily Load Phosphorous Study (Washington Department of Ecology 2002)

Shoreline Habitat Characterization and Analysis for the Moses Lake Project (Geo-Ecology Research Group, 2004)

2) Digital Databases

In addition, the following digital databases were also used as part of the inventory and analysis process:

- Washington State Department of Natural Resources. (2000). Digital 1:100,000-scale Geology of Washington.
- United States Department of Agriculture, Natural Resources Conservation Services. (2003). Soil Survey Geographic (SSURGO) Database.
- Washington State Department of Ecology. (1995). Lake Bathymetry of Washington.
- Federal Emergency Management Agency Flood Insurance Program Maps.
- United States Fish and Wildlife Service. (2003). National Wetlands Inventory Data.
- Washington Department of Fish and Wildlife (2002). Priority Habitats and Species and Natural Heritage Site databases
- Washington State Department of Fish and Wildlife. (1997). GAP Species Data.
- Interior Columbia Basin Ecosystem Management Project. (1995). Potential Natural Vegetation.
- Washington State Department of Natural Resources. (1996). Digital 1:24,000-scale Transportation (Roads and Railroads) of Washington.
- United States Census Bureau. (2000). Census TIGER® 2000/ Line Data; Railroads. Data retrieved 2004 from www.geographynetwork.com.
- Washington Department of Ecology. (1998). 303(d) Listings.
- Washington State Department of Ecology. (1998). DOE Facilities.
- Washington State Department of Ecology. (2004). Leaking Storage Tanks.
- Storm sewer outlets (City of Moses Lake)
- Grant County Zoning (Grant County)
- City parcels and land use (City of Moses Lake)

3) Data Sources Developed by Geo-Ecology Research Group

The following digital datasets were developed from a variety of sources:

- Soil permeability, runoff, erosion characteristics. Reclassified soil data from United States Department of Agriculture, Natural Resources Conservation Services [NRCS] Soil Survey Geographic (SSURGO) Database through cross reference of digital data and the NRCS Grant County Soil Survey information (1984). Data Acquired January 2004.
- Slopes > 15%. Developed using ESRI Spatial Analyst and U.S. Geological Survey 10-m DEM.
- Nearshore exposure due to lake drawdown, fish communities, and substrate type. Developed from data collected and analyzed for Washington Department of Fish and Wildlife (2004)
- Fishing "hot spots". Digitized from Fish-n-Map Co. map.
- Riparian tree cover. Digitized from 2002 1:24,000 Washington Department of Transportation (DOT) aerial photographs rectified using 1996 DOT 1:24,000 black and white orthophotos.
- City of Moses Lake zoning. Digitized from pdf image Comprehensive Plan maps
- Imperviousness estimated from land use, based on Total Imperviousness Area Method (NRCS, 1986)
- Parks and boat launches. Digitized from Park, Recreation & Open Space Plan (City of Moses Lake, 2001).
- Archaelogical or historical resources as identified by the Washington State Department of Archaeology & Historic Preservation.Archaeological properties are of a sensitive nature and can be subject to vandalism. Records, maps, or other information identifying the location of archaeological sites are exempt from public disclosure per RCW 42.17.310 (1)(k). Sites are given as approximate positions, using offset polygons the width of the shoreline jurisdiction and 500 m in length.
- Shoreline environmental designations. Digitized from hard copy SMP maps for Grant County and the City of Moses Lake.

We also conducted a field survey of the City's shoreline jurisdiction in 2004 to collect information on riparian vegetation conditions and land use, as well as map the following information using a Garmin 3+ GPS unit:

- bulkheads
- docks
- emergent vegetation

Report Organization

The report is divided into three principal sections. After Section 1, the Introduction, Section 2 provides the regional context and characterization of watershed conditions and ecosystem-wide processes. Section 3 provides the inventory and analysis of ecological functions in the shoreline jurisdiction by reach. This section includes a presentation and discussion of the shoreline reach breaks used, and separate discussions of the physical, biological, and cultural modification, and jurisdictional characteristics of each reach. These discussions are augmented by several tables in the appendix, as well as synthesis maps included in the accompanying DVD map portfolio. Each reach-level inventory and analysis includes a summary of shoreline conditions, including draft environmental designations and identification of potential opportunities for protecting and restoring ecological functions. Again, accompanying maps are included in the DVD map portfolio.

Use of Map Portfolio

To provide final synthesis maps at appropriate viewing scales that will inform the analysis report and illustrate findings, we chose to use an electronic map portfolio accessed through ESRI ArcReader, a free, easy-to-use mapping application that allows users to view, explore, and print maps. ArcReader © is a great way to deliver interactive mapping capabilities that access a wide variety of dynamic geographic information. Using ArcReader ©, anyone can view high-quality maps created using the ArcGIS© software (ESRI 2005).

Included on the DVD are 8 main folders:

- an ArcReader90 folder
- 7 data/map folders
    - Physical (physical.pmf)
    - Biological (biological.pmf)
    - Cultural Modifications (cultural_modification.pmf)
    - Cultural Jurisdictional (cultural_jurisdiction.pmf)
    - Protection Opportunities (opp_protection.pmf)
    - Restoration Opportunities (opp_restoration.pmf)
    - Environmental Designations (Env_Desig.pmf)

To begin using ArcReader to view maps, install ArcReader by navigating to the folder 'ArcReader90'. Click on Setup.exe and follow on-screen instructions.

Once ArcReader has been successfully installed, navigate to one of the data/map folders. Each of these folders contains two other folders called 'data' and 'pmf'. Ignore the data folder. Open the pmf folder and double click the pmf file with the same name as the parent folder.

If ArcReader has been installed properly (note – ArcReader will not install on PCs running Windows 98.) the ArcReader map will open up. The table of contents has intentionally been disabled in each of these ArcReader maps. Upon opening, a warning will flash on screen telling you as much, click OK. You are now ready to view and print ArcReader map files.

Two different versions of maps published into ArcReader have been delivered to the City of Moses Lake:

1. **Maps displaying biological information** (biological.pmf): data layers may be activated or deactivated on the map;

2. **All other map files**: Ability for user to manipulate data has been deactivated to simplify the viewing of maps.

Each of the map files opens to the full extent of a SMA jurisdiction. If the user navigates to **VIEW → BOOKMARKS,** then they can zoom the map to each individual reach or to the extent of the entire jurisdiction. This option is always available to the user. The user may also explore the map data using the zoom tool. There are two sets of zoom tools in ArcReader ©. One tool (#1) is used to zoom within the data window and the second tool (#2) is used to zoom in on the entire map document (Figure A). In most cases the user will want to use the first zoom tool.

When viewing biological data, it may be necessary to navigate to **VIEW→ TABLE OF CONTENTS** to open the **Table of Contents** window. The individual data layers can be activated and deactivated from the **Table of Contents** (Figure B).

The user may also use the software to print maps by navigating to **FILE → PRINT** on the main menu.

Figure A

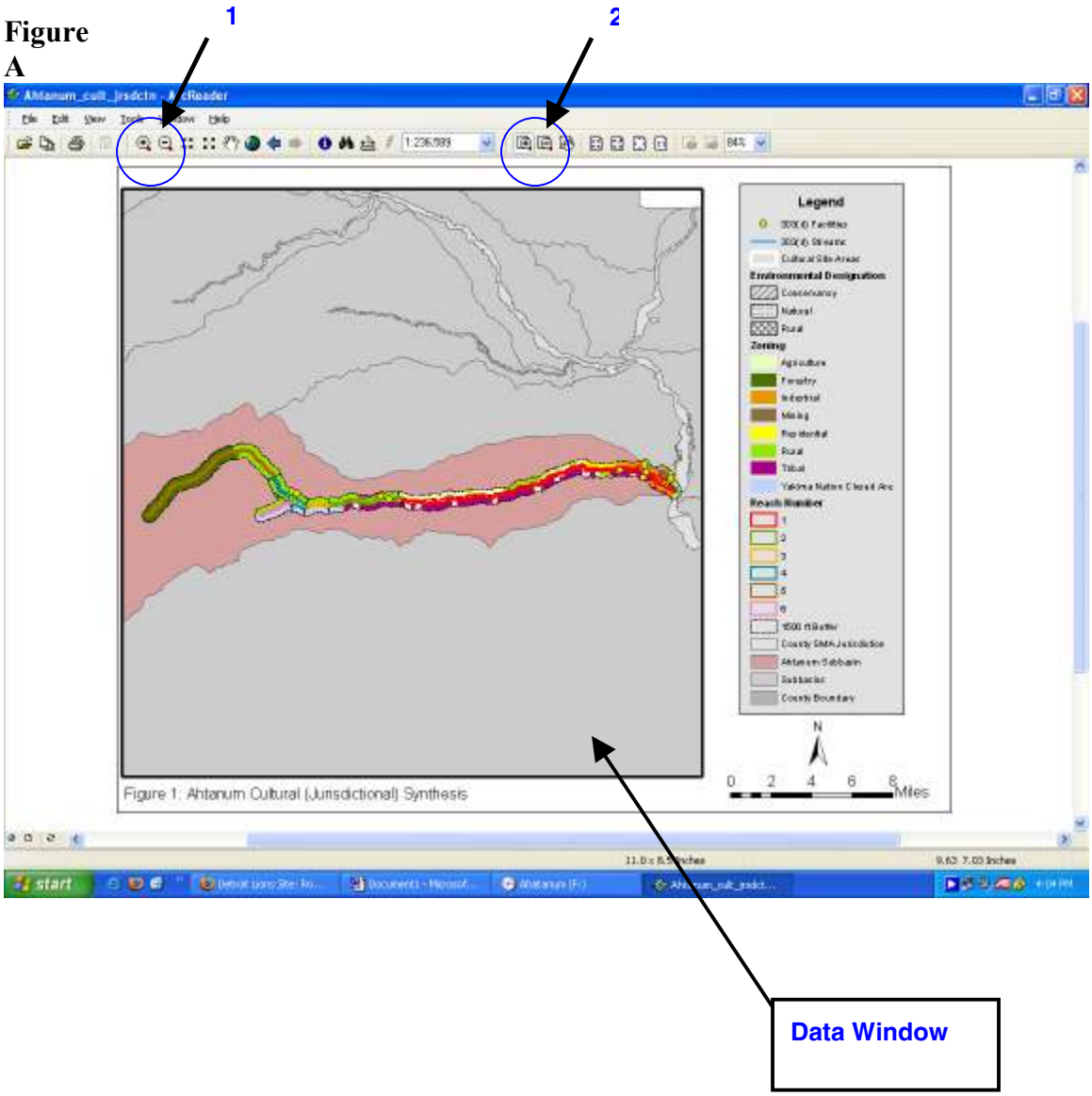
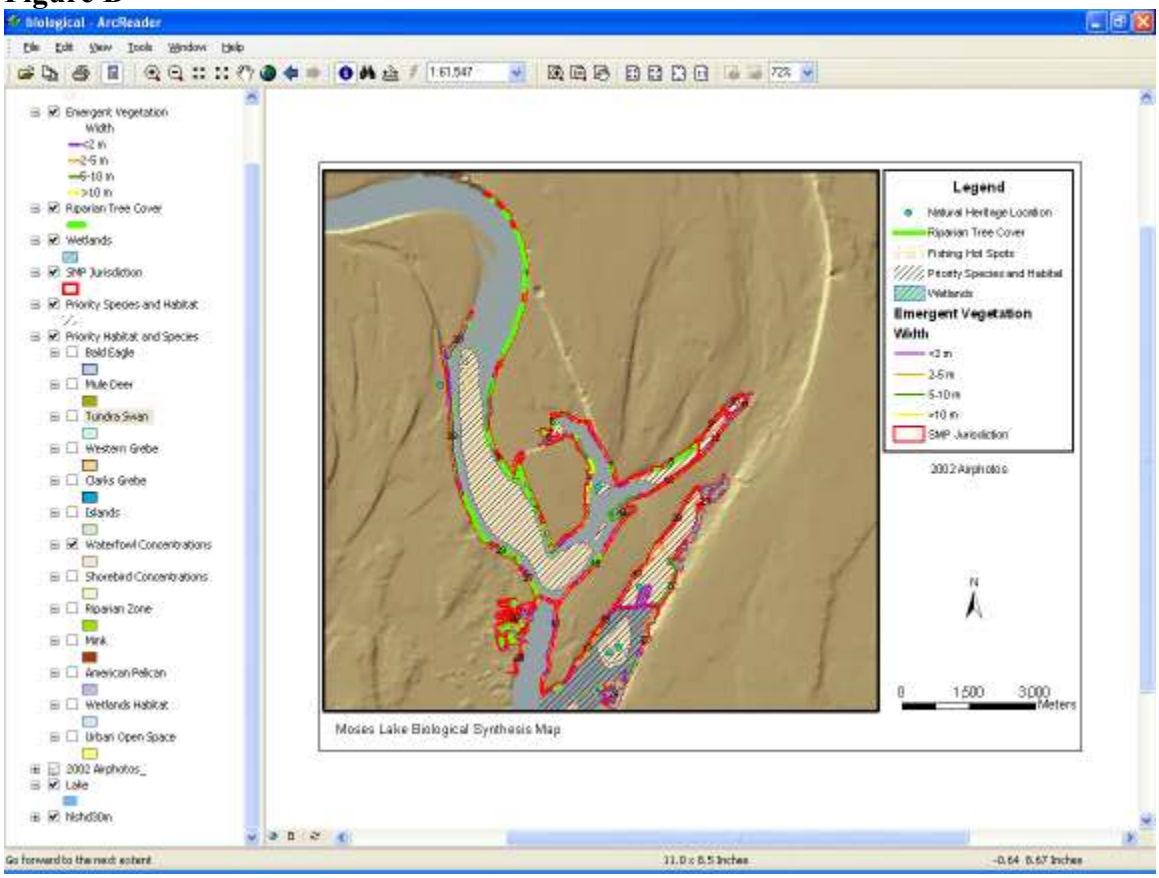

1
2
Legend
Environmental Designation
Zoning
Reach Number
N
0 2 4 6 8
Miles
Figure 1: Ahtanum Cultural (Jurisdictional) Synthesis
Data Window

Figure B


Biological - ArcReader
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Emergent Vegetation
Width
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Riparian Tree Cover
Wetlands
SMP Jurisdiction
Priority Species and Habitat
Priority Habitat and Species
Bald Eagle
Mule Deer
Tundra Swan
Western Grebe
Clarks Grebe
Islands
Waterfowl Concentrations
Shorebird Concentrations
Riparian Zone
Mink
American Pelican
Wetlands Habitat
Urban Open Space
2002 Airphotos_
Lake
hshd30in
Legend
Natural Heritage Location
Riparian Tree Cover
Fishing Hot Spots
Priority Species and Habitat
Wetlands
Emergent Vegetation
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Moses Lake Biological Synthesis Map
Go forward to the next extent

2. ECOSYSTEM-WIDE SUMMARY

Regional Setting and Topography

The City of Moses Lake is located along the southern portion of a 6800 acre fresh water coulee lake in the central Columbia Plateau region in Washington. The surrounding topography is characterized by relatively flat depositional terraces and cross-cutting, abandoned erosional channels, and surface drainage is generally toward Moses Lake (Fig. 1). These terraces step steeply down to the lake shoreline in several areas where cut banks were eroded by floodwaters, exposing thick sequences of the flood gravels along the lake shoreline (Grolier and Foxworthy, 1961).

Climate

The climate of Moses Lake is semiarid to arid with hot, dry summers, and moderately cold winters. The Cascade Mountain range, approximately 58 kilometers to the west of the lake acts as a precipitation barrier and funnels hot dray air in the summer and cold arctic air in to the Columbia Basin in the winter. Mean temperatures in the area range from a high of 88 degrees Fahrenheit in July to a low of 35 degrees in January. Average annual precipitation is about 9 inches, with approximately 80 percent falling from October through March.

Geology

Throughout much of the Moses Lake area, basalts are directly overlain by fine-grained deposits of the late Miocene to Pliocene-age Ringold Formation (Pitz, 2003)(Fig. 2). In the Moses Lake area Ringold sediments are primarily comprised of lacustrine clay, silt, and fine sand. Overlying the Ringold sediments are a sequence of Pleistocene-age flood deposits that mantle the ground surface around the majority of the lake. These unconsolidated glacio-fluvial deposits are largely comprised of massive to well-stratified boulder to granule-sized basaltic gravel, with lesser deposits of sand, silt, and non-basaltic gravel. These coarse sediments were deposited as a result of repeated, high-energy catastrophic floods that occurred with the rapid release of water from glacial-age Lake Missoula in Montana. Localized Quaternary deposits of eolian, lacustrine, and alluvial sediments have subsequently accumulated within low-lying portions of the study area.

Soils

Surface soils in the Moses Lake area are largely from the Ephrata and Malaga series. These soils are typically characterized by very deep profiles of well-drained to excessively well-drained material formed on glacial flood deposits (Bain, Jr., 1990). The grain size profile with depth is normally characterized by a shallow-horizon gravelly sandy loam (Ephrata) or cobbly sandy loam (Malaga) grading to deep-horizon extremely gravelly and cobbly coarse sand (USDA, 1984; Bain, 1990). Soil permeability is moderately rapid within the upper horizons, and very rapid in the lower most portion of

the soil profile, reflecting the coarse-grained nature of the underlying parent deposits. Wind-born deposits of loess may be incorporated into the upper soil profile, and calcium carbonate coatings on particles are often present (Pitz, 2003).

Hydrology

Moses Lake is a shallow warm water lake that was created as a result of ice age glaciers and ancient floods that moved across eastern Washington (City of Moses Lake, 2001a). Moses Lake is an extended natural impoundment that was formed due to the deposition of dune sands across a channel system cut as a result of the ancient floods (Bain, Jr. 1990). The lake is over 20 miles in total length, approximately 11 square miles in total area, and has a mean depth of 18.5 feet. Rocky Ford Creek and Crab Creek are two SMA streams that drain into the lake, part of the 2,450 square miles of watershed that contribute runoff the Moses Lake (Fig. 1). Crab Creek drains approximately 84% of the watershed, including discharges from the Rocky Coulee Wasteway, a drainage conduit for major irrigation return flows. The lake drains into the Potholes Reservoir to the south.

Surface discharge from the lake is controlled by two US Bureau of Reclamation-operated dams located at the southern end of the lake, which manipulate lake surface elevation throughout the year for irrigation management as part of the Columbia Basin Project, serving as a supply route for water passing from the East Low Canal to the Potholes Reservoir (Pitz, 2003)(Fig. 2). In mid-March, the lake level is set to a relatively high and constant elevation, where it remains throughout the summer. In October, the lake level is lowered by approximately 1.5 m to create storage capacity for winter/early spring runoff, and to protect and allow maintenance of shoreline structures.

The lake is segmented into three major arms or horns (Bain, Jr., 1990)(Fig. 3). The main arm extends north, draining Rocky Ford Creek. The southern end of the lake includes Parker and Pelican Horns, which are separated by a peninsula. A smaller embayment, called Lewis Horn, is connected to Parker Horn, which is fed by Crab Creek. While flooding is normally not an issue, Crab Creek can exceed channel capacity in the upper reaches of Parker Horn during flash flood conditions (City of Moses Lake, 2001a).

The groundwater hydrology of the region primarily consists of several complex aquifers comprised of basalt formations and overburden deposits (Pitz, 2003). The majority of groundwater that interacts with Moses Lake moves through the unconfined, high permeability flood deposits, with limited direct interaction from the basalt system. Groundwater interacting with the lake along the southeastern shoreline of Pelican Horn (as well as in the area of the big bend), is presumably transported through the finer grained Ringold deposits present above and adjacent to the lake. There is no evidence that basalts are in direct contact with the lake. Depth to groundwater over the study area tends to relate directly to topography; depth to groundwater is routinely less than 20 feet in low relief areas adjacent to the lake shoreline (e.g. along the peninsula between Parker and Pelican Horns), while the depth to the water table on high bluffs around the lake may be over 100 feet.

Due to the extremely coarse character of the flood deposits, infiltration rates at the surface are considered to be very rapid, with limited attenuation capacity for pollutants (Pitz, 2003). Recharge to the local aquifer system originates from a combination of precipitation, infiltration of groundwater and surface water derived irrigation, and groundwater injection. Discharge from the aquifer system is primarily from water-supply withdrawals, discharge to local surface waterbodies, including the lake and Crab and Rocky Ford Creeks.

The majority of the groundwater that discharges into the lake moves through the unconfined, highly permeable gravels, cobbles, and boulders of the Missoula Flood deposits (Pitz, 2003)(Fig. 2). This discharge is likely concentrated in the nearshore areas of the lake bottom along the northwestern and eastern shorelines. Similarly, lake water recharges surficial aquifers along the southwestern and far southern shorelines.

Land Uses

Much of the land in the Crab Creek watershed is devoted to agriculture, including rangeland (630,000 acres), irrigated cropland (130,500 acres in the lower watershed), and dryland farming (781,500 acres in the upper watershed)(Bain, Jr., 1990)(Fig. 1). Extensive irrigated cropland is present to the west, southeast, east and northeast of the lake. Dry range and shrubland is the primary land use adjacent to the northern shorelines of the lake, which also include low density rural development and irrigated agricultural land. Urban and suburban shoreline residential development is occurring along much of the lake shoreline, especially the southern shorelines of the lake, concentrated along the peninsula between Parker and Pelican Horns, and on the northern shoreline of upper Parker Horn (Fig. 3). In total, more than 27,000 people live around the lake, with the majority concentrated in and around the city (Carroll et al., 2000). Rapid development has occurred over the last 15 years in several unincorporated areas beyond the city boundaries. The lake is primarily used for recreational purposes such as boating, fishing, jet skiing, and swimming.

Management Issues

Alterations to hydrology**:** Although Moses Lake was natural in origin, a dam was installed at the tributary of Crab Creek to control water levels. The lake is heavily influenced by irrigation and return flows – it is hyper-eutrophic with a flushing rate ~2x per year. The outlets are regulated by the Bureau of Reclamation and the Moses Lake Irrigation District. The combination of dam regulation and a low average annual precipitation of approximately 7.8 inches results in significant annual drawdown of approximately 5 feet in late summer. Several freshwater courses have also been altered in Moses Lake by filling or piped diversions (City of Moses Lake, 2001a).

Water quality and sediment: Water quality issues have been identified beginning in the 1960s when excessive nutrient loads began resulting in nuisance algal growth. The lake

has been classified as "hyper-eutrophic", which indicates that it is receiving excessive nutrient loading. Moses Lake is presently a 303(d) listed water body for exceeding set criteria for phosphorous. In the past, during certain years, Crab Creek has delivered total phosphorous loads to Moses Lake during large winter/spring runoff events greater than 500 cfs. Nitrate trends in some surface waters in the Columbia Plateau Agricultural Initiative (CPAI) area, such as Crab Creek, have also increased due to an increase of irrigated acreage.

Water quality in Moses Lake is of concern both to local residents and downstream users of Potholes Reservoir waters. A primary water quality problem is overproduction of algae, particularly blue-green algae, which form unsightly, floating mats during the summer recreation season (Bain, Jr., 1990). Development along the shoreline has also increased the amount of impervious surfaces, leading to increased stormwater runoff and the possibility of contaminants. Additional risks include agriculture runoff and septic failures. The primary sources of wastewater likely impacting local groundwater include leachate from septic systems, municipal waste lines, and infiltration of municipal wastewater (Pitz, 2003).

High nutrient loads also have contributed to excessive aquatic weed growth covering over half of the Moses Lake shoreline, which can impede boat traffic and swimming along the more developed shorelines such as along Parker Horn., as well as impede streamflow in Rocky Ford Creek (Bain, Jr., 1990). Water quality issues such as turbidity and release of nutrients is further aggravated by carp feeding and spawning activity, especially in Pelican Horn and lower Rocky Creek.

Riparian and wetland habitat**:** The lake, once a premier crappie, bass, bluegill, sunfish and trout fishery in central Washington, began to decline in the late 1970s. Annual drawdown of the lake may affect fish habitat by dewatering aquatic vegetation and exposing root structures to wave erosion and freezing. Residents along the shoreline have also been identified as removing aquatic vegetation. Development activities also affect the quality of freshwater habitat through removal of upland and wetland vegetation and increasing silt, organic debris, and other stormwater contaminants that enter the natural drainage system.

Good riparian habitat is primarily found along undeveloped shoreline of Moses Lake and Crab Creek, as well as undeveloped islands in the lake, while wetlands, typically ranging in 1-3 acres in size, are scattered throughout the Moses lake urban growth area, totaling approximately 610 acres (City of Moses Lake, 2001a)(Fig. 3). Significant wetlands are located in the northern tip of Pelican Horn and the eastern lakeshore, as well as along the Crab Creek shoreline. Small pockets of urban natural open space are also found along the shoreline. The greatest risk to these habitats is the continued pace of urban land conversions-particularly land development patterns that remove riparian cover and erode productive topsoil. Urban tolerant species, like raccoons and crows, invade the remaining habitat from the urban edges, supplanting and driving out remaining native species. Exotic species can become a nuisance when they reduce the amount of habitat and resources used by native species. In addition, stabilization methods such as bulkheads

often associated with residential development disconnect the critical ecological linkages between the water and land environments.

The wetlands, riparian zones, and urban natural open spaces may support a variety of mammals (e.g. beaver, muskrat, mink, raccoon, weasel) and waterfowl (e.g. mallards, American widgeons, green-wing teal, blue heron, common merganser, and Canadian goose)(City of Moses Lake, 2001a). Portions of Moses Lake may also provide habitat for the bald eagle and osprey.

Species of Concern: A number of species of concern to federal and state agencies have been reported in the Moses Lake area. While data sufficient to map the areas used by most of those species have not been collected, it is reasonable to expect that some or all of the following species may be found within the City's shoreline jurisdiction, based on anecdotal information and biophysical characteristics of the shoreline area.

Species	Federal Status	State Status
American White Pelican	None	State Endangered
Bald Eagle	Threatened	Threatened. Breeding areas, communal roosts, regular and regular large concentrations, regularly-used perch trees in breeding areas are on PHS list
Burrowing Owl	Species of concern	Candidate; breeding areas, foraging areas, regular concentrations are on PHS list
Great Blue Heron	None	Monitor species; breeding areas on PHS list
Merlin	None	Candidate; breeding sites are on PHS list
Western Grebe	None	Candidate; breeding sites are on PHS list (1/04 addendum)
Yuma Myotis	Species of concern	None; breeding areas, foraging areas, regular concentrations are on PHS list
Townsend's Big-Eared Bat	Species of concern	Candidate; any occurrence is on the PHS list
Northern Leopard Frog	Species of concern	Endangered

The Washington Department of Fish and Wildlife (2002) has also classified certain habitats as Priority Habitats for protection along the Moses Lake shoreline. These include wetlands and riparian areas, as well as habitats for mink and mule deer, wintering bald eagle and Tundra swan, as well as breeding and nesting habitat for waterfowl, shorebirds, and Western and Clark's grebe.

Management Measures to Protect Ecosystem-Wide Processes

- **Hydrology issues:** Permits for new development and setback legislation can be used to mitigate stormwater flows. New developments should be required to use Stormwater Best Management Practices (BMPs).

● **Water quality issues** Wetlands and riparian vegetation within SMP jurisdiction can be protected to mitigate effects of upland sources. Public education on fertilizer and pesticide impacts may be useful, especially for shoreline residents. Slow runoff from construction sites with proper erosion controls. Avoid development on hydric or highly erodible soils. Identify neighboring jurisdictions for coordination of water quality management plans.

● **Riparian habitat issues:** New development can be regulated to ensure protection of riparian habitat and migration corridors. Use zoning and shoreline regulations to prevent encroachment of riparian and wetland habitat by new development within the SMP jurisdiction, including the use of buffers and adequate shoreline setbacks for new construction. Protect wetland and riparian vegetation within SMP jurisdiction to mitigate effects of upland nonpoint pollution sources, both by maintaining natural shoreline and aquatic plants as well as preventing their removal. Work with conservation districts and irrigation districts to institute livestock fencing along riparian areas. Prevent protection of shoreline with hard structures.

Management Measures to Restore Ecosystem-Wide Processes

- **Hydrology issues**: Work with Bureau of Reclamation and irrigation districts to alter dam and irrigation operations, such as timing drawdown to limit impacts to aquatic vegetation.

- **Water quality issues:** Effects on lake from upland developments can be addressed through integration with GMA planning. Direct storm runoff away from waterways or install containment ponds. Highlight locations for most effective stormwater retrofitting. Work with conservation districts and irrigation districts to institute BMPs for agriculture, including efficient use of irrigation water and fertilizer, control of animal waste and sediment, as well as livestock fencing along riparian areas. Develop public education programs to reduce fertilizer use on residential land near the shoreline.

- **Riparian habitat issues:** Implement a program to protect lakeside terrestrial and emergent vegetation. Retrofit shore protection structures with bioengineered approaches to help restore riparian vegetation and function. Maintain vegetative buffer along shoreline zones to help limit nonpoint source pollution. Maintain and enhance the biological and physical functions and values of wetlands. Provide for reasonable buffers around wetlands in order to provide a local habitat for wetland plant and animal communities, and to reduce or minimize intrusions from humans and domestic animals. Stewardship strategies should be implemented for the long term management of wetlands. Maintain the natural value of wetlands to control and filter storm water runoff.

3. REACH INVENTORY AND ANALYSIS

SHORELINE JURISDICTION REACH BREAKS

Several sources were used to map the shoreline jurisdiction as shown on Figure 3 and synthesis maps in the map portfolio. The City of Moses Lake city and urban growth boundary were received from the City of Moses Lake. Lake boundaries were digitized from Washington Department of Transportation 1:24,000 black and white orthophotos (1996), based on estimating the ordinary high water mark using "greenline" estimation. Associated wetland locations were mapped based on National Wetland Inventory information. For the purposes of this inventory, those wetlands assumed to be associated with shorelines (fall within 200 feet as measured from the ordinary high water mark, or if they are connected to the defined lake shoreline environment) are included in the shoreline area shown on Figure 3. To categorize distinct reaches of the Town's shorelines for characterization, the shoreline jurisdiction was classified into thirty preliminary reaches based on biophysical characteristics, as well as general land uses. Table 1 indicates the location of shoreline segments, as well as the justification for breaks between reaches. Reaches are also shown on Figure 3.

SHORELINE CHARACTERIZATIONS AND ASSESSMENTS

REACH 1

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 1 is predominately flood gravels. Part of a Missoula Flood cut bank, 76% of the area has slopes greater than 15% (U.S. Geological Survey [USGS] 2000). Nearshore sediment sizes are classified as a combination of mixed alluvium (59.8%) and cobble (40.5%). The soils within the SMP jurisdiction are predominately Malaga cobbly sandy loam (50.1%) or Malaga very stony sandy loam (35.6%) (U.S. Department of Agriculture, Natural Resources Conservation Service [NRCS], 2003). As a result, soil permeability is entirely moderately rapid while runoff is primarily classed as moderate (85.7%). The hazard of soil erosion is also predominately moderate (85.7%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the southwest and northwest. Fetch lengths range between 1.00 and 2.78 km and are higher for both the southwest and northwest. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the entire shoreline having nearshore exposure widths less than 10 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation

Upland

For Reach 1, potential natural vegetation is primarily shrub-steppe (United States Forest Service [USFS], 1995).

Riparian

Overhanging vegetation is present along 64.7% of Reach 1. Principal upland species include willow (*Salix)*, poplar (*Populus*), pine (*Pinus*), and maple (*Acer)*. Emergent vegetation in the littoral zone is restricted to a narrow corridor less than 2 m wide along the shoreline. This corridor extends along less than 1% of Reach 1.

Based on information collected for Washington Department of Fish and Wildlife (WDFW) in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University [CWU], 2005). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*). In addition, the unprotected cobble shorelines tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species. (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*). By comparison, protected cobble shorelines tend to have a slightly lower diversity of species, including 5 submergent and 1 emergent species, softstem bulrush (Table 11). The submergent species are dominated by white stem pondweed, sago pondweed, Eurasian water milfoil, and curly leaf pondweed.

Wetlands

No wetlands are found in the SMP jurisdiction (United States Fish and Wildlife Service [USFWS], 2003).

Wildlife

Fish

Based on data collected by WDFW between 2002 and 2003, at least ten fish species may be found along Reach 1, dominated by yellow perch (39%), bluegill (14%), largemouth bass (14%), and black crappie (10%) (Fig. 4) (Gabriel and Jordan, 2004). Other notable species include walleye (8%), black bullhead (8%), and smallmouth bass (5%) (Table16). Portions of the shoreline have also been identified as good bass fishing (Fish-n-Map Co., n.d.).

Avian
Reach 1 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of riparian tree cover and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region.

Terrestrial
Reach 1 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the northern half of the reach is classified as a priority riparian habitat, primarily consisting of willow and Russian olive trees (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 1, 57.8% are classified as undeveloped. Of the remaining 42.2% of SMP jurisdiction lands, 30.2% is under single family residential development, 11.7% is mining and 0.3% is commercial. Based on land use, imperviousness of this reach is estimated to be approximately 3.6%. Parcel sizes in the reach have an average width of 60 m and an average depth of approximately 175 m. Based on a survey of 16 shoreline structures, average structure setback from the shoreline along Reach 1 is 34.4 m, ranging from 23.2 to 57.5 m. There is no public land ownership classified within the SMP jurisdiction, though 5.1% is zoned as Urban Public Facilities.

Transportation Infrastructure (Table 6)
Roadways occupy a total of 4 meters of Reach 1 (WDNR, 1996). There are no storm sewer outfalls along this reach (City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 2.7% of the shoreline along Reach 1 is hardened with bulkheads. In addition, 29 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 1 is predominantly Urban Residential 2 (61.0%) and Urban Residential 3 (28.8%), with smaller areas of Urban

Light Industrial (5.1%) and Urban Public Facilities (5.1%). Currently the Grant County SMP environmental designation for Reach 1 is a combination of Rural and Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 1 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 1 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 76%	Undeveloped: 57.8% Riparian tree cover: 64.7% Priority habitats: 1 Species of concern: 4 Fish Species: 10	Public land: 5.1%	Principal land use: undeveloped Imperviousness: 3.6% Roads: 4 m Bulkheads: 2.7% Docks: 29

Ecological functions along Reach 1 are impaired by residential development, which covers 30.2% of the jurisdiction, and account for the majority of the estimated 3.6% imperviousness within the reach. Upland vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extremely limited in extent (less than 1% of the reach), though this might be in part due to the relatively steeper nearshore and greater windward fetch found along this reach. The majority of the reach is presently undeveloped (57.8%) and has overhanging vegetation (64.7%), which helps provide shading of aquatic habitat and bank stability. The northern half of the reach is classified as a priority riparian habitat, primarily consisting of willow and Russian olive trees.
Only a small portion of the reach has shoreline hardening (2.7%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the ten fish species found along this reach. This aquatic habitat is further impaired by the fairly large number of docks (29) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
1A	Shoreline Residential - Resource	Zoned residential; riparian tree cover, steep slopes, largely unplatted and undeveloped
1B	High Intensity	Gravel mining
1C	Shoreline Residential - Resource	Zoned residential; riparian tree cover, steep slopes

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect priority riparian habitat as identified by WDFW.
B. Protect vegetative buffer on residential and agricultural land.
C. Prevent increase in the number of bulkheads on the shoreline

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.

REACH 2

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 2 is predominately flood gravels. This section is a combination of a glacial outwash point bar system and another Missoula Flood cut bank. Nearshore sediment sizes are classified as being entirely mixed alluvium. The soils within the SMP jurisdiction are predominately comprised of Ephrata Malaga complex (72.1%) (NRCS, 2003). Soil permeability is moderately rapid while runoff and hazard of soil erosion are entirely slow.

Fetch and Near-Shore Exposure
The shoreline is exposed to wind directions ranging from the south to northwest. Fetch lengths range between 0.79 and 2.39 km, and are higher from both the south and northwest. The relatively shallow nearshore tends to be moderately impacted by the fall lake level drawdown of 1.5 m, with 56.7% of the reach having nearshore exposure widths between 10-35 m. However, an additional 17.6% of the reach has a seasonal nearshore exposure between 36-60 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 44.6% of Reach 2. The principal upland species include Willow (*Salix*) and Elm (*Ulmus*). Emergent vegetation in the littoral zone is fairly extensive, with an average width of 5-10 m extending along 40.3% of the reach. In addition, another 7.9% of the reach has emergent vegetation zones with widths ranging between 2-5 m and less than 2 m. The primary emergent vegetation species of Reach 2 are softstem bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), common reed (*Phragmites australis*), and reed canary grass (*Phlaria aruninacea*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Gabriel and Jordan, 2004). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Wetland habitat in Reach 2 is fairly extensive, dominated by palustrine, emergent forest wetlands and comprising 11.6% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least ten fish species may be found along Reach 2, dominated by yellow perch (69%), bluegill (11%), and walleye (7%) (Fig. 5) (Gabriel and Jordan, 2004). Other notable species include smallmouth bass (5%), largemouth bass (4%), and black crappie (3%) (Table 17).

Avian
Reach 2 provides potential habitat for numerous avian species, such as mallard, Canada Goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. In addition, most the reach's nearshore is classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for geese (WDFW, 2002).

Terrestrial
Reach 2 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 2, 50.6% are classified as residential single-family. Of the remaining 49.4% of SMP jurisdiction lands, 47.8% is undeveloped, 0.3% is unclassified and 1.3% is classified as parks/open land. Based on land use, imperviousness of this reach is estimated to be approximately 11.4%. Parcel sizes in the reach have an average width of 42 m and an average depth of approximately 87 m. Based on a survey of 22 shoreline structures, average structure setback from the shoreline along reach 2 is 33.7 m, ranging from 23.2 to 55.9 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 167 meters of SMP jurisdiction land in Reach 2, though no storm sewer outfalls occur along this reach (WDNR 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 4.6 % of the shoreline along Reach 2 is hardened with bulkheads. In addition, 24 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 2 is entirely Urban Residential 3. Currently the Grant County SMP environmental designation for Reach 2 is Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 2 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 2 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 0.4%	Wetlands: 11.6% Undeveloped: 47.8% Riparian tree cover: 44.6% Priority habitats: 1 Species of concern: 4 Fish Species: 10		Principal land use: undeveloped Imperviousness: 11.4% Roads: 167 m Bulkheads: 4.6% Docks: 24

Ecological functions along Reach 2 are impaired by residential development, which covers 50.6% of the jurisdiction and accounts for the majority of the estimated 11.4% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 167 m of the jurisdiction, may be another source of nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly extensive, though is only found along less than half the reach. Most of the reach's nearshore is classified as a priority habitat for waterfowl concentrations, while approximately 11.6% of the reach is also classified as wetlands (WDFW, 2002). Much of the reach is presently undeveloped (47.8%) and has overhanging vegetation (44.6%), which helps provide shading of aquatic habitat and bank stability. Only a small portion of the reach has shoreline hardening (4.6%), which

increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the ten fish species found along this reach. This aquatic habitat is further impaired by the fairly large number of docks (24) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
2A	Shoreline Residential - Resource	Residential use; riparian tree cover,
2B	Water-Oriented Park	Public park
2C	Shoreline Residential – Special Resource	Residential use; wetlands; riparian tree cover
2D	Shoreline Residential – Resource	Residential use; docks; riparian tree cover; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect emergent vegetation near docks, residential areas, and public access areas.
C. Protect existing wetlands from encroachment by residential development
D. Protect emergent vegetation near docks, residential areas, and public access areas.
E. Protect vegetative buffer on residential and agricultural land.
F. Protect priority habitat for waterfowl identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
C. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
D. Develop vegetative buffers around parking areas on public land, as well as direct overland flow away from lake.

REACH 3

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 3 is dominantly flood gravels. This section is a mid island bar that was created by glacial outwash that split into two channels and deposited its sediments in the middle. Approximately 20.3% of the reach has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as being entirely of mixed alluvium. The soils within the SMP jurisdiction are predominately Malaga cobbly sandy loam (36.5%) or Ephrata-Malaga complex (33.2%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff and hazard of erosion is predominantly slow (63.5%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the northwest to the south. Fetch lengths ranging between 0.83 and 1.70 km. and are higher from both the south and west. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the majority of the shoreline having nearshore exposure widths less than 10 m (79.3%). However, an additional 20.7% of the reach has a seasonal nearshore exposure between 36-60 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 51.7% of Reach 3. The principal upland species is willow (*Salix*). Emergent vegetation in the littoral zone is fairly limited with an average width of less than 2 m extending along 27.5% of the reach. In addition, another 1.3% of the reach has emergent vegetation zones with widths ranging between 2-5 m. The primary emergent vegetation species of Reach 3 is softstem bulrush (*Scirpus validus*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Gabriel and Jordan, 2004). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Wetland habitat in Reach 3, composed of palustrine forested and emergent wetlands, is limited, as it comprises only 0.6% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least ten fish species may be found along Reach 3, dominated by yellow perch (71%), bluegill (6%), largemouth bass (5%), and black crappie (5%) (Fig. 6) (Gabriel and Jordan, 2004). Other notable species include walleye (3%), smallmouth bass (4%), and bullhead (8%) (Table 18).

Avian
Reach 3 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. In addition, a small northern portion the reach's nearshore is classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for geese (WDFW, 2002).
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Terrestrial
Reach 3 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf*

Land Use (Table 5)*)*
Of the SMP jurisdiction lands along Reach 3, 64.5% are classified as single family residential. Of the remaining 35.5 % of SMP jurisdiction lands, 28.9% is undeveloped, 4.7% is multi-family residential, 1.1% is unclassified, and 0.6% is classified as open land. Based on land use, imperviousness of this reach is estimated to be approximately 15.9%. Parcel sizes in the reach have an average width of 40 m and an average depth of approximately 101 m. Based on a survey of 18 shoreline structures, average structure setback from the shoreline along Reach 3 is 27.2 m, ranging from 0 to 46.1 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 342 meters of SMP jurisdiction land in Reach 3, though no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 21.4% of the shoreline along Reach 3 is hardened with bulkheads. In addition, 40 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 3 is entirely Urban Residential 3. Currently the Grant County SMP environmental designation for Reach 3 is Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 3 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 3 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 20.3%	Wetlands: 0.6% Undeveloped: 28.9% Riparian tree cover: 51.7% Priority habitats: 1 Species of concern: 4 Fish Species: 10		Principal land use: residential. Imperviousness: 15.9% Roads: 342.1 m Bulkheads: 21.4% Docks: 40

Ecological functions along Reach 3 are impaired by residential development, which covers 64.5% of the jurisdiction and accounts for the majority of the estimated 15.9% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 342 m of the jurisdiction, may be another source of nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly limited, found in narrow strips along less than one third of the reach. In addition, wetlands are only found in 0.6% of the reach. A small northern portion the reach's nearshore is also classified as a priority habitat for waterfowl concentrations (WDFW, 2002). While much of the reach is presently undeveloped (28.9%), most of the reach has overhanging vegetation (51.7%), which helps provide shading of aquatic habitat and bank stability. Despite having only

moderate windward fetch and erosion-resistant mixed alluvium shorelines, a relatively large portion of the reach has shoreline hardening (21.4%), which increases wave reflectivity, thereby affecting aquatic vegetation and the ten fish species found along this reach. This aquatic habitat is further impaired by the fairly large number of docks (40) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
3A	Shoreline Residential - Resource	Residential use; priority habitat
3B	Natural	Undeveloped; priority habitat; riparian tree cover
3C	Shoreline Residential – Resource	Residential use; docks; priority habitat; emergent vegetation; riparian tree cover
3D	Shoreline Residential – Special Resource	Undeveloped; unplatted; extensive riparian tree cover
3E	Shoreline Residential – Resource	Residential use; docks; riparian tree cover; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect priority riparian habitat as identified by WDFW.
B. Protect emergent vegetation near docks, residential areas, and public access areas.
C. Prevent increase in the number of bulkheads on the shoreline.
D. Prevent increase in the number of bulkheads on the shoreline.
E. Protect emergent vegetation near docks, residential areas, and public access areas.
F. Protect vegetative buffer on residential and agricultural land

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
C. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
D. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).

E. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.

REACH 4

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 4 is dominantly flood gravels. There is a mid island bar created by glacial outwash and 4.8% of the area have slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Ephrata-Malaga complex (52.4%) or Ephrata fine sandy loam (34.8%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is classed as slow. The hazard of soil erosion is also entirely classed as slow.

Fetch and Near-Shore Exposure
The shoreline is exposed to wind directions ranging from the north to the south. Fetch lengths range between 0.17and 1.99 km, and are higher from both the south and southeast. The relatively shallow nearshore tends to be moderately impacted by the fall lake level drawdown of 1.5 m, with 40.1% of the reach having nearshore exposure widths less than 10 m. However, an additional 70.8% of the reach has a seasonal nearshore exposure between 10-35 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 8.2% of Reach 4. The principal upland species is willow (*Salix*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is extensive, with an average width of greater than 10 m extending along 36.8% of the reach, and an average width of 5-10 m extending along 21.1% of the reach. In addition, another 11.9% of the reach has emergent vegetation zones with widths ranging between 2-5 m and less than 2 m. The primary emergent vegetation species of Reach 4 include softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Gabriel and Jordan, 2004). On the other hand, the portion of protected mixed alluvium shorelines tend to

have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands

Palustrine emergent wetland habitat in Reach 4 is fairly extensive, comprising 16.3% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 1997).

Wildlife

Fish

Based on data collected by WDFW between 2002 and 2003, at least twelve fish species may be found along Reach 4, dominated by yellow perch (52%), bluegill (8%), largemouth bass (12%), and bullhead (8%) (Fig. 7) (Gabriel and Jordan, 2004). Other notable species include black crappie (7%) and walleye (6%) (Table 19). Portions of the shoreline have also been identified as good bass and walleye fishing areas (Fish-n-Map Co., n.d.).

Avian

Reach 4 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The middle third of the reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for geese and ducks (WDFW, 2002). A Clark's grebe nesting colony has been identified as a Natural Heritage site on nearby Crest Island, which is also classified as a priority habitat nesting area for ducks, geese and pheasant. Part of the shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial

Reach 4 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 4, 49.9% are single family residential development, 47.3% are undeveloped, 2.5% are mobile home residential development, and 0.3% is unclassified. Based on land use, imperviousness of this reach is estimated to be approximately 7.6%. Parcel sizes in the reach have an average width of 59 m and an average depth of approximately 153 m. Based on a survey of 17 shoreline structures, average structure setback from the shoreline along reach 4 is 28.7 m, ranging from 6.6 to 59.3 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 14 meters of SMP jurisdiction land in Reach 4, though no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 11.4% of the shoreline along Reach 4 is hardened with bulkheads. In addition, 38 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 4 is predominantly Urban Residential 3 (93.2%) with a smaller area of Urban Commercial (6.8%). Currently the Grant County SMP environmental designation for Reach 4 is Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 4 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 4 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 4.8%	Wetlands: 16.3% Undeveloped: 47.3% Riparian tree cover: 8.2% Priority habitats: 4 Species of concern: 4 Natural Heritage points: 1 Fish Species: 12		Principal land use: residential. Imperviousness: 7.6% Roads: 14 m Bulkheads: 11.4% Docks: 38

Ecological functions along Reach 4 are impaired by residential development, which covers 52.4% of the jurisdiction and accounts for the majority of the estimated 7.6% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly extensive along most of the reach, notably exceeding 10m in width for over one-third of the reach. Four types of priority habitat are found along this reach. In addition, approximately 16.3% of the reach is classified as wetlands. While much of the reach is presently undeveloped (47.3%), very little of the reach has overhanging vegetation (8.2%), which helps provide shading of aquatic habitat and bank stability, though this vegetation includes Russian olive, a highly invasive exotic species. A relatively small portion of the reach has shoreline hardening (11.4%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the twelve fish species found along this reach. This aquatic habitat is further impaired by the fairly large number of docks (38) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
4A	Shoreline Residential - Resource	Residential use; docks; emergent vegetation; riparian tree cover
4B	Shoreline Residential – Special Resource	Undeveloped; unplatted; wetland habitat; emergent vegetation
4C	Shoreline Residential – Resource	Residential use; docks; emergent vegetation;

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect emergent vegetation near docks, residential areas, and public access areas.
C. Protect existing wetlands from encroachment by residential development
D. Protect priority habitat for waterfowl identified by WDFW.
E. Protect emergent vegetation near docks, residential areas, and public access areas.
F. Protect emergent vegetation near docks, residential areas, and public access areas.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.
C. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
D. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
E. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.

REACH 5

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 5 is entirely flood gravels. Erosional processes involved in the splitting of the fluvial channel formed this section of shoreline before the point bar associated with reach 2 was formed. This boggy, marshy area is the product of the fluvial processes that swung the main current of glacial outwash out of the Lewis Horn channel and into the main channel. Slopes greater than 15% equal 14.7% (USGS, 2000). Nearshore sediment sizes are entirely classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Malaga gravelly sandy loam (44.9%) in combination with ponded Aquents (25.8%) (NRCS, 2003). As a result, soil permeability is predominately moderately rapid (74.2%) while runoff is primarily classed as slow (74.2%). The hazard of soil erosion is entirely classified as slow.

Fetch and Near-Shore Exposure
The shoreline is exposed to wind directions ranging from the north to the south, with relatively low fetch lengths ranging from 0.03 to 0.08 km. Fetch lengths are higher from both the northeast and east. The shallow sloped nearshore tends to be highly impacted by the fall lake level drawdown of approximately 1.5 m, where 59.5% of the shoreline has nearshore exposure widths ranging from 36-60 m. An additional 16.9% of the reach has a seasonal nearshore exposure between 61-85 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 4% of Reach 5. The principal upland species are willow (*Salix*) and elm (*Ulmus*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is restricted, with 7.4% of the reach has emergent vegetation zones with widths ranging between 2-5 m and less than 2 m. The primary emergent vegetation species of Reach 5 are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Gabriel and Jordan,

2004). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Palustrine emergent wetland habitat in Reach 5 is extensive, comprising 28.3% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least eleven fish species may be found along Reach 5, dominated by yellow perch (46%), largemouth bass (21%), walleye (12%), and bluegill (8%)(Fig. 8) (Gabriel and Jordan, 2004). Other notable species include black crappie (6%) and bullhead (3%)(Table 20).

Avian
Reach 5 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The small embayments and wetlands at the end of Lewis Horn are also classified as a priority habitat for waterfowl concentrations, primarily as a duck brooding area (WDFW, 2002).

Terrestrial
Reach 5 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 5, 48.4% are classified as single family residential, 43.5% is undeveloped, 7.5% is unclassified, and 0.6% is commercial.. Based on land use, imperviousness of this reach is estimated to be approximately 5.8%. Parcel sizes in the reach have an average width of 87 m and an average depth of approximately 138 m. Based on a survey of 6 shoreline structures, average structure setback from the shoreline along reach 5 is 24.9 m, ranging from 0.0 to 53.4 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 322 meters of SMP jurisdiction land in Reach 5, though no storm sewer outfalls occur along this reach (WDNR, 1996 ,City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 3.1% of the shoreline along Reach 5 is hardened with bulkheads. There are no docks along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 5 is predominantly Urban Residential 4 (57.3%) and Urban Residential 2 (27.6%), with smaller areas of Urban Commercial (13.7%) and Urban Residential 3 (1.4%). Currently the Grant County SMP environmental designation for Reach 5 is Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 5 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 5 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 14.7%	Wetlands: 28.3% Undeveloped: 43.5% Riparian tree cover: 4% Priority habitats: 2 Species of concern: 4 Fish Species: 11		Principal land use: residential. Imperviousness: 5.8% Roads: 322 m Bulkheads: 3.1%

Ecological functions along Reach 5 are impaired by residential development, which covers 48.4% of the jurisdiction and accounts for the majority of the estimated 5.8% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 322 m of the jurisdiction, may be another source of nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extremely restricted, extending less than 7.4% of the reach, which has a predominantly shallow nearshore. However, approximately 28.3% of the reach is classified as wetlands. The small embayments and wetlands at the end of Lewis Horn are also classified as a priority habitat for waterfowl

concentrations. Much of the reach is presently undeveloped (43.5%), while most of the reach has overhanging vegetation (64.7%), which helps provide shading of aquatic habitat and bank stability, though this vegetation includes Russian olive, a highly invasive exotic species. Having limited fetch and a substrate comprised of erosion-resistant mixed alluvium, a very limited portion of the reach has shoreline hardening (3.1%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the eleven fish species found along this reach. This aquatic habitat is further impaired by exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
5A	Shoreline Residential - Resource	Residential use; priority habitat
5B	Shoreline Residential – Special Resource	Undeveloped; wetland and priority habitat
5C	Shoreline Residential - Resource	Residential use; wetland and priority habitat
5D	Shoreline Residential – Special Resource	Largely undeveloped and unplatted; priority habitat
5E	Shoreline Residential – Resource	Residential use

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect existing wetlands from encroachment by residential development
C. Protect priority habitat for waterfowl identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).

REACH 6

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 6 is dominantly flood gravels. This reach contains some fairly steep slopes, with 13.1% greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Malaga stony sandy loam (40.0%) and Ephrata fine sandy loam (57.2%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is primarily classed as slow (67.7%). The hazard of soil erosion is also predominately slow (67.7%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the southeast and west. Fetch lengths range between 0.35 and 1.80 km are higher from both the southeast and southwest. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the entire shoreline having nearshore exposure widths less than 10 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 7.4% of Reach 6. The principal upland species include willow (*Salix)*, poplar (*Populus*), and elm (*Ulmus*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is fairly limited, with an average width of 2-5 m extending along 10.7% of the reach. In addition, another 13% of the reach has emergent vegetation zones with widths ranging between 5-10 m and less than 2 m. The primary emergent vegetation species of Reach 6 is softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Gabriel and Jordan, 2004). On the other hand, the portion of protected mixed alluvium shorelines tend to

have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Palustrine emergent wetland habitat in Reach 6 is extremely limited, comprising 1.9% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least nine fish species may be found along Reach 6, dominated by yellow perch (54%), bluegill (11%), and largemouth bass (19%)(Fig. 9) (Gabriel and Jordan, 2004). Other notable species include black crappie (6%) and smallmouth bass (6%)(Table 21).

Avian
Reach 6 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, and parks/open land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region.

Terrestrial
Reach 6 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and parks/open land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)

Of the SMP jurisdiction lands along Reach 6, 43.0% are classified as parks/open land. Of the remaining 57% of SMP jurisdiction lands, 39.2% is under single family residential development, 11% is agricultural, and 4.8% is unclassified, 1.8% is multi family residential, and 0.3% is transportation and utilities. Based on land use, imperviousness of this reach is estimated to be approximately 5.8%. Parcel sizes in the reach have an average width of 82 m and an average depth of approximately 125 m. Based on a survey of 12 shoreline structures, average structure setback from the shoreline along reach 6 is 34.0 m, ranging from 18.0 to 51.2 m.

The City of Moses Lake public lands cover approximately 42.9% of Reach 6, including Cascade Park. Considered and environmental conservancy area, Cascade Park facilities

include two boat launch ramps, day boat moorage, restrooms, playground, and picnic areas (City of Moses Lake, 2001a). The park also includes a campground containing 32 tent sites, 41 RV sites and group camping areas.

Transportation Infrastructure (Table 6)
Roadways occupy 440 meters of SMP jurisdiction land in Reach 6, though no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 5.2% of the shoreline along Reach 6 is hardened with bulkheads. In addition, 21 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 6 is predominantly Public (42.9%), Urban Residential 3 (28.2%), and Urban Residential 4 (27.8%), with a smaller area of Single Family Residential (1.1%). Currently 44.1% of the reach is designated as Conservancy by the City of Moses Lake SMP, and 55.9% is designated as Suburban by the Grant County SMP.

Cultural Resource Designations (Table 6)

There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 6 on file with the Washington State Office of Archaeology and Historic Preservation. One facility/site has been identified as being of interest to DOE due to pollution/permitting concerns (DOE, 1998b).

ECOLOGICAL FUNCTION SUMMARY

Reach 6 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 13.1%	Wetlands: 1.9% Riparian tree cover: 7.4% Species of concern: 4 Fish Species: 9	Public land: 42.9% Parks: 1 Boat launches: 1	Principal land use: parks/open land Imperviousness: 5.8% Roads: 440 m Bulkheads: 5.2% Docks: 21 DOE Facility/Site: 1

Ecological functions along Reach 6 are impaired by recreational and residential development, which account for the majority of the estimated 5.8% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings, lawns and

parking lots, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 440 m of the jurisdiction, may be another source of nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly restricted (less than 25% of the reach), though this might be in part due to the relatively steeper nearshore found along this reach. In addition, only 1.9% of the reach is classified as wetlands, while only a small portion of the reach has overhanging vegetation (7.4%), which helps provide shading of aquatic habitat and bank stability. This vegetation includes Russian olive, a highly invasive exotic species. Despite having limited fetch and a substrate comprised of erosion-resistant mixed alluvium, a limited portion of the reach has shoreline hardening (5.2%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the nine fish species found along this reach. This aquatic habitat is further impaired by the fairly large number of docks (21) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
6A	Shoreline Residential – Resource	Residential use; priority habitat; riparian tree cover; emergent vegetation
6B	Water-Oriented Park	Public park

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands WDFW from encroachment by residential development.
B. Protect priority habitat for waterfowl identified by WDFW.
C. Prevent increase in the number of bulkheads on the shoreline.
D. Protect existing wetlands from encroachment by residential development
E. Protect emergent vegetation near docks, residential areas, and public access areas

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
C. On public land, move parking areas out of the SMP jurisdiction or set them back from the shoreline.
D. Restore emergent vegetation on publicly owned land, and manage areas of emergent vegetation to support healthy ecological processes and functions.

E. Restore emergent vegetation on publicly owned land, and manage areas of emergent vegetation to support healthy ecological processes and functions

REACH 7

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 7 is dominantly flood gravels. The reach has been formed as the result of the erosion occurring at the confluence of the flood channels of Rocky Ford and Crab Creek. As a result 65.9% of the reach contains slopes that are greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Malaga cobbly sandy loam (83.9%) or Ephrata fine sandy loam (16.1%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid (100%) while runoff is primarily classed as moderate (90.3%). The hazard of soil erosion is also primarily classed as moderate (90.3%).

Fetch and Near-Shore Exposure
The shoreline is exposed to wind directions ranging from the south and northwest. Fetch lengths range between 0.4 and 1.3 km, and are higher from both the northwest and south. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of 1.5 m, with 72.1% of the reach having nearshore exposure widths less than 10 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 5.4% of Reach 7. The principal upland species are willow (*Salix)* and salt bush (*Atriplex*). Emergent vegetation in the littoral zone is fairly restricted, with an average width of less than 2 m extending along 28.4% of the reach. In addition, another 9.6% of the reach has emergent vegetation zones with widths ranging between 2-5 m. The primary emergent vegetation species of Reach 7 is softstem bulrush (*Scirpus validus*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species

(Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
No wetlands are found in the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least nine fish species may be found along Reach 7, dominated by yellow perch (52%), bluegill (16%), walleye (16%), and largemouth bass (7%)(Fig. 10) (Gabriel and Jordan, 2004). Other notable species include black crappie (4%) and smallmouth bass (4%)(Table 22). Portions of the shoreline have also been identified as good bass and walleye fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 7 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. A Clark's grebe nesting colony has also been identified on nearby Crest Island as a Natural Heritage site, which is also classified as a priority habitat nesting area for ducks, geese and pheasant (WDFW, 2002). Part of the shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial
Reach 7 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS *– see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 7, 89.9% is classified as single family residential development and 10.1% is undeveloped. Based on land use, imperviousness of this reach is estimated to be approximately 19.8%. Parcel sizes in the reach have an average width of 31 m and an average depth of approximately 98 m. Based on a survey of 6 shoreline structures, average structure setback from the shoreline along reach 7 is 52.3 m, ranging from 48.1 to 59.8 m. There are 0.2% public lands within the SMP

jurisdiction. This small portion of public land is Cascade Park and is owned by the City of Moses Lake.

Transportation Infrastructure (Table 6)
There are no roadways on SMP jurisdiction land in Reach 7 and no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 7.1 % of the shoreline along Reach 7 is hardened with bulkheads. In addition, 18 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 7 is dominantly Single Family Residential (99.8%), with a smaller area of Public land (0.2%). Currently 12.6% of the reach is designated as Urban and 87.4% as Conservancy by the current SMP.

Cultural Resource Designations (Table 6)
There is one Archeological Site Form record of a cultural site within the SMP jurisdiction of Reach 7 on file with the Washington State Office of Archaeology and Historic Preservation. The site is recorded as a habitation site.

ECOLOGICAL FUNCTION SUMMARY

Reach 7 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 65.9%	Undeveloped: 10.1% Riparian tree cover: 5.4% Species of concern: 4 Priority habitats: 2 Natural Heritage points: 1 Fish Species: 9	Public land: 0.2% Parks: 1	Principal land use: residential. Imperviousness: 19.8% Bulkheads: 7.1% Docks: 18

Ecological functions along Reach 7 are impaired by residential development, which covers 89.9% of the jurisdiction and accounts for the estimated 19.8% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings, lawns and footpaths to the shore, which can promote increased runoff and nonpoint source pollution. While no wetlands are located in the reach, emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, covers approximately 40% of the reach, though the limits to extent and widths might be in part due to the relatively steep upland slope and nearshore found along this reach. In addition, only a small portion of the reach is presently undeveloped (10.1%) or has overhanging

vegetation (5.4%), which helps provide shading of aquatic habitat and bank stability. Two priority habitats and one Natural Heritage site are associated with this reach. Despite having a limited fetch and a substrate comprised of erosion-resistant mixed alluvium, a portion of the reach has shoreline hardening (7.1%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the nine fish species found along this reach. This aquatic habitat is further impaired by a number of docks (18) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
7	Shoreline Residential - Resource	Residential use with docks; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect vegetative buffer on residential and agricultural land.
B. Prevent increase in the number of bulkheads on the shoreline.
C. Protect emergent vegetation near docks, residential areas, and public access areas.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
B. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).

REACH 8

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 8 is entirely flood gravels. Due to the fluvial processes associated with Crab Creek, this reach shifts from gentle to steep slopes. Approximately 3.5 % of the shoreline has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as mixed alluvium. The soils within the SMP jurisdiction are a combination of Ephrata fine sandy loam (39.6%), Starbuck very fine sandy loam (33.5%), or Malaga cobbly sandy loam (26.9%) (NRCS, 2003). As a result, soil permeability is predominantly moderately rapid (66.5%) while runoff is classed as primarily moderate (73.3%). The hazard of soil erosion is also primarily classified as moderate (73.3%).

Fetch and Near-Shore Exposure
The shoreline is exposed to wind directions ranging from the east to the northwest. Fetch lengths range between 0.26 and 0.81 km and are higher for both the northwest and east. The relatively shallow nearshore is moderately impacted by the fall lake level drawdown of approximately 1.5 m, where the 30.7% of the shoreline has nearshore exposure widths less than 10 m and the remaining 69.3% experiences exposure widths ranging from 10-35 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 33.1% of Reach 8. The principal upland species are willow (*Salix*) and salt bush (*Atriplex*). Emergent vegetation in the littoral zone is fairly restricted, with an average width of 2-5 m extending along 7.2% of the reach. In addition, another 7.0% of the reach has emergent vegetation zones with widths of less than 2 m. The primary emergent vegetation species of Reach 8 are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington

University, 2005). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Palustrine forested wetland habitat in Reach 8 is somewhat limited, comprising 5.0% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least six fish species may be found along Reach 8, dominated by yellow perch (51%), smallmouth bass (34%), and bluegill (10%)(Fig. 11; Table 23) (Gabriel and Jordan, 2004).

Avian
Reach 8 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat and denser zones of emergent vegetation or riparian tree cover (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for ducks (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial
Reach 8 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach's nearshore is also classified as a priority habitat for mink, rated as moderate to high density (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 8, single family residential use comprises the entire shoreline. Based on land use, imperviousness of this reach is estimated to be approximately 30%. Parcel sizes in the reach have an average width of 27 m and an average depth of approximately 57 m. Based on a survey of 32 shoreline structures,

average structure setback from the shoreline along reach 8 is 27.4 m, ranging from 11.6 to 46.8 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
There are no roadways within the SMP jurisdiction of Reach 8 (WDNR, 1996). However, there is one storm sewer outfall found along this reach (City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 62.0% of the shoreline along Reach 8 is hardened with bulkheads. In addition, 41 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 8 is entirely Single Family Residential. Currently 100% of the reach is designated as Urban by the City of Moses Lake SMP.

Cultural Resource Designations (Table 6)
There is one Archeological Site Form record of a cultural site within the SMP jurisdiction of Reach 8 on file with the Washington State Office of Archaeology and Historic Preservation. One facility/site has been identified as being of interest to DOE due to pollution/permitting concerns, associated with a gas station (DOE, 1998b).

ECOLOGICAL FUNCTION SUMMARY

Reach 8 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 3.5%	Wetlands: 5% Undeveloped: 5.75 Riparian tree cover: 33.1% Priority habitats: 3 Species of concern: 4 Fish Species: 6		Principal land use: residential-1 family Imperviousness: 30% Bulkheads: 62% Storm drains: 1 Docks: 41 DOE Facility/Site: 1

Ecological functions along Reach 8 are impaired by residential development, which covers the entire jurisdiction and accounts for the estimated 30% imperviousness for the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. One storm sewer outfall also is found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extremely restricted, extending less than 15% of the reach. In addition, only 5% of the reach is classified as wetland habitat. However, approximately one-third of the reach has overhanging

vegetation, which helps provide shading of aquatic habitat and bank stability. In addition, three types of priority habitats are associated with this reach. Despite having limited windward fetch and a substrate comprised of erosion-resistant mixed alluvium, a very high portion of the reach has shoreline hardening (62.0%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the six fish species typically found along this reach. This aquatic habitat is further impaired by exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
8A	Shoreline Residential	Residential use with extensive docks and bulkheads
8B	Shoreline Residential -Resource	Residential use with docks and bulkheads; riparian tree cover

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect emergent vegetation near docks, residential areas, and public access areas.
B. Prevent increase in the number of bulkheads on the shoreline.
C. Prevent increase in the number of bulkheads on the shoreline.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Restore emergent vegetation on publicly owned land, and manage areas of emergent vegetation to support healthy ecological processes and functions.
C. Retrofit storm sewer outfalls to limit pollution loading to the lake.
D. Retrofit storm sewer outfalls to limit pollution loading to the lake.

REACH 9

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 9 is predominately flood gravels with about one fourth of the reach consisting of alluvium. This reach is a continuation of the cut , with 13% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Malaga cobbly sandy loam (42.8%) or Malaga stony sandy loams (38.5%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is predominantly classed as slow (57.2%). The hazard of soil erosion is also predominantly classed as slow (57.2%). Approximately 6.1% of the jurisdiction is in the floodway (DOE, 1998c).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the east and southwest. Fetch lengths range between 0.20 and 0.78 km and are higher for both the southwest and south. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths predominantly less than 10 m (50.9%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 9. The principal upland species are willow (*Salix*) and salt bush (*Atriplex*). The primary emergent vegetation species of Reach 9 are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Wetland habitat in Reach 9 is fairly extensive, composed primarily of palustrine open water and emergent wetlands comprising 7.5% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
This reach within Parker Horn is an important area for spring walleye spawning migrations (Gabriel and Jordan, 2004).

Avian
Reach 9 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western Grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for ducks (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial
Reach 9 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach's nearshore is also classified as a priority habitat for mink, rated as moderate to high density (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 9, 48.7% are classified as commercial. Of the remaining 51.3% of SMP jurisdiction lands, 24.8% are transportation, utilities, 20.6% are residential single family, 5.7% is undeveloped, and 0.2% is recreation. Based on land use, imperviousness of this reach is estimated to be approximately 43.9%. Parcel sizes in the reach have an average width of 177m and an average depth of approximately 72m. Based on a survey of 7 shoreline structures, average structure setback from the shoreline along Reach 9 is 31.5 m, ranging from 23.6 to 43.7 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 1045 meters of SMP jurisdiction land in Reach 9 (WDNR, 1996). Railroads occupy 182.5 meters of SMP jurisdiction and 1 storm sewer outfall occurs along this reach (United States Census Bureau 2000, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 1.8% of the shoreline along Reach 9 is hardened with bulkheads. In addition, 1 dock is located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 9 is predominantly General Commercial and Business (85.0%), with a smaller area of Single Family Residential (3.0%) and 12.0% with no zoning designation. Currently 93.6% of the reach is designated as Urban and 6.4% as Conservancy by the current SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 9 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 9 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 13% Floodway: 6.1%	Wetlands: 7.5% Undeveloped: 5.7% Priority habitats: 3 Species of concern: 4		Principal land use: commercial Imperviousness: 43.9% Roads: 1045 m Bulkheads: 1.8% Storm drains: 1 Docks: 1

Ecological functions along Reach 9 are impaired by commercial and residential development, which accounts for the majority of the estimated 43.9% imperviousness for the reach. Riparian vegetation has been removed and replaced with lawns, which can promote increased runoff and nonpoint source pollution. Roadways and a railroad, which cover 1045 m of the jurisdiction, may be additional sources of nonpoint source pollution. One storm sewer outfall also is found along this reach. While 7.5% of the reach is classified as wetland habitat, there is no overhanging vegetation found along this reach. Three types of priority habitat are found along this reach. Having limited windward fetch and a substrate comprised of erosion-resistant mixed alluvium, a very small portion of the reach has shoreline hardening (1.8%), which increases wave reflectivity, thereby affecting aquatic vegetation and aquatic habitat. Only one dock is found along this reach.

This aquatic habitat is further impaired by exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
9A	High Intensity	Highway
9B	High Intensity -Resource	Commercial and residential use; wetlands

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential development

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.

REACH 10

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 10 is predominately alluvium with about one third of the reach consisting of flood gravels. Part of the original Crab Creek channel and floodplain, there are no slopes greater than 15% (USGS, 2000). The soils within the SMP jurisdiction are predominately Kittitas silt loam (76%) and Malaga stony sandy loams (13.5%) (NRCS, 2003). As a result, soil permeability is predominantly moderately slow (76%), moderately rapid (19.6%). Runoff is primarily classed as ponded (76%). The hazard of soil erosion is predominately none (76%) or slow (19.6%). Approximately 52.5% of the jurisdiction is in the floodway (DOE, 1998c).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the east, south and southwest. Fetch lengths range between 0.16 and 0.25 km and are higher for the southwest, south and east.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 10. The principal upland species are willow (*Salix*) and salt bush (Atriplex). The primary emergent vegetation species are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Wetlands
Wetland habitat in Reach 10 is extensive, comprising 38.3% of the SMP jurisdiction and composed of palustrine emergent and palustrine emergent scrub/shrub wetlands (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and juncus mixed with open water areas (WDFW, 2002). This habitat is classified as being high quality habitat for waterfowl, upland gamebirds, nongame birds and furbearers.

Wildlife
Fish
This reach within Parker Horn is an important area for spring walleye spawning migrations (Gabriel and Jordan, 2004).

Avian

Reach 10 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore, wetlands and offshore island are also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, an important migration and wintering area for Canada geese and dabbling ducks, and an important brooding habitat for ducks (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves. In addition, the nearshore and wetlands at the Crab Creek inlet at end of the bay are classified as priority habitat for shorebird concentrations of dowitcher, yellow legs, blacknecked stilts, avocet, sandpipers, phalarope, killdeer and other species, primarily in the late summer and fall.

Terrestrial

Reach 10 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach's nearshore is also classified as a habitat for mink, rated as moderate to high density (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)

Of the SMP jurisdiction lands along Reach 10, 70.8% are classified as undeveloped and 29.2% are under commercial development. Based on land use, imperviousness of this reach is estimated to be approximately 24.8%. Parcel sizes in the reach have an average width of 274m and an average depth of approximately 91m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)

There are no roadways or storm sewer outfalls that occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)

None of the shoreline along Reach 10 is hardened with bulkheads and there are no docks located along this reach (Central Washington University 2004a, 2004b).

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 10 is entirely Multi Family Residential (100%). Currently 100% of Reach 10 is designated as Natural.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 10 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 10 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Floodway: 52.5%	Wetlands: 38.3% Undeveloped: 70.8% Priority habitats: 5 Species of concern: 4		Principal land use: undeveloped Imperviousness: 24.8%

Ecological functions along Reach 10 are impaired by commercial development, which accounts for the estimated 24.8% imperviousness for the reach. While the reach is primarily undeveloped and dominated by wetland habitat, which comprises 38.3% of the reach, some riparian vegetation has been removed, which can promote increased runoff and nonpoint source pollution. Besides wetland habitats, four types of priority habitats are found along this reach. There is no overhanging vegetation found along this reach. No shoreline hardening or docks are found along this reach.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
10	Natural	Undeveloped; wetlands; priority habitats

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential development.
B. Protect priority habitat for waterfowl and shorebirds identified by WDFW

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*
none

REACH 11

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 11 is predominately basalt flows with about one fourth of the reach consisting of alluvium and about another one fourth of the reach consisting of flood gravels. This reach is also part of the original Crab Creek channel and floodplain, with none of the area having slopes greater than 15% (USGS, 2000). The soils within the SMP jurisdiction are predominately Prosser very fine sandy loams (45.5%) with smaller areas of Ephrata-Malaga complex (30.9%) and Kittitas silt loam (20.3%) (NRCS, 2003). As a result, soil permeability is mostly moderate (48.8%) while runoff is primarily classed as moderate (48.8%). The hazard of soil erosion is also predominately moderate (48.8%). Approximately 13.5% of the jurisdiction is in the floodway (DOE, 1998c).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the southwest and northwest. Fetch lengths range between 0.03 and 0.25 km and are higher for both the north and west.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 11. The principal upland species are willow (*Salix*) and salt bush (Atriplex). The primary emergent vegetation species are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Wetlands
Palustrine emergent wetland habitat in Reach 11 is extensive, comprising 41.4% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and juncus mixed with open water areas (WDFW, 2002). This habitat is classified as being high quality habitat for waterfowl, upland gamebirds, nongame birds and furbearers.

Wildlife
Fish
This reach within Parker Horn is an important area for spring walleye spawning migrations (Gabriel and Jordan, 2004). Portions of the shoreline have also been identified as black crappie and bluegill fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 11 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore, wetlands and offshore island are also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, an important migration and wintering area for Canada geese and dabbling ducks, and an important brooding habitat for ducks (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves. In addition, the nearshore and wetlands at the Crab Creek inlet at end of the bay are classified as priority habitat for shorebird concentrations of dowitcher, yellow legs, blacknecked stilts, avocet, sandpipers, phalarope, killdeer and other species, primarily in the late summer and fall.

Terrestrial
Reach 11 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach's nearshore is also classified as a priority habitat for mink, rated as moderate to high density (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 11, 90.7% are classified as commercial retail. Of the remaining 9.3% of SMP jurisdiction lands, 6.0% is undeveloped and 3.2% is transportation and utilities. Parcel sizes in the reach have an average width of 564 m and an average depth of approximately 335 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
There are no roadways and no storm sewer outfalls along this reach.

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 11 is hardened with bulkheads and there are no docks located along this reach (Central Washington University 2004a, 2004b).

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 11 is entirely Heavy Industrial. Currently 100% of Reach 10 is designated as Natural.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 11 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 11 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Floodway: 13.5%	Wetlands: 41.4% Undeveloped: 6% Priority habitats: 5 Species of concern: 4		Principal land use: commercial

Ecological functions along Reach 11 are impaired by commercial development. While the reach is dominated by wetland habitat, which comprises 41.4% of the reach, some riparian vegetation has been removed, which can promote increased runoff and nonpoint source pollution. Besides wetland habitats, four types of priority habitats are associated with this reach. There is no overhanging vegetation found along this reach. No shoreline hardening or docks are found along this reach.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
11	Natural	Undeveloped commercial; wetlands; priority habitats

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential development

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

none

REACH 12

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 12 is predominately flood gravels. This relatively flat reach is part of the original flood channel from the Crab Creek sector of the Missoula Floods, with 2.5% of the area having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Ephrata-Malaga complex (59.1%) and Ephrata fine sandy loams (30.4%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff and hazard of erosion are classed as slow. Approximately 3.6% of the jurisdiction is in the floodway (DOE, 1998c).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.21 and 0.33 km and are higher for both the north and west. The relatively shallow nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly greater than 85 m (51.8%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 12. The principal upland species include willow (*Salix*) and elm (*Ulmus*). The primary emergent vegetation species are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005).

Wetlands
Wetland habitat in Reach 12 is fairly extensive, comprising 22.2% of the SMP jurisdiction and composed of palustrine emergent and palustrine emergent scrub/shrub wetlands (USFWS, 2003).

Wildlife

Fish

This reach within Parker Horn is an important area for spring walleye spawning migrations (Gabriel and Jordan, 2004).

Avian

Reach 12 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. In addition, the reach's nearshore is classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for ducks (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial

Reach 12 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach's nearshore is also classified as a priority habitat for mink, rated as moderate to high density (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)

Of the SMP jurisdiction lands along Reach 12, 25.3% are under transportation and utilities. Of the remaining 74.7% of SMP jurisdiction lands, 21.5% are classified as commercial, 21.0% are multifamily residential, 18.6% are undeveloped, 10.6% are unclassified, and 3.0% are classified as parks/open land. Based on land use, imperviousness of this reach is estimated to be approximately 20.8%. Parcel sizes in the reach have an average width of 60 m and an average depth of approximately 203 m. Based on a survey of 5 shoreline structures, average structure setback from the shoreline along reach 12 is 50.4 m, ranging from 42.6 to 58.2 m.

The small parcel of public land (0.9%) owned by the City of Moses Lake is the Neppel Landing Park. Considered an environmental and historical conservancy area, Neppel Landing is a 2.5 acre park with green space, picnic shelters, a bike and walking path, boat dock, and kayak and canoe racks (City of Moses Lake, 2001a).

Transportation Infrastructure (Table 6
Roadways occupy 1855 meters of SMP jurisdiction land in Reach 12 (WDNR, 1996). Railroads occupy 922 meters of SMP jurisdiction, and one storm sewer outfall is located along this reach (United States Census Bureau 2000, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 12 is hardened with bulkheads. In addition, 1 dock is located along this reach (Central Washington University 2004a, 2004b).

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 12 is predominantly Light Industrial (53.0%), Multi Family Residential (16.0%) and Heavy Industrial (11.2%), with smaller areas of Central Business District (9.2%), Public (0.9%) and 9.7% with no zoning designation. Currently 63.7% of the reach is designated as Urban and 8.2% as Conservancy by the current SMP and 28.0% is Natural.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 12 on file with the Washington State Office of Archaeology and Historic Preservation. One facility/site has been identified as being of interest to DOE due to pollution/permitting concerns, associated with a tire dealership (DOE, 1998b).

ECOLOGICAL FUNCTION SUMMARY

Reach 12 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Floodway: 3.6% Steep slopes: 2.5%	Wetlands: 22.2% Undeveloped: 18.6% Priority habitats: 3 Species of concern: 4	Public land: 1% Parks: 1	Principal land use: transportation-utilities Imperviousness: 20.8% Roads: 1855 m Storm drains: 1 Docks: 1 DOE Facility/Site: 1

Ecological functions along Reach 12 are impaired by a wide variety of development. While three priority habitat are found along this reach and 22.2% is classified as wetland habitat, riparian vegetation has been removed and replaced with buildings, lawns, and parking lots, which can promote increased runoff and nonpoint source pollution. Imperviousness for the reach is estimated at 20.8%. Roadways and a railroad, which cover 2.77 km of the jurisdiction, may be additional sources of nonpoint source pollution. Water quality may be further impacted by stormwater discharges from the one storm

sewer outfall found along this reach. While there are no bulkheads along the reach, artificial fill for the railroad grade has covered littoral habitat with coarse materials, increasing slope and wave reflectivity, thereby affecting aquatic vegetation and habitat for the seven fish species found along this reach. Only one dock is found along this reach. This reach is important for spring walleye spawning migrations.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
12A	Natural	Undeveloped commercial; wetlands; priority habitats
12B	High Intensity - Resource	Developed commercial use; wetlands
12C	High Intensity	Highway

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by light industrial development

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.

REACH 13

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 13 is dominantly flood gravels. Part of a mid island bar created by the Missoula Floods, 8.2% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as a combination of mixed alluvium (35.1%) and cobble (66.5%). The soils within the SMP jurisdiction are predominately Malaga stony sandy loams (50.8%) and Ephrata fine sandy loam (48.5%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is classed as slow. The hazard of soil erosion is also slow.

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.29 and 0.86 km and are higher for both the northeast and west. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the entire shoreline having nearshore exposure widths less than 10 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 13. The principal upland species include willow (*Salix*) and elm (*Ulmus*). Emergent vegetation in the littoral zone is limited, with an average width of less than 2 m extending along only 4.1% of the reach. The primary emergent vegetation species of Reach 13 are softstem bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), and common reed (*Phragmites australis*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines found in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). In addition, the unprotected cobble shorelines tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species. (Table 10) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*).

Wetlands
Palustrine emergent wetland habitat is extremely limited along Reach 13, comprising only 0.3% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least seven fish species may be found along Reach 13, dominated by yellow perch (43%), black crappie (15%), and smallmouth bass (14%)(Fig. 12) (Gabriel and Jordan, 2004). Other notable species include walleye (13%) and bluegill (13%) (Table 24). Portions of the shoreline have also been identified as walleye fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 13 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and parks/open land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore and shoreline is classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important brooding area for ducks (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial
Reach 13 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and parks/open land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach's nearshore is also classified as a priority habitat for mink (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 13, 38.1% are classified as commercial retail. Of the remaining 61.9% of SMP jurisdiction lands, 36.3% is under parks/open land, 17.5% is transportation/utilities, 3.3% is residential single family, 1.7% is unclassified, 2.3% is lodging and 0.7% is multi family residential. Based on land use, imperviousness of this reach is estimated to be approximately 32.8%. Parcel sizes in the reach have an average width of 400 m and an average depth of approximately 36 m. Based on a survey of 19 shoreline structures, average structure setback from the shoreline along reach 13 is

40.8 m, ranging from 26.0 to 58.0 m. Within the SMP jurisdiction, 26.7% of Reach 13 contains public lands owned by the City of Moses Lake (Neppel Landing).

Transportation Infrastructure (Table 6)
Roadways occupy 2512 meters of SMP jurisdiction land in Reach 13 (WDNR, 1996). Railroads occupy 1502 meters of SMP jurisdiction and 2 storm sewer outfalls occur along this reach (United States Census Bureau 2000, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 13 is hardened with bulkheads. In addition, 1 dock is located along this reach (Central Washington University 2004a, 2004b).

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 13 is predominantly General Commercial and Business (35.6%), Public (26.6%), and Light Industrial (24.4%), with a smaller area of Central Business District (13.4%). Currently 49.5% of the reach is designated as Urban and 50.5% as Conservancy by the current SMP.

Cultural Resource Designations (Table 6)
There is one Archeological Site Form record of cultural sites with in the SMP jurisdiction of Reach 13 on file with the Washington State Office of Archaeology and Historic Preservation. Seven facilities/sites has been identified as being of interest to DOE due to pollution/permitting concerns, primarily related to automotive businesses, gas stations and underground storage tanks (DOE, 1998b).

ECOLOGICAL FUNCTION SUMMARY

Reach 13 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 8.2%	Wetlands: 0.3% Priority habitats: 3 Species of concern: 4 Fish Species: 7	Public land: 26.7% Parks:1	Principal land use: commercial-retail Imperviousness: 32.8% Roads: 2512 m Storm drains: 2 Docks: 1 DOE Facilities/Sites: 7

Ecological functions along Reach 13 are impaired by the Columbia Basin Railroad and recreational and commercial development found along the reach, which account for the majority of the estimated 32.8% imperviousness for the reach. While 3 priority habitats are found along this reach, wetland habitat comprises only 0.3% of the reach, while riparian vegetation has been removed and replaced with buildings, lawns, and parking

lots, which can promote increased runoff and nonpoint source pollution. Roadways and a railroad, which cover 4.0 km of the jurisdiction, may be additional sources of nonpoint source pollution. Water quality may be further impacted by stormwater discharges from the two storm sewer outfalls found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extremely restricted, extending 4.1% of the reach, though the limits to extent and widths might be in part due to the relatively steep nearshore found along this reach. While there are no bulkheads along the reach, artificial fill for the railroad grade has covered littoral habitat with coarse materials, increasing slope and wave reflectivity, thereby affecting aquatic vegetation and habitat for the seven fish species found along this reach. Only one dock is found along this reach. This aquatic habitat is further impaired by exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
13A	Water-Oriented Park	Public park
13B	High Intensity	Developed downtown commercial use

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by light industrial development.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.
B. Retrofit storm sewer outfalls to limit pollution loading to the lake.
C. Provide public access at railroad grade in Neppel Park and restore emergent vegetation and vegetative buffer.

REACH 14

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 14 is dominantly flood gravels. This reach was probably caused by the alleviation of velocity of the water when the lake was dammed, with no areas having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Ephrata-Malaga complex (89.9%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is classed as slow. The hazard of soil erosion is also slow.

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.07 and 2.32 km and are higher for both the southwest and west. The relatively gentle nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths primarily between 36 and 60m (43.7%) and 10-35m (36.4%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 14. The principal upland species is salt bush (Atriplex). Emergent vegetation in the littoral zone is extensive, with an average width of 5-10 m extending along 94.8% of the reach. The primary emergent vegetation species of Reach 14 are softstem bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), and common reed (*Phragmites australis*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). In addition, wetland shorelines tend to have11 species of aquatic vegetation species found in the nearshore, including 5 submergent species, dominated by sago pondweed and Eurasian water milfoil, and 6 emergent species, dominated by softstem bulrush (Table 16).

Wetlands
Palustrine emergent wetland habitat is extremely extensive along Reach 14, comprising 52.8% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least three fish species may be found along Reach 14, including walleye (53%), bullhead (43%), and bluegill (14%) (Fig. 13; Table 25) (Gabriel and Jordan, 2004). Portions of the shoreline have also been identified as good bass and walleye fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 14 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. Small islands offshore are classified as a priority nesting habitat area for ducks (WDFW, 2002).

Terrestrial
Reach 14 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 14, 76.0% are undeveloped. Of the remaining 24.0% of SMP jurisdiction lands, 18.8% are under single family residential development, 3.9% are unclassified, and 1.3% are classified as commercial. Based on land use, imperviousness of this reach is estimated to be approximately 5.3%. Parcel sizes in the reach have an average width of 46 m and an average depth of approximately 67 m. Based on a survey of 3 shoreline structures, average structure setback from the shoreline along reach 14 is 36.6 m, ranging from 13.7 to 50.0 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 206 meters of SMP jurisdiction land in Reach 14 (WDNR, 1996). Railroads occupy 50 meters of SMP jurisdiction, though no storm sewer outfalls occur along this reach (United States Census Bureau 2000,City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 14 is hardened with bulkheads or docks.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 14 is predominantly Multi Family Residential (93.6%), with a smaller area of Light Industrial (6.4%). Currently 18.2% of the reach is designated as Urban and 81.8% as Conservancy by the current SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 14 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 14 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
	Wetlands: 52.8% Undeveloped: 76% Species of concern: 4 Priority habitat: 2 Fish Species: 14		Principal land use: undeveloped Imperviousness: 5.3% Roads: 206 m

Ecological functions on Reach 14 are relatively intact. The shoreline within this reach is predominantly made up of wetlands identified by the National Wetland Inventory, providing priority habitat for a wide variety of wildlife and fish species. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extensive, with an average width between 5-10 m extending along 94.8% of the reach. The shoreline is an important spawning and rearing area for walleye, as well as bullhead and bluegill. While the reach is principally undeveloped (76.0%), residential development in the upland is encroaching on the wetland environment and is a potential source of stormwater runoff and nonpoint pollution such as sediment, fertilizers and pesticides. Imperviousness is estimated to be 5.3% along this reach. Roadways and a railroad, which cover 256 m of the jurisdiction, may be additional sources of nonpoint source pollution. Currently there are no shoreline protection structures along this reach.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
14A	Natural	Undeveloped; wetlands; emergent vegetation
14B	Shoreline Residential - Resource	Residential use; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential development.
B. Protect spawning and rearing habitat for important fish species.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Provide incentives for landowners to develop vegetative buffers around parking areas, as well as direct overland flow away from lake, on sites already developed.

REACH 15

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 15 is predominately flood gravels. A mid channel bar, 33.1% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as cobble. The soils within the SMP jurisdiction are predominately Malaga stony sandy loams (41.0%) and Malaga cobbly sandy loam (38.5%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is primarily classed as slow (61.5%) and moderate (38.5%). The hazard of soil erosion is also slow (61.5%) and moderate (38.5%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.25 and 2.51 km and are higher for both the north and west. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (89.8%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 9.6% of Reach 15. The principal upland species are sagebrush (Artemesia) and giant rye (Elymus condensatus). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is relatively limited, with an average width of less than 2 m extending along 12.2% of the reach. The primary emergent vegetation species of Reach 15 is softstem bulrush (Scirpus validus).

Based on information collected for WDFW in 2003, the unprotected cobble shorelines tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species (Central Washington University, 2005). (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*). By comparison, protected cobble shorelines tend to have a slightly lower diversity of species, including 5

submergent and 1 emergent species, softstem bulrush (Table 10). The submergent species are dominated by white stem pondweed, sago pondweed, Eurasian water milfoil, and curly leaf pondweed.

Wetlands
No wetlands are found in the SMP jurisdiction (USFWS, 2003), though a small island largely comprised of emergent vegetation is located offshore.

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least ten fish species may be found along Reach 15, dominated by yellow perch (23%), black crappie (19%), and largemouth bass (16%)(Fig. 14) (Gabriel and Jordan, 2004). Other notable species include bluegill (12%), walleye (11%), and bullhead (10%)(Table 26). Portions of the shoreline have also been identified as good bass and walleye fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 15 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore and a small offshore island largely comprised of emergent vegetation are also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important nesting area for geese and ducks (WDFW, 2002).

Terrestrial
Reach 15 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 15, 42.8% are classified as residential single family. Of the remaining 57.2 % of SMP jurisdiction lands, 18.3% is lodging, 11.3% is under residential multi-family, 7.9% is undeveloped, 8.0% is residential mobile home, 2.3% is commercial and 9.5 is unclassified. Based on land use, imperviousness of this reach is estimated to be approximately 25.2%. Parcel sizes in the reach have an average

width of 30 m and an average depth of approximately 70 m. Based on a survey of 37 shoreline structures, average structure setback from the shoreline along reach 15 is 30.8 m, ranging from 9.0 to 48.8 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 950 meters of SMP jurisdiction land in Reach 15, and one storm sewer outfall occurs along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 42% of the shoreline along Reach 15 is hardened with bulkheads. In addition, 29 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 15 is predominantly Multi-Family Residential (82.1%) and Single and Two Family Residential (17.9%). Currently 92% of the reach is designated as Urban and 8% as Conservancy by the current SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 15 on file with the Washington State Office of Archaeology and Historic Preservation. One facility/site has been identified as being of interest to DOE due to pollution/permitting concerns, related to the metal industry (DOE, 1998b).

ECOLOGICAL FUNCTION SUMMARY

Reach 15 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 33.1%	Undeveloped: 7.9% Riparian tree cover: 9.6% Priority habitats: 1 Species of concern: 4 Fish Species: 10		Principal land use: residential Imperviousness: 25.25 Roads: 950 m Bulkheads: 42% Storm drains: 1 Docks: 29 DOE Facility/Site: 1

Ecological functions along Reach 15 are impaired by residential and commercial development, which covers most of the jurisdiction and accounts for the majority of the estimated 25.2% imperviousness for the reach. Only 7.9% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings, lawns, and parking lots, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 950 m of the jurisdiction, may be an additional source

of nonpoint source pollution. One storm sewer outfall also is found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extremely limited, with an average width of less than 2 m and extending only 12.2% of the reach, though this might be in part due to the relatively steeper nearshore and greater windward fetch found along this reach. There are no wetlands located in this reach, though it is associated with 1 priority habitat. In addition, only 9.6% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. This vegetation includes Russian olive, a highly invasive exotic species. Despite a substrate comprised of erosion-resistant cobble, a very high portion of the reach has shoreline hardening (42.0%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the ten fish species typically found along this reach. This aquatic habitat is further impaired by the fairly large number of docks (29) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
15A	Shoreline-Residential	Residential with extensive docks and bulkheads; minimal riparian tree cover and emergent vegetation
15B	High Intensity	Developed commercial use

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect emergent vegetation near docks, residential areas, and public access areas.
C. Prevent increase in the number of bulkheads on the shoreline.
D. Prevent increase in the number of bulkheads on the shoreline.
E. Prevent increase in the number of bulkheads on the shoreline.
F. Protect vegetative buffer on residential and agricultural land.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Provide incentives for landowners to develop vegetative buffers around parking areas, as well as direct overland flow away from lake, on sites already developed.
C. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.

D. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.
E. Retrofit storm sewer outfalls to limit pollution loading to the lake.
F. Provide incentives for landowners to develop vegetative buffers around parking areas, as well as direct overland flow away from lake, on sites already developed.

REACH 16

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 16 is predominately flood gravels with some small areas of conglomerate. This reach is a mid channel bar, with none of the area having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as cobble. The soils within the SMP jurisdiction are predominately Malaga cobbly sandy loam (71.8%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is primarily classed as moderate (71.9%). The hazard of soil erosion is also predominately moderate (71.9%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the south and northwest. Fetch lengths range between 0.08 and 1.32 km and are higher for both the southwest and northwest. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (99.1%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 1.7% of Reach 16. The principal upland species are sagebrush (Artemesia) and giant rye (Elymus condensatus). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone has an average width of less than 2 m extending along 31.1% of the reach. In addition, another 4.1% of the reach has emergent vegetation zones with widths ranging between 2-5 m. The primary emergent vegetation species of Reach 16 are softstem bulrush (*Scirpus validus*) and common reed (*Phragmites australis*).

Based on information collected for WDFW in 2003, the unprotected cobble shorelines tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species (Central Washington University, 2005). (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*). By comparison, protected cobble shorelines tend to have a slightly lower diversity of species, including 5

submergent and 1 emergent species, softstem bulrush (Table 10). The submergent species are dominated by white stem pondweed, sago pondweed, Eurasian water milfoil, and curly leaf pondweed.

Wetlands
No wetlands are found in the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least twelve fish species may be found along Reach 16, dominated by yellow perch (29%), walleye (22%), and bluegill (21%)(Fig. 15) (Gabriel and Jordan, 2004). Other notable species include largemouth bass (15%) and black crappie (11%)(Table 27). Portions of the shoreline have also been identified as good bass and walleye fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 16 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore in the leeward portion of the peninsula is also classified as a priority wintering habitat for Tundra Swan and priority breeding habitat for the Clark's and Western grebe (WDFW, 2002).

Terrestrial
Reach 16 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, a small portion of the east end of the reach is classified as a priority riparian habitat, including willow, Russian olive, greasewood, Chinese elm, and saltgrass (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 16, 81.7% are classified as residential single family. Of the remaining 18.3% of SMP jurisdiction lands, 9.3% are unclassified, 3.6% are residential mobile home, 3.6% are undeveloped, and 1.9% are classified as lodging. Based on land use, imperviousness of this reach is estimated to be approximately 24.8%. Parcel sizes in the reach have an average width of 32 m and an average depth of approximately 69 m. Based on a survey of 48 shoreline structures, average structure

setback from the shoreline along reach 16 is 21.0 m, ranging from 0.0 to 42.3 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 1455 meters of SMP jurisdiction land in Reach 16, and 2 storm water outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 28.6% of the shoreline along Reach 16 is hardened with bulkheads. In addition, 46 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 16 is predominantly Single Family Residential (86.6%) and Multi Family Residential (4.3%) , with no zoning designation for 9.1% of the reach. Currently 92.0% of the reach is designated as Urban by the current City of Moses Lake SMP and 8.0% contains no environment designation.

Cultural Resource Designations (Table 6)
There is one Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 16 on file with the Washington State Office of Archaeology and Historic Preservation. This site is recorded as a habitation site.

ECOLOGICAL FUNCTION SUMMARY

Reach 16 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
	Undeveloped: 3.6% Riparian tree cover: 1.7% Priority habitats: 3 Species of concern: 4 Fish Species: 8		Principal land use: residential-1 family Imperviousness: 24.8% Roads: 1455 m Bulkheads: 28.6% Storm drains: 2 Docks: 46

Ecological functions along Reach 16 are impaired by residential development, which predominantly covers the jurisdiction and accounts for the majority of the estimated 24.8% imperviousness for the reach. Only 3.6% of the land is still undeveloped along the reach. While 3 priority habitats are found along this reach, riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 1455 m of the jurisdiction, may be an additional source of nonpoint source pollution. Two storm sewer outfalls are also found

along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution is limited, primarily comprised of an average width of less than 2 m extending along approximately one third of the reach (though this might be in part due to the relatively steeper nearshore and greater windward fetch found along this reach). There are no wetlands located along this reach. In addition, only 1.7% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. This vegetation includes Russian olive, a highly invasive exotic species. Despite a substrate comprised of erosion-resistant cobble, a substantial portion of the reach has shoreline hardening (28.6%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the twelve fish species typically found along this reach. This aquatic habitat is further impaired by the extremely high number of docks (46) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
16A	High Intensity	Highway and commercial use (lodging)
16B	Shoreline Residential - Resource	Residential use with docks and bulkheads; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect emergent vegetation near docks, residential areas, and public access areas.
B. Prevent increase in the number of bulkheads on the shoreline.
C. Protect emergent vegetation near docks, residential areas, and public access areas.
D. Prevent increase in the number of bulkheads on the shoreline.
E. Protect emergent vegetation near docks, residential areas, and public access areas.
F. Protect priority riparian habitat as identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.
C. Retrofit storm sewer outfalls to limit pollution loading to the lake.
D. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
E. Retrofit storm sewer outfalls to limit pollution loading to the lake.

F. Retrofit storm sewer outfalls to limit pollution loading to the lake.
G. Retrofit storm sewer outfalls to limit pollution loading to the lake.

REACH 17

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 17 is dominantly conglomerate. This reach is a mid channel bar, with none of the area having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as cobble (100%). The soils within the SMP jurisdiction are predominately Ephrata- Malaga complex (97.8%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is primarily classed as slow (97.8%). The hazard of soil erosion is also predominately slow (97.8%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the northeast and south. Fetch lengths range between 0.92 and 1.87 km and are higher for both the south and east. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (80.4%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 17. The principal upland species are sagebrush (Artemesia) and giant rye (Elymus condensatus). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is extensive, with an average width of 2-5 m extending along 98.4% of the reach. The primary emergent vegetation species of Reach 17 is softstem bulrush (*Scirpus validus*).

Based on information collected for WDFW in 2003, the unprotected cobble shorelines found along this reach tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species (Central Washington University, 2005). (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*). By comparison, protected cobble shorelines tend to have a slightly lower diversity of species, including 5 submergent and 1 emergent species, softstem bulrush

(Table 10). The submergent species are dominated by white stem pondweed, sago pondweed, Eurasian water milfoil, and curly leaf pondweed.

Wetlands
No wetlands are found in the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least seven fish species may be found along Reach 17, dominated by yellow perch (25%), walleye (20%), bluegill (16%), and smallmouth bass (16%)(Fig. 16) (Gabriel and Jordan, 2004). Other notable species include black crappie (9%), largemouth bass (9%), and rainbow trout (5%)(Table 28).

Avian
Reach 17 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore and nearby Goat Island are also classified as a priority wintering habitat for tundra swan and breeding habitat for the Clark's and Western grebe, while a Clark's grebe nesting colony has been identified as a Natural Heritage site on nearby Goat Island (WDFW, 2002). The reach's nearshore and offshore island are also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, and an important nesting habitat for ducks and geese.

Terrestrial
Reach 17 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach is classified as a priority riparian habitat, including willow, Russian olive, greasewood, Chinese elm, and saltgrass (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf*

Land Use (Table 5)*)*
Of the SMP jurisdiction lands along Reach 17, 51.5% are classified as recreation. Of the remaining 48.5% of SMP jurisdiction lands, 28.7% is agricultural development, 15.9% is undeveloped, 0.4% is residential single family, and 3.6% is unclassified. Based on land use, imperviousness of this reach is estimated to be approximately 0.05%. Parcel sizes in the reach have an average width of 113 m and an average depth of approximately 234 m.

Within the SMP jurisdiction, 50.8% of Reach 17 contains public lands, including the 22 acre Lower Peninsula Park. Considered an environmental conservancy area, the park contains restroom facilities, a picnic area, two boat launch ramps, and day boat moorage (City of Moses Lake, 2001a).

Transportation Infrastructure (Table 6)
There are no roadways and no storm sewer outfalls that occur along this reach.

Bulkheads and Docks (Table 6)
Approximately 0.7% of the shoreline along Reach 17 is hardened with bulkheads. In addition, 1 dock is located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 17 is predominantly Public (50.8%) and Single Family Residential (49.2%). Currently 45.7% of the reach is designated as Rural and 54.3% as Conservancy by the current SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 17 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 17 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
	Undeveloped: 15.9% Priority habitats: 4 Species of concern: 4 Natural Heritage points: 1 Fish Species: 7	Public land: 50.8% Parks: 1 Boat launches: 1	Principal land use: recreation Imperviousness: 0.05% Docks: 1

Ecological functions along Reach 17 are impaired by recreational development. Riparian vegetation has been removed and replaced with parking lots, which can promote increased runoff and nonpoint source pollution. While there are no wetlands located along this reach, emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is extensive, with an average width between 2-5 m extending along 98.4% of the reach. One Natural Heritage location, four priority habitats, and at least seven fish species are found along this reach. Only 0.7% of the reach has shoreline hardening, and only one dock is found along the reach, associated with Lower Peninsula Park. The riparian habitat is further impaired by Russian olive, a

highly invasive exotic species, as well as the exotic submergent species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
17A	Water-Oriented Park	Public park
17B	Shoreline Residential-Resource	Residential and agriculture use; unplatted; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect emergent vegetation near docks, residential areas, and public access areas.
B. Protect priority riparian habitat as identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. On public land, move parking areas out of the SMP jurisdiction or set them back from the shoreline.

REACH 18

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 18 is predominately flood gravels with only about one fourth of the reach consisting of conglomerate. This reach is a mid channel bar, with no areas having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as cobble (100%). The soils within the SMP jurisdiction are entirely Ephrata-Malaga complex (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is classed as slow (100%). The hazard of soil erosion is also slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the east and south. Fetch lengths range between 0.95 and 1.54 km and are higher for both the south and southeast. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (93.2%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 18. The principal upland species are sagebrush (Artemesia) and giant rye (*Elymus condensatus*). This riparian zone also supports Russian olive (Elaeagnus) and yellow flag (*Iris pseudacorus L.)*, which are invasive species. Emergent vegetation in the littoral zone has an average width of less than 2 m extending along 40.8% of the reach. In addition, another 10.5% of the reach has emergent vegetation zones with widths ranging between 2-5 m. The primary emergent vegetation species of Reach 18 are softstem bulrush (*Scirpus validus*) and yellow flag (*Iris pseudacorus L.*).

Based on information collected for WDFW in 2003, the unprotected cobble shorelines found in this reach tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species (Central Washington University, 2005). (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*). By

comparison, protected cobble shorelines tend to have a slightly lower diversity of species, including 5 submergent and 1 emergent species, softstem bulrush (Table 10). The submergent species are dominated by white stem pondweed, sago pondweed, Eurasian water milfoil, and curly leaf pondweed.

Wetlands
No wetlands are found in the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least eight fish species may be found along Reach 18, dominated by yellow perch (58%), bluegill (10%), largemouth bass (11%), and common carp (10%)(Fig. 17) (Gabriel and Jordan, 2004). Other notable species include black crappie (7%) and smallmouth bass (4%)(Table 29).

Avian
Reach 18 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as an important wintering area for tundra swans (WDFW, 2002).

Terrestrial
Reach 18 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, a small portion of the south end of the reach is classified as a priority riparian habitat, including willow, Russian olive, greasewood, Chinese elm, and saltgrass (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 18, 48.8% are classified as residential single-family. Of the remaining 51.2% of SMP jurisdiction lands, 24.8 is transportation and utilities, 15.4% is unclassified, and 9.7% is undeveloped and 1.3% is multi-family residential. Based on land use, imperviousness of this reach is estimated to be approximately 13.0%. Parcel sizes in the reach have an average width of 38 m and an average depth of approximately 53 m. Based on a survey of 10 shoreline structures,

average structure setback from the shoreline along reach 18 is 24.8 m, ranging from 19.9 to 33.0 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways 592 meters of SMP jurisdiction land in Reach 18, though no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 34% of the shoreline along Reach 18 is hardened with bulkheads. In addition, 9 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 18 is predominantly Single Family Residential (52.8%) and Multi Family Residential (24.7%) , with no zoning designation for 22.5%. Currently 77.0% of the reach is designated as Urban by the current SMP and 23.0% contains no environment designation.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 18 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 18 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
	Undeveloped: 9.7% Priority habitats: 3 Species of concern: 4 Fish Species: 8		Principal land use: residential-1 family Imperviousness: 13% Roads: 592 m Bulkheads: 34% Docks: 9

Ecological functions along Reach 18 are impaired by residential development, which covers the majority of the jurisdiction and accounts for most of the estimated 13% imperviousness for the reach. Only 9.7% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Roadways, which cover 592 m of the jurisdiction, may be an additional source of nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution is limited, primarily comprised of an average width of less than 2 m extending

along approximately half of the reach (though this might be in part due to the relatively steeper nearshore found along this reach). While there are no wetlands found along this reach, it is associated with three types of priority habitat. In addition, none of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. The riparian vegetation includes Russian olive and Yellow flag iris, both highly invasive exotic species. Despite a limited windward fetch and a substrate comprised of erosion-resistant cobble, a substantial portion of the reach has shoreline hardening (34.0%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the eight fish species typically found along this reach. This aquatic habitat is further impaired by the relatively small number of docks (9) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
18A	Shoreline Residential-Resource	Residential use; emergent vegetation
18B	High Intensity	Highway

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.

REACH 19

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 19 is dominantly flood gravels. This reach is a mid channel bar, with no areas having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as cobble (100%). The soils within the SMP jurisdiction are predominately Ephrata-Malaga complex (73.2%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is classed as slow (100%). The hazard of soil erosion is also slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the northeast and southwest. Fetch lengths range between 0.21 and 0.78 km and are higher for both the southeast and east. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly between 36 and 60 m (51.0%) and less than 10m (39.8%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 19. The principal upland species are sagebrush (Artemesia) and giant rye (Elymus condensatus). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is fairly extensive, with an average width of 2-5 m extending along 49.4% of the reach. In addition, another 8.2% of the reach has emergent vegetation zones with widths averaging less than 2 m. The primary emergent vegetation species of Reach 19 are softstem bulrush (*Scirpus validus*) and Yellow flag (*Iris pseudacorus L.*).

Based on information collected for WDFW in 2003, the unprotected cobble shorelines found in this reach tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species (Central Washington University, 2005). (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*). By comparison, protected cobble shorelines tend to have a slightly lower diversity of species, including 5 submergent and 1 emergent species, softstem bulrush (Table 10). The

submergent species are dominated by white stem pondweed, sago pondweed, Eurasian water milfoil, and curly leaf pondweed.

Wetlands
Palustrine emergent wetland habitat in Reach 19 is fairly extensive, comprising 6.8% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife
Fish

Based on data collected by WDFW between 2002 and 2003, at least seven fish species may be found along Reach 19, dominated by bluegill (46%), yellow perch (20%), largemouth bass (15%), and smallmouth bass (11%)(Fig. 18) (Gabriel and Jordan, 2004). Other notable species include walleye (3%), black crappie (3%), and rainbow trout (3%) (Table 30). Portions of the shoreline have also been identified as good common carp fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 19 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's shoreline and nearshore are classified as a priority habitat for tundra swan wintering, Clark's and Western grebe breeding, and waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial
Reach 19 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 19, 80.1% are classified as residential single family. Of the remaining 19.9% of SMP jurisdiction lands, 10.0% is under unclassified, 3.1% is commercial, 2.8% is lodging, 2.5% is undeveloped, 0.8% is multi-family

residential and 0.7% is transportation, utilities. Based on land use, imperviousness of this reach is estimated to be approximately 24.2%. Parcel sizes in the reach have an average width of 26 m and an average depth of approximately 65 m. Based on a survey of 28 shoreline structures, average structure setback from the shoreline along reach 19 is 23.7 m, ranging from 0.0 to 49.4 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 562 meters of SMP jurisdiction land in Reach 19 (WDNR, 1996). Railroads occupy 65 meters of SMP jurisdiction and 3 storm sewer outfalls occur along this reach (United States Census Bureau 2000,City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 42.7% of the shoreline along Reach 19 is hardened with bulkheads. In addition, 32 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 19 is predominantly Single Family Residential (87.6%), with smaller areas of Multi Family Residential (5.9%) and Single and Two Family Residential (5.3%) with no zoning designation for 1.2%. The remaining lands (1.2%) have no zoning designation. Currently 100% of the reach is designated as Urban by the current SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 19 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 19 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
	Wetlands: 6.8% Undeveloped: 2.5% Priority habitats: 5 Species of concern: 4 Fish Species: 7		Principal land use: residential-1 family Imperviousness: 24.2% Roads: 562 m Bulkheads: 42.7% Storm drains: 3 Docks: 32

Ecological functions along Reach 19 are impaired by residential development, which covers the majority of the jurisdiction and accounts for most of the estimated 24.2%

imperviousness for the reach. Only 2.5% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Roadways and railroads, which cover 627 m of the jurisdiction, may be an additional source of nonpoint source pollution. Three storm sewer outfalls are also found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution is fairly extensive, primarily comprised of an average width between 2-5 m extending along 58% of the reach. Five types of priority habitat are associated with this reach. In addition, 6.8% of the reach is classified as wetland habitat. However, none of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. The riparian vegetation includes Russian olive and Yellow flag iris, both highly invasive exotic species. Despite a limited windward fetch and a substrate comprised of erosion-resistant cobble, a substantial portion of the reach has shoreline hardening (42.7%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the seven fish species typically found along this reach. This aquatic habitat is further impaired by the relatively high number of docks (32) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
19A	Shoreline Residential	Residential use with extensive docks and bulkheads
19B	Shoreline Residential - Resource	Residential use; wetlands and emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect emergent vegetation near docks, residential areas, and public access areas.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.
B. Retrofit storm sewer outfalls to limit pollution loading to the lake.
C. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.
D. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).

E. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
F. Retrofit storm sewer outfalls to limit pollution loading to the lake.
G. Retrofit storm sewer outfalls to limit pollution loading to the lake.
H. Retrofit storm sewer outfalls to limit pollution loading to the lake.

REACH 20

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 20 is dominantly flood gravels. This reach is a mid island bar, with 5.8% of the area having slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as cobble. The soils within the SMP jurisdiction are predominately Ephrata fine sandy loam (64.3%) (NRCS, 2003). As a result, soil permeability is entirely moderately rapid while runoff is classed as slow (100%). The hazard of soil erosion is also predominately slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the east and south. Fetch lengths range between 0.42 and 0.72 km and are higher for the south. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (93.7%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 20. Emergent vegetation in the littoral zone is limited, with an average width of 2-5 m extending along 6.1% of the reach. The primary emergent vegetation species of Reach 20 are softstem bulrush (*Scirpus validus*) and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, the unprotected cobble shorelines found along this reach tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species (Central Washington University, 2005). (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil (*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*).

Wetlands
No wetlands are found in the SMP jurisdiction (USFWS, 2003).

Wildlife

Fish

Based on data collected by WDFW between 2002 and 2003, at least eight fish species may be found along Reach 20, dominated by yellow perch (56%), bluegill (24%), smallmouth bass (9%), and black crappie (6%)(Fig. 19; Table 31) (Gabriel and Jordan, 2004). Portions of the shoreline have also been identified as good black crappie fishing areas (Fish-n-Map Co., n.d.).

Avian

Reach 20 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's shoreline and nearshore are classified as a priority habitat for tundra swan wintering, Clark's and Western grebe breeding, and waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial

Reach 20 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with parks/open land and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)

Of the SMP jurisdiction lands along Reach 20, 27.5% are classified as single-family residential. Of the remaining 72.5% of SMP jurisdiction lands, 21.0% is under parks/open land, 15.2% is undeveloped, 12.6% is residential multi-family, and 10.4% is governmental services, 9.0% is unclassified, 4.4% is transportation and utilities. Based on land use, imperviousness of this reach is estimated to be approximately 15.1%. Parcel sizes in the reach have an average width of 39 m and an average depth of approximately 54 m. Based on a survey of 26 shoreline structures, average structure setback from the shoreline along reach 20 is 25.7 m, ranging from 16.1 to 38.1 m.

Within the SMP jurisdiction, 27.2% of Reach 20 contains public lands owned by the City of Moses Lake, including McCosh Park. Considered and environmental conservancy area, McCosh Park is a 20 acre facility that includes 6 lighted tennis courts, playground

and picnic areas, basketball courts, and restrooms (City of Moses Lake, 2001a). Within the park there is also a family aquatic center and an amphitheater for summer concerts.

Transportation Infrastructure (Table 6)
Roadways occupy 768 meters of SMP jurisdiction land in Reach 20 (WDNR, 1996). Railroads occupy 125 meters of SMP jurisdiction, and one storm sewer outfall occurs along this reach (United States Census Bureau 2000, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 20 is hardened with bulkheads. Eleven docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 20 is predominantly Single and Two Family Residential (53.7%), followed by Public lands (27.0%) and Multi Family Residential (15.3%) with no zoning designation for 4.0%. Currently 78.6% of the reach is designated as Urban and 21.4% as Conservancy by the current SMP.
Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 20 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 20 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 5.8%	Undeveloped: 15.2% Priority habitats: 4 Species of concern: 4 Fish Species: 7	Public land: 27.2% Parks: 1	Principal land use: residential. Imperviousness: 15.1% Roads: 768 m Storm drains: 1 Docks: 11

Ecological functions along Reach 20 are impaired by residential and recreational development, which cover the majority of the jurisdiction, though 15.2% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings, lawns, and parking lots, which can promote increased runoff and nonpoint source pollution. Based on land use, imperviousness of this reach is estimated to be approximately 15.1%. Roadways and railroads, which cover 893 m of the jurisdiction, may be additional sources of nonpoint source pollution. One storm sewer outfall also is found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution is extremely limited, primarily

comprised of an average width between 2-5 m extending along 6.1% of the reach (though this might be in part due to the relatively steeper nearshore found along this reach). In addition, there are no wetlands found along this reach. The reach provides four types of priority habitat as well as habitat for eight species of fish. The aquatic habitat is impaired by the relatively small number of docks (11) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
20A	Shoreline Residential-Resource	Primarily residential use; priority habitats
20B	Water-Oriented Park	Public park

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect priority habitat for waterfowl, Tundra Swan, Clark's Grebe, and Bald Eagle identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
C. Retrofit storm sewer outfalls to limit pollution loading to the lake.
D. Retrofit storm sewer outfalls to limit pollution loading to the lake.

REACH 21

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 21 is predominately conglomerate with about one fourth of the reach consisting of basalt flows and another one fourth consisting of flood gravels. This reach is a relict cut bank, which has been eroded by the Missoula Floods in the sandstone portion of the lake. There are no areas with slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as a combination of mixed alluvium (97.3%) and cobble (2.7%). The soils within the SMP jurisdiction are predominately Aquents (42.9%) (NRCS, 2003). As a result, soil permeability is mostly moderately slow (42.9%) while runoff is primarily classed as ponded (55.4%). The hazard of soil erosion is predominately slow (79.7%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the southwest and northwest. Fetch lengths range between 0.37 and 2.56 km and are higher for both the southwest and northwest. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (43.4%) and greater than 85m (30.4%). The shoreline also has nearshore exposure widths 10-35m (26.2%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 21. The principal upland species is Salt bush (*Atriplex*). This riparian zone also supports Russian olive (*Elaeagnus*), an invasive species.

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). In addition, the unprotected cobble shorelines tend to have 12 species of aquatic vegetation found in the nearshore, including 6 submergent and 6 emergent species. (Table 9) The submergent species are dominated by sago pondweed and Eurasian water milfoil

(*Myriophyllum spicatum*), while the emergent species are dominated by reed canary grass (*Phalaris arundinacea*) and softstem bulrush (*Scirpus validus*).

Wetlands

Wetland habitat, dominated by palustrine emergent wetlands, is extremely extensive along Reach 21, comprising 77.2% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife

Fish

Based on data collected by WDFW between 2002 and 2003, at least four fish species may be found along Reach 21, including bluegill (76%), yellow perch (14%), largemouth bass (10%), and black crappie (3%)(Fig. 20; Table 32) (Gabriel and Jordan, 2004). Portions of the shoreline have also been identified as good black crappie fishing areas (Fish-n-Map Co., n.d.).

Avian

Reach 21 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's wetlands and nearshore are also classified as a priority habitat for tundra swan wintering, Clark's and Western grebe breeding, and waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves.

Terrestrial

Reach 21 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)

Of the SMP jurisdiction lands along Reach 21, 45.6% are classified as single family residential. Of the remaining 54.4% of SMP jurisdiction lands, 22.7% is undeveloped, 16.7% is parks/open land, 3.5% is residential mobile home, 5.9% is unclassified, 2.5% is

commercial, 0.7% is governmental services and 2.4% is residential multi-family. Based on land use, imperviousness of this reach is estimated to be approximately 12.9%. Parcel sizes in the reach have an average width of 53 m and an average depth of approximately 92 m. Based on a survey of 9 shoreline structures, average structure setback from the shoreline along reach 21 is 34.6 m, ranging from 20.5 to 47.9 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways 698 meters of SMP jurisdiction land in Reach 21, and 3 storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 21 is hardened with bulkheads. In addition, 5 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 21 is predominantly Multi Family Residential (71.5%) and Single Family Residential (28.5%). Currently 15.7% of the reach is designated as Conservancy and 68.7% Urban by the current SMP and 15.6% is not designated by the current City of Moses Lake SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 21 on file with the Washington State Office of Archaeology and Historic Preservation. Two facilities/sites have been identified as being of interest to DOE due to pollution/permitting concerns, related to underground storage tanks (DOE, 1998b).

ECOLOGICAL FUNCTION SUMMARY

Reach 21 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
	Wetlands: 77.2% Undeveloped: 22.7% Priority habitats: 5 Species of concern: 4 Fish Species:3		Principal land use: residential Imperviousness: 12.9% Roads: 698 m Storm drains: 3 Docks: 5 DOE Facilities/Sites: 2

While the shoreline within Reach 21 is predominantly made up of priority habitat wetlands also identified by the National Wetland Inventory, ecological functions are

impaired by residential and recreational development, which cover the majority of the jurisdiction, though 22.7% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings, lawns, and parking lots, which can promote increased runoff and nonpoint source pollution. Based on land use, imperviousness of this reach is estimated to be approximately 12.9%. Roadways, which cover 698 m of the jurisdiction, may be additional sources of nonpoint source pollution. Three storm sewer outfalls are also found along this reach. Besides wetlands, the reach provides four other types of priority habitat, as well as habitat for four species of fish. The aquatic habitat is impaired by the relatively small number of docks (5) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
21A	Natural	Undeveloped; wetlands; priority habitats
21B	Shoreline Residential-Special Resource	Relatively undeveloped; wetlands; priority habitats
21C	Shoreline Residential- Resource	Residential use; priority habitats

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect priority habitat for waterfowl, Tundra Swan, Clark's Grebe, and Bald Eagle identified by WDFW.
B. Protect existing wetlands from encroachment by residential development.
C. Protect vegetative buffer on residential and agricultural land.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.
B. Retrofit storm sewer outfalls to limit pollution loading to the lake.
C. Retrofit storm sewer outfalls to limit pollution loading to the lake.
D. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.

REACH 22

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 22 is predominately conglomerate with a small area of basalt flows and the part of the reach that extends over the lake is classified as alluvium. This reach is a relict cut bank, which has been eroded by the Missoula Floods in the sandstone portion of the lake. Approximately1% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as a mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Umapine silt loam (67.9%) and aquents (23.7%) (NRCS, 2003). As a result, soil permeability is predominantly moderate (76.3%) while runoff is primarily classed as ponded (91.6%). The hazard of soil erosion is primarily none (67.9%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.28 and 1.36 km and are higher for both the north and northwest. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (41.8%), 10-35m (32.3%) and 36-60m (25.3%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 22. The principal upland species is salt bush (*Atriplex*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is fairly extensive, with an average width of less than 2 m extending along 37.6% of the reach. In addition, another 29.8% of the reach has emergent vegetation zones with widths averaging 5-10 m. The primary emergent vegetation species of Reach 22 are softstem bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), common reed (*Phragmites australis*), and reed canary grass (*Phalaris arundinacea*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005).

Wetlands
Wetland habitat in Reach 22, dominated by palustrine emergent wetlands, is extensive, comprising 45.8% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least ten fish species may be found along Reach 22, dominated by yellow perch (36%), bluegill (25%), smallmouth bass (24%), and largemouth bass (10%)(Fig. 21); Table 33) (Gabriel and Jordan, 2004). Portions of the shoreline have also been identified as good common carp fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 22 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and parks/open land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's shoreline and nearshore are classified as a priority habitat for tundra swan wintering, Clark's and Western grebe breeding, and waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). The shoreline is also classified as a priority habitat for wintering bald eagles, which tend to congregate in small groups on shoreline trees, offshore islands, and ice shelves. A Clark's grebe nesting colony has been identified as a Natural Heritage site on the connected Marsh Island, which is also classified as a priority habitat for Marsh hawks and a nesting area for duck and geese.

Terrestrial
Reach 22 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and parks/open land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 22, 63.9% are undeveloped. Of the remaining 36.2% of SMP jurisdiction lands, 20.9% is transportation and utilities, 11.0% is parks/open land, 2.5% is unclassified, and 1.7% is single family residential. Based on

land use, imperviousness of this reach is estimated to be approximately 0.2%. Parcel sizes in the reach have an average width of 221 m and an average depth of approximately 176 m. Based on a survey of 1 shoreline structure, average structure setback from the shoreline along reach 22 is 18.5 m.

There are 12.8 % of public lands within the SMP jurisdiction that are owned by the City of Moses Lake, including Montlake. Considered an environmental conservancy area, Montlake Park is a 9 acre public facility with playground and picnic areas, boat launch, day boat moorage, restrooms and an unsupervised swim area (City of Moses Lake, 2001a).

Transportation Infrastructure (Table 6)
Roadways occupy 2650 meters of SMP jurisdiction land in Reach 22 (WDNR, 1996). Railroads occupy 296 meters of SMP jurisdiction, though no storm sewer outfalls occur along this reach (United States Census Bureau 2000, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 22 is hardened with bulkheads. In addition, there are 2 docks located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 22 is predominantly Single Family Residential (43.5%) and Public (10.9%), with a smaller area of Urban Residential 2 (1.6%) and 44% has no zoning designation. Currently 38.1% of the reach is designated as Conservancy and 35.8% as Urban by the current SMP and 26.1% contains no environment designation.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 22 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 22 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 1% High erosion soils: 6.7% High soil runoff: 6.7%	Wetlands: 45.8% Undeveloped: 63.9% Priority habitats: 7 Natural Heritage sites: 1 Species of concern: 4 Fish Species: 10	Public land: 12.8% Parks: 1 Boat launches: 1	Principal land use: undeveloped Imperviousness: 0.2% Roads: 2650 m Docks: 2

Ecological functions on Reach 22 are relatively intact. The shoreline within this reach is predominantly made up of priority habitat wetlands also identified by the National Wetland Inventory, providing potential habitat for a wide variety of wildlife and fish species. While the reach is largely undeveloped (63.9%), residential development in the upland is encroaching on the wetland environment and is a potential source of stormwater runoff and nonpoint pollution such as sediment, fertilizers and pesticides. Roadways and railroads, which cover 2.9 km of the jurisdiction, may be an additional source of nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution is fairly extensive, extending over two-thirds of the reach, with approximately half having emergent vegetation zones with widths averaging 5-10 m. Besides wetlands and one Natural Heritage site, the reach provides six other types of priority habitat, as well as habitat for ten species of fish, including common carp, which may affect the health of the emergent vegetation along this shoreline. The aquatic habitat is impaired by two docks found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
22A	Natural	Undeveloped; park use; wetlands; emergent vegetation
22B	Natural	Relatively undeveloped; wetlands; emergent vegetation
22C	High Density	Highway
22D	Natural	Undeveloped island; wetlands; emergent vegetation; priority habitats

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect priority habitat for waterfowl, Tundra Swan, Clark's Grebe, and Bald Eagle identified by WDFW.
B. Protect existing wetlands from encroachment by residential development.
C. Protect emergent vegetation near docks, residential areas, and public access areas.
D. Develop construction runoff controls for new construction, especially in high soil erosion areas with limited riparian vegetation.
E. Protect priority wetland habitat identified by WDFW.
F. Protect priority island habitat supporting important wildlife nesting areas identified by WDFW.
G. Protect priority habitat for waterfowl identified by WDFW.
H. Protect priority habitat for Clark's Grebe identified by WDFW

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.

REACH 23

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 23 is predominately conglomerate with a small area of basalt flows. This reach is a relict cut bank, which has been eroded by the Missoula Floods in the sandstone portion of the lake. Approximately 32.5% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Wiehl fine sandy loams (48.1%) or Umapine silt loam (38.1%) (NRCS, 2003). As a result, soil permeability is primarily moderate (86.2%) while runoff is primarily classed as very rapid (48.1%) or ponded (38.1%). The hazard of soil erosion is also predominately very high (48.1%) with some areas of no hazard of soil erosion (38.1%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.26 and 1.13 km and are higher for both the west and northwest. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly between 10 and 35m (53.7%) and less than 10m (31.7%). The remainder of the nearshore exposure widths is 36-60m (14.6%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 14.1% of Reach 23. The principal upland species is salt bush (*Atriplex*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is fairly extensive, with an average width of 2-5 m extending along 36.7% of the reach. In addition, another 37.3% of the reach has emergent vegetation zones with widths of less than 2 m. The primary emergent vegetation species of Reach 23 are softstem bulrush (*Scirpus validus*) and common reed (*Phragmites australis*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005).

Wetlands
Palustrine emergent wetland habitat in Reach 23 is fairly extensive, comprising 36.1% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least seven fish species may be found along Reach 23, dominated by yellow perch (48%), bluegill (27%), and smallmouth bass (13%)(Fig. 22) (Gabriel and Jordan, 2004). Other notable species include largemouth bass (5%) and black crappie (4%)(Table 34).

Avian
Reach 23 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat and denser zones of emergent vegetation or riparian tree cover (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore and nearby Goat Island are also classified as a priority habitat for tundra swan wintering and Clark's and Western grebe breeding, while a Clark's grebe nesting colony has been identified as a Natural Heritage site on Goat Island (WDFW, 2002). The island is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring, as well as a nesting area for duck and geese.

Terrestrial
Reach 23 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 23, 99.9% are classified as residential single family and 0.1% is unclassified. Based on land use, imperviousness of this reach is estimated to be approximately 14.0%. Parcel sizes in the reach have an average width of 37 m and an average depth of approximately 175 m. Based on a survey of 5 shoreline structures, average structure setback from the shoreline along reach 23 is 41.6 m, ranging from 23.8 to 56.6 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
There are no roadways and no storm sewer outfalls along Reach 23.

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 23 is hardened with bulkheads. There are 20 docks along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 23 is entirely Urban Residential 2. Currently the Grant County SMP environmental designation for Reach 32 is Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 23 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 23 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 32.5% High erosion soils: 48% High soil runoff: 48%	Wetlands: 36.1% Riparian tree cover: 14.1% Priority habitats: 5 Species of concern: 5 Natural Heritage points: 1 Fish Species: 7		Principal land use: residential-1 family Imperviousness: 14% Docks: 20

While over one-third of Reach 23 is comprised of priority habitat wetlands identified by the National Wetland Inventory, ecological functions along Reach 23 are impaired by residential development, which covers the majority of the jurisdiction and accounts for all the estimated 14% imperviousness found in this reach. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly extensive, extending along approximately three-quarters of the reach. In addition, 14.1% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. The riparian vegetation includes Russian olive, a highly invasive exotic species. Besides wetlands and one Natural heritage location, the reach provides four other types of priority habitat as well as habitat for seven species of fish. This aquatic habitat is impaired by a relatively high number of docks (20) found in this reach, as well as exotic

weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
23	Shoreline Residential - Resource	Residential use with docks; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect emergent vegetation near docks, residential areas, and public access areas.
B. Protect vegetative cover on areas prone to high soil erosion.
C. Protect emergent vegetation near docks, residential areas, and public access areas.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.
B. Restore vegetative cover and riparian buffer on areas prone to high soil erosion.
C. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.

REACH 24

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 24 is predominantly basalt flows with about one fourth of the reach consisting of flood gravels and another one fourth consisting of conglomerate. This reach is a depositional feature that postdates the floods. Approximately 2.7% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Ephrata-Malaga complex (91.8%) (NRCS, 2003). As a result, soil permeability is primarily moderately rapid (95.3%) while runoff is primarily classed as slow (91.8%). The hazard of soil erosion is also predominately slow (91.8%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and northwest. Fetch lengths range between 0.94 and 1.63 km and are higher for both the north and northeast. The relatively shallow nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly between 10 and 35m (46.0%) and 36-60m (29.0%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 4.5% of Reach 24. Emergent vegetation in the littoral zone is fairly extensive, with an average width of less than 2 m extending along 31.1% of the reach. In addition, another 16.5% of the reach has emergent vegetation zones with widths ranging between 2-5 m and 5-10 m. The primary emergent vegetation species of Reach 24 is softstem bulrush (*Scirpus validus*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005).

Wetlands
Wetland habitat in Reach 24, dominated by palustrine emergent wetlands, is extremely extensive, comprising 72.8% of the SMP jurisdiction (USFWS, 2003).

Wildlife

Fish

Based on data collected by WDFW between 2002 and 2003, at least eight fish species may be found along Reach 24, dominated by yellow perch (51%), bluegill (14%), largemouth bass (13%), and walleye (13%)(Fig. 23) (Gabriel and Jordan, 2004). Other notable species include smallmouth bass (6%), and black crappie (2%)(Table 35). Portions of the shoreline have also been identified as good bass and walleye fishing areas (Fish-n-Map Co., n.d.).

Avian

Reach 24 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for tundra swan wintering and Clark's and Western grebe breeding (WDFW, 2002).

Terrestrial

Reach 24 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)

Of the SMP jurisdiction lands along Reach 24, 48.3% are classified as residential single-family. Of the remaining 51.7% of SMP jurisdiction lands, 33.1% is undeveloped, 7.6% is agriculture, 5.8% is parks/open land, and 5.3% is unclassified. Based on land use, imperviousness of this reach is estimated to be approximately 12.1%. Parcel sizes in the reach have an average width of 30 m and an average depth of approximately 77 m. Based on a survey of 7 shoreline structures, average structure setback from the shoreline along reach 24 is 37.0 m, ranging from 14.2 to 60.1 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 247.7 meters of SMP jurisdiction land in Reach 24, and there are no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 24 is hardened with bulkheads. In addition, 7 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 24 is entirely Urban Residential 2. Currently the Grant County SMP environmental designation for Reach 24 is Suburban.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 24 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 24 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 2.7%	Wetlands: 72.8% Undeveloped: 33.1% Riparian tree cover: 4.5% Priority habitats: 2 Species of concern: 5 Fish Species: 8		Principal land use: residential-1 family Imperviousness: 12.1% Roads: 247 m Docks: 7

While the shoreline within Reach 24 is predominantly made up of wetlands identified by the National Wetland Inventory, ecological functions are impaired by residential development, which predominantly covers the jurisdiction, though 33.1% of the land is still undeveloped along the reach. Based on land use, imperviousness of this reach is estimated to be approximately 12.1%. Riparian vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly extensive, extending along approximately 47% of the reach. In addition, 4.5% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. Besides two types of priority habitat, the reach provides habitat for eight species of fish. This aquatic habitat is impaired by a relatively small number of docks (7) found in this reach,

as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
24A	Water-Oriented Park	Public park
24B	Shoreline Residential – Special Resource	Residential uses and undeveloped land; wetlands; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect emergent vegetation near docks, residential areas, and public access areas.
B. Protect existing wetlands from encroachment by residential development

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Provide incentives for landowners to develop vegetative buffers around parking areas, as well as direct overland flow away from lake, on sites already developed.

REACH 25

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 25 is dominantly flood gravels. This reach is a sand dune area, with dunes seeming to overlay a point bar type landform. Approximately 18.1% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as sand (100%). The soils within the SMP jurisdiction are predominantly Quincy fine sands (74.5%) (NRCS, 2003). As a result, soil permeability is entirely rapid while runoff is classed as slow (100%). The hazard of soil erosion is also classed as slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the east and south. Fetch lengths range between 0.59 and 2.65 km and are higher for both the south and southeast. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the entire shoreline having nearshore exposure widths between 10 and 35m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is not present along Reach 25. The principal upland species are salt bush (*Atriplex*) and wild rose (*Rosa canina*). This riparian zone also supports Russian olive (Elaeagnus) and Yellow flag (*Iris pseudacorus L.)*, which are invasive species. Emergent vegetation in the littoral zone is somewhat limited, with an average width of 2-5 m extending along 22.6% of the reach. The primary emergent vegetation species of Reach 25 are softstem bulrush (*Scirpus validus*) and yellow flag (*Iris pseudacorus L.)*.

Based on information collected for WDFW in 2003, dune shorelines tend to have 8 species of aquatic vegetation in the nearshore, including 5 submergent species, dominated by sago pondweed and white stem pondweed, and 3 emergent species, dominated by softstem bulrush (Table 13) (Central Washington University, 2005).

Wetlands
Wetland habitat in Reach 25, comprised of palustrine open water, emergent, and forested wetlands, is fairly extensive, comprising 14.8% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least thirteen fish species may be found along Reach 25, dominated by yellow perch (56%), largemouth bass (12%), bluegill (11%), and walleye (7%)(Fig. 24) (Gabriel and Jordan, 2004). Other notable species include black crappie (5%), smallmouth bass (4%), and bullhead (3%)(Table 36).

Avian
Reach 25 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region.

Terrestrial
Reach 25 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 25, 100% are classified as undeveloped. Based on land use, imperviousness of this reach is estimated to be 0%. Parcel sizes in the reach have an average width of 732 m and an average depth of approximately 213 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
There are no roadways that occupy SMP jurisdiction land in Reach 25, and no storm sewer outfalls occur along this reach.

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 25 is hardened with bulkheads. In addition, there are no docks located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 25 is entirely Urban Residential 3. Currently the Grant County SMP environmental designation for Reach 25 is Conservancy.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 25 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 25 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep Slopes: 18.1% Rapid permeability: 100%	Wetlands: 14.8% Undeveloped: 100% Species of concern: 4 Fish Species: 13		Principal land use: undeveloped

Ecological functions on Reach 25 are relatively intact. The shoreline within this reach is entirely made up of undeveloped sand dunes, providing potential habitat for a wide variety of wildlife and fish species, including wetland habitat, which comprises 14.8% of the reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution is relatively limited, primarily comprised of an average width between 2-5 m extending along 22.6% of the reach (though this might be in part due to the relatively steeper nearshore found along this reach). The reach provides habitat for thirteen species of fish, the greatest diversity of any of the reaches. The riparian and aquatic habitat is impaired by exotic weed species such as Russian olive, Yellow flag iris, Eurasian water milfoil and curly-leaf pondweed.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
25	Natural	Undeveloped dunes; emergent vegetation; wetlands

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential development
B. Protect vegetation and habitat in dune areas.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

none

REACH 26

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 26 is dominantly flood gravels. This reach is a sand dune area, with dunes seeming to overlay a point bar type landform. Approximately 3.1% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as sand. The soils within the SMP jurisdiction are predominately Quincy fine sand (57.2%) (NRCS, 2003). As a result, soil permeability is entirely rapid while runoff is classed as slow (100%). The hazard of soil erosion is also classed as slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the west. The fetch length is equal to 0.13 km. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly between 10 and 35m (70.4%) and less than 10 m (29.1%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 33.9% of Reach 26. The principal upland species are salt bush (*Atriplex*) and wild rose (*Rosa canina*). This riparian zone also supports Russian olive (Elaeagnus) and yellow flag (*Iris pseudacorus L.)*, which are invasive species. Emergent vegetation in the littoral zone is fairly limited, with an average width of less than 2 m extending along 7.6% of the reach. In addition, another 8.8% of the reach has emergent vegetation zones with widths ranging between 2-5 m and 5-10 m. The primary emergent vegetation species of Reach 26 are softstem bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), common reed (*Phragmites australis*), and yellow flag (*Iris pseudacorus*).

Based on information collected for WDFW in 2003, unprotected residential sand shorelines found in this reach tend to have 13 species of aquatic vegetation found in the nearshore, including 6 submergent and 7 emergent species (Table 11) (Central Washington University, 2005). The submergent species are dominated by sago pondweed while the emergent species are dominated by reed canary grass, softstem bulrush, and yellow flag iris (*Iris pseudacorus*). Protected residential sand shorelines

tend to have a lower diversity of species than along unprotected sand shorelines, including 6 submergent species, dominated by sago pondweed, and only 1 emergent species, softstem bulrush (Table 12).

Wetlands
Wetland habitat in Reach 26, comprised of palustrine open water, aquatic bed, emergent, and forested wetlands, is fairly extensive, comprising 7.1% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least thirteen fish species may be found along Reach 26, dominated by yellow perch (57%), largemouth bass (13%), bluegill (12%), and black crappie (5%)(Fig. 25) (Gabriel and Jordan, 2004). Other notable species include walleye (4%), smallmouth bass (4%), and bullhead (3%)(Table 37).

Avian
Reach 26 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for Clark's and Western grebe breeding (WDFW, 2002).

Terrestrial
Reach 26 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach is classified as a priority riparian habitat consisting of Russian olive and willow trees on the residential shoreline areas, as well as a priority habitat for mule deer, though this has likely been impaired by extensive shoreline development (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 26, 65.6% are classified as residential single-family. Of the remaining 34.4% of SMP jurisdiction lands, 20.3% is undeveloped, 6.1% is transportation and utilities, 4.3% is lodging, 1.8% is parks/open land, and 1.6% is unclassified. Based on land use, imperviousness of this reach is estimated to be

approximately 16.4%. Parcel sizes in the reach have an average width of 35 m and an average depth of approximately 59 m. Based on a survey of 59 shoreline structures, average structure setback from the shoreline along reach 26 is 17.6 m, ranging from 0.0 to 47.4 m. Approximately 3.7% of the area within the SMP jurisdiction is in public ownership.

Transportation Infrastructure (Table 6)
Roadways occupy 1710 meters of SMP jurisdiction land in Reach 26, and 10 storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 21.7% of the shoreline along Reach 26 is hardened with bulkheads. In addition, 83 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf* **)**

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 26 is predominantly Single Family Residential (73.7%), with smaller areas of Urban Residential 3 (8.4%), General Commercial and Business (5.2%), Public (3.7%), Multi Family Residential (4.5%), and Single and Two Family Residential (3.7%) , with no zoning designation for 0.8%. Currently 6.2% of the reach is designated as Conservancy and 66.8% as Urban by the City of Moses Lake SMP and 27.0% is designated as Conservancy by the Grant County SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 26 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 26 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 3.1% Rapid permeability: 100%	Wetlands: 7.1% Undeveloped: 20.3% Riparian tree cover: 33.9% Priority habitats: 3 Species of concern: 4 Fish Species: 13	Public land: 3.7%	Principal land use: residential-1 family Imperviousness: 16.4% Roads: 1710 m Bulkheads: 21.7% Storm drains: 10 Dock: 83

Ecological functions along Reach 26 are impaired by residential development, which covers the majority of the jurisdiction (65.9%), though 20.3% of the land is still

undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings and lawns, both of which can promote increased runoff and nonpoint source pollution. Roadways, which cover 1710 m of the jurisdiction, may be an additional source of nonpoint source pollution. Ten storm sewer outfalls are also found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly limited, extending along 16% of the reach. In addition, 7.1% of the reach is classified as wetland habitat, while over one-third of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. The riparian vegetation includes Russian olive, a highly invasive exotic species. The reach is associated with three types of priority habitat. Despite a limited windward fetch, a substantial portion of the reach has shoreline hardening (21.7%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the thirteen fish species typically found along this reach (the high diversity of any reach). This aquatic habitat is further impaired by the extremely high number of docks (83) found in this reach, as well as exotic weed species such as Eurasian water milfoil, curly-leaf pondweed, and yellow flag iris typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
26A	Natural	Undeveloped dunes; wetlands; riparian tree cover
26B	Shoreline Residential – Resource	Residential uses; riparian tree cover; emergent vegetation; priority habitats
26C	High Intensity-Resource	Commercial use (water-oriented, lodging); emergent vegetation
26D	High Intensity	Highway

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential development
B. Protect vegetative buffer on residential and agricultural land.
C. Protect emergent vegetation near docks, residential areas, and public access areas.
D. Prevent increase in the number of bulkheads on the shoreline.
E. Protect priority habitat for Western Grebe and shorebirds identified by WDFW.
F. Protect emergent vegetation near docks, residential areas, and public access areas.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Retrofit storm sewer outfalls to limit pollution loading to the lake.

B. Retrofit storm sewer outfalls to limit pollution loading to the lake.
C. Retrofit storm sewer outfalls to limit pollution loading to the lake.
D. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
E. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
F. Retrofit storm sewer outfalls to limit pollution loading to the lake.
G. Retrofit storm sewer outfalls to limit pollution loading to the lake.
H. Retrofit storm sewer outfalls to limit pollution loading to the lake.

REACH 27

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 27 is dominantly flood gravels. This reach is a sand dune area, with dunes seeming to overlay a point bar type landform. Approximately 19.8% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as fine sand. The soils within the SMP jurisdiction are entirely Quincy fine sands (NRCS, 2003). As a result, soil permeability is entirely rapid while runoff is classed as slow (100%). The hazard of soil erosion is also slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and east. Fetch lengths range between 0.77 and 1.73 km and are higher for both the north and east. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the entire shoreline having nearshore exposure widths between 10 and 35 m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 33.9% of Reach 27. The principal upland species is willow (*Salix)*. This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is fairly extensive, with an average width of 2-5 m extending along 21.9% of the reach. In addition, another 30.7% of the reach has emergent vegetation zones with widths of less than 2 m. The primary emergent vegetation species of Reach 27 is softstem bulrush (*Scirpus validus*).

Based on information collected for WDFW in 2003, unprotected residential sand shorelines found in this reach tend to have 13 species of aquatic vegetation found in the nearshore, including 6 submergent and 7 emergent species (Table 11) (Central Washington University, 2005). The submergent species are dominated by sago pondweed while the emergent species are dominated by reed canary grass, softstem bulrush, and yellow flag iris (*Iris pseudacorus*).

Wetlands
Wetland habitat in Reach 27, comprised of palustrine forested and emergent wetlands, is limited, comprising 2.1% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least twelve fish species may be found along Reach 27, dominated by yellow perch (55%), bluegill (12%), largemouth bass (11%), and walleye (6%)(Fig. 26) (Gabriel and Jordan, 2004). Other notable species include black crappie (5%), smallmouth bass (5%), and bullhead (4%)(Table 38).

Avian
Reach 27 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). In addition, the northern half of the reach is classified as a priority riparian habitat, consisting mainly of willow and elm trees, which provide habitat for pheasants, quail, and nongame birds.

Terrestrial
Reach 27 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 27, 60.9% are classified as undeveloped and 39.1% is parks/open land. Based on land use, imperviousness of this reach is estimated to be 0%. Parcel sizes in the reach have an average width of 343 m and an average depth of approximately 334 m. Based on a survey of 1 shoreline structure, average structure setback from the shoreline along reach 27 is 33.4 m. Approximately 79.5% of the area within the SMP contains Moses Lake public lands. The Moses Lake Community Park is also found along this reach. Considered an environmental conservancy area, the park is a 78-acre facility with 3 restrooms, a playground area, picnic shelters, two boat launch

ramps, and an unsupervised swimming area (City of Moses Lake, 2001a). It also adjoins a fishing bridge located on the I-90 right of way.

Transportation Infrastructure (Table 6)
There are no roadways that occupy jurisdiction land in Reach 27, and no storm sewer outfalls that occur along this reach (WDNR, 1996 ,City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
None of the shoreline along Reach 27 is hardened with bulkheads. However, there is one dock located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 27 is predominantly Public (87.9%), with a smaller area of Single Family Residential (12.1%). Currently 87.0% of the reach is designated as Natural and 13.0% is designated as Urban by the SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 27 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 27 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep Slopes: 19.8% Rapid permeability: 100%	Wetlands: 2.1% Undeveloped: 60.9% Riparian tree cover: 33.9% Priority habitats: 2 Species of concern: 4 Fish Species: 13	Public land: 87.9% Parks: 1 Boat launches: 1	Principal land use: undeveloped Docks: 1

Ecological functions along Reach 27 are impaired by recreational development within a park, which covers 39.1% of the jurisdiction, while the majority of the jurisdiction is still undeveloped along the reach (60.9%). Riparian vegetation has been removed and replaced with lawns, and parking lots, which can promote increased runoff and nonpoint source pollution. While only 2.1% of the reach is classified as wetland habitat, emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is fairly extensive, extending along over half of the reach, though primarily at widths less than 2 m. The reach is associated with two types of priority habitat. In addition, 33.9% of the reach has overhanging vegetation, which helps provide shading of

aquatic habitat and bank stability. The riparian vegetation includes Russian olive, a highly invasive exotic species. The reach provides habitat for twelve species of fish. This aquatic habitat is impaired by one dock found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type. Moses Lake Community Park, found along this reach, is a 78-acre park with 3 restrooms, a playground area, picnic shelters, boat launch, and an unsupervised swimming area.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
27	Water-Oriented Park	Public park; riparian tree cover; emergent vegetation

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect emergent vegetation near docks, residential areas, and public access areas.
B. Protect existing wetlands from encroachment by residential development.
C. Protect priority riparian habitat as identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

none

REACH 28

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 28 is dominantly flood gravels. This reach is a sand dune area, with dunes seeming to overlay a point bar type landform. Approximately 26.9% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as a combination of mixed alluvium (94.6%) and sand (5.4%). The soils within the SMP jurisdiction are predominately Quincy fine sand (92.6%) (NRCS, 2003). As a result, soil permeability is primarily rapid (92.6%) while runoff is classed as slow (100%). The hazard of soil erosion is also slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the north and east. Fetch lengths range between 1.10 and 1.84 km and are higher for both the north and northeast. The nearshore tends to be moderately impacted by the fall lake level drawdown of approximately 1.5 m, with the entire shoreline having nearshore exposure widths between 10 and 35m.

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 45.5% of Reach 28. The principal upland species is willow (*Salix*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is relatively limited, with an average width of 5-10 m extending along 8.5% of the reach. The primary emergent vegetation species of Reach 28 is softstem bulrush (*Scirpus validus*).

Based on information collected for WDFW in 2003, the unprotected mixed alluvium shorelines in this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). On the other hand, the portion of protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*). In addition, unprotected residential sand shorelines found in this reach tend to have 13 species of aquatic vegetation found in the nearshore, including 6 submergent and 7 emergent

species (Table 11). The submergent species are dominated by sago pondweed while the emergent species are dominated by reed canary grass, softstem bulrush, and yellow flag iris (*Iris pseudacorus*). Protected sand shorelines tend to have a lower diversity of species than along unprotected sand shorelines, including 6 submergent species, dominated by sago pondweed, and only 1 emergent species, softstem bulrush (Table 12).

Wetlands
Wetland habitat in Reach 28, comprised of palustrine forested and open water wetlands, is fairly extensive, comprising 7.3% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least twelve fish species may be found along Reach 28, dominated by yellow perch (55%), bluegill (13%), largemouth bass (11%), and walleye (6%)(Fig. 27) (Gabriel and Jordan, 2004). Other notable species include black crappie (5%), smallmouth bass (5%), and bullhead (4%)(Table 39).

Avian
Reach 28 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). In addition, the reach is classified as a priority riparian habitat, consisting mainly of willow and elm trees, which provide habitat for pheasants, quail, and nongame birds.

Terrestrial
Reach 28 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat, parks/open land, and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf*

Land Use (Table 5)*)*
Of the SMP jurisdiction lands along Reach 28, 63.2% are classified as residential single-family. Of the remaining 36.8% of SMP jurisdiction lands, 18.5% is under multi-family residential development, 6.5% is undeveloped, 9.2% is unclassified, and 2.6% is

parks/open land. Based on land use, imperviousness of this reach is estimated to be approximately 27.8%. Parcel sizes in the reach have an average width of 41 m and an average depth of approximately 52 m. Based on a survey of 19 shoreline structures, average structure setback from the shoreline along reach 28 is 17.8 m, ranging from 5.0 to 55.8 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
There are no roadways that occupy SMP jurisdiction land in Reach 28, but there is one storm sewer outfall occurs along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 61.3% of the shoreline along Reach 28 is hardened with bulkheads. In addition, 25 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 28 is entirely Single Family Residential. Currently 100% of the reach is designated as Urban by the SMP.

Cultural Resource Designations (Table 6)
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 28 on file with the Washington State Office of Archaeology and Historic Preservation.

ECOLOGICAL FUNCTION SUMMARY

Reach 28 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 26.9% Rapid permeability: 92.6%	Wetlands: 7.3% Undeveloped: 6.5% Riparian tree cover: 45.5% Priority habitats: 2 Species of concern: 4 Fish Species: 12		Principal land use: residential-1 family Imperviousness: 27.8% Bulkheads: 61.3% Storm drains: 1 Docks: 25

Ecological functions along Reach 28 are impaired by residential development, which covers the majority of the jurisdiction (81.7%), though 6.5% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings and lawns, both of which can promote increased runoff and nonpoint source pollution. One storm sewer outfall is also found along this reach. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is relatively limited, extending along 8.5% of the reach. On the other hand, over 45% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and

bank stability. The riparian vegetation includes Russian olive, a highly invasive exotic species. In addition, 7.3% of the reach is classified as wetland habitat, while two types of priority habitat are also associated with this reach. Despite limited windward fetch and an erosion-resistant substrate of mixed alluvium, the majority of the reach has shoreline hardening (61.3%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the twelve fish species typically found along this reach (the second highest diversity of any reach). This aquatic habitat is further impaired by the relatively high number of docks (25) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
28	Shoreline Residential	Residential uses with extensive docks and bulkheads

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect existing wetlands from encroachment by residential development.
C. Protect priority riparian habitat as identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of emergent vegetation on developed parcels and in agricultural areas.
C. Retrofit storm sewer outfalls to limit pollution loading to the lake.
D. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.

REACH 29

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 29 is dominantly flood gravels. This reach is a prominent cut bank, and was an area of erosive energy when the Missoula Floods were racing through the area. Approximately 42.8% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are classified as mixed alluvium (100%). The soils within the SMP jurisdiction are predominately Malaga stony sandy loam (75.8%) (NRCS, 2003). As a result, soil permeability is primarily moderately rapid (98.8%) while runoff is primarily classed as slow (100%). The hazard of soil erosion is also predominately slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the northeast and southeast. Fetch lengths range between 0.87 and 3.99 km and are higher for both the southeast and northeast. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline having nearshore exposure widths mostly less than 10 m (99.1%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 62.5% of Reach 29. The principal upland species include willow (*Salix)*, poplar (*Populus*), and elm (*Ulmus*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is relatively extensive, with an average width of less than 2 m extending along 75.3% of the reach. The primary emergent vegetation species of Reach 29 are softstem bulrush (*Scirpus validus*) and common reed (*Phragmites australis*).

Based on information collected for WDFW in 2003, unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). On the other hand, protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
No wetlands are found in the SMP jurisdiction along Reach 29 (USFWS, 2003).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least twelve fish species may be found along Reach 29, dominated by yellow perch (55%), bluegill (13%), largemouth bass (11%), and walleye (7%)(Fig. 28) (Gabriel and Jordan, 2004). Other notable species include black crappie (5%), bullhead (4%), and smallmouth bass (4%)(Table 40). Portions of the shoreline have also been identified as good bass fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 29 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the late fall and early spring (WDFW, 2002). In addition, the reach is classified as a priority riparian habitat, consisting mainly of willow and elm, which provide habitat for pheasants, quail, and nongame birds.

Terrestrial
Reach 29 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern.

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 29, 54.2% are classified as single-family residential, 20.4% is agriculture, 8.8% is unclassified, 7.7% is classified as mining, 7.1% is undeveloped, 0.9% is recreation, and 0.9% is transportation and utilities. Based on land use, imperviousness of this reach is estimated to be approximately 11.9%. Parcel sizes in the reach have an average width of 48 m and an average depth of approximately 69 m. Based on a survey of 50 shoreline structures, average structure setback from the shoreline along reach 29 is 22.1 m, ranging from 3.1 to 49.3 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 3987 meters of SMP jurisdiction land in Reach 29, though no storm sewer outfalls occur along this reach (WDNR, 1996 ,City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 17.9% of the shoreline along Reach 29 is hardened with bulkheads. In addition, 49 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 29 is predominantly Urban Residential 3 (93.7%), with a smaller area of Single Family Residential (6.3%). Currently the Grant County SMP environmental designation for Reach 29 is a combination of Suburban and Rural

Cultural Resource Designations (Table 6)
There is one Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 29 on file with the Washington State Office of Archaeology and Historic Preservation. This site is a habitation site.

ECOLOGICAL FUNCTION SUMMARY

Reach 29 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 42.8% Rapid permeability: 1.2%	Undeveloped: 7.1% Riparian tree cover: 62.5% Priority habitats: 2 Species of concern: 5 Fish Species: 12		Principal land use: residential-1 family Imperviousness: 11.9% Roads: 3987 m Bulkheads: 17.9% Docks: 49

Ecological functions along Reach 29 are impaired by residential development, which covers the majority of the jurisdiction (54.2%), though 7.1% of the land is still undeveloped along the reach. Riparian vegetation has been removed and replaced with buildings and lawns, both of which can promote increased runoff and nonpoint source pollution. Based on land use, imperviousness of this reach is estimated to be approximately 11.9%. Roadways occupy 3987 meters of SMP jurisdiction land in Reach 29, may be an additional source of nonpoint pollutants. While no wetlands are located in this reach, emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is relatively extensive, extending along approximately three-quarters of the reach, though at average widths of less than 2 m (this might be in part due to the relatively steeper nearshore found along this reach). In addition, over

62.5% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. The riparian vegetation includes Russian olive, a highly invasive exotic species. Two types of priority habitat are found along this reach. Despite limited windward fetch and an erosion-resistant substrate of mixed alluvium, a substantial portion of the reach has shoreline hardening (17.9%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the twelve fish species typically found along this reach (the second highest diversity of any reach). This aquatic habitat is further impaired by the extremely high number of docks (49) found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
29	Shoreline Residential – Resource	Primarily residential use; riparian tree cover

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Prevent increase in the number of bulkheads on the shoreline.
B. Protect emergent vegetation near docks, residential areas, and public access areas.
C. Protect vegetative buffer on residential and agricultural land.
D. Protect emergent vegetation near docks, residential areas, and public access areas.
E. Protect vegetative buffer on residential and agricultural land.
F. Protect priority riparian habitat as identified by WDFW.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).
B. Use education and incentives to encourage restoration of vegetative buffers on developed parcels and in agricultural areas.
C. Develop vegetative buffers around parking areas on public land, as well as direct overland flow away from lake.

REACH 30

ABIOTIC (TABLES 2 AND 3) – *see Physical Synthesis Map in the Map Portfolio DVD (physical.pmf)*

Geology and Soils
The surface geology of Reach 30 is dominantly flood gravels. This reach is a product of glacial outwash of the ice sheet working in conjunction with the existing topography. Approximately 12% of the area has slopes greater than 15% (USGS, 2000). Nearshore sediment sizes are entirely classified as mixed alluvium. The soils within the SMP jurisdiction are predominately Ephrata gravelly sandy loam (31.5%) and Ephrata-Malaga complex (30.1%) (NRCS, 2003). As a result, soil permeability is moderately rapid (100%), while runoff is classed as slow (100%). The hazard of soil erosion is also slow (100%).

Fetch and Near-Shore Exposure
The shoreline is primarily exposed to wind directions from the northeast and south. Fetch lengths range between 1.12 and 2.71 km and are higher for both the south and northeast. The relatively steep nearshore tends to be minimally impacted by the fall lake level drawdown of approximately 1.5 m, with the shoreline primarily having nearshore exposure widths less than 10 m (99.2%).

BIOTIC (TABLE 4) – *see Biological Synthesis Map in the Map Portfolio DVD (biological.pmf)*

Natural Vegetation
Upland
The potential natural vegetation is primarily shrub-steppe (USFS, 1995).

Riparian
Overhanging vegetation is present along 57.4% of Reach 30. The principal upland species is willow (*Salix*). This riparian zone also supports Russian olive (Elaeagnus), an invasive species. Emergent vegetation in the littoral zone is relatively extensive, with an average width less than 2 m extending along 77.8% of the reach. The primary emergent vegetation species of Reach 30 are softstem bulrush (*Scirpus validus*), common reed (*Phragmites australis*), and broad-leaved cattail (*Typha latifolia*).

Based on information collected for WDFW in 2003, unprotected mixed alluvium shorelines found along this reach tend to have approximately 11 species of aquatic vegetation found in the nearshore, including 6 submergent and 5 emergent species, dominated by sago pondweed (*Potamogeton pectinatus*) (Table 7) (Central Washington University, 2005). On the other hand, protected mixed alluvium shorelines tend to have lower diversity of species, including 4 submergent and 4 emergent species (Table 8), dominated by sago pondweed and white stem pondweed (*Potamogeton praelongus*).

Wetlands
Palustrine emergent wetland habitat in Reach 30 is fairly extensive, comprising 8.1% of the SMP jurisdiction (USFWS, 2003). Much of this habitat is classified as priority habitat, consisting of hardstem bulrush, cattail and common reed (WDFW, 2002).

Wildlife
Fish
Based on data collected by WDFW between 2002 and 2003, at least eight fish species may be found along Reach 30, dominated by bluegill (36%), walleye (30%), and largemouth bass (15%)(Fig. 29) (Gabriel and Jordan, 2004). Other notable species include black crappie (8%) and bullhead (6%)(Table 41). Portions of the shoreline have also been identified as good bass fishing areas (Fish-n-Map Co., n.d.).

Avian
Reach 30 provides potential habitat for numerous avian species, such as mallard, Canada goose, and red-winged blackbird, most likely associated with wetland habitat, denser zones of emergent vegetation or riparian tree cover, and undeveloped land (WDFW, 1997). Refer to Table 42 for a complete list of species. Among these species is the Western grebe, a species of current concern. In addition, Table 43 lists the avian species that have been observed in the Moses Lake area from 1998–2003 and may potentially be found in the region. The reach's nearshore is also classified as a priority habitat for waterfowl concentrations of several species of ducks and Canada geese in the later fall and early spring (WDFW, 2002). In addition, the reach is classified as a priority riparian habitat, consisting mainly of willow and elm, which provide habitat for pheasants, quail, and nongame birds.

Terrestrial
Reach 30 provides potential habitat for numerous terrestrial species, such as the painted turtle, raccoon, and striped skunk, most likely associated with wetland habitat and undeveloped land (WDFW, 1997). Refer to Table 44 for a complete list of species. Among these species, the Northern leopard frog, Townsend's big-eared bat, and yuma myotis are species of current concern. In addition, the reach is classified as a priority riparian habitat (WDFW, 2002).

CULTURAL MODIFICATIONS – *see Cultural Modifications Synthesis Map in the Map Portfolio DVD (cultural_modifications.pmf)*

Land Use (Table 5)
Of the SMP jurisdiction lands along Reach 30, 47.7% are classified as undeveloped, 17.9% as recreation, 17.7% are under single-family residential, and 16.7% are classified as commercial. Based on land use, imperviousness of this reach is estimated to be approximately 2.1%. Parcel sizes in the reach have an average width of 268 m and an average depth of approximately 319 m. Based on a survey of 3 shoreline structures,

average structure setback from the shoreline along reach 30 is 38.0 m, ranging from 36.3 to 39.5 m. There are no public lands within the SMP jurisdiction.

Transportation Infrastructure (Table 6)
Roadways occupy 67.0 meters of SMP jurisdiction land in Reach 30, though no storm sewer outfalls occur along this reach (WDNR, 1996, City of Moses Lake, n.d. b).

Bulkheads and Docks (Table 6)
Approximately 8.5% of the shoreline along Reach 30 is hardened with bulkheads. In addition, 4 docks are located along this reach.

CULTURAL JURISDICTIONS – *see Cultural Jurisdictional Synthesis Map in the Map Portfolio DVD (cultural_jurisdiction.pmf)*

Zoning (Table 5)
Current zoning within the SMP jurisdiction of Reach 30 is entirely Urban Residential 2. Currently the Grant County SMP environmental designation for Reach 30 is Rural.

Cultural Resource Designations (Table 6)
There are two Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 30 on file with the Washington State Office of Archaeology and Historic Preservation. One Campsite and one lithic scatter. One site is recorded as a lithic scatter and the other site is recorded as a campsite.

ECOLOGICAL FUNCTION SUMMARY

Reach 30 Shoreline Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 12%	Wetlands: 8.1% Undeveloped: 47.7% Riparian tree cover: 57.4% Priority habitats: 3 Species of concern: 4 Fish Species: 8		Principal land use: undeveloped Imperviousness: 2.1% Roads: 67 m Bulkheads: 8.5% Docks: 4

Ecological functions along Reach 30 are impaired by residential and recreational development, though much of the land is still undeveloped along the reach (47.7%). Riparian vegetation has been removed and replaced with buildings, lawns and a golf course, all of which can promote increased runoff and nonpoint source pollution. Based on land use, imperviousness of this reach is estimated to be approximately 2.1%. Emergent vegetation in the littoral zone, which is both an important habitat and buffer for nonpoint pollution, is relatively extensive, extending along approximately three-quarters of the reach, though at average widths of less than 2 m (this might be in part due to the relatively steeper nearshore found along this reach). In addition, 8.1% of the reach is

classified as wetland habitat, while over 62.5% of the reach has overhanging vegetation, which helps provide shading of aquatic habitat and bank stability. The riparian vegetation includes Russian olive, a highly invasive exotic species. Besides wetland habitat, the reach is also associated with two other types of priority habitat and 5 Natural heritage locations. Despite limited windward fetch and an erosion-resistant substrate of mixed alluvium, a relatively small portion of the reach has shoreline hardening (8.5%), which increases wave reflectivity, thereby affecting aquatic vegetation and the habitat for the eight fish species typically found along this reach. This aquatic habitat is further impaired by the four docks found in this reach, as well as exotic weed species such as Eurasian water milfoil and curly-leaf pondweed typically found along this shoreline type.

Draft Environmental Designations – *see Environmental Designations Map in the Map Portfolio DVD (env_designations.pmf)*

Reach	Designation	Rationale
30	Shoreline Residential – Resource	Residential uses; riparian tree cover; wetlands; emergent vegetation; priority habitats

Opportunities for Protection – *see Opportunities Map in the Map Portfolio DVD (opp_protection.pmf)*

A. Protect existing wetlands from encroachment by residential and recreational development.
B. Develop construction runoff controls for new construction, especially in high soil erosion areas with limited riparian vegetation.
C. Protect vegetative buffer on residential and agricultural land.
D. Prevent increase in the number of bulkheads on the shoreline.

Opportunities for Restoration – *see Opportunities Map in the Map Portfolio DVD (opp_restoration.pmf)*

A. Reduce number of bulkheads by replacing with bioengineering approaches or upland retaining walls and emergent vegetation (perhaps develop pilot demonstration project on public lands).

REFERENCES

Bain Jr., Richard C. 1998. Moses Lake Area: Water Quality Monitoring Report (1997). Moses Lake Irrigation and Rehabilitation District.

Bain Jr., Richard C. 1987. Moses Lake Clean Lake Project. Irrigation Water Management Final Stage 3 Report. Moses Lake Irrigation and Rehabilitation District.

Bain Jr., Richard C. 1990. Moses Lake Clean Lake Project. Irrigation Water Management Final Report. Moses Lake Irrigation and Rehabilitation District.

Carroll, James V. 2002. Moses Lake Total Maximum Daily Load Phosphorous Study (Draft). Washington Department of Ecology, Publication No.03-03-02.

CH2MHill. 1994. Sewer System Plan, City of Moses Lake, Washington.

City of Moses Lake. n.d.a. City Parcels and Land Use. Data received June 2004.

City of Moses Lake. 1997. Comprehensive Plan. City of Moses Lake, Washington.

City of Moses Lake. 2001a. Park, Recreation, & Open Space Plan, Moses Lake, Washington.

City of Moses Lake. 1988. Shoreline Management Master Plan.

City of Moses Lake. 2003. Storm Sewer Lines and Outlets. AutoCad map format. Data received June 2004.

City of Moses Lake. 2001b. Water System Plan for the Year 2000. Prepared by the City of Moses Lake Municipal Services Department Engineering Division.

Fish-n-Map Co. n.d. Potholes Lake, Moses Lake, Lake Sammamish.

Gabriel, A.O., and L. Jordan. 2004. Shoreline Habitat Characterization and Analysis for the Moses lake Project. WDFW Contract Report. Contract #33030533. Geo-Ecology Research Group, Central Washington University, Ellensburg, WA.

Grant County. 2004. Grant County Zoning. Data received December 2004.

Pitz, Charles F., L.G, L.HG. 2003. Moses Lake Total Maximum Daily Load Groundwater Study. Washington Department of Ecology, Publication No. 03-03-005.

United States Census Bureau. (2000). Census TIGER® 2000/ Line Data; Railroads. Data retrieved 2004 from www.geographynetwork.com.

United States Department of Agriculture, Natural Resources Conservation Services. (2003). Soil Survey Geographic (SSURGO) Database. Data acquired January 2004. **http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/**

United States Department of Agriculture, Natural Resources Conservation Services. (1986). Urban Hydrology for Small Watersheds. Technical Release 55.

United States Fish and Wildlife Service. 2003. National Wetlands Inventory Data. Data retrieved 2004. **http://www.nwi.fws.gov/**

United States Geological Survey. 2000. 10-m Digital Elevation Model. Data retrieved 2004.

Washington State Department of Ecology. 1998a. 303(d) Listings. Data retrieved 2003. http://www.ecy.wa.gov/services/gis/data/watqual/ai_read_me.htm#license.

Washington State Department of Ecology. (1998b). DOE Facilities/Sites. Data retrieved 2004. **http://www.ecy.wa.gov/services/gis/data/agreement.asp?name=facility**

Washington State Department of Ecology. (1998c). FEMA Q3 Flood Data. Data retrieved 2004. **http://www.ecy.wa.gov/services/gis/data/flood/agreement.asp?name=c53065**

Washington State Department of Ecology. 1995. Lake Bathymetry of Washington. Data retrieved 2004. **http://www.ecy.wa.gov/services/gis/data/data.htm**

Washington State Department of Ecology. 2004. Leaking Storage Tanks. Data retrieved 2004.
http://www.ecy.wa.gov/programs/tcp/ust-lust/ust-lst2.html

Washington State Department of Ecology. 2004. Shoreline Master Program Development. http://www.ecy.wa.gov/programs/sea/sma/st_guide/SMP/index.html.

Washington State Department of Fish and Wildlife. 1997. GAP Analysis. Data retrieved 2004.
http://www.wdfw.wa.gov/wlm/gap/vdm.htm.

Washington Department of Fish and Wildlife. 2002. Priority Habitats and Species and Natural Heritage Site databases. Received December 2004.

Washington State Department of Natural Resources. 2000. Geology of Washington (1:100,000-scale). Data retrieved 2004.
http://www3.wadnr.gov/dnrapp6/dataweb/dmmatrix.html#Geology.

Washington State Department of Natural Resources. (1996). Transportation (Roads and Railroads) of Washington (1:24,000-scale). Data retrieved 2004.
http://www3.wadnr.gov/dnrapp6/dataweb/transd.html

APPENDIX

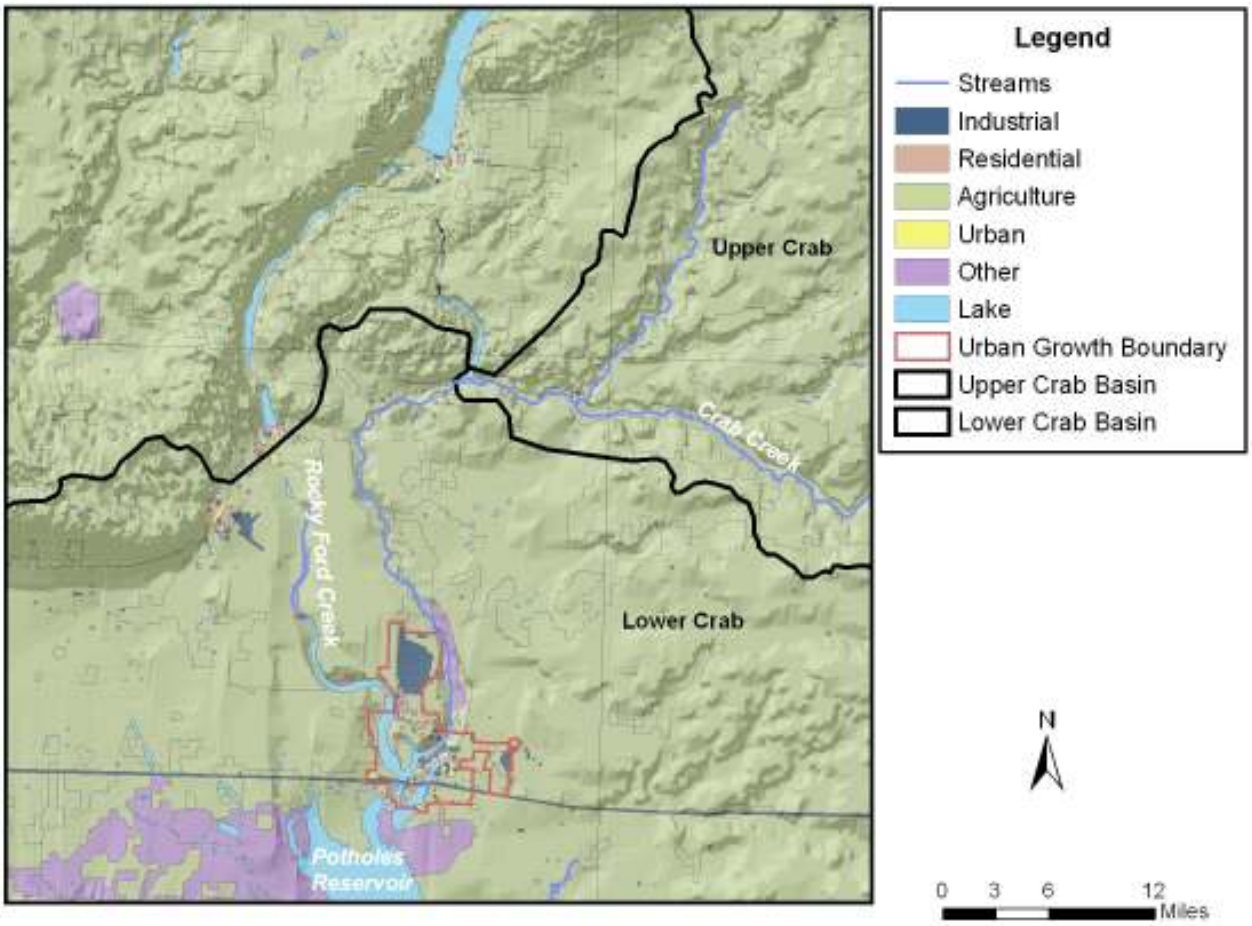

Fig. 1. Regional Context for City of Moses Lake Shoreline, Washington.

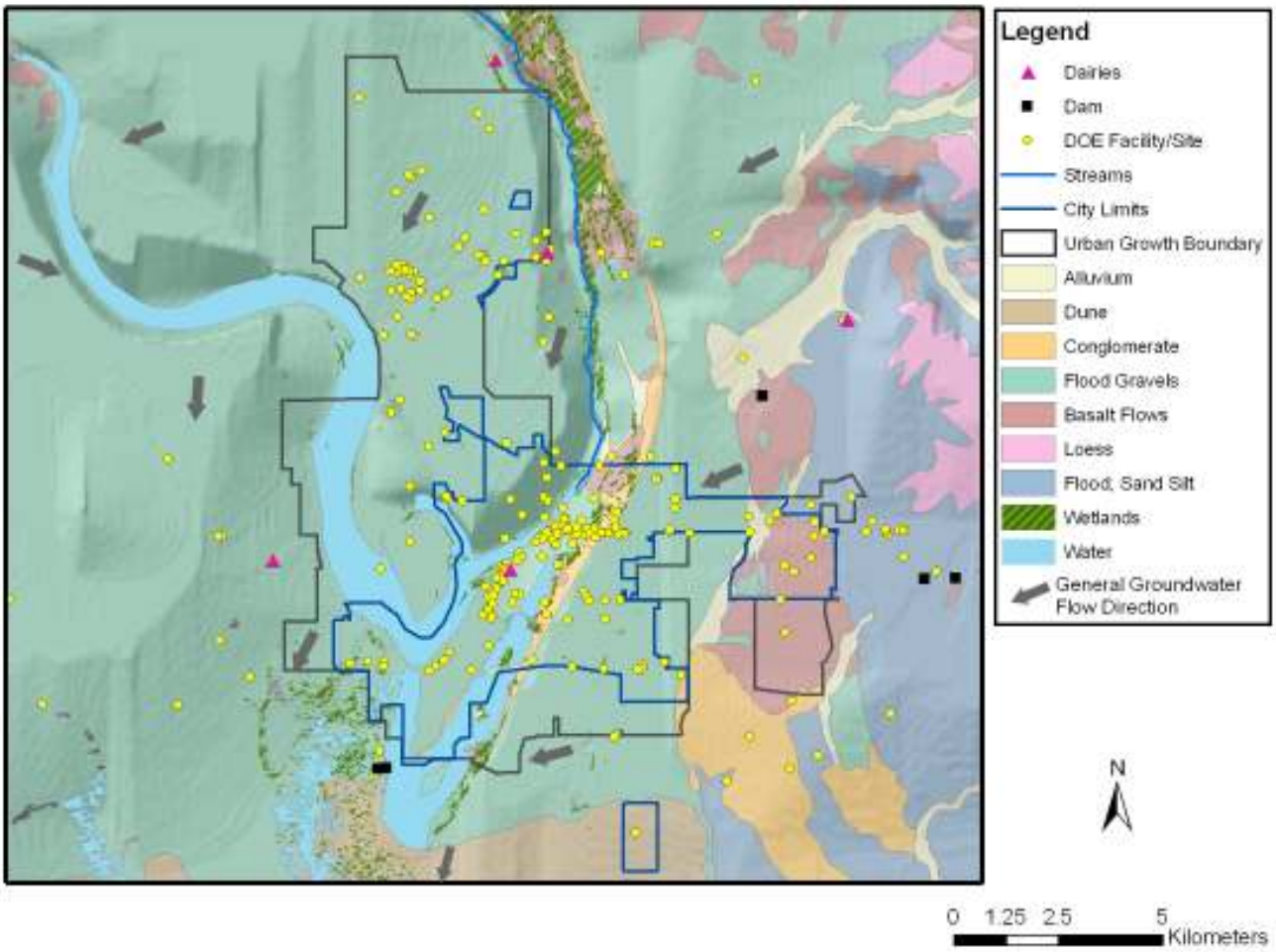

Fig. 2. Ecosystem-Wide Management Issues, City of Moses Lake, Washington

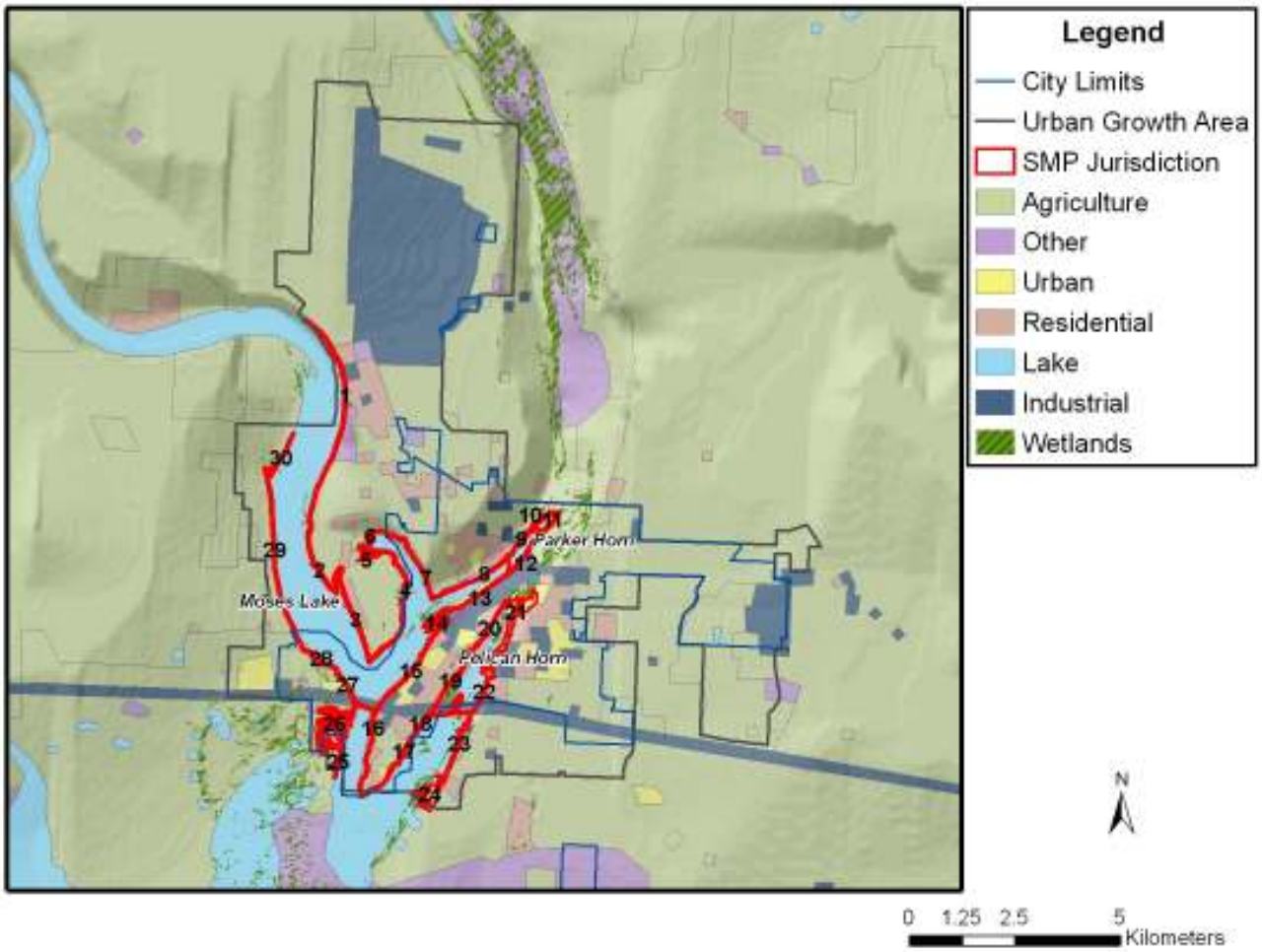

Fig. 3. SMP Jurisdiction and Reaches, City of Moses Lake, Washington.

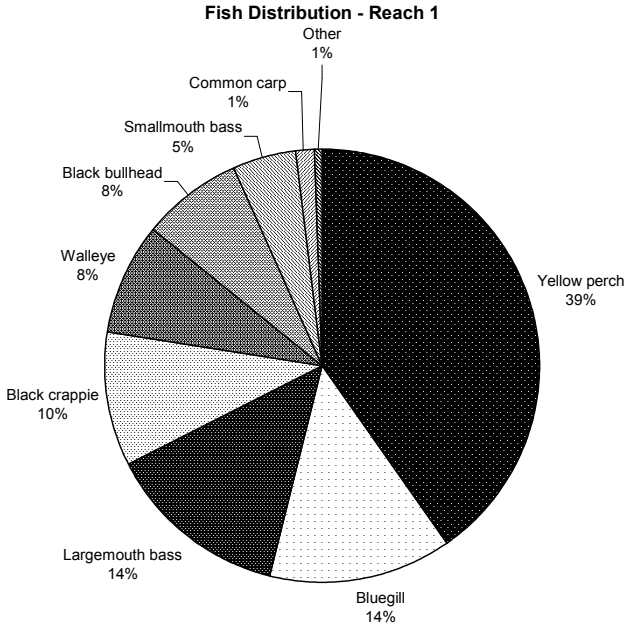

Fig. 4 Fish Distribution – Reach 1, Moses Lake, WA., 2002-2004

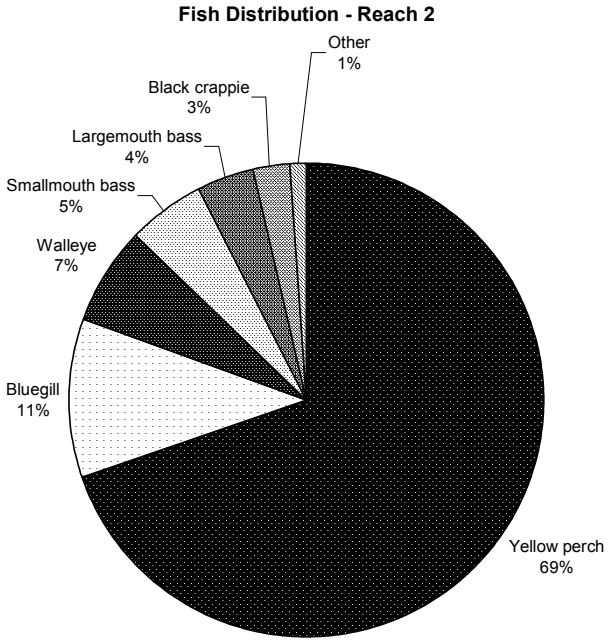

Fig. 5 Fish Distribution - Reach 2, Moses Lake, WA., 2002-2004

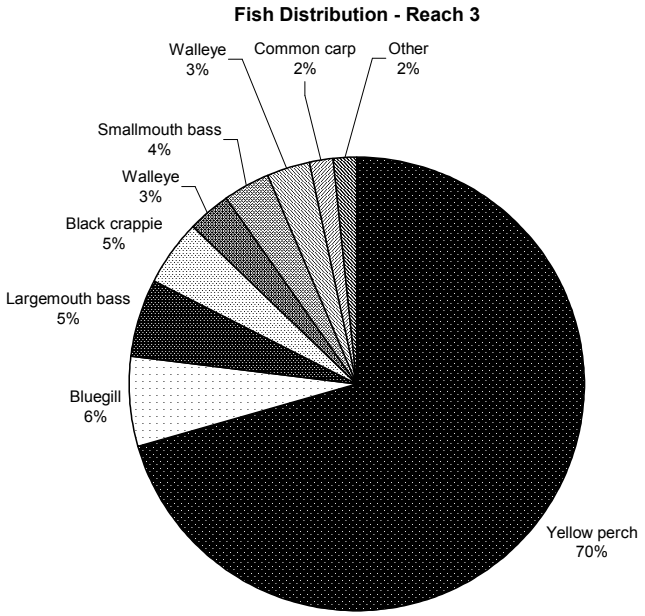

Fig. 6 Fish Distribution - Reach 3, Moses Lake, WA., 2002-2004

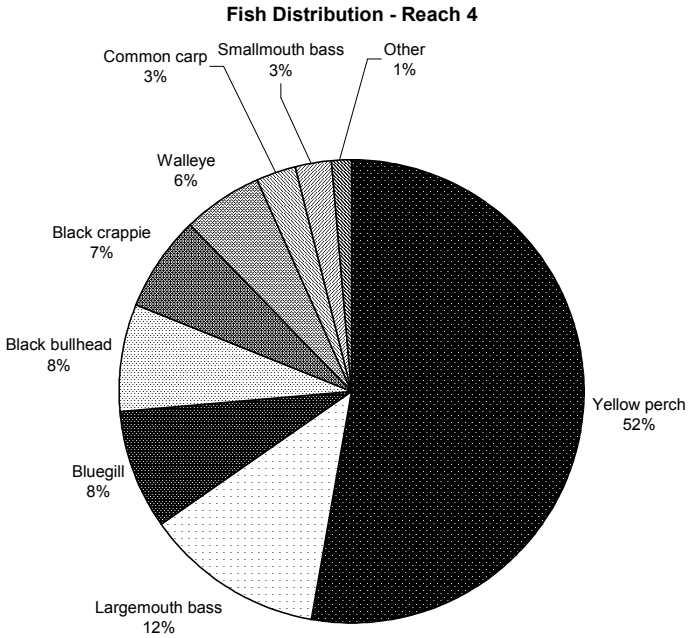

Fig. 7 Fish Distribution – Reach 4, Moses Lake, WA., 2002-2004

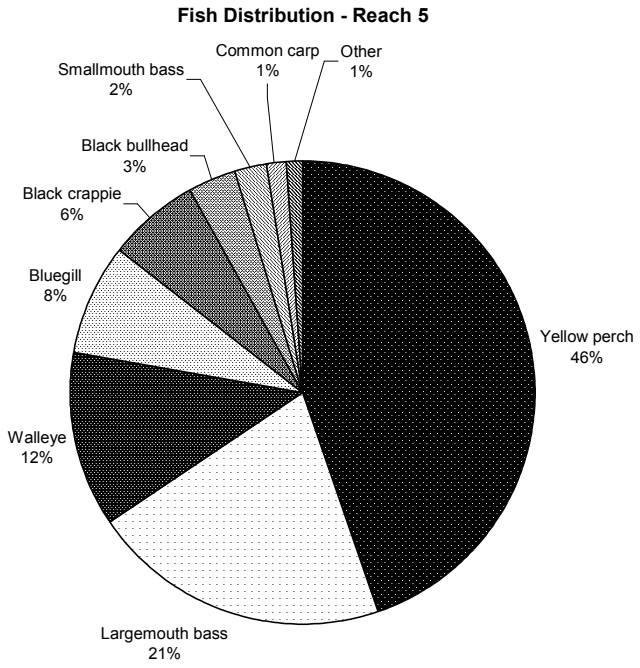

Fig. 8 Fish Distribution – Reach 5, Moses Lake, WA., 2002-2004

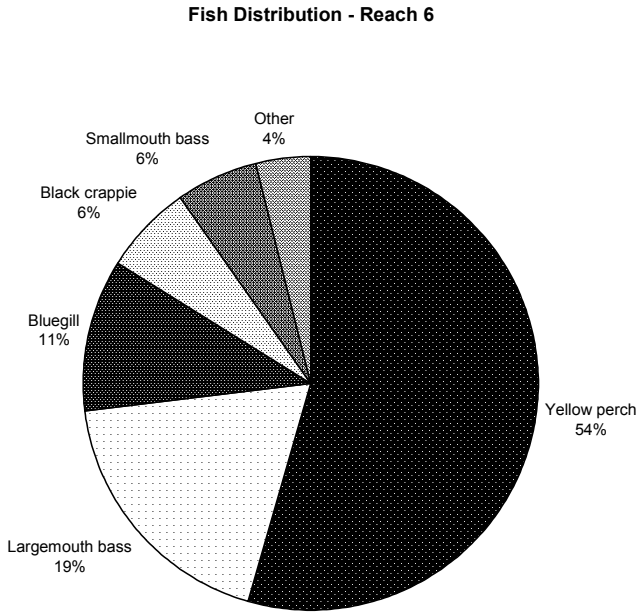

Fig. 9 Fish Distribution – Reach 6, Moses Lake, WA., 2002-2004

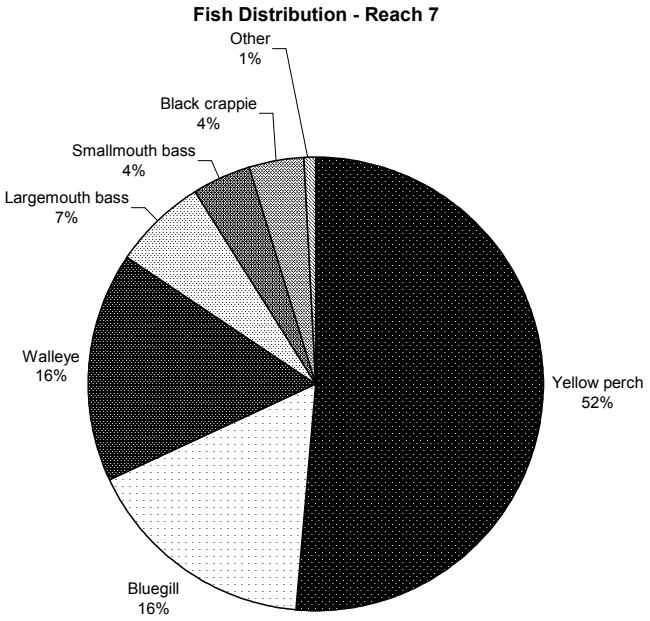

Fig. 10 Fish Distribution – Reach 7, Moses Lake, WA., 2002-2004

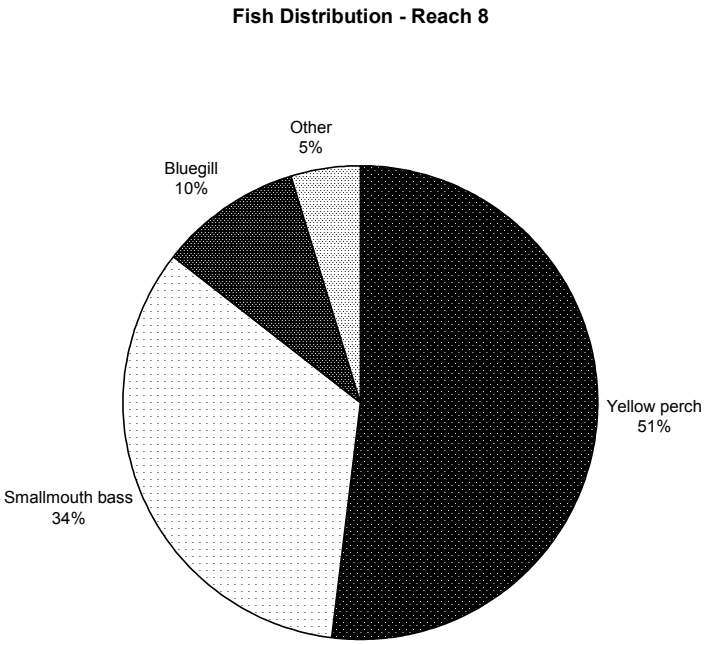

Fig. 11 Fish Distribution – Reach 8, Moses Lake, WA., 2002-2004

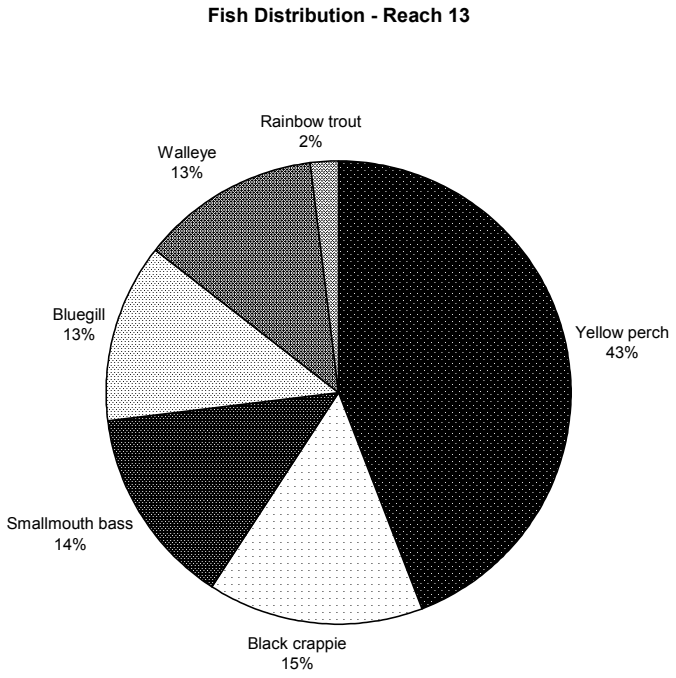

Fig. 12 Fish Distribution – Reach 13, Moses Lake, WA., 2002-2004

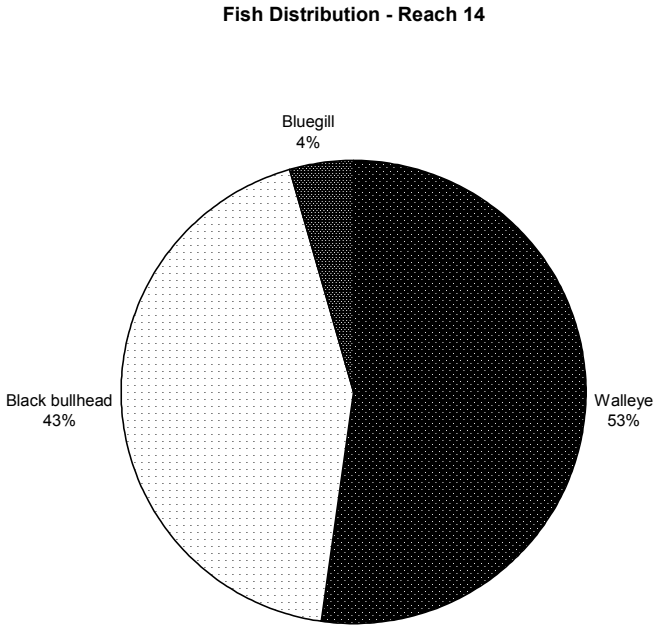

Fig. 13 Fish Distribution – Reach 14, Moses Lake, WA., 2002-2004

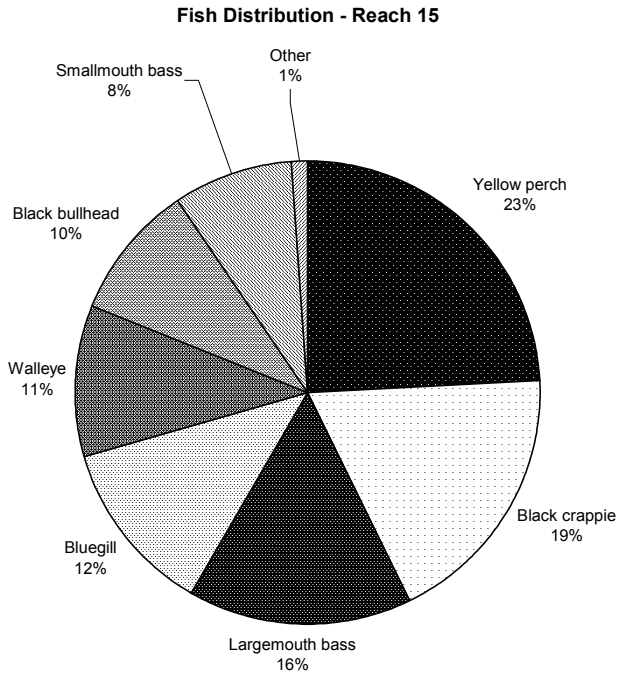

Fig. 14 Fish Distribution – Reach 15, Moses Lake, WA., 2002-2004

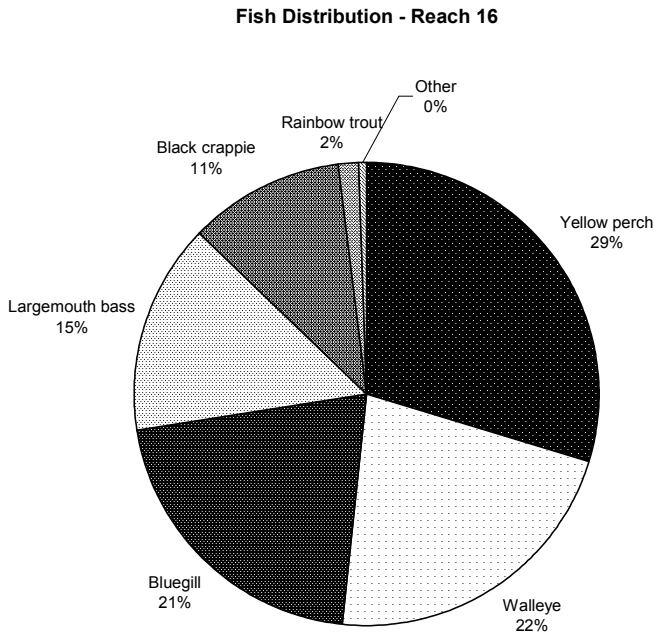

Fig. 15 Fish Distribution – Reach 16, Moses Lake, WA., 2002-2004

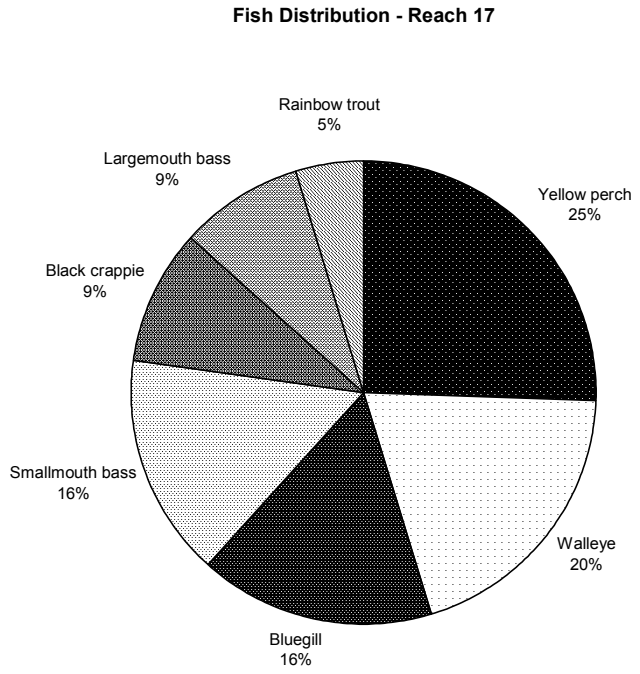

Fig. 16 Fish Distribution – Reach 17, Moses Lake, WA., 2002-2004

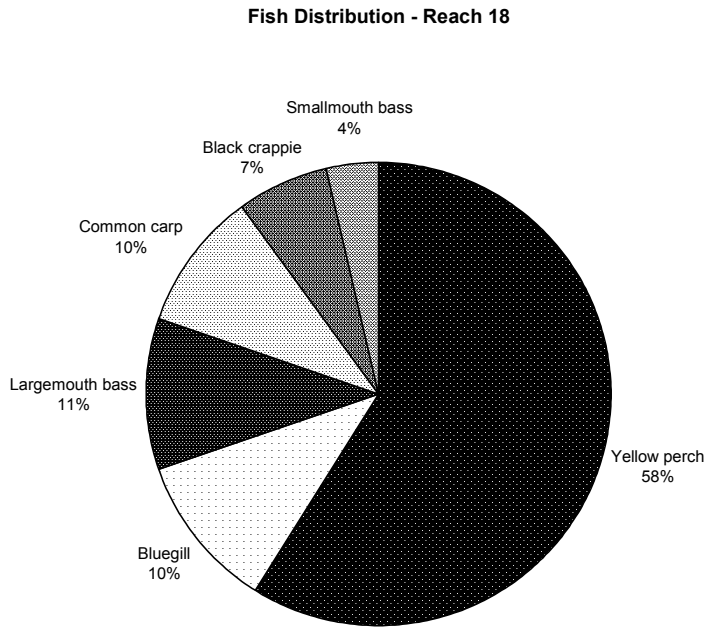

Fig. 17 Fish Distribution – Reach 18, Moses Lake, WA., 2002-2004

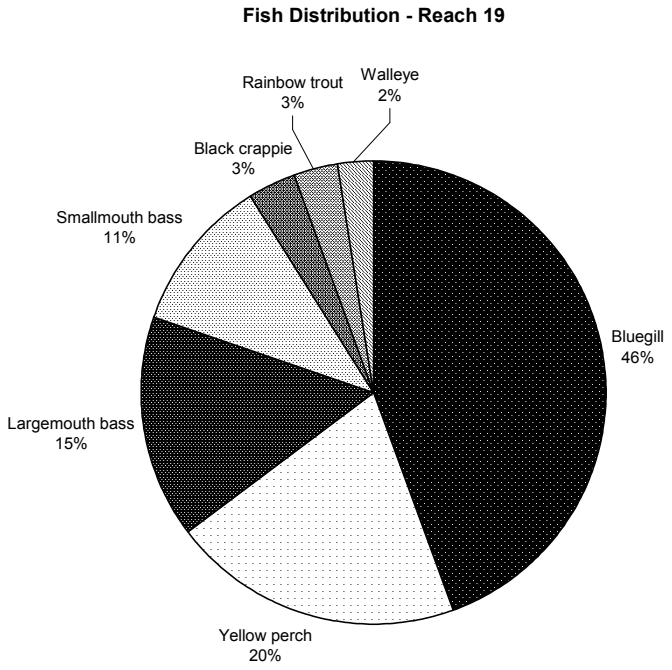

Fig. 18 Fish Distribution – Reach 19, Moses Lake, WA., 2002-2004

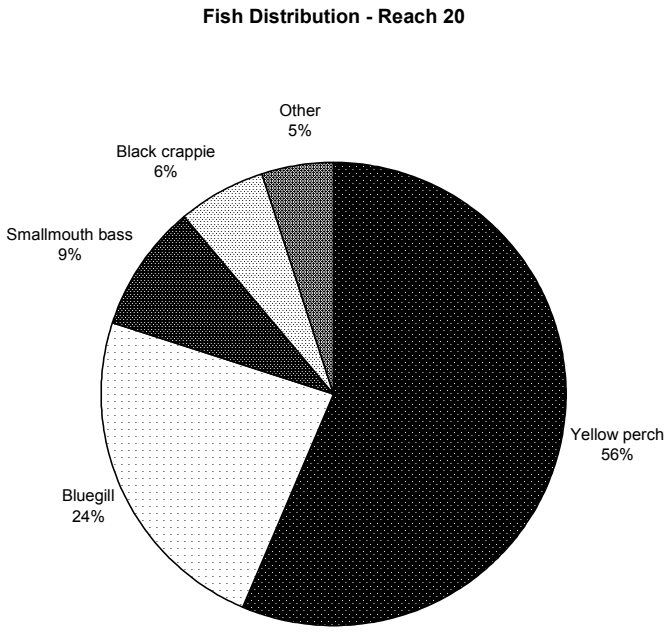

Fig. 19 Fish Distribution – Reach 20, Moses Lake, WA., 2002-2004

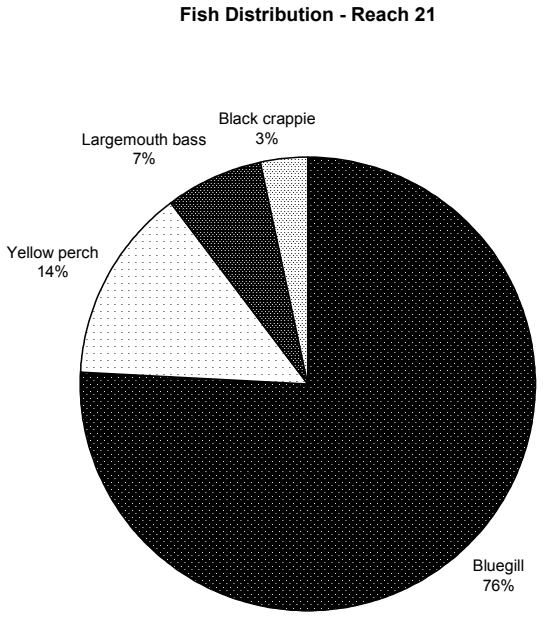

Fig. 20 Fish Distribution – Reach 21, Moses Lake, WA., 2002-2004

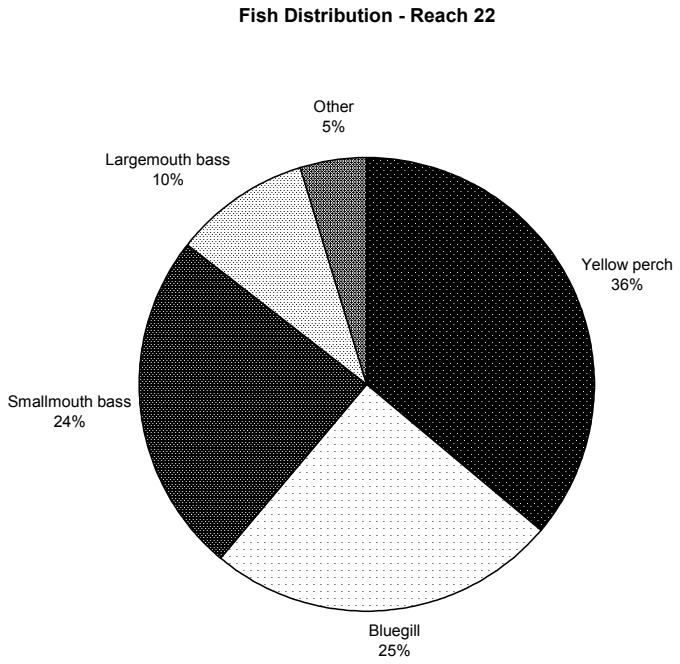

Fig. 21 Fish Distribution – Reach 22, Moses Lake, WA., 2002-2004

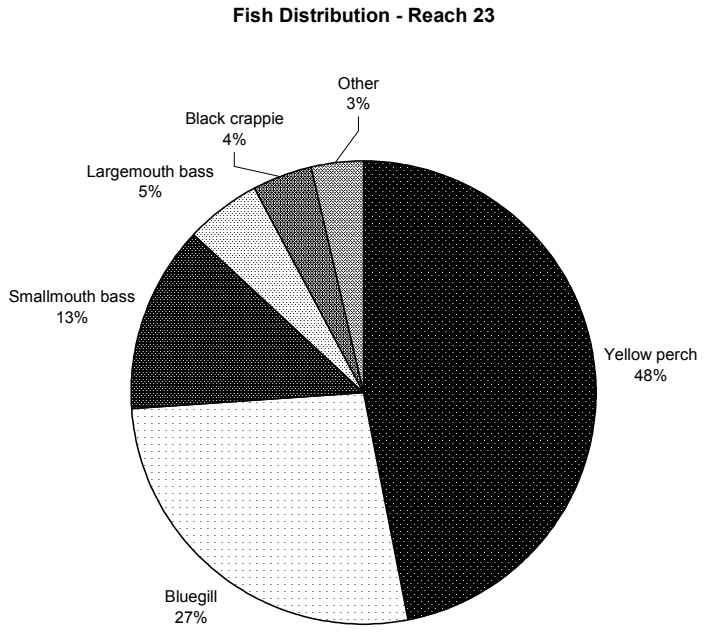

Fig. 22 Fish Distribution – Reach 23, Moses Lake, WA., 2002-2004

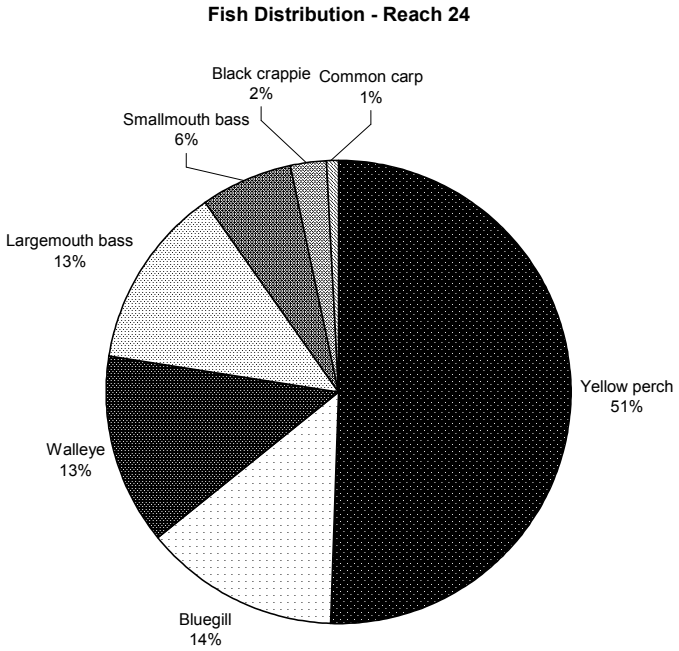

Fig. 23 Fish Distribution – Reach 24, Moses Lake, WA., 2002-2004

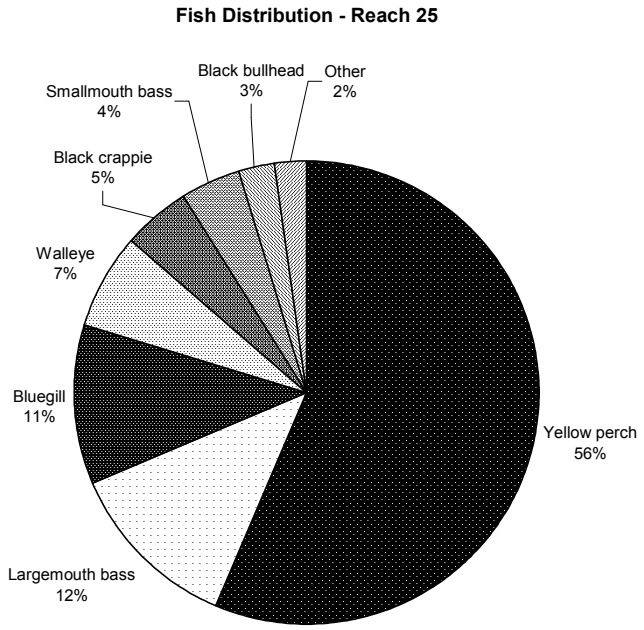

Fig. 24 Fish Distribution – Reach 25, Moses Lake, WA., 2002-2004

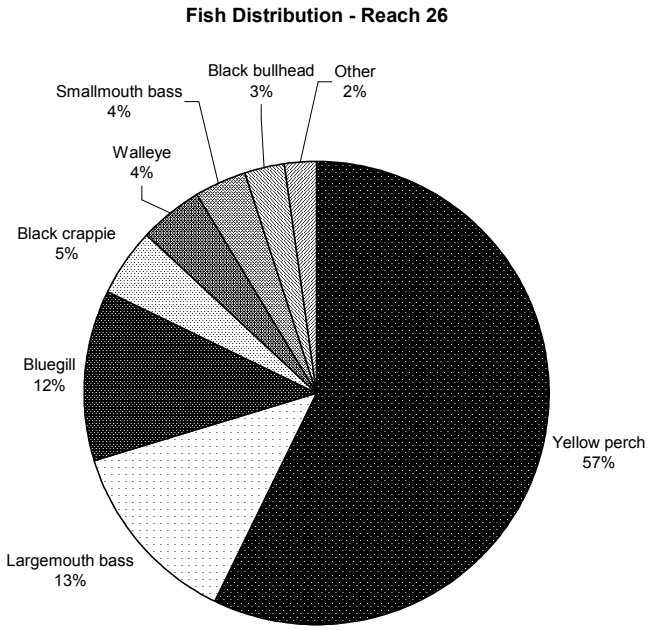

Fig. 25 Fish Distribution – Reach 26, Moses Lake, WA., 2002-2004

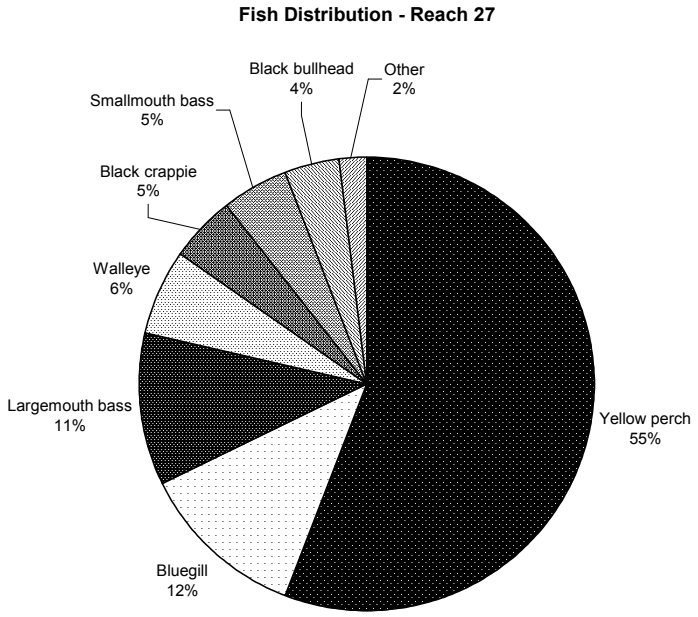

Fig. 26 Fish Distribution – Reach 27, Moses Lake, WA., 2002-2004

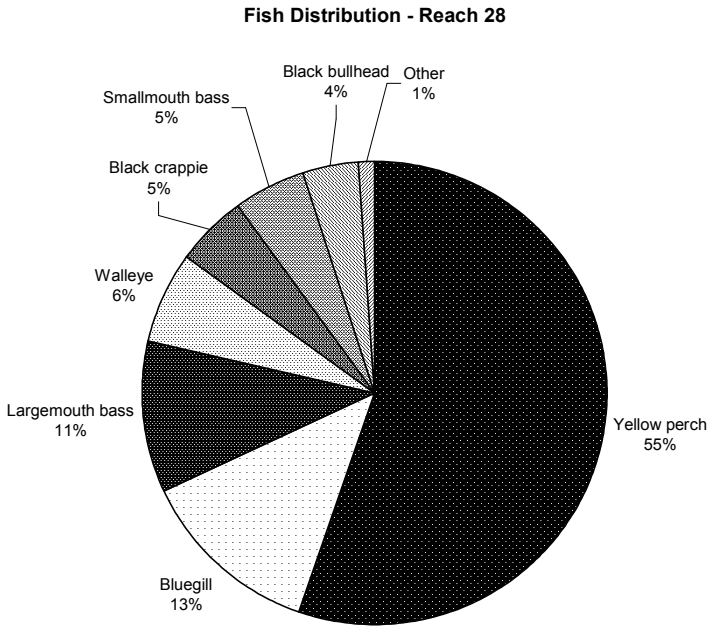

Fig. 27 Fish Distribution – Reach 28, Moses Lake, WA., 2002-2004

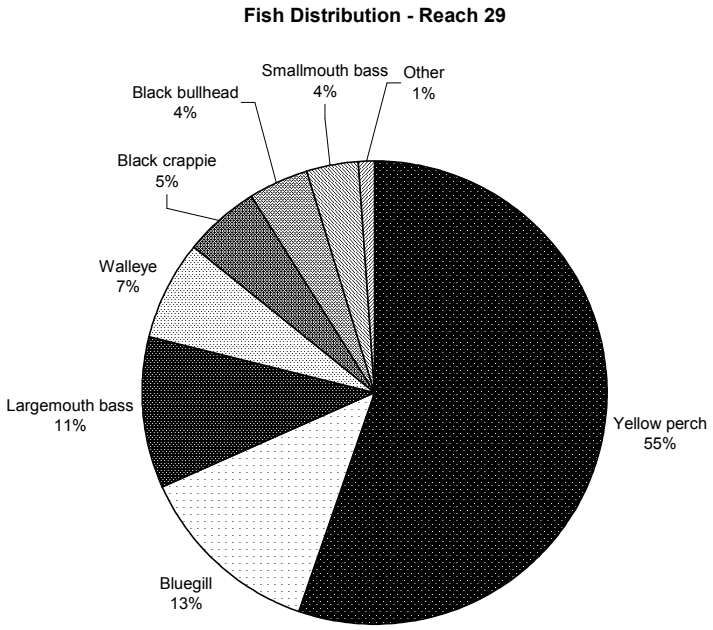

Fig. 28 Fish Distribution – Reach 29, Moses Lake, WA., 2002-2004

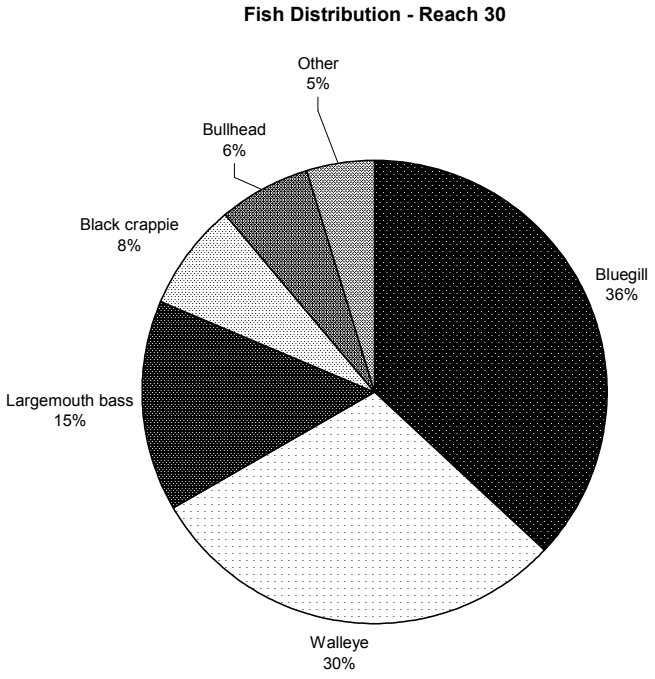

Fig. 29 Fish Distribution – Reach 30, Moses Lake, WA., 2002-2004

Table 1. SMP Reach Breaks for Inventory and Analysis, City of Moses Lake.

Reach	Length	Start	Reach Break Justification	End
1	4.39 km	SE¼,NE¼, S31,T20N, R28E	City of Moses Lake Urban Growth Boundary	NW¼,SW¼, S7, T19N, R28E
2	3.68 km	NW¼,SW¼, S7, T19N, R28E	Change in nearshore slope from greater than 15% to less than 15%.	SW¼,SE¼, S17, T19N, R28E
3	3.02 km	SW¼,SE¼, S17, T19N, R28E	Change in shoreline configuration, natural break at bay. Change in slope, presence of slopes greater than 15%.	NW¼,NW¼, S28, T19N, R28E
4	3.11 km	NW¼,NW¼, S28, T19N, R28E	Change in nearshore slope from greater than 15% to less than 15%. End of existing riparian tree cover.	NW¼,SW¼, S16, T19N, R28E
5	1.67 km	NW¼,SW¼, S16, T19N, R28E	Change in shoreline type. Shallow bay, high nearshore exposure. Absence of docks.	NE¼, SE¼, S17, T19N, R28E
6	1.48 km	NE¼, SE¼, S17, T19N, R28E	Change in shoreline type from shallow bay with high nearshore exposure to shoreline with low nearshore exposure. Presence of docks.	NW¼, SE¼, S16, T19N, R28E
7	1.79 km	NW¼, SE¼, S16, T19N, R28E	Change in land use from park to residential use. Change in nearshore slope to greater than 15%.	NW¼, NW¼, S22, T19N, R28E
8	1.65 km	NE¼, SE¼, S15, T19N, R28E	Change in nearshore slope from greater than 15% to less than 15%.	NE¼, SE¼, S15, T19N, R28E
9	1.92 km	NE¼, NW¼, S14, T19N, R28E	Shoreline modification, presence of road causeway. Change in land use from residential to commercial use.	NE¼, NW¼, S14, T19N, R28E
10	0.60 km	North line of S15, T19N, R28E	Shoreline modification, presence of road causeway. Change in land use from existing commercial use to undeveloped land.	North line of S15, T19N, R28E
11	0.59 km	North line of S14, T19N, R28E	City of Moses Lake Urban Growth Boundary	SE¼, NW¼, S14, T19N, R28E
12	1.61 km	SE¼, NW¼, S14, T19N, R28E	Shoreline modification, presence of road causeway.	SE¼, SE¼, S15, T19N, R28E
13	1.68 km	SW¼, NW¼, T19N, R28E	Shoreline modification, presence of road causeway. Change in land use from commercial use to park.	SW¼, NW¼, T19N, R28E
14	2.26 km	SW¼, NW¼, T19N, R28E	Change in shoreline type, high nearshore exposure. Change in land use from commercial use to undeveloped land. Presence of wetlands.	NW¼, SW¼, S22, T19N, R28E
15	2.78 km	NW¼, SW¼, S22, T19N, R28E	Shoreline configuration-natural break at bay. Land use change from undeveloped land to residential use.	SW¼, SW¼, S28, T19N, R28E

Reach	Length	Start	Reach Break Justification	End
16	3.97 km	SW¼, SW¼, S28, T19N, R28E	Shoreline modification, presence of road causeway. Change in land use from lodging use to residential use.	SE¼, SW¼, S33, T19N, R28E
17	0.74 km	SE¼, SW¼, S33, T19N, R28E	Land use change from residential use to recreational and agricultural uses.	SW¼, NE¼, S33, T19N, R28E
18	0.98 km	SW¼, NE¼, S33, T19N, R28E	Land use change from recreational and agricultural uses to residential use.	North boundary of I-90 right of way of NE¼, NE¼, S33, T19N, R28E
19	2.01 km	North boundary of I-90 right of way of NE¼, NE¼, S33, T19N, R28E	Shoreline modification, presence of road causeway.	NE¼, NW¼, S27, T19N, R28E
20	1.70 km	NE¼, NW¼, S27, T19N, R28E	Shoreline modification, presence of railroad causeway.	East line of S22, T19N, R28E
21	1.70 km	East line of S22, T19N, R28E	Land use change from park to undeveloped wetlands.	NE¼, NE¼, S27, T19N, R28N
22	4.14 km	NE¼, NE¼, S27, T19N, R28N	Land use change from residential use to undeveloped land.	South boundary of I-90 right-of-way S34, T19N, R28E
23	1.87 km	South boundary of I-90 right-of-way S34, T19N, R28E	Shoreline modification, presence of road causeway.	SW¼, SW¼, S34, T19N, R28E
24	1.88 km	SW¼, SW¼, S34, T19N, R28E	Change from soils with high potential for erosion to soils with moderate potential for erosion. Shoreline configuration change, natural break at the peninsula.	SE¼, NE¼, S4, T18N, R28E
25	0.81 km	South line of t19n-r28e-s32	City of Moses Lake Urban Growth Boundary	NE¼, SW¼, S32, T19N, R28E
26	8.65 km	NE¼, SW¼, S32, T19N, R28E	Change in shoreline type from open water to embayment. Change in land use from undeveloped land to residential use.	North line SE¼, SE¼, S29, T19N, R28N
27	0.90 km	North line SE¼, SE¼, S29, T19N, R28N	Shoreline modification, presence of road causeway.	SW¼, NE¼, S29, T19N, R28E
28	1.05 km	SW¼, NE¼, S29, T19N, R28E	Land use change from undeveloped land to residential use.	NW¼, NW¼, S29, T19N, R28
29	4.41 km	NW¼, NW¼, S29, T19N, R28	Change in soil permeability from rapid to moderately rapid.	NE¼, SW¼, S7, T19N, R28E
30	1.47 km	NE¼, SW¼, S7, T19N, R28E	Change in slope from greater than 15% to less than 15%. Change in shoreline configuration, natural break at bay.	North line of S7, T19N, R28E

Table 2. Soil and Slope Characteristics of SMP Jurisdiction, City of Moses Lake.

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
1	Ephrata fine sandy loam	3.3	76.0	Moderately Rapid	99.5	Moderate	85.7	Moderate	85.7
	Ephrata-Malaga complex	9.1				Slow	13.8	Slow	13.8
Area: 66.3 Acres	Malaga gravelly sandy loam	0.3							
Length: 4.39 km	Malaga cobbly sandy loam	50.1							
	Malaga stony sandy loam	1.1							
	Malaga very stony sandy loam	35.6							
	Pits	0.5							
2	Ephrata fine sandy loam	19.8	0.4	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	72.1							
Area: 53.3 Acres	Malaga gravelly sandy loam	1.0							
Length: 3.68 km	Malaga stony sandy loam	7.2							
3	Ephrata fine sandy loam	19.0	20.3	Moderately Rapid	100.0	Moderate	36.5	Moderate	36.5
	Ephrata-Malaga complex	33.2				Slow	63.5	Slow	63.5
Area: 43.6 Acres	Malaga stony sandy loam	11.3							
Length: 3.02 km	Malaga cobbly sandy loam	36.5							
4	Ephrata fine sandy loam	34.8	4.8	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	52.4							
Area: 45.5 Acres	Malaga gravelly sandy loam	1.9							
Length: 3.11 km	Malaga stony sandy loam	11.0							

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
5	Aquents, ponded	25.8	14.7	Moderately Rapid	74.2	Slow	74.2	Slow	100.0
	Ephrata fine sandy loam	12.9		Moderately Slow	25.8	Ponded	25.8		
Area: 21.1 Acres	Ephrata-Malaga complex	5.5							
Length: 1.67 km	Malaga gravelly sandy loam	44.9							
	Malaga stony sandy loam	11.0							
6	Ephrata fine sandy loam	57.2	13.1	Moderately Rapid	100.0	Moderate	32.3	Moderate	32.3
	Malaga cobbly sandy loam	2.8				Slow	67.7	Slow	67.7
Area: 22.8 Acres	Malaga stony sandy loam	40.0							
Length: 1.48 km									
7	Ephrata fine sandy loam	16.1	65.9	Moderately Rapid	100.0	Moderate	90.3	Moderate	90.3
Area:26.2 Acres	Malaga cobbly sandy loam	83.9				Slow	9.7	Slow	9.7
Length: 1.79 km									
8	Ephrata fine sandy loam	39.6	3.5	Moderately Rapid	66.5	Moderate	73.3	Moderate	73.3
	Malaga cobbly sandy loam	26.9		Moderate	33.5	Slow	26.7	Slow	26.7
Area: 25.2 Acres	Starbuck very fine sandy loam	33.5							
Length: 1.65 km									
9	Ephrata fine sandy loam	18.7	13.0	Moderately Rapid	100.0	Moderate	42.8	Moderate	42.8
	Malaga stony sandy loam	38.5				Slow	57.2	Slow	57.2
Area: 18.8 Acres	Malaga cobbly sandy loam	42.8							
Length: 1.92 km									

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
10	Ephrata fine sandy loam	6.2	0.0	Moderately Rapid	19.6	Moderate	4.4	Moderate	4.4
	Malaga stony sandy loam	13.5		Moderate	4.4	Slow	19.6	Slow	19.6
Area: 9.0 Acres	Kittitas silt loam	76.0		Moderately Slow	76.0	Ponded	76.0	None	76.0
Length: 0.60 km	Starbuck very fine sandy loam	4.4							
11	Ephrata-Malaga complex	30.9	0.0	Moderately Rapid	30.9	Moderate	48.8	Slow	30.9
	Kittitas silt loam	20.3		Moderate	48.8	Slow	30.9	None	20.3
Area: 10.0 Acres	Prosser very fine sandy loam	45.5		Moderately Slow	20.3	Ponded	20.3	Moderate	48.8
Length: 0.59 km	Starbuck very fine sandy loam	3.3							
12	Ephrata fine sandy loam	30.4	2.5	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	59.1							
Area: 21.6 Acres	Malaga stony sandy loam	10.5							
Length: 1.61 km									
13	Ephrata fine sandy loam	48.5	8.2	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	0.7							
Area: 25.2Acres	Malaga stony sandy loam	50.8							
Length: 1.68 km									
14	Ephrata fine sandy loam	1.7	0.0	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	89.9							
Area: 29.2 Acres	Malaga stony sandy loam	8.3							

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
Length: 2.26 km									
15	Ephrata fine sandy loam	2.7	33.1	Moderately Rapid	100.0	Moderate	38.5	Moderate	38.5
	Malaga gravelly sandy loam	17.8				Slow	61.5	Slow	61.5
Area: 40.1 Acres	Malaga stony sandy loam	41.0							
Length: 2.78 km	Malaga cobbly sandy loam	38.5							
16	Ephrata fine sandy loam	14.1	28.6	Moderately Rapid	100.0	Moderate	71.9	Moderate	71.9
	Ephrata-Malaga complex	3.4				Slow	28.1	Slow	28.1
Area: 54.3 Acres	Malaga gravelly sandy loam	10.6							
Length: 3.97 km	Malaga cobbly sandy loam	71.8							
	Malaga very stony sandy loam	0.1							
17	Ephrata-Malaga complex	97.8	0.0	Moderately Rapid	100.0	Moderate	2.2	Moderate	2.2
Area:11.0 Acres	Malaga cobbly sandy loam	2.2				Slow	97.8	Slow	97.8
Length: 0.74 km									
18	Ephrata-Malaga complex	100.0	0.0	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
Area: 13.1 Acres									
Length: 0.98 km									
19	Ephrata fine sandy loam	26.8	0.0	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	73.2							
Area: 27.9 Acres									
Length: 2.01 km									

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
20	Ephrata fine sandy loam	64.3	5.8	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	0.1							
Area: 24.6 Acres	Malaga stony sandy loam	35.7							
Length: 1.70 km									
21	Aquents, ponded	42.9	0.0	Moderate	29.2	Moderate	7.8	Moderate	7.8
	Ephrata fine sandy loam	27.7		Moderately Rapid	27.9	Slow	36.8	Slow	79.7
Area: 74.0 Acres	Malaga stony sandy loam	0.2		Moderately Slow	42.9	Ponded	55.4	None	12.5
Length: 1.70 km	Starbuck very fine sandy loam	7.8							
	Umapine silt loam	12.5							
	Prosser very fine sandy loam	8.9							
22	Aquents, ponded	23.7	1.0	Moderate	76.3	Very Rapid	6.7	Very High	6.7
	Prosser Very Fine Sandy Loam	1.7		Moderately Slow	23.7	Slow	1.7	Slow	25.4
Area: 58.7 Acres	Umapine silt loam	67.9				Ponded	91.6	None	67.9
Length: 4.14 km	Wiehl fine sandy loam	6.7							
23	Malaga cobbly sandy loam	8.2	32.5	Moderately Rapid	13.8	Moderate	8.2	Very High	48.1
	Malaga stony sandy loam	5.6		Moderate	86.2	Very Rapid	48.1	Moderate	8.2
Area: 29.9 Acres	Umapine silt loam	38.1				Slow	5.6	Slow	5.6
Length: 1.87 km	Wiehl fine sandy loam	48.1				Ponded	38.1	None	38.1

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
24	Ephrata-Malaga complex	91.8	2.7	Moderately Rapid	95.3	Moderate	3.5	Moderate	3.5
	Malaga cobbly sandy loam	3.5		Moderate	4.7	Slow	91.8	Slow	91.8
Area: 69.8 Acres	Umapine silt loam	4.7				Ponded	4.7	None	4.7
Length: 1.88 km									
25	Quincy fine sand	74.5	18.1	Rapid	100.0	Slow	100.0	Slow	100.0
	Wanser-Quincy fine sands	25.5							
Area: 12.7 Acres									
Length: 0.81 km									
26	Quincy sand, eroded	15.2	3.1	Rapid	100.0	Slow	100.0	Slow	100.0
	Quincy fine sand	57.2							
Area: 112.9 Acres	Wanser-Quincy fine sands	27.5							
Length: 8.65 km									
27	Quincy fine sand	100.0	19.8	Rapid	100.0	Slow	100.0	Slow	100.0
Area: 12.8 Acres									
Length: 0.90 km									
28	Malaga stony sandy loam	7.4	26.9	Rapid	92.6	Slow	100.0	Slow	100.0
Area: 16.3 Acres	Quincy fine sand	92.6		Moderately Rapid	7.4				
Length: 1.05 km									
29	Ephrata fine sandy loam	7.2	42.8	Rapid	1.2	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	15.8		Moderately Rapid	98.8				
Area: 67.5 Acres	Malaga stony sandy loam	75.8							
Length: 4.41 km	Quincy fine sand	1.2							

Reach	Soil		Slopes >15%	Soil Characteristics					
	Type	%Area	% Area	Permeability	% Area	Runoff	% Area	Hazard of Erosion	% Area
30	Ephrata gravelly sandy loam	31.5	12.0	Moderately Rapid	100.0	Slow	100.0	Slow	100.0
	Ephrata-Malaga complex	30.1							
Area: 20.5 Acres	Malaga gravelly sandy loam	12.8							
Length: 1.47 km	Malaga stony sandy loam	13.0							
	Timmerman coarse sandy loam	12.6							

Table 3. Nearshore Physical Characteristics, City of Moses Lake.

Reach	Substrate		Fetch- Length to Closest Bank from Mid-Point of Reach (km)								Drawdown	
	Type	%Shoreline Length	N	NE	E	SE	S	SW	W	NW	Shoreline Exposure Range (m)	% Shoreline Length
1	Cobble	40.5	0.0	0.0	0.0	0.0	0.0	2.78	1.00	2.53	< 10	100.0
Area: 70.7 Acres	Mixed Alluvium	59.8										
Length: 4.39 km												
2	Mixed Alluvium	100.0	0.0	0.0	0.0	0.0	2.39	1.14	0.79	1.53	< 10	25.7
Area: 54.5 Acres											10 - 35 m	56.7
Length: 3.68 km											36 - 60 m	17.6
3	Mixed Alluvium	100.0	0.0	0.0	0.0	0.0	1.70	1.19	1.52	0.83	< 10	79.3
Area: 43.6 Acres											36 - 60 m	20.7
Length: 3.02 km												
4	Mixed Alluvium	100.0	0.17	0.60	0.54	0.80	1.99	0.0	0.0	0.0	< 10	40.1
Area: 42.9 Acres											10 - 35 m	70.8
Length: 3.11 km												
5	Mixed Alluvium	100.0	0.04	0.08	0.05	0.03	0.03	0.0	0.0	0.0	< 10	5.3
Area: 20.3 Acres											10 - 35 m	0.3
Length: 1.67 km											36 - 60 m	59.5
6	Mixed Alluvium	100.0	0.0	0.0	0.0	1.80	0.35	0.51	0.39	0.0	< 10	100.0
Area: 20.1 Acres												
Length: 1.48 km												

Reach	Substrate		Fetch- Length to Closest Bank from Mid-Point of Reach (km)								Drawdown	
	Type	%Shoreline Length	N	NE	E	SE	S	SW	W	NW	Shoreline Exposure Range (m)	% Shoreline Length
7	Mixed Alluvium	100.0	0.0	0.0	0.0	0.0	0.92	0.85	0.4	1.3	< 10	72.1
Area: 24.8 Acres											No data	27.9
Length: 1.79 km												
8	Mixed Alluvium	100.0	0.0	0.0	0.40	0.26	0.31	0.0	0.0	0.81	< 10	30.7
Area: 19.9 Acres											10 - 35 m	69.3
Length: 1.65 km												
9	Mixed Alluvium	100.0	0.0	0.0	0.25	0.20	0.34	0.78	0.0	0.0	< 10	50.9
Area: 16.3 Acres											36 - 60 m	18.5
Length: 1.92 km												
10	No Data	0.0	0.0	0.0	0.22	0.16	0.22	0.25	0.0	0.0	No Data	0.0
Area: 7.0 Acres												
Length: 0.60 km												
11	No Data	0.0	0.25	0.0	0.0	0.0	0.0	0.03	0.24	0.18	No Data	0.0
Area: 10.4 Acres												
Length: 0.59 km												
12	Mixed Alluvium	100.0	0.33	0.0	0.0	0.0	0.0	0.0	0.23	0.21	< 10	18.9
Area: 25.4 Acres											36 - 60 m	14.4
Length: 1.61 km											> 85 m	51.8

Reach	Substrate		Fetch- Length to Closest Bank from Mid-Point of Reach (km)								Drawdown	
	Type	%Shoreline Length	N	NE	E	SE	S	SW	W	NW	Shoreline Exposure Range (m)	% Shoreline Length
13	Cobble	66.5	0.31	0.86	0.0	0.0	0.0	0.0	0.75	0.29	< 10	100.0
Area: 30.4 Acres	Mixed Alluvium	35.1										
Length: 1.68 km												
14	Mixed Alluvium	100.0	0.13	0.0	0.0	0.0	0.0	2.32	0.55	0.07	No data	6.4
Area: 30.7 Acres											< 10	2.6
Length: 2.26 km											10 - 35 m	36.4
											36 - 60 m	43.7
											61 - 85 m	10.9
15	Cobble	100.0	2.51	0.0	0.0	0.0	0.0	0.25	1.88	0.74	< 10	89.8
Area: 47.5 Acres											10 - 35 m	10.2
Length: 2.78 km												
16	Cobble	100.0	0.0	0.0	0.0	0.0	0.08	1.32	0.66	0.84	< 10	99.1
Area: 54.8 Acres												
Length: 3.97 km												
17	Cobble	100.0	0.0	1.10	1.13	0.92	1.87	0.0	0.0	0.0	< 10	80.4
Area: 9.3 Acres											No data	19.6
Length: 0.74 km												
18	Cobble	100.0	0.0	0.0	0.95	1.13	1.54	0.0	0.0	0.0	< 10	93.2
Area: 11.0 Acres												
Length: 0.98 km												
19	Cobble	100.0	0.0	0.21	0.73	0.78	0.44	0.49	0.0	0.0	< 10	39.8
Area: 23.0 Acres											36 - 60 m	51.0

Reach	Substrate		Fetch- Length to Closest Bank from Mid-Point of Reach (km)								Drawdown	
	Type	%Shoreline Length	N	NE	E	SE	S	SW	W	NW	Shoreline Exposure Range (m)	% Shoreline Length
Length: 2.01 km											61 - 85 m	9.1
20	Cobble	100.0	0.0	0.0	0.42	0.42	0.72	0.0	0.0	0.0	< 10	93.7
Area: 20.3 Acres											36 - 60 m	5.4
Length: 1.70 km											> 85 m	0.9
21	Cobble	2.7	0.0	0.0	0.0	0.0	0.0	2.56	0.37	0.40	< 10	43.4
Area: 28.9 Acres	Mixed Alluvium	97.3									10 - 35 m	26.2
Length: 1.70 km											> 85 m	30.4
22	Mixed Alluvium	100.0	1.36	0.28	0.0	0.0	0.0	0.0	0.0	0.34	< 10	41.8
Area: 57.4 Acres											10 - 35 m	32.3
Length: 4.14 km											36 - 60 m	25.3
23	Mixed Alluvium	100.0	0.26	0.0	0.0	0.0	0.0	0.0	1.13	0.84	< 10	31.7
Area: 31.5 Acres											10 - 35 m	53.7
Length: 1.87 km											36 - 60 m	14.6
24	Mixed Alluvium	100.0	1.63	1.09	0.0	0.0	0.0	0.0	1.02	0.94	< 10	25.0
Area: 25.2 Acres											10 - 35 m	46.0
Length: 1.88 km											36 - 60 m	29.0
25	Sand	100.0	0.0	0.0	0.59	0.83	2.65	0.0	0.0	0.0	10 - 35 m	100.0
Area: 10.3 Acres												
Length: 0.81 km												
26	Sand	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.13	0.0	< 10	29.1
											10 - 35 m	70.4
Area: 110.7 Acres												

Reach	Substrate		Fetch- Length to Closest Bank from Mid-Point of Reach (km)								Drawdown	
	Type	%Shoreline Length	N	NE	E	SE	S	SW	W	NW	Shoreline Exposure Range (m)	% Shoreline Length
Length: 8.65 km												
27	Sand	100.0	1.73	0.77	1.08	0.0	0.0	0.0	0.0	0.0	10 - 35 m	100.0
Area: 13.0 Acres												
Length: 0.90 km												
28	Sand	5.4	1.84	1.21	1.10	0.0	0.0	0.0	0.0	0.0	10 - 35 m	100.0
Area: 17.3 Acres	Mixed Alluvium	94.6										
Length: 1.05 km												
29	Mixed Alluvium	100.0	0.0	1.24	0.87	3.99	0.0	0.0	0.0	0.0	< 10	99.1
Area: 64.1 Acres											10 - 35 m	0.9
Length: 4.41 km												
30	Mixed Alluvium	100.0	0.0	2.40	1.12	1.29	2.71	0.0	0.0	0.0	< 10	99.2
Area: 17.6 Acres												
Length: 1.47 km												

Table 4. Biological Characteristics of the SMP Jurisdiction, City of Moses Lake.

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
1		0	64.7	<2	0.3	Riparian	Northern Leopard Frog
							Townsend's Big-Eared Bat
Area: 66.3 Acres							Western Grebe
							Yuma Myotis
2	Palustrine, emergent, forest	10.9	44.6	< 2 m	4.7	Waterfowl concentration	Northern Leopard Frog
	Palustrine, open water	0.6		2 - 5 m	3.2		Townsend's Big-Eared Bat
Area: 53.3 Acres	Palustrine emergent	0.1		5 - 10 m	40.3		Western Grebe
	TOTAL	11.6					Yuma Myotis
3	Palustrine, forested	0.4	51.7	< 2 m	27.5	Waterfowl concentration	Northern Leopard Frog
	Palustrine emergent	0.2		2 - 5 m	1.3		Townsend's Big-Eared Bat
Area: 43.9 Acres	TOTAL	0.6					Western Grebe
							Yuma Myotis
4	Palustrine emergent	16.3	8.2	< 2 m	3.8	Wetland	Northern Leopard Frog
				2 - 5 m	8.1	Waterfowl concentration	Townsend's Big-Eared Bat
Area: 45.5 Acres				5 - 10 m	21.1	Waterfowl nesting	Western Grebe
				> 10 m	36.8	Bald eagle wintering	Yuma Myotis

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
5	Palustrine emergent	28.3	4	< 2 m	1.5	Wetland	Northern Leopard Frog
				2 - 5 m	5.9	Waterfowl concentration	Townsend's Big-Eared Bat
Area: 21.2 Acres						Waterfowl nesting	Western Grebe
						Bald eagle wintering	Yuma Myotis
6	Palustrine emergent	1.9	7.4	< 2 m	4.7		Northern Leopard Frog
				2 - 5 m	10.7		Townsend's Big-Eared Bat
Area: 22.8 Acres				5 - 10 m	8.3		Western Grebe
							Yuma Myotis
7		0	5.4	< 2 m	28.4	Waterfowl concentration	Northern Leopard Frog
				2 - 5 m	9.6	Waterfowl nesting	Townsend's Big-Eared Bat
Area: 26.2 Acres						Bald eagle wintering	Western Grebe
							Yuma Myotis
8	Palustrine, forested	5	33.1	< 2 m	7	Waterfowl concentration	Northern Leopard Frog
				2 - 5 m	7.2	Bald eagle wintering	Townsend's Big-Eared Bat
Area: 25.2 Acres						Mink	Western Grebe
							Yuma Myotis

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
9	Palustrine emergent	2.9	0	N/A	N/A	Waterfowl concentration	Northern Leopard Frog
	Palustrine, open water	4.6				Bald eagle wintering	Townsend's Big-Eared Bat
Area: 18.8 Acres	TOTAL	7.5				Mink	Western Grebe
							Yuma Myotis
10	Palustrine emergent	28.4	0	N/A	N/A	Wetland	Northern Leopard Frog
	Palustrine emergent, scrub/shrub	9.9				Waterfowl concentration	Townsend's Big-Eared Bat
Area: 9.0 Acres	TOTAL	38.3				Bald eagle wintering	Western Grebe
						Shorebird concentrations	Yuma Myotis
						Mink	
11	Palustrine emergent	41.4	0	N/A	N/A	Wetland	Northern Leopard Frog
						Waterfowl concentration	Townsend's Big-Eared Bat
Area: 10.0 Acres						Bald eagle wintering	Western Grebe
						Shorebird concentrations	Yuma Myotis
						Mink	

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
12	Palustrine emergent	16.3	0	N/A	N/A	Waterfowl concentration	Northern Leopard Frog
	Palustrine emergent, scrub/shrub	5.9				Bald eagle wintering	Townsend's Big-Eared Bat
Area: 21.6 Acres	TOTAL	22.2				Mink	Western Grebe
13	Palustrine emergent	0.3	0	< 2 m	4.1	Waterfowl concentration	Northern Leopard Frog
						Bald eagle wintering	Townsend's Big-Eared Bat
Area: 25.2 Acres						Mink	Western Grebe
							Yuma Myotis
14	Palustrine emergent	52.8	0	5 - 10 m	94.8	Wetland	Northern Leopard Frog
						Waterfowl nesting	Townsend's Big-Eared Bat
Area: 29.2 Acres							Western Grebe
							Yuma Myotis
15		0	9.6	< 2 m	12.2	Waterfowl concentration	Northern Leopard Frog
							Townsend's Big-Eared Bat
Area: 40.1 Acres							Western Grebe
							Yuma Myotis

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
16		0	1.7	< 2 m	31.1	Tundra swan wintering	Northern Leopard Frog
				2 - 5 m	4.1	Clark's and western grebe breeding	Townsend's Big-Eared Bat
Area: 54.3 Acres						Riparian	Western Grebe
							Yuma Myotis
17		0	0	2 - 5 m	98.4	Tundra swan wintering	Northern Leopard Frog
						Clark's and western grebe breeding	Townsend's Big-Eared Bat
Area: 11.0 Acres						Waterfowl concentration	Western Grebe
						Riparian	Yuma Myotis
18		0	0	< 2 m	40.8	Tundra swan wintering	Northern Leopard Frog
				2 - 5 m	10.5	Waterfowl concentration	Townsend's Big-Eared Bat
Area: 13.1 Acres						Riparian	Western Grebe
							Yuma Myotis

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
19	Palustrine emergent	6.8	0	< 2 m	8.2	Wetland	Northern Leopard Frog
				2 - 5 m	49.4	Tundra swan wintering	Townsend's Big-Eared Bat
Area: 27.9 Acres						Clark's and western grebe breeding	Western Grebe
						Waterfowl concentration	Yuma Myotis
						Bald eagle wintering	
20		0	0	2 - 5 m	6.1	Tundra swan wintering	Northern Leopard Frog
						Clark's and western grebe breeding	Townsend's Big-Eared Bat
Area: 24.6 Acres						Waterfowl concentration	Western Grebe
						Bald eagle wintering	Yuma Myotis
21	Palustrine emergent	58.8	0	N/A	N/A	Wetland	Northern Leopard Frog
	Palustrine scrub/shrub	11.8				Tundra swan wintering	Townsend's Big-Eared Bat
Area: 74.0 Acres	Palustrine open water	5.7				Clark's and western grebe breeding	Western Grebe
	Palustrine forested	0.9				Waterfowl concentration	Yuma Myotis
	TOTAL	77.2				Bald eagle wintering	

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
22	Palustrine emergent	32.5	0	< 2 m	37.6	Wetland	Northern Leopard Frog
	Palustrine scrub/shrub	12.7		5 - 10 m	29.8	Tundra swan wintering	Townsend's Big-Eared Bat
Area: 58.7 Acres	Palustrine open water	0.6				Clark's and western grebe breeding	Western Grebe
	TOTAL	45.8				Waterfowl concentration	Yuma Myotis
						Bald eagle wintering	
						Mink	
						Waterfowl nesting	
23	Palustrine emergent	36.1	14.1	< 2 m	37.3	Wetland	Burrowing Owl
				2 - 5 m	36.7	Tundra swan wintering	Northern Leopard Frog
Area: 29.9 Acres						Clark's and western grebe breeding	Townsend's Big-Eared Bat
						Waterfowl concentration	Western Grebe
						Waterfowl nesting	Yuma Myotis

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
24	Palustrine emergent	64.1	4.5	< 2 m	31.1	Tundra swan wintering	Burrowing Owl
	Palustrine open water	7.7		2 - 5 m	12.2	Clark's and western grebe breeding	Northern Leopard Frog
Area: 69.8 Acres	TOTAL	72.8		5 - 10 m	4.3		Townsend's Big-Eared Bat
							Western Grebe
							Yuma Myotis
25	Palustrine open water	7.2	0	2 - 5 m	22.6		Northern Leopard Frog
	Palustrine emergent	5.2					Townsend's Big-Eared Bat
Area: 12.7 Acres	Palustrine forested	2.4					Western Grebe
	TOTAL	14.8					Yuma Myotis
26	Palustrine aquatic bed	0.1	8.1	< 2 m	7.6	Clark's and western grebe breeding	Northern Leopard Frog
	Palustrine emergent	2.5		2 - 5 m	7.7	Riparian	Townsend's Big-Eared Bat
Area: 112.9 Acres	Palustrine forested	2.1		5 - 10 m	1.1	Mule deer	Western Grebe
	Palustrine open water	2.4					Yuma Myotis
	TOTAL	7.1					

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
27	Palustrine emergent	0.2	33.9	< 2 m	30.7	Waterfowl concentration	Northern Leopard Frog
	Palustrine forested	1.9		2 - 5 m	21.9	Riparian	Townsend's Big-Eared Bat
Area: 12.8 Acres	TOTAL	2.1					Western Grebe
							Yuma Myotis
28	Palustrine forested	3.9	45.5	5 - 10 m	8.5	Waterfowl concentration	Northern Leopard Frog
	Palustrine open water	3.4				Riparian	Townsend's Big-Eared Bat
Area: 16.3 Acres	TOTAL	7.3					Western Grebe
							Yuma Myotis
29		0	62.5	< 2 m	75.3	Waterfowl concentration	Burrowing Owl
						Riparian	Northern Leopard Frog
Area: 67.5 Acres							Townsend's Big-Eared Bat
							Western Grebe
							Yuma Myotis

REACH	Wetlands Area (%)		Riparian Tree Cover	Emergent Vegetation		Priority Habitats	Potential Species of Concern
	Type	Area (%)	Length (%)	Width (m)	Length (%)		
30	Palustrine emergent	8.1	57.4	< 2 m	77.8	Wetland	Burrowing Owl
						Waterfowl concentration	Northern Leopard Frog
Area: 20.5 Acres						Riparian	Townsend's Big-Eared Bat
							Western Grebe
							Yuma Myotis

Table 5. City of Moses Lake Land Use and Zoning within the SMP Jurisdiction

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	**% Area**	**Width (m)**	**Depth (m)**	**Numerical Measure**	**Value**	**% Area**	**Type**	**% Area**
1	COMMERCIAL	0.3	60	175	Min (m)	23.2	0.0	Urban Light Industrial	5.1
	RESIDENTIAL- SINGLE FAMILY	30.2			Max (m)	57.5		Urban Public Facilities	5.1
	UNDEVELOPED	57.8			Mean (m)	34.4		Urban Residential 2	61.0
	MINING	11.7			n (count)	16		Urban Residential 3	28.8
2	PARKS/OPEN LAND	1.3	42	87	Min (m)	23.2	0.0	Urban Residential 3	100.0
	RESIDENTIAL- SINGLE FAMILY	50.6			Max (m)	55.9			
	UNDEVELOPED	47.8			Mean (m)	33.7			
	UNCLASSIFIED	0.3			n (count)	22			
3	PARKS/OPEN LAND	0.6	40	101	Min (m)	0.0	0.0	Urban Residential 3	100.0
	RESIDENTIAL- MULTI FAMILY	4.7			Max (m)	46.1			
	RESIDENTIAL- SINGLE FAMILY	64.5			Mean (m)	27.2			
	UNDEVELOPED	28.9			n (count)	18			
	UNCLASSIFIED	1.1							
4	RESIDENTIAL- MOBILE HOME	2.5	59	153	Min (m)	6.6	0.0	Urban Commercial 1	6.8
	RESIDENTIAL- SINGLE FAMILY	49.9			Max (m)	59.3		Urban Residential 3	93.2
	UNDEVELOPED	47.3			Mean (m)	28.7			
	UNCLASSIFIED	0.3			n (count)	17			

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
5	COMMERCIAL	0.6	87	138	Min (m)	0.0	0.0	Urban Commercial 1	13.7
	RESIDENTIAL- SINGLE FAMILY	48.4			Max (m)	53.4		Urban Residential 2	27.6
	UNDEVELOPED	43.5			Mean (m)	24.9		Urban Residential 3	1.4
	UNCLASSIFIED	7.5			n (count)	6		Urban Residential 4	57.3
6	AGRICULTURE	11.0	82	125	Min (m)	18.0	42.9	Public	42.9
	PARKS/OPEN LAND	43.0			Max (m)	51.2		Single Family Residential	1.1
	RESIDENTIAL- MULTI FAMILY	1.8			Mean (m)	34.0		Urban Residential 3	28.2
	RESIDENTIAL- SINGLE FAMILY	39.2			n (count)	12		Urban Residential 4	27.8
	TRANSPORTATION, UTILITIES	0.3							
	UNCLASSIFIED	4.8							
7	RESIDENTIAL- SINGLE FAMILY	89.9	31	98	Min (m)	48.1	0.2	Public	0.2
	UNDEVELOPED	10.1			Max (m)	59.8		Single Family Residential	99.8
					Mean (m)	52.3			
					n (count)	6			
8	RESIDENTIAL- SINGLE FAMILY	100.0	27	57	Min (m)	11.6	0.0	Single Family Residential	100.0
					Max (m)	46.8			
					Mean (m)	27.4			
					n (count)	32			

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
9	COMMERCIAL	48.7	177	72	Min (m)	23.6	0.0	General Commercial and Business	85.0
	RESIDENTIAL- SINGLE FAMILY	20.6			Max (m)	43.7		Single Family Residential	3.0
	TRANSPORTATION, UTILITIES	24.8			Mean (m)	31.5		Not Zoned	12.0
	UNDEVELOPED	5.7			n (count)	7			
	RECREATION	0.2							
10	COMMERCIAL	29.2	274	91	N/A	N/A	0.0	Multi Family Residential	100.0
	UNDEVELOPED	70.8							
11	COMMERCIAL	90.7	564	335	N/A	N/A	0.0	Heavy Industrial	100.0
	TRANSPORTATION, UTILITIES	3.2							
	UNDEVELOPED	6.0							
12	COMMERCIAL	21.5	60	203	Min (m)	42.6	1.0	Central Business District	9.2
	PARKS/OPEN LAND	3.0			Max (m)	58.2		Heavy Industrial	11.2
	RESIDENTIAL- MULTIFAMILY	21.0			Mean (m)	50.4		Light Industrial	53.0
	TRANSPORTATION, UTILITIES	25.3			n (count)	5		Multi Family Residential	16.0
	UNDEVELOPED	18.6						Public	0.9
	UNCLASSIFIED	10.6						Not Zoned	9.6

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
13	COMMERCIAL- RETAIL	38.1	400	36	Min (m)	26.0	26.7	Central Business District	13.4
	PARKS/OPEN LAND	36.3			Max (m)	58.0		General Commercial and Business	35.6
	RESIDENTIAL- MULTI FAMILY	0.7			Mean (m)	40.8		Light Industrial	24.4
	LODGING	2.3			n (count)	19		Public	26.6
	RESIDENTIAL- SINGLE FAMILY	3.3							
	TRANSPORTATION, UTILITIES	17.5							
	UNCLASSIFIED	1.7							
14	COMMERCIAL- RETAIL	1.3	46	67	Min (m)	13.7	0.0	Light Industrial	6.4
	RESIDENTIAL- SINGLE FAMILY	18.8			Max (m)	50.0		Multi Family Residential	93.6
	UNDEVELOPED	76.0			Mean (m)	36.6			
	UNCLASSIFIED	3.9			n (count)	3			
15	COMMERCIAL	2.3	30	70	Min (m)	9.0	0.0	Multi Family Residential	82.1
	LODGING	18.3			Max (m)	48.8		Single and Two Family Residential	17.9
	RESIDENTIAL- MOBILE HOME	8.0			Mean (m)	30.8			
	RESIDENTIAL- MULTI FAMILY	11.3			n (count)	37			
	RESIDENTIAL- SINGLE FAMILY	42.8							

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
	UNDEVELOPED	7.9							
16	LODGING	1.9	32	69	Min (m)	0.0	0.0	Multi Family Residential	4.3
	RESIDENTIAL- MOBILE HOME	3.6			Max (m)	42.3		Single Family Residential	86.6
	RESIDENTIAL- SINGLE FAMILY	81.7			Mean (m)	21.0		Not Zoned	9.1
	TRANSPORTATION, UTILITIES	9.3			n (count)	48			
	UNDEVELOPED	3.6							
17	AGRICULTURE	28.7	113	234	N/A	N/A	50.8	Public	50.8
	RECREATION	51.5						Single Family Residential	49.2
	RESIDENTIAL- SINGLE FAMILY	0.4							
	UNDEVELOPED	15.9							
	UNCLASSIFIED	3.6							
18	RESIDENTIAL- MULTI FAMILY	1.3	38	53	Min (m)	19.9	0.0	Multi Family Residential	24.7
	RESIDENTIAL- SINGLE FAMILY	48.8			Max (m)	33.0		Single Family Residential	52.8
	UNDEVELOPED	9.7			Mean (m)	24.8		Not Zoned	22.5
	TRANSPORTATION, UTILITIES	24.8			n (count)	10			
	UNCLASSIFIED	15.4							
19	COMMERCIAL	3.1	26	65	Min (m)	0.0	0.0	Multi Family Residential	5.9

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
	LODGING	2.8			Max (m)	49.4		Single and Two Family Residential	5.3
	RESIDENTIAL- MULTI FAMILY	0.8			Mean (m)	23.7		Single Family Residential	87.6
	RESIDENTIAL- SINGLE FAMILY	80.1			n (count)	28		Not Zoned	1.2
	TRANSPORTATION, UTILITIES	0.7							
	UNDEVELOPED	2.5							
	UNCLASSIFIED	10.0							
20	PARKS/OPEN LAND	21.0	39	54	Min (m)	16.1	27.0	Multi Family Residential	15.3
	GOVERNMENTAL SERVICES	10.4			Max (m)	38.1		Public	27.0
	RESIDENTIAL- MULTI FAMILY	12.6			Mean (m)	25.7		Single and Two Family Residential	53.7
	RESIDENTIAL- SINGLE FAMILY	27.5			n (count)	26		Not Zoned	4.0
	TRANSPORTATION, UTILITIES	4.4							
	UNDEVELOPED	15.2							
	UNCLASSIFIED	9.0							
21	COMMERCIAL	2.5	53	92	Min (m)	20.5	0.0	Multi Family Residential	71.5
	GOVERNMENTAL SERVICES	0.7			Max (m)	47.9		Single Family Residential	28.5

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
	PARKS/OPEN LAND	16.7			Mean (m)	34.6			
	RESIDENTIAL- SINGLE FAMILY	45.6			n (count)	9			
	RESIDENTIAL MOBILE HOME	3.5							
	RESIDENTIAL- MULTI FAMILY	2.4							
	UNDEVELOPED	22.7							
	UNCLASSIFIED	5.9							
22	PARKS/OPEN LAND	11.0	221	176	Min (m)	18.5	12.8	Public	10.9
	RESIDENTIAL- SINGLE FAMILY	1.7			Max (m)	18.5		Single Family Residential	43.5
	TRANSPORTATION, UTILITIES	20.9			Mean (m)	18.5		Urban Residential 2	1.6
	UNDEVELOPED	63.9			n (count)	1		Not Zoned	44.0
	UNCLASSIFIED	2.5							
23	RESIDENTIAL- SINGLE FAMILY	99.9	37	175	Min (m)	23.8	0.0	Urban Residential 2	100.0
	UNCLASSIFIED	0.1			Max (m)	56.6			
					Mean (m)	41.6			
					n (count)	5			
24	AGRICULTURE	7.6	30	77	Min (m)	14.2	0.0	Urban Residential 2	100.0
	PARKS/OPEN LAND	5.8			Max (m)	60.1			
	RESIDENTIAL- SINGLE FAMILY	48.3			Mean (m)	37.0			

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
	UNDEVELOPED	33.1							
	UNCLASSIFIED	5.3			n (count)	7			
25	UNDEVELOPED	100.0	732	213	N/A	N/A	0.0	Urban Residential 3	100.0
26	LODGING	4.3	35	59	Min (m)	0.0	3.7	General Commercial and Business	5.2
	PARKS/OPEN LAND	1.8			Max (m)	47.4		Multi Family Residential	4.5
	RESIDENTIAL- MULTI FAMILY	0.3			Mean (m)	17.6		Public	3.7
	RESIDENTIAL- SINGLE FAMILY	65.6			n (count)	59		Single and Two Family Residential	3.7
	TRANSPORTATION, UTILITIES	6.1						Single Family Residential	73.7
	UNDEVELOPED	20.3						Urban Residential 3	8.4
	UNCLASSIFIED	1.6						Not Zoned	0.8
27	PARKS/OPEN LAND	39.1	343	334	Min (m)	33.4	87.9	Public	87.9
	UNDEVELOPED	60.9			Max (m)	33.4		Single Family Residential	12.1
					Mean (m)	33.4			
					n (count)	1			
28	PARKS/OPEN LAND	2.6	41	52	Min (m)	5.0	0.0	Single Family Residential	100.0
	RESIDENTIAL- MULTI FAMILY	18.5			Max (m)	55.8			
	RESIDENTIAL- SINGLE FAMILY	63.2			Mean (m)	17.8			

Reach	Parcel Land Use		Average Parcel Dimensions		Structure Setback		Public Lands	Zoning	
	Type	% Area	Width (m)	Depth (m)	Numerical Measure	Value	% Area	Type	% Area
	UNDEVELOPED	6.5			n (count)	19			
	UNCLASSIFIED	9.2							
29	AGRICULTURE	20.4	48	69	Min (m)	3.1	0.0	Single Family Residential	6.3
	MINING	7.7			Max (m)	49.3		Urban Residential 2	93.7
	RECREATION	0.9			Mean (m)	22.1			
	RESIDENTIAL- SINGLE FAMILY	54.2			n (count)	50			
	TRANSPORTATION, UTILITIES	0.9							
	UNDEVELOPED	7.1							
	UNCLASSIFIED	8.8							
30	COMMERCIAL	16.7	268	319	Min (m)	36.3	0.0	Urban Residential 2	100.0
	RESIDENTIAL- SINGLE FAMILY	17.7			Max (m)	39.5			
	RECREATION	17.9			Mean (m)	38.0			
	UNDEVELOPED	47.7			n (count)	3			

Table 6. Cultural Modifications and Sites within the SMP Jurisdiction, City of Moses Lake.

Reach	Boat Launches (#)	Known Cultural Sites (#)	Bulkheads (Length)	Docks (#)	Total Road Length (m)	Length of Railroad (m)	Impervious Surface (%)	Storm Outfalls (#)
1	0	0	2.7	29	3.7	0.0		0
2	0	0	4.6	24	167.4	0.0		0
3	0	0	21.4	40	342.1	0.0		0
4	0	0	11.4	38	13.6	0.0		0
5	0	0	3.1	0	322.2	0.0		0
6	1	0	5.2	21	439.7	0.0		0
7	0	1	7.1	18	0.0	0.0		0
8	0	1	62.0	41	0.0	0.0		1
9	0	0	1.8	1	1045.2	182.5		1
10	0	0	0.0	0	0.0	0.0		0
11	0	0	0.0	0	0.0	0.0		0
12	0	0	0.0	1	1855.1	922.4		1
13	0	1	0.0	1	2512.1	1501.8		2

Reach	Boat Launches (#)	Known Cultural Sites (#)	Bulkheads (Length)	Docks (#)	Total Road Length (m)	Length of Railroad (m)	Impervious Surface (%)	Storm Outfalls (#)
14	0	0	0.0	0	205.6	49.9		0
15	0	0	42.0	29	949.7	0.0		1
16	0	1	28.6	46	1455.4	0.0		2
17	1	0	0.7	1	0.0	0.0		0
18	0	0	34.0	9	591.8	0.0		0
19	0	0	42.7	32	561.6	65.3		3
20	0	0	0.0	11	768.3	124.6		1
21	0	0	0.0	5	697.7	0.0		3
22	1	0	0.0	2	2650.2	296.5		0
23	0	0	0.0	20	0.0	0.0		0
24	0	0	0.0	7	247.7	0.0		0
25	0	0	0	0	0.0	0.0		0
26	0	0	21.7	83	1710.1	0.0		10
27	1	0	0.0	1	0.0	0.0		0

Reach	Boat Launches (#)	Known Cultural Sites (#)	Bulkheads (Length)	Docks (#)	Total Road Length (m)	Length of Railroad (m)	Impervious Surface (%)	Storm Outfalls (#)
28	0	0	61.3	25	0.0	0.0		1
29	0	1	17.9	49	3987.2	0.0		0
30	0	2	8.5	4	67.0	0.0		0

Table 7. Vegetation species list, unprotected mixed alluvium shorelines, Moses Lake.

Broad-leaved cattail (*Typha latifolia*)
Common reed (Phragmites australis)
Curly-leaf pondweed (*Potamogeton crispus*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Slender water-nymph (*Najas flexilis*)
Softstem bulrush (*Scirpus validus*)
White-stem pondweed (*Potamogeton praelongus)*
Willow (*Salix* spp.)
Yellow flag iris (*Iris pseudacorus*)

Table 8. Vegetation species list, protected mixed alluvium shorelines, Moses Lake.

Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Softstem bulrush (*Scirpus validus*)
White-stem pondweed (*Potamogeton praelongus)*
Willow (*Salix* spp.)

Table 9. Vegetation species list, unprotected cobble shorelines, Moses Lake.

Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Nitella (*Nitella* spp.)
Nightshade (Bittersweet) (*Solanum dulcamara*)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Slender water-nymph (*Najas flexilis*)
Softstem bulrush (*Scirpus validus*)
White-stem pondweed (*Potamogeton praelongus)*
Willow (*Salix* spp.)
Yellow flag iris (*Iris pseudacorus*)

Table 10. Vegetation species list, protected cobble shorelines, Moses Lake.

Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Sago pondweed (*Potamogeton pectinatus*)
Softstem bulrush (*Scirpus validus*)
White-stem pondweed (*Potamogeton praelongus)*

Table 11. Vegetation species list, unprotected sand shorelines, Moses Lake.

Broad-leaved cattail (*Typha latifolia*)
Common reed (Phragmites australis)
Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Nitella (*Nitella* spp.)
Nightshade (Bittersweet) (*Solanum dulcamara*)
Purple loosestrife (Lythrum salicaria)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Softstem bulrush (*Scirpus validus*)
Stonewort (*Chara* sp.)
White-stem pondweed (*Potamogeton praelongus)*
Yellow flag iris (*Iris pseudacorus*)

Table 12. Vegetation species list, protected sand shorelines, Moses Lake.

Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Nitella (*Nitella* spp.)
Sago pondweed (*Potamogeton pectinatus*)
Slender water-nymph (*Najas flexilis*)
Softstem bulrush (*Scirpus validus*)

Table 13. Vegetation species list, dune shorelines, Moses Lake.

Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Softstem bulrush (*Scirpus validus*)
White-stem pondweed (*Potamogeton praelongus)*
Yellow flag iris (*Iris pseudacorus*)

Table 14. Vegetation species list, wetland shorelines, Moses Lake.

Broad-leaved cattail (*Typha latifolia*)
Common reed (Phragmites australis)
Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Nettle (Stinging) (*Urtica dioica*)
Purple loosestrife (Lythrum salicaria)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Softstem bulrush (*Scirpus validus*)
White-stem pondweed (*Potamogeton praelongus)*
Yellow flag iris (*Iris pseudacorus*)

Table 15. Vegetation species list, emergent island shorelines, Moses Lake.

Broad-leaved cattail (*Typha latifolia*)
Common reed (Phragmites australis)
Curly-leaf pondweed (*Potamogeton crispus*)
Elodea (*Elodea canadensis*)
Eurasian water milfoil (*Myriophyllum spicatum*)
Reed canary grass (Phalaris arundinacea)
Sago pondweed (*Potamogeton pectinatus*)
Slender water-nymph (*Najas flexilis*)
Softstem bulrush (*Scirpus validus*)
Yellow flag iris (*Iris pseudacorus*)

Table 16. Fish species list, Reach 1, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 17. Fish species list, Reach 2, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 18. Fish species list, Reach 3, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 19. Fish species list, Reach 4, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Rainbow trout (*Oncorhynchus mykiss*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 20. Fish species list, Reach 5, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 21. Fish species list, Reach 6, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 22. Fish species list, Reach 7, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 23. Fish species list, Reach 8, Moses Lake.

Bluegill (*Lepomis macrochirus*)
Bullhead (
Largemouth bass (*Micropterus salmoides*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 24. Fish species list, Reach 13, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 25. Fish species list, Reach 14, Moses Lake.

Bluegill (*Lepomis macrochirus*)
Bullhead (
Walleye (*Stizostedion vitreum*)

Table 26. Fish species list, Reach 15, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 27. Fish species list, Reach 16, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 28. Fish species list, Reach 17, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 29. Fish species list, Reach 18, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 30. Fish species list, Reach 19, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 31. Fish species list, Reach 20, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 32. Fish species list, Reach 21, Moses Lake.

Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Yellow perch (*Perca flavescens)*

Table 33. Fish species list, Reach 22, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 34. Fish species list, Reach 23, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Largemouth bass (*Micropterus salmoides*)
Rainbow trout (*Oncorhynchus mykiss*)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 35. Fish species list, Reach 24, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 36. Fish species list, Reach 25, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Rainbow trout (*Oncorhynchus mykiss*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 37. Fish species list, Reach 26, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Rainbow trout (*Oncorhynchus mykiss*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 38. Fish species list, Reach 27, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Rainbow trout (*Oncorhynchus mykiss*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 39. Fish species list, Reach 28, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 40. Fish species list, Reach 29, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Sculpin (*Cottus spp*.)
Smallmouth bass ((*Micropterus dolomieui*)
Sucker (*Catostomus spp*.)
Walleye (*Stizostedion vitreum*)
Whitefish (*Coregonus clupeaformis; Prosopium williamsoni*)
Yellow perch (*Perca flavescens)*

Table 41. Fish species list, Reach 30, Moses Lake.

Black crappie (*Pomoxis nigromaculatus*)
Bluegill (*Lepomis macrochirus*)
Bullhead (
Common carp (*Cyprinus carpio*)
Largemouth bass (*Micropterus salmoides*)
Pumpkinseed sunfish (*Lepomis gibbosus*)
Walleye (*Stizostedion vitreum*)
Yellow perch (*Perca flavescens)*

Table 42: WDFW GAP analysis avian species list for Moses Lake area (WDFW, 1997). Bold text indicates priority species.

Species Common Name	Species Scientific Name
Spotted Sandpiper	Actitis macularia
Clark`s Grebe	Aechmophorus clarkii
Western Grebe	**Aechmophorus occidentalis**
Red-winged Blackbird	Agelaius phoeniceus
Greater white-fronted goose	Anser albifrons
Northern Shoveler	Anas clypeata
Green-winged Teal	Anas crecca
Cinnamon Teal	Anas cyanoptera
Mallard	Anas platyrhynchos
Gadwall	Anas strepera
Great Blue Heron	Ardea herodias
Short-eared Owl	Asio flammeus
Long-eared Owl	Asio otus
Redhead	Aythya americana
Canada Goose	Branta canadensis
Red-tailed Hawk	Buteo jamaicensis
Swainson`s Hawk	Buteo swainsoni
Great Horned Owl	Bubo virginianus
California Quail	Callipepla californica
House Finch	Carpodacus mexicanus
Great Egret	Ardea alba
American Goldfinch	Carduelis tristis
Belted Kingfisher	Ceryle alcyon
Common Nighthawk	Chordeiles minor
Killdeer	Charadrius vociferus
Northern Harrier	Circus cyaneus
Marsh Wren	Cistothorus palustris
Northern Flicker	Colaptes auratus
Common Raven	Corvus corax
Rock Dove	Columba livia
Horned Lark	Eremophila alpestris
Brewer`s Blackbird	Euphagus cyanocephalus
Prairie Falcon	Falco mexicanus
American Kestrel	Falco sparverius
American Coot	Fulica americana
Common Snipe	Gallinago gallinago
Black-necked Stilt	Himantopus mexicanus
Cliff Swallow	Hirundo pyrrhonota
Barn Swallow	Hirundo rustica
Bullock`s Oriole	Icterus bullockii
California Gull	Larus californicus
Ring-billed Gull	Larus delawarensis
Song Sparrow	Melospiza melodia
Brown-headed Cowbird	Molothrus ater
Black-crowned Night-Heron	Nycticorax nycticorax
Ruddy Duck	Oxyura jamaicensis

Species Common Name	Species Scientific Name
Lazuli Bunting	Passerina amoena
Deer Mouse	Peromyscus maniculatus
Double-crested Cormorant	Phalacrocorax auritus
Black-headed Grosbeak	Pheucticus melanocephalus
Wilson`s Phalarope	Phalaropus tricolor
Black-billed Magpie	Pica pica
Downy Woodpecker	Picoides pubescens
Pied-billed Grebe	Podilymbus podiceps
Sora	Porzana carolina
American Avocet	Recurvirostra americana
Bank Swallow	Riparia riparia
Rock Wren	Salpinctes obsoletus
Say`s Phoebe	Sayornis saya
Caspian Tern	Sterna caspia
Forster`s Tern	Sterna forsteri
Northern Rough-winged Swallow	Stelgidopteryx serripennis
European Starling	Sturnus vulgaris
Violet-green Swallow	Tachycineta thalassina
American Robin	Turdus migratorius
Barn Owl	Tyto alba
Eastern Kingbird	Tyrannus tyrannus
Western Kingbird	Tyrannus verticalis
Yellow-headed Blackbird	Xanthocephalus xanthocephalus
Mourning Dove	Zenaida macroura

Table 43. Audubon Society species list for Moses Lake region (1998-2003).

Species Name	Species Name	Species Name
Accipiter sp.	Glaucous-winged Gull	Savannah Sparrow
American Coot	Golden-crowned Kinglet	Sharp-shinned Hawk
American Crow	Gray Partridge	Short-eared Owl
American Goldfinch	Great Blue Heron (Blue form)	Snowy Owl
American Green-winged Teal	Great Egret	Song Sparrow
American Kestrel	Great Horned Owl	Sora
American Robin	Greater White-fronted Goose	Spotted Towhee
American Tree Sparrow	grebe sp.	Swamp Sparrow
American White Pelican	gull sp.	Tundra Swan
American Wigeon	Herring Gull	Varied Thrush
Bald Eagle	Hooded Merganser	Virginia Rail
Barn Owl	Horned Grebe	Western Grebe
Belted Kingfisher	Horned Lark	Western Meadowlark
Bewick's Wren	House Finch	White-throated Sparrow
Black-billed Magpie	House Sparrow	white-winged gull sp.
blackbird sp.	Killdeer	Wood Duck
Black-crowned Night-Heron	Lapland Longspur	Yellow-headed Blackbird
Blue-winged Teal	Lesser Scaup	Yellow-rumped Warbler
Bohemian Waxwing	Lesser Yellowlegs	
Bonaparte's Gull	Long-billed Dowitcher	
Brewer's Blackbird	Mallard	
Brown Creeper	Marsh Wren	
Brown-headed Cowbird	Merlin	
Bufflehead	Mourning Dove	
Burrowing Owl	Northern (Red-shafted) Flicker	
Buteo sp.	Northern (Yellow-shafted) Flicker	
California Gull	Northern Flicker	
California Quail	Northern Harrier	
Canada Goose	Northern Pintail	
Canvasback	Northern Shoveler	
Carpodacus sp.	Northern Shrike	
Cedar Waxwing	peep sp.	
Common Goldeneye	Pied-billed Grebe	
Common Merganser	Pine Siskin	
Common Raven	Prairie Falcon	
Common Snipe	Red-breasted Nuthatch	
Cooper's Hawk	Red-breasted Sapsucker	
Dark-eyed (Oregon) Junco	Redhead	
Dark-eyed (Slate-colored) Junco	Red-tailed Hawk	
Double-crested Cormorant	Red-winged Blackbird	
Downy Woodpecker	Ring-billed Gull	
duck sp.	Ring-necked Duck	
Dunlin	Ring-necked Pheasant	
Eared Grebe	Rock Dove	
European Starling	Rough-legged Hawk	
Gadwall	Ruby-crowned Kinglet	

Species Name	Species Name	Species Name
Glaucous Gull	Ruddy Duck	

Table 44. WDFW GAP analysis terrestrial species list for Moses Lake area (WDFW, 1997). Bold text indicates priority species.

Common Name	Scientific Name
Tiger Salamander	Ambystoma tigrinum
Pallid Bat	Antrozous pallidus
Coyote	Canis latrans
Rubber Boa	Charina bottae
Painted Turtle	Chrysemys picta
Big Brown Bat	Eptesicus fuscus
Porcupine	Erethizon dorsatum
Western Skink	Eumeces skiltonianus
Hoary Bat	Lasiurus cinereus
Bobcat	Lynx rufus
Striped Skunk	Mephitis mephitis
Montane Vole	Microtus montanus
Meadow Vole	Microtus pennsylvanicus
Long-tailed Weasel	Mustela frenata
Long-eared Myotis	Myotis evotis
Small-footed Myotis	Myotis ciliolabrum
Fringed Myotis	Myotis thysanodes
Yuma Myotis	**Myotis yumanensis**
Bushy-tailed Woodrat	Neotoma cinerea
Mule Deer	Odocoileus hemionus
Muskrat	Ondatra zibethicus
Townsend`s Big-eared Bat	**Plecotus townsendii**
Raccoon	Procyon lotor
Pacific Treefrog	Hyla regilla
Bullfrog	Rana catesbeiana
Northern Leopard Frog	**Rana pipiens**
Western Harvest Mouse	Reithrodontomys megalotis
Vagrant Shrew	Sorex vagrans
Nuttall`s Cottontail	Sylvilagus nuttallii
Western Terrestrial Garter Snake	Thamnophis elegans
Common Garter Snake	Thamnophis sirtalis