City of Millwood, Washington

Shoreline Cumulative Impacts Analysis

This report was funded in part through a grant from the Washington State Department of Ecology.

Contents

Tables & Figures 3
Section 1: Introduction 4
1.1 Introduction: 4
Section 2: Existing Conditions 6
2.1: Proper Functional Condition Rating 6
2.2 Spokane River Channel Migration and Floodplain 9
2.3 Aquifer Discharge/Recharge 11
2.4 Wetlands 11
2.5 Lakes and Reservoirs 12
2.6 Fish and Wildlife Habitat Conservation Areas 12
2.7 Identification and Characterization of the Local Fauna 12
2.8 Identification and Characterization of the Local Flora 14
2.9 Water Quality 15
2.10 Geologically Hazardous Areas 19
Section 3: Shoreline Land Use Patterns 20
3.1 General Land Use Patterns 20
3.2 Shoreline Land Use Patterns – By Environmental Designation 22
3.3 Shoreline Residential Environment (SRE) 23
3.4 Shoreline Industrial Environment (SIE) 25
3.5 Public Reserve Environment (PRE) 26
Section 4: Anticipated Development 28
4.1: Permit History, 1991-2011 28
4.2 Shoreline Residential Environment (SRE) 29
4.3 Shoreline Industrial Environment (SIE) 31
4.4 Public Reserve Environment (PRE) 32
Section 5: Protective SMP Provisions 33
5.1: Permit/Development Table 33
Section 6: Effect on Permitting of Other State and Local Agencies and Programs 36
6.1: Washington State Department of Fish and Wildlife 36
6.2: Spokane County Law Enforcement 36

6.3: Washington State Department of Ecology 37
6.4: United States Army Corps of Engineers 37
Section 7: Net Effect on Ecological Function 39
7.1: Findings 39
7.2 Conclusions 40
Section 8: References 42
Section 9: Appendices 44

Tables & Figures

2.1 WDFW Priority Species Distribution in Spokane County 13
3.1 Land Use Pattern for Western Shore 21
3.2 Land Use Pattern for Eastern Shore 22
3.3 Land Use Pattern by Environmental Designation 22
3.4 Impervious Surfaces in Shoreline Residential Environment 23
3.5 Impervious Surfaces in Shoreline Industrial Environment 25
3.6 Impervious Surfaces in Public Reserve Environment 26
4.1 Millwood Shoreline Permit History 1991 – 2011 27
5.1 Development Standards within Environmental Designations 32
6.1 River Widths within City Limits 35
7.1 Projected Impact of Development 38

Section 1: Introduction

1.1 Introduction:

The State of Washington Shoreline Master Program guidelines, chapter 173-26 WAC, require local Shoreline Master Plans (SMP's) to regulate new development to "achieve no net loss of ecological function." The Administrative Code further says:

> "When based on the inventory and analysis requirements and completed consistent with the specific provisions of these guidelines, the master program should ensure that development will be protective of ecological functions necessary to sustain existing shoreline natural resources and meet the standard. The concept of "net" as used herein, recognizes that any development has potential or actual, short-term or long-term impacts and that through application of appropriate development standards and employment of mitigation measures in accordance with the mitigation sequence, those impacts will be addressed in a manner necessary to assure that the end result will not diminish the shoreline resources and values as they currently exist. Where uses or development that impact ecological functions are necessary to achieve other objectives of RCW 90.58.020, master program provisions shall, to the greatest extent feasible, protect existing ecological functions and avoid new impacts to habitat and ecological functions before implementing other measures designed to achieve no net loss of ecological functions." WAC 173-26-201(2)(c)

To meet these requirements, the SMP contains goals, policies and regulations that seek to prevent degradation of ecological functions relative to a baseline condition as documented in the City's Shoreline Characterization and Analysis Report. In addition, where development results in a degradation of ecological functionality, the SMP requires mitigation and the result of that mitigation must provide a return to this baseline.

This analysis looks at the result of cumulative impacts to the shoreline ecology, due to development efforts both anticipated and unanticipated. In addition, current mitigation efforts sponsored by outside agencies are included in our evaluation. This informed viewpoint provides a yardstick for use when fine-tuning the regulatory efforts that appear in the SMP.

When evaluating cumulative impacts, the following factors are considered:

1. Current human factors and natural processes that currently effect the shoreline;

2. Reasonably foreseeable future development and the variety of uses that take place on the shoreline; and

3. Beneficial effects of any established regulatory programs already under way by other local, state and federal agencies.

This analysis is organized into the following sections:

- An overview of existing conditions on the City's shoreline;
- Current land use patterns sorted and examined by environmental designation;
- Anticipated development within the environmental designations;
- Regulatory protections built into the updated SMP;
- Jurisdiction of outside agencies that work with the City to protect the local environment; and
- A discussion of the expected net impact on ecological function.

Section 2: Existing Conditions

2.1: Proper Functional Condition Rating

This section is based on and expands on the information contained in the Millwood Shoreline Analysis and Characterization Report.

The northern boundary of Millwood is a Shoreline of Statewide Significance (per RCW 90.58.030(2)) on the Spokane River. After adoption, the updated SMP will govern activities along the shoreline, which is the northern boundary of Millwood, and the area two hundred (200) feet inland from the shoreline, as defined in SMP regulations (RCW 90.58.030(2)(d)(ii)).

An ecosystem-wide ecological process analysis of the Spokane River watershed, as it flows through Spokane County, was prepared by the Spokane County Conservation District (SCCD) in 2005. This report provides baseline data for Millwood's shoreline characterization. In the original report, Millwood's entire shoreline received the same ratings, which will be discussed below. While preparing Millwood's SMP update, the SCCD was asked to come back and update a portion of the original assessment, but on a focused area that encompassed only the southern shoreline of the Spokane River east of the Argonne Road Bridge to the eastern City limit. The character of the shoreline in the eastern half of the City is definitely different from that on the western half, as it has been left more to natural processes which is reflected in the character of the area. This reassessment was completed on December 8, 2011. Since very little had changed along the shoreline in the area west of the Argonne Road Bridge to the western City limit since the original report was completed, this area was not reassessed. Appendix 2 of this analysis presents a GIS map detailing the City's jurisdiction, including the 200' Shoreline Management Area.

The recent reassessment separated the Spokane River, as it passes by the City, into two (2) discrete segments, called reaches; one east of the Argonne Road Bridge and extending to the eastern boundary of Millwood, called Reach 7A, and one west of the Argonne Road Bridge that extended to River Mile 81.1, just downstream from the western boundary of Millwood, called Reach 7B. Please see Appendix 1 for river mile and reach identification.

The purpose of the SCCD assessment was to provide each segment of the river with a set of ratings that describe its current ecological condition:

- The first rating, called Proper Functioning Criteria (PFC), describes how close the current shoreline is to having a properly functioning ecological condition. The

PFC rating methodology is described in Technical Reference 1737-15, (USDI Bureau of Land Management, 1998).

The PFC methodology employs four (4) categories of river or stream functionality:

1. A Proper Functioning Condition designation describes a riparian area with adequate vegetation, landform, and large woody material present that can:
    a. Dissipate stream energy, reducing erosion and improving water quality;
    b. Filter sediment, capture bedload and aid floodplain development;
    c. Improve flood-water retention and ground-water recharge;
    d. Develop root masses that stabilize stream banks;
    e. Develop diverse channel characteristics to provide habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding and other uses;
    f. Support greater biodiversity.

2. A Functional-At Risk designation indicates a riparian area that is in a proper functioning condition, but an existing soil, water, or vegetation attribute now makes them susceptible to degradation during a high flow event.

3. A Non-Functional designation indicates a riparian area where there is not adequate vegetation, landform, or woody material to dissipate stream energy associated with a high flow event. The possibility for erosion is enhanced and the area's ability to filter and improve water quality is degraded.

4. Unknown.

- The second rating, called an Ecological Condition rating, includes three (3) categories which assess the diversity of the riparian landscape and whether it provides adequate food, cover, and reproductive habitat for wildlife.

Ecological Condition ratings include:

1. Good. Well connected, high quality habitats that support a diverse native plant community over at least ninety (90) percent of the reach;

2. Fair. Discontinuous habitats that support minimum assemblages of native or non-native plant communities over ten (10) to ninety (90) percent of the reach;

3. Poor. Little to no habitat continuity, usually due to human influences.

- A third rating, called a Restoration Potential rating, includes three (3) categories which measure the ability of the riparian area to naturally regenerate and reach its full potential, given no political, social, or economic constraints. Generally, this means reducing human influence and allowing natural resiliency to occur. Some restoration assistance may be necessary to raise the rating.

  Restoration Potential ratings include:

1. Good. Full restoration is possible if limiting factors were removed or moderated. Restoration assistance would accelerate recovery, but is not a necessity.

2. Fair. A moderate probability that full restoration is possible. Limitations may be due to natural conditions or the site requires restoration assistance.

3. Poor. Minimal probability that full restoration is possible, with or without restoration assistance.

As mentioned above, the portion of the Spokane River that flows through Millwood was assessed and inventoried by the Spokane County Conservation District in 2005 and again in December, 2011. This assessment separated the Spokane River into discrete segments (reaches) that exhibit similar habitat and functionality. Within our jurisdiction, the River east of the Argonne Road Bridge is identified as reach Seven A (7A) of the Spokane River. Reach 7A extends between River Mile eighty-three point four (83.4), six tenths (.6) miles downstream from the Centennial Trail Foot Bridge near Plantes Ferry and River Mile eighty-two point four (82.4), the eastern side of the Argonne Road Bridge. The River west of the Argonne Road Bridge is identified as Reach Seven B (7B), and extends between River Mile eighty-two point four (82.4) starting at the western edge of the Argonne Road Bridge and River Mile eighty one point one (81.1), one point three (1.3) miles downstream of the Argonne Road Bridge.

Reaches 7A and 7B are backwatered from Upriver Dam with a channel that is deep and slow moving. There is little sinuosity, meaning the channel does not change due to high-water events. The gradient is very low and erosion is low due to relatively slow water, except during spring runoff, and the existence of man-made structures for erosion control. However, erosion from boat wakes is a growing concern.

***

The Proper Functional Condition of reach 7A is assessed as Proper Functioning Condition.

The Ecological Condition of reach 7A is assessed as Fair to Good.

The Restoration Potential of reach 7A is assessed as Fair to Good.

***

The Proper Functional Condition of reach 7B is assessed as Functional-at-Risk, due to the number of bulkheads and lack of natural riparian vegetation. However, reach 7B includes long stretches of shoreline outside the Millwood City Limits, including much that is undeveloped.

The Ecological Condition of reach 7B is assessed as Poor to Fair.

The Restoration Potential of reach 7B is assessed as Poor to Fair.

2.2 Spokane River Channel Migration and Floodplain

Reach 7A: The primary land use east of the Argonne Bridge (Reach 7A) is industrial. All of the shoreline east of the bridge, to the eastern City limit, is owned by the Inland Empire Paper Company. Reach 7A is backwatered from Upriver Dam with a channel that is moderately to highly entrenched in a low sinuosity channel. There is little to no floodplain development. Due to the depth of the pool, the bed materials are unknown. The streambanks, excluding the boulders at the eastern end of the reach, are composed of unconsolidated, heterogeneous, non-cohesive materials. Because of the dams upstream and downstream, during periods of non-snowmelt, the current is slow and the sediment supply is low. Spring runoff, depending on the snow level in the Spokane River watershed, temporarily raises the speed and pool height of the river and temporarily increases the erosion of the streambanks. The channel is vertically and laterally stable and is comprised of a single deep pool.

Large woody debris is available on the southern bank of the river. The vegetation established on the bank is adequate to dissipate energy and protect the bank from erosion. The southern bank of the river has a fairly continuous dense bank of scrub shrub communities approximately eighty (80) feet wide on average. The bank contains a mix of black cottonwoods (*Populus trichocarpa*), Ponderosa Pine (*Pinus ponderosa*) and various willows. A row of mature golden willows is established on the bank along

the IEP property. IEP planted these trees decades ago. The width of the riparian area is reduced from its historic range. A service road runs the length of the reach approximately fifty (50) feet landward of the Ordinary High Water Mark (OHWM). A varied age class distribution is present within the vegetation on the southern bank. Natural recruitment of riparian vegetation is sporadic throughout the reach. Beaver activity has damaged some stands of cottonwoods. Knapweed is prevalent on the southern bank and above the service road.

The sinuosity (the quality of having bends or curves) for reach 7A is approximately one (1.0). Rivers with a sinuosity of 1.5 or less are considered straight. The sinuosity appears to be controlled by the entrenched stream channel, bedrock outcrops, and large boulder deposits. The gradient (the grade measured by the ratio of drop in a stream per unit distance, usually expressed as feet per mile) for the reach is approximately 0.00042. The width/depth ratio is low due to the impoundment of this reach from Upriver Dam.

Reach 7B: Reach 7B is also backwatered from Upriver Dam and the channel here is moderately to highly entrenched, with little to no floodplain development. Single Family housing, landscaped yards, and related bulkheads dominate the streambanks along this reach. The streambanks are composed of unconsolidated, heterogeneous, non-cohesive materials. Because of the dams upstream and downstream, the sediment supply is low, unless the streambanks are eroding. Several areas along the bank are primarily covered with manicured lawn grasses. Large woody debris is lacking, but because of the low water velocities for most of the year, the man-made structures along the banks are adequate to dissipate energy and protect banks.

The sinuosity for reach 7B is approximately one (1.0). This sinuosity is controlled by the entrenched stream channel and man-made bulkheads. The gradient for the reach is approximately 0.00042. The width/depth ratio is low, due to the impoundment of this reach from the dam downstream.

The majority of this reach lacks a vigorous native riparian plant community due to significant development of residential properties. Many of the riparian areas within the reach are reduced due to bulkheads at the shoreline and landscaping to the water's edge. As a result, the natural riparian area is considerably diminished in width. There are small pockets of intact riparian communities, but even these are subject to several escaped domestic plant species. The majority of the reach does not maintain sufficient riparian vegetation to protect banks and provide a source of large woody material.

The dominant tree and shrub species include black cottonwoods (*Populus trichocarpa*) and Ponderosa pine (*Pinus ponderosa*). Various willow species (*Salix spp.),* Douglas fir (*Pseudotsuga menziesii*), Japanese Elm (*Ulmus davidiana*), black locust (*Robinia*

pseudo-acacia), maple (*Acer spp.),* sumac (*Rhus glabra*), Sycamore (*Platanus occidentalis*), poplar (*Populus spp.),* blue elderberry (*Sambucus cerulea*), saskatoon serviceberry (*Amelanchier alnifolia*), Douglas hawthorn (*Crataegous douglasii*), common chokecherry (*Prunus virginiana*), wild rose (*Rosa nutkana*), common lilac (*Syringa vulgaris*) and Oregon grape (*Berberis repens*) are present on the site. Herbaceous species present include arrowleaf balsamroot (*Balsamorhiza sagitatta*), lupine (*Lupinus spp.),* and water iris (*Iris pseudacorus*).

2.3 Aquifer Discharge/Recharge

The Spokane River is located within, and is influenced by, the Spokane Valley-Rathdrum Prairie (SVRP) aquifer. From the source of the Spokane River, at the southern end of Lake Coeur d'Alene, to Latah Creek at the eastern edge of Spokane County, there are no other permanent tributaries providing input to the river system. There is, however, considerable interaction between the Spokane River and the aquifer. Please see Appendix 3 for a GIS map showing the geographical distribution of the SVRP aquifer across Washington and Idaho.

The SVRP aquifer begins in Idaho between Spirit Lake and the south end of Lake Pend Oreille. The aquifer flows south until it reaches the middle of the Rathdrum Prairie, where it turns west and flows through the City of Spokane Valley, the City of Millwood, and the City of Spokane. Most of the flow turns north near the western edge of the City of Spokane, flows through the Hillyard Trough, and then discharges into the Little Spokane River.

The Spokane River is the only watercourse over the SVRP aquifer that remains on the surface for any extended distance. The section of the Spokane River between Lake Coeur d'Alene and Flora Road, in the City of Spokane Valley and east of Millwood, contains a set of losing reaches, discharging water from the river into the aquifer. Between Flora Road and the Green Street Bridge in the City of Spokane west of Millwood, the river contains a set of gaining reaches, where the aquifer discharges water back into the Spokane River. The City of Millwood lies within this later section of water accumulation. It is estimated that "between the Trent Avenue and Green Street bridges, stream flow gains range from 260 cfs in November to 450 cfs in July." (Gearhart, 2001) These gains affect not only stream flow, but also water temperature, and water quality.

2.4 Wetlands

There are no wetlands, as listed on the National Wetland Inventory, mapped in the City of Millwood.

2.5 Lakes and Reservoirs

There are no designated lakes and reservoirs in the City of Millwood.

2.6 Fish and Wildlife Habitat Conservation Areas

In the City of Millwood's Critical Areas Ordinance (CAO), chapter 18.08 MMC, the City identifies the first 50 feet inland of the Ordinary High Water Mark (OHWM) of the Spokane River as a Critical Fish and Wildlife Habitat area buffer and presents goals for the protection of habitat within this area. This same area is identified within the SMP, for all environmental designations, as the Minimum Native Conservation Area.

The following goals are included in the CAO:

- Conserve fish and wildlife habitat areas for the management and maintenance of fish and wildlife resources as the City recognizes the role these areas play in the local ecosystem.

- Conserve fish and wildlife habitat areas for public health, safety and well-being and the aesthetic value they bring to the community.

- Ensure that priority fish and wildlife species, as identified by the Washington Department of Fish and Wildlife, and species of local importance, do not become increasingly imperiled due to land use changes, habitat alteration, and other human activities.

The Spokane River contains fisheries and spawning areas that are important for maintaining and protecting unique or locally significant fish populations, including interior redband trout, cutthroat trout, and mountain whitefish. Spawning areas for redband trout were identified in the 2003 Avista studies at Sullivan Road and the Spokane River Centennial Trail (SRCT) Bridge. The gaining reaches of the river below Sullivan Bridge are considered critically important for the survival of salmonids in the river system.

2.7 Identification and Characterization of the Local Fauna

Wildlife along the Spokane River, as observed during the Spokane County Proper Functioning Condition study, included red-winged blackbirds, mallards, common mergansers, dipper, Canada geese, mourning doves, goldfinch, magpies, red-tailed hawks, coyote, and beaver activity. Residents along the river have reported seeing bald eagles, osprey, pheasant, deer, moose, rabbits, beaver, skunk, raccoon, mink, river otters, and many seasonal and year-round bird populations.

The Washington State Department of Fish and Wildlife publishes a Priority Habitats and Species (PHS) list. This list contains a catalog of species considered to be priorities for conservation and management in Spokane County. Many of these species are found in the Millwood area. Please see Table 2.1 below for this list.

Table 2.1: WDFW Priority Species Identified in Spokane County

Life Form	Species
Fish	Kokanee
	Rainbow Trout/Steelhead/Inland Redband Trout
	Westslope Cutthroat
	Brown Trout
	Largemouth and Smallmouth Bass
	Eastern Brook Trout
Amphibian	Columbia Spotted Frog
	Northern Leopard Frog
	Western Toad
Birds	American White Pelican
	Western Grebe
	E WA breeding concentrations of Grebes, Cormorants
	E WA breeding Terns
	Great Blue Heron
	Cavity-nesting ducks: Wood Ducks, Barrow's Goldeneye, Common Goldeneye, Bufflehead, Hooded
	Tundra Swan
	Waterfowl concentrations
	Bald Eagle
	Golden Eagle
	Merlin
	Northern Goshawk
	Prairie Falcon
	Dusky Grouse
	Peregrine Falcon
	Sandhill Crane

	Upland Sandpiper
	E WA breeding occurrences of: Phalaropes, Stilts and Avocets
	Yellow-billed Cuckoo
	Burrowing Owl
	Flammulated Owl
	Vaux's Swift
	Black-backed Woodpecker
	Lewis' Woodpecker
	Pileated Woodpecker
	White-headed Woodpecker
	Sage Thrasher
Mammals	Merriam's Shrew
	Preble's Shrew
	Roosting Concentrations of: Big-Brown Bat, Myotis Bats, Pallid Bat
	Townsend's Big-eared Bat
	White-tailed Jackrabbit
	Martin
	Wolverine
	Moose
	Northwest White-tailed Deer
	Elk
	Rocky Mountain Mule Deer
Invertebrates	Giant Columbia River Limpet
	Great Columbia River Spire Snail
	California Floater
	Silver-bordered Fritillary

Source: Washington Department of Fish and Wildlife

The Washington State Department of Fish & Wildlife performs physical surveys of nesting areas, breeding areas and priority habitats for both protected and non-protected species on a regular basis. The most recent update for our area was completed in 2011 and within the Millwood City limits, at this time, there are no designated priority habitat breeding areas.

2.8 Identification and Characterization of the Local Flora

Plant associations along the Spokane River provide food and cover for many of the different species listed above. Natural plant assemblages and growing conditions are different, depending on which bank of the river they appear. The Spokane River generally runs from east to west through the City of Millwood. The south-facing banks

receive more afternoon sun; this results in a different microclimate and plant association on that side of the river. This north side of the river, where it has not been impacted by urban development, tends to contain more dry-tolerant vegetation than the southern side. The bank we are concerned with, the south side of the river, retains moisture somewhat better and native vegetation is typically denser, providing better cover for wildlife and birds.

Some of the most beneficial plant associations for supporting a wide variety of shade and cover for fish and wildlife in the Millwood area include those containing:

- Quaking Aspen
- Common Chokecherry
- Common Snowberry
- Water Birch
- Willows
- Douglas Fir
- Black Cottonwood
- Ponderosa Pine
- Saskatoon Serviceberry

2.9 Water Quality

Water quality in the Spokane River is a result of natural influences, such as the aquifer interchange, and man-made influences from upstream, such as mining and logging, point source effluents, combined sewer outflows, and stormwater discharge.

The Federal Clean Water Act (33 U.S.C. §1251 et seq.), adopted in 1972, requires that all states restore their waters to be "fishable and swimmable." Pursuant to this act, the State of Washington's Water Quality Assessment process maintains a list of the water quality status for water bodies in the State. This assessment meets the federal requirements for an integrated status report under Sections 303(d) and 305(b) of the Federal Clean Water Act.

The portion of the Water Quality Assessment called the 303(d) list, as described in Section 303(d) of the Federal Clean Water Act, indicates waters deemed to be polluted. In other words, the water bodies that appear on the 303(d) list fall short of State surface water quality standards. The Spokane River is on the State of Washington's Impaired Waters list as well as the Federal 303(d) list. "The last comprehensive freshwater and marine water 303(d) list for Washington State was prepared in 2008. Listing updates

are now staggered, with the marine list completed in 2010 and the freshwater list scheduled to be completed again in 2012. The next opportunity to evaluate compliance with water quality standards in the Spokane River will be in 2012". (Serdar, et al, 2011)

The primary pollutants affecting water quality in the Millwood area include:

- **Heavy Metals:** Sediments in much of the Spokane River are contaminated with metals that resulted from mining and milling activities in the Coeur d'Alene Basin and from industrial activities along the river. Spokane sediment, water and fish samples have detectable concentrations of arsenic, cadmium, copper, lead, nickel, mercury, and zinc. Metal concentrations are present all along the river and "their incidence generally increases during high spring flows". (USGS 1998) This contamination impacts safe public use of the river and its shorelines. Due to sediment deposits, the Washington Department of Health (WDOH) and the Spokane Regional Health District (SRHD) has issued an advisory to reduce recreational exposure to shoreline sediments.

  In May 1999, The Washington State Department of Ecology initiated a program to try to stop further pollution of the Spokane River from heavy metals. The process began with testing for metals that already exist in the river. This testing was followed with cleanup of selected beaches along the river, including the beach on Donkey Island, where the metals had settled out in amounts high enough to threaten human health. While several areas have already been cleaned up, more cleanups are planned.

- **Polybrominated Diphenyl Ethers (PBDEs.)**

  PBDEs are chemical additives used in everyday household products as fire retardants. Studies indicate that PBDEs build up over time in people's bodies, in the bodies of local animals, and in the environment. Identifying the sources of the PBDE contamination is a high priority for Ecology. Once sources are located, measures can be taken to control them.

  Testing of fish bodies, including rainbow trout and largescale sucker samples from Plante's Ferry (River Mile 84, or half a mile above Millwood's eastern City limit), has found unusually high amounts of PBDEs, as compared to similar fish studies in the rest of the State. As stated in a recent Ecology publication, "In 2005, Ecology conducted a statewide PBDE survey along with a more intensive study of fish tissues from 6 reaches of the Spokane River. Results from these studies have identified the Spokane River as having the highest PBDE levels in

both water and fish tissue samples statewide. Currently, sources and causes of elevated PBDE concentrations in the Spokane River are unknown." (Furl & Meredith, 2010)

PBDE concentrations grow in intensity as the Spokane River flows west from Idaho, through Spokane County. "The highest PBDE concentrations in Ecology's study were found in the three furthest downstream reaches of the river, particularly the Nine Mile stretch. Concentrations in largescale suckers display an increasing trend from the Idaho border through Mission Park." (Furl & Meredith, 2010)

- **Dioxins and Furans.**

  Dioxins and furans are the shortened names for a group of harmful by-products that are created when other chemicals or products are made. Some of the chemicals that produce dioxins and furans include herbicides and products in the pulp and paper industry. They can also be produced when such materials as municipal waste, sludge, medical waste, and wood are burned. Nationwide, dioxins and furans are ubiquitous, and have been found in the air, soil, sediment and human food supply.

- **Polychlorinated Biphenyls (PCBs.)**

  Sediment and fish testing along the Spokane River has found high amounts of PCBs. Similar to PBDS's, "total PCB concentrations in water increased with successive reaches moving downstream from the Idaho border (106 pg/l, parts per quadrillion) to lower Lake Spokane (formerly Long Lake; 399 pg/l)." (Serdar, et al, 2011) PCBs get into the Spokane River through industrial discharges, wastewater treatment plants, airborne particulates, and storm water. At this time, we have not identified where all the PCBs are coming from. Businesses along the river, conservation groups, and tribal members, have recently teamed together to work with Ecology to locate the sources or processes that are moving PCB's into the waterway.

  One successful remediation effort has been the removal of contaminated soils at the Kaiser Trentwood plant in the Spokane Valley. This has reduced PCB concentrations in water leaching into the soil at the Trentwood location, and then reaching the Spokane River. In January 2012, the Kaiser Trentwood plant announced plans for an additional $16 million cleanup plan. Kaiser will remove additional top soil, or cap polluted areas, to halt the absorption of precipitation

which leaches pollutants into the aquifer. Ecology is overseeing this contamination reduction plan.

In addition, the Inland Empire Paper Company (IEP) has taken major steps to reduce the small amount of PCB's in the effluent from the mill. IEP uses recycled paper as a major component in its paper-making process. PCB's, though not produced any longer in the United States, are found in small quantities in the inks that are used on the recycled paper. IEP's existing treatment process results in significant removal of the PCB's found in these inks. Currently, the mill is testing new technologies that will further enhance treatment efforts in 2012. These efforts will push the limits for removal of ever smaller particles from the environment.

"Based on the elevated PCB and lead levels in Spokane river fish, the Washington State Department of Health and the Spokane Regional Health District issued a public advisory in 2003 to avoid or limit consumption of fish in parts of the Spokane River. The health departments later concluded that the above mentioned advisory would also be protective for PBDEs. The latest advisory, updated in April 2008 based on fish tissue samples" (Serdar, et al, 2011) recommends that one not consume any species of fish removed from the Spokane River from the Idaho border to Upriver Dam.

- **Municipal wastewater from upstream dischargers.**

  Municipal discharges from Liberty Lake, Hayden, Post Falls, and Coeur d'Alene add nutrients such as phosphorus and nitrogen into the Spokane River. Kaiser Aluminum and Inland Empire Paper Company also discharge wastewater into the Spokane River. All of the above entities work closely with Ecology and other State agencies, to reduce nutrient loading in the Spokane River.

- **Non-point source contributions including septic tank effluent and urban stormwater runoff.**

  The Spokane County sewer projects for the Spokane Valley are almost complete with the following areas scheduled to be completed in 2012:

  - West Farms
  - South Greenacres Phase 3
  - South Greenacres Phase 4
  - Corbin

- Cronk
- Green Haven
- Micaview

Increased urbanization of the Spokane Valley results in increased impervious cover. This cover results in increased stormwater runoff and insertion of pollutants from lawn care and automobiles into the river and aquifer.

Along with the substances listed above, the 303d report also tracks water temperature, dissolved oxygen levels, ammonia levels and pH.

2.10 Geologically Hazardous Areas

Geologically hazardous areas in Millwood are limited to shore-side slide hazards due to erosion and steep banks within the Shoreline Management Area. Erosion and/or landslide hazard areas in Millwood contain at least one of the following characteristics:

- Slopes of 30% or greater.
- Soils identified by the Natural Resource Conservation Service as having a severe potential for erosion.
- Unstable areas, as a result of rapid stream or stream bank erosion.

According to the National Resource Conservation Service, the soils in Millwood, detailed in the Soils Report in Appendix 4, consist of:

- 86 %, type GgA, Garrison gravelly loam on 0-5% slopes
- 5%, type GgB, Garrison gravelly loam on 5-20% slopes
- 1.1%, type GmB, Garrison very gravelly loam, on 0-8% slopes
- 7.9% water

Section 3: Shoreline Land Use Patterns

3.1 General Land Use Patterns

The Comprehensive Plan for the City of Millwood provides land use and zoning regulations for the City. Land use and zoning regulations manage the types of uses that will appear in a specific area, along with height, setback and size limitations. In addition, the SMP partners with land use and zoning regulations to manage the activities that impact the Shoreline Management Area.

This section of our analysis will discuss the current contents of the Shoreline Management Area. Like before, we will break the area into two sections, one east of the Argonne Road Bridge and one west of the bridge. Along the Spokane River, the primary land use west of the Argonne Bridge to the western City boundary (Reach 7B) is composed of single-family and multi-family residential parcels. The primary land use east of the Argonne Bridge (Reach 7A) is industrial. All of the shoreline east of the bridge, to the eastern City limit, is owned by the Inland Empire Paper Company.

West of the Argonne Road Bridge: West of the bridge, there are thirty-six (36) residential parcels that reside wholly or partially within the 200 foot Shoreline Management Area. Twenty-seven (27) parcels touch the shoreline. Of these parcels, one (1) parcel is multi-family, with a six (6)-unit apartment building, and twenty-three (23) parcels contain single family residential units. The 27 residential parcels on the shoreline stretch for two thousand six hundred seventy two (2,672) feet of frontage. Currently, three (3) of the residential parcels along the shore are vacant. In addition, within the shoreline management area west of the Argonne Road Bridge, there are three (3) City easements: one of 15' width corresponding to an alleyway east of Marguerite Road; one of 20' width at the end of Dale Road; and one of 40' width at the northern end of Sargent Road. Each easement projects the terminus of a street or alleyway to the water.

Except for in the largest City easement, there has been limited casual public access to the river west of the Argonne Bridge. In this 40' easement, since the 1950's, there has traditionally been neighborhood access to the shoreline. There is no dock at this location. There is evidence of erosion within this easement area as the public has made a serpentine path down the bank to the river. Along with the path, native and non-native vegetation has been trimmed to maintain river views. The easement is the only the only location in Millwood where residents enjoy open views of the river. In mid 2011, the City contacted the Spokane County Conservation District for help with planning efforts that would provide protection to the bank from further erosion while

providing citizens with a usable pathway to the water. In 2012, the Department of Ecology located the OHWM within the easement area and consulted on ideas for improving water access. Volunteers have built a path of locally obtained shale rock.

Every residential parcel, except for the two contiguous vacant ones, currently includes at least a path through the Minimum Native Conservation Area, some form of bank hardening, or a dock along the shoreline. Most residential parcels employ all three.

The square footage of the residential parcels, plus the three City easements that are within the 200 foot Management Area comprises 11.39 acres of land. Table 3.1 describes how that land is currently being used. This area is completely urban, with 97.9% of the area in Medium and High Density Housing on lots of 7,200 square feet or larger.

Table 3.1: Land Use Pattern for Western Shore

Zoning	Acreage	Percentage
UR-2, Medium Density Residential	10.57	92.9%
UR-3, High Density Residential	.60	5.2%
City Easements	.22	1.9%
Total Acreage	11.39	100.00%
Impervious Surfaces	Acreage	Percentage
Rooftops	1.82	15.94%
Pavement	0.90	7.93%
Roadway	0.49	4.28%
Total Impervious Space	2.54	28.15%

Source: Spokane County Assessor

East of the Argonne Road Bridge: East of the bridge, there are five (5) large industrial parcels, small portions of five (5) residential parcels, and a small portion of abandoned Union Pacific Railroad right-of-way that are located within the 200 foot Shoreline Management Area. The rails have been removed from the abandoned right-of-way. Four (4) large parcels, all zoned industrial, touch the shoreline. The industrial parcels all belong to the Inland Empire Paper Company. The residential parcels that partially enter the Shoreline Management area are zoned low density single family. There are four thousand six hundred eighty two (4,682) feet of frontage from the Argonne Road Bridge to the eastern City boundary.

East from the Argonne Road Bridge, industrial activity is heavy for approximately the first two thousand three hundred fifty (2,350) feet of the shoreline. Today, the remaining two thousand three hundred thirty two (2,332) feet of shoreline is mostly fallow and contains gravel roadways parallel to the shore. This area has historically been actively used by the Inland Empire Paper Company for the storage of logs. Since at least 1992, photographs of the city show that heavy industrial use has ceased in this area and the

land has been left fallow. Along the entire section, the banks are not hardened and they contain mature trees and grasses. There is no authorized public access to the river east of the Argonne Bridge, to the City limits.

The square footage of the residential and industrial parcels on the east side, plus the small piece of Union Pacific right of way, comprises 21.98 acres of land. Table 3.2, describes how that land is currently being used. This area is predominantly industrial, comprising 97.2% of the area.

Table 3.2: Land Use Pattern for Eastern Shore

Zoning	Acreage	Percentage
I-2, Industrial	21.36	97.2%
UR-1, Low Density Residential	.22	0.9%
Abandoned RR Right of Way	.41	1.9%
Total Acreage	21.98	100.00%
Impervious Surfaces	Acreage	Percentage
Rooftops	2.40	10.90%
Pavement	2.10	9.54%
Roadway	0	0
Total Impervious Space	4.50	20.44%

Source: Spokane County Assessor

3.2 Shoreline Land Use Patterns – By Environmental Designation

If we look at the amount of land within each of the Environmental Designations, as detailed in Table 3.3 below, we find that over 65% of the acreage within the Shoreline Management Area lies within the Shoreline Industrial Environmental Designation. The Shoreline Industrial Environmental Designation encompasses the area within Reach 7A. This Reach has a shoreline area with a Proper Functional Condition, an Ecological Condition of Fair to Good, and a Restoration Potential of Fair to Good. Since this area carries the highest ecological ratings in the City, care will have to be taken in this environment to provide the necessary levels of mitigation and restoration.

Table 3.3: Land Use Pattern by Environmental Designation

Environmental Designation	Waterfront Length	Percent of Total Shoreline Frontage	Acres in Shoreline Management Area	Percent of Total Shoreline Area
Shoreline Residential	2,672 Feet (0.51 Miles)	35.9%	11.39 Acres	34.1%
Shoreline Industrial	4,682 Feet (0.89 Miles)	63.0%	21.77 Acres	65.2%
Public Reserve	75 Feet (0.01 Miles)	1.1%	.22 Acres	.7%
Totals	**7429 Feet (1.41 Miles)**	**100%**	**33.38 Acres**	**100%**

Source: City of Millwood

3.3 Shoreline Residential Environment (SRE)

Approximately 36% of the Shoreline Management Area is in the Shoreline Residential Environmental designation. Due to the number of existing bulkheads and lack of natural riparian vegetation, this area rates poor to fair in ecological condition and restoration potential.

The shoreline area covered by this environmental designation is residential. It is largely developed, with only three (3) vacant parcels. As shown below, in Table 3.4, approximately 27% of the area is covered by impervious surfaces. This is well within the 35% maximum that exists in the local zoning regulations. It is expected that expansion, redevelopment or alterations to existing single-family units will occur over time.

Table 3.4 below, also includes, in the "Landward from OHWM" column, the approximate distance landward from the OHWM to where the first impervious surface is encountered. The mean distance between the OHWM and the nearest impervious surface is approximately seventy (70) feet. The Minimum Native Conservation Area setback in this environment is fifty (50) feet, leaving room for lawn areas for most of the current residences. Only four (4) current residences encroach into the 50 foot natural area.

Table 3.4: Impervious Surfaces in Shoreline Residential Environment

Parcel Numbers	Square Feet Lot	Square Feet Roof	Square Feet Paving	Square Feet Road	Landward from OHWM

45064.0701	24,490	4,336	5,793	0	68
45064.0702	17,184	1,544	1,167	0	119
45064.0703	11,675	3,606	752	0	91
45064.0704	15,358	2,604	593	610	98
45064.0705	29,801	2,764	0	1,550	73
45064.0706	11,907	0	0	0	Vacant
45064.0708	14,158	3,209	75	853	58
45064.0709	14,614	2,404	1,235	118	58
45064.0026	20,044	2,647	0	0	48
45064.0023	11,000	2,338	0	0	32
45064.0022	19,840	1,989	6,181	0	43
45064.0071	21,350	4,272	1,062	1,022	75
45064.0051	19,191	1,905	1,453	0	69
45064.0101	17,550	3,551	1,344	60	51
45064.0102	14,959	3,025	1,246	4,579	52
45064.0103	15,408	1,506	885	2,285	78
45064.0104	17,107	2,930	467	2,901	80
45064.0105	13,683	2,265	704	1,356	112
45064.0106	17,478	3,370	1,144	441	100
45064.0053	12,298	3,951	1,874	271	66
45064.0054	10,454	2,711	3,074	0	44
45064.0055	11,879	4,159	2,777	0	56
45064.0057	8,604	2,627	2,459	0	73
45064.0058	9,327	2,428	1,473	0	76
45064.0059	10,720	0	0	0	Vacant
45064.0060	11,326	0	0	0	Vacant
45064.0061	42,435	4,941	2,396	0	63
45064.0205	303	0	0	0	No Shoreline
45064.0204	1,132	0	105	0	No Shoreline
45064.0203	2,199	66	308	0	No Shoreline
45064.0202	3,648	1,171	245	0	No Shoreline
45064.0201	4,554	1,197	0	0	No Shoreline
45064.0052	12,710	2,290	0	0	No Shoreline
45064.0019	7,266	1,393	535	796	No Shoreline
45064.0022	3,916	920	0	534	No Shoreline
45064.0025	6,472	1,001	0	0	No Shoreline
45054.0308	470	0	0	0	No Shoreline
45054.0325	2,152	0	0	0	No Shoreline
45054.0310	2,088	0	0	0	No Shoreline
45054.0311	2,216	0	0	0	No Shoreline
45054.0312	2,454	0	0	0	No Shoreline

Total Area	505,729	79,120	39,347	17,376	1,683
Percentages		15.6%	7.8%	3.4%	70.13 Mean

Source: City of Millwood

Of the twenty-seven (27) shoreline properties in the Shoreline Residential Environment, fourteen (14), or just over half, are armored at the shoreline. Nineteen (19) of the properties have docks.

There are three parcels that are vacant, all on the shoreline. It is expected that these will be developed into single-family residences within the life of this plan.

Per the UR-2 Residential zoning regulations, there is only one sub-dividable lot within the SRE environment. However, the home that is on the parcel would have to be removed first, so the City does not expect that this subdivision will happen within the life of this plan.

3.4 Shoreline Industrial Environment (SIE)

Almost two-thirds of the shoreline area within the City of Millwood is included in the Shoreline Industrial Environmental designation. The results of the December 2011 shoreline condition analysis show that this area rates fair to good in ecological condition and restoration potential.

Table 3.5: Impervious Surfaces in Shoreline Industrial Environment

Parcel Numbers	Square Feet Lot	Square Feet Roof	Square Feet Paving	Landward from OHWM
45453.0001	542,026	101,496	88,000	51
45053.0002	6,880	2,884	3,326	48
45054.0201	146,082	0	0	
45054.0210	155,699	0	0	
45054.0306	79,830	0	0	
RR ROW	17,707	0	0	
Total Area	948,224	104,380	91,326	99
Percentages		11.0%	9.6%	Mean 49.5

Source: City of Millwood

The shoreline area covered by this environmental designation is entirely industrial. It is heavily developed within the western two parcels, but mostly fallow in the eastern half. The two easternmost parcels include tall, steep banks and steep slopes rising to the abandoned Railroad Right-of-Way. As shown above, in Table 3.5, approximately 21%

of the area is in impervious surfaces. This is well within the 35% maximum included in the zoning regulations for this area. It is expected that expansion, redevelopment or alterations to the existing mill will occur over time.

Also shown in Table 3.5, is the distance landward from the OHWM to where the first impervious surface is encountered. There is a paved road shoreward from the westernmost parcels. This is where the measurement to the OHWM extends. The mean distance between the OHWM and the nearest impervious surface in these parcels is approximately fifty (50) feet. The Minimum Native Conservation Area in this environment is fifty (50) feet.

There is no armoring on the shoreline east of the Argonne Road Bridge, although there is a small, over-water structure that contains a pump house for fire protection, approximately six hundred eighty (680) feet east of the bridge.

Per the I-2 Industrial zoning regulations, all of the parcels within the SIE environment are sub-dividable. Since the area is owned by a single entity, and this entity uses the area to support industrial operations, sub-division of the parcels included makes no sense. Per zoning regulations, the land cannot be used for any other purpose than support of Paper and Pulp manufacturing.

3.5 Public Reserve Environment (PRE)

Just over one (1) percent of the shoreline area within the City of Millwood is included in the Public Reserve Environmental designation. All of the land within this environmental designation is made up of street or alley ends that contain City easements. All three easements are west of the Argonne Road Bridge, interspersed within the Shoreline Residential Environment. These easements are the most natural areas of a shoreline that rates poor to fair in ecological condition and restoration potential.

As shown in Table 3.6, the distance to the nearest impervious surface in two of the easements is the distance from the road end to the OHWM. In the third easement, the distance listed is measured to a covering for a sewage lift station. The square footage totals for paving measure the road ends back to the 200' line.

Table 3.6: Impervious Surfaces in Public Reserve Environment

Parcel Numbers	Square Feet Lot	Square Feet Roof	Square Feet Paving	Landward from OHWM
45064.0706 (A)	2,350	0	1,456	157

45064.0059 (B)	2,700	0	0	102
45064.0060 (C)	5,259	0	2,399	83
Total Area	10,309	0	3,855	342
Percentages		0.0%	37.4%	114 Mean

Source: City of Millwood

There is no armoring on the shorelines within the Public Reserve environment.

Since the City easements are the only public access points to the Spokane River, light development is expected. There currently is a rough foot path to the water in easement C and there is a desire to request grant money to help create a more easily usable path to the river here.

None of the easements contain a parcel number, and none are divisible into smaller sections.

Section 4: Anticipated Development

4.1: Permit History, 1991-2011

In order to gauge the intensity of probable future development, we look to the past. A study of the permitting records for the City of Millwood, from 1991-2011, is presented in table 4.1 below. When reading the table, be aware that the permit counts do not match in all cases, since multiple permits may have been issued for any specific project. Hence, this summary table slightly underestimates historic shoreline activity. In addition, a number of exemptions, not included in the summary table, have been issued.

Table 4.1: Millwood Shoreline Permit History, 1991 – 2011

				Permit Types - Millwood					
Year	Dock	Bulkhead	Upland Structure	Building	Substantial Development	Conditional Use	Variance	No Permit	External Permit
1991			3	7					
1992	1		4	9					1
1993	1		2	4					
1994	3		5	10					
1995			3	5	1				
1996			1	2					1
1997	2	1	2	2	1			1	
1998			2	4	3				
1999			1	3	1				
2000		1	6	10	1			1	
2001	1		1	2					
2002			2	3			2		
2003			1	2					
2004	1	1	3	5	1				1
2005			2	3			1		
2006									
2007				2			1		
2008			2	2					
2009		1	1	4					1
2010				1					
2011			2	3					
Totals	**9**	**4**	**43**	**83**	**8**	**0**	**4**	**2**	**4**

Source: City of Millwood

There are few trends immediately apparent;

1. One definite trend, in the Shoreline Residential Environment, is that when a new single family structure is built on the shoreline, permitting for a dock and some form of shoreline armoring has followed closely. New shoreline regulations will make sure that standard suburban landscaping will not extend into the 50" area shoreward from the OHWM and natural plantings currently in place will be protected. In addition, every effort will be made to employ a bioengineered system for protecting the shoreline from wave action instead of a concrete wall.

2. When an existing home is sold, requests for permits for building, dock, and bulkhead updates usually follow quickly. Since the Master Program is not a retroactive instrument, efforts to restoration of degraded ecological functionality will rely on incentives from the City, and as maintenance efforts and new development is permitted on these properties, current SMP regulations will apply.

4.2 Shoreline Residential Environment (SRE)

The nature of the Shoreline Residential Environment is not expected to change over the next 20 years. The area is made up of single-family homes, plus one multi-family building next to Argonne Road. Periodic home upgrades and expansions are expected. As older homes sell, they are generally updated and expanded. Outdoor amenities, including paths to the water and docks are generally updated as sales occur.

Currently, there is no public boat launch along the Spokane River with access to the pool surrounding Millwood. With the closing of the Upriver Dam boat launch to new riverfront home owners after February 1, 2011, over time there will be fewer home owners keeping power boats on the river. For the time that this situation continues, the number of dock additions and expansions in the City will be limited and a slow decrease in the amount of erosion via wave action should occur along the City shorelines. The City does not expect that the current power boat launching restriction will be a permanent situation, but the restriction is in effect at this time. A local homeowners association is working with Spokane Airport to allow all local homeowners to use the floatplane launch ramp at Felts Field.

Development is expanding east of Millwood in the Coyote Rock area. Land has been parceled in the City of Spokane Valley for a 250 home subdivision along the Spokane River that includes 30 waterfront lots. Approximately 30 new docks are also planned. If

all of the parcels were allowed a dock and a public launch was built, boat traffic would increase significantly within the pool that fronts the Millwood area.

There are currently three vacant parcels in the Shoreline Residential Environment. Within the next 20 years, it is expected that these parcels will be developed. Development of new residential parcels results in replacement of pervious, vegetated areas with impervious surfaces. In addition, with new development we can expect a new landscaping regimen, including periodic chemical lawn treatments, increased outdoor lighting, a path or paths cut through the riparian vegetation to the waterfront, and the installation of stairs, docks and shoreline armoring.

As new development occurs in the SRE, we expect:

- Increased surface water runoff due to reduced infiltration area;
- Increased percentages of impervious surfaces;
- Reduction in the ability of the site to improve the quality of the water passing through vegetation;
- Potential contamination of surface water from chemical and nutrient application; and
- Elimination of some upland habitat.

Although the development of three fallow parcels on the shoreline is unlikely to change the baseline ecological functioning of the entire environmental designation, increases in impervious surfaces, and the uses these surfaces are put to, are potentially detrimental. Single-family and multi-family homes generally have clean roof and sidewalk runoff. However, most single-family homes contain between two and four vehicles and oils from these vehicles can provide a significant avenue for pollution.

On the positive side, new development after adoption of the updated SMP will maintain a full width Minimum Native Conservation Area. In previous years, large portions of this area would have been used for lawn or other non-native landscaping.

On the waterfront lots in the SRE, the median distance between the OHWM and the nearest shoreward impervious surface is approximately 75 feet. The SMP proposes a Minimum Native Conservation Area of 50 feet. The conservation area is set aside for natural vegetation and minimum impervious surfaces. A pervious path to the water, through the setback area, is allowed for shoreline access. Since the majority of parcels

currently have lawn in the proposed setback area, there is a ready supply of land that can be used for mitigation.

4.3 Shoreline Industrial Environment (SIE)

The SIE is evenly split today between heavy industrial use and fallow ground. Procedures already undergoing testing to meet future effluent treatment restrictions will expand the heavily industrialized portion further east into currently empty ground. The development most likely to occur first in the eastern half of the SIE will be an expansion of IEP's wastewater treatment system to comply with more stringent effluent limitations that requires the mill to have new phosphorus treatment technology installed and operational by November 1, 2018. The magnitude of this equipment will require installation into the undeveloped eastern half of the SIE. Even after this expansion, the industrialized area will still fit within the Millwood City boundaries.

Periodic equipment and process upgrades and expansions are expected as the plant continues to modernize and the need for additional equipment increases. Approximately half of the permitting activity shown in Table 4.1 comes from expansion and modernization at the Inland Empire Paper mill. In this environmental designation, there are only two active in-water structures along the shoreline, a pump house and outfall piping.

Today, approximately half of the Shoreline Industrial Environmental Designation is fallow. Across the western half, which is heavily industrial, there is a paved road approximately 50 feet landward from the OHWM. Across the eastern half, there is a single lane gravel road approximately 50 feet shoreward from the OHWM with spurs for inland access to previously graded areas. These areas were once used to store logs, which were chipped on site for paper production. There were also rail lines within the area for the delivery of the logs.

New development in the eastern half of the Shoreline Industrial Environment may lead to the replacement of pervious, vegetated areas with impervious surfaces. The preference for any new use along the shoreline is given first to water-dependent purposes, then to water-related and water-enjoyment purposes. Because of this direction, we have to expect that some form of access to the shoreline will accompany development. Similar to expanded development in the Shoreline Residential Environment, we can expect new landscaping regimens, increased outdoor lighting, paths cut through the riparian vegetation to the waterfront, and the installation of structures, stairs, docks and shoreline armoring.

4.4 Public Reserve Environment (PRE)

The PRE consists of three City easements with a total size of 10,309 square feet (.24 acre). Each easement is the continuation of a street or alley end and each easement contains a City utilities. Due to the existence of City utilities, we will continue to see routine maintenance activity in all easement areas. All three easements touch the shoreline and the largest one contains a rough path to the water that is used as a canoe and kayak launch point. There are no docks or shoreline armoring within the PRE.

As these easements are the only public points of access to the shoreline, the potential for some form of development is high. This development would have to be grant driven, as the City has no budgeted plans to develop these properties.

Section 5: Protective SMP Provisions

5.1: Permit/Development Table

The major classification scheme, and the vehicle for all protective regulations in the SMP, is the Environmental Designation. There are three environments recognized in the SMP for Millwood. The table below reorganizes the information provided in MMC 18.16.330 into a hierarchy of high-impact to low impact use types.

For each use type, individual practices are marked either as prohibited (X); as requiring a Shoreline Substantial Development permit (SD); or as requiring a Shoreline Conditional Use permit (CU). The most restrictive response to development requests, of course, is the indication that the use is not allowed at all. The least restrictive is a written shoreline exemption. (See RCW 90.58.030 for the list of exemptions). Both SMP regulations and zoning regulations are reflected in the level of allowance for uses in the table below.

Table 5.1: Development Standards within Environmental Designations

Key: E = Exemption SD = Substantial Development CU = Conditional Use X = Prohibited and not eligible for a Variance or Conditional Use Permit	Public Reserve	Shoreline Residential	Shoreline Industrial
Resource Land Uses			
Forest Practices	X	X	SD
Mining	X	X	X
Commercial Uses			
Water-Dependant Uses			
Marina	X	X	X
Floating Boathouse	X	X	X
Dock for Permitted Water-Dep. Use	X	X	SD
Boat Launch – Motorized craft	X	X	SD
Boat Launch – Non-motorized	X	X	SD

craft			
Water Dep. Industrial Uses	X	X	SD
Water Dep. Institutional Uses	X	X	SD
Water Dep. Recreational Uses	X	X	SD
Parking Acc. To Permitted Use	X	X	X
Water-Related and Water-Enjoyment Uses			
Water Rel. Industrial Uses	X	X	SD
Water Rel. Institutional Uses	X	X	SD
Water Rel. Recreation	X	X	SD
Water Enj. Recreation	X	X	SD
Dock for Public Access	X	X	SD
Parking Facility as Primary Use	X	X	X
Parking Accessory to Permitted Use	X	X	SD
Non Water Oriented Uses			
Non Water Oriented Industrial Uses	X	X	SD
Non Water Oriented Institutional Uses	X	X	SD
Non Water Oriented Recreational Uses	X	X	SD
Business Signage	X	X	SD
New Arterial Streets	X	X	X
New Local Access Streets	X	X	SD
Maintenance Roads Accessory To Permitted Use	SD	SD	SD
Ped/Bike Linkages to Trails	SD	SD	SD
New Rail Lines	X	X	SD
Extension of Existing Rail Lines	X	X	SD
Recreational Uses			
Dock for Recreational Purposes	SD	SD	X
Boat Launch – Motorized Craft	CU	CU	CU
Boat Launch – Non-motorized Craft	SD	SD	SD
Residential Uses			
Single-Family Residence	X	SD/E	X
Two-Family Residence	X	SD/E	X
Multi-Family Residence (3 or more)	X	SD	X
Accessory Dwelling Unit	X	SD	SD
Detached Accessory Structures	SD	SD	SD
Group Home	X	SD	X
Single or Multi-Family Residential Dock	X	SD/E	X
Land Division			

Subdivisions, Including Binding Site Plans	X	SD	SD
Utilities			
Utility Processing Facilities	SD	SD	SD
Shoreline Modifications			
Dredging	X	X	X
Dredge Material Disposal	X	X	X
Fill – Waterward of OHWM	X	X	X
Fill – Landward of OHWM	CU	CU	CU
Shoreline Habitat and Natural Systems Enhancement Projects	SD	SD	SD
Removal of Vegetation Within Shoreline Setback	SD	SD	SD
Shoreline Armoring – New or Enlarged	SD/E	SD/E	SD/E
Shoreline Armoring – Replacement	SD/E	SD/E	SD/E

Source: City of Millwood

Section 6: Effect on Permitting of Other State and Local Agencies and Programs

All of the agencies listed below work together with the City of Millwood to help manage the impacts of development on, and in, the Spokane River. Expertise is provided to City staff and to local citizens both before and after the permitting process

6.1: Washington State Department of Fish and Wildlife

The Washington State Department of Fish and Wildlife (WDFW) has jurisdiction over in-water and over-water activities up to and including the Ordinary High Water Mark (OHWM), as well as any other activities that could "use, divert, obstruct, or change the bed or flow of State waters" (http://www.wdfw.wa.gov/hab/hpapage.htm). Practically speaking, these activities in the City of Millwood include, but are not limited to, installation or modification of shoreline stabilization measures, docks, and boatlifts.

In partnership with the City's permitting process, WDFW requires that development projects in State waters obtain a written Hydraulic Project Approval. Prior to granting approval, the Area Habitat Biologist (AHB) will visit the site prior to project initiation and may attach conditions concerning the equipment used for the development project, protection of water quality at the site, and the types of materials that can be used. In some cases, the project may be denied by WDFW if significant impacts would occur that could not be adequately mitigated. Our partnership with WDFW provides the City access to personnel trained in protecting and improving the biological integrity of our shoreline.

6.2: Spokane County Law Enforcement

The northern boundary of the City of Millwood is the southern OHWM of the Spokane River. Enforcement of civil law upon activities on the river itself is the responsibility of the Spokane County Sherriff's Office. Under Spokane County regulations, power boat traffic, above a no-wake speed, is limited to river areas 100 feet of more from either bank. The average river width within the Millwood City limits is 234 feet, allowing a narrow path for water skiing down the center of the river. Sample river widths are listed in Table 6.1 below.

Table 6.1: River Widths within City Limits

Western City Limit	Sargent Easement	Alley Easement	Argonne Bridge	IEPCo Bone yard	Eastern City Limit
271'	258'	220'	234'	214'	290'

Source: City of Millwood

Manpower issues limit the number of times the Sherriff's Office can have personnel on the water. Reports from concerned citizens, when violations occur, will raise the visibility of problems and help protect the safety of citizens on the river and prevent increased wave action along the bank.

6.3: Washington State Department of Ecology

The Washington State Department of Ecology (Ecology) will review and may condition a variety of project types, including any project that needs a permit from the United States Army Corps of Engineers, any project that requires a Shoreline Conditional Use permit, or Shoreline Variance, and any project that disturbs more than one (1) acre of land.

Just as with WDFW, the additional resources provided by Ecology add expertise to City staff to help design mitigation efforts and reduce the effects of development in the area two hundred (200) feet landward from the shoreline. Prior to the start of development, Ecology will provide resources to help evaluate current conditions and assist the City when discussing alternatives with shoreline property owners. Ecology is responsible for administering the Shoreline Management Act (RCW 90.58), the Water Code (RCW 90.03), the state Water Pollution Control Act (RCW 90.48), the state Clean Air Act (RCW 70.94), and the Model Toxics Control Act and provides expertise to the City in all these areas.

6.4: United States Army Corps of Engineers

The United States Army Corps of Engineers has jurisdiction over any work in or over navigable waters under Section 10 of the Federal Rivers and Harbors Act of 1899, and discharges of dredged or fill material into waters of the United States under Section 404 of the Federal Clean Water Act.

Corps permits are necessary for any work, including construction and dredging, in the Nation's navigable waters. During the permit process, the Corps will consider the views of other Federal, state and local agencies, interest groups, and the general public. Any adverse impacts to the aquatic environment will be offset by mitigation requirements, which may include restoring, enhancing, creating and preserving aquatic functions and

values. The Corps strives to make its permit decisions in a timely manner that minimizes impacts to the regulated public.

Section 7: Net Effect on Ecological Function

7.1: Findings

In summary, here are the findings from the data presented above, with conclusions:

1. Water cleanup activities from State and Federal agencies and local industrial firms have been successful in finding and mitigating many sources of pollution that that enter the aquifer and river. These projects are ongoing. As each project is completed, this provides the local shoreline ecology with a small but growing positive impact as time goes on.

2. In the Shoreline Residential Environment, we expect development of the three remaining vacant parcels. Covering a portion of these parcels with impervious surfaces and removing native plantings will provide a negative impact to the current condition of the shoreline area. The SMP addresses these impacts through the mitigation process of avoiding as much change as possible and then requiring replanting, application of pervious surfaces where possible and then compensation for any remaining development impact. The SMP regulations suggest softer shoreline armoring, if any is necessary, and the retention of a 50 foot buffer of native plantings. Where possible, compensatory development should be made on the same parcel as the development, but in those situations where this is not possible, the mitigation efforts can be applied off-site. Even with mitigation, all impacts cannot be foreseen, so redevelopment of the fallow parcels has to be seen as providing a slight negative impact to the ecology of the shoreline.

3. Although the SMP is not retroactive, insistence on mitigation measures that did not appear in the last plan and the institution of restoration efforts, which also did not appear in the last plan, will result in slow improvement throughout the shoreline area.

4. Recent removal of the public boat launch at Boulder Beach provides a positive benefit in reducing the erosion on the shorelines in the City, due to reduced wake activity. This positive benefit will remain as long as this restriction exists.

5. Recently, the seasonal boat launch at Upriver Dam has been closed to property owners who purchased riverfront property between Upriver Dam and Coyote Rock after February 1, 2011. Today, homeowners who had purchased property

prior to February 1, 2011, and who also had mooring facilities located on their property, can put one power boat into the river each spring and remove it in the fall. This restriction on the number of power boats on the water within the Millwood area will provide a small, but growing, positive benefit, due to reduced wake activity on the shoreline, as long as this restriction exists.

6. In the future, the largest anticipated negative impact to the shoreline environment in the City will be the construction of 30 new docks at the Coyote Rock development. If they are allowed to be built, these docks will be less than one half mile from the eastern boundary of the City and since there are rapids directly to the east of the Coyote Rock development, boats can only go downriver from there. Not having jurisdiction over anything waterward of the OHWM makes the situation difficult for Millwood to mitigate. The City will have to work with Spokane County, the Department of Fish and Wildlife and interested river organizations to protect the Spokane River and in turn, protect as much of the shoreline along Millwood's northern boundary as possible.

   Today, there are 19 properties within the City that have docks. On the northern back, between the western edge of Millwood and the eastern edge of the Coyote Rock development, there are also 19 docks. If 30 additional docks are constructed at Coyote Rock, and each one services a motorized craft, we can expect a 78% increase in boat traffic on the river between Upriver Dam and Coyote Rock at any given time. This impact will cause a concomitant increase in shoreline erosion due to wave action and increased friction between power boaters and human powered craft.

7. In the future, there will be many unanticipated and unseen developments along the shoreline. Unpermitted development will occur. These activities will provide a constant negative impact on the area. The SMP addresses this mainly through citizen education; on planting native shoreline vegetation; removal of noxious weeds; and softer alternatives for armoring. The SMP also addresses this is through requirements for more than a 1:1 ratio of compensatory actions along the shoreline.

7.2 Conclusions

The Cumulative Impacts Analysis is designed to acknowledge development that is anticipated by the SMP, plus development that is not anticipated, and present an analysis for use in addressing the result of these actions. The analysis provides

information on the current state of the shoreline ecology and presents the reasoning supporting restoration activities that mitigate future development.

In the Shoreline Residential Environment, we are looking at an urban area that is almost entirely developed. There are three fallow parcels that we expect will contain new homes in the near future, but for the most part, development in this area is driven by updating older homes as financing allows. Human activity is constant throughout this area. We do not anticipate that this environment will see any change in use over the life of this plan. Any ecological improvement in this area will come from homeowner activities in response to regulations within the updated SMP. As these regulations are followed, new development will be minimized or compensated for, providing the opportunity for slow improvement in the ecological functions of the area. Monitoring will be necessary to identify opportunities for mitigation of unforeseen development.

The Shoreline Industrial Environment includes a paper mill that has been in operation on the same site since 1910. Throughout the past century, the technology of paper making has evolved and the mill has kept up with the changes, constantly updating its machinery and processes as necessary. Over time, the manufacturing process has required activities to expand east from the main mill, and then pull back again. For the recent past, as wood chips and used paper have supplemented whole logs, heavy mill activity has been contracting in area, leaving almost half of the total industrial land fallow. Future plans may expand activity east again.

In the Shoreline Industrial Environment, the ecology of the shoreline depends on the activities of the Inland Empire Paper mill. At this time, the stewardship of the property, both in active use and fallow, is positive, and protective. As long as the mill remains, the majority of this environment will continue to exhibit its current ecological ratings throughout the life of this plan. Due to the mill's stewardship, this Environmental Designation holds the highest ratings within the City.

In the Public Reserve Environment, we do expect a small amount of careful development to make each easement more accessible to the public. It is up to the City to ensure that this development provides positive results for the environment that exists today.

The activities that are regulated in the SMP, and the meaning of the regulatory language that appears there, are a direct result of the analysis performed here. Also, as time goes on, updates of the Master Program will reflect changes in the baseline ecology of the area that will once again feed into any regulatory updates required in the future to maintain no net loss of shoreline function.

Section 8: References

Avista Corporation, (2005). Spokane River Hydroelectric Project FERC No. 2545. Final Application for New License – Existing Dam

City of Spokane Valley, (2010). *Shoreline Master Plan Draft Update.* pp. 9-17

Furl, C. & Meredith, C., (2009), Washington State Department of Ecology. (2010, March). *PBT Monitoring: PBDE Flame Retardants in Spokane River Fish, 2009* (Publication No. 10-03-015). Olympia, WA.

Gearhart, C.M., (2001). The Hydraulic connection between the Spokane River and the Spokane Aquifer: Gaining and Losing Reaches of the Spokane River from State Line, Idaho, to Spokane, Washington. Eastern Washington University, Cheney, Washington

Knutson, K. L. & Naef, V. L., (1997). Management recommendations for Washington's priority habitats: riparian. Washington Department of Fish and Wildlife, Olympia, WA.

Mayer, P.M., Reynolds, S.K., McCutchen, M.D., & Canfield, T.J. (2006). *Riparian buffer width, vegetative cover, and nitrogen removal effectiveness: A review of current science and regulations.* EPA/600/R-05/118. Cincinnati, OH, US Environmental Protection Agency.

NMFS (National Marine Fisheries Service). 2008. Implementation of the National Flood Insurance Program in the State of Washington Phase One Document – Puget Sound Region. Endangered Species Act – Section 7 Consultation. Final Biological Opinion. Consultation conducted by Magnuson-Stevens Fishery Conservation and Management Act Essential Fish habitat Consultation. National Marine Fisheries Service, Northwest Region. Issued by D. Robert Lohn, Regional Administrator. NMFS Tracking Number F/NWR/2006/00472.

Sandvick, P., (2010). Washington State Department of Ecology, (2010, April) *Trend Monitoring for Chlorinated Pesticides, PCBs, PAHs, and PBDEs in Washington Rivers and Lakes, 2008* (Publication No. 10-03-027). Olympia, WA.

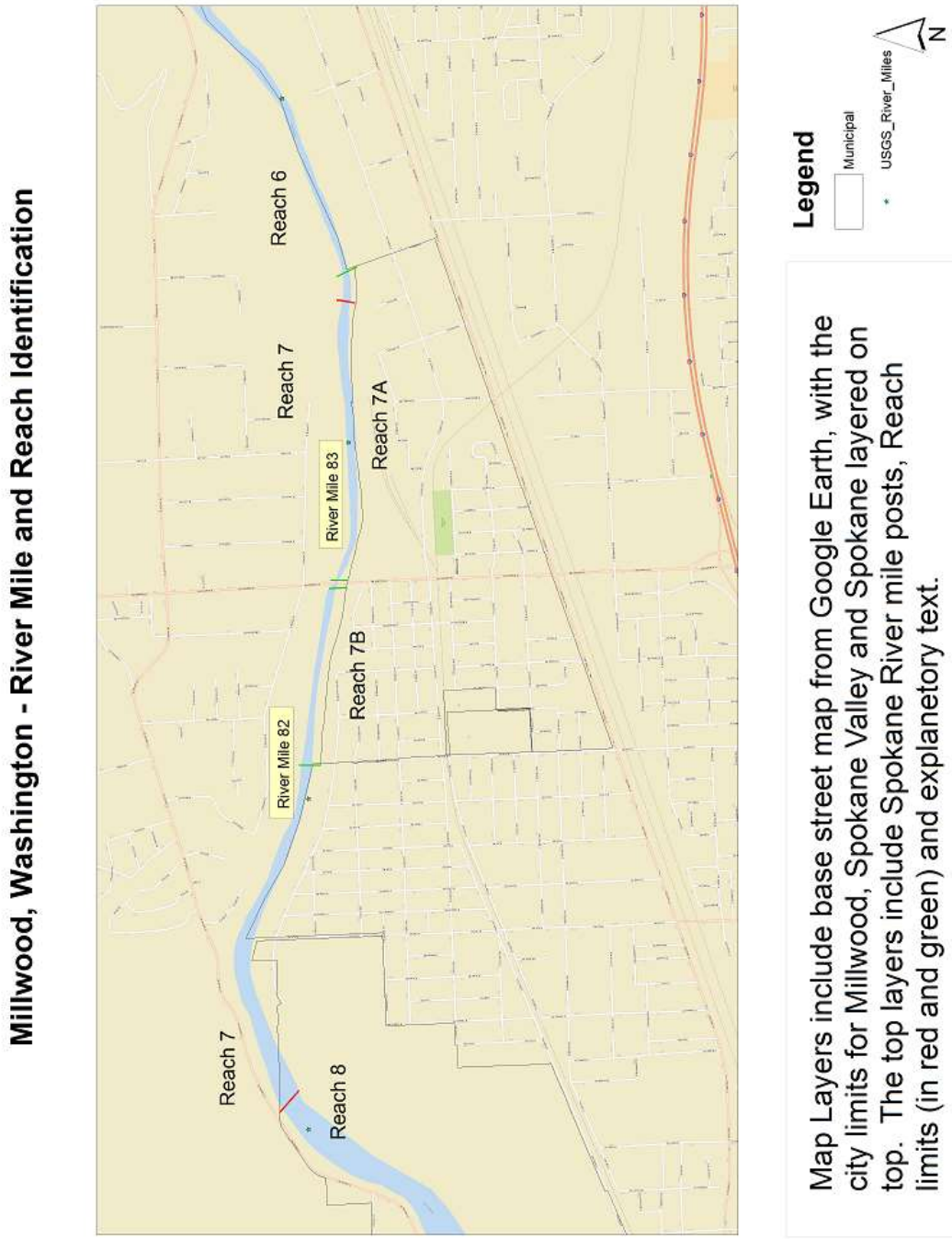
Serdar, D., Lubliner, B., Johnson, A., & Norton, D., (2011). Washington State Department of Ecology, (2011, April). *Spokane River PCB Source Assessment 2003-2007* (Publication No. 11-03-013). Olympia, WA.

The Spokane County Conservation District, (2005). *Spokane County proper functioning condition stream inventory,* pp. 6-56. (Updated in 2011 for Reach 7A).

USDA, Department of the Interior, Bureau of Land Management 1998. Riparian Area Management, A User Guide to Assessing Proper Functioning Condition and The Supporting Science for Lotic Areas, Technical Reference 1737-15. National Applied Resource Sciences Center, Denver, CO.

Section 9: Appendices

Appendix 1: River Miles and Reach information. Reaches 7A and 7B are artifacts of Reach 7. See CIA text in section 1.2 above.



Appendix 2: Millwood Shoreline with 200 foot Buffer

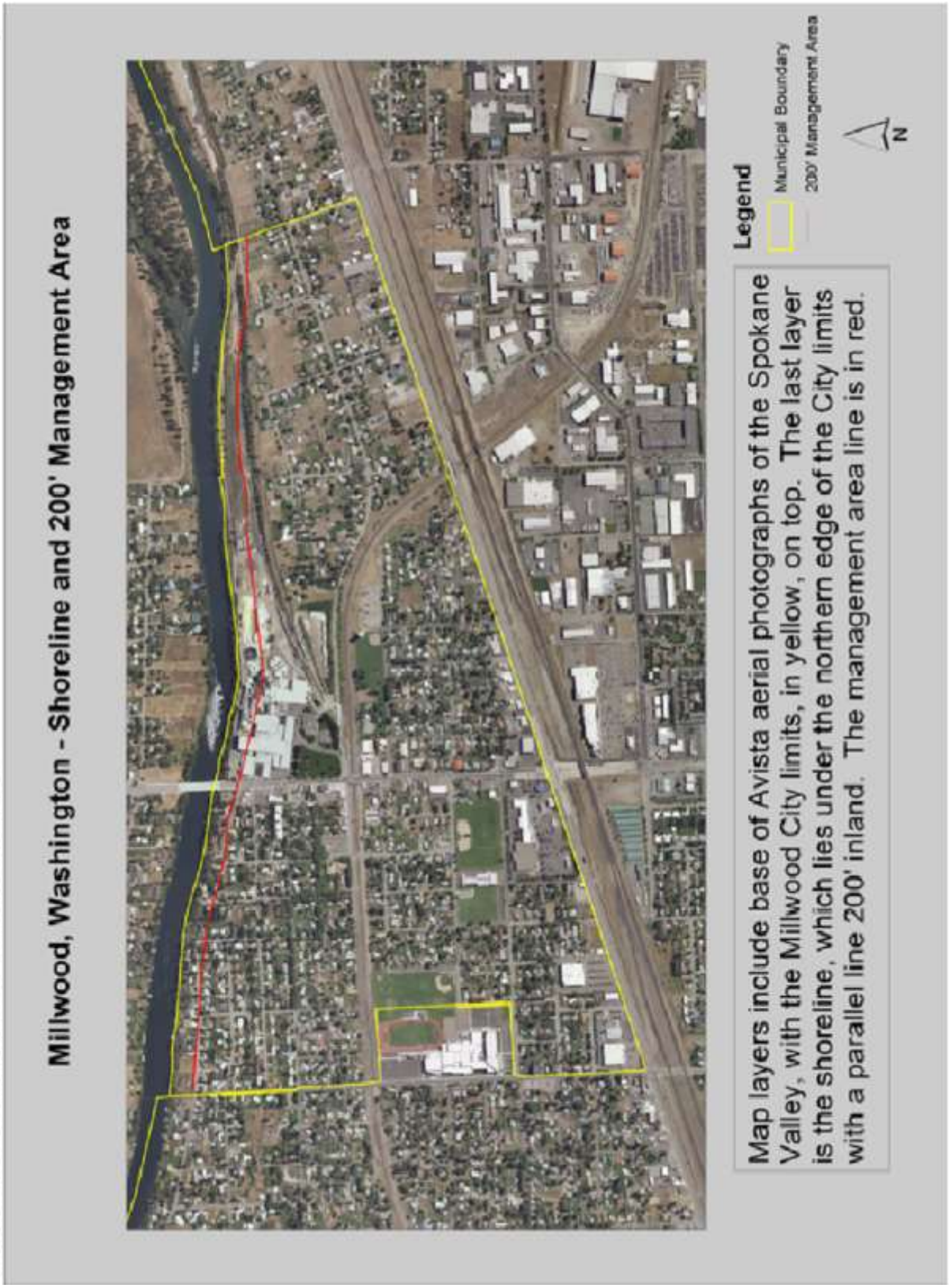
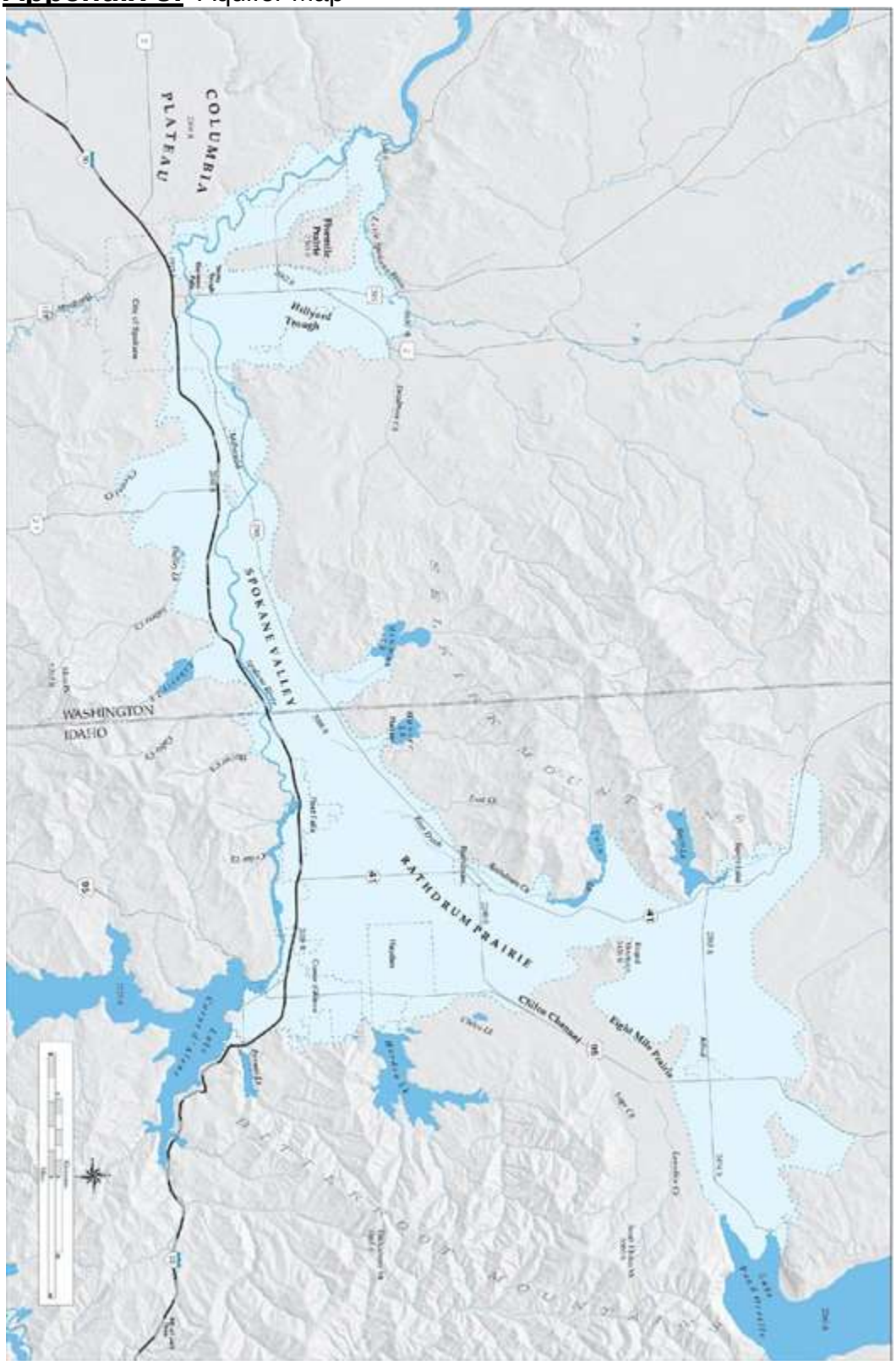


Figure 1: Shoreline and 200' Management Area

Appendix 3: Aquifer Map



Appendix 4: Soils Report

United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Spokane County, Washington

Soils in Millwood, WA

August 5, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

2

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

3

Contents

Preface 2
How Soil Surveys Are Made 5
Soil Map 7
Soil Map (Soils in Millwood, WA) 8
Legend 9
Map Unit Legend (Soils in Millwood, WA) 10
Map Unit Descriptions (Soils in Millwood, WA) 10
Spokane County, Washington 12
GgA—Garrison gravelly loam, 0 to 5 percent slopes 12
GgB—Garrison gravelly loam, 5 to 20 percent slopes 12
GmB—Garrison very gravelly loam, 0 to 8 percent slopes 13
W—Water 14
References 15

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

5

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

7

Custom Soil Resource Report
Soil Map (Soils in Milwood, WA)

Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:12,200 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Spokane County, Washington
Survey Area Data: Version 2, Jun 9, 2009

Date(s) aerial images were photographed: 7/2/2008

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Soils in Millwood, WA)

Spokane County, Washington (WA063)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GgA	Garrison gravelly loam, 0 to 5 percent slopes	505.4	86.0%
GgB	Garrison gravelly loam, 5 to 20 percent slopes	29.4	5.0%
GmB	Garrison very gravelly loam, 0 to 8 percent slopes	6.7	1.1%
W	Water	46.2	7.9%
Totals for Area of Interest		587.7	100.0%

Map Unit Descriptions (Soils in Millwood, WA)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Spokane County, Washington

GgA—Garrison gravelly loam, 0 to 5 percent slopes

Map Unit Setting

Elevation: 1,400 to 2,800 feet
Mean annual precipitation: 15 to 25 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 120 to 170 days

Map Unit Composition

Garrison and similar soils: 100 percent

Description of Garrison

Setting

Landform: Outwash plains
Parent material: Glacial outwash mixed with a component of loess and volcanic ash

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3e
Ecological site: Pinus ponderosa var. ponderosa/Festuca idahoensis (F043XY802WA)

Typical profile

0 to 15 inches: Gravelly loam
15 to 44 inches: Very gravelly loam
44 to 60 inches: Stratified very gravelly loamy coarse sand to very gravelly sandy loam
60 to 70 inches: Extremely gravelly coarse sand

GgB—Garrison gravelly loam, 5 to 20 percent slopes

Map Unit Setting

Elevation: 1,400 to 2,800 feet
Mean annual precipitation: 15 to 25 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 120 to 170 days

Map Unit Composition

Garrison and similar soils: 100 percent

Description of Garrison

Setting

Landform: Outwash plains

Parent material: Glacial outwash mixed with a component of loess and volcanic ash

Properties and qualities

Slope: 5 to 20 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability (nonirrigated): 4e

Ecological site: Pinus ponderosa var. ponderosa/Festuca idahoensis (F043XY802WA)

Typical profile

0 to 15 inches: Gravelly loam

15 to 44 inches: Very gravelly loam

44 to 60 inches: Stratified very gravelly loamy coarse sand to very gravelly sandy loam

60 to 70 inches: Extremely gravelly coarse sand

GmB—Garrison very gravelly loam, 0 to 8 percent slopes

Map Unit Setting

Elevation: 1,400 to 2,800 feet

Mean annual precipitation: 15 to 25 inches

Mean annual air temperature: 46 to 50 degrees F

Frost-free period: 120 to 170 days

Map Unit Composition

Garrison and similar soils: 100 percent

Description of Garrison

Setting

Landform: Outwash plains

Parent material: Glacial outwash mixed with a component of loess and volcanic ash

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability (nonirrigated): 4s
Ecological site: Pinus ponderosa var. ponderosa/Festuca idahoensis (F043XY802WA)

Typical profile

0 to 15 inches: Very gravelly loam
15 to 44 inches: Very gravelly loam
44 to 60 inches: Stratified very gravelly loamy coarse sand to very gravelly sandy loam
60 to 70 inches: Extremely gravelly coarse sand

W—Water

Map Unit Composition

Water: 100 percent

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing, 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.