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List of Abbreviations and Acronyms

Bureau of Land Management	**BLM**
Channel Habitat Types	**CHTs**
Coarse Woody Debris	**CWD**
Cubic Feet per Second	**CFS**
Department of Environmental Quality	**DEQ**
Department of Geology and Mining Industries	**DOGAMI**
Dissolved Oxygen	**DO**
Division of State Lands	**DSL**
Endangered Species Act	**ESA**
Environmental Protection Agency	**EPA**
Geographical Information Systems	**GIS**
Large Woody Debris	**LWD**
Local Wetland Inventory	**LWI**
National Marine Fisheries Service	**NMFS**
National Wetland Inventory	**NWI**
Natural Resource Conservation Service	**NRCS**
Oregon Department of Fish and Wildlife	**ODFW**
Oregon Department of Forestry	**ODF**
Oregon State University Extension Service	**OSUES**
Oregon Watershed Assessment Manual	**OWAM**
Oregon Watershed Enhancement Board	**OWEB**
River Mile	**RM**
Soil and Conservation Service	**SCS**
Total Maximum Daily Load	**TMDL**
United State Geological Survey	**USGS**
Water Resources Department	**WRD**
Yamhill Basin Council	**YBC**
Yamhill Soil and Water Conservation District	**YSWCD**

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Letter to the Reader

I moved to Oregon in December of 1999 with the intention of starting a graduate program at Oregon State University in Corvallis. It was through a professor there that I learned of the Americorps program RARE (Resource Assistance for Rural Environments). The program offered me a position as the Project Manager to write assessments for the Yamhill Basin. I was apprehensive about taking the position. I had never heard of anadromous fish (salmon aren't a topic of study at the University of Minnesota where I received my undergraduate degree). Seasonal rains that pour October through April and then stop were unheard of to this daughter of mid-western plains farmers, and when I saw the instruction manual with the guidelines for writing the assessment, I wondered if graduate school might be easier than tackling this mighty task. These some 10 months later have been the best educational experience of my life.

The water quality, quantity, and fish species of the North Yamhill watershed depend on you.

I am finishing my term of service with RARE by December of this year. I will have finished two watershed assessments, the one in your hands, and another for the South Yamhill-Deer Creek watershed. I am in graduate school at OSU. I do not live in the Yamhill Basin, nor do I own property here. I do not fish in its streams, and I do not drink the water. I wrote this document, and this hefty sheaf of paper is all that I know about the place you call home. The health of the watershed will not improve if I am the only person who has done the reading and looked at the available research and see the data gaps.

This document is the start for you. It is the start of learning more about the place where you live, the water you drink, the effects on the watershed of your land use practices and those of your neighbors. I have been regaled with tales of cutthroat trout that were as long as a man's forearm, heard of days when kids and adults alike splashed in the streams without worries of getting sick from the water. These days were not that long ago – maybe only 20 years ago. There are no big industrial polluters along the waterways, little urban area or sprawl, no big chemical spills, there is no villain to point a finger at to say, "Hey you, stop polluting our water!" The changes that have occurred in this watershed, to Baker, Fairchild, Panther, Turner, and Hawn creeks have not been catastrophic. They have been incremental changes, a year at a time, cumulative changes that have altered the way water moves across the landscape outside your windows. A wetland drained here, a bank rip-rapped there, a few trees removed from the riparian area, leaking septic tanks, none of which seem that significant individually. Collectively, they have impacted the entire watershed. Have some of our actions improved over the years? Absolutely. Timber practices once removed trees all the way to the water's edge, farmers left fields fallow and with bare soil during heavy winter rains, actions we are working to change. Are we doing all we can as stewards of the land? Absolutely not. But now, the difficult work begins. Assessing our own impacts, deciding what we can do to help improve the quality of water whether we live in town, on a farm, or in the woods. The path ahead involves complicated directions: collaboration, education and struggling with where to begin. Does that mean everyone should stay home and forget about it? I hope not.

This watershed is not a priority for those in the state working to restore salmon habitat. Oregon Department of Fish and Wildlife's fish biologist for the region has only been here occasionally. The watermaster from the Water Resource Department only visits to hear resident complaints and the Department of Environmental Quality has the basin scheduled for the TMDL process in 2007, near the bottom of the list. I write this not to discourage you from getting involved, but to point out that no one is going to do this for you, not in the near future, and maybe not ever. The water quality, quantity, and fish species of the North Yamhill watershed depend on you. Read this document, question it, talk to your agency personnel, and get involved. This is your watershed, and your home, and if you don't care – who will?

Chapter 1 Introduction and Watershed Overview

Purpose

The North Yamhill watershed assessment was prepared for the Yamhill Basin Council (YBC), watershed residents, and landowners. It contains technical and educational information about the past and current watershed conditions. The primary purpose of the assessment is to evaluate how natural and human processes influence the watershed's ability to produce clean water and suitable habitat for aquatic life. It will serve as a baseline for developing and prioritizing restoration activities. The information collected in this assessment is intended to aid the YBC and the community in developing restoration projects and monitoring plans for the North Yamhill watershed. This is considered a living document and is to be amended, added to, or changed over time and as it is used.

Methods

The guidance to develop and write this assessment came from a watershed assessment manual developed specifically for Oregon. This manual, referred to as the Oregon Watershed Assessment Manual (OWAM), provides information on the resources available to do the assessment, information on watershed functions in Oregon, and a chapter with the steps to take to complete each section of the assessment.

Data from a wide variety of sources was utilized in the preparation of this document. The Bureau of Land Management's *Deer Creek, Panther Creek, Willamina Creek, and South Yamhill Watershed Analysis* and *North Yamhill Watershed Analysis* were of great assistance in the preparation of this document. Interviews with natural resource personnel from a wide variety of federal, state, and local agencies as well as local residents were a valuable source of information.

Table 1. North Yamhill Watershed GIS Data Layers

Watershed boundaries*
Streams*
- -perennial
- -intermittent

- •Roads*
- •Land-use
- •Land ownership*
- •Urban growth boundaries*
- •Current vegetation
- •Historic vegetation
- •Soils
- •Geology*
- •Irrigation rights
- •Wells
- •Dams*
- •FEMA floodplain
- •Debris flow
- •Township, range, section lines

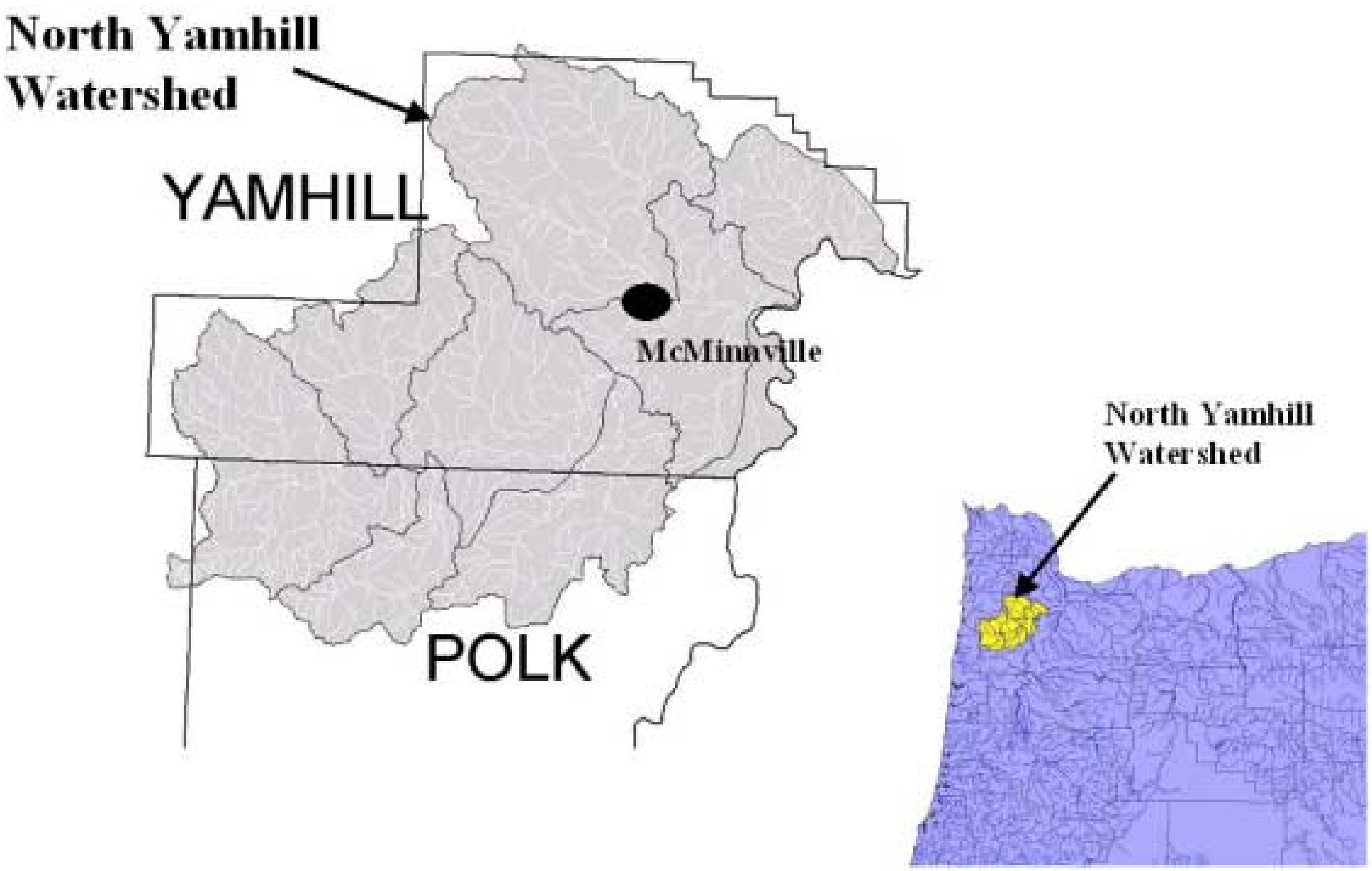
*** BLM data layer**

Geographic Information Systems

All of the maps for this document were produced with a computer program called ArcView 3.1. This program allows maps to be produced from geographic coordinates. These maps are very versatile and allow many watershed features to be displayed together or separately. For example, the streams and watershed boundaries appear on every map in this document, but the wetlands do not. The wetlands, streams, and soils can all be displayed simultaneously to provide a better picture of the watershed conditions.

This technology makes some types of calculations very easy, for example, miles of roads in the watershed or acres of land under cultivation. However, the scale these maps are produced at for this document makes some features difficult to see on paper. The watershed area of approximately 113,000 acres is being printed on a

Figure 1. Watershed Location Map



scale that fits on 8.5 x 11 paper thus some of the detail is lost, especially with the vegetation and hydric soils. The maps are only for approximating locations. Further information would be needed to determine actual restoration locations and potentials.

The production of these maps would not have been possible without the data layers produced by the BLM. The data layers used in this assessment are provided in Table 1, those produced by the BLM are indicated with an asterisk.

North Yamhill Watershed Background

Location

The North Yamhill watershed is part of the Yamhill River Basin in the northwestern Willamette Valley. The 113,441-acre watershed is on the eastern side of the Coastal Mountain range. Almost the entire watershed is in Yamhill County, less than three percent is in Washington County. *See Figure 1 for watershed location.*

Mainstem tributaries generally flow toward the North Yamhill River. The Bureau of Land Management data show 445 miles of waterways in the North Yamhill watershed (BLM, 1998). Major streams in the watershed include North Yamhill River, Panther Creek, Baker Creek, Turner Creek, Fairchild Creek, and Haskins Creek.

Elevations in the watershed range from 120 feet above sea level where the North Yamhill River leaves the watershed on the east side to 3,423 feet in the west at Trask Mountain. Other geographical features include Mt. Richmond (1,276 feet), Slide Mountain (1,965 feet), Kutch Mountain (2,045 feet), and Ball Bearing Hill (2,290 feet).

The watershed was divided into six sub-watersheds based on the guidelines set forth in the Oregon Watershed Assessment Manual (OWAM). The six sub-watersheds (6^{th} field watersheds) are Baker Creek, Panther Creek, Haskins Creek, Upper North Yamhill (above Pike), Lower North Yamhill, and Turner Creek. *See Figure 2.*

Population

The human population density of the watershed is concentrated mainly in the towns of Yamhill (pop. 975) and Carlton (pop. 1,525). The watershed boundary does include the northern section of McMinnville as well, but the population of McMinnville living in the watershed was not estimated. Both Carlton and Yamhill are located in the eastern side of the watershed. Portland State University's Center on Population Research shows the population of Yamhill County as 65,551 from 1990 census data.

The county's population continues to increase with more people wanting to purchase acreage and build a home. Ken Friday of the Yamhill County Planner's Office, believes the low interest rates encouraged many people to buy land in the rural area of the watershed. This increase in landowners has increased building permit applications. The state land-use laws are complicated regarding what lands can be developed within the exclusive farm use zone of the county. These zones were determined for the entire state as a way to stem urban growth and encourage denser development. Many landowners become discouraged when trying to negotiate their way through the building permit process. In order to build a residence on acreage within the exclusive farm use zone, it is necessary to prove the land can produce $40,000 or $80,000 a year depending on the quality of the soils. The land-use laws only affect acreage purchased or sub-divided after 1985, so some landowners have a lot of freedom to develop, while others are not allowed to do so. This leads to some contention and a feeling that the laws are unfair. It is Friday's opinion that Oregonians will have to decide if they want to continue with this system of land-use planning and stay committed to the ideal of planned communities with centralized transportation and services, or change the laws to allow further development in the exclusive farm zone.

The county's increasing population also increases the need for McMinnville, Yamhill, and Carlton to develop municipal water sources. McMinnville's water supply is from Haskins Creek, supplemented by the McGuire Reservoir (which is in the Nestucca Watershed) during the summer months. This supply is adequate to meet substantial growth in population and water demand.

Climate and Topography

The North Yamhill watershed's climate is marine-influenced with extended winter rainy seasons and hot, dry summers. Snow and ice does not accumulate in the higher elevations during winter, it is not usually cold enough for long enough. 'Rain on snow'[1] events are rare due to the few days of during the year when sufficient snow accumulates. However, during the 1964 and 1996 winter storms, enough snow accumulated in the Coast Range to contribute to the record flooding that occurred.

Average annual precipitation estimates were made from a map available from the Oregon Climate Service. Rainfall amounts vary from west to east in the watershed. The watershed experiences two very different rainfall regimes due to variations in elevation. The western section with the highest elevations in the watershed is located in the Coast Range Mountains and receives 80 to 100 inches of precipitation annually. Reports on Trask Mountain show it receiving over 135 inches annually (BLM, 1997). The low elevations on the eastern side of the watershed receive 40 to 60 inches annually, while the middle elevations receive 60 to 80 inches annually.

As is typical for the west side of the state, the rainfall is not spread evenly over the calendar year, but rather falls during the winter and spring months. Figure 2 shows the average monthly temperatures and precipitation at McMinnville. This data is from the archives at the Oregon Climate Service at Oregon State University. The city of McMinnville was the closest location with temperature data. The precipitation data from both Haskins Creek dam (elevation 760 feet) and the city of McMinnville (elevation 150 feet) are included to illustrate the difference in precipitation with elevation.

[1] 'Rain on snow' events occur when heavy snow accumulation is followed by intensive spring rains and can increase the magnitude of the flooding.

Figure 2. Average Monthly Precipitation (at McMinnville and Haskins Dam 1961-1990)

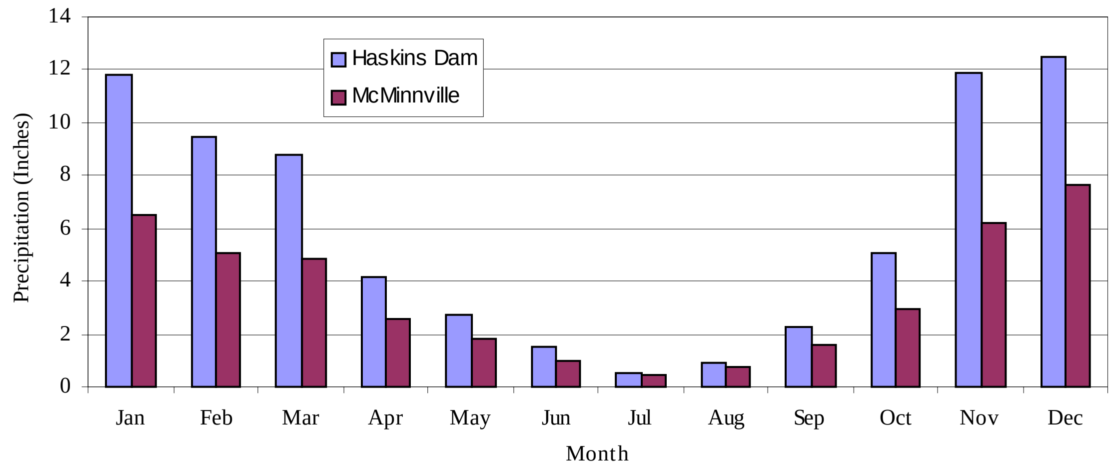
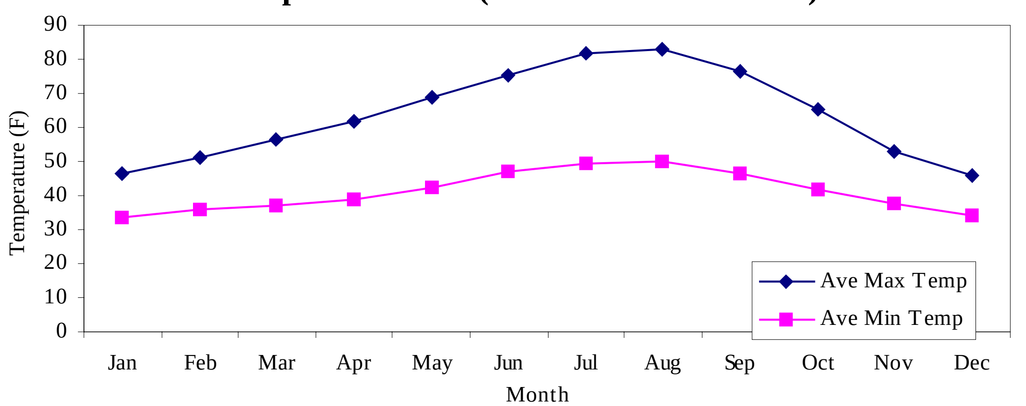


Figure 3. Monthly Average Maximum and Minimum Temperature Data (McMinnville 1961-1990)



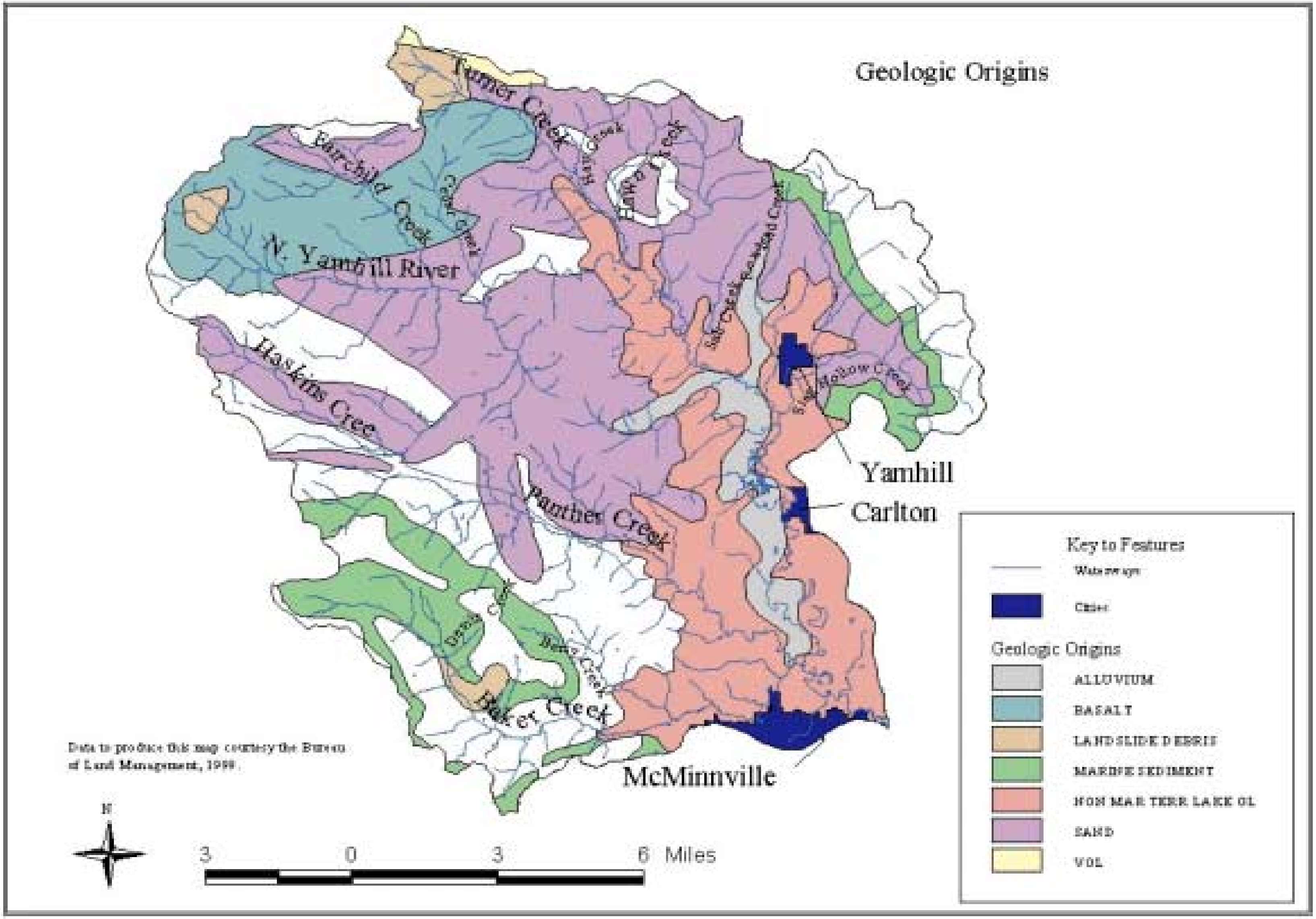
Geology and Soils

The geology of the watershed is shown in Figure 4. This information helps us understand the formation of the local landscape as well as to determine the parent material of the soils, and to understand how river channels may react to channelization and bank destabilization. The geology of the area also determines the water storage capacity of the landscape.

The North Yamhill watershed soils are comprised of weathered volcanic and sedimentary rock. Rock of volcanic origin is located in the headwater region of the watershed and is only a small area of the watershed.

The more easily eroded sedimentary rock is in the lower watershed. The erosion resistant volcanic headwaters tend to contain steep, confined channels that transport water, wood and sediment rapidly. The mid-elevation channels are more erosive, moderately confined, and lower

Figure 4.



Geologic Origins
Fairchild Creek
N. Yamhill River
Haskins Cree
Panther Creek
Baker Creek
Yamhill
Carlton
McMinnville
Key to Features
Geologic Origins
ALLUVIUM
BASALT
LANDSLIDE DEBRIS
MARINE SEDIMENT
NON MAR TERR LAKE OL
SAND
VOL
N
3 0 3 6 Miles

in gradient and flow through sedimentary rock layers. The mid-elevation channels transition to the lower North Yamhill, Haskins Creek, and Turner Creeks which provide floodplain and meanders which slow water and provide sites for sediment deposition. The low elevation main channels tend to flow over bedrock preventing any further down-cutting.

The Soil Survey of Yamhill County (SCS, 1974) lists 4 main soil associations for the North Yamhill watershed. In-depth information on the soils and their locations can be found in that publication. The watershed's different soil associations form as concentric polygons. The soils in the center are along the North Yamhill River below the town of Yamhill and along Highway 47 above the town of Yamhill. These soils are of the Wapato-Cove association and are poorly drained silty clay loams and clays. The next ring is nearly 2 miles in diameter on either side and comprised of Woodburn-Willamette association with moderately well drained and well-drained steep silt loams and silt loams over silty clay loams.

The outer third ring five miles wide on either side is of the Peavine association with some Willakenzie-Hazelair association. These areas are dominated by well-drained to somewhat poorly drained, gently sloping to very steep soils on low foothills of the Oregon Coast Range. Willakenzie-Hazelair association silty clay loams are formed over sedimentary rock (siltstone). The farthest west section is of the Hembre-Astoria-Klickitat association with very strongly acidic silt loams over silty clay loam, and stony loams over very gravelly clay loam. Further information on the watershed's soils can be found in the Sediment Section of this document.

Vegetation

The vegetation in the watershed changes dramatically from west to east. The steep western section in the Coast Range is mostly forested while the eastern section with its flat topography is dominated by agricultural uses including grass seed, vineyards, orchards, row crops and pasture. The vegetation including current, and historic conditions, riparian conditions, species of special concern, wetlands, and weeds are addressed in detail in the chapter on vegetation.

Fire History

For at least four thousand years and possibly as long as ten thousand years, humans had systematically burned the Willamette Valley, which played a major role in the evolution of valley ecosystems.

The watershed was occupied by the Kalapuyans and regularly burned by them. They evolved a system of what could be called "wildland management" in order to create and maintain favorable plant community characteristics. *See Kalapula sidebar in Chapter 3.*

It is difficult to know precisely the history of fire in forest areas. The BLM did a study to reconstruct the changes in forest stand age classes from 1850 to 1940 (Teensma et al, 1991). Figure 5 and 6 show the areas of the watershed that burned during that time frame according to their research. The most significant fires are the Nestucca Fire of 1850, the 1933 Tillamook Burn, and the 1939 Tillamook Burn (reburn) (BLM, 1997).

Figure 5.

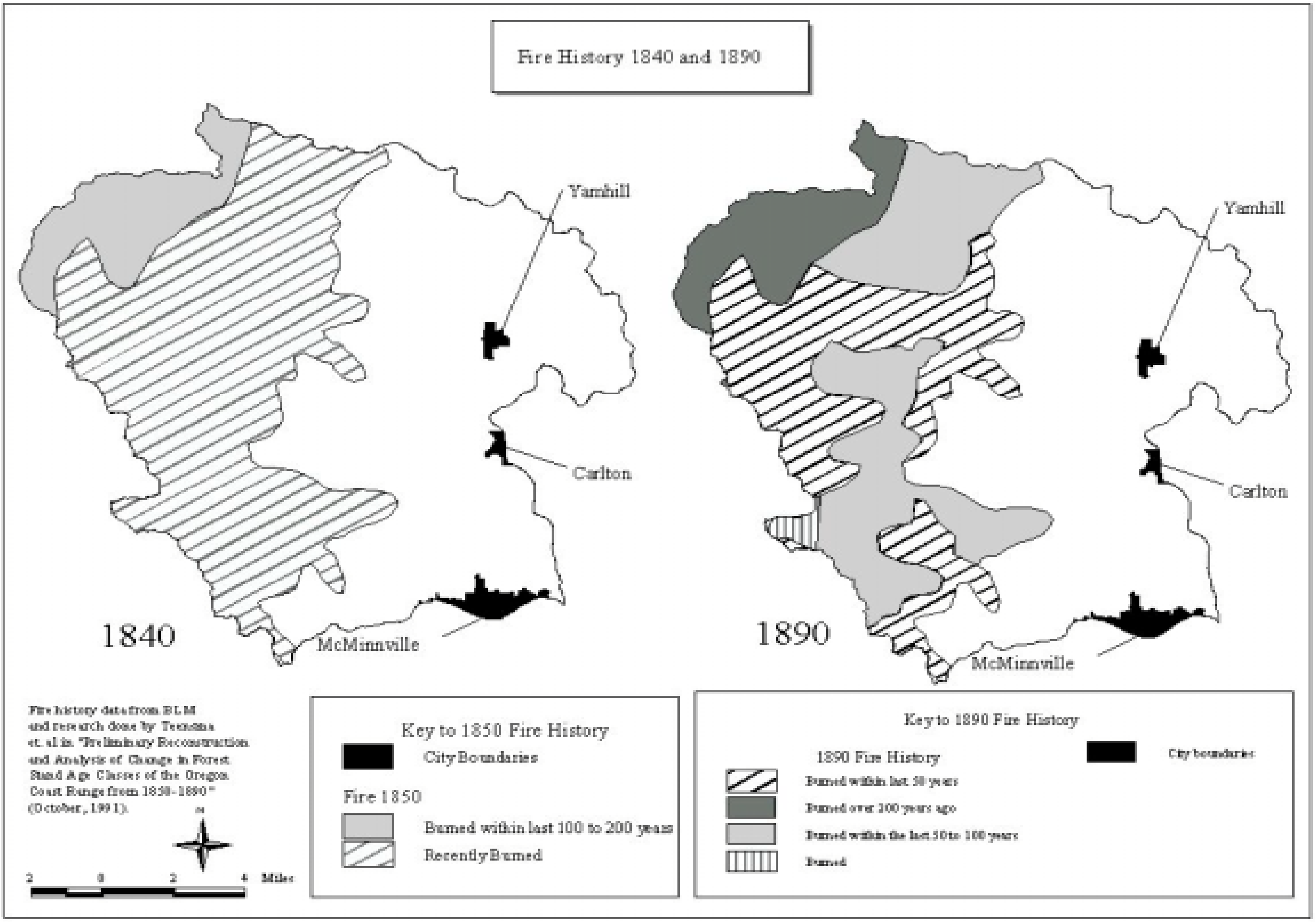

Fire History 1840 and 1890
Yamhill
Carlton
McMinnville
1840
Yamhill
Carlton
McMinnville
1890
Fire history data from BLM
and research done by Teensma
et. al in "Preliminary Reconstruction
and Analysis of Change in Forest
Stand Age Classes of the Oregon
Coast Range from 1850-1890"
(October, 1991).
2 0 2 4 Miles
Key to 1850 Fire History
City Boundaries
Fire 1850
Burned within last 100 to 200 years
Recently Burned
Key to 1890 Fire History
1890 Fire History
Burned within last 50 years
Burned over 200 years ago
Burned within the last 50 to 100 years
Burned
City boundaries

Figure 6.

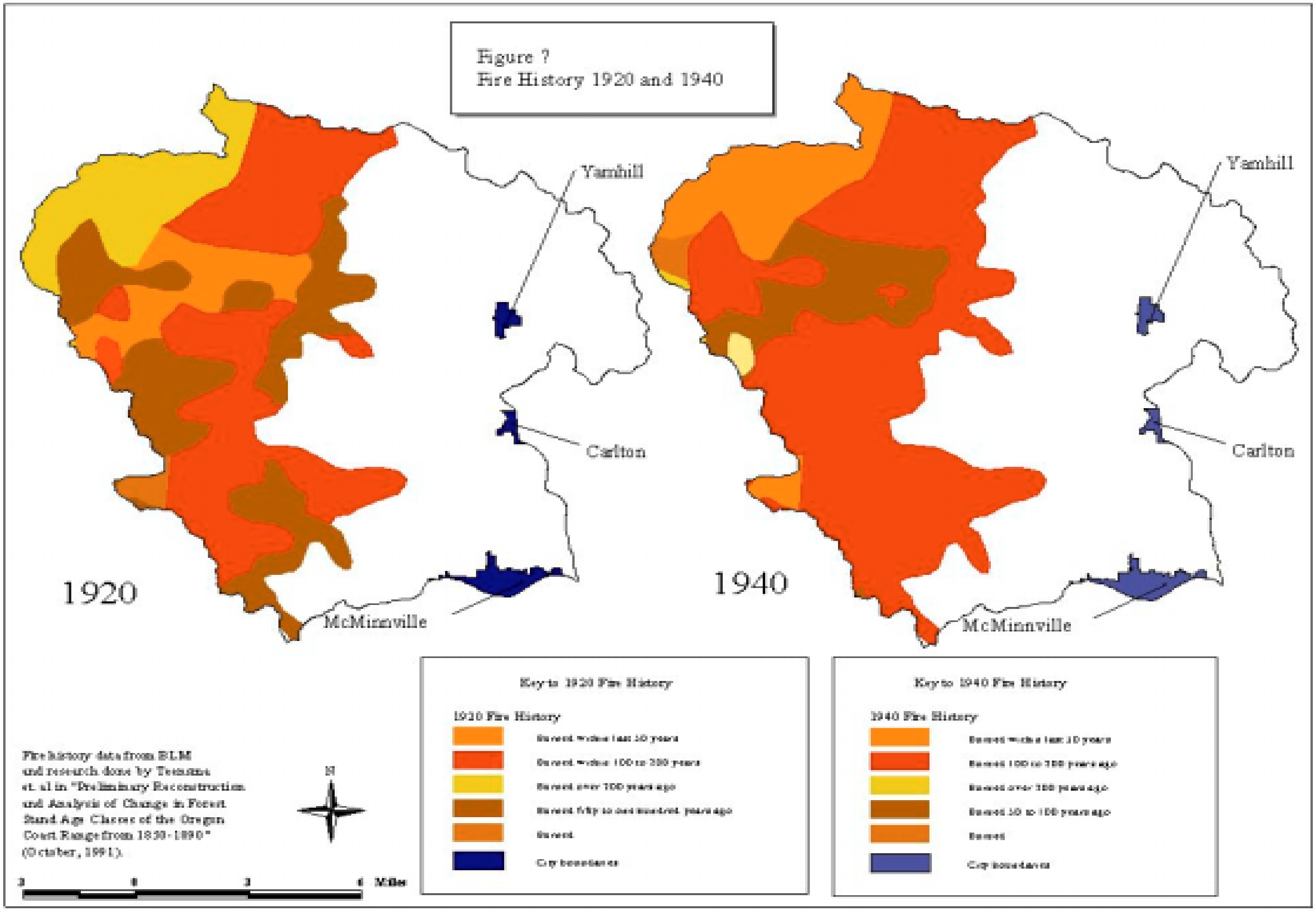


Figure ?
Fire History 1920 and 1940
Yamhill
Carlton
McMinnville
1920
Yamhill
Carlton
McMinnville
1940
Key to 1920 Fire History
1920 Fire History
Key to 1940 Fire History
1940 Fire History
Fire history data from BLM
and research done by Teensma
et. al in "Preliminary Reconstruction
and Analysis of Change in Forest
Stand Age Classes of the Oregon
Coast Range from 1850-1890"
(October, 1991).
N
Miles

Fire was used by early settlers for a variety of reasons including hunting, cooking, land clearing, amusement, (i.e. setting fires for fun), and trail building. It was not uncommon in the late 1800s and early 1900s to abandon burning campfires in the woods. Fires set to clear land were kept burning through even the most dangerous fire periods (BLM, 1998).

The settlers forced the Kalapuyans to stop burning during the late 1840s. During the 1850s, the Coast Range experienced an increase in forest fires. Most of the fires set during this period have been attributed to settlers (BLM, 1998).

The impact of settlement on the frequency and location of fires is not well documented. Fire occurrence appears to have been commonplace from fires escaping control during the burning of slash piles and carelessness. Many fires occurred in 1902 and in 1910. Heightening public awareness of the dangers was the number of deaths and the losses of property during these years. By the early 1930s, fire suppression crews were organized and working to suppress wildfires (BLM, 1997).

Severe windstorms have also been significant in determining the age class distributions and composition of the forested vegetation in the watershed. The Columbus Day Storm of 1962 caused blowdowns on the average of 80 acres per square mile. The total amount west of the Cascades killed during this storm equaled the acreage burned during the 1933 Tillamook Burn (BLM, 1997), nearly 240,000 acres (Upton, 2000).

Present day rural residential developments may face catastrophic fires. The lack of fire breaks surrounding private residential properties, limited water availability during periods of low precipitation, and the absence of fire over the last 100 or more years contribute to a fire hazard in the forested area of the watershed. The tremendous number of fires burning throughout the western U.S. the summer of 2000 avoided the Coast Range. Dry summer conditions and areas with sufficient fuel abound in the Coast Range, and large fires are a possibility.

Currently in Yamhill and Washington counties, plans are under development for an integrated fire response-training program that combines fire-fighting personnel from industry, rural departments, logging contractors and the Oregon Department of Forestry. Training burns are planned for fall 2000. Participants will have the opportunity to acquire fire fighting skills and network with the people they would work with on most real fires. Professional forestry crews currently perform the bulk of fire fighting in the watershed. The training will produce more people capable of fighting the fire locally (Upton, 2000). Timberland owners may contract with ODF for protection from fire. The BLM also contracts with ODF for fire protection services on the land it manages. Most large industrial landowners participate along with a number of small woodland owners. There is a formal organization that governs local arrangements, calculates assessments, and works with ODF on fire protection and suppression issues. The focus is on prevention and early suppression (Upton, 2000).

Suppression of fire has shaped the current vegetation just as historically burning affected the vegetation. The watershed has a greater acreage of Douglas-fir and much less oak savanna and prairie due in part to the absence of fire. Landscapes with fire will favor more open landscapes such as oak savanna and prairie, whereas fire suppression favors species that are either intolerant of fire, or late successional species. See Figures 8 and 9 for maps of the current and historic vegetation.

Land Ownership/Use Summary

Land ownership was provided by a GIS BLM map. The majority of the watershed, 100,000 acres, is privately owned. Private industrial landowners including Hampton Forests, Boise Cascade, Willamette Industries, and Stimson Lumber Company own forested watershed areas in the Upper North Yamhill, and the headwaters of Baker and Panther subwatersheds. The BLM administers 12,829 acres of primarily forested land in the western watershed.

Agriculture is a significant land use in Lower North Yamhill, Turner Creek, and lower Panther and Baker subwatersheds. Table 2 shows general land use categories. The county uses many more zoning categories. Figures on more specific land uses (i.e. Ag-For, Mixed-EFU, etc) are available by contacting the Yamhill County Planning Department (503) 434-7516.

Table 2. General land use

Land Use	Acres	Percentage
Agriculture/Forestry	68,275	60.2%
Forestry	41,840	37.0%
Rural Residential	1,221	1.1%
Carlton Urban Growth Boundary	171	0.2%
McMinnville Urban Growth Boundary	1,590	1.4%
Yamhill Urban Growth Boundary	294	0.3%
Total	113,391	100.2%

Figures derived from ArcView analysis of Yamhill county data provided to the BLM 1998.

Mining

Gravel quarries in the North Yamhill watershed mine rock for road construction, fill, asphalt paving, or ready mix concrete. Quarry operators are required to obtain permits from the Department of Geology and Mining Industries (DOGAMI). The Grant of Total Exemption Rule (DOGAMI) states that person(s) disturbing less than 5,000 cubic yards and/or less than one acre in a 12-month period need not apply for a permit with the state. Thus, small amounts of earth are allowed to be moved without permit – unless they are near a wetland or waterbody, in which case, the Department of State Lands would need to issue a permit.

Permits are filed with the DOGMAI office in Albany, Oregon if more than 5,000 cubic yards is being disturbed. This permitting process became law in 1974, making records of mines and quarries before that date unknown or anecdotal. One rock pit and three quarries are shown on the USGS topographical maps of the watershed. For further information on these quarries, contact the USGS office in Portland.

Table 3. Quarry Permits

Permit Number	Status	Name of Permit Holder	Type of Permit
36-0013	New	Private landowner	Unknown

36-0031	Permitted	Private landowner	Unknown
36-0034	Closed	Yamhill County Road Department	Quarry
36-0045	Closed	Yamhill County Road Department	Unknown
36-0048	Closed	Reid-Wolf, Inc.	Unknown
36-0051	New	Flying M Ranch	Unknown

From DOGAMI office in Albany, Oregon.

Agriculture

Since Yamhill County was organized in the 1840s, agriculture has been an important part of the economy. From the information in historical accounts it is difficult to know what information pertains only to the North Yamhill watershed. Therefore, the following information describes Yamhill County and is excerpted from Robert Bower's *Mill Watershed Assessment* that describes the agricultural history of the region. Interviews with residents and agency personnel were also used to compile information for this section and are noted.

During the years following the settlement of the watershed, agriculture meant cattle grazing and subsistence farming. During the first 20 years, "the valleys were settled rapidly, the range cattle were pushed back into the hills, and the growing of wheat on the level lands became the dominant industry" (Bower, 1999). A census by the United States in 1880 reported wheat, oats, and hay accounted for 99 percent of the agricultural production in the area.

During the 1880s, farmers were so successful in growing clover that it became the dominant cash crop. "By 1900, this crop occupied 1,216 acres, wild grasses 250 acres, tame grasses 8,007 acres while 3,033 acres of grain were cut green for hay" (Bower, 1999). With an increase in clover production the livestock industry flourished. Hops also became a significant part of the local agricultural economy with a 1900 census reporting 1,801 acres in production in Yamhill County alone.

From 1900 to 1910, the dairy industry came into being and gradually expanded in the area. The increase in dairy cattle increased the production of clover, grasses and hay. By 1909, clover production showed an increase of nearly 500% and acres of grain cut green for hay had increased by 600%. Fruit and nut production started as well and contributed significantly to the agricultural economy by 1909. Production of hogs, sheep, goats and poultry continued to make large contributions to the agricultural economy.

After 1919, wheat production decreased while dairy and prune production increased. By 1925, it was reported that there were 2,864 farms in Yamhill County with an average size of 83.56 acres per farm. The twenty-five year period between 1925-1950 witnessed a drop in the fruit tree production of apples and pears while filbert production increased.

Commercial production of berries came into play following World War I. Loganberries strawberries, raspberries, blackberries, and gooseberries comprised the initial berry crops with strawberries the dominant crop. Walnuts and Franquette nuts also became an important part of this history.

During the 1930s, the federal government started to encourage the planting of cover crops during the winter to hold soil. Grass seed crops became important between 1935 and 1939, and the acreage for lawn grass seed continued to increase to its present day levels.

Stan Christensen, life long Yamhill County resident had the following information on the historical and agricultural conditions of the county.

> Early to mid 1900s, most of the landowners in the county were highly diversified. It was not uncommon for one farmer to grow wheat, oats, barley, clover, and alfalfa. The size of the farm equipment available meant smaller farm fields. As well, these farms supported a wide range of animals including sheep, poultry, cattle and pigs. Most of the fields were fenced to either keep animals in or out.
>
> As technology improved, farmers could increase the size of their fields and increase their yields with the application of pesticides. However, increasing yields forced down prices and many farmers quit growing small grains. As well, the market changed to favor large producers. Many growers diversified into plum orchards, but these did not last long. In 1962, the October 12th Columbus Day storm blew down the orchards, knocking flat most of the trees. Land at this time could have been sold for $100 an acre, but no one wanted to buy it.
>
> In 1970, the vineyard industry sprang up in the valley in the aftermath of the fallen prune trees. Grapes were not uncommon in the valley previously, but they had been grown for personal use, not as a commercial crop.
>
> The advent of grass seed production has dramatically changed agriculture in the Willamette Valley. Pieces of land that were too wet for much of the year to farm without extensive drainage projects could now be put into grass seed production. This is a crop that can withstand heavy winter rains, and once planted can stay in the ground for 7 years. It is harvested mid-summer which coincides with the time of year with the least amount of precipitation. It is estimated that 85% of the grass seed in the country is grown in the Willamette Valley.

Susan Aldrich-Markham of the Oregon State University Extension Office related the following historic information.

> Historically, crops in the North Yamhill area were wheat and clover grown on a rotation basis. Wheat would be grown one year, followed by one year of crimson clover or two years of red clover, which is a perennial. When the price of wheat went too low to sustain a living from growing it, many people changed to growing tall fescue and perennial rye. The Willamette Valley has always been a premier seed production area and the shift from wheat to grass seed has continued that tradition.
>
> The ability of growers to secure a living on traditional farms has decreased over the years. Growers need more land in production in order to make a profit, but cannot afford the land prices, and thus own a very small acreage themselves. They have to lease land from a multitude of small landowners and may end up with 20 or more “landlords” on whose land they raise crops.
>
> In general, historically, there was more animal production than there is now. There is very little commercial beef production in the county now. Instead many people own a small piece of land and have a few animals for their own use. This move toward small farms is largely a result of the influx of people moving to the region and purchasing a piece of land in the Exclusive Farm Use zone. Zoning ordinances require the land to be in production, since that is the zoning designation. However, these new landowners do not always have the technical or practical experience or a large enough piece

> of land to make a living. So, they will have a pasture with a few animals, and make a living at a non-farm job.
>
> The increase in rural development creates the need for many private wells and septic systems as well as roads. It also has increased the number of people seeking assistance from the extension service. Many of these new landowners are new to owning land and have questions concerning its management. Many seek assistance when the grazing that has taken place on their property has eliminated all the suitable forage and only weedy species remain. It is hoped that in the future an extension program will be developed to address the needs of these landowners. Currently, the extension service offers advice and literature, but no specific classes for people with these needs.

For specific crop information, or questions concerning land management practices, contact the Farm Service Agency and Soil and Water Conservation District or Oregon State University County Extension, both located in McMinnville.

Forestry

Forestry has played an important role in the economy and ecological history of the watershed. When settlers first arrived, the forests were cleared for agricultural and commercial uses. Building material products were developed for local construction and for supplying markets throughout the nation. Historically, the Oregon Coast Range vegetation communities have been influenced by disturbance from fire. Since the mid 1800's, the disturbance patterns have been a combination of fire and development. Within the last 50 years, large fires have burned in the Nestucca, Trask, North Yamhill, Turner, and Willamina drainages. The Tillamook fires (1933-1952 burned over 300,00 acres including the headwaters of Turner Creek and the North Yamhill River) and the Oxbow fire (1973 burned 35,00 acres) are examples of recent fires that impacted local ecology and economy. Protection from fire has limited the number and intensity of wild fires in Northwest Oregon. Although the threat of wildfire still exists given the right climate and forest conditions, local forest ecological disturbance is now provided by forestry activity and to some degree by local fire, floods and windstorms (Upton, 2000).

Historic logging disturbances to the watershed were numerous and damaging when compared to current standards and practices. Early transportation systems used streams and rivers to bring logs to convenient locations for sawing. Skid roads were often located in stream bottoms for ease of development and access to timber.

The focus of this section is the effects of logging practices on the waterways. The long-term effects of these early logging practices contribute to current stream health and conditions. Trees provide a multitude of functions within riparian and upland locations. Riparian benefits include shading the water to prevent its exposure to direct sunlight and heating, natural recruitment of large woody debris to create pool habitats, rotting and releasing nutrients back to the soil, and habitat for wildlife. Original timber harvest practices first selected those trees located closest to the waterways and adjacent upland locations. There was very little regard for preserving riparian areas and most were probably removed from logging damage with a resulting negative impact on remaining ecological systems. But, riparian areas are resilient and reproduce to recreate the functions listed above. The old growth has been replaced with the current second generation of trees. Although the legacy of early logging impacts are evident to an extent today, implementation of current harvest and forestry practices has introduced techniques that aid in restoration of riparian functions that ultimately improve stream and habitat conditions. The following excerpts provide a view of the effects of historic logging practices on the present condition of the waterways.

The 1997 BLM analysis of the North Yamhill included the following history of logging and splash damming.

> The first record of flooding is associated with the desire to transport wood from the system. Log drives and splash damming operations of the 1883-1910 exposed channels to extreme "flood" events on an annual basis. These events would be equivalent to a "dam break flood" or "debris torrent" where streambed material and wood would be mixed in a fluid mass scouring the channel and stream banks. The magnitude of the equivalent peak flow associated with these events is estimated to have a 50 to 100 year return period. The Fairchild Creek splash dam impounded 5 million cubic feet of water. In some years this occurred twice a year as logs were distributed along the channel during the summer and transported to the mill during the winter high flow. During the drives of 1906, logs were "splashed" daily during the winter period. Splash damming and the associated impacts occurred throughout the mainstem of the North Yamhill up to RM 30 and on Haskins Creek and Fairchild Creek. See channel modifications map for splash dam locations.
>
> In terms of impacts, the release of a splash dam had far greater impact than a natural reference flood event. The frequency of occurrence, the size of material transported and the velocity at which these floods traveled were outside the natural range of variability. Large logs carried with the force of the flood brought tremendous shear stress to the streambed and banks. The result of these drives was the overall downstream movement of most streambed and bank material. Due to the forces disturbing the bed and the amount of water available for transport, it is reasonable to assume that the channel became entrenched and scoured exposing bedrock in the main channel below the splash dams. To facilitate movement of logs, the drivers would also clean the channel of any obstructions (large rock and wood) and create channel conduits for wood and water.
>
> It is inferred that for the 27 years of splash dam operation, the channel was kept in this most "efficient state" transporting wood and sediment out of the system at rapid rated when compared with the pre-settlement period. In effect, these channels had been converted from flood water dissipator and sediment collection sites to a conduit. The agricultural community in the vicinity of Pike provided further degradation of the floodplain by impinging on the channel by removing riparian vegetation for agricultural cropping (p. 38).
>
> A water powered sawmill was built around 1863 in the Fairdale area (*Oregonian* 1934). When Ivan Daniels father moved to Pike in 1873, his father rented an existing sawmill at that location. The Daniels family was the first to use the North Yamhill River for log drives. Logs were cut mostly in the early summer and logged with oxen. The logs would be placed in the river and the Daniels then waited for the river to rise in the winter and drive the logs to their mill. The first reported splash dam on the river was built in 1883 or 1884 five miles above the mouth of Fairchild Creek. This 14-foot tall dam was used in the winter to increase the flow of the stream to float the larger logs, and in the summer to spread logs down from their rollways (piling areas) in preparation for the winter freshets.
>
> Many more splash dams were used on the North Yamhill System before their use was discontinued around 1910. The end of splash damming can be attributed to two main factors (1) the railroad provided a new way of transporting logs in the watershed, and (2) loggers were faced with a growing threat of litigation by stream-adjacent farmers weary of the damage caused by the splash dam operations (p. 28).
>
> Salvage logging in the Tillamook Burn began in the late 1930's. Activity was accelerated to meet the lumber demands of World War II. This logging made a substantial reduction in the number of snags and produced many access roads. High-grading was a common practice (taking only the most valuable timber) and substantially delayed the reforestation efforts. Yarding methods were primarily tractor and cable – both high leading and ground leading. It was not uncommon for tractor operators

to use streambeds for yarding roads. Operations were conducted throughout the year (p. 39).

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Chapter 2 Historical Conditions

Introduction

This chapter compiles a timeline of ecological events that have shaped the watershed over the last 200 years. By understanding the ecological history of the watershed, the natural and human made changes that have occurred, it is hoped that the planning of restoration and enhancement projects can take this knowledge into account.

Methodology

Historical information was collected using the guidelines set forth by the *Oregon Watershed Assessment Manual*. Sources of information included the Oregon State Library archives in Salem, Mill Watershed Assessment, and Oregon State University Library in Corvallis. Arrival of Europeans brought many changes to the landscape of the Willamette Valley. Specific information on the early history of North Yamhill watershed is difficult to find, but general information on the Willamette Valley is substantial.

The Willamette Valley has a long history of human habitation (BLM, 1997). Humans have likely lived here since the glaciers began receding (Matthews, 1998). The Kalapuyans inhabited the area for approximately 10,000 years before the influx of European-American settlers in the 1840s. The North Yamhill watershed was one of the early areas settled in the Willamette Valley.

The Kalapuyans occupied the Willamette Valley for 7,000 to 10,000 years prior to European Americans settled in the valley. They had a subsistence lifestyle that used the rivers, mountains, and floodplains for fishing, camas and acorn collecting, seed and berry gathering and big and small game hunting. Plant food dominated their diets with camas being the most important. The Yamhill and Tualatin (sub-groups of the Kalapuya) were known to travel through the Coast Range to trade their camas and wappato for whalebone and seashells with the coastal peoples. While most of the Kalapuyan's subsistence resources occurred in the Willamette Valley and the vicinity, there is some evidence that the Tualatins fished for winter steelhead and fall salmon on coastal tributaries. The Yamhills were know to have bartered for fishing rights at Willamette Falls (BLM, 1998)."

Historical Information

The following timeline is a chronological list of some important events that contributed to the current watershed conditions. A brief narrative of these events is given in the italicized sidebars.

North Yamhill Watershed Timeline

1782 Smallpox reaches the Pacific Northwest native populations.

1800s Large scale fire mapped on BLM 1850 fire maps shows the west side of the watershed burned sometime the early 1800s.

1812 European Americans in direct contact with Indians of Willamette Valley (BLM, 1997).

1820s Explorer and naturalist David Douglas travels through the region and describes the mainstem Yamhill River as being, "for the greater part mud and sand." Large woody debris was common; the lower mainstem Yamhill River is reported to have been completely blocked by drift jams for 100-1500 meters in the mid 1800s (BLM, 1997).

1826 Douglas documents prairie burning in the Willamette Valley (BLM, 1997).

1831 Eighty percent or more of Native people in the region die of malaria (BLM, 1998).

1840+ Wetland areas tiled and drained to make land available for agriculture and residential development

1841 Kalapuya population estimated at 600 for Willamette Valley. Malaria outbreaks continue a mounting toll on the Kalapuya population. Open areas in the valley reclaimed by forests.

1843 Over 1,000 emigrants arrive in Oregon (BLM, 1997).

1848 Settlers force an end to burning by the Kalapuyans (BLM, 1997).

1849 Kalapuya population down to 60.

1850 Settlement increases with passage of the Oregon Land Donation Act. Nestucca fire burns 10,000 to 20,000 acres of the watershed (BLM, 1997).

1855 Kalapuya, Umpqua, and Takelma peoples moved to the Grand Ronde Reservation. Congress ratifies treaty with Confederated bands of Grande Ronde.

1861 Large flood on the South Yamhill River and its tributaries. Estimates of magnitude comparable to those of 1964 flood levels.[2]

1862 Nelson Fairchiles builds first known sawmill on the upper North Yamhill in Fairdale area (BLM, 1997).

1867 Mail and stage road built through the watershed – Portland to Tillamook via Yamhill, Fairdale, Trask Mountain, Trask River (BLM, 1997).

When settlers first arrived, they did not farm the valley floor.The threat of floods was too great, and the soils were poorly drained. Rather, they chose the lands on the open foot slopes of the hills. The soils of the hillslopes however, were not as fertile and they were subject to severe erosion during the winter rainy season when they were left bare. Eventually, systems of crop rotation and cropping in alternate years with summer fallow between, were developed. Soil erosion though continued to be severe.

In 1867, a trail once used by the Kalapuyans to access the coast, was developed into a mail route and stage road. The stage, called the Tillamook Express, traveled from Portland to Tillamook. It crossed the Coast Range on the Trask Toll Road. Contracts were awarded to individuals to manage this road and to carry the mail. An overnight stop was usually made at a hotel in the Fairdale area. The stage line and associated travelers and tourists caused Nelson Fairchiles to develop the Fairdale Mineral Springs as a resort in 1884. The facility included a hotel, a dance hall, and a refreshment stand. The construction of a railroad connected Portland to Tillamook spelled the end of the stage line in 1911 (BLM, 1997).

[2] Flood information from Yamhill River Flood Plain Information, Yamhill Soil and Water Conservation District, January 1976.

1873 First log drive on the North Yamhill River (BLM, 1997).

1883 First splash dam built on the North Yamhill River (BLM, 1997).

1884 Fairdale Mineral springs developed as a resort (BLM, 1997).

1892 First "cleaning" of the mainstem Yamhill River. An estimated 1200 trees and snags were cut and floated out of the lower 17 miles of river to allow greater river access for commercial traffic. Clearing the channel also made log drives easier. The impacts of channel clearing and log drives include: simplification and widening of the channel, loss of instream cover for fish, scouring of gravels needed for salmonids spawning, and the loss of vegetation and soils from the channel sides (BLM, 1998) pg. 56.

1900 Yamhill locks constructed on the Yamhill River at Lafayette (BLM, 1998).

1904 North Yamhill River dammed to form Carlton Lake (BLM, 1998).

General Land Office surveys from 1852 to 1853 show a surprising number of farms and roads in the lower Turner Creek area. In a 1934 Oregonian interview, Nelson Fairchiles recalled that his father settled in the Fairdale area in 1863. He was the sixth person to have taken up the homestead. The others were reportedly "starved out." As settlement increased, sawmills and grist mills sprang up along the North Yamhill River as high up as the Fairdale area, using dams to harness the power of the river (BLM, 1998).

1900+ Nearly all of Upper North Yamhill, Upper Baker, Upper Panther, and Upper Turner sub-watersheds heavily logged. This creates present day forest age classes from early (0-39 years) to middle (40-80 years).

1900s Row crops such as wheat and hay gave way to a valley-wide orchard boom in the early 1900s. Largely clean cultivated, orchards tended to suffer serious erosion and to be permanently damaged (Willamette Basin Task Force, 1969).

1910 First logging railroad (Carlton and Coast) built into the watershed. End of splash damming (BLM, 1998).

1911 First track type tractor developed. Lumber companies replace animals with tractors for logging on gentle slopes (BLM, 1998).

1918 Carlton Lake dam dismantled (BLM, 1998).

The Legacy of Timber Harvest

Historically, the timber industry made significant changes in the flow of water in the area. The most dramatic was the building of splash dams. These human made dams were constructed to hold back a stream and provide storage for felled logs. Once the desired amount of timber was in the stream, these dams were then blasted out, carrying the logs downstream with the rush of water. This scoured the stream bed, tore away protective stream vegetation, and left the area susceptible to future rain events and future erosion.

Historically, logging roads were constructed with little thought to erosion processes. Thus, roads easily washed away during powerful storms, and fill material was placed directly into streams. Prior to Word War II, huge areas were deforested and then abandoned. Tracts of private land reverted back to the county as tax delinquent as soon as the timber was harvested (Willamette Basin Task Force, 1969).

1922 Flora Logging Co. buys out Carlton and Coast Railroad and extends the line to access timber northwest of the watershed. Carlton dam restored by Flora Logging Co (BLM, 1998).

1923 Hydraulic sheave mounted to rear of tractors, allowing line logging on steep hillsides (BLM, 1998).

1931 Fifty-year flood in March of this year (BLM, 1998).

1933 Tillamook burn, approximately 1,340 acres of the watershed burned (BLM, 1998).

1930s The Depression greatly affected agriculture and ended the production of hops and prunes as major crops. Hops farmers lost the market due to prohibition. The next big change in land use came in the 1930s with the development of the seed industry. Production of hairy vetch seed largely replaced grain production in the valley, and eventually perennial grass seed came into production, which meant the ground was covered year round.

1939 Tillamook reburn. Approximately 14,040 acres of the watershed burned (BLM, 1997). Flora Logging Co. abandons railroad due to fire losses. The burn affected almost half of the watershed. The Burn and accelerated cutting during World War II account for a high percentage of 40 to 60 year old trees.

1940 Log trucks replace railroad as primary means of transporting logs (BLM, 1997).

1948 One of Yamhill County's greatest forest fires burned several thousand acres in the Gopher Valley and East Creek. See the section on Fire History for further information.

1951 Haskins Dam construction completed. The dam provides water storage to supply the town of McMinnville. The dam has blocked fish passage since.

1955 One hundred year flood in December.

1960 Columbus Day storm.

1964 The floods of 1964 did considerable damage to agricultural lands. An estimated 20 million tons of soil was washed into streams by this flood. As well, significant damage occurred from the accumulation of logs and other logging debris on agricultural lands when the wood was washed into swollen streams and then deposited in fields as the waters subsided. Bridges were destroyed when the accumulation of woody debris in a channel jammed against a bride causing it to wash out. A total of $32,750 dollars was spent in 1965 to repair the damage done by this flood event, including the restoration of 26,000 feet of stream channels (Soil and Water Conservation District, 1979).

1965 First hatchery raised coho salmon introduced to the watershed. Releases would continue into the 80s, but with little or no success. Carlton Lake dam removed.

1970s Concerns raised over land-use planning. From 1974 to 1977, 1500 acres of rural land was taken out of production annually.

"…These trends show that a large percentage of good croplands are being lost to housing… If we are to curtail their loss, less productive lands must be utilized for housing development instead of our prime land. (Soil and Water Conservation District, 1979).

Awareness of water quality problems and their causes led to this recommendation:

"Troughs or other means should be utilized to water animals instead of allowing them to drink directly from streams to avoid waste and sediment problems (Soil and Water Conservation District, 1979)."

1980s Hatcheries stocking of coho salmon and rainbow trout discontinued after biologists begin to question the interactions between wild and stocked species.

1996 Large-scale flooding in North Yamhill watershed and throughout the Willamette Basin (100+ year event). DEQ lists the North Yamhill River and Turner Creek on 303(d) list of water quality limited streams.

1997 Elk, deer, black bear, and cougar populations are either stable or increasing within the watershed. Elk and deer damage to young trees and agricultural lands is a problem at lower elevations and creates the need for maintaining forage areas in uplands. Black bear damage to young conifer trees, bear and cougar damage to livestock, and bear and cougar and human encounters are expected to increase due to current hunting restrictions (no baiting or hounds) (BLM, 1997).

1998 Winter Steelhead in Upper Willamette watershed, including the North Yamhill watershed, are listed as threatened under the Federal Endangered Species Act.

2000 Yamhill Basin Council conducting stream temperature monitoring on the North Yamhill River, Turner Creek, Wildwood Creek, Hay Creek, and Hawn Creek. Timber companies and the BLM also conducting temperature monitoring in the watershed.

Chapter 3 Channel Habitat Types

Introduction

The 1999 OWAM draws on several stream classification systems to create a volunteer friendly system for classifying streams based on channel habitat types. CHT classifications allow for the partitioning of streams into segments based on stream gradient, channel confinement, and stream size. These segments will be used later in the assessment, along with the other components, to determine a stream's sensitivity to restoration efforts. This classification will aid in identifying those stream reaches with the greatest potential for response to restoration efforts.

Methodology

Identifying CHTs was done by analyzing aerial photos on a 1:660 scale and USGS 1:24,000 topographical quadrant maps. Only perennial (streams with water year-round) streams were examined due to time limitations. Each stream was measured using a map wheel, and then split into segments depending on the elevation changes. Segments of at least 1,000 feet in length and with at least 60 feet change in elevation were marked on the map.

The next step was to break the streams into channel gradient classes. Descriptions of each CHT are provided by the OWAM, 1998. Using these characteristics together with the information collected off the topographic maps, a CHT was assigned to each segment. This data was then added to a stream shapefile in ArcView as a new feature. This was not done with digitizing. The topographic map with an overlay of the CHTs was examined, and then each stream segment was highlighted and assigned a CHT in the shapefile.

The map in this document is only a representation of the CHT locations. For more precise locations, consult the YBC who retains the actual maps with the reach sections marked and measured that were used to determine the CHTs. The final step involved field verifying the designations and areas of uncertainty.

Channel Habitat Types

The channels of the watershed do not neatly conform to the choices available in the OWAM. Many of the stream beds in the lower watershed are deeply incised or downcut. Historically these areas would have been flood plain, but currently, they more closely fit the description for low gradient, moderately confined. These streams however (see Table 11) do not meet the description of "variable confinement by low terraces or hill slopes." The confinement is from the downcutting of the stream banks.

Stream surveys of the North Yamhill River and Cedar Creek, conducted by the ODFW in 1993, show that the channel system is a highly disturbed and simplified system. The findings show that LWD is limited to 4 pieces per stream mile. The survey also indicates that the main channels of the North Yamhill and Cedar Creek are constrained by terraces that are not flooded during high flows. There is no wide floodplain and the channel shape indicates downcutting has occurred. Bedrock substrate is found on nearly 40% of the reach. Lateral scour can be seen as the banks actively erode (BLM, 1997).

The stream processes that are creating this situation are too lengthy to address in this document. This information is provided to bring the situation to attention; further data would be needed to analyze how this is happening.

Possible reasons for stream incision:

- **Loss of historic flood plain due to tiling and drainage projects.** Larger quantities of water are being forced into the system during a shorter period of time, which causes higher velocities of water to move through the system. These higher velocities carry more energy and so have more power to erode and scour the channel.

- **Loss of large wood debris in the system.** Large wood debris (LWD) was removed from the system in the ;ate 1800s to early 1900s with through log deives. Splash dams and clearing for navigation. Additional large wody debris (LWD) was removed from the streams during the 1960s with the hope of increasing fish habitat. Removing the wood did not have the desired effect and actually decreased the quality of available fish habitat. LWD is valuable because it decreases the velocity of the water as it moves down stream and creates pools of slower moving water upstream.

- **Stream bank modifications such as hardening of the bank with rip-rap (rocks that hold the soil in place) or concrete.** These prevent the stream from changing its meanders and finding the best way to dissipate energy.

- **Accumulation of historic actions**. Channels are being affected by the culmination of activities that took place from European settlement to the present. Splash dams and logging removed riparian vegetation and simplified channel beds. These channels lost their depositional sites and no longer accumulated sediments – which led to higher velocities.

Table 4 provides descriptions of the gradient, channel confinement, stream size, and the sensitivity of that channel to restoration as provided by the OWAM. Stream gradient is the steepness of the channel. The gradient is highest near the headwaters closest to the Coast Range and lowest in the valley where the land is flat. Confinement describes whether that stream is connected to its floodplain. An unconfined stream would be allowed to meander freely, flooding during high flows and cutting new banks and creating a new channel. A confined stream would have limits, such as steep valley walls, prohibiting lateral movement. Confined streams do not carve oxbows or create meanders. A moderately confined stream is somewhere between these two descriptions. Channel sensitivity describes how receptive streams are to enhancement and restoration work.

Table 4. Channel Habitat Types

Channel Habitat Type	Gradient	Channel Confinement	Stream Size	Sensitivity
Low gradient large floodplain **(FP 1)**	<1%	Unconfined	Large	High
Low gradient medium floodplain **(FP2)**	<2%	Unconfined	Medium	High
Low gradient small floodplain **(FP3)**	<1%	Unconfined	Small to	High

			medium	
Low gradient confined **(LC)**	<2%	Confined	Variable	Medium
Low gradient moderately confined **(LM)**	<2%	Moderately confined	Variable	High
Moderate gradient moderately confined **(MM)**	2-4%	Moderately confined	Variable	High
Moderate gradient confined **(MC)**	2-4%	Confined	Variable	Medium
Moderate gradient headwaters **(MH)**	1-6%	Confined	Small	Medium
Moderately steep narrow valley **(MV)**	3-10%	Confined	Small to medium	Medium
Very steep headwaters **(VH)**	>16%	Confined	Small	Low
Steep narrow valley **(SV)**	8-16%	Confined	Small	Low

(From the Oregon Watershed Assessment Manual, 1999)

The channel habitat type descriptions are noted in Table 5 . The miles of stream column indicates the approximate miles of stream that best fit that category and description. Figure 7 shows the locations of the streams and the color of the stream denotes the channel habitat type.

Table 5. Channel Habitat Types and descriptions

Channel Habitat Type	Miles of Stream	Description	Fish Utilization
Low Gradient Large Floodplain **(FP1)**	56.3	Lowland and valley bottom channels. Normally, these channels have extensive valley floodplains and river terraces. Sloughs, oxbows, wetlands, and abandoned channels are common. Numerous overflow side-channels are characteristic.	Anadromous: Potential steelhead rearing. Resident: Potential overwintering.
Low Gradient Medium Floodplain **(FP2)**	24.0	Main-stem streams in broad valley bottoms with well-established floodplains. Dissected foot slopes, and hill slope and lowland landforms may directly abut FP2 floodplains. Channels are often sinuous, with extensive gravel bars, multiple channels, and terraces. May include such features as sloughs, side-channels, wetlands, beaver pond complexes, and small groundwater-fed tributary channels.	Anadromous: Potential steelhead rearing. Resident: Potential overwintering.
Low Gradient Small Floodplain Channel (**FP3**)	23.5	Located in valley bottoms and flat lowlands. Usually adjacent to toe of foot slopes or hill slopes within the valley bottom. May contain wetlands. Beavers can dramatically alter channel characteristics. Sediment from upstream temporarily stored in these channels and on the adjacent floodplain.	Anadromous: Potential steelhead rearing. Resident: Potential overwintering.
Low Gradient Confined Channel **(LC)**	2.0	Channels are incised or contained within adjacent, gentle landforms, or incised in volcanic flows or uplifted coastal landforms. Frequent bedrock outcrops, high terraces, control lateral channel migration or hill slopes along stream banks. Stream	Anadromous: Potential steelhead spawning and rearing. Resident: Potential spawning, rearing, and

		banks can be susceptible to landslides in areas where steep hill slopes of weathered bedrock, glacial till, or volcanic-ash parent materials abut the channel.	overwintering
Low Gradient Moderately Confined Channel (**LM**)	18.0.	Low gradient reaches that display variable confinements by low terraces or hill slopes. A narrow floodplain approximately two to four times the width of the medium to large sized channel.	Anadromous: Potential steelhead spawning and rearing. Resident: Potential spawning, rearing, and overwintering
Moderate Gradient Moderately Confined Channel (**MM**)	24.0	Variable controls on channel confinement. Alternating terraces and /or adjacent mountain-slope, foot-slope, and hill-slope landforms limit channel migration and floodplain development. Similar to LM channels. Narrow floodplain usually present.	Anadromous: Potential steelhead spawning and rearing. Resident: Potential spawning, rearing, and overwintering.
Moderate Gradient Constrained Channel (**MC**)	18.5	Narrow valleys with little river terrace development, or deeply incised into valley floors. Hill slopes and mountain slopes composing the valley walls may lie directly adjacent to the channel. Bedrock steps, short falls, cascades, and boulder runs may be present; these are usually sediment transport systems. Moderate gradients, well-contained flows, and large particle substrate indicate high stream energy.	Anadromous: Potential steelhead spawning and rearing. Resident: Potential spawning, rearing, and overwintering.
Moderate Gradient Headwater Channel (**MH**)	1.3	Common in plateaus in Columbia River basalts, young volcanic surfaces, or broad drainage divides. May be sites of headwater beaver ponds. Similar to LC channels, but exclusive to headwaters. Potentially above the anadromous fish zone.	Anadromous: Potential steelhead spawning and rearing. Resident: Potential spawning, rearing, and overwintering.
Moderately Steep, Narrow Valley Channel (**MV**)	46.3	Moderately steep gradient, confined by adjacent moderate to steep hill slopes. High flows are generally contained within the channel banks. A narrow floodplain, one channel width or narrower.	Anadromous: Potential steelhead spawning and rearing. Resident: Potential spawning, rearing, and overwintering.
Steep Narrow Valley Channel **(SV)**	39.3	Constricted valley bottom bounded by steep mountain or hill slopes. Vertical steps or boulders and wood with scour pools, cascades and falls are common. Channels are found in the headwaters of most drainages or side slopes to larger streams. May be shallowly or deeply incised into the hill slope. Channel gradient may be variable due to falls and cascades.	Anadromous: Lower gradient segments may provide rearing. Resident: Limited spawning and rearing.
Very Steep Headwater **(VH)**	9.2	See SV above, similar characteristics, but VH channels are steeper.	Usually waterfalls too steep for fish to negotiate.

Total Stream Miles Analyzed	**262.4**		

(From the Oregon Watershed Assessment Manual, 1999)

Table 6 provides descriptions of the restoration potential associated with the each channel habitat type. Channels respond to change differently based on their position in the watershed. The headwaters of all the large streams in the watershed including Turner Creek, Fairchild Creek, North Yamhill River, Haskins Creek, Panther Creek, and Baker Creek are steep, with low sensitivity to changes in channel pattern, location, width, depth, sediment storage, and bed roughness. These are not areas to focus on for enhancement projects. The segments labeled moderate gradient, moderately confined including those on Turner Creek, North Yamhill River, Fairchild Creek, and Panther Creek are highly sensitive to change making them more likely candidates for enhancement projects. Refer to the CHT map and Figure 7 for stream locations.

The low gradient streams that are most responsive to change are also the ones in the most developed parts of the watershed where the land is under cultivation. (Refer to the Current Vegetation map Figure 8.). The North Yamhill River, Panther, and Baker creeks each have significant stretches that could be enhanced. With the current land use, and the proximity of the road to the waterways, these areas would benefit most from riparian enhancement projects that would not encourage meandering or flooding, but would improve the quality of the vegetation along the channels. (Refer to the Riparian Chapter of this document for more information.)

Table 6. CHT restoration potential

Channel Habitat Type	**Riparian Enhancement Opportunities**
Low gradient large floodplain **(FP1)**	Due to the unstable nature of these channels, the success of many enhancement efforts is questionable. Opportunities for enhancement occur where lateral movement is slow. Efforts to restrict meandering will often result in undesirable alteration of channel conditions downstream. Smaller side-channels may be candidates for efforts that improve shade and bank stability, but it is likely that these efforts may be more beneficial and longer-lived elsewhere in the basin.
Low gradient medium floodplain **(FP2)**	Can be among the most responsive in the basin. Stream allowed to move both laterally and vertically. These channels can move large amounts of sediment during high flows and create new channels.
Low gradient small floodplain **(FP3)**	The limited power of these streams [i.e. low stream flows] offers a better chance for success of channel enhancement activities than the larger floodplain channels. While the lateral movement [i.e. meandering] of the channel will limit the success of many efforts, localized activities to provide bank stability or habitat development can be successful.
Low gradient moderately confined **(LM)**	Like floodplain channels, these channels can be among the most responsive of channel types. Unlike floodplain channels, however, the presence of confining landform features … help limit the destruction of

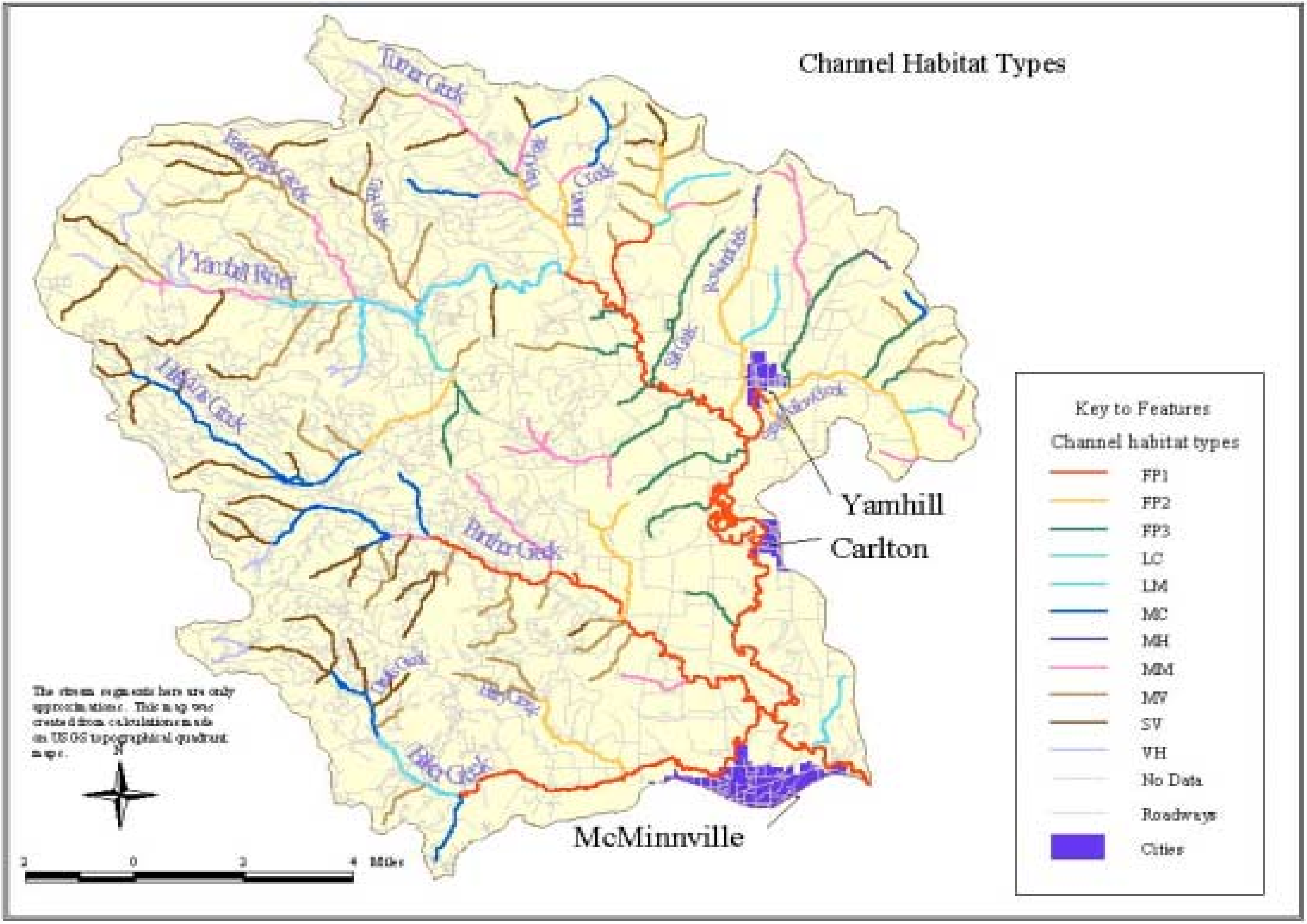
	enhancement efforts common to floodplain channels. Because of this, LM channels are often good candidates for enhancement efforts. In forested basins, habitat diversity can often be enhanced by the addition of wood or boulders. Pool frequency and depth may increase, and side-channel development may result from these efforts. Channels of this type in nonforested basins are often responsive to bank stabilization efforts such as riparian planting and fencing. Beavers are often present in the smaller streams of this channel type.
Moderate gradient moderately confined **(MM)**	Same as LM, except that the slightly higher gradients impart a bit more uncertainty as to the outcomes of the enhancement efforts when compared to LM channels.
Moderate gradient confined **(MC)**	Same as LC.
Moderate gradient headwaters **(MH)**	These channels are moderately responsive. In basins where water temperature problems exist, the stable banks generally found in these channels lend themselves to the establishment of riparian vegetation. In nonforested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from livestock access and control measures.
Moderately steep narrow valley **(MV)**	Same as LC and MC.
Steep narrow valley **(SV)**	These channels are not highly responsive and in-channel enhancements may not yield intended results. Although channels are subject to relatively high energy, they are often stable. Where stable banks exist, opportunity for riparian enhancement. This may serve as a recruitment effort for large woody debris in the basin.
Very steep headwater **(VH)**	Same as SV

(From Oregon Watershed Assessment Manual, 1999)

Covered:
Channel gradient designations using blue line streams of USGS topographical maps.
Channel habitat types using maps, aerial photos and field verification visits.

Not Covered:
CHTs were determined only for blue line streams. CHTs should be determined for many of the intermittent streams in the watershed.

Figure 7.


Channel Habitat Types
Key to Features
Channel habitat types
FP1
FP2
FP3
LC
LM
MC
MH
MM
MV
SV
VH
No Data
Roadways
Cities
Turner Creek
Panther Creek
Baker Creek
Yamhill
Carlton
McMinnville
N
2
0
2
4
Miles

Chapter 4 Vegetation

In order to better understand the current and historic vegetation patterns, including wetland and riparian vegetation conditions, current seral stages, sensitive/threatened species, and exotic plant species, all of these areas were combined in one section.

Figure 8 shows the current watershed vegetation. This map was created from a map of the vegetation of the Willamette Valley produced in 1998 by ODFW Ecological Analysis Center and the Northwest Region Habitat Program (NWHI). NWHI mapped ninety percent of the vegetation with field verification and the other 10 percent was verified using aerial photos. The accuracy for Yamhill County is given as 83%. Most of error is in determining the difference between annual and perennial grasses. Any changes to land use since the late 1990s are not mapped. However, there has been little change in the dominant vegetation in the watershed during this time. Descriptions of the land uses and some explanation on how they are mapped are given in Table 7.

Table 7. Vegetation and land use types

Vegetation/Land use	Acres	Percent of Watershed	Explanation of vegetation and land use classes
Row crops	965	0.900%	Farmland could be vegetables or herbs.
Annual grass	3,684	3.200%	Farmland for production of wheat, oats, barley, and rye. Generally, without irrigation.
Perennial grass	24,872	21.900%	Farmland for production of perennial grass such as grass seed and hay. Generally grown without irrigation.
Orchards, berry farms, nurseries	2,643	2.300%	Farmland used for fruit trees, berries, Christmas trees, and nursery stock. High volume of irrigation.
Unmanaged pasture	6,350	5.600%	Farmland that appears to have no active management such as fertilizer application, irrigation or weed control. Might be grazed. Land usually has been cleared and farmed intensively in the past.
Recreational fields/parks	6	0.005%	Too small to be seen on this map.
Urban/industrial	1,330	1.200%	Includes area consisting of industry or housing on the subdivision level. Does not follow urban growth boundaries. It depicts actual land use at the time of map construction.
Water	163	0.200%	Only areas of water that could fit the scale of the map are included – this is why only large water bodies like the N. Yamhill River are visible.
Black hawthorn riparian/hedgerows	2,479	2.200%	Many of these areas are too small to be seen clearly on the map at this scale.
Cottonwood riparian	18	0.020%	Located along waterways. These areas are too small to be seen on the map at this scale.
Willow	42	0.040%	Expect willow along most waterways. These areas are too small to be seen on the map at this scale.

Reed canary wetland	109	0.100%	Exotic species! See Non-native section of this document for more information.
Cattail – bulrush	3	0.003%	Most area that would support cattails has been converted to farmland.
Ash/cottonwood/maple bottom pasture	2,195	1.900%	This habitat is usually a seasonal wetland, bordering streams.
Oak/Douglas-fir oak>50%	4,001	3.500%	Usually very diverse habitat with many species of forbs and grasses in the understory.
Douglas-fir/oak >50% Douglas-fir	4,446	3.900%	These areas mapped up to the edges of the valley – not into the Coast Range.
Oak/madrone	35	0.030%	Not possible to see this easily at this scale, all pockets of it are on the NW side of the watershed in the edge of the unclassified forest at the map's edge.
Maple/alder/fir Hardwoods dominant	1,562	1.400%	Along North Yamhill River and tributaries. Developed in response to logging or fire or failure to replant with coniferous species.
Douglas-fir	12,948	11.400%	This only represents the areas in the foothills of the Coast Range. Any small Christmas tree plantings likely got this classification.
General forest unclassified	45,589	40.200%	Area not examined in detail.
Total	113,440	100.000%	

Figure 9 shows the historic vegetation of the area. The data was not complete and nothing was available for the far western area, including the headwaters of most of the larger tributaries. The map shows approximate acreage of the various vegetation types present before the area was settled. The data was collected and analyzed by The Nature Conservancy and the maps were drawn by reading and interpreting the surveyor notes from the General Land Survey undertaken in the mid 1800s. Table 8 shows the general categories, along with the more complete vegetation descriptions along with the approximate acreage of each type. The total historic vegetation acreage is at the bottom of Table 8 does not match the total acreage of current vegetation because the historic data is unavailable for the farthest western region of the watershed.

Table 8 Historic vegetation descriptions and acreages

General Category	Specific Categories that correspond to the general category.	Approximate acreages	Percent of total
Closed Forest: Riparian and Wetland	White oak-ash riparian forest, sometimes with ponderosa pine, cottonwood, and willow.	1,847	2%
	Ash swamp and ash swale, sometimes with alder		
	Ash-mixed deciduous riparian forest with combinations of red alder, bigleaf maple, black cottonwood, white oak, dogwood. Conifers may be present in small numbers.		

	Ash willow swamp, sometimes with ninebark and briars very thick.		
Closed forest, upland	Douglas-fir forest, often with bigleaf maple, grand fir, dogwood, hazel, yew. No other conifers present.	25,670	28%
	Douglas-fir, white oak, bigleaf maple forest, with brushy understory of hazel, young oak, oak brush, oak sprout, bracken, briars, sometimes willows.		
	FF, but burned, often with scattered trees surviving fire.		
	FFHC, but burned, often with scattered trees surviving fire.		
	Mesic mixed conifer forest with mostly deciduous understory. May include Douglas-fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak and red alder.		
Emergent Wetlands	Marsh, composition unknown; includes wet meadow.	560	<1%
	Swamp, composition unknown.		
Wet and dry prairie	Seasonally wet prairie. May have scattered trees, most with distances greater than 100 links.	23,291	25%
	Upland prairie, xeric. May have scattered trees, most with distances greater than 100 links.		
Savanna	White oak savanna	18,281	19%
	White oak, Douglas-fir savanna, mostly herbaceous undergrowth		
Shrubland	Willow swamp, sometimes with ninebark, including riparian stands on gravel or sand bars. May contain small amounts of ash.	28	<1%
Woodland	Scattered or thinly timbered white oak woodland, brushy understory of hazel, oak, bracken. No fir or black oak.	23,773	25%
	Conifer-dominated woodland; various combinations of Douglas-fir, red cedar, hemlock, bigleaf maple, brushy understory of hazel, young oaks, oak brush, young fir, bracken. No pine.		
	Scattering or thinly timbered Douglas-fir, white oak woodland. May contain big leaf maple, brushy understory of hazel, young oaks, oak brush, young fir, and bracken.		
	Total acreage of area examined	**93,450**	**100%**

Comparisons of historic and current vegetation maps show a much larger acreage of Douglas-fir forest than historically. This can be contributed to the cessation of prairie burning and the planting of Douglas-fir for timber. Other significant differences include the loss of wetland and upland prairie, conversion of prairie and white oak savanna to agricultural use, loss of swamp areas, less vegetation diversity overall and large areas of non-native species. One striking comparison is how much settlement and agriculture have impacted the floodplain and lower elevations of the watershed. The entire east side of the watershed is entirely different vegetation from what it was 150 years ago.

Figure 10 shows the seral stage and age class distribution of vegetation in the North Yamhill watershed above Pike including Turner and Upper North Yamhill subwatershed. This data is

Figure 8.

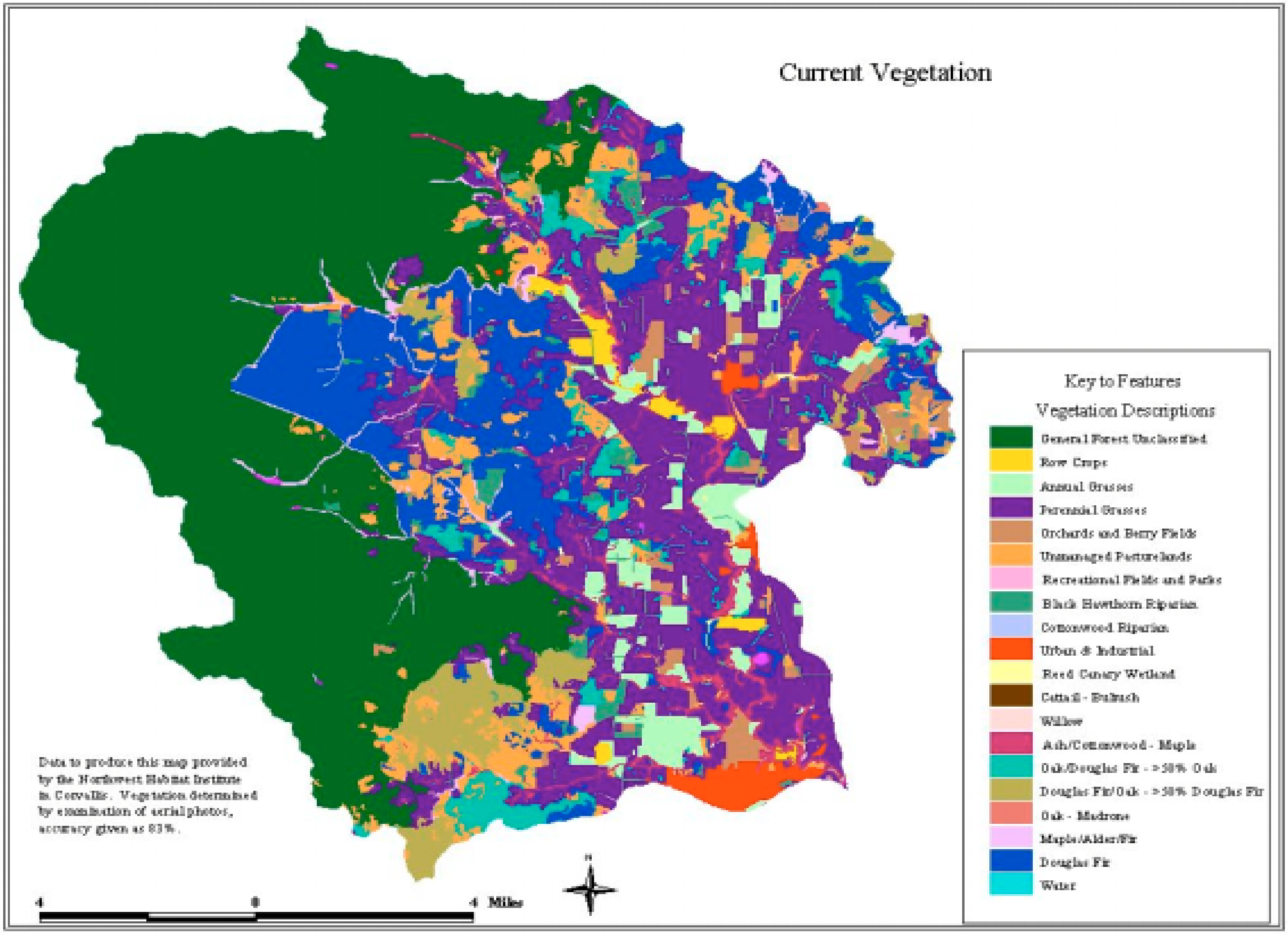
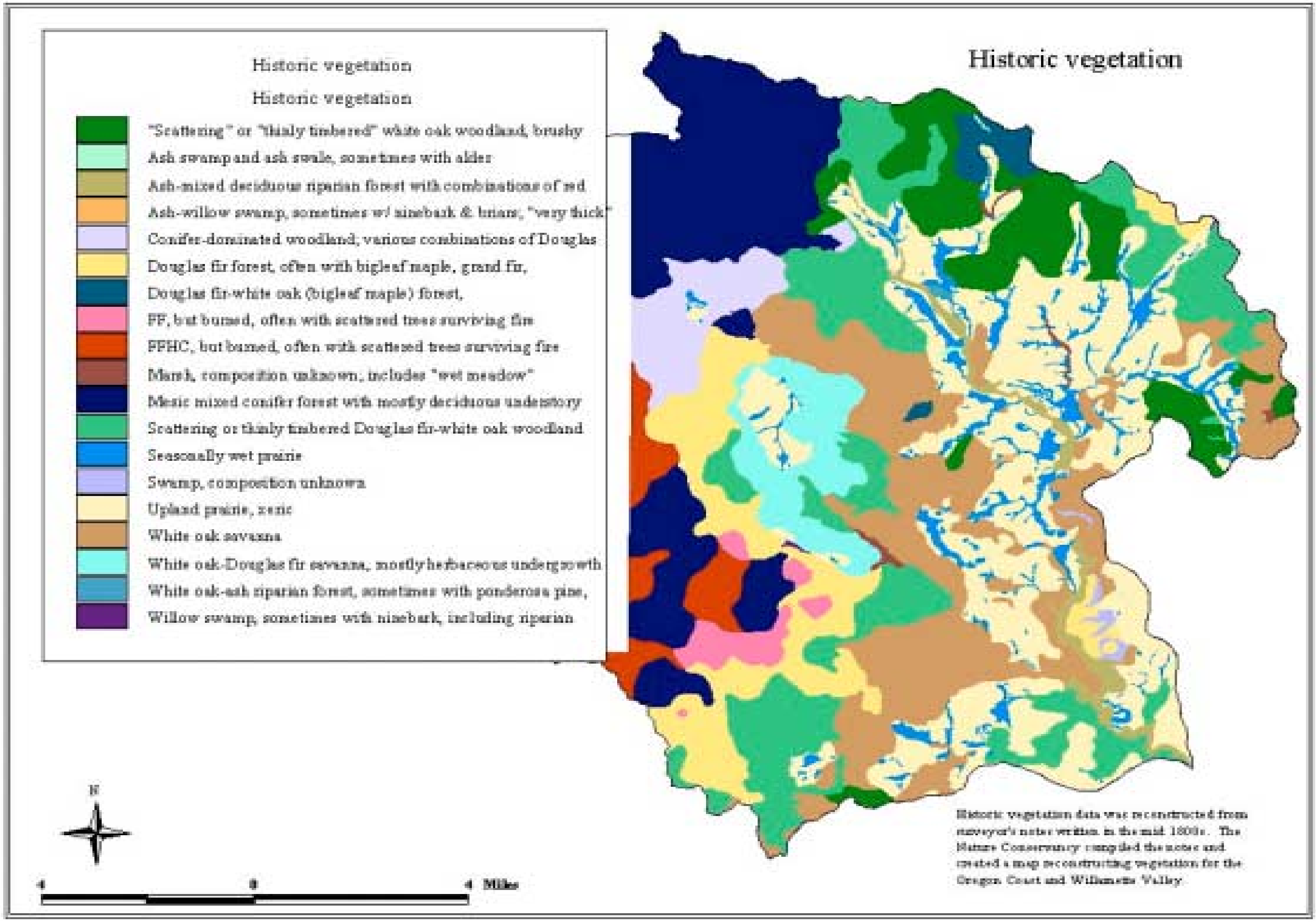

Current Vegetation
Key to Features
Vegetation Descriptions
General Forest Unclassified
Row Crops
Annual Grasses
Perennial Grasses
Orchards and Berry Fields
Unmanaged Pasturelands
Recreational Fields and Parks
Black Hawthorn Riparian
Cottonwood Riparian
Urban & Industrial
Reed Canary Wetland
Cattail - Bulrush
Willow
Ash/Cottonwood - Maple
Oak/Douglas Fir - >50% Oak
Douglas Fir/Oak - >50% Douglas Fir
Oak - Madrone
Maple/Alder/Fir
Douglas Fir
Water
Data to produce this map provided by the Northwest Habitat Institute in Corvallis. Vegetation determined by examination of aerial photos, accuracy given as 83%.
4 0 4 Miles

Figure 9.



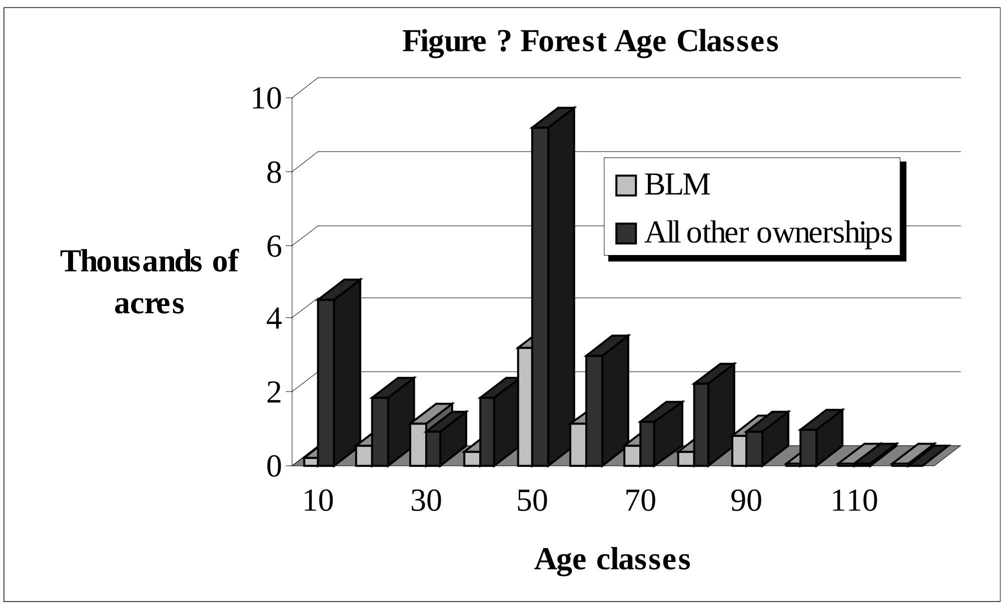
Historic vegetation
Historic vegetation
"Scattering" or "thinly timbered" white oak woodland, brushy
Ash swamp and ash swale, sometimes with alder
Ash-mixed deciduous riparian forest with combinations of red
Ash-willow swamp, sometimes w/ ninebark & briars; "very thick"
Conifer-dominated woodland; various combinations of Douglas
Douglas fir forest, often with bigleaf maple, grand fir,
Douglas fir-white oak (bigleaf maple) forest,
FF, but burned, often with scattered trees surviving fire
FFHC, but burned, often with scattered trees surviving fire
Marsh, composition unknown; includes "wet meadow"
Mesic mixed conifer forest with mostly deciduous understory
Scattering or thinly timbered Douglas fir-white oak woodland
Seasonally wet prairie
Swamp, composition unknown
Upland prairie, xeric
White oak savanna
White oak-Douglas fir savanna, mostly herbaceous undergrowth
White oak-ash riparian forest, sometimes with ponderosa pine,
Willow swamp, sometimes with ninebark, including riparian
Historic vegetation
N
4
0
4 Miles
Historic vegetation data was reconstructed from surveyor's notes written in the mid 1800s. The Nature Conservancy compiled the notes and created a map reconstructing vegetation for the Oregon Coast and Willamette Valley.

from the 1997 BLM North Yamhill watershed analysis. This classification represents data from 1993 air photos. Harvest and other management activities conducted since that time are not included in this analysis. The only areas included in this analysis are the forested areas. 'Early' seral stage is vegetation between 0-10 years, which includes recently planted forested lands. The 'Open' and 'Closed' sapling seral stages designate growth between 20-30 years and 40-70 years respectively. The 'Mature' designation is for vegetation 80-110 years old. Old growth designation is for land with vegetation over 200 years old.

These stands are primarily Douglas-fir with some western hemlock, western redcedar, red alder, and bigleaf maple. The majority of private forestlands are in the 50-year age class, reflecting the fire history and salvage in the watershed (BLM, 1997).

Common understory plants include sword fern, salal, Oregon-grape, and red huckleberry. Sub-climax Douglas-fir dominates most of the conifer forest areas. These areas generally support only sparse understory vegetation because of the high tree density.

Figure 10.



If given sufficient time without disturbance, western hemlock and western redcedar would dominate the upland portions of the watershed because of their greater tolerance to the shade of other trees. However even at ages of 400 to 600 years, most stands would still support significant numbers of Douglas-fir because of their longevity (Taush, 2001). Increased diversity and more variable stand density generally accompany succession to an old growth condition. This component is nearly absent from the watershed at present, with only scattered individuals and groups of old growth trees having survived past fires and logging.

The upper watershed is intensively managed for timber production. This translates into a short rotation time and results in predominately even-aged Douglas-fir stands. The rotation currently in use is 40 to 60 years. This is not long enough to produce large wood debris of the size needed to increase channel complexity in the watershed. The trees left standing in the riparian area after a clearcut are the only source for large wood to the streams. Deciduous trees are less desirable because they do not attain a very large size, decompose more rapidly, and do not provide in-channel structure for very long.

Laminated root rot is present in the watershed. The fungus *Phellinus weirii*, a native root pathogen that attacks and kills Douglas-fir, causes laminated root rot. *Phellinus weirii* greatly affects Douglas-fir stands because it travels by root contacts. The infected trees are subject to windthrow, which makes openings in the stands, and to attack by the Douglas-fir beetle *Dendroctonus pseudotsugae* causing additional openings in the stands. (BLM, 1998). A large infected area is present in Baker subwatershed along High Heaven Road in Section 25, T3S, R6W. The Douglas-fir plantation is close to 40 years old and continues to experience heavy mortality and growth loss from the disease (BLM, 1998). See Chapter 11 on restoration and enhancement projects for further information.

Gaps in the canopy provide habitat for shrubs, hardwoods, and shade and diseases tolerant species. Since western redcedar and western hemlock have a greater resistance, they are being planted in many infected areas on federal lands. The dying of the Douglas-fir also provides snags and a source of coarse woody debris (BLM, 1998).

The lower watershed lacks large wood debris and diverse riparian vegetation. It is intensively managed for agriculture. Most of the vegetation is a narrow one to two tree strip of vegetation along the stream bank, mostly deciduous. In many areas, non-native blackberry dominates the streambanks. If there are woody plants present, the dominant species is red alder with a few big leaf maple and willow present and even fewer large conifers (BLM, 1998).

Terrestrial Habitats/Historical vegetation

This section of the report was researched and written with extensive assistance from Dave Hanson, local resident and historian.

Vegetation Patterns:

There are four main habitat types in the Willamette Valley ecoregion that all evolved in relation to fire and flooding/groundwater patterns — riparian forest, wet and dry prairie, woodlands, and oak savanna. Historically, these vegetation patterns dominated the watershed. These habitats were extremely productive and sustained large populations of wildlife. *See Figure 6 for a map of the historic vegetation.*

Figure 6 shows the approximate vegetation of the watershed in 1851, prior to settlement. The data to produce this map was collected by the Nature Conservancy. The land descriptions written by surveyors for the Government Land Office in the mid 1800s were used to construct maps of the historic conditions and vegetation. Their sometimes very detailed descriptions give the best information on what the area looked like before it was densely inhabited.

This map and the current vegetation map are most instructive when compared side by side. The current vegetation is more specific and can be viewed with greater certainty. The historic vegetation represents the best reconstruction, as actual data do not exist. Even so, note that the habitat wet prairie is not present in the current watershed. Additionally, the amount of land classified as forest has increased. The lack of fire has allowed Douglas-fir to expand its range. There is still an easy to see transition zone of Douglas-fir and oak between the valley and the coast range. The areas of wetlands are now cultivated land. Compare these maps with Figure 19 of the acreage under irrigation. Note that the areas under irrigation are also former wetland.

Lowland Riparian Forest

In the lower elevations of the watershed, historically, the rivers and streams had extensive floodplains with closed-canopy forests of deciduous trees like Oregon ash, alder, black cottonwood, and big leaf maple, and grew mixed together with conifers like Douglas-fir, grand fir, and ponderosa pine. Western redcedar may have occasionally been present but since it is very fire sensitive it would not have been common. As elsewhere in the valley, fire were set by humans to burn off brush, grasslands, and trees. But the high levels of soil moisture present in the riparian areas made them resistant to burning and they tended to develop a dense understory of shrubs. Generally these forests were within 50 feet of rivers, and then transition into wet prairies (see Figure 9).

In the valley bottoms with a low gradient, the streams tended to develop a meandering, sinuous channel pattern. Beavers were plentiful in the region, and produced dams that slowed the water and trapped and stored sediment. As the beaver ponds filled in, a new channel would be created around the obstructing dam and this led to the creation of multiple side-channels. Other dams were produced by fallen trees and log jams of large, woody debris carried downstream from the forested uplands, this also resulted in the formation of shallow, multiple channels. The strong forces of floodwaters and debris flows were slowed and dissipated by these dams along with the dense riparian vegetation and were dispersed over the adjacent floodplains. Sediments accumulated on these floodplains and their seasonal inundation recharged groundwater levels, essential to maintain sufficient flows and cool stream temperatures during the dry summers.

The Columbia white-tailed deer was wholly dependent on these riparian forests. It has been locally extirpated since the 1800s and is a federally listed species.

Upland Riparian Forest

In the upland regions of the watershed with greater the stream gradient and the less frequent fire, the riparian species were typically alder, maple and conifer species including Douglas-fir, hemlock, yew and western redcedar.

The previously forested riparian corridors are now primarily red alder. However, there is a great deal of habitat for species that thrive on disturbance or early seral stage habitats. These species include several bird species as well as deer and elk. Non-native vegetation dominates many areas of the stream banks in the lower watershed. Once non-native plants, such as Scotch broom or Himalayan blackberry, are introduced, it takes intense effort and constant vigilance to remove them and re-establish native vegetation.

Forested riparian areas with large conifers provide shade to the streams as well as large wood to the stream channels. In the lower elevations of the watershed, the trees that do line the riparian corridors are too small to be advantageous for creating complexity in the stream channels.

Prairie: wet and dry

Historically, prairies dominated the valley floor, a result of the periodic burning by the native people. One third of the prairie was wet prairie. The grass species tufted hairgrass (*Deschampsia cespitosa)* dominated the extensive wet prairies of the Willamette Valley. This tall perennial grass was well adapted to both periodic fires and hydric soils. It provided forage for the herds of deer, elk, and pronghorn, which the natives hunted for food.

Growing intermixed in the prairies with the grasses were numerous species in the lily family that that had been semi-cultivated for centuries by humans, and were also adapted to the annual burning practices of the Kalapuyan people. The fires burned back the more competitive grasses allowing the wildflowers to flourish and utilize the nutrients released by burning. The primary species among these bulbs was camas (*Camassia quamash*), which formed a staple crop for many tribes in the west, although many other members of the Lily family were also utilized for food.

The Kalapuya burned prairies throughout the valley and into the foothills of the Coast Range to elevations of 1000 feet. Robert Boyd has reconstructed a likely scenario for burning:

In late spring and early summer the Indians were probably concentrated at "primary flood plain" sites in the wet prairies, where root crops such as camas were collected and processed. There was no burning at this time. During midsummer (July and August) the focus shifted to the dry prairies, and "narrow valley plain" sites were more intensively occupied. Burning in July and August was apparently sporadic, most likely occurring after the harvesting of seasonally and locally available wild foods (grass seeds, sunflower seeds, hazelnuts and blackberries), in limited areas. The intermediate effect of the early burns would be a "cleaning up" process; the long-term result would be to facilitate the re-growth, in future seasons, of the plants involved. In late summer fire was used, on the high prairies, as a direct tool in the gathering of tarweed and insects. This was followed, in October, by firing of the oak openings after acorns had been collected. Finally, from the "valley edge" sites, the Kalapuya initiated large-scale communal drives for deer, which provided a winter's supply of venison. The sequence ended as they returned to their sheltered winter villages along the river banks.

The dominant grass of the dry prairies was red fescue (*Festuca rubra rommerii*). In both the wet prairies and the dry prairies, shrubs and small trees like hazel, serviceberry, and cascara grew, and burning would kill them back and force a burst of sprouts in the spring. This re-sprouting was the source for most of the native people's fiber materials.

The BLM North Yamhill watershed analysis focuses on species affected by timber management. Since the eastern half of the watershed is non-forested, there is little information available on how the grassland animal species have been affected by loss of native vegetation. Agriculture has decreased the acreage of oak woodland habitat. Species such as acorn and Lewis' woodpeckers and gray squirrels that depend on it, live in a habitat in declining condition (BLM, 1997).

Conifer Forest

The climax forest of the Oregon Coast Range is western hemlock, western red cedar, and Douglas-fir. Age at climax ranges from 400-700 years (Upton, 2000).

Private timberlands (and federal timberland up to the early 1990's before the implementation of

President Clinton's Forest Plan) in Upper N. Yamhill, Baker, Panther, and Turner subwatersheds and are intensively managed for timber production. Rotation age ranges from 60-70 years and results in predominately sub-climax, even-aged Douglas-fir timber stands. The short harvest rotation eliminates "old-growth" sized trees from upland sites, but Riparian Management Area protection laws require live conifer retention, which will produce large woody debris. The existing riparian area species composition is a combination of conifer and deciduous trees resulting from natural and human disturbance 70 to 100 years ago. Deciduous trees are less desirable for large woody debris recruitment since in-water longevity is shortened by more rapid decomposition than occurs with coniferous trees. Current Oregon Forest Practices Act regulations provide an option for active management for conservation of hardwood brush segments adjacent to streams. Replanting with conifer, with no option for future harvest, develops large woody debris recruitment (Upton, 2000).

The interior forest habitat (undisturbed area without roads and edges) has been developing for the past 100 years. The North Yamhill watershed has been impacted by disturbance from fire and logging. Early logging, wildfire in 1910 on the south side of the North Yamhill upstream from the Flying M Ranch, the 1939 and 1945 Tillamook burns, salvage logging, and the infrastructure developed for this activity have all been part of the process that has created the present forest condition. Age diversity exists, but in a more narrow range of ages (Upton, 2000).

If continued, local extinction of some species may occur. Species such as the spotted owl, hairy woodpecker, northern flicker, western bluebird, northern flying squirrel and several bat species lack sufficient habitat. Large green trees, snags, and coarse woody debris provide shelter, nesting platforms, foraging or drumming substrates, lookout posts or perching habitat, hiding cover, or thermally regulated micro-habitats (BLM, 1998). The BLM is working to manage its lands to provide these functions (Hooper, 2000). There is evidence to suggest that forest fragmentation with the resulting patchiness in forest habitats is important for wildlife at the landscape level. Several bat species use snags in clearcuts and do not necessarily require large trees. In addition, the spotted owl, hairy woodpecker, northern flicker, western bluebird, and northern flying squirrel are all found in managed second growth forests. Fragmentation has not been shown to be a concern for most wildlife species in Western Oregon forests (Brill, 1999).

Currently, the Oregon Forest Practices Rules require 2 wildlife trees greater than 11 inches diameter at breast height (DBH) and at least 30 feet tall, and 2 down logs greater than 12 inches in diameter per acre (50% of which may be hardwood) be left on the site after clearcuts. This may not be adequate to maintain populations of some species (BLM, 1998). New proposed rule changes to the Oregon Forest Practices Act will require leaving more, big trees in the outer portion of the Riparian Management Area and provide greater protection for non-fish bearing streams which currently have the most relaxed timber harvest regulations (Curry, 2000). According to research by the BLM, without snags of a diameter 20 inch, the pileated woodpecker population will suffer. Without pileated woodpeckers making cavities in the trees, species such as flying squirrel and saw-whet owls that depend on these cavities for nests, will also decline according to BLM biologists. It is not known if these species exist in the watershed, population figures do not exist. Anecdotal evidence (personal observation from 1973-2000) confirms the species are found within the watershed (Upton, 2000).

This is where forest management becomes complicated. As a society, we want affordable wood products. We also want healthy, diverse forests. Forests grow at a rate that makes experimentation difficult. The outcomes of forest practices implemented today will not be apparent for many more years. It is very different from agriculture where each year brings the opportunity to try alternative management practices. According to Mike Curry of the Oregon Department of Forestry, forest health and harvesting techniques have come a long way in the last 100 years. Curry acknowledges that mistakes were made in the past, but that foresters are managing the land very differently today. Timber companies are putting large wood back into streams, upgrading culverts and repairing roads to standards that exceed those of the state. He sees industry doing more than ever before to ensure the health of the watershed (Curry, 2000).

Dan Upton, Resident Forester of Willamette Industries, described how his company works with wildlife biologists, foresters, consultants, and regulators to harvest company land in a sustainable manner while maintaining and developing wildlife habitat. A combination of habitat conditions are preferred and selected, such as trees with extensive branching and irregular shapes, micro sites with riparian features (small bogs or wetlands) and riparian areas adjacent to streams. Harvest practices incorporate a long-range schedule that provides a map for development that can identify potential problem areas, such as nest sites, unstable soils, and stream locations. Development and harvest technique is matched to local site conditions and potential problems are diminished. For example, wildlife leave trees and unique sites are identified and marked before harvest. Engineering reconnaissance identifies risky locations for roads. Cable logging systems are used during wet weather periods instead of ground harvesting equipment. He maintains that his company acts in a highly responsible manner toward the resource they use and they follow or exceed the state and federal guidelines for forestry management practices (Upton, 2000).

Oak Savanna Habitat

Where oak woodlands merge into valleys is the oak savanna habitat type. Oregon white oak is the dominant species; black cottonwood, red alder and Oregon ash are also present. Historically oak stands had more open canopies with large spaces between trees or groves of trees. Due largely to fire management practices, the canopy now is more closed (BLM, 1998). Oregon white oak stands provide more cavity habitat than any other cover type in the Coastal Range. Twenty-eight bird species use cavities in oak stands including white-breasted nuthatch and black-capped chickadee along with several mammals that are not usually found Douglas-fir dominated stands (BLM 1998).

Non-native Plants

Non-native plants (also known as exotics) are those species introduced to an ecosystem in which they would not naturally grow and have the potential to adversely impact the area to which they were introduced. The Oregon Department of Agriculture (ODA) identifies noxious weeds as plants having the potential to cause economic losses without control. It is very costly to eliminate them once they are established, and usually requires intensive herbicide treatment to manage the population. Some species have bio-control methods available, but these are by far the minority. The BLM identifies Scotch broom (Cytisus scoparius), St. Johnswort (*Hypericum* *perforatum*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare),* and tansy ragwort (*Senecio jacobaea*) as species widely distributed and beyond eradication (BLM, 1997, p. 63).

The Native Plant Society of Oregon listed 37 noxious invasive species in 1997. These species are either being cultivated by naïve gardeners, sold by local nurseries, or introduced through some other means. Contact the Native Plant Society for a list and further information on these species.

In 1999, the Farm Agency in Yamhill County listed the species in Table 9 on its noxious weed list.

Table 9. Yamhill County Noxious Weeds

Common Name	**Scientific Name**	**List/Add date**
Class "A" List		
Italian thistle	*Carduus pycnocephalus*	1-29-90
Gorse	*Ulex europaeus*	1-29-90
Meadow knapweed	*Centaurea pratensis*	8-13-90
Yellow starthistle	*Centaurea solstitials*	2-26-91
Purple loosestrife	*Lythrum slaicaria*	2-26-91
Puncturveine	*Tribulus terrestirs L.*	3-03-93
Class "B" List		
Mile thistle	*Silybu marianum*	11-13-89
Canada thistle	*Cirsium arvense*	11-13-89
Tansy ragwort	*Senecio jacobaea*	11-13-89
Scotch broom	*Cytisus scoparaius*	11-13-89
Field bindweed	*Convolvulus arvensis*	2-26-91
Large crabgrass	*Digitaria sangunimalis*	2-26-91
Blackgrass	*Alopecurus myosuroides*	2-26-91
Velvetleaf	*Sorghum halepense*	3-26-97
Field dodder	*Abutilon theophratsti*	3-26-97
Johnsongrass	*Cuscuta pentagona*	3-26-97

Noxious weeds such as Himalayan blackberry, reed canary grass, and Scotch broom invade disturbed areas such as clearcuts and roadside disturbances and form monocultures making regeneration of native species near to impossible without significant assistance (BLM, 1998).

The Northwest Area Noxious Weed Control Program FEIS determined that noxious weeds are increasing their acreage on BLM lands at an estimated average of 14% annually for most species. Every five to six years or less, the infested acreage is expected to double. Infestation rates have reached the point in many areas where complete eradication is no longer possible (BLM, 1997). This rate of spread is probably common on most forested lands in the headwater reaches. The BLM and the Oregon State Department of Agriculture have an integrated noxious weed control program to maintain weed levels below levels that can cause more degradation (BLM, 1997).

Sensitive Species

The Federal or State government lists fourteen species found in the North Yamhill watershed as rare, threatened or endangered. These species have been field verified by the Oregon Natural Heritage Program (ORNHP, 1998). *See Table 10.* Additionally, the BLM lists many species as special or sensitive status species that **may** be present in the watershed. These species are either federally listed, federally proposed, federal candidate species or special attention species. This list includes only those species that would be found in the forested western side of the watershed because it only considered BLM lands. *See Tables 11 and 12.* Neither of the two BLM categories has been field verified for this watershed.

There are two known northern spotted owl sites in the watershed; one on BLM land, the other on private land. Both pairs have less than 30% suitable habitat within their home range. All of the BLM lands considered possible spotted owl habitat have been surveyed. There are probably no other owls in the watershed and the long-term viability of the existing pairs is questionable (BLM, 1998, pg. 7)

Historically, these species were much more widespread than they are today. The importance of preserving their habitat and working to ensure their future survival is nothing less than preserving Oregon's natural heritage for generations to come. With the loss of any species, whether it is plant, mammal, amphibian, or insect, a valuable piece of the ecosystem in which we live is also lost. Often we hear about the loss of genetic diversity and think that it is inevitable, natural, or that we have no role in it. This attitude prevents meaningful discussion about the role each of us has in making sure Oregon's unique and diverse species have a place to thrive.

The following lists give the names of the species that are in danger of disappearing from this watershed. Due to space limitations, further information on these species is not included in this document. Please consult one of the following organizations to learn more about any of these species listed here.

The Oregon Natural Heritage Program
821 SE 14th Avenue
Portland, OR 97124-2531
(503) 731-3070 ext. 335 or 338
http://ocelot.tnc.org/nhp/us/or/index.html#mission

Bureau of Land Management
Salem District Office
1717 Fabry Road S.E.
Salem, OR 97306
(503) 876-3582

Table 10. Threatened and endangered species listed by USFW under the terms of the ESA and by the state of Oregon.

Threatened and endangered species listed by ESA and state of Oregon

Sidalcea nelsoniana	Nelson's sidalcea
Lupinus sulphureus ss Kincaidii	Kincaid's lupine
Strix occidentalis caurina	Northern spotted owl
Brachyramphus marmoratus	Marbled murrelet

Candidate for protection under ESA

Icaricia icarioides fenderi	Fender's blue butterfly
Erigeron decumbens var decumbens	Willamette Valley daisy

Species of concern listed by ESA

Cimicifuga elata	Tall bugbane
Ascaphus truei	Tailed frog
Rana aurora aurora	Northern red-legged frog
Clemmys marmorata marmorata	Northwestern pond turtle

State of Oregon candidate for listing as endangered or threatened or species of concern

Sidalcea campestris	Meadow checker-mallow
Chrysemys picta	Painted turtle
Rhyacophila fenderi	Fender's rhyacophilan caddisfly

Table 11. Special Status Species (BLM, 1997) possibly found in North Yamhill Watershed.

Annelids

Driloleirus macelfreshi	Oregon Giant Earthworm

The Oregon giant earthworm, which can grow to three feet, prefers deep, undisturbed soils, which are usually the oldest soils in a watershed. There is no data to determine the location and amount of suitable habitat for these creatures. There are no known sites and no identification keys for this worm (BLM, 1997, p. 95).

Arthropods

Agonum belleri	Beller's Carabid Beetle
Icaraicia icarioides fenderi	Fender's Blue Butterfly
Pterostischus rothi	Roth's Blind Carabid Beetle

Fender's blue prefers natural balds (shallow soil types, usually on mountain ridges, where grasses, herbs, and forbs dominate) or meadows. Beller's Carabid beetle prefers aquatic environments in the forest and Roth's blind carabid beetle occurs in cool-cold high elevation soils, usually above 3,000 feet; there is very little of this habitat type in the watershed (BLM, 1997, p. 96).

Amphibians

Rana aurora	Red-Legged Frog
Rhyacotriton variegatus	Southern Torrent Salamander
Ascaphus truei	Tailed Frog
Rana pretiosa	Western Spotted Frog

The red-legged, tailed frog and southern torrent salamander are expected to occur in suitable aquatic/riparian environments in the watershed, probably at higher elevations where waters are the coolest (BLM, 1997, p. 96).

The western spotted frog also prefers aquatic/riparian habitat, but it is believed that this species has been extirpated from the Coast Range. There have been no sightings of the frog in western Oregon for over 20 years (BLM, 1997, p. 96).

Reptiles

Clemmys marmorata	Western Pond Turtle

Western pond turtles appear to be rare in western Oregon north of Salem. There are no known sites for this species in the watershed. They prefer marshes, lakes, ponds, and pool habitat in larger streams, and can be found in upland habitats while nesting, overwintering and dispersing.

Birds

Falco peregrinus	American Peregrine Falcon
Haliaeetus leucoephalus	Bald Eagle
Accipiter gentilis	Northern Goshawk
Histrionicus histrionicus	Harlequin Duck
Strix occidentalis	Northern Spotted Owl

The American peregrine falcon breeds along the Oregon coast, in the Columbia gorge, and the Cascade Range. There is no known nesting habitat for the falcon in the Coast Range. However, falcons could use the watershed for foraging during the non-breeding season since their preferred prey species, the band-tailed pigeon and mourning dove, are common residents (BLM, 1997, p. 97).

Bald eagles are not known to nest in this watershed. There is suitable nesting and foraging habitat available in the watershed, but these areas may be too far from each other, and the foraging areas may be too small and too accessible to humans (BLM, 1997, p. 97).

The northern goshawk is considered a rare visitor and nonbreeder in the Oregon Coast Range. There are no known nesting goshawks in the watershed (BLM, 1997).

The harlequin duck is a rare breeder in the Coast Range. Nesting and foraging occurs in streams and riparian areas. There are no records of this duck occurring in the watershed (BLM, 1997).

The watershed is considered habitat for marbled murrelet – however there are no known nesting sites in the watershed (BLM, 1997).

Mammals

Martes pennanti	Fisher
Myotis thysanodes	Fringed Myotis
Myotis evotis	Long-eared Myotis
Myotis volans	Long-Legged Myotis
Corynorhinus townsendii	Townsend’s Big-Eared Bat
Phenacomys albipes	White-Footed Vole

Myotis yumanensis	Yuma Myotis

There are no known sites within the watershed for any of these mammals.

The fisher prefers large stands of old-growth forest and may no longer be present in the watershed.

The white-footed vole seems to prefer riparian zones and appears to be uncommon or even rare when suitable habitat is available.

The Townsend's big-eared bat and the fringed, long-eared, and yuma myotis require caves or mine shafts or abandoned buildings for maternity roosts and winter roosts. These types of structures are lacking in the watershed (BLM, 1997, p. 99).

The long-legged myotis may use cave-like structures for maternity or hibernating roosts. They have also been found under bark and in snags. This type of habitat could be found in existing older patches of forest in the watershed (BLM, 1997, p. 99).

Table 12. Special Attention Species (BLM, 1997)

Mollusks	
Prophysaon coeruleum	Blue-gray Tail-dropper
Deroceras hesperium	Evening Fieldslug
Megomphix hemphilli	Oregon Megomphix Snail
Prophysaon dubium	Papillos Tail-dropper

These four mollusks may occur in damp areas in older forests in the watershed. There are no known sites in the watershed and no surveys have been done.

Mammals	
Arborimus longicaudas	Red Tree Vole
Lasionycteris noctivagans	Silver-Haired Bat

The red tree vole is expected to occur in its preferred habitat, the wettest and oldest forest in the watershed (BLM, 1997, p. 99).

The silver-haired bat, like the long-legged bat, is also known to roost under bark or in snags (BLM, 1997, p. 99).

There are no known sites within the watershed for any of these animals and no surveys have been done (BLM, 1997, p. 99).

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Chapter 5 Riparian and Wetland Conditions

Riparian Conditions

Introduction

Riparian area describes the land closest to streams, rivers, and wetlands with unique plant and animal species. Some people refer to the land bordering waterways as buffer zones referring to the function of the vegetation to filter or "buffer" water moving across and through the landscape prior to entering the waterway. Riparian areas generally have higher moisture levels in the soil than the adjacent upland areas. The elevated moisture levels generally support a more abundant and diverse ecosystem.

Riparian vegetation influences fish habitat and water quality in a variety of ways including:

- Provides shade, which aids the decrease of daily fluctuations in water temperature and provides fish cover from predation.
- Stabilizes the stream banks, which decreases erosion and prevents downcutting of banks.
- Provides habitat for insects and macro-invertebrates, which are a food source for fish.
- Provides detritus or organic litter to the stream, which adds nutrients to the entire ecosystem.
- Riparian areas are also important sources of large wood recruitment to the stream system. Large wood is vital for fish habitat because it provides cover for fish, diverts channels and obstructs flows, which in turn increases channel and habitat complexity (OWAM, 1999).

The map of the historical vegetation provides background on what the vegetation looked like prior to extensive European settlement. *See Figure 6.* This map shows that the vegetation bordering the waterways was very different from what exists today. This map is not a snapshot of the vegetation at that time, but rather an approximation of what the vegetation was in the mid 1800s.

Methodology

Riparian conditions for the watershed were determined using the OWAM protocol to examine riparian width, vegetation types, and vegetation density, stream shading, and the continuity or interruption of the riparian zone from road crossings, streamside roads, and other land uses.

The Importance of Large Woody Debris

Throughout the entire watershed, there is a lack of large woody debris (LWD) and LWD recruitment. Large trees close to streams are needed to create in-channel habitat diversity. The size and diameter of the trees necessary to perform this function is directly related to the size of the stream.

Streams with higher flows and wider bankfull widths need larger wood in order for the wood to remain in place during winter storm events. Trees that can provide this function need to be close enough to the stream so that when they die and fall down, they land across the channel.

LWD across a stream slows down the water filling in behind it, which causes the sediment to drop out of it, creating an area with gravels upstream from the log. The downstream side will have a scour pool due to the velocity of the water moving over the LWD and its loss of sediment.

Black and white air photos on the scale of one inch equals 660 feet were borrowed from the Farm Service Agency in McMinnville to complete this analysis. The summer 1994 fly over was the primary source. However, summer vegetation makes it difficult to determine the difference between hardwoods and conifers. So, when further verification was needed, the 1980 winter fly over (same scale) was used. Additionally, the Yamhill County soil surveys were used to locate stream channels in the heavily vegetated areas of the watershed.

Small streams are very difficult to detect on air photos. It was assumed that where the channel was not visible in a narrow band of vegetation that it would be in the center. This is why the Riparian Condition Units appendix does not differentiate between the right and left banks of the streams. It was not possible to discern the left or right stream banks for any stream other than the North Yamhill River with any degree of accuracy.

A map wheel was used to determine the length of each reach. The length of each segment was rounded to the nearest 50 feet. The vegetation width was divided into three categories: small (0-25 feet), medium (25-50 feet), and large (greater than 50 feet). Within these categories, the type of vegetation was broken into 5 classes: hardwoods, conifers, mixed, brush/grass, or no vegetation. A special category was made to describe a situation where hardwoods are directly adjacent to the stream, but conifers are within 25 feet of the stream directly upland from the hardwood vegetation strip.

Conditions

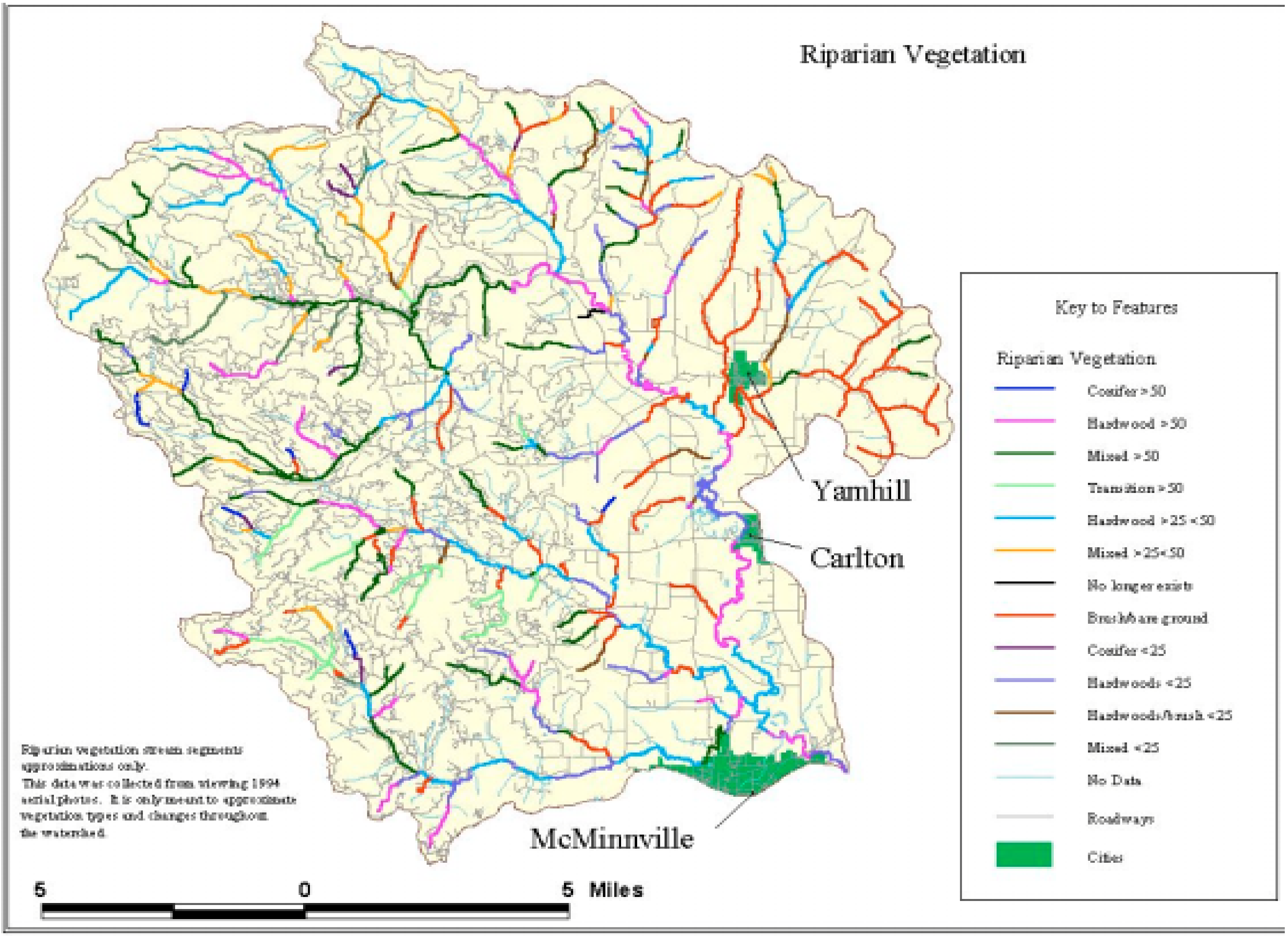
The current riparian conditions were to be compared with what would historically have been found in the watershed. The scale of the historical vegetation map and the current vegetation map do not allow specific species to be named for each waterway. Rather, general statements about the historic conditions versus current conditions can be made.

It should be noted that the 1994 air photos are limited in that they are 6 years old. Many changes have occurred in the upper watershed since these photos were taken. Where possible, these areas were field verified. The maps with the segment measurements and data sheets are kept by the YBC.

The reaches represented on the map included here represent approximations only and are not meant for use in determining precise locations for restoration or enhancement projects. More in-depth analysis of a specific area is recommended before proceeding with such projects. This map and information is meant to provide starting points and areas of concern, not to pinpoint specific locations. The map kept by the YBC has more accurate measurements. Please consult them if you have specific questions.

The heavily forested Upper North Yamhill subwatershed has the greatest riparian widths of the watershed while the largely agricultural Lower North Yamhill subwatershed has the narrowest widths. Table 13 gives the miles of stream in each riparian class. The majority of streams surveyed are bordered by either a narrow or wide band of hardwoods or mixed hardwoods and conifers. It is important to note that 18% of the streams surveyed were bare ground, short grass or brush.

Figure 11.


Riparian Vegetation
Key to Features
Riparian Vegetation
Conifer > 50
Hardwood > 50
Mixed > 50
Transition > 50
Hardwood > 25 < 50
Mixed > 25 < 50
No longer exists
Brush/bare ground
Conifer < 25
Hardwoods < 25
Hardwoods/brush < 25
Mixed < 25
No Data
Roadways
Cities
Yamhill
Carlton
McMinnville
Riparian vegetation stream segments approximations only.
This data was collected from viewing 1994 aerial photos. It is only meant to approximate vegetation types and changes throughout the watershed.
5
0
5 Miles

Ideally, the trees that function as LWD are conifers. Hardwoods decompose more easily and do not provide long-term structure in the stream. From the air photos and field verification, it was determined that conifers (and conifer recruitment) are lacking in most of the watershed. However, the air photos show that most streams are well shaded. Thus, they are providing the desired effect of shading the water and helping keep the water temperature cooler.

Figure 11 shows the streams with different colors representing different riparian widths. The red segments indicate streams with little or no vegetation and should be areas of concern. This map only provides approximate locations. Further information and the map wheel measurements taken from the air photos can be found in the data tables, which are kept by the YBC.

Table 13 Riparian Condition Units for Watershed

Riparian description	Total length (miles)	Percent of total
Conifers > 25 feet	2.86	1.1
Hardwoods > 25 ft	34.78	13.5
Mixed hardwoods and conifers >25 ft	50.66	19.6
Hardwoods with adjacent conifers >25 ft	12.66	4.9
Hardwoods >25 ft <50 ft	41.68	16.1
Mixed hardwoods and conifers >25 ft < 50 ft	16.60	6.4
Channel no longer exists	0.63	.2
Brush, bare ground and grass <25ft	47.32	18.3
Conifers <25 ft	3.09	1.2
Hardwoods < 25 ft	30.64	11.9
Hardwoods and brush <25 ft	7.40	2.9
Mixed hardwoods and conifers <25 ft	10.10	3.9
Total	**258.42**	**100%**

Wetlands

Introduction

Oregon Division of State Lands defines wetlands for the removal-fill program as:

> [Wetlands are] those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

There are many different types of wetland, but they share three characteristics: water, saturated soil, and wetland plants.

1. An abundance of water from either high water table, rain water "perched" over impervious layers in the soil, frequent flooding, or groundwater seeps is necessary. However, there does not need to be visible water year round. This is the area of wetland determination that people find most difficult to understand. Water levels vary from year to year and season to season within a given year. That is why standing water is one of three components that examined.
2. Saturated soils called hydric soils. This soil type is without oxygen, and has a distinctive appearance because of the lack of oxygen.
3. A plant community called hydrophytes, plants with special adaptations for life in permanently or seasonally saturated soils (DSL, 2000).

Sometimes we refer to wetlands as swamps, marshes, or bogs. They can be wet meadows, swales, seasonal seeps, and sometimes ditches. Wetlands can be dry during the summer months. It is beyond the scope of this document to give in-depth explanations of the delineation and designation process as many volumes of information have been written on the subject. *Refer to the wetlands resources list at the end of this chapter for more information.*

In order to be considered a wetland, a piece of land must meet two of the three criteria. Agricultural areas are assessed on the basis of hydrologic conditions and soils since wetland vegetation is not present. The absence of wetland vegetation does make delineation more challenging, but if a piece of land meets the other two criteria, it is considered wetland. An area does not have to be mapped by the state or otherwise designated to fall under regulations (DSL, 1991).

Wetlands play several critical roles in watershed health. Their role includes:

- the ability to connect uplands and aquatic ecosystems
- the ability connect lakes, streams, rivers and riparian areas to each other
- the capture of sediment from run-off
- removal of nutrients from the system
- improve groundwater recharge
- maintain base flows to streams
- provide water storage during high flows
- provide habitat to wildlife and rare and endangered species
- provide humans open space, outdoor recreation, education, and for aesthetics.

Not all wetlands provide all of these benefits. Each type functions differently, and individual wetlands function at different levels. It is beyond the scope of this assessment to evaluate the functions and condition of each wetland in the watershed. Rather, this assessment will provide the background as a starting point for further investigation. *Refer to the wetlands resources list at the end of this chapter for more information.*

Several agencies are involved in the regulation and protection of wetlands including: Oregon Division of State Lands (DSL), State Department of Forestry under the Forest Practices Act, U.S. Natural Resources Conservation Service under the Farm Bill, and the U.S. Army Corps of Engineers under the federal Clean Water Act and Rivers and Harbors Act. Permits for work taking place in wetlands or for their creation and enhancement are issued through DSL and

Corps of Engineers.

Methodology

The first step in examining the wetlands was to gather the Soil Survey of Yamhill County with information on areas prior converted outlined by the Natural Resource Conservation Service (SCS, 1974 scale 1:20,000), National Wetlands Inventory (NWI) maps (NWI 1976, 1982, scale 1:24,000 and 1:62,500), USGS topographical maps (scale 1:24,000) and black and white aerial photos (1994 flyover, scale 1 inch equals 660 feet). The wetlands map included here has the NWI polygons from maps that were available digitally. The entire watershed is not represented on these maps; the western side was not available. However, there are relatively few wetlands on that steep section of the watershed nearest the Coast Range.

As part of the National Wetlands Inventory, the U.S. Fish and Wildlife Service has mapped the wetlands using color infrared aerial photographs with a scale of 1:58,000. Most wetlands on the map are not field-verified. The minimum acreage mapped is 2 acres, so smaller wetlands do not appear on the maps. Wetlands that are cultivated and cropped are not included in NWI maps, but may be regulated. *Further information on NWI maps available from the DSL publication: Just the Facts #1.*

The USGS streams and roads, and NWI wetlands were available as layers to use in ArcView. The hydric soils were pulled from the soil map and added to the base map and are shown in Figure 12.

The shape and size of the wetlands is represented in the map included in this assessment. These were also available digitally, but only for the eastern side of the watershed. The western side has not been digitized yet, but does not have many wetlands that were mapped. That is not to say there are not wetlands in the Coast Range, there are – but they are difficult to map from aerial photos due to the density of the vegetation. The actual size and shape of the wetlands is difficult to determine from viewing the map in this document. The wetlands are so small, they appear insignificant. The size of the paper limits the visible detail. However, the NWI maps are inexpensive and give greater detail of the area in question if you need specifics for a particular wetland.

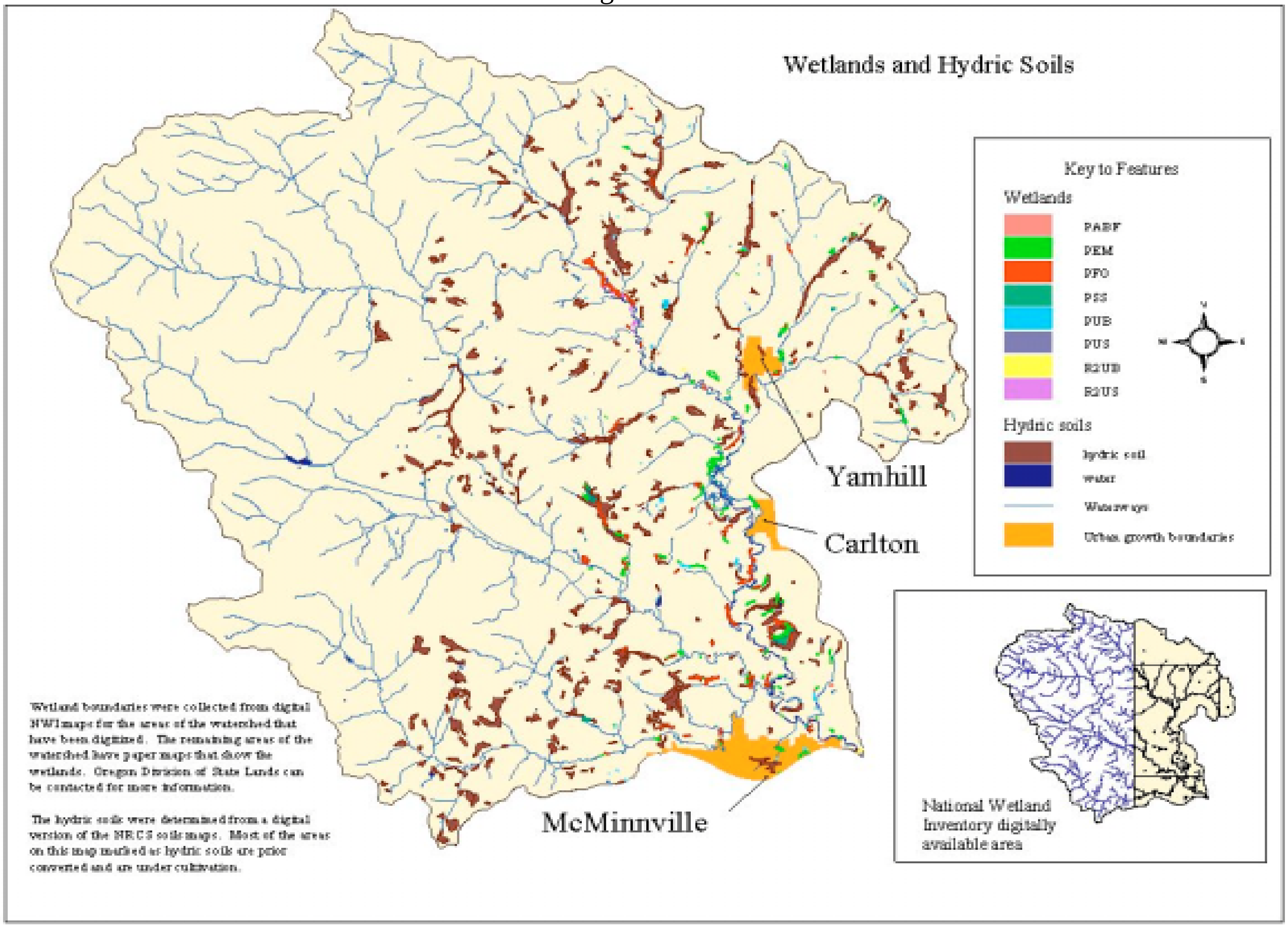
The connection of the wetlands to surface water was also determined. This information is in the data sheets for the wetlands – contact the YBC for more specifics.

Wetland Distribution and Trends

The distribution and acreage of wetlands in the watershed is only a *rough* estimate of the total wetlands actually in the watershed. As was stated earlier, the NWI maps are not very precise at the small scale. The majority of wetlands in the watershed are linear wetlands – too narrow to be mapped in acreage.

On Figure 12, it can be seen that the area of hydric soils is much larger than the area that is currently designated as wetlands. Most of the wetlands occur in the low elevations and areas

Figure 12.


Wetlands and Hydric Soils
Key to Features
Wetlands
PABF
PEM
PFO
PSS
PUB
PUS
R2UB
R2US
Hydric soils
hydric soil
water
Waterways
Urban growth boundaries
Yamhill
Carlton
McMinnville
National Wetland Inventory digitally available area
Wetland boundaries were collected from digital NWI maps for the areas of the watershed that have been digitized. The remaining areas of the watershed have paper maps that show the wetlands. Oregon Division of State Lands can be contacted for more information.
The hydric soils were determined from a digital version of the NRCS soils maps. Most of the areas on this map marked as hydric soils are prior converted and are under cultivation.

with low slopes and these have been converted for farmland.

As was stated earlier, the vast majority of the land under cultivation in the watershed (greater than 50 percent and maybe up to 80 percent) also uses tile to drain excess water from the landscape. There has not been any monitoring to document this, and the records of tiles and drainage are not open to the public or are not available. However, this is the estimate by NRCS staff who work in the area. The drainage tiles have created a situation where the water isn't being stored in the system throughout the year. Now, many former wetlands are classified as prior converted. The designation of prior converted means that the area was wetland at one time, but has been converted to another use, in this instance farmland, prior to the enactment of the 1985 Farm Bill.

Wetlands are most commonly classified using the Cowardin system of classification. The Oregon Department of State Lands uses this system to describe the wetlands in the state. These are also the descriptions that are used on the National Wetlands Inventory Maps. Use of this terminology makes it easy to compare wetlands across the state. More specific descriptions are used when developing Local Wetlands Inventories (LWI). Local wetland inventories are usually completed as a partnership between the Oregon Division of State Lands and a community.

Table 14 shows the wetland classifications that apply to the watershed. The chart moves from the general description on down to more specific descriptions. Each wetland marked on a NWI map has a code associated with it. Figure 12 shows each wetland and its' assigned general code of palustrine or riverine. More than 80% of the wetlands in the watershed are in the palustrine category. Then, the wetlands are described further by subsystem codes. These describe the hydrologic conditions (only applies to Riverine systems and these are not included here). The final level is the class level, which describes the vegetation or substrate of the wetland. The classification system also includes modifiers that can by applied to describe human alterations to the wetland.

Table 14. Wetlands Descriptions

Ecological System
Palustrine (P) These are the freshwater wetlands commonly referred to as marshes, bogs, and swamps. Included are wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and some non-vegetated wetlands that do not meet the criteria for Lacustrine wetlands.
Riverine (R) River, creek and stream habitats contained within a channel, where water is usually, but not always flowing. Riverine systems are usually unvegetated but may include nonpersistent emergent vegetation; Palustrine

Classes

Aquatic Bed (AB)
Wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season during an average year.
Emergent Wetland (EM) These wetlands have rooted herbaceous vegetation standing above the water or ground surface.
Unconsolidated Bottom (UB)
Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7cm) and a vegetative cover less than 30%.

Scrub-shrub Wetland(SS)
Wetlands dominated by shrubs and tree saplings that are less than 20 feet high.
Forested Wetland (FO)
Wetlands dominated by trees that are greater than 20 feet high.

Special Modifier

Farmed (I)
Farmed wetlands are wetlands which have been manipulated and cropped before December 23, 1985, but which continue to exhibit important wetland values. In addition, farmed wetlands include areas which pond water for 15 consecutive days during the growing season. Farmed wetlands are subject to federal wetland jurisdiction.

Diked/Impounded (h)
Created or modified by a manufactured barrier or dam that obstructs the inflow or outflow of water.
Excavated (x)
Lies within a basin or channel excavated by human means

Conclusions

Historically, wetlands were much more extensive than they are today. With European American settlement, the Kalapuya Indians' burning of these areas ended, allowing woody vegetation to move in. Over the past century and a half, wetland acreage has been significantly reduced through draining and tiling in order to make agricultural land available. Wet prairie is now almost non-existent in the watershed. It once played a significant role for providing habitat for fish and other wildlife, provided off-channel storage of flood waters, and groundwater recharge to the system during low flow summer months, to name a few of the valuable functions.

Wetland restoration and enhancement projects could help restore some of these functions to this system in localized areas. It is important to realize that the land that has been converted in many cases, and will not be reclaimed. The next steps will involve determining where the best opportunities exist to enhance or restore wetlands.

Funds could be sought to assist local landowners with enhancement or restoration projects on land that floods seasonally.

Resources for Further Information on Wetlands:

Oregon Freshwater Assessment Methodology (OFWAM)
Wetlands Program
Oregon Division of State Lands
775 Summer Street NE
Salem, OR 97310

Wetland Bioassessment Fact Sheets
U.S. Environmental Protection Agency
Office of Wetlands, Oceans, and Watersheds Division
Washington, DC
EPA843-F-98-001

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Chapter 6 Channel Modifications

The OWAM describes channel modifications as dams, dredging or filling of water bodies or wetlands, splash damming, hydraulic mining, stream cleaning, rip-rapping or hardening of the streambanks. I am enlarging this category to include road and stream crossings and streams with a permanent discontinuity due to a road running parallel to the stream.

Channels are dynamic systems that respond to physical watershed features with or without human involvement. This section examines how humans have impacted the channel morphology or structure, and aquatic habitat. This information is a compilation of the historic conditions, CHTs, and channel modifications.

Methodology

The channel modification section was completed by gathering historic information from residents, fill and removal permits and streambank hardening projects (such as riprapping) were gathered from DSL, dam information was collected from WRD and the BLM, road discontinuities were gathered from aerial photos, and FEMA floodplain maps were also examined.

Historical Channel Modifications

Historically, the streams the North Yamhill watershed were used for transporting logs. Refer to the forestry section in the introduction chapter for further information on the history of splash dams. Historic logging disturbance 150 years ago and into the mid 1900s, made a tremendous impact on the shape of the stream channels in the watershed. The treatment of the streams as log transport systems, removal of in-stream wood, removal of riparian vegetation, loss of large trees in the watershed, bank stabilization through rip-rap, dam structures for water storage are just some of the actions that have affected the channels we see today. These issues are discussed in the history, vegetation, and fish chapters in addition to the information provided here.

Agriculture has also significantly impacted the streams. Historical air photographs show large flooded or wetland areas along the North Yamhill River in 1948. The land adjacent to the river shows oxbows and flooded is land clearly visible (Oregon State University Library Photo Archive). On the air photos from 1994, some of the oxbows are still visible on the tilled land. Over the last 100 years, large areas of wetland have been drained and tiled to make more land available for cultivation. Estimates of land under cultivation in the watershed that has undergone drainage and tiling run upwards of 50 percent (NRCS personnel, 2000).

It is not uncommon for small intermittent tributaries to be disked and plowed during the dry season. These tributaries are also referred to as get-away ditches. The removal of these channels and the installation of drainage tiles allow land to dry out faster in the spring and permits farmers to access their fields earlier in the season. These small tributaries are difficult to find on air photos and none of the intermittent tributaries were examined in detail for this assessment.

Wetlands were systematically drained and tiled in the Willamette Valley with the help of the Soil Conservation Service (SCS). In 1977, the SCS wrote *Willamette Valley Drainage Guide* to assist landowners with draining agricultural lands. It details the soil physical factors, drainage problems associated with a particular soil, and drainage methods to address the problems. What is notable about the publication is that it encouraged landowners to remove water from wetlands on their property. The photos show channels that are devoid of any vegetation, perfectly tilled and disked right up to the edge of the water. There is no mention of riparian areas or vegetated buffers. The manual was written in the late 1970s, but some of the land practices continue to this day. We do not understand all the relationships between surface water, soil, plants and animals, but we need to realize that the mistakes of the past cannot be continued.

> *The drainage guide describes one of the watershed's most common soils associations, Woodburn, as follows:*
>
> *Drainage Problems and Considerations:*
> Closed pattern drainage is recommended for improved drainage or flatter slopes.
> Closed random tile may be used to relieve wetter areas.
> Surface methods will improve drainage on flatter slopes.
> Fragipan is principle restriction to drainage.
>
> *Applicable Drainage Methods*
> Subsurface Drainage: closed pattern drainage, closed random drainage
> Surface Drainage: field ditches, land smoothing, land grading (U.S.D.A. Soil Conservation Service, 1977, p 122)

In order to fill or remove material from a wetland, a permit must be obtained from the Division of State Lands (DSL). It is difficult to assess the extent and location of historic channel modifications other than those visible from air photos. The fill and removal permits database from the DSL was queried to find out what historic modifications had taken place. Several of the files were missing, however those that could be examined found several instances of channel modification or in-stream work. This information is included to provide an understanding of the impacts the system has received over the past 30 years. The only areas that can be examined are those with old permits on file with DSL, so landowners that modified channels or filled wetlands without getting a permit are not included here.

The most commonly permitted projects in the DSL files were for stream stabilization with riprap placement. Figure 13 shows the Baker Creek watershed with the years in-stream work was permitted. There are several areas of Baker Creek that have perpetual problems with erosion or sedimentation. In the upper reach of the channel, the creek is dammed to create Rainbow Lake. The earthen dam has been in danger of washing out on several occasions and requires maintenance to remove the sediment that builds up behind it. The lake receives sediment from a slide that occurred during the 1996 floods. This will likely be a problem as long as the slide material is still available.

Baker Creek is also impacted by the proximity of housing developments on its banks. The floods of 1977 eroded a substantial area of stream bank. The Soil and Water Conservation District office worked to secure funds for local residents along the unstable bank. The state received over 3 million dollars in federal funds and some 150 projects were proposed. In the watershed, over 20 riprap projects on the section of Baker Creek close to McMinnville were completed. See Figure 13.

The area is still desirable to developers and homebuyers, and recently a permit for over 100 new homes to be built near the Baker Creek went to DSL. When a new development goes in, access

Figure 13.

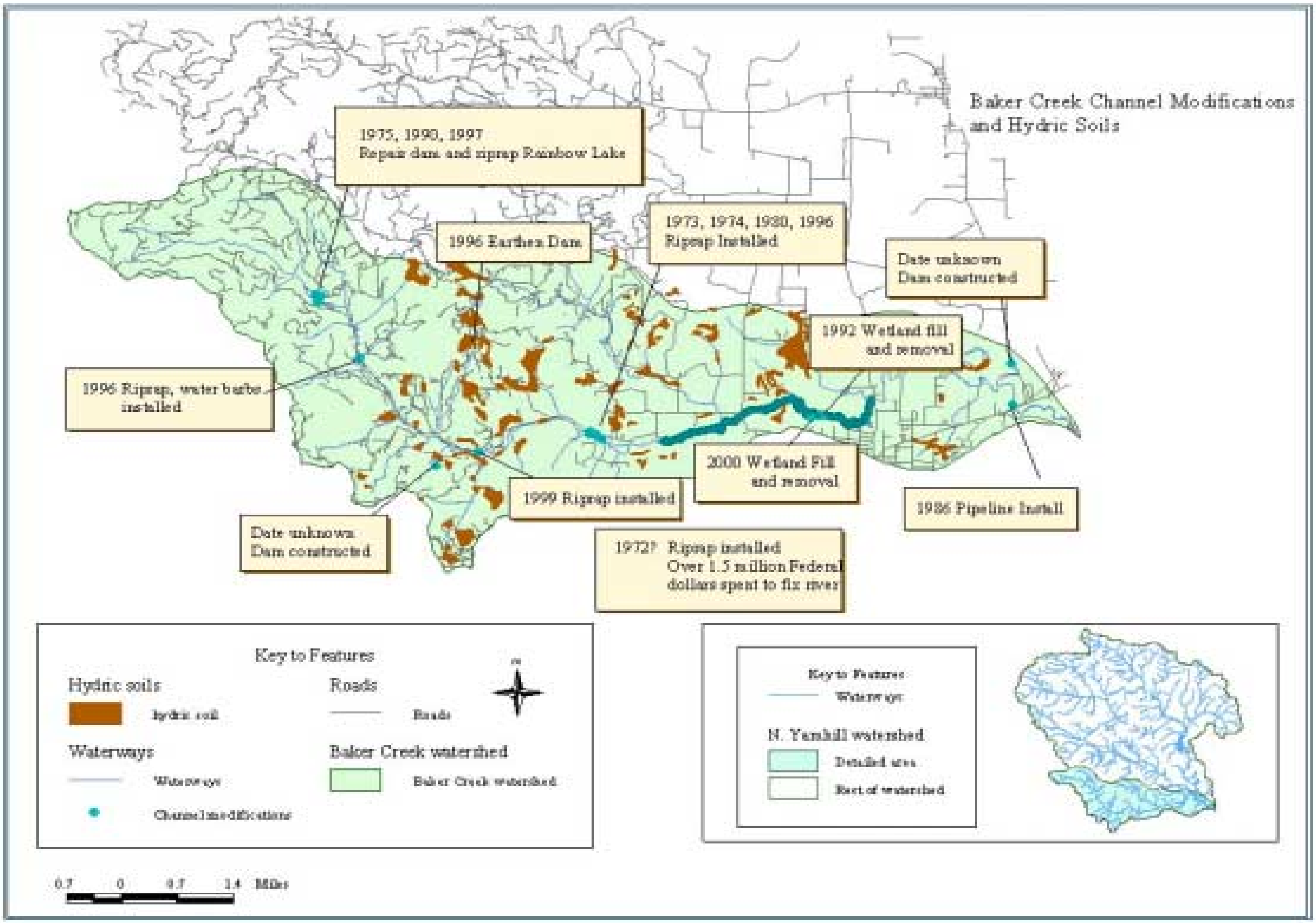
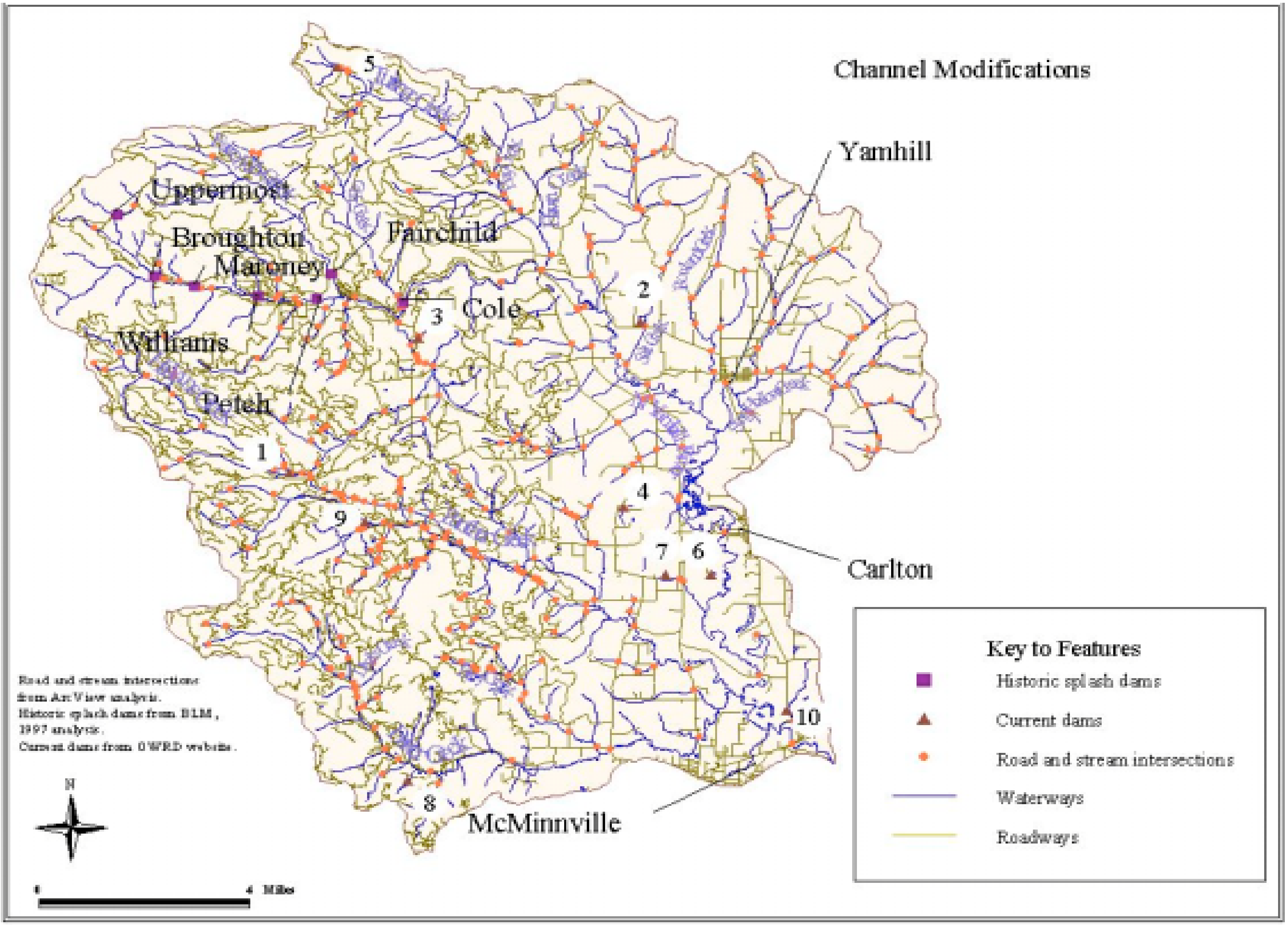

Baker Creek Channel Modifications and Hydric Soils
1975, 1990, 1997
Repair dam and riprap Rainbow Lake
1996 Earthen Dam
1973, 1974, 1980, 1996
Riprap Installed
Date unknown
Dam constructed
1992 Wetland fill
and removal
1996 Riprap, water barbs
installed
2000 Wetland Fill
and removal
1999 Riprap installed
1986 Pipeline Install
Date unknown
Dam constructed
1972? Riprap installed
Over 1.5 million Federal
dollars spent to fix river
Key to Features
Hydric soils
hydric soil
Roads
Roads
Waterways
Waterways
Channel modifications
Baker Creek watershed
Baker Creek watershed
Key to Features
Waterways
N. Yamhill watershed
Detailed area
Rest of watershed
0.7
0
0.7
1.4
Miles

Figure 14.



Channel Modifications
Yamhill
Uppermost
Broughton
Fairchild
Maroney
Cole
Williams
Petch
Carlton
McMinnville
1
2
3
4
5
6
7
8
9
10
Road and stream intersections from ArcView analysis.
Historic splash dams from BLM, 1997 analysis.
Current dams from OWRD website.
N
0
4 Miles
Key to Features
Historic splash dams
Current dams
Road and stream intersections
Waterways
Roadways

roads must also be built, usually are near the stream, impacts wetlands and riparian areas. If the river is to be crossed, a costly bridge must be built and then maintained. Bridge maintenance requires several tons of riprap to secure the banks near the footings. Sometimes this work is not completed according to schedule, and the bank is left bare, eroding into the channel until riprap is placed. The Poverty Bend Road bridge over the North Yamhill River was replaced in 1998 in order to comply with state standards for Highway Transportation vehicles, including emergency vehicles. The bank stabilization work was not completed in time for the 1998 winter storms and was bare as of April 1999.

Emergency repair work occurred in May of 1999 on a bridge that crosses Panther Creek. The banks were eroded and the stream had cut behind the bridge footings, washing away material under the support beams, causing the bridge deck to sink. To protect the bridge, 58 cubic yards of fill were dumped around the footings. Emergency roadwork also occurred on Yamhill Creek in 1999. A sinkhole 60 feet long by 50 feet wide by 20 feet deep developed over the winter of 1998-99, and washing out all the old riprap and threatening to wash out a road. Over 500 cubic yards of material was used in an attempt to stop the erosion.

Turner Creek has also experienced considerable erosion. The silt and debris in the creek affects more than homes and roads, but also the drinking water supply for the city of Yamhill. In 1998, an emergency permit was granted to the city to remove 1,500 cubic yards of sediment from upstream of the city's water supply intake.

The channels and riparian areas are not only modified by encroaching housing developments, intense winter storms, and road development, they are also impacted by excavation. In 1986, the Northwest Natural Gas Company installed a 6-inch gas pipeline 5 feet below the bed of the North Yamhill River within the state Highway 99 right-of-way. The stream was dug out and then the material was replaced after the completion of the work. No further information is available on the maintenance of the pipe or what if any monitoring of the pipe takes place.

Figure 14 shows that roads parallel many streams in the watershed. This construction leads to the need for channel hardening and bank stabilization so that channel movement does not disrupt the extensive road network. This has affected the channels in two ways: first, by constraining the flow to one channel bed, the stream loses its ability to meander to disperse energy. Second, due to being constrained, the stream maintains a high velocity, begins to downcut and erodes the channel. Roads next to the stream also result in the loss of side channels, lateral pools, and impair riparian function.

Due to the proximity of roads to the streams, the roads have to cross the streams multiple times. Additionally, private residences that access their property on either side of a stream also require a bridge or culvert. Figure 14 shows each stream and road intersection in the watershed, this was done using ArcView, and the number of intersections is 391. From this, it is easy to see that the streams do not have much opportunity to meander. This is addressed in greater detail in the sediments section of this assessment.

Dams are mapped on Figure 14. Dam types, purposes, and sizes are noted in Table 15 (data from the Oregon Water Resources Department web page).

Table 15. Current dam locations and descriptions.

Dam Map Number	Name of Owner (if publicly owned)	Name of Dam	Year Completed	Purpose	Dam Length (ft)	Dam Height (ft)	Storage (acre/ft)	Surface Area	Drainage Area (sq. mi.)
1	City of McMinnville	Haskins Creek Imponding Reservoir	1930	Water supply	280	72	325	18.0	5.00
2	Bailey Nursery	Fidel Bros. Irr. Res.	1969	Irrigation	2787	20	7.29	10.5	NA
3	City of Carlton	Panther Creek Reservoir	1971	Water supply	170	49	1180	4.3	3.10
4	Private	Ober Reservoir	1970	Recrea-tion	950	35	125	1.2	0.10
5	City of Yamhill	Turner Creek Reservoir	1978	Water supply	250	26	136	5.3	0.72
6	Private	Private	NA	NA	NA	15	NA	NA	NA
7	Private	Private	NA	NA	NA	16	NA	NA	NA
8	Private	Private	NA	NA	NA	18	NA	NA	NA
9	Private	Private	NA	NA	NA	10	NA	NA	NA
10	Private	Private	NA	NA	NA	10	NA	NA	NA

Dam locations and dimensions are only given for those dams that meet the criteria to be monitored. According to Jon Faulk of WRD, only those dams that exceed 10 feet in height need a dam permit. Smaller structures would only have water rights permits, and not be a part of this database. Faulk also notes that a structure less than 10 feet high could have a storage pond of 9.2 acre feet which is approximately 3 million gallons of water stored.

The dam structures in the table with a number in the drainage area column, representing the square miles being drained, are in-channel storage. In-channel storage is important to note because of its possible effects on non-native fish introduction, loss of spawning and rearing habitat, possible migration barrier, and water quality impacts. These dams need further investigation to determine if temperature or fish passage are issues that need to be addressed for any of them. When water is impounded behind a dam, more of its surface area is exposed to the sun, and its passage is slowed or stopped both of which cause the water to store heat.

Haskins Dam has been in service since the early 1900's, providing domestic use water for the town of McMinnville. In the 1950s, the dam was raised and improved to its current dimensions of 72 feet high, 280 feet long. It impounds 325 acre-feet of water, which is over 100 million gallons. After the 1996 storms, a sinkhole was observed in the embankment that creates Haskins Dam. Maintenance and repairs took place the summer of 2000. There is no allowance for spill or runoff past the dam during the summer low flow period. This means that Haskins Creek below the dam has very low flow during summer months. The dam does not have any fish passage. Steelhead spawning is documented for the lower part of the river, but natural production is likely limited by the lack of water in channel during the low flow summer months

(BLM, 1997).

Water from the reservoir is gravity fed to the treatment plant in McMinnville. The water treatment facility on the east side of McMinnville discharges the water after it has been treated into the South Yamhill River. During summer months, the water supply for McMinnville is supplemented with water from the McGuire reservoir in the Nestucca watershed. This is an unusual water supply scheme because the water that is stored and released from the McGuire reservoir does not re-enter the watershed it originated in, but rather enters the North Yamhill watershed.

The Turner Creek dam and reservoir was built for the City of Yamhill in 1978 to provide additional flows during the high demand summer period. The quality of the water is greatly affected by the upstream debris flow that contributes fine sediments to the system. The city is working to obtain funding to do repairs to the system and install a screening device that would alleviate the need to enter the channel continually to remove sediment and create fish passage.

From 1904 to 1965, the Carlton Mill Dam located 9 miles from the mouth of the North Yamhill River blocked fish passage. It created the Carlton Lake seen on some maps of the watershed even to this day, although the dam has been removed for several decades and the lake is no longer a waterbody., although some wetlands have been created.

The Federal Emergency Management Agency 100 year flood-plain map is included in this section as Figure 18. Unfortunately, it was not available in another format, so it is not the same size as the other maps. Figure 18 shows the entire Yamhill County instead of just the watershed. The names of the streams in the North Yamhill watershed are in type. Flood history and implications are discussed in-depth in the Hydrology chapter of this document.

The lower North Yamhill River historically would be a meandering river that would routinely flood its banks, change directions and carve side channels. The current shape of the river with its many twists and curves clearly shows this as does the historic vegetation map. Wet prairie and ash forests were the dominant vegetation along the river according to land surveys from the 1800s (see the riparian section of this document for more information on historical conditions and a map of the historic vegetation). The BLM North Yamhill analysis provides the following insight to the historic channel conditions.

> Geomorphic floodplain analysis of the lower reaches of Turner Creek (RM 0-2.5) and the North Yamhill (RM 25-26) provided evidence of old meander scars and side channels which reflects a system which spread water and allowed more interaction with the floodplain than the terrace areas of today. These reaches accessed a wider floodplain than the present incised channel and acted to dissipate the energy of episodic floods. Sediment transported by these high flow events would be deposited in calm backwater and floodplain areas enriching the fertility and thus production of wetland and riparian sites. Access to floodplain and the presence of stable root systems along the channel relieved floodflow stress on stream banks. This follows the assumption that streambank erosion was not a significant source of sediment during this period.

Currently, the river is restricted to one channel, has lost many of the side channels, and no longer routinely floods. It is unlikely the historic conditions will be returned. The river now flows through valuable farmland. What can be done to enhance the river as it exists? There are opportunities for enhancing the vegetation to provide more diversity. Where possible, land owners with land that floods year after year could be encouraged to leave that land undeveloped and allow it to provide off channel water storage and wetland area for wildlife. This is an area that would need further examination before plans were developed.

The restoration and enhancement section of this document discusses some of the projects that have been done or are in the works that address some of these issues.

Covered

- FEMA (Federal Emergency Management Agency) 100-year flood plain maps.
- National Wetland Inventory (NWI) maps.
- USGS quadrangle maps 7.5 minute scale.
- USDA Farm Service Aerial photographs (1:660).
- Yamhill County road maps.
- Division of State Lands fill and removal permits

Not Covered

- Not all areas were field verified.
- Historical logging and county road maps.

Chapter 7 Sediments

Introduction

Sediments are of great concern in the watershed due to their effects on water quality and aquatic resources. Erosional features actively contributing sediment to streams are landslides, roads, and streambanks. Bank erosion potential is greatest in the lower elevation main channels where soils and banks contain mostly fine material and few coarse fragments so they erode easily. This is also where stream entrenchment encourages lateral scour of the streambanks (BLM, 1998). Roads are likely the greatest producer of sediments in the watershed (BLM, 1997).

Landslides and soil creep (ravel) are the dominant natural erosion factors. Landslides are frequent in the areas with contact between marine sediments and impermeable volcanic soils in the steep headwaters areas. Timber harvest has increased the natural erosion process. Forest roads and off-highway vehicle (OHV) trails provide significant sources of eroding soils to enter stream channels. Eroding soils with volcanic origins results in coarse textured, low nutrient soils. Soils formed from sedimentary materials may contain finer textures and higher nutrients that can contribute to elevated turbidity and increase nutrient loading to the system (BLM, 1998, pg 5).

Information on roads and their sediment contributions is limited to including only county and BLM roads. Private timber companies' roads are limited in the GIS database.

The water draining from roads can move considerable amounts of sediment from the inside of drainage ditches and unpaved road surfaces. The road ditch is filled in with sediment from ravel, sliding and erosion of the road cut slope. Usually, roads incorporate a design that allows water flowing through the ditch to pick up this sediment and carry it as it flows into streams or small draws. It is important to remember ditches drain directly to streams.

The amount of sediment potentially contained in runoff from any single road is difficult to estimate because road conditions can change so rapidly. A road surfaced with high-quality rock can be quickly reduced to a quagmire if water is allowed to pool during wet weather and there is heavy truck traffic. Conversely, a road with a poor-quality surface may not degrade much at all it if used mainly during dry weather (OWAM, 1999).

Methodology

The sediments section was compiled with information from interviews with the Yamhill County Public Works Department personnel, the Oregon Department of Forestry, ArcView data from the BLM and the county, and the 1997 BLM North Yamhill watershed analysis.

The Oregon Department of Forestry data is used to provide a map of forested areas with potential for debris flow.

Unfortunately, there was not enough time to cover each area of the sediments assessment. What follows is a brief overview of sediment sources in the watershed, areas that are in need of further investigation, and some of the projects and concerns for the North Yamhill watershed.

Landslide Contributions to Sediment

There are approximately 1,307 acres of land that are considered unstable above Pike. The instability is attributed to steep (>60%) slopes, with headwalls and steep convex slopes where debris slides can become chronic and contribute sediment continually (BLM, 1997).

A major concern about erosion is the contribution from forested areas that are being logged. Figure 15 shows the areas that the Oregon Department of Forestry has classified as having a moderate or high **potential** for debris flows. This map does not predict areas that will slide, only shows the areas at risk. High-risk areas are 1,666 acres and at moderate risk is 24,447 acres. Debris flows are initiated by landslides on steep slopes that quickly transform into semi-fluid masses of soil, rock and other debris. Typically they scour materials for a portion of their travel distance and move rapidly down steep hill slopes and confined channels. Very small landslides can become large debris flows, so this map does not indicate minimum size (ODF, 1999).

These determinations were made with a model that took geology and slope information from the 1996 floods, historical information on debris flows, and fan shaped land formations below long steep slopes into account. They do not represent areas that have slides and they are not predicted slide areas. They are only to mark areas that have a high likelihood of sliding and thus contributing sediment to the system. The areas with the greatest potential are those closest to the Coast Range. Most of this land is owned by private timber companies and the BLM. For further information on this map and how it was produced point your browser to: http://www.odf.state.or.us/his/pdf/debrismap.pdf

Landslides that contribute sediment continually are located on Fairchild, Perkins, and Turner Creeks. The Turner Creek slide contributes sediment to Turner Creek during rainfall events. During summer rainfall events, the turbidity regularly exceeds intake standards for 6-8 hours following rainfall events of 0.5-0.75 inches (BLM, 1997, City of Yamhill). This increases the need for increased water treatment during these conditions.

Petch Creek is another area vulnerable to sediment loading. A fishpond constructed at Flying M Ranch appears to receive sediment load from road crossings in the headwaters. (Need to contact Flying M to find out what the situation is with the sediment at their location.)

The headwaters of both Panther and Baker creeks are vulnerable to slides. A slide in the headwaters of Baker Creek is a constant source of sediment directly to the creek. Bare mineral soil continues to ravel and road maintenance is an on-going problem. At the headwaters of Panther Creek is a large active slump that crosses the Nestucca Access Road. The BLM is in the process of developing a plan to address these problems (Hooper, 2000).

Landslide failure rate and sediment transport are highest where roads cross unstable areas. High-risk unstable road/stream crossings exist throughout the upper watershed. Potentially unstable road crossings on private lands occur in upper Maroney, Perkins, and Turner creeks.

Figure 15.

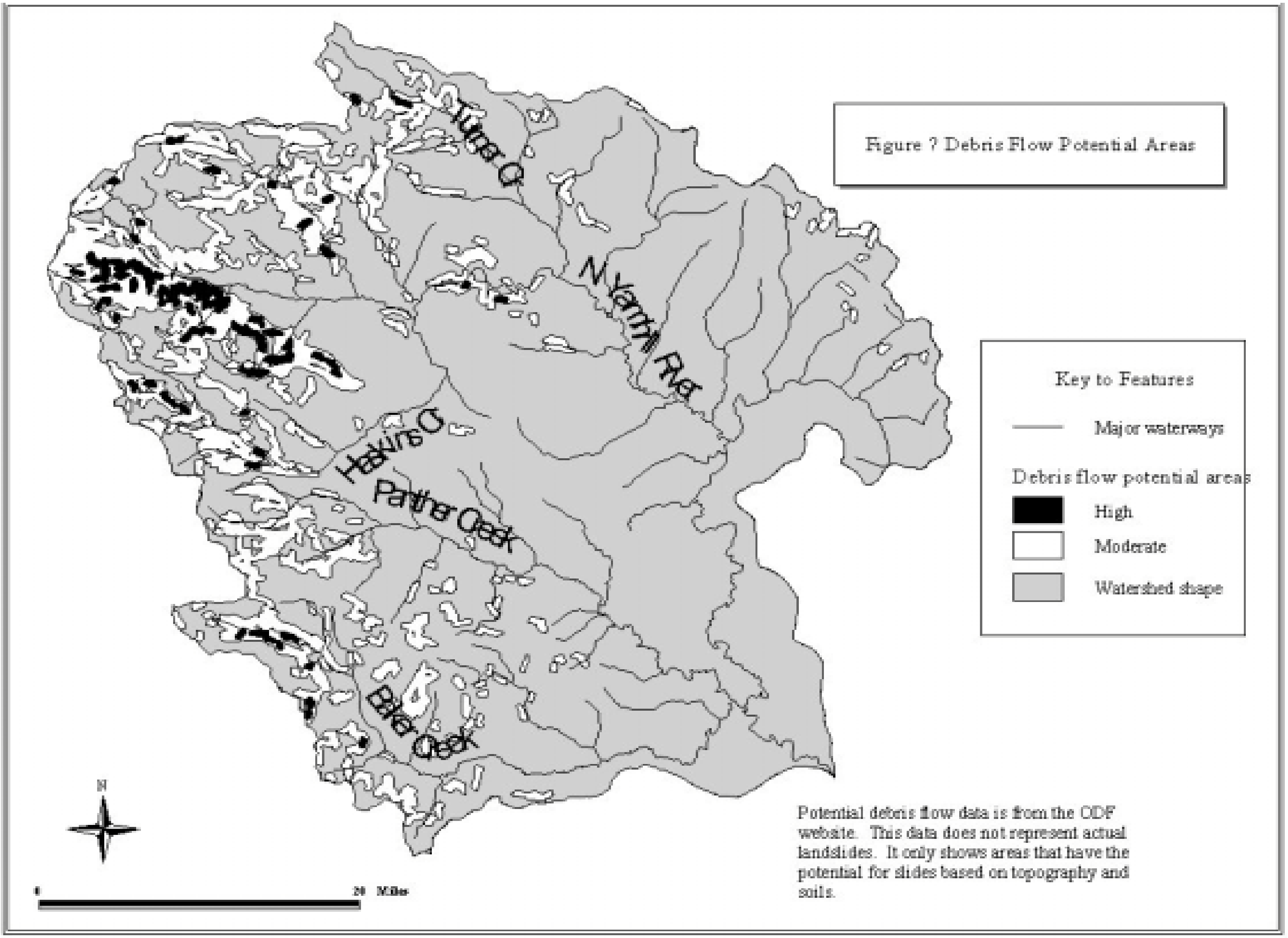


Figure 7 Debris Flow Potential Areas
Turner Cr
N Yamhill River
Haskins Cr
Panther Creek
Baker Creek
Key to Features
Major waterways
Debris flow potential areas
High
Moderate
Watershed shape
N
0
20 Miles
Potential debris flow data is from the ODF website. This data does not represent actual landslides. It only shows areas that have the potential for slides based on topography and soils.

Road Contributions to Sediment

Roads are the likely contributor of great amounts of sediment to the system. Natural surface and winter haul roads are believed to provide the highest potential source of fine sediments. Natural surface roads expose compacted soil to the rainfall, and haul roads without adequate surface rock allow the sub-grade to be exposed, providing a significant sediment source (BLM, 1997).

Early road construction methods were almost entirely cut and fill regardless of the side slope steepness. This contributed tremendous amounts of sediment to the system due to the construction methods. The road builder constructed the outside shoulder of the roadbed with the excavated material and a very unstable roadbed would result. Excavated material not needed for the road construction was simply cast over the side, and likely eroded into the nearest waterway (BLM, 1998, p. 18).

Recent standards use cut and fill on slopes less than 50%. Excess materials are minimized through better design and planning. On side slopes greater than 50%, excess materials are moved to more stable locations and are used for roads or placed in waste areas (BLM, 1998, p. 18).

Early stream crossings were either log stringer brides or wooden culverts, both prone to failure and deterioration. More recently, road stream crossings use metal or plastic pipe capable of passing 25 or 50-year flood events. Bridges use more concrete and metal in their structure and footings. BLM standards are changing to require culvert sizes that will handle 100-year flood events (BLM, 1998, p. 18).

After the 1939 Tillamook Burn, roads were rapidly constructed throughout the burned areas of the watershed to provide access to salvage as much timber as possible. These early roads were poorly constructed and most were naturally surfaced. Over time, the main roads were graveled while OHV and horse owners use the abandoned roads as trails.

Most of the main roads needed to access timber have been constructed, however, as areas are logged, spur trails connecting these roads are constructed. Additionally, the BLM is obligated by the terms of Reciprocal Right of Way Agreements to provide access to industrial forest landowners across its lands. The fees charged for this service do not nearly cover the cost of repairing and maintaining the roads. The BLM has approximately 18% of the necessary funds to do the required maintenance on its roads. Some industrial users maintain the roads they need to use themselves in cooperation with the BLM.

The BLM is in the process of inventorying its roads and determining the priority roads, and those which could be left without maintenance. This is difficult to do because roads left alone will eventually fail and contribute great quantities of sediment to the system. However, to retire a road, significant shaping and revegetating is necessary, which is costly. There are over 200 miles of BLM roads in Yamhill County, and approximately 125 of those miles are in a low maintenance category. If they are used for hauling (as happens with logging), the user pays a fee based on the number of loads that will be hauled. The BLM has only approximately 10% of the funding necessary for upkeep of roads on its lands. The funding has been decreasing due to decreases in timber harvest on federal lands (Shuford, 2000). Even if the federal land is not being logged, the roads have to be maintained for private landowners to use due to the reciprocal access agreements private timber companies have with the BLM. The access is necessary due to the checkerboard ownership pattern. Private landowners have to cross federal land in order to access their own.

Roads constructed in the forested areas by private timber companies are built under guidelines issued by the Oregon Department of Forestry. They can be contacted for further information on these requirements and restrictions.

The county roads section was given a cursory examination. Yamhill County maintains most of the public roads within the watershed. The county maintains the vegetation in its ditches by mowing. However, the county does not mow all the ditches along gravel roads, only those roads where visibility is an issue are mowed.

Recognizing that rural roads contribute significant amounts of sediment to waterways, the Yamhill Basin Council formed a Roadside Water Quality Committee that meets monthly to bring together those concerned about the conditions of the county roads. Currently, the members include representatives from the Yamhill Basin Council, Yamhill and Polk County Public Works Departments, Oregon Department of Transportation, Yamhill Soil and Water Conservation District, and Oregon State University Extension.

The committee has developed a plan for Yamhill County to improve the conditions of the ditches through a seeding project. Roadside seeding projects have taken place in Yamhill County over the last 10 years (Gille, 2000). The success of the projects was limited however, because often the landowners were not partners in the project and would herbicide spray the ditch. This would negate all the seeding work done by the county. The current project involves talking with the landowners prior to the reshaping and seeding taking place on their property. The implementation of the plan is starting this summer. The goal is to improve the ability of the ditches to transport water while leaving the soil in place. This is accomplished through reshaping the ditch, preparing a good seed bed by eliminating weeds, and seeding a low growing grass such as creeping red fescue or a bluegrass in the ditch.

With assistance from an OWEB grant, the Yamhill SWCD, YBC and the Yamhill Department of Public Works, roadside seeding took place on Baker Creek Road during summer 2000. This road was chosen because of the high use and the number of accidents that occur on it. Work on the roadside finished in November.

Ditches in Yamhill County are re-ditched on a ten-year rotation, seven to eight years would be ideal, but budget constraints prevent that schedule (Carter, 2000). Some areas have yearly maintenance and others only every twenty or so years. Ideally, re-ditching would be restricted to the driest months of the year to prevent sediment from the exposed surface from entering the waterways. However, due to the amount of work that needs to be done, road ditching is scheduled year round. Most gravel road grading occurs during the winter months when the road substrate has enough moisture to be reshaped.

County road maintenance personnel also respond to complaints from citizens on ditch failures or blockages. Often when ditch failures occur, there is an obvious source for the excess water or the blockage. Examples include: apple trees next to a ditch – the unpicked apples fall and plug the ditch; lawn waste dumped into ditches, drainage tile lines from agricultural land routed directly to a ditch, overwhelming the ditch system during high flows. These are actions that individuals can take responsibility for changing. Everything that is in the ditches eventually makes it to the streams and creeks.

If you would like further information on roadside seeding or other road related issues contact the following and ask for the “Roadside Vegetation Management” brochure:

Yamhill Soil and Water Conservation District
2200 SW 2nd St.
McMinnville, OR 97128
(503) 572-6403

Off Highway Vehicle Contributions to Sediment

The OHV area in the watershed receives high use, with recent estimates of up to 10,000 visits per year. The Greg Oriet from the Oregon State Police sees two trends influencing OHV use, the new kinds of vehicles that have been developed over the last 20 years and the marketing that has been aimed at users of all ages. A cooperative closure area has been designated in an attempt to decrease the OHV impact to streams, reduce conflicts between user groups, and promote public safety. This closure area was established in cooperation with the BLM, Willamette Industries, ODF, Oregon State Police, Yamhill County Sheriff, and the Trask Mountain Motorcycle Club.

OHV trails and stream crossings are perceived to be a source of erosion and sediments. There is little data on the extent of this contribution. OHVs use existing roads, old skidroads, abandoned haul roads, and create trails through the woods. The disturbance and soil compaction can result in the channeling of flows, erosion of the surface and the formation of gullies. All of these are readily visible throughout the upper watershed. Currently, there is no map of these areas or a methodology to assess their contribution. According to Oriet, the High-Heaven area that drains into Baker Creek and Rainbow Lake is known as the “playground” and is used by heavy weight 4-wheel drive vehicles.

There is law enforcement time dedicated to catching and prosecuting OHV users who do not respect trails. However, the number of people caught and ticketed is only a small number and there is more impact through education efforts by local organized groups (Oriet, 2000).

According to Karen Fisher, member of the Pacific Northwest Four-Wheel Drive Association, her organization maintains a code of conduct and is very active in youth education and safety efforts in the community. They are doing outreach to SUV users on trails and appropriate use. They also have trail patrols of volunteers and spend time out helping users or documenting abuses to get the sheriff involved. The organization also does trail work to deter would-be users from using sensitive areas.

Streambank Erosion Contributions to Sediment

Bank erosion is the direct erosion of the channel into the stream. It is likely not a significant contributor to sediment in the upper reaches of the watershed. However in the lower agricultural reaches, the banks have less coarse material and are eroded down to bedrock, which leads to lateral scouring of the streambank.

Little data exists to examine this sediment contribution. ODFW stream surveys of Cedar Creek (the lower 6,300 feet) and the North Yamhill main channel (from river mile 20 to river mile 30) show that both channels were rated as having poor stability with approximately 59% and 21% (respectively) of the area examined actively eroding. This data indicate that stream banks could be significant contributors to sediment load during high flow events.

Agriculture Contributions to Sediment

The agricultural contributions to sediment were not examined in depth. The soils map was examined in conjunction with the current vegetation map. Aerial photos and field verification was not conducted.

Chapter 8 Hydrology and Water Use

Introduction

The general pattern of water movement is called the hydrologic cycle. It has six main components including precipitation, interception, surface run-off, ground water flow, transpiration, and evapotranspiration. Human activities influence all of these to some degree and affect some more than others. It is beyond the scope of this document to address all of these areas.

This section covers the hydrology of the watershed as it relates to flood history, land use and the probability that different land uses significantly affect peak low and high flows, and water rights. Precipitation was addressed in the introduction section, and will be covered briefly again in this section.

Peak Flows

Peak flows describe the highest flow of water in a stream, usually measured annually. They are not necessarily floods. The rainstorms that cause peak flows in the North Yamhill watershed occur during the months of October through May in an average year. The watershed seldom receives significant amounts of snow.

The amount of precipitation that falls is not the only factor that influences the peak events in the watershed. Stream flows are influenced by uses such as drinking water withdraws, irrigation withdraws, stream channel modifications, changes in land use and practices, and upstream vegetation removal such as clearcuts. These actions affect the amount of water that is present in the streams, as well as the rate of release of water into the stream, and how fast water enters a stream during a storm event. For example, if a formerly braided channel is channelized to one specific channel bed, that stream will no longer store water across the landscape. This is evident in the lower reach of the North Yamhill River. From aerial photos and maps it is easy to see the channel historically moved in response to high flows creating oxbows and a widely meandering channel. Now, the channel is stabilized in one location and the flow more rapidly enters the main channel during rain events, leaving less water available to gradually enter the channel over a longer period of time. Human changes in the landscape have caused the land to drain more rapidly which leads the stream to reach a higher peak faster.

Drainage tiles, ditching, rip-rapping stream banks, and channel straightening all change the way water flows across the land and enters a stream. Drainage tiles provide a way for water to be transported quickly off the land and into the nearest body of water. These human changes can be seen in all the sub-watersheds. Although documenting their locations was not possible for this assessment due to time. Drainage tiles in agricultural lands and road ditches are widespread in the eastern agricultural side of the basin. Human influenced peak flows can cause flooding, increase bank erosion, or deepen channels through incision.

However, if the streams are ready to handle peak flows, there can be many benefits after their occurrence. Streams that are functioning properly can receive benefits from increased water in the system. The streams in the North Yamhill watershed do not typically receive these benefits from peak flow events because the channels have been confined to one channel or have restricted movement because of the close proximity of roads. (Long Tom Watershed Assessment, 2000.) The list of benefits to healthy streams from peak flow events are:.

1. Deeper flood plain soils for water storage and plant growth;
2. Raised channels that reach the flood plain more often exchange water with wetlands, and transfer water to riparian areas more efficiently;
3. Greater sinuosity (meandering) resulting in more stream-riparian contact, larger riparian areas, and slower velocities;
4. Changes in channel location that create backwaters and other aquatic habitat;
5. More and deeper pools;
6. Disturbance of the riparian area which enables new growth to take hold;
7. Higher base flows and less damage from peak flows;
8. More frequent local valley flooding and less frequent downstream flooding.

Low Flows

Low flows are the lowest flow rates for a given stream over a given time period, usually recorded annually. Low flows lead to increases in stream temperatures and decreased water quality conditions, which adversely affect aquatic habitat for some species. The lower the amount of water in the stream, the easier it is for the sun to heat it, much like boiling a pot of water. It takes only a few minutes to heat a gallon of water, but many hours for your water heater to heat several hundred gallons. The sun affects in-stream water in a similar way. The less water in a stream, the less energy it takes to heat it up.

Low flows don't provide sufficient water to dilute pollution. Pollution from agriculture or municipal waste water treatment plants, animal or human waste, faulty septic systems, and others are minimized when there is a large quantity of water in the stream. Imagine a dropper of food coloring released into a glass of water, the strong color that results. Then imagine a dropper of food coloring released into a bathtub of water, barely perceptible color change. Having larger quantities of water available to dilute it minimizes water pollution.

Low flows also restrict water use for consumption for junior users (this is covered in greater detail in the Water Rights section). Low flows are influenced by the same factors as high flows, ditching, tiling, etc. The two types of flow go hand in hand – if you have a stream that experiences extreme peaks, it will likely experience extreme dips. More information on the effects of high temperatures and water pollution on salmon can be found in the Water Quality chapter.

Irrigation water use has increased over past 100 or so years as methods of pumping have improved. The BLM compared gauge records above and below (Fairdale vs. Pike) areas of diversion and showed that for the historic period of record, there was a 66% decrease in the 7-day lowflow discharge between the two stations. This means that over time, the low flow conditions of the lower elevation channels has significantly decreased. Irrigation water rights began being granted in the North Yamhill in 1875, Turner Creek in 1899, and Haskins Creek in

1903 (BLM, 1997).

Floods

There have been 8 streamflow gages within the North Yamhill Watershed. Table 16 is a summary of information for those stations.

Table 16. North Yamhill Streamflow Gages

USGS Gage #	Name	Period of Record	Drainage Area (sq. miles)	Upstream regulation
7000	North Yamhill River at Pike	1948-1973	66.8	Haskins Dam on Haskins Creek City of Yamhill on Turner Creek Irrigation
6500	North Yamhill River near Pike	1940-1951	47.8	Haskins Dam on Haskins Creek
5000	Haskins Creek near McMinnville	1928-1951	6.48	None
4300	North Yamhill River near Fairdale	1958-1966 1967-1987	9.03	None
7300	Panther Creek near Carlton	Not avail.	Not avail.	Not avail.
5600	Haskins Creek divide to McMinnville	Not avail.	Not avail.	Not avail.
6000	Haskins Creek below reservoir near McMinnville	Not avail.	Not avail.	Not avail.
6001	Haskins Creek below reservoir plus divide to McMinnville	Not. Avail.	Not avail.	Not avail.

These stations provide a record of flow history, including floods, and can provide information on what conditions to expect in the future. The flood information in Table 17 was taken from the station on the North Yamhill River at Pike. The period of record available was from 1948 to 1973. The floods that occurred after that date do not have data from that location.

Table 17. Floods in the North Yamhill River Watershed

Order of Magnitude	Date of Crest	Estimated Peak Flow Discharge (cfs)
1.	December 21, 1955	9,350
2.	December 22, 1964	8,940
3.	January 20, 1972	7,380
4.	November 25, 1962	6,520
5.	February 10, 1949	6,280

Other large-scale floods have occurred with some regularity in the watershed including years 1861, 1931, 1949, 1960, 1962, 1965, 1972, 1974 and 1996.

The flood of 1861, has limited data available. But the estimates are that it was comparable in size to the December of 1964 flood. In November of 1861, continuous rainstorm activity in the valley paired with snowstorms in the Coast Range resulted in a tremendous flood for much of the Willamette Valley. At Fort Haskins, 26 miles SW of McMinnville, 13 inches of precipitation fell between November 28th and December 3rd (Army Corps of Engineers, 1976).

The flood in December of 1964 was largely a result of unusually intense precipitation on frozen topsoil combined with snowmelt in the mountains in valley. The following is an excerpt from a news story on the event.

> Early this week, a warm air mass moved in bringing heavy rains, which caused a rapid melting of snow. The frozen ground was unable to absorb the water and streams across the state began rising rapidly…Sheriff's deputies kept the Carlton Lake dam under observation throughout most of the day. They reported large amounts of water going over the dam, but indicated the dam itself was in no immediate danger of going out (McMinnville Daily News Register, 1964).

During the 1964 flood, the alder riparian area next to the channel was scoured similarly to how it responded to splash damming. The high elevations of the North Yamhill were significantly widened, but the channels of Fairchild and Haskins were not as dramatically affected. The banks naturally revegetated with alder, but this was short lived. The peak flows of 1972 widened the lower North Yamhill River again. Since the 1970s, alder has grown into the floodplain, leaving the bank stability in question (BLM, 1997).

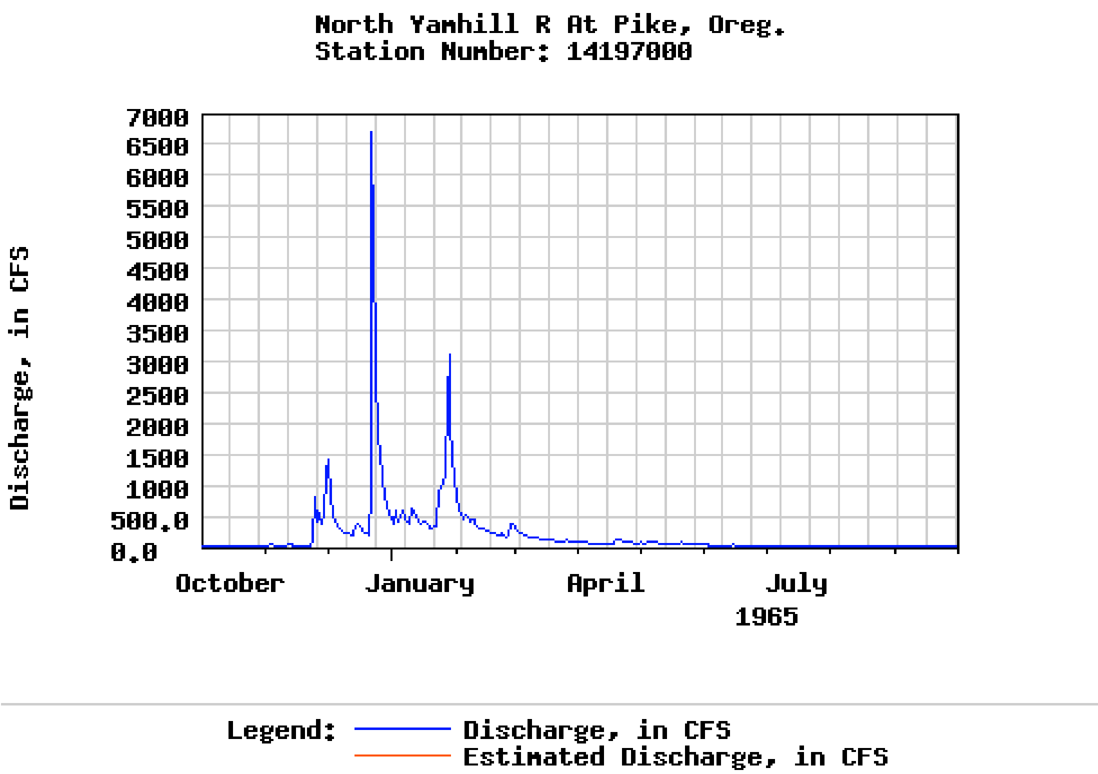
In the BLM's 1997 review of the 1964 flood data, they concluded that the flood of the North Yamhill River and Haskins Creek might have been much higher if the dam and reservoir on Haskins Creek had not been present. The reservoir captured much of the storm runoff .

The 1964 flood brought such a tremendous sediment load to the system that the Carlton Lake dam was filled with silt and removed in 1965. The flood also removed much of the large wood from the channels and left it in culverts and bridges. It is assumed that most of this wood was removed after the flood because at that time, clean channels were thought to be healthier for fish and the watershed (BLM, 1997, p.40)

During the 1964 flood, Turner Creek experienced a large debris flow that is still bringing fine sediment to the system. The toe of the slide is located on BLM land. This slide has been actively moving and delivering sediment for the last 25 years, and is still visible on 1994 air photos (BLM, 1997).

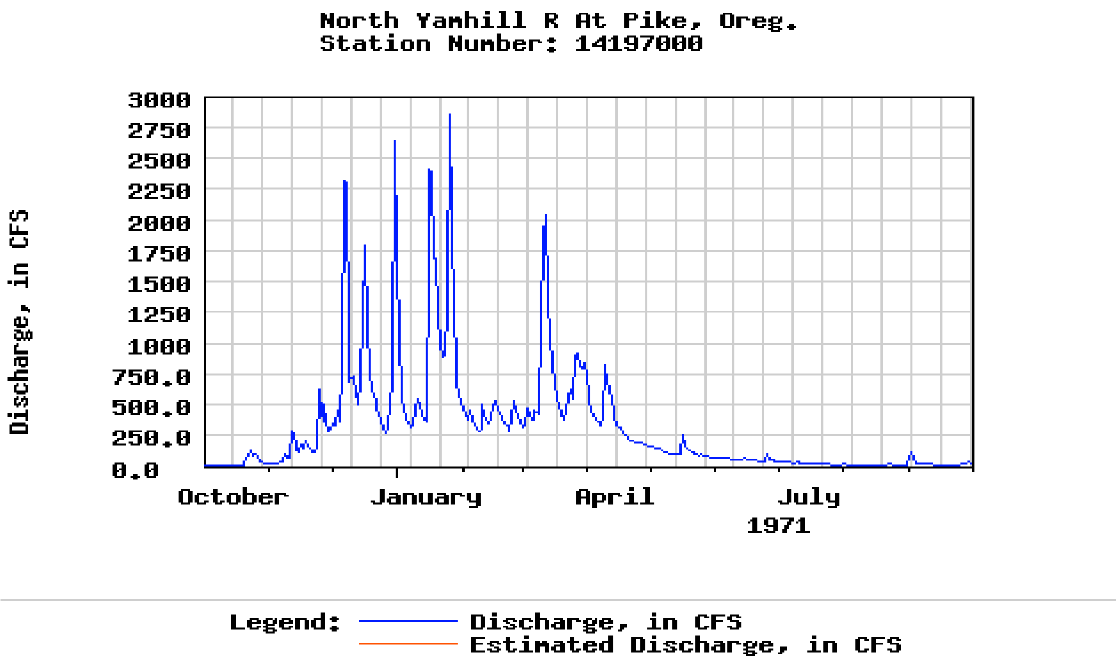
Figure 16 shows the hydrograph of the North Yamhill River at Pike in 1964. The numbers on the left side of the graph show the cubic feet per second (cfs). Notice how the precipitation is concentrated during a few months of the year and falls to nothing for the remainder of the year. Compare this hydrograph with the one from 1970, Figure 17. Notice how difference in cfs between the graphs. The 1970 figure shows less than half as much water during the peak month compared with the 1964 figure.

Figure 16. Hydrograph 1964-65 North Yamhill River



By looking at the historic streamflow records it is possible to determine the probability that low or peak flow events will occur. Models have been developed to examine the relationship between precipitation and land uses to predict flood recurrence levels without actual flow data. That is beyond the scope of this document. Even areas where flow records exist, predicting floods is not exact. The best records in Oregon only date back 100 years. Most areas have a much shorter record to examine. We assume that the floods on the North Yamhill River were also flood events on its tributaries.

Figure 17. 1970 Hydrograph North Yamhill River



The state climatology service examines weather trends for Oregon and believes the state has a 20-year wet and 20 year dry cycle. The significance of this for flood information is that if data collected from a stream is for a 30 year period, and 20 years of that were during a dry cycle, the flood predictions will be different than if the data were collected during a 20 year wet cycle.

Concept of Flood Frequency

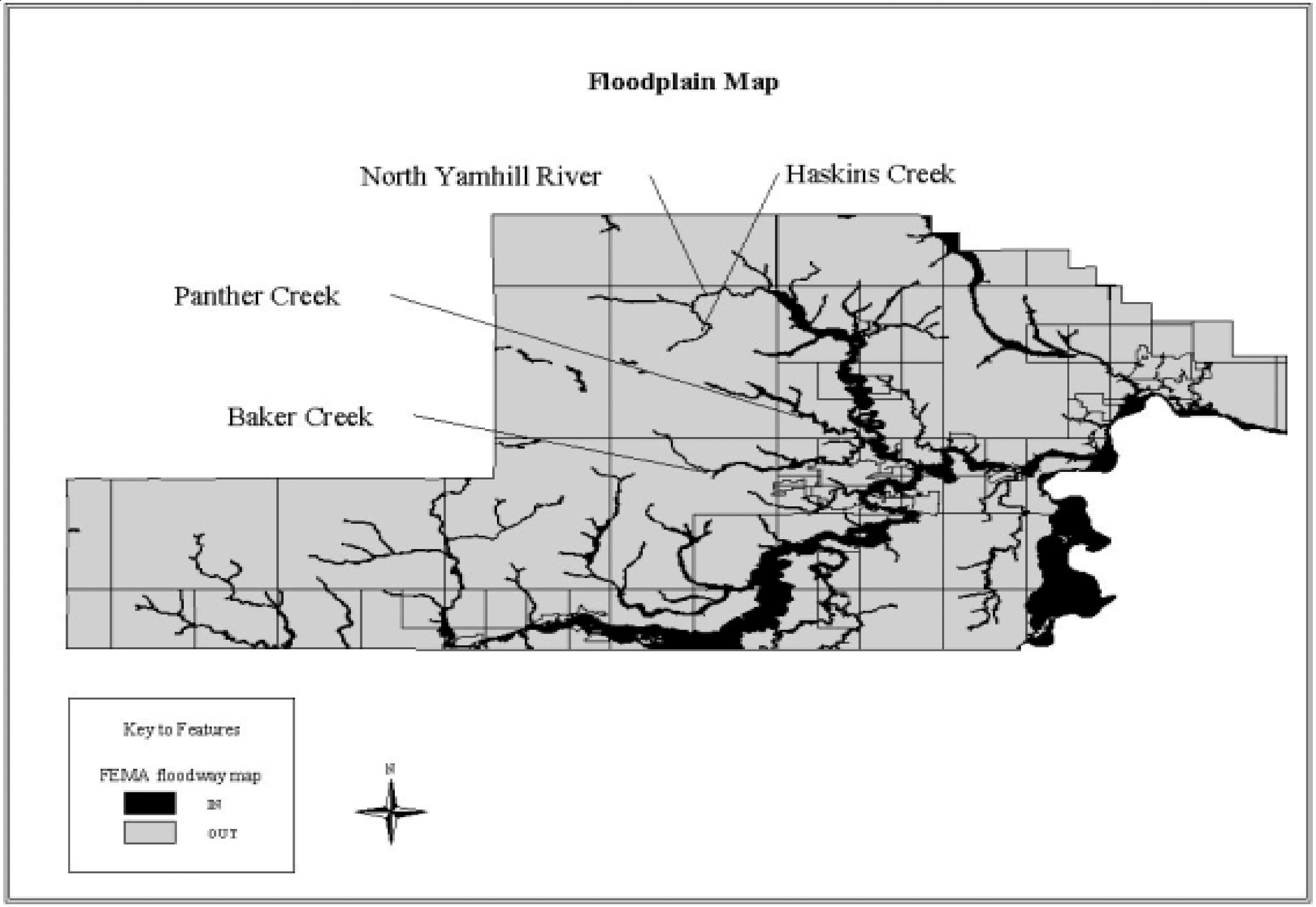
Flood recurrence levels are a way to express the likelihood of a given flood event occurring in a given year. Flood frequency is based on historic records of flow at stream gaging stations. It is a measure of probability. A one hundred-year flood has a 1 in 100 chance of occurring in a given year. Over the course of 30 years (the average length of a home mortgage), there is a 26% chance that there will be a 100-year flood. The longer one waits, the greater the possibility of a flood event occurring (Ellis-Sugai, 2000).

A map of the county and the flood plain as outlined by the Federal Emergency Management Agency (FEMA) has been included, Figure 11. The projection of this data did not match with existing data for the watershed. The rivers in the watershed with floodplain are labeled.

Sources of Error in Determining Flood Levels

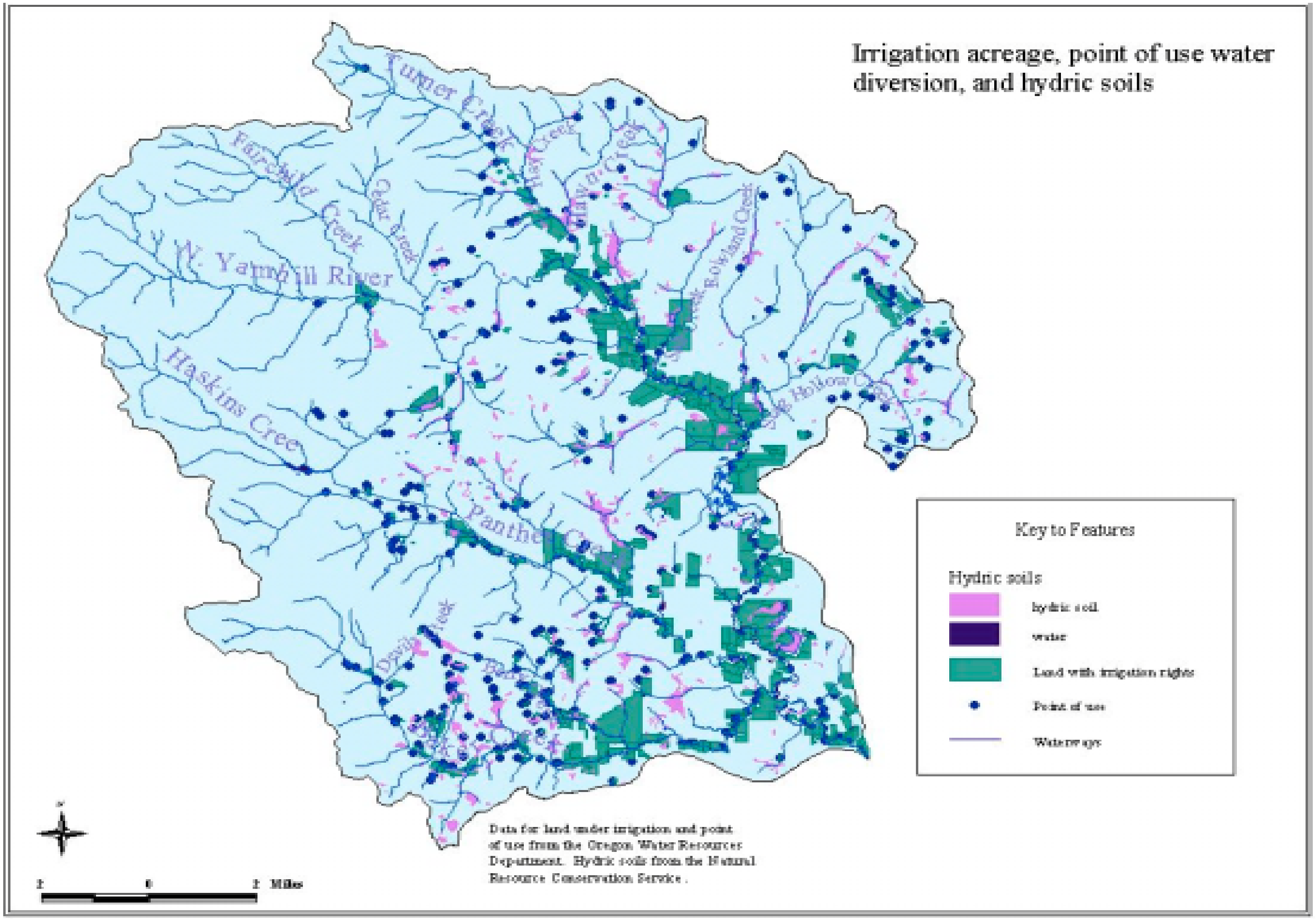
1. Length of record that statistics are based on. The shorter the record, the greater the error. Many stream gages in Oregon have only been recording data for 30 years. For a record 25 years long, there is an 85% confidence level. This means that the probable height of a 100-year flood can be off by 15%.
2. Conditions in the watershed may change over time. Increasing urbanization tends to increase

Figure 18.



Floodplain Map
North Yamhill River
Haskins Creek
Panther Creek
Baker Creek
Key to Features
FEMA floodway map
IN
OUT
N

Figure 19.


Irrigation acreage, point of use water diversion, and hydric soils
Turner Creek
Fairchild Creek
Cedar Creek
N. Yamhill River
Haskins Cree
Rowland Creek
Key to Features
Hydric soils
hydric soil
water
Land with irrigation rights
Point of use
Waterways
Miles
Data for land under irrigation and point of use from the Oregon Water Resources Department. Hydric soils from the Natural Resource Conservation Service.

the size of a flood for the same amount of rain. This means the mapped 100-year flood plain may be out of date.

Summary

Peak and low flows are influenced by human land uses. Activities such as the clear-cutting in the Upper N. Yamhill watershed, agricultural practices in the low-lands, and urban development in McMinnville, Carlton, and Yamhill, impact the speed with which water moves through the watershed. Some land use practices lead to an increase in the peak flows during winter storms and exacerbates low flows during the summer months.

What this means for salmon:

Rearing habitat (streams where juvenile salmon live) requires certain flow. The flow in many of the streams in the watershed is not sufficient. Data collected by the Water Resources Department show that the rivers are overallocated. (This is explained further in this chapter). The data that shows that water demand is higher than water availability and yet the rivers are not completely dry in the summer months. This is an area that needs further investigation, especially of flow and **actual water usage**.

Water Rights and Use

Under Oregon law, all water is publicly owned. Therefore, before surface water is used, a water right needs to be obtained. In some cases, water rights are needed for ground water. Water rights need to be obtained for the use of water from a creek, stream, or river even if the water is for domestic use. Landowners with water flowing through their property do not have an automatic right to use that water. Water rights are issued through an application process administered by Oregon's Water Resources Department (WRD, 1997).

Seasonal water demands exceed water supplies with growing frequency. Competition between instream and out-of-stream uses is intensifying (Willamette Basin Report, 1992). At present, no further water rights are being allocated for the watershed. Applications are accepted and kept on file, but the present over allocation during most of the year (April – December) prohibits further rights from being issued for those months (Ferber, 2000).

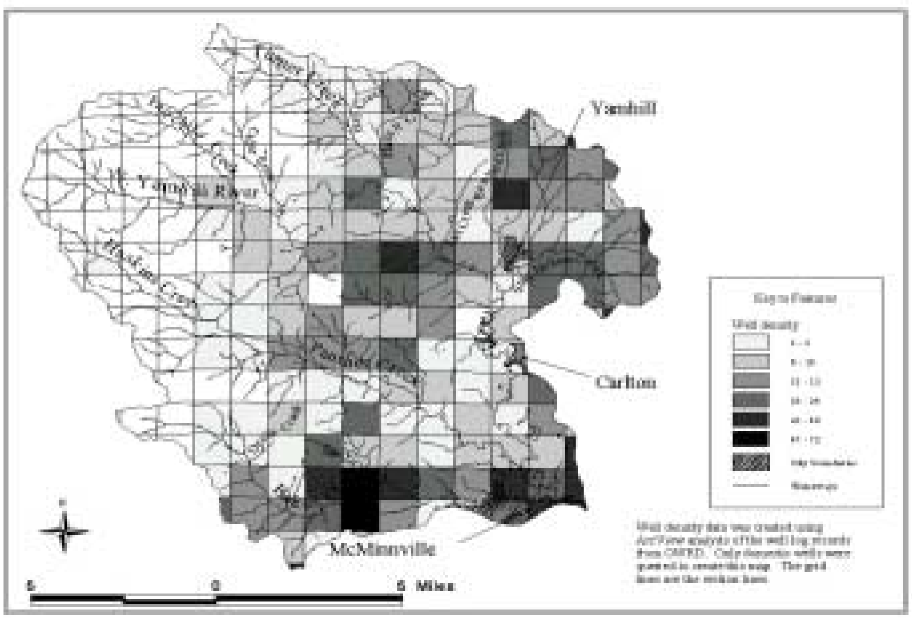
Haskins, Panther, and Turner creeks and the North Yamhill River, are currently over allocated. This means when summed, the allocated water rights are greater than the estimated flow in the river. However, this simplification of the watershed does not take into account that water removed for uses such as irrigation or domestic use will flow back into the system, or that users may not exercise their entire right. Also the time of day that the water is used is not taken into consideration.

Oregon water law states that water rights that are not exercised for five consecutive years are forfeited. However, there is no system in place to monitor or regulate the amount of water withdrawn by users unless they have a meter, which is rare. Therefore, it is difficult to determine the amount of water actually being used by irrigation.

Figure 20 shows the land area with irrigation rights, and the well diversion points. These maps were developed with assistance from Karl Wozniak of the Oregon Water Resources Department. This map shows only approximate locations for wells and approximate acreage with water rights. The well diversion points are supplied by the well log database maintained by the Oregon Water Resources Department. The contractors who dig the wells supply the data to OWRD. That is why the locations are approximate. Additionally, the dots do not represent specific wells, just the location within a township, section, and range. Wozniak cautioned that the polygons representing the area under irrigation were mapped in the early 1990s, and therefore may not capture all current water rights. However, this area of the basin has not seen much new irrigation development in the past 10 years, so the map is probably fairly accurate. As well, these polygons represent areas with rights to irrigate that acreage. It does not mean those rights are being exercised and may not actually be irrigated. In fact, most of that area is in grass seed production (see Figure 8) and is likely not in need of irrigation.

The well data was analyzed using ArcView to look at the distribution and concentration of domestic wells by section. This analysis does not include wells for irrigation, livestock, or monitoring. Figure 20 illustrates that the highest concentration of wells occurs west of McMinnville along Baker Creek, west of the town of Yamhill, and north of Yamhill

Figure 20. Domestic well concentrations



The data used to create this map is from the Oregon Water Resources Department. Well information is available on line at www.owrd.state.us.or

The website provides the well records of any location by Section, Range, Township.

Water Storage

The major reservoirs in the watershed are the Haskins Creek Reservoir, water supply for McMinnville, Carlton Lake Reservoir, water supply to Carlton and a reservoir on Turner Creek that supplies water to the city of Yamhill. Rainbow Lake is a reservoir on Baker Creek but it is not a water supply to any community.

There are also a number of small dams throughout the basin that provide water storage to the individual landowners. Collectively, it is not known what amount of water they store and if they are all still in use, and what possible effects this has on stream temperature, but they may affect the stream they are built on by restricting all flow during summer months. These dam locations are marked on the map for the Channel Modifications section.

Water Rights and Stream Flow

Water rights for Haskins Creek, Panther Creek, Turner Creek, and the North Yamhill River exceed the available flow during the summer months. Rarely on the ground does it occur. If it did occur, senior users would be granted their full right and junior users after them in order of permit date. Junior users can be told to stop using water if a senior user is unable to exercise his/her full right.

This is significant for salmonid recovery because the water rights that have seniority are usually consumptive uses such as municipal water supply, domestic use, or irrigation (these are not all consumptive to the same degree) and these take priority over junior in-stream water rights for wildlife. This has led to interest in an option for senior water rights holders to be able to lease or sell their higher priority rights to provide water to the stream.

An Online Introduction to Oregon's Water Law and Water Rights System on the website for OWRD states,

> "Watermasters respond to complaints from water users and determine in a time of water shortage who has the right to use water. They may shut down junior users in periods of shortage.
>
> Watermasters work with all of the water users on a given water system to ensure that the users voluntarily comply with the needs of more senior users. Occasionally, watermasters take more formal actions to obtain the compliance of unlawful water users or those who are engaged in practices which "waste" water. The waste of water means the continued use of more water than is needed to satisfy the specific beneficial use for which the right was granted.
>
> Instream water rights are not guarantees that a certain quantity of water will be present in the stream. When the quantity of water in a stream is less than the instream water right, the Department will require junior water right holders to stop diverting water. However, under Oregon law, an instream water right cannot affect a use of water with a senior priority date (OWRD 1996)."

According to Bill Ferber, the WRD watermaster for the area, conflict seldom happens. On paper, these streams appear over-allocated, in reality; users have not been denied access to water. How is this possible? Ferber has two hypotheses to explain this situation: 1) users are not exercising their full right since we have had good rain the past ten or so years, lowering irrigation demands, and 2) he suspects that much of the irrigation water eventually works through the water table and re-enters the stream. Another possibility is that users are not all taking the water from the stream at the same time of the day. Some may remove water at night or in the evening while others are removing water during the day.

When the human uses are combined with the instream water rights for Haskins, Turner, Panther, creeks, and the North Yamhill River, the net available water is a negative number. This is illustrated in Figure 16. The net water available is developed by the OWRD and does not represent actual flow from a given year. It is a compilation of flow averages from the 1950s to 1980s.

Figure 21.

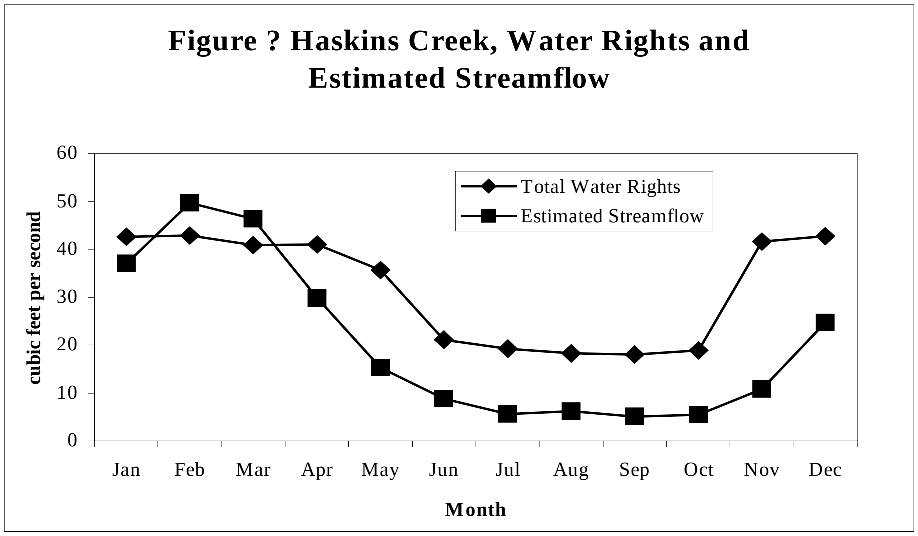


Figure 22.

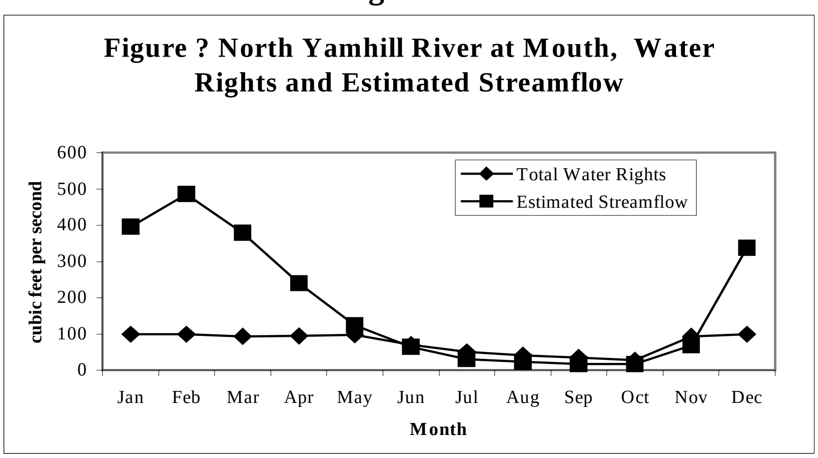


Figure 23.

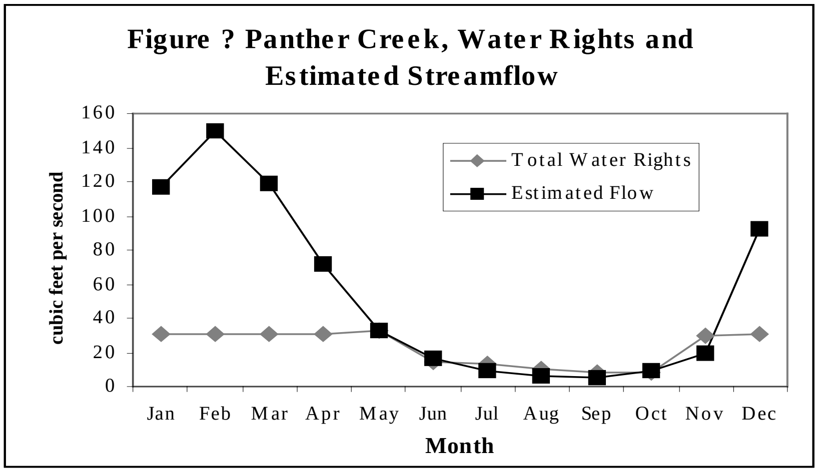
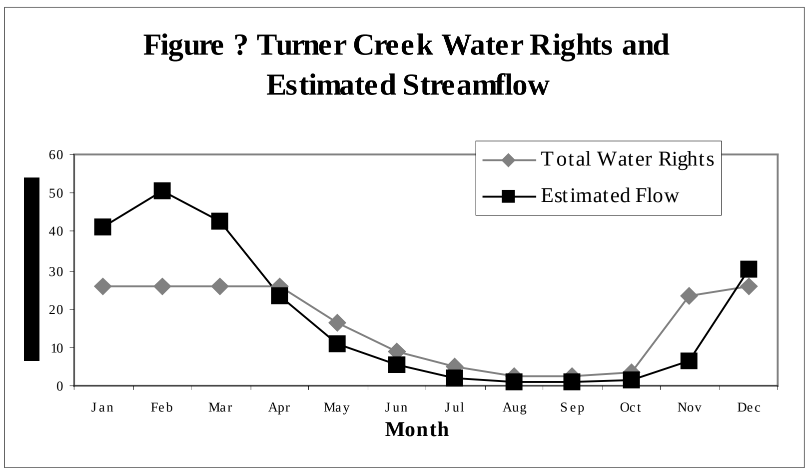


Figure 24.



A lack of sufficient streamflow to dilute pollutants and support aquatic life (including salmonids) is an issue throughout the Willamette Basin, the North Yamhill watershed included.

Groundwater is the primary source of water to the streams in summer. Summer flows are naturally low due to the lack of precipitation in the valley during summer months, and the lack of snow melt in the Coast Range to augment flow. This condition is worsened by out-of-stream demands especially for irrigation (Willamette Basin Report, 1992).

In the 1997 BLM analysis of the watershed, Haskins Creek below the dam was identified as the most critical low flow issue in the analysis area. In August and September, streamflow below the dam may be only a function of the local groundwater outflow. The water from Haskins Creek is pumped out of the watershed and into McMinnville for municipal use. This low flow is vulnerable to heating, creating an unfavorable environment for salmonids. The City of McMinnville can supplement their supply out of the McGuire Reservoir in the Nestucca Watershed.

At this time, there are no plans for the basin or the state to change the way water rights are allocated or to increase the enforcement of the “use it or lose it” policy. However, this discrepancy between available water and water rights has not been tested by a severe drought (necessitating that more users exercise their irrigation water rights) or by crops that necessitate large amounts of supplemental water, such as nursery crops (Wozniak, 2000).

Time constraints and the unavailability of some data resulted in some of the components of the hydrology section not being addressed. These are outlined below.

Covered:
- Flood history
- Peak and low flow analyses
- Road density
- Water use and availability

Not Covered:
- Impacts of land use on peak and low flows

Chapter 9 Water Quality

Introduction

This section provides a screening level assessment of the water quality in the North Yamhill watershed. This is a broad overview and addresses water issues not examined in the other sections including: temperature, dissolved oxygen, pH, nutrients, bacteria, chemical contaminants, and turbidity. This section provides a starting point to analyze the water quality of the watershed. It is important to note the dissolved oxygen, pH, and bacteria data available for the watershed is for the years 1986 to 1988. The temperature data ranges from the 1980s into the present for some areas of the watershed and has been collected by a variety of agencies.

The method of analysis for this section involved (1) identifying the beneficial uses for the watershed, (2) selecting the appropriate water quality criteria to apply, and (3) assembling existing water quality data for the watershed.

Beneficial Uses

In-stream water quality is maintained to protect "beneficial uses." These are legally defined in the Oregon Water Quality standards to include: domestic water supply, fishing, aesthetic quality, resident fish and aquatic life, salmonid fish rearing, salmonid fish spawning, and water contact recreation.

In most cases, the most sensitive of these uses is maintaining water for the rearing and spawning of salmonids. Salmonids serve as an important indicator of the overall health of the stream. If salmon are not spawning in areas they were found historically, then the quality of that water body may be impaired. Salmonids need specific water conditions for spawning and rearing fry and juvenile fish. They are very sensitive to changes in water quality at these early stages in development.

Recognizing this need for specific conditions for the success of salmonid reproduction and growth, the state set standards to measure water quality. The national government also has standards for water quality. When the federal standards are violated, the stream becomes "listed" under the 303(d) rules of the Federal Clean Water Act. Listing means the water body is not in compliance with the law, and steps need to be taken to bring it into compliance. The Oregon Department of Environmental Quality (DEQ) administers the rules and manages the data that determine stream listings.

DEQ determines which water bodies should be listed through a rigorous process. No streams are listed without sufficient evidence, according to the DEQ. They seek all available information on the water body including data submitted by individuals, organizations, government agencies, and their own data. This data is all reviewed to ensure it meets minimum standards for quality assurance. It is important to keep in mind that the listing only identifies water quality problems, not the causes and only identifies those areas where data has been gathered.

In the North Yamhill watershed Turner Creek and the North Yamhill River violate some of the standards. The details of these listings are shown on Table 18.

- Temperature (North Yamhill River from mouth to the headwaters and Turner Creek from its mouth to Severt Creek).
- Bacteria (North Yamhill River from mouth to Turner Creek).
- Flow Modification (North Yamhill River from mouth to Turner Creek).

The DEQ also maintains a list of water bodies that need to have more information collected. Many streams that do not have available data could be in violation of the standards, but since no information is available for those streams, they are not listed. The watershed has several areas that are in need of more information. These are listed in Table 19.

Table 18. Water Quality Limited Streams from 303(d) list

Stream Location	Parameter examined	Criteria	Season of concern	Basis for Listing	Supporting Data
North Yamhill River, mouth to Turner Creek	Bacteria	Water contact, recreation	Winter, spring, summer, fall	DEQ data: d1 in 305(b) Report (DEQ, 1994); NPS Assessment segment 368: severe.	DEQ data; (2 sites: 402605, 402606; RM 1.5, 4.5) 30% (6 of 20) and 40% (21 of 53) values exceeded fecal coliform standard with maximum values of 2400, 2400 between water years 1986-1995.
North Yamhill River, mouth to Turner Creek	Bacteria	Water contact, recreation	Summer	DEQ data, d1 in 305(b) report (DEQ, 1994); NPS Assessment segment 368: severe, data (DEQ, 1988)	DEQ data (3 sites: 402605, 402606, 402607; RM 1.5-10.0): 50% (3 of 6); 25% (8 of 32); 60% (3 of 5) values exceeded fecal coliform standard (400) with maximum values of 2400, 1600, 2400 between WY 1986-1995.
North Yamhill River, mouth to Turner Creek	Temperature	Rearing of salmonids 64 F (17.8 C)	Summer	DEQ data (Temperature Issue Paper, 1994); NPS assessment segment 368: moderate, observation (DEQ, 1988)	DEQ data 77% (33 of 43) samples exceeded temperature standard (64) with exceedences each year and a maximum of 78.8 in water years 1986-1995.
North Yamhill River, Turner Creek to Headwaters	Temperature	Rearing of salmonids 64 F (17.8 C)	Summer	BLM data	Two BLM sites: RM 20 and 27 in 1995, 7 day ave. max temperature was 71.9/64.4 F, both sites exceeded temperature standard
Turner Creek,	Temperature	Rearing of	Summer	NPS Assessment –	Two BLM sites: at

mouth to Severt Creek		salmonids 64 F (17.8 C)		segment 369 and 523: moderate, observation (DEQ, 1988); BLM data	RM 1 in 1994/95 the 7 day ave. Max. temperature was 69.8/68.9. RM 4 in 1995 was 63.5 F. Lower site exceeds temperature standard in both years.
North Yamhill River mouth to Turner Creek	Flow modification			USGS (1990), IWR (ODFW); WRD data; ODFW (1990)	Cutthroat populations are a stock of concern with low flows and high temperatures constraining populations in some coast range streams (ODFW, 1992); in-stream water right is often not met at UGS gage 14197000

Table 19. Water Bodies of Concern

Stream Location	**Criteria**	**Basis for Consideration of Listing**	**Listing status**
Haskins Creek, mouth to headwaters	Sedimentation, Flow Modification, Temperature	NPS Assessment, segment 370: moderate, observation (DEQ, 1988).	Need data
Hawn Creek, mouth to headwaters	Toxics, Sediment, Nutrients, Bacteria, Flow Modification, Dissolved Oxygen, Temperature	NPS Assessment, segment 367 (DEQ, 1988).	Need data
Panther Creek, mouth to headwaters	Bacteria, Sedimentation	NPS Assessment, segment 371: severe, data, observation (DEQ, 1988)	Need data
Turner Creek, mouth to headwaters	Sedimentation, Flow Modification	NPS Assessment, segment 369/523, moderate observation (DEQ, 1988)	Need data
North Yamhill River, mouth to headwaters	Toxics	USGS data, Willamette River Basin Water Quality Study Phase I/II.	Atrazine, cycloate, simazine, terbacil were found but either do not have or were below any water quality standard, guidance level, or criteria. No other pesticdes detected. Did not meet listing criteria.
North Yamhill River, mouth to Turner Creek	Sedimentation, Nutrients	NPS Assessment segment 368: moderate, observation (DEQ, 1988).	Need data

North Yamhill River, Turner Creek to headwaters	Bacteria	NPS Assessment, severe, data (DEQ, 1988).	Need data

Explanation of parameters used for listings

Fecal coliforms

Fecal coliforms are microorganisms that indicate when feces (animal or human) are present in the water and warn us of the associated pathogenic health hazards. Sources of bacteria include wastewater treatment facilities, faulty septic systems, runoff from animal husbandry, and wild animals.

Since the time of this listing, DEQ has changed the fecal indicator from the bacterial group of fecal coliforms to a subset of that group known as *Escherichia coli (E.coli).* The change is to improve the accuracy of the standard. Fecal coliform standards will be established for the watershed using this new technique during the total maximum daily load process scheduled for the Yamhill basin in 2007. This process will assess the 'natural' or background concentrations of fecal pollution and then establish a threshold by which the watershed will be monitored (Bower, 2000).

According to Dyke Mace, Registered Sanitarian and Waste Management Specialist for the county, every household outside of city limits has a septic tank and drainfield. Even some people within the urban growth boundary have septic systems because the city has to sign-off on any installations or repairs within the boundary. Some households became a part of the urban growth boundary years after the installation of a septic system and choose to stay on that system rather than get city sewer (Mace, 2000).

Mace did not have an estimate of the number of septic systems in the watershed. He did however believe there are 300-400 installations or repairs in the county per year. There are no requirements of either owners of the system or the county to do inspections or maintenance. The site and system is evaluated prior to installing the septic system, but once it is installed, it is the owner's responsibility to maintain it. There is no requirement for the system to be inspected when the property changes hands. His office recommends pumping every 5-7 years depending on usage.

The life expectancy of a septic system has changed over the past decade. Ten and more years ago, systems were designed to last 20 or more years. That is not usually the case anymore. The move away from solid fats to oils for cooking, the addition of garbage disposals to most households, hobbies with chemicals, and chlorine bleach all increase the amount of solids in the average household's tank (Mace, 2000).

Since 1984, regulations have been in place to address difficult building sites that have large groundwater fluctuations. Systems installed prior to 1984 could have severe problems such as drain fields that run down tile lines directly into streams or drain fields that interact directly with the groundwater table during high water. Without an inspection, it is not possible to know which systems are faulty. Mace believes many people new to the county and to living in rural areas are not familiar with how septic systems operate and the condition of their system. He encourages people to come and view the records for their property. They are open to the public and can be viewed at the Yamhill County Planning and Development Office at 401 NE Evans in McMinnville. All that is needed to access information on what has been permitted for the site is a tax lot number. Homeowners can also pay to have an inspection of their system (Mace, 2000).

Temperature

The maximum seven day average temperature standard for the North Yamhill watershed is 64°F. This means that over any seven-day period during the hottest time of the year, the average of those seven daily stream temperatures is not to exceed 64°F. During spawning season for winter Steelhead, the seven-day moving average temperature is not to exceed 55°F in order to support salmon spawning, egg incubation, and fry emergence from the egg and from the gravels. These standards are widely debated because temperature cycles vary daily and seasonally, and different life stages and species of fish exhibit different tolerances (OWEB, 1999).

Stream temperatures are affected by solar radiation (sun), cool water seeps, volume of water in the stream, and the water temperature directly upstream. Landowners who maintain a healthy riparian buffer can significantly decrease the amount of solar radiation that reaches the stream and slow stream warming.

How high temperatures affect fish:

- High temperatures can be stressful to fish and even lethal.
- High temperatures increase metabolism, and fish cannot eat enough food to maintain body weight.
- As temperatures increase, salmonids become less competitive in catching food and lose their appetites (WSLG, 2000).

The North Yamhill River and Turner Creek are on the 303(d) list for temperature. This means they do not meet the temperature standard outlined above.

The North Yamhill River is listed for temperature along its entire length. Data has been collected from its forested headwaters to its confluence with the Yamhill River. There are other areas of the watershed likely in violation of the temperature standard, however these have not been added to the list because of a lack of data. Turner Creek is listed for temperature from the confluence with the North Yamhill River to Severt Creek.

Data is available from 1993 to the present for some stream locations. Several of the streams are monitored in multiple locations to provide information on where the stream temperature begins to rise. These are listed in Table 21. The data collected for each site is substantial and is included as Appendix A. Questions regarding specifics of the data set can be directed to the Yamhill Basin Council. Figure 25 shows a representative graph for the temperature dataset. Each location would have a unique graph because none of the locations heat in exactly the same way. However, all the streams have a similarly shaped graph with the heating and cooling occurring during the same period.

Figure 25.

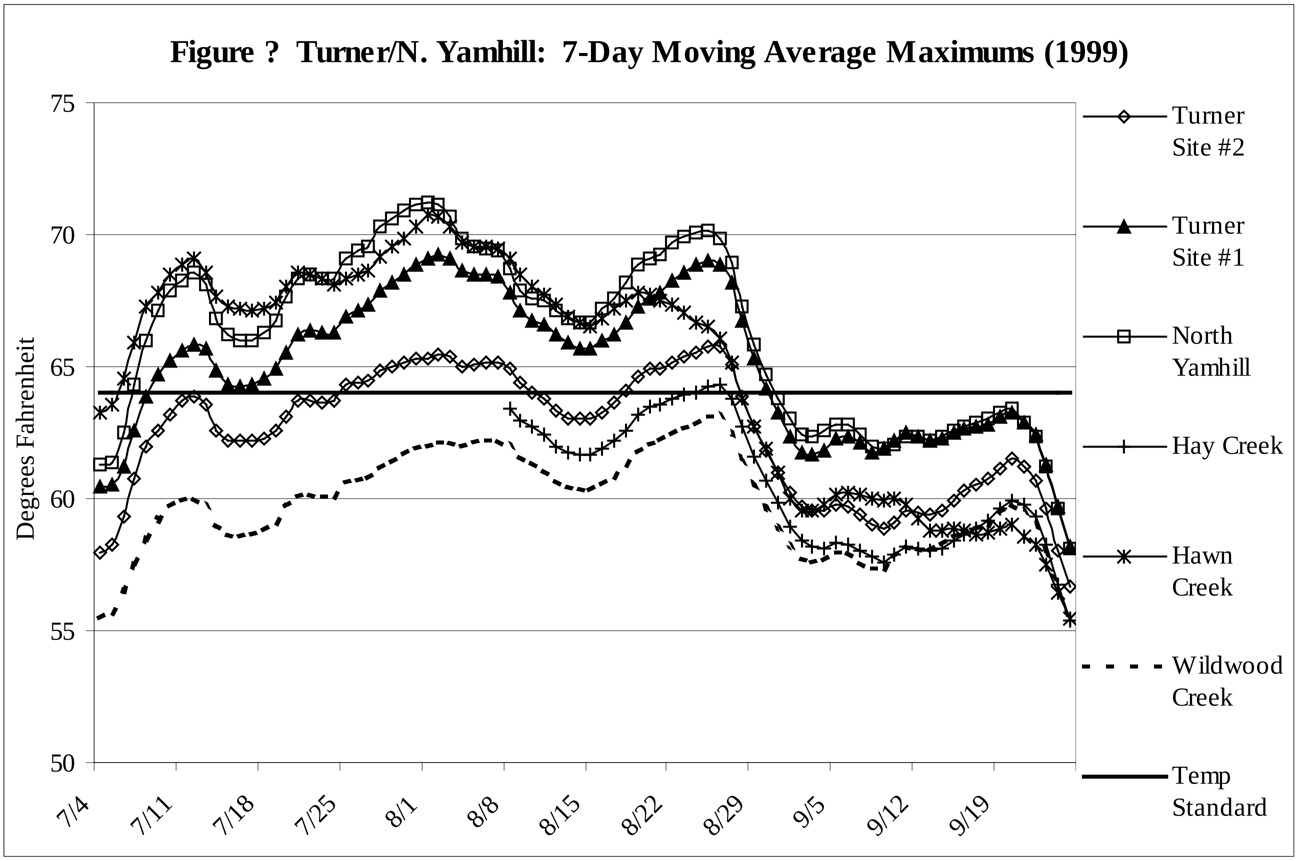
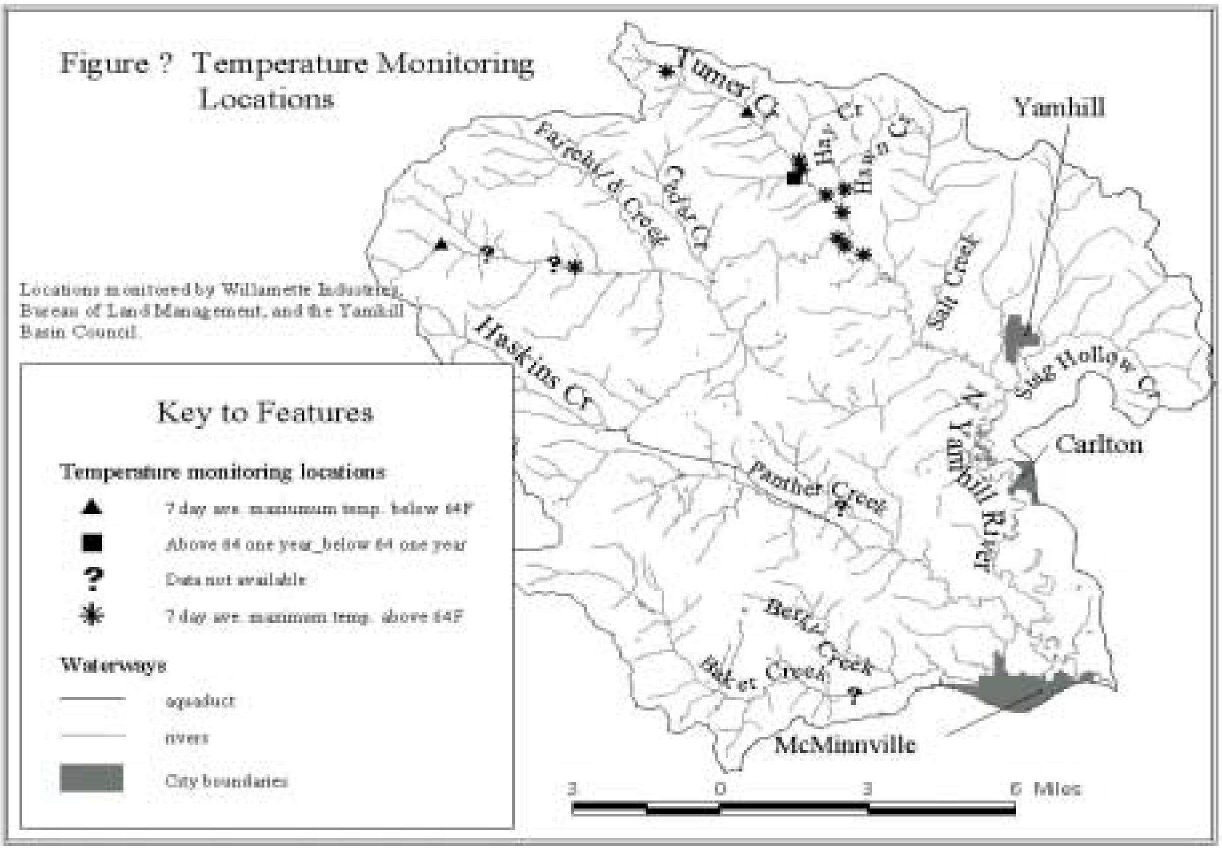


Figure 26 shows a map of the watershed with the monitoring locations noted. Some of the monitoring is done by the timber industry and the temperature data is not available for this assessment. The BLM used to do temperature monitoring in the watershed. The BLM is no longer doing any monitoring in the Yamhill Basin in order to concentrate their resources on basins that are working with the Oregon Department of Environmental Quality to establish TMDLs (Total Maximum Daily Loads) for temperature. The Yamhill Basin will go through the TMDL process in 2007. The Yamhill Basin Council is doing temperature monitoring at eight sites in the watershed during the summer of 2000. This data will be used when looking at stream heating and determining priorities for restoration and enhancement projects.

Figure 26.



The significance of the data is not the specifics of the numbers. Rather, it is important to know that the streams are too warm to support salmonids. Figure 27 in chapter 10 on fish shows the rivers in the watershed that winter Steelhead use.

Table 20 N. Yamhill Watershed Temperature Monitoring

Site Name	Location	Year	Agency	7-Day average Date	Maximum
Baker Creek	No specific location determined.	1993	BLM		*60.3*
		1996	BLM		*64.6*
		1997	BLM		*below 64*
		1998	BLM	07/26/98	**65.1**
		1999	BLM		
Fairchild Creek	~ rm 2.5	1998	BLM	07/26/98	63.8
Hawn Creek	~ RM 0.5	1998	YBC	07/26/98	**72.5**
	~ RM 0.5	1999	YBC	08/01/99	**70.7**
	near mouth	1998	YBC	07/28/98	**67.1**

	near mouth	1999	YBC	08/26/99	**64.3**
Moroney Creek		1998	BLM	07/26/98	62.5
North Yamhill River	@ Pike	1997	BLM		**71.6**
	@ Pike	1999	YBC	08/01/99	**71.2**
	RM 20	1995	BLM		**71.8**
	RM 27	1995	BLM		**64.4**
	RM 27.7	1998	Willamette		**67.4**
	RM 27.7	1999	Willamette		**66.6**
	RM 29	1998	Willamette		**65.8**
	RM 29	1999	Willamette		**66.9**
	RM 30 ?	1999	BLM		
Petch Creek	near mouth	1998	BLM	07/26/98	**68.7**
		1999	USGS		
Turner Creek	RM 0	1998	YBC	07/26/98	**72.5**
	RM 0	1999	YBC	08/02/99	**69.2**
	RM 1	1994	BLM		***above 64***
	RM 1	1995	BLM		**68.9**
	RM 1.5	1998	YBC	07/26/98	**71.6**
	RM 2.3	1998	YBC	07/26/98	**69.0**
	RM 2.3	1999	YBC	08/26/99	**65.8**
	RM 4	1995	BLM		*63.0*
	RM 4	1997	BLM		*below 64*
	RM 4	1998	BLM	07/26/98	**65.7**
	RM 4	1999	BLM		
	RM 6	1998	BLM	07/26/98	**75.8**
	RM 6	1999	BLM		
Wildwood Creek	~ RM 0.5	1998	YBC	07/26/98	**65.9**
	~ RM 0.5	1999	YBC	08/26/99	63.1

When DEQ begins working on the TMDLs for the Yamhill Basin in 2007, they will examine temperature and determine if 64 degrees is an attainable temperature for the watershed. People have expressed concern that historically, many areas in the watershed were not at or below 64 degrees. There is no historic temperature data to examine to make this determination. The DEQ uses a computer model and current monitoring data to determine the standard for the region.

Dissolved Oxygen

Dissolved oxygen (DO) is important to support cold-water organisms such as salmon and trout. Throughout their lifecycle, these species have different dissolved oxygen demands. The Oregon Water Quality Standards specify the amount of dissolved oxygen to meet the needs of these species. For the screening level of this assessment, the level of DO that is desired is 8mg/L. For the North Yamhill River, mouth to Turner Creek, the DEQ data taken in summer shows the samples at river mile 4.5 violated the standard in three samples out of one hundred and eleven samples. Those in violation were at 6.2 mg/L. The stream is not listed for being in violation of the standard since it is such a small number of samples.

pH

The pH measures the hydrogen ion concentration in water. It is used to tell the relative acidity or alkalinity of a solution. Values greater than seven indicate alkaline conditions and those less than seven indicate acidic conditions. The pH can affect nutrient, chemical, and biological reactions and characteristics of water. Most organisms have a narrow pH range in which they can live (Oregon State University Extension Service, 2000). The Oregon Water Quality Standards specify the expected pH range as 6.5 to 8.5 for basins west of the Cascades. It is important to note that pH values vary during different times of the year based on natural conditions such as photosynthesis and respiration cycles of algae present in the water.

In the North Yamhill River, summer data was collected at three sites from river mile 1.5 to 10.0. No samples were outside the range of 6.5 to 8.5. During fall, winter, and spring, the DEQ data from these same sites violated the standard at two sites between 1986 and 1998. The river is not listed for violating the pH standard because the number of samples in violation is small.

Nutrients

Total phosphorus is a way to measure the amount of phosphates in the water column and phosphorus in suspended organic material. Total nitrate is a measurement of the majority of nitrogen present in the water. Scientists identify phosphates and nitrogen as the major limits to plant growth. If there are excessive amounts of phosphorus and nitrates, plant growth increases and can be a problem in slow-moving water. Algae and other plants remove dissolved oxygen from the water, can interfere with recreation, and with certain algae, and produce chemicals that are toxic to livestock and wildlife (OWAM, 1999).

A Total Maximum Daily Load (TMDL) for phosphorus has been established for both the North Yamhill River and the entire Yamhill basin by DEQ and was approved in December of 1992. This TMDL is in the process of being implemented.

Turbidity/Suspended Solids

Turbidity is a measure of water clarity. It can be caused by runoff of sediment or by suspended material such as algae. Turbidity is measured by recording the amount of light that passes through a water sample. High values (>50 Hach FTU) indicate high amounts of suspended sediments or particles in the system. Sediment affects salmonids by damaging their gills and reducing their ability to sight their prey. Sediments also clog the gravels salmonids use for spawning. This is an area that needs further investigation in the watershed. Several areas are listed as being of concern for sediments including the North Yamhill River, Turner Creek, Panther Creek, Hawn Creek, and Haskins Creek.

Other Contaminants: Organic Compounds, Pesticides, and Metals

The literature concerning pesticides and other water quality contaminants is extensive. Many studies have been conducted in the Willamette Basin. Most of the reports focus on the Willamette River with occasional references to the North Yamhill. There is little specific information for the rest of the streams in the watershed.

In general, there are several different pesticides likely to exist in the streams and rivers of the watershed. The most commonly found pesticides in the Willamette basin are atrazine, desethylatrazine, simazine, metolachlor, and diuron (Anderson, et al, 1997).

Given the dominant upland vegetation and crops present, there are likely to be a number of agricultural contaminants in the water. According to Susanne Aldrich Markham of the OSU Extension Service out of McMinnville, diuron and metolachlor are used on grass seed fields in the basin. Atrazine and simazine are used on Christmas tree farms. Atrazine is no longer used on grass seed fields.

A USGS report and Willamette River Basin data found atrazine, cycloate, simazine, and Terbacil, however either there are no standards for the amount of these pesticides allowed, or the exceedance levels were not violated. This is an area that continued research is taking place and is a concern since many of the communities in the basin rely on surface water for drinking water.

Aldrich-Markham asserts that glyphosate, marketed under the tradename Roundup, does not travel through the soil to reach the water table and thus doesn't pose problems for the watershed. However, according to a report by Oregon Pesticide Education Network,

> "Roundup, or glyphosate, has been publicized as an environmentally friendly herbicide that breaks down shortly after application. However, experiments have shown that glyphosate may persist in the environment for as long as 3 years (Torstensson et al. 1989). Its metabolite, AMPA, may persist even longer (World Health Organization 1994). Glyphosate is typical of many pesticides in that its breakdown is dependent upon the environmental conditions in which it is used and that the toxicity of its breakdown products is equal to or greater than the toxicity of glyphosate itself. Pesticides may remain in the environment much longer than expected or claimed, and the breakdown products may also be toxic to organisms (Oregon Pesticide Education Network, 1999)."

Roundup is applied by hand using backpack sprayers and is not used in large quantities, however it is important to note that while it has been touted as safe, there are some concerns associated with its use.

Additionally, the residents of the watershed likely contribute significant amounts of chemicals from lawn or garden chemicals applied incorrectly. There is no direct study of this, but in the USGS report, urban areas contributed significantly to the chemicals present in the watershed areas studied. It is likely that this watershed is no different, although the relatively small population probably has a small effect on the river.

The data available on pesticides is beyond the scope of this document and could not be easily summarized. The parameters and explanations of how the research was designed are just too cumbersome to include. Additionally, the findings are so broad that it is difficult to know what is about this watershed specifically. Further information on effects of pesticides on aquatic life can be found by downloading the report found at: http://www.pond.net/~fish1ifr/salpest.htm

Permits

The following information is from the Internet and can be accessed by going to http://waterquality.deq.state.or.us/SISData/Facility/Home.asp. Permits to discharge waste pollutants into the waters of the state or ground. Waters of the state are wetlands, ponds, streams or rivers. Discharges occur through disposal systems including land irrigation, seepage ponds, on-site sewage systems, or dry wells. Permits are also issued for discharge to surface water that occurs directly through a pipe or ditch. Permits are also issued for the storm water run-off from certain industrial activities. These permits are required by the Federal Clean Water Act and are issued by the Oregon Department of Environmental Quality (ODEQ).

There are two types of permits: National Pollution Discharge Elimination System (NPDES) permits and WPCF (Water Pollution Control Facility) permits. NPDES permits generally cover all discharge to waters of the state. NPDES permits are also issued for disturbing more than 5 acres including clearing, grading and excavating.

WPCF permits are required by state statute and are issued by ODEQ. WPCF permits cover discharges not covered by NPDES including discharges to ground water. WPCF permits cover wastewater treatment plants.

The watershed has 12 permits. Some of the specific information on these permits is listed in the table below. Further information can be found on the Internet at the site listed above.

Table 21. Water Discharge Permits

Legal Name/Common Name	Hydro code and River Mile	Permit Type	Expiration Date	Permit Status
Private citizen/Yamhill Auto Wrecking	22J N. Yamhill River RM 14.9	GEN12Z	6/30/02	Active
Pacific Telecom Cable/Moores Valley Earth Station	22J N. Yamhill River RM 25	GEN54	5/31/00	Active
Fruithill Inc/Fruithill Inc	22J N. Yamhill River RM 6	GEN14A	6/30/00	Active
Wildcat Development Co. LLC/The Mahon Farm	22M Baker Creek RM 5	GEN12C	12/31/00	Active
City of Carlton/Carlton STP	22J N. Yamhill River RM 10	NPDES	6/30/05	Active
Laidlaw Transit Inc./Laidlaw Transit Inc	22J N. Yamhill River RM13	GEN12Z	6/30/02	Active
Yamhill Encampment Corp/Camp Yamhill	22J N. Yamhill River RM 19	WPCF-OS	4/30/04	Active
City of Yamhill/Yamhill STP	22J N. Yamhill River RM 13	NPDES	2/28/02	Active
Belle Pente Wine Cellars, LLC/Belle Pente Wine Cellars, LLC	Unknown	GEN14A	6/30/00	Active

Private citizen/Willakenzie Estate Winery	22J N. Yamhill River RM 13	GEN14A	6/30/00	Active
Yamhill County Mushrooms Inc/Yamhill County Mushrooms Inc	22J N. Yamhill River RM 13	GEN14B	6/30/00	Active

Covered

- Beneficial uses of water in the watershed
- Analysis of water quality data from EPA/DEQ.
- Identification of water quality limited sections of stream
- Well water information as available

Not Covered

- EPA publications pertinent to the watershed not sought.

References (not complete)

Aldrich-Markham, Susanne, personal communications, May 2000.

Ewing, Richard D., *Diminishing Returns: Salmon Decline and Pesticides.* Oregon Pesticide Education Network. February 1999.

Ferber, Bill, personal communications, February 2000.

Chapter 10 Fish Species, Habitat, History and Barriers

Introduction and Methodology

The objectives of this section are to identify fish species in the watershed, historical and current fish populations, stocking history, current locations of these species, and to evaluate the current fish habitat conditions. Winter Steelhead are listed as threatened under federal Endangered Species Act (ESA). The watershed is also home to many other native fish species that will benefit from any restoration or enhancement projects in the watershed and should be considered as well.

Cutthroat trout play important roles in the North Yamhill's aquatic ecosystem. Cutthroat trout are the watershed's most plentiful salmonid, and ODFW is concerned about habitat for this species. Cutthroat trout are perhaps a better indicator species when looking at overall watershed health or system function than focusing entirely on winter Steelhead. Much attention is focused on salmon, steelhead, and trout, and there is a great diversity of fish that go largely unnoticed (Galovich, 2000).

By understanding the current and historical fish habitats and conditions, restoration and conservation efforts can focus on those areas where they will have the greatest potential impact.

The 1999 OWAM was used as a guide for what to include in this section. Data provided by the ODFW, BLM, and agency personnel make up the bulk of the section.

Fish History

Pre-European settlement historical fish population information is not available. It can be assumed that prior to habitat altering practices such as extensive timber harvest, road construction, and European American settlement, fish populations were greater and more diverse.

While we do not know the specifics of the channel conditions prior to European settlement, some generalizations from the pattern of settlement can be made. The in-stream habitat was vastly different from present conditions. Large woody debris from upslope forests was deposited in the channels, fish passage barriers such as culverts and dams were non-existent, water quality was higher, mature timber provided stream shade resulting in cooler water temperatures and greater dissolved oxygen, and stream meanders provided complex habitat with pools and riffles. *See the vegetation section for a longer description of historical conditions.*

Even with healthy streams, the North Yamhill watershed probably never supported great numbers of winter Steelhead, this watershed does not have many miles of stream with its preferred habitat conditions. However, the watershed does support large numbers of salmonids such as cutthroat trout. Willamette Falls has influenced the life history of anandromous fish but not their numbers. The falls also determined what speices of anadromous fish are native to the upper Willamette, but not necessarily the numbers of those fish.
Current salmonid populations were also affected by the locks and dam USCE built in 1902 on

the Yamhill River one-mile upstream from Lafayette. It is hypothesized that the locks are responsible for the decrease in anadromous fish in the watersheds above the dam. The locks were not fish passable, although a fish ladder of sorts had been constructed; it was not kept in good repair (ODFW, 1959). The locks remained in use until they were removed in the 1960s. They were removed because they posed a barrier to fish. Additionally, with the highway system in place, they were no longer needed to impound water to provide barge transport.

The North Yamhill Watershed Analysis[3] written by the BLM in 1997 provides the following information on winter steelhead:

> "Winter steelhead populations in the watershed are expected to remain at very low numbers. Steelhead populations throughout the entire Columbia Basin and the coastal U.S. have been declining… Hatchery stocking of non-native winter steelhead has been stopped, but the long-term effects of stocking non-native steelhead is unknown (sic). Some studies indicate that stocking with non-native fish will eventually cause the productivity of native stocks to decline. Indeed, the very presence of a native steelhead stock in the North Yamhill watershed is controversial.
>
> Steelhead production is thought to be very poor in the North Yamhill; no spawning has been observed since 1990. ODFW collected juvenile steelhead in Fairchild Creek in 1993, but no steelhead were collected in Turner Creek… Given the multitude of habitat problems in the watershed, it is not surprising that steelhead production may be at record low levels (BLM, 1997 pg. 112).
>
> Steelhead are known to occur in the North Yamhill mainstem, Fairchild Creek, Haskins Creek, and suspected to occur in Turner Creek, Cedar Creek, and Petch Creek. Many of these streams currently have reduced habitat capacity. Portions of the North Yamhill mainstem and Turner Creek have summer water temperatures that are high enough to be stressful for steelhead. Haskins Creek may be dewatered in the summer and may have water temperature problems. Cedar Creek appears to have a sediment problem. LWD is known to be lacking in the North Yamhill and Cedar Creek and is suspected to be lacking in most streams in the watershed. Pool habitat is fair in the North Yamhill and lower Cedar Creek and is probably only fair at best in other streams. The lower gradient stream reaches, which are often the most productive fish habitats, are affected by stressful summer water temperatures (BLM, 1997 pg. 112).

Current Fish Status

Since specific historical information on fish populations is not available, the list in Table 22 that follows is a general species list for the watershed. These are species that are found or are likely to be found in the watershed given the habitat, water quality, connection with the Yamhill River, and what ODFW has found in other similarly sized streams. It is important to note that some of these species may only be present seasonally. The list is general and uses the most common names to avoid confusion (BLM, 1997).

This list does not include species that have been introduced into the waters by residents in the area. It is not uncommon to find species that have been stocked in private ponds that escape into open waters.

[3] The North Yamhill Watershed Analysis only examines the watershed above Pike. Neither Baker or Panther Creeks are included in the document nor the tributaries downstream of Pike.

Table 22. Aquatic Species Found and Likely To be found in N. Yamhill Watershed

Aquatic species (common name)	Scientific Name
Winter steelhead	*Oncorhynchus mykiss*
Cutthroat trout	*Oncorhynchus kisutch*
Coho salmon	*Oncorhynchus clarki*
Dace (speckled, longnose, etc.)	*Rhinichthys* spp.
Redside shiner	
Threespine stickleback	
Pacific lamprey	*Lampetra tridentata*
Brook lamprey	*Lampetra richardson*
Northern pike minnow	*Ptychocheilus oregonesis*
Coarse-scale sucker	*Catostomus* spp.
Mosquitofish*	
Crayfish	
Sand roller	*Percopsis transmontana*
Largemouth bass*	*Micropterus salmoides*
Smallmouth bass*	*Micropterus dolomieui*
Sculpins	*Cottus* spp.
Bullhead*	*Ictalurs* spp.
Crappie*	*Pomoxis*

* indicates non-native species
From 1997 BLM North Yamhill Watershed Analysis

According to Galovich, the state angling regulations for the watershed currently allow catch and release fishing from late May through October. The reason harvest is no longer allowed and the season opens later (May instead of April) than historically is to protect juvenile winter Steelhead. Juvenile steelhead can be incidentally caught while angling for cutthroat trout and can be difficult to differentiate from juvenile and small cutthroat trout. By late May, most of the two year old steel head have left the basin for the sea. This is why the season opens later than it did historically – to reduce the risk that an angler will incidentally catch a steelhead while fishing for trout. There is opportunity to fish if you enjoy catch and release fishing using flies or lures. ODFW is not telling people they cannot fish, only that they have to fish differently (Galovich, 2000).

Fish Hatcheries-Winter Steelhead

The following information is excerpted from the 1992 ODFW report, "Coast Range Subbasin Fish Management Plan."

> No hatcheries are currently located in the Coast Range subbasin. Early salmonid releases were from the Big Creek and Klaskanine hatcheries.
>
> In the late 1960s and early 1970s, winter Steelhead were released into the watershed to establish

steelhead populations to provide a fishery. Releases were primarily early-run Big Creek stock. Some coastal stocks were also released. Coastal steelhead stocks are susceptible to the parasite *Ceratomyxa shasta*. Consequently it is believed that the coastal stocks experienced poor survival and naturally produced steelhead present today are descendents of the Big Creek stock.

The hatchery smolt stocking program was discontinued after 1982 when the amount of natural production was deemed sufficient to support the fishery. Adult production from fry releases is uncertain. Hatchery releases have been eliminated in the subbasin, except for releases of hatch-box fry.

Table 23 below provides the release year, number of fish released, and the release location for winter steelhead in the North Yamhill watershed.

Table 23 Winter Steelhead Hatchery Releases

Release Year	Number Released	Release Location	Stock (hatchery)
1966	13,583 (yearling)	North Yamhill	Big Creek
1967	10,875 (yearling)	North Yamhill	Big Creek
1966	232 (adult)	North Yamhill	Big Creek
1967	402 (adult)	North Yamhill	Big Creek
1968	10,577 (yearling)	North Yamhill	Big Creek
1968	200 (adult)	North Yamhill	Big Creek
1971	200 (adult)	North Yamhill	Big Creek
1972	200 (adult)	North Yamhill	Big Creek
1973	200 (adult)	North Yamhill	Big Creek
1980	16,000 (yearling)	North Yamhill	Big Creek
1981	20,145 (yearling)	North Yamhill	Big Creek
1982	20,035 (yearling)	North Yamhill	Big Creek
1983	10,018 (yearling)	North Yamhill	Big Creek
1983	21,500 (fry)	North Yamhill	Big Creek
1985	29,072 (fry)	Fairchild Creek	Big Creek
1986	88,325 (fry)	North Yamhill	Big Creek
1987	61,994 (fry)	North Yamhill	Big Creek
1988	49,700 ?	North Yamhill	Big Creek
1989	24,800 ?	North Yamhill	Big Creek

This data shows that a lot of fish were stocked in the watershed. Did stocking increase the number of fish returning to spawn in the watershed? ODFW did spawning surveys[4] in the late 1980s and early 1990s and documented winter Steelhead presence on the North Yamhill River, Haskins Creek, and Fairchild Creek. The following data show the number of redds[5] counted per river mile. This data is from annual index spawning surveys using representative reaches. Surveys can be repeated annually and provide an index of population. Many miles of streams are

[4] To know the areas where winter steelhead spawn, ODFW personnel walk the streams looking for evidence of fish presence and make notes on the condition of the habitat
[5] A redd is the nest of gravel where fish lay their eggs.

examined but only observations within the index reach are used in estimating returns. The result is data that represents trends rather than total counts or returns for the basin.

Table 24 Redds per Mile

Stream	Miles	1985	1986	1987	1988	1989	1990	1991
N. Yamhill River	0.5	8.0	6.0	12.0	14.0	4.0	0.0	0.0
Haskins Creek	0.3	6.7	13.3	26.7	6.7	3.3	6.7	0.0
Fairchild Creek	0.4	7.5	2.5	5.0	2.5	0.0	2.5	0.0

No new fish survey data has been collected in the watershed since the early 1990s. ODFW believes that winter steelhead are spawning in the watershed. This summer, fish surveys are being conducted on Fairchild Creek. That information was not available at the time this document was written. If you have questions regarding that survey, contact Kim Jones at the Corvallis Research Office, phone (541) 757-4263 ext. 260.

Fish Hatcheries-Coho Salmon

Coho salmon are not native to the Willamette basin above Willamette Falls. They were introduced above the falls in the 1920s and were released until the 1980s. The ODFW stocking program hoped to establish new coho runs and supplement the popular ocean sport and commerical fisheries. Because of their importance to the Oregon economy, it made sense to many to attempt to expand coho numbers through introduction to areas of suitable habitat. Releases occurred in the North Yamhill watershed from 1950s to the 1980s (ODFW, 1992). Some of these fish found their way to the North Yamhill watershed to spawn in subsequent years.

In the 1980s, concerns over the effect of coho on native cutthroat trout, winter steelhead and their effect on Oregon fisheries, caused ODFW to re-formulate their hatchery release plan for the basin. In introducing coho, ODFW did not want to decrease populations of native fish. There is a limit to how many fish a watershed can support under given conditions. If fish are becoming rare in a waterway that historically was home to an abundance of fish, unless the habitat issues are resolved, the fish will not populate the stream. Stocking coho for all those years never resulted in a stable coho population, so stocking was discontinued (ODFW, 1992).

Table 25 shows the stocking history of coho in the watershed.

Table 25. Coho Salmon Stocked in the North Yamhill Watershed

Release Year	Number Released	Release Location	Stock (hatchery)
1962	300,000 (fry)	N. Yamhill R. tribs	Toutle (Bonneville)
1963	291,886 (fry)	N. Yamhill R. tribs	Toutle (Sandy)
1963	10,060 (yearling)	N. Yamhill R. tribs	Toutle (Sandy)
1965	100,031 (fingerling)	N. Yamhill R. tribs	Toutle (Cascade)

1966	29,321 (yearling)	N. Yamhill R. tribs	Toutle (Sandy)
1965	700 (adult)	N. Yamhill R. tribs	Toutle (Sandy)
1965	117 (adult)	N. Yamhill R.	NA (Alsea)
1966	308,628 (fry)	N. Yamhill R. tribs	Toutle (Sandy)
1967	193,502 (fry)	N. Yamhill R.	Trask (Trask)
1967	140,196 (fingerling)	N. Yamhill R.	Toutle (Sandy)
1967	300 (adult)	N. Yamhill R. trib	NA (Siletz)
1967	406 (adult)	N. Yamhill R.and trib	Toutle (Klaskanine)
1968	226 (adult)	N. Yamhill R.	Toutle (Bonneville)
1970	86,115 (yearling)	N. Yamhill R. and trib	Toutle (Klaskanine)
1969	429 (adult)	N. Yamhill R.	Toutle (Big Creek)
1970	98,080 (fingerling)	N. Yamhill R. trib	Toutle (Sandy)
1971	85,280 (yearling)	N. Yamhill R. and trib	Toutle (Cascade)
1972	86,258	N. Yamhill R. tribs	Toutle (Cascade)
1976	55,010 (yearling)	N. Yamhill R. and tribs	Toutle (Cascade)
1983	56,400 (fry)	N. Yamhill R.	Toutle (Gnat Cr.)
1982	19,000 (fry)	Panther Cr.	Toutle (STEP)
1985	351,185 (fingerling)	N. Yamhill R.	Cowlitz (Oxbow)
1985	200,550 (fingerling)	N. Yamhill R.	Cowlitz (Bonneville)
1985	140,180 (fingerling)	Panther Cr.	Cowlitz (Oxbow)
1985	84,760 (fingerling)	Baker Cr.	Cowlitz (Oxbow)
1985	49,698 (fry)	Panther Cr.	Toutle (STEP)
1986	74,124 (fry)	Panther Cr.	Toutle (STEP)
1987	74,142 (fry)	Panather Cr.	Toutle (STEP)
1988	39,589 (fry)	Panther Cr.	Toutle (STEP)

Cutthroat Trout

Cutthroat trout in the basin are native, and have never been stocked. Although this species is not an endangered species, it is a species that is being managed for by ODFW. Since it can live its entire life in one watershed, it is easier to determine if habitat restoration efforts are impacting the survival of the fish. It is difficult to monitor anadromous species populations to know if restoration or enhancement efforts are improving the habitat and increasing the numbers of fish. The journey from stream to ocean and back could negatively affect the species, making the efforts of individual watershed restoration projects more difficult to discern. Therefore, it is more useful to understand the native resident fish populations and monitor their responses (Galovich, 2000).

Table 26. Stocking history summary table

Fish Species	A=Anadromous[6] R=Resident	Native	Non-native	Stocking Notes
Winter Steelhead Trout (*Oncorhynchus mykiss*)	A-Winter/Spring spawn	X		No hatcheries present in watershed. Not many fish present historically, hatchery releases into the N.Yamhill River 1966-89 from Big Creek stock. Area may not have any indigenous stock. STEP fry releases in recent years.
Coho Salmon (*Oncorhynchus kisutch)*	A- Late Fall early Winter		X	No hatcheries in basin. Stocking from Bonneville, Oxbow, Eagle Creek, Cascade, and Sandy and in 1983, from Cowlitz Hatchery in WA. Many releases in 60s and 70s, to supplement Columbia River run. In 1980s, number of streams stocked decreased to minimize effects on steelhead and cutthroat.
Cutthroat trout (*Oncorhynchus clarki clarki)*	A-some migrate R-some stay year round	X		Neither currently nor historically stocked.
Rainbow trout (*Oncorhynchus mykiss)*	R		X	Hatchery rainbow trout released to create fishery. Early as 1920s, 30s. until 1980s. No evidence of natural reproduction.

Table 27. Summary of fish life history patterns

Fish Species	Location	Spawning	Interesting Notes
Winter Steelhead Trout (*Oncorhynchus mykiss*)	No fish counting stations in basin. No documented runs. Prefer fast moving water, stream gradient>5%, cool waters, large woody debris	Late January – late April Juveniles stay 1-2 yrs. Migrate to the ocean in spring where they stay 2-3 years. Return to spawn in winter. May spawn more than once in a season. Ocean distribution not well understood. It appears steelhead move further offshore than other salmonids (OSUES, 1998).	Prefer fast moving water, stream gradient >5%, cool waters, large woody debris important component for their habitat
Coho Salmon (*Oncorhynchus kisutch)*	Spawning surveys from 60s and 70s	Juveniles rear throughout watersheds, live in pools in summer. Juveniles migrate to ocean in Spring, rear just off OR coast. Adults return to rivers late fall/early winter. Spawn when 3 years old. Following spawning, they die.	Prefer gravel bars and upper watersheds.
Cutthroat trout	Occur in most	Variable spawning and	Only native trout in basin.

[6] Anadromous fish are those that spend part of their life in freshwater, migrate to the ocean, and return to the stream of their birth to spawn. The length of time spent in each of these ecosystems varies between species.

(*Oncorhynchus clarki clarki)*	perennial streams, in some intermittent streams. Prefer smallest, highest tributaries in a basin.	migration. Potanadromous cutthroat migrate into small headwater streams in fall/winter, spawn, return to larger streams. Some do not migrate at all. Some migrate to estuaries.	Prefer slow moving water, overhanging vegetation. Isolated populations occur above barriers in Haskins and Baker Creeks.
Rainbow trout (*Oncorhynchus mykiss)*	Occur in stocked streams. Not native to the watershed.	No evidence of spawning or natural reproduction. Released only to provide a sport fishery.	

Fish Habitat

The critical habitat maps produced by ODSL show known steelhead spawning and rearing habitat, and do not include any of the North Yamhill watershed. However, the website StreamNet, provides the ability to search for distribution maps by watershed, and this map shows the North Yamhill River, Panther Creek, and Baker Creek as winter steelhead habitat. This is also the area the BLM believes has winter steelhead presence.

According to Gary Galovich of ODFW, the maps produced by ODSL that don't show any steelhead habitat, are not accurate. The entire watershed could be habitat for juvenile steelhead rearing even though they were spawned somewhere else in the system. Small headwater streams might be used by salmonids during the winter months as refuge areas allowing fish to avoid the raging waters of main stem streams.

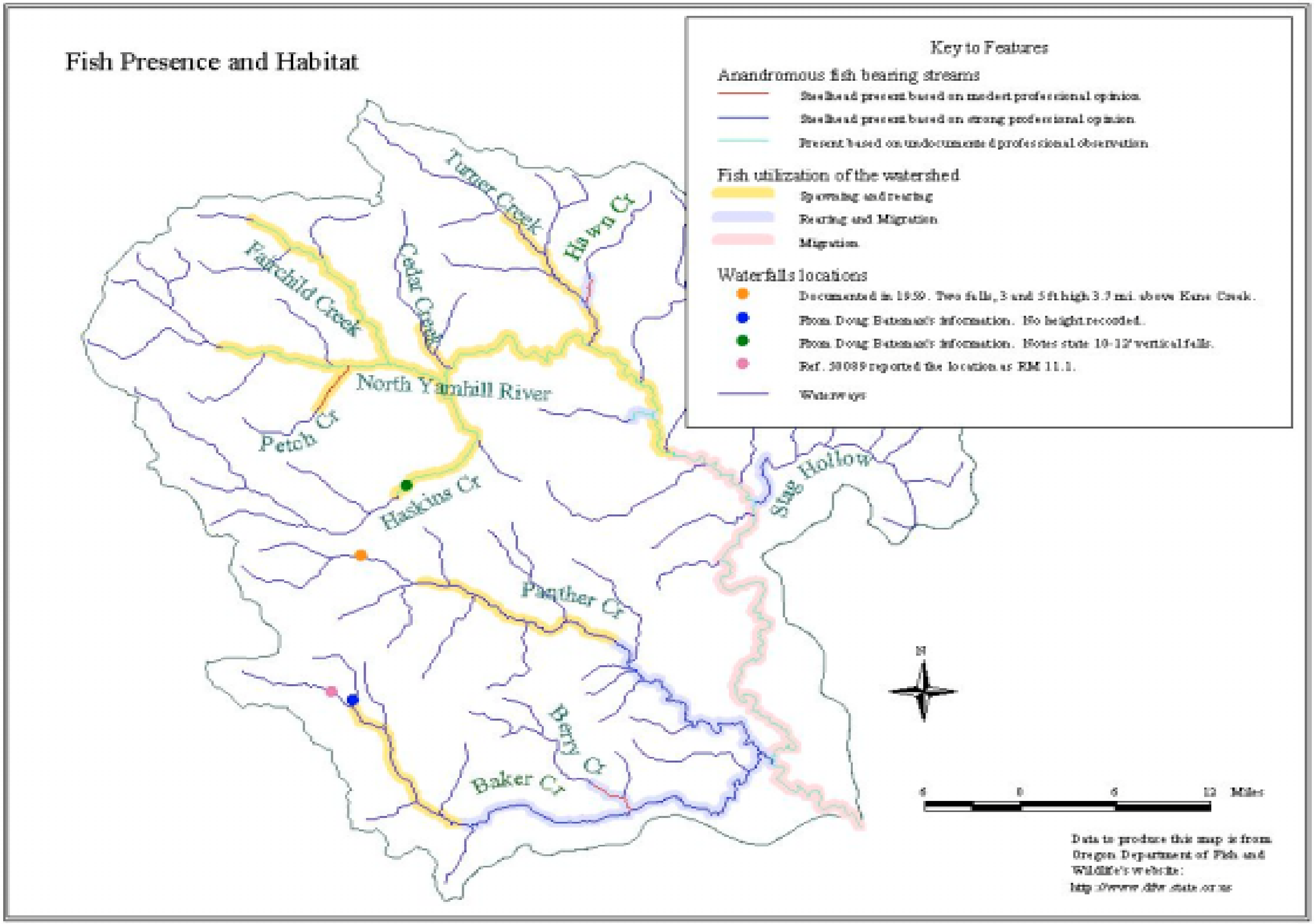
An endangered salmonid may never enter a particular stream reach, but other species that contribute to conditions of the system do utilize that stream reach. The point isn't to be concerned about restoring only salmonid habitat, but rather to improve stream functions for all aquatic life because the salmon are only one part of the system.

Fish Barriers

Fish barriers are either natural or human created obstacles that impede the passage of fish. Barriers include culverts, dams, waterfalls, logjams and beaver ponds. These barriers can impede fish movements throughout the watershed for both anadromous and resident fish species. Anadromous fish utilize the watershed from freshwater steams the ocean and back again, and barriers can prevent migration. Barriers isolate resident fish, preventing them from seeking out the best habitat in the stream system. Barriers can also prevent juvenile fish movement of anadromous fish. Beaver ponds and dams are seldom barriers. A beaver dam is a rough structure that fish can often pass through or under and the ponds provide elcellent rearing habitat (Galovich, 2001). As habitat, population, or water quality conditions change throughout the year or lifetime of resident fish, they move to watershed locations with more favorable habitat conditions.

Fish barrier locations were collected from an ODFW database. A note of caution, this database is not considered comprehensive. There are many sites ODFW is not aware of and this database is specific to culverts on public right of ways and excludes culverts in urban areas (Galovich,

Figure 27.


Fish Presence and Habitat
Key to Features
Anandromous fish bearing streams
Fish utilization of the watershed
Spawning and rearing
Rearing and Migration
Migration
Waterfalls locations
Documented in 1959. Two falls, 3 and 5 ft high 3.7 mi. above Kane Creek.
From Doug Bateman's information. No height recorded.
From Doug Bateman's information. Notes state 10-12' vertical falls.
Ref. 30089 reported the location as RM 11.1.
Waterways
Turner Creek
Hawn Cr
Fairchild Creek
Cedar Creek
North Yamhill River
Petch Cr
Haskins Cr
Stag Hollow
Panther Cr
Berry Cr
Baker Cr
N
6
0
6
12
Miles
Data to produce this map is from
Oregon Department of Fish and
Wildlife's website:

2001). These barriers are all culverts and currently are classified as low or medium priority. They are described in Table 28 below. Further information on the culverts' size, and location is available, but was not included with this chart because it is too lengthy to explain what those parameters mean. If you want more information on a specific culvert, contact the Yamhill Basin Council. The council has the complete data set.

The categories in Table 28 are determined by ODFW. The stream names are taken from USGS topo maps of the area. The priority categories are low, medium or high. None of the culverts in the database for this area received a high rating. The comment box gives a description of the problem with the culvert. The road number is from the Yamhill County map and is the road that the culvert crosses beneath. The barrier type describes the type of culvert. CCL is a concrete culvert, CMP is a corrugated metal pipe, and CP is concrete pipe casing. ODFW personnel assessed the habitat quality. The possible ratings are Good, Fair, Poor, and Unknown. Fair and good ratings were assigned to all areas in the watershed.

Table 28. Fish passage barriers

Stream Name/Number	Priority	Comment	Road	Barrier Type	Habitat Quality
Russell Creek	M	Barrier	231	CCL	Fair
Beaver Creek	M	Step barrier at low flows; velocity barrier at high flows.	231	CCL	Fair
Trib. to Panther Creek	L	Juvenile step barrier at low flows	231	CMP	Fair
Trib. to N. Yamhill River	M	Not in Co. Rd. log. Step barrier. Culvert corroded.	7	CMP	Fair
Trib to Beaver Creek	M	Blocked, submerged, impassable. 0.55 miles from intersection with 231. Co. Rd log lists as two 26" diam culverts.CM:	2	CCL	Fair
Trib to Berry Creek	L	Fluorescent orange gate just N. of culvert. Culver a barrier. Logs at top also a barrier.	228	CMP	Fair
Trib to Baker Creek	M	Velocity barrier. 1.7 mi NW of intersection w/High Heaven Rd.	9	CCL	Good
Trib to Baker Creek	M	Culvert bowed up near bottom; impassable at most flows. Rock at top increases velocity. At High Heaven Rd.	9	CCL	Good
Trib to Berry Creek	M	At Box # 13750. Velocity barrier.	228	CCL	Fair
Trib to N. Yamhill River	M	0.6 miles N. of Meadowlake Rd. Double culvert, one 48" diam, and one 24" diam	21	CP	Fair
Puddy Gulch	M	Culvert parameters estimated due to accessibility problems. 0.2 miles east of Moores Valley Rd.	224	CMP	Fair
Trib to N. Yamhill River	M	Not in Co Rd log. At intersection with Rockyford Rd.	244	CCL	Fair
Trib to N. Yamhill River	M	Not in Co Rd log. 1'-2' step out of culvert due to a bend in culvert.	290	CMP	Fair

Trib to Panther Creek	M	Velocity barrier at most flows.	2	CCL	Fair
Hutchcroft Creek	M	Not in Co Rd log. Slope in upper end, lower end submerged. May prohibit passage at high flows.	224	CCL	Fair
Yamhill Creek	M	Debris piled at upper end.	264	CMP	Fair

What does all this mean for fish population in the watershed?

The precise origin of the winter steelhead in the basin is unknown, however the Yamhill winter steelhead are treated as wild by ODFW and under ESA. Runs of Big Creek stock were established with the hatchery program. Winter steelhead numbers in the watershed are expected to remain low (BLM, 1997 pg. 112). Many factors may be affecting these populations including ocean habitat conditions, hatchery interactions and loss or alteration of habitat. Smolt survival is negatively affected by conditions in the Willamette River. Some of these factors are beyond the control of the watershed (BLM, 1997 pg. 112).

Steelhead prefer fast moving cool water. High summer temperatures and low flow limit the population in the watershed. Steelhead production is not well studied in this area, but is believed to be poor. No spawning has been observed since 1990 (BLM, 1997). ODFW collected juvenile steelhead in Fairchild Creek in 1993. Steelhead are known to occur in the North Yamhill mainstem, Fairchild Creek, Haskins Creek, and are suspected to occur in Turner Creek, Cedar Creek, and Petch Creek. These streams have poor habitat quality. The North Yamhill and Turner Creek have summer temperatures that are high enough to be stressful for steelhead. Haskins Creek may have temperature problems and is nearly diverted to no flow to supply water for McMinnville. Cedar Creek has sediment loading that makes it unsuitable salmon habitat. Large woody debris is absent through most of the basin. The lower gradient streams in the agricultural zone of the watershed have stressful summer water temperatures.

The following information is from the 1997 BLM *North Yamhill Watershed Analysis*.

> Fairchild Creek is probably the most important steelhead stream in the watershed. While no habitat inventory is available, the habitat capability of Fairchild Creek maybe (sic) the best in the watershed. There is (sic) several miles of low gradient stream reaches. Unlike Turner Creek and Haskins Creek, Fairchild Creek has little agricultural use, is unregulated, and probably has acceptable summer water temperatures (no data available but the drainage is mostly forested). Fairchild Creek has been affected by fire, timber harvest, and in the first mile, splash dam operation, so it is likely that habitat problems arise. From a federal perspective, the BLM manages more potential steelhead habitat on Fairchild Creek than on any other stream in the watershed.

Covered

- Fish life history and patterns
- Important habitat areas
- Stocking history
- Known or suspected migration barriers
- Selected field verification

Not Covered

- Species interactions at the watershed scale
- Specific fish distribution information unavailable

Fish References and Resources

Bureau of Land Management (BLM). *Deer Creek, Panther Creek, Willamina Creek and South Yamhill Watershed Analysis.* Tillamook Resource Area, Salem District, Tillamook, OR. Pages 7-8, 66-68.

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Oregon Department of Fish and Wildlife. (ODFW) 1992. *Coast Range Sub-watershed-Fish Management Plan.* NRCS, McMinnville, OR.

Mirati A. (Fish passage coordinator). 1999. *Fish Passage Culvert Database from ODOT and County Roads.* Oregon Department of Fish and Wildlife, Portland, OR.

Chapter 11 Restoration/Enhancement Projects

Introduction

Before beginning any new restoration or enhancement programs, it is valuable to examine the efforts already underway. Coordination of efforts and monitoring can make for a more successful impact, as well as generate new ideas and provide for sharing information.

The scope of this section is limited by the data reporting method. Currently, all information on projects is included from restoration practitioners who report to the state on a voluntary basis. Many landowners are not aware of the opportunity to report their project. The Oregon Plan Watershed Restoration Inventory maintains this database. The projects are summarized to be included in the Oregon Plan Annual Report. If you or a landowner you know would like to be included in this voluntary data base contact Bobbi Riggers by e-mail: Bobbi.Riggers@orst.edu.

The Farm Service Office and Natural Resource Conservation District Office in McMinnville cannot provide information on federally funded projects. It is up to individual landowners to provide it. Therefore, the projects included here are limited to the ones in the database and unfortunately do not include those done on agricultural lands.

DSL permits reviewed for the sediments section included permits for wetland enhancement and creation projects. In the files available for public review, three were for wetland creation projects. These landowners are not in the Oregon Plan Inventory.

It is important for future project planning that information from people who have made efforts on their own land is collected. What has been successful and worked, or what has not been successful is important to know for future projects. With the proposed annexation of more land near Baker Creek into the Urban Growth Boundary for McMinnville, there will be even more impervious surface and the potential for more problems with flooding on property near the creek. Already, residents along Baker Creek have had to riprap extensively and in some areas, vertical banks drop for tens of feet down to water below.

Many opportunities exist for landowners of agricultural, forested, rural, and urban lands to participate in restoration and enhancement cost-sharing programs. The Yamhill Soil and Water Conservation District is the best place to start for finding resources to accomplish land stewardship goals. The soil and water conservation districts were created to provide resource assistance to land owners, institutions, and groups in the community on how to manage their own conservation programs. The district cooperates with the Yamhill Basin Council on issues relating to watershed health.

Further information and to find out if you are eligible for funds contact:

USDA Service Center
2200 SW 2nd Street
McMinnville, OR 97128
By phone: (503) 472-1474

Yamhill Soil and Water Conservation District
2200 SW 2nd Street
McMinnville, OR 97128
By phone: (503) 472-6403

Types of Restoration
Restoration and enhancement do not always involve a lot of time and money. There are basically two types of restoration that are described here from a presentation by Barbara Ellis-Sugai, Fluvial Geomorphologist with the U.S. Forest Service.

Passive Restoration
Passive restoration can involve less time, money and maintenance. This type of restoration is "allowing nature to take its course." Basically, it is the removal of human made disturbances. For example, install cattle waterers to prevent cattle from entering the streams, and allow the stream to recover naturally. It is a wait and see approach to restoration. It does not involve planting vegetation on the banks or re-structuring the streambank.

Active Restoration
Active restoration or enhancement is to speed up the recovery process in an attempt to restore function to a system faster than would take place if it were left alone, or to restore a function that might be outright missing from the system. If there is not a source of large woody debris in the system (such as in an urban setting) than it would have to be introduced because no matter how long you wait, it would not appear in the stream. Other examples of this include planting riparian vegetation, or the of use bioengineering techniques to compliment the natural recovery process. This can be trickier because done incorrectly, some types active restoration or enhancement such as placement of large woody debris, can actually do more harm than good.

Additionally, plantings should incorporate native vegetation to reduce the potential of introducing noxious weeds and natives are better adapted to the area and require less care to become established. The NRCS office in McMinnville has information on appropriate vegetation for riparian planting.

Project Information

The table below summarizes the projects listed with OPWRI. Notice that the vast majority of the projects in the database are those from the timber industry. Voluntary reporting for landowners involves additional paper work and many people are not aware of the database that is tracking this information.

Table 29. Restoration projects in OPWRI's database.

Location	Agency/Landowner	Project summary	Date completed	Cost
North Yamhill River	Willamette Industries	Stream Enhancement, instream large wood placement; riparian planting, legacy road improvement	9/1/96	$5,387
Berry Creek	ODFW	Instream large wood placement	11/1/92	$2,300

Haskins Creek	Boise Cascade	ODF riparian forestry measures	12/31/95	NA
Silver Creek	Boise Cascade	ODF riparian forestry measures	3/31/96	NA
North Yamhill River	Willamette Industries	Riparian planting, western redcedar	2/19/97	$500
North Yamhill River	Willamette Industries	ODF riparian forestry measures	5/1/97	$52,500
Fairchild Creek	Willamette Industries	ODF riparian forestry measures	4/1/97	$12,000
Fairchild Creek	Willamette Industries	Legacy road improvements, culverts installed	5/1/97	$27,930
North Yamhill River	Willamette Industries	Legacy road improvements, culverts installed/upgraded	9/1/95	$12,050
North Yamhill River	Willamette Industries	Legacy road improvements, culverts installed	9/1/97	$7,950
Maroney Creek	Willamette Industries	Legacy road improvements, culverts installed	9/1/95	$4,630
Baker Creek	Willamette Industries	Legacy road improvements, culverts installed	8/1/97	$1,420
Baker Creek	Willamette Industries	Slide Removal, Rainbow Lake	7/15/96	$5,300
Berry Creek	Willamette Industries	Surface drainage improvements, culvert installed, slide removal	3/1/96	$2,100
Baker Creek	Willamette Industries	Surface drainage improvements, culverts installed, ditching, slide removal	6/1/96	$8,450
North Yamhill River	Willamette Industries	Surface drainage improvements, culverts installed	7/1/96	$40,500
Fairchild Creek	Willamette Industries	Legacy road improvements, culverts installed	12/1/97	$19,000
Fairchild Creek	Willamette Industries	Surface drainage improvements, culverts installed	12/1/97	$1,900
Fairchild Creek	Willamette Industries	Surface drainage improvements, culverts installed	7/1/96	$10,150
North Yamhill River	Willamette Industries	Surface drainage improvements, culverts	7/1/96	$3,500

		installed		
North Yamhill River	Boise Cascade	Surface drainage improvements, culvert installed	12/31/98	$606
North Yamhill River	Boise Cascade	Surface drainage improvements; culvert installed	12/99	$539
North Yamhill River	Willamette Industries	Surface drainage improvements; culverts installed	12/98	$10,992
North Yamhill River	Willamette Industries	Peak flow improvements; surface drainage improvements, culverts	8/99	$19,544
North Yamhill River	Willamette Industries	Peak flow improvements, surface drainage improvements, culverts	10/99	$17,630
North Yamhill River	Willamette Industries	Surface drainage improvements, culverts installed	7/99	$4,450
North Yamhill River	Willamette Industries	Surface drainage improvements, culverts installed	7/99	$5,013
North Yamhill River	Willamette Industries	Peak flow improvements, culvert upgraded	7/99	$2,851
North Yamhill River	Willamette Industries	Peak flow improvements, culvert upgraded	1/99	$700
Fairchild Creek	Willamette Industries	Surface drainage improvements, culverts installed	7/1/96	$10,250
Turner Creek	Willamette Industries	Legacy road improvements, culvert installed	7/1/96	$17,000
Panther Creek	Willamette Industries	Surface drainage improvement, log fill removed	9/12/98	$2,278
Kane Creek	Willamette Industries	Peak flow improvements, culvert upgraded	9/11/98	$1,298
Baker Creek	Willamette Industries	Surface drainage improvements	9/10/98	$9,607
Fairchild Creek	Willamette Industries	Surface drainage improvements	8/31/98	$1,330
North Yamhill River	Willamette Industries	Surface drainage improvements	9/98	$26,285

North Yamhill River	Willamette Industries	Legacy road improvements, surface drainage improvements	9/98	$59,740
North Yamhill River	Willamette Industries	Legacy road improvements, surface drainage improvements	9/98	$160,480
North Yamhill River	Willamette Industries	Legacy road and peak flow improvements, culverts installed/upgraded	9/98	$52,730
Total Expenditures in database as of January 2000				**$620,890**

Notes on Beavers

Several watershed residents expressed concern about beaver effects on restoration or enhancement projects. Rob Tracey of the NRCS in McMinnville provided the following information.

> Beaver activity can be very beneficial to restoration of watershed function. Their pons can serve to slow runoff, trap sediment, recharge groundwater, and provide valuable wetland and aquatic habitat for numerous other species. However, where these ponds are not appreciated, the creation of additional wetland or the flooding of lands used for other purposes can be a nuisance for landowners. An active beaver population can also have a very negative effect on efforts to establish riparian vegetation along a stream or wetland. Where beaver are present it is often necessary to protect seedlings and trees with wire cages or other types of protection.

Jeff Brent of the USFWS provided the following information.

> Beaver are a protected fur-bearer in the state of Oregon, although there is a season on them. ODFW regulates beaver trapping. The beaver populations are very healthy in the Willamette Valley. There is a very small number trapped compared with the total.
>
> USFWS and ODFW do not like to translocate [live-trap the beavers and move them to a different location] for several reasons. It is not simple to do and involves crossing several different jurisdictions [local, county, and state wildlife personnel have to get involved]. It does not do the beaver any favors because usually, the food supply in the area they are located to is being used by other animals, or there isn't any food available.
>
> The county has had between 8 and 30 beaver trapped each year between 1993 and 1999. This number does not reflect beaver trapped on private property with or without a permit.
>
> Beaver and people encounters have been increasing steadily over the years based on complaints received at the Salem office. Their population continues to grow and they have no predators other coyotes. The biggest limiting factor to their population is a diminished food supply. Trapping out a problem beaver does not always work. If the habitat is preferred habitat, chances are another beaver will move in.

BLM Proposed Projects

The BLM Tillamook office is currently in the process of developing recommendations for projects for the Baker and Panther Creek subwatershed (referred to as 6th field watersheds by the BLM). These creeks were chosen as areas to concentrate on from the 104,000 acres the Tillamook office manages.

The proposed projects fall into 4 categories. Table 30 lists the categories and project ideas. BLM project manager for the area, Carolina Hooper, would like to see the public involved in this process. They will be asking for public comment on their proposed projects as funding becomes available. They also would like to hear project ideas from residents.

Table 30. BLM project categories and proposed actions

Category	Proposed Actions
Wildlife	1. Create snags with coarse woody debris in spotted owl habitat. Selectively log to produce individual tree release in Next Best Habitat. Post a popular target shooting area as closed.
Silviculture	1. Conduct commercial thinning. Currently the area is dense even-aged Douglas-fir, susceptible to laminated root rot with the possibility of losing entire forested areas to the disease. (See Chapter 4 on Vegetation for further information on laminated root rot.) 2. Plant laminated root rot resistant trees in the areas most affected by the disease.
Public Safety	1. Clean up illegal garbage dump sites. • Close shooting sites. 3. Replace old culverts, create driveable water bars, close roads located on unstable soils, construct a bridge to cross an area currently using a culvert.
Recreation	1. Continue collaborative efforts to create the Cross Coast Range non-motorized trail.

References

Brent, Jeff. USFWS. September 2000. *Personal communications.*

Ellis-Sugai, Barbara. February 23, 2000. "Going With the Flow: A Lecture About Rivers".

Hooper, Carolina. September, 2000. *Personal communications.*

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Tracey, Rob. January 2001. *Personal communications*.

Chapter 12 Watershed Conditions Summary

The North Yamhill Watershed is similar to other watersheds in the Willamette Basin that have been impacted by forestry and agricultural land uses. Private ownership of more than 90% of the watershed leads to diverse perspectives on restoration priorities and objectives. This document hopefully will serve as a starting point to improve the water quality and habitat conditions in the watershed. What follows is a summary of each chapter of the longer assessment document. The major findings for each chapter are summarized. This is far from a complete analysis of the watershed and all the complexities of the historic and current conditions. Rather, it provides basic, starting point information on a wide range of watershed conditions. Further analysis is needed before designing actual projects. However, goals and objectives could be determined with the available information.

The maps were designed using ArcView 3.1, a computer program that uses GIS data to create layers that can be used interchangeably. This powerful tool allowed streams, vegetation types, fish habitat, wetlands, etc. to be placed on the same size map and even on the same map to do analysis.

Chapter 1: Introduction and Watershed Characteristics

1. Watershed's approximately 114,000 acres was divided into 6 subwatersheds based on drainage patterns and dominant land use. The sub watersheds are Baker, Panther, Haskins, and Turner creeks and Upper North Yamhill and Lower North Yamhill.
2. The majority of the watershed, 100,000 acres is privately owned. The Bureau of Land Management owns over 12,000 acres.
3. Historically, **fire played an important role in the maintenance of oak savanna and prairie ecosystems** in the watershed. The suppression of fire has allowed Douglas fir to expand its range and occupy more area than it did historically.
4. The watershed is **home to 12 federal or state plant and animal species of special concern** due to their relative rarity.
5. Agriculture has been and continues to be an important component of the watershed's economy. While the history of cultivated crops has changed over the years and included plums, hops and currently grass seed, grapes, and nursery plants, the acreage under cultivation has remained fairly constant. Over 60% of the watershed is designated as agriculture/forestry. Another 37% is designated as exclusive forestry. **Perennial grass seed production uses 22% of the watershed's acreage, the largest cultivated crop use**.
6. Increased interest in living in the country has led to more people purchasing acreage in the rural areas of the watershed. This has increased the number of small family farms that in many cases do not have the skills to successfully manage their acreage.

Chapter 2: Historical Conditions

1. Kalapuya Indians used fire to control Douglas-fir and prevent it from encroaching into the watershed's lower elevations. Prior to European American settlement, Douglas-fir forests were more diverse with white oak, bigleaf maple and grand fir. Following settlement and subsequent fire suppression and land conversion to farming, the savanna habitat was lost. Prairies, both wet and dry, are nearly absent from the watershed today.
2. The majority of wetlands in the watershed were drained and tiled to make land available for

agriculture, resulting in the loss of all but a tiny percentage of the wet prairie in the watershed.
3. Farm and orchard practices that left soil bare during the winter rains resulted in massive soil erosion in the late 1800s and into the mid 1900s, a problem that still exists to a lesser extent today.
4. Forests in the watershed have been logged intensively. There has been a near conversion to the entire forested acreage to even aged Douglas-fir. The Bureau of Land Management and others are working to attempt creation of uneven aged mosaics in patches through the landscape. A native root pathogen that attacks the roots of Douglas-fir and eventually kills them has increased the need to create more stand diversity in the watershed.
5. Early 20th century logging practices included splash damming – the use of small, temporary dams to pool water and logs until the water level was sufficient to blast the logs downstream. This practice was used in six locations on the upper North Yamhill River resulting in a straightened stream channel, an incised channel, and loss of salmonid spawning gravels.

Chapter 3. Channel Habitat Types

1. Channel habitat types were assigned by analyzing USGS topographic maps and aerial photo interpretation. Some field verification was also conducted.
2. Channel habitat type classification assists with understanding the potential of streams for restoration or enhancement projects.
3. The majority of channels in the lower watershed including the lower North Yamhill River, lower Baker and Panther creeks, as well as the small streams in the northeastern corner of the watershed, were all seasonally wet prairie and connected with flood plain. Now, they are deeply incised and meet the criteria for low gradient moderately confined channels rather than the criteria for floodplain channels as their topography and historic dominant vegetation show. These streams pose the greatest challenges to restoration or enhancement efforts.
4. **Many of the streams in the middle to upper elevations of the watershed have potential to become salmon habitat**. Forestry practices that demand leaving standing trees as a buffer along the channels will eventually lead to large wood recruitment. This wood will eventually fall into the channel and provide pool habitat.
5. The headwaters streams offer little opportunity for enhancement or restoration. They are too steep for salmonids to swim. They are recruitment area for large wood debris, and current forest practices laws are protecting trees in the riparian area to allow for wood recruitment to downstream channels.

Chapter 4: Current and Historic Vegetation

1. Historic vegetation characteristics were determined by evaluating The Nature Conservancy's recreation of historic conditions from mid to late 1800s land surveyor's notes.
2. Current vegetation was evaluated using digital data available from The Northwest Habitat Institute.
3. Vegetation in the watershed varies dramatically from west to east. The steep west side on the eastern edge of the Coast Range is heavily forested with young Douglas-fir. The east side with its flatter topography is mostly under cultivation.
4. Estimation of historic conditions finds wet prairie, white oak savanna, forest, and thinly timbered woodlands to be the dominant vegetation types.
5. Estimation of **current vegetation conditions finds perennial grass and Douglas-fir to be**

the dominant vegetation types.
6. Some vegetation types such as wet and dry prairie are no longer present in any amount that can be seen using air photos.

Chapter 5: Riparian Zone and Wetlands

1. Riparian conditions were examined using aerial photos. The photos are from 1994 flyover and changes in vegetation or channel modifications after that date are not known.
2. The majority of streams have vegetation along the banks. However, **bare ground, brush and grass make up the vegetation along almost 20% of the channels**. These are areas that have great potential for enhancement. The majority of the bare areas border streams through agricultural fields in the lower watershed.
3. **Himalayan blackberry, a non-native and invasive species, is dominant along many miles of stream**.
4. The loss of wetlands due to drainage and tiling projects along with development projects (in north McMinnville along Baker Creek) has led to the near loss or degradation of all wetlands in the watershed. The remaining few are mostly in agricultural areas and are considered prior converted farmland.
5. The loss of wetlands is a factor in the channelization of streams in the watershed.

Chapter 6: Channel Modifications

1. Road construction paralleling stream channels is a major barrier to stream meandering and flooding and has resulted in numerous riprapping channel stabilization projects, especially along Baker Creek.
2. Road and stream crossings are likely bridge placements. ArcView analysis shows there are **391 road and stream intersections in the watershed**. Many of these are likely driveway bridges. Bridges make river or stream meanders difficult if not impossible. Riprap or concrete hardening is done to keep the stream from washing out the bridge.
3. Channel hardening projects were prolific in the watershed during the 1960s and 70s according to records at the Division of State Lands. Many projects to enhance fish habitat were also undertaken during this time, although there is no record of their successes.
4. Channel modification projects done on Baker Creek during the 1970s to the present have shifted the erosive impact of the water from one location to another without addressing the reasons for the river to need the hardening projects. (Disconnection from the floodplain, lack of overland water storage.)

Chapter 7: Sediments

1. Potential sources of sediment include erosion of rural road surfaces and ditches, urban runoff from impervious surfaces, slope failure on forest roads, and surface erosion from agricultural lands.
2. The county, in cooperation with landowners, is reshaping and seeding the ditches to decrease their sediment contribution. However, **individual actions have great impact on the function of the ditches**. Careless depositions of lawn debris, orchard trees with fruit falling into the ditches and clogging them, and the position of drainage tiles all negatively impact the ability of the ditch to deliver water to streams. Additionally careless deposition of materials into ditches eventually washes into streams.
3. Potential land slide areas were identified by ODF. These areas are not necessarily going to

slide, but the slope and soil type indicate slides are possible.

4. This is an area in need of more on the ground investigation. Sediment sources are difficult to pinpoint especially those that come from non-point sources such as overland flow from agricultural fields.

Chapter 8: Hydrology and Water Use

1. The watershed has flow information for the North Yamhill River and Haskins Creek.
2. Peak flows occur in the winter months when rainfall is the heaviest. The watershed does not receive snowfall, so there is no source of moisture during the dry season other than springs or groundflow of water to the streams.
3. The **watershed's water rights are overallocated**. If all those with rights to the water used those rights, the streams would run dry. There has not been much conflict over water because most users are not exercising their full water right.
4. Irrigation rights are held for land along the North Yamhill River and tributaries in the eastern watershed. This land was historically, wet prairie. Drainage and tiling projects have decreased its ability to store water during the winter months. Many of the water rights are not used because the crop under cultivation is grass seed, which does not require a moisture input during the summer months.

Chapter 9: Water Quality

1. Water quality data is available for several streams in the watershed, however much of it is not current and was taken with grab samples. No continuous monitoring, other than for temperature, is taking place.
2. Several **stream locations are listed in violation of the national Clean Water Act standards**. These include: the North Yamhill River for bacteria, temperature, and flow modifications. Turner Creek is listed for temperature. Haskins, Hawn, Panther, Turner and the North Yamhill each have several areas of concern for which there is insufficient data to either put them on the list or declare them satisfying the standards.
3. Temperature monitoring has been conducted on many of the streams in the watershed. Most of the segments that have been tested are in violation of the standard.

Chapter 10: Fish

1. **The only native threatened salmonid in the watershed is winter Steelhead**.
2. Coho salmon were stocked in the watershed throughout the 1970s and 80s, but this practice was discontinued due to concerns over the interactions between hatchery stocked fish and native fish. Additionally, the Coho were never found to be returning to spawn in large numbers.
3. **Cutthroat trout were once abundant in the watershed**. They are still present in substantial numbers, although no monitoring data exists. Fishing regulations for the watershed ban keeping any cutthroat caught in the watershed.
4. Stream surveys have been completed for several segments of rivers in the watershed, but most pre-date the 1996 floods during which the channels change dramatically. ODFW has not had the time or resources to devote to this area and the fish biologist for the watershed has only visited the area once or twice in the past several years.
5. **Winter Steelhead do return to the watershed to spawn**, however not in great numbers. This basin probably never supported large numbers of salmonids. The BLM believes that

Fairchild Creek is the best location to concentrate efforts to restore salmonid habitat as it has the best riparian and temperature conditions.

6. There are no high priority culvert replacements, only medium and low priority ones. Efforts need to be continued to produce a map with these culvert locations clearly marked and labeled for Yamhill County Road Department.

Chapter 11: Restoration

1. A great many restoration projects have been completed in the watershed, most of them by private timber companies and the Oregon Department of Fish and Wildlife. There has been little effort to maintain a database or to collect information about the on-going status of these projects and whether they accomplished their goal.
2. To date, **over a half million dollars has been spent in the watershed by industry and ODFW alone to restore steelhead habitat**, and there is little information to document what effect if any this has had on the salmon. This is an area in need of further investigation.
3. The state maintains a database of projects that have been completed to improve water quality and enhance salmon habitat. Unfortunately, few private landowners take the time to fill out the paperwork to be included in this database. This is an area where volunteers could assist landowners with this step in order to have a better idea of areas where restoration/enhancement has been tried in the watershed and what has been affective. Additionally, it would allow for projects to interlock and have a greater impact on the watershed.