DEER CREEK WATERSHED ASSESSMENT AND ACTION PLAN

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1. Introduction

1.1. Purpose of the Watershed Assessment and Action Plan

The Umpqua Basin Watershed Council

The Deer Creek Watershed Assessment and Action Plan was prepared for the Umpqua Basin Watershed Council (UBWC), which is organized to address issues of water quality and fish habitat in accordance with the Oregon Salmon Plan. The Umpqua Basin Watershed Council is a non-profit organization, which represents interest groups of agriculture, livestock, timber, aggregates, construction, mining, fishing, recreation, conservation, cities, special districts, public utilities, and the county. Council members are working toward effective, efficient, and realistic management solutions for clean water and healthy, native fish populations. As a part of these efforts, the Watershed Council is conducting watershed assessments and defining action plans for the watersheds of the Umpqua Basin.

Watershed Assessment and Action Plan

The purpose of this Watershed Assessment is to:
1. Document the history and current status of water quality and stream conditions for fish habitat; and
2. Understand the processes that affect these conditions; and
3. Discover enhancement opportunities to improve water quality and fish habitat.

In the event that the Watershed Assessment identifies restoration opportunities that can be done voluntarily by landowners, an Action Plan is developed that lists both general areas of concern and specific projects.

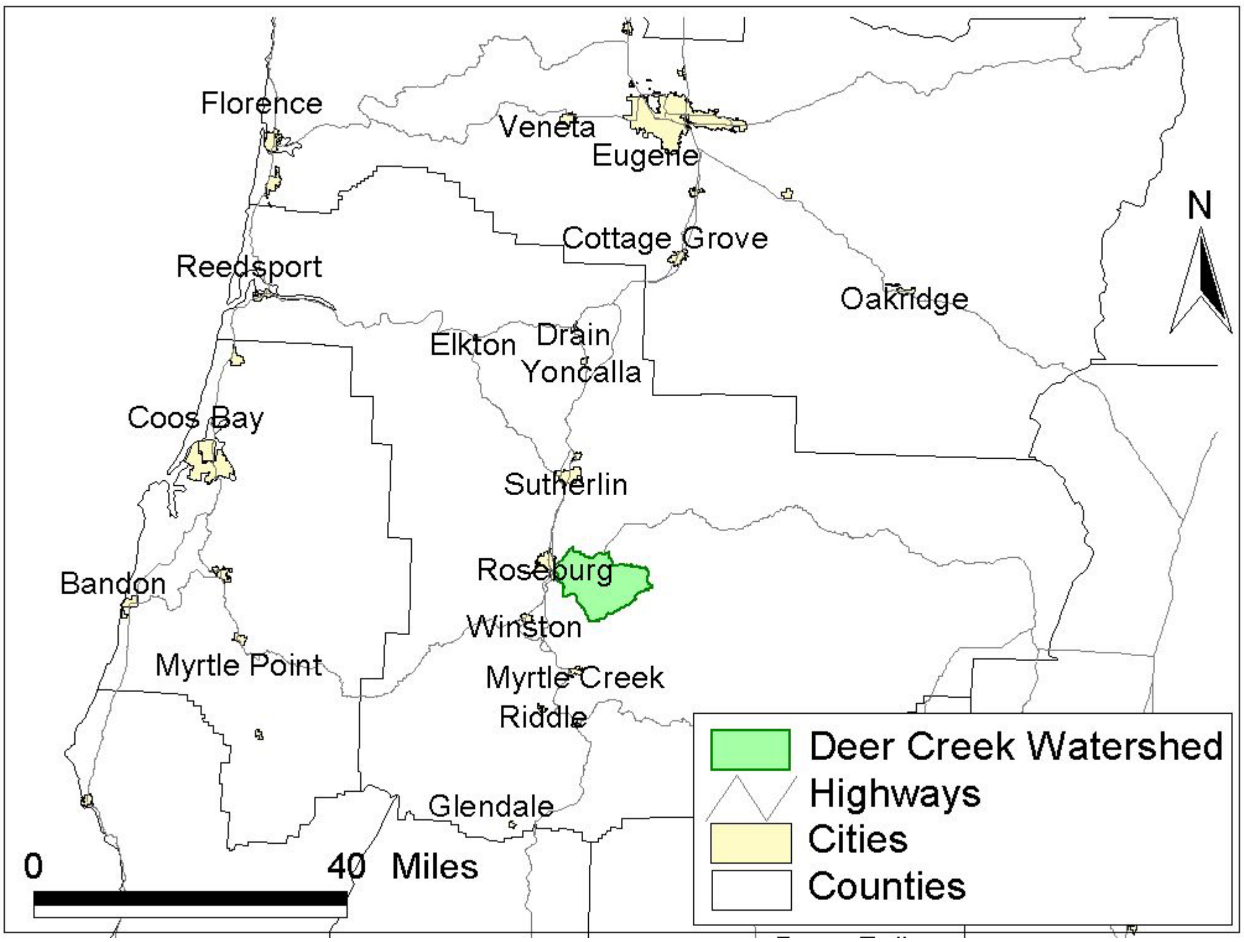
The purpose of an Action Plan is to:
1. Provide a reference list of activities and locations thereof designed to improve water quality and fish habitat in the watershed; and
2. Recommend future data collection needs; and
3. Determine opportunities for objective-based landowner training and education programs; and
4. Identify resources to support voluntary or grant-funded actions.

1.2. Process of the Watershed Assessment and Action Plan

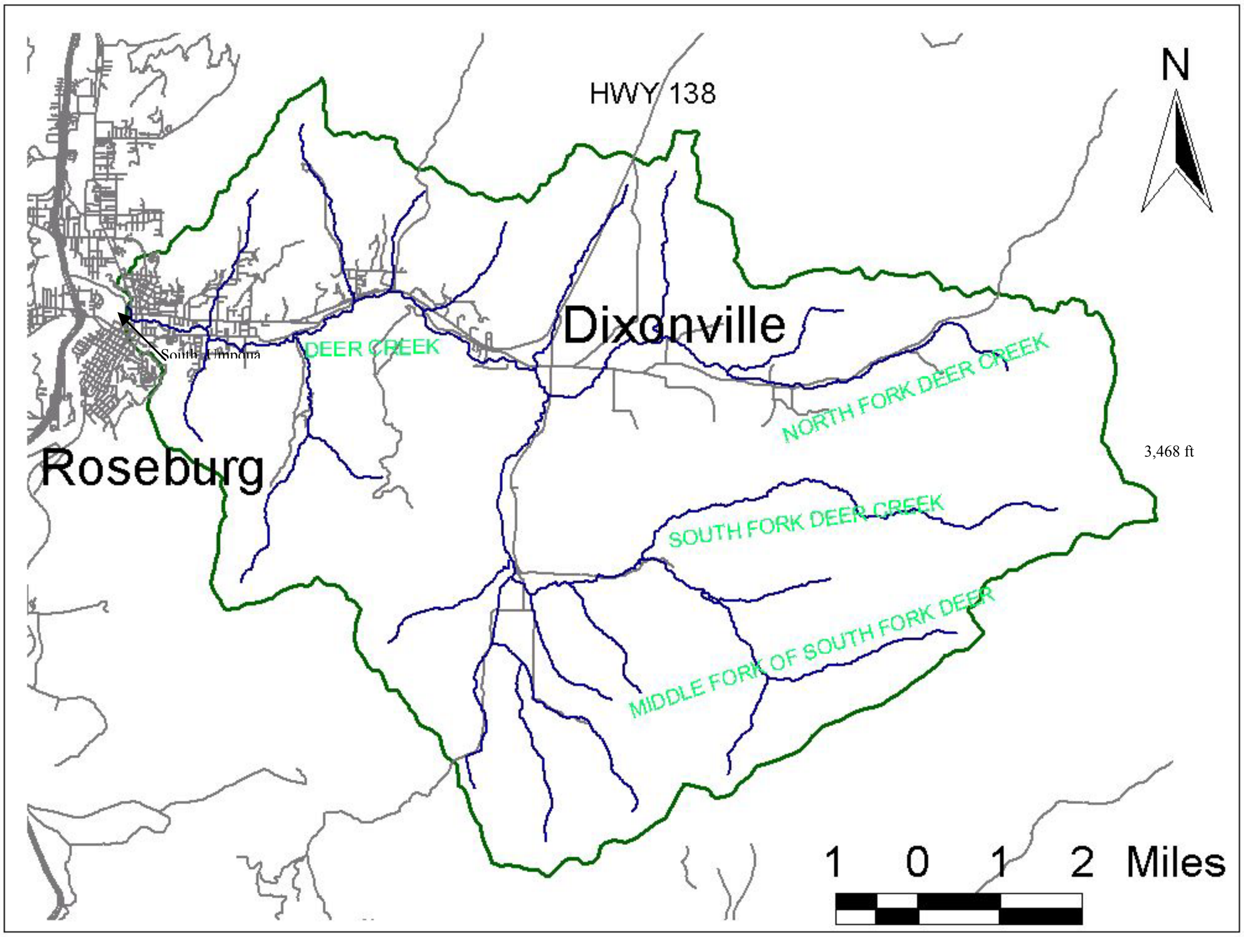
The Deer Creek Watershed Assessment process has been followed by a group of local landowners. The organization of this document was constructed as a combination of the informational needs of the Deer Creek landowners and the framework of the Oregon Watershed Assessment Manual. The group has met twelve times to review the data going into the document, followed by three meetings to review the assessment and develop the action plan. Members of the Deer Creek landowner group represented sheep ranches, cattle ranches, industry within Deer Creek, the City of Roseburg, private industrial timber companies, city residents, rural residents, the UBWC, the Bureau of Land Management (BLM), the Department of Environmental Quality (DEQ), the Douglas Soil and Water Conservation District (DSWCD), and the Douglas Small Woodlands Association.

1.3. Watershed Description

Deer Creek is a tributary of the South Umpqua River and is located in Douglas County, Oregon, near Roseburg (Map 1:1). Deer Creek flows generally east to west and enters the South Umpqua River in Roseburg. The watershed, which drains water into Deer Creek and its tributaries, is 43,090 acres in size. The headwaters drain into two main tributaries: North Fork Deer Creek and South Fork Deer Creek, which come together in Dixonville, approximately five miles east of Roseburg. The highest point along the watershed boundary is Lane Mountain (3,468 feet above sea level) and the lowest point is the junction with the South Umpqua River at 420 feet above sea level (Map 1:2).



Map 1:1. Deer Creek Watershed Vicinity.



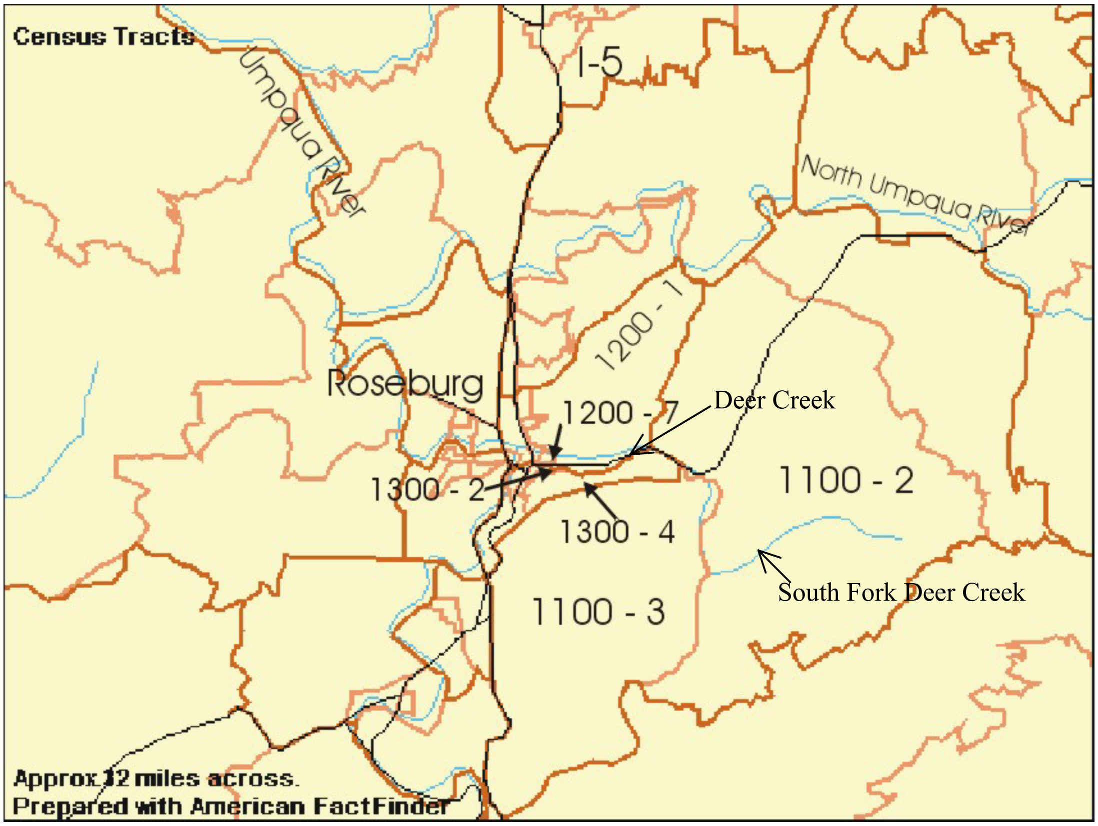
Map 1:2. Deer Creek Watershed

The Deer Creek Watershed described in this document is slightly larger than that defined by the US Geological Survey, which only includes the North and South Forks of Deer Creek. For this report, the Deer Creek Watershed was extended to include all area draining into Deer Creek.

Topography in the watershed is hilly to mountainous. Hillside slopes in much of the area are 25% to 35%. Stream gradients average 4.5% in the tributaries and 0.5 % for the mainstem. The land ownership of the Deer Creek Watershed is 93.70% private, 6.06% BLM, 0.18% Douglas County, 0.04% City of Roseburg, and 0.02% State of Oregon. Approximately 2% of the watershed is within the city limits of Roseburg.

Population

In 1990, the population of the Deer Creek Watershed was approximately 6,170 (US Census Bureau). There are three census tracts with six block groups that cover the area of the Deer Creek Watershed (Map 1:3). A census tract is a geographic unit defined by the Census Department, that is then subdivided into block groups. Table 1-1 shows the 1990 population count in each of these blocks. Four of the blocks are located within Roseburg and contained 4,462 people in 1990, which was 72% of the population of the Deer Creek Watershed.



Map 1:3. Census Tracts in the Deer Creek Watershed

This table corresponds with Map 1:3. By combining the census tract number and the block group number, the block group can be located on the map.

Name	Census Tract	Block Group	1990 Population
SF and NF Deer Creek	1100	2	1,050
Deer Creek	1100	3	657
Roseburg North	1200	1	1,921
Jackson Street	1200	7	548
Downtown Roseburg	1300	2	635
Roseburg Summit Hills	1300	4	1,358

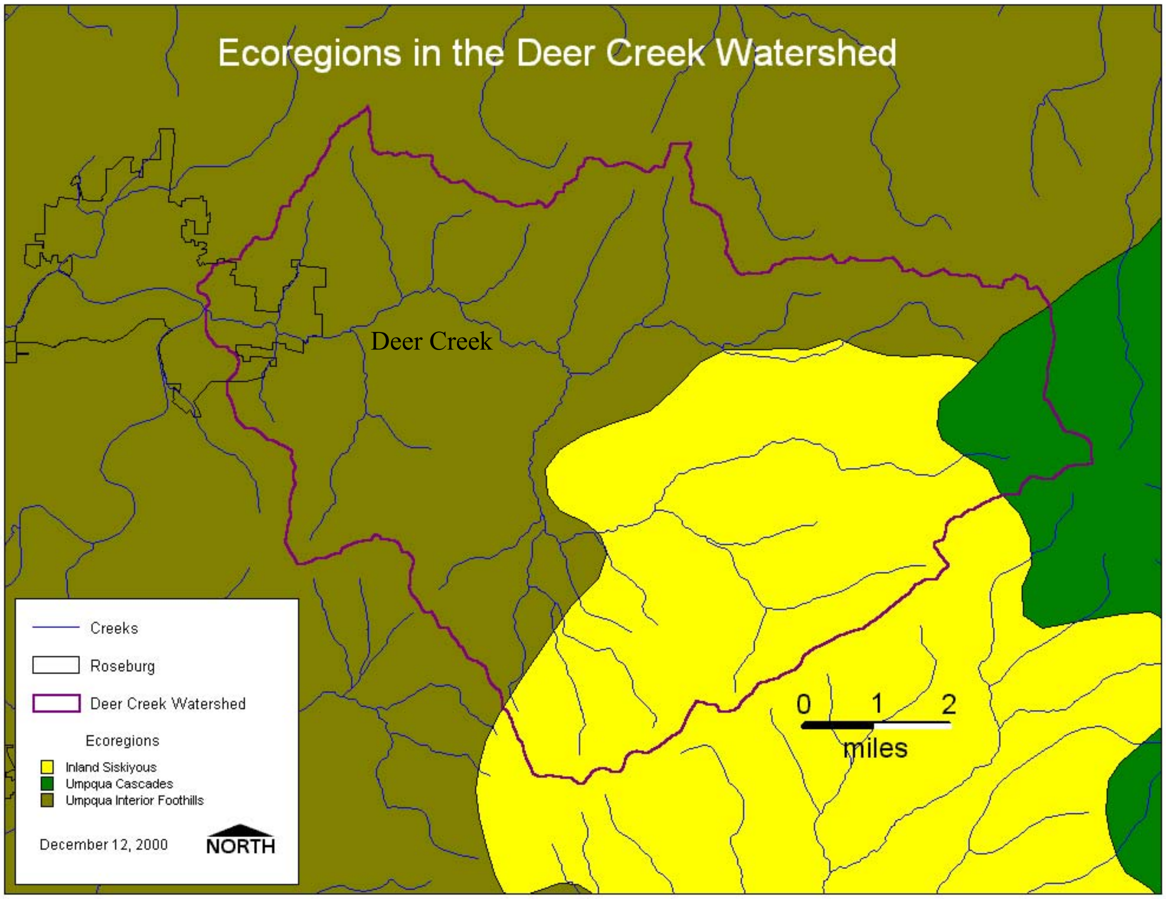
Table 1-1. Deer Creek Watershed 1990 Population

1.3.1. Ecoregions

Ecoregions are a way to describe areas with similar climate, geology and vegetation patterns. Deer Creek is located in the Coast Range Umpqua Valley Ecoregion. According to Omernik's Level IV ecoregion classification (1998), the Deer Creek Watershed contains parts of three level IV ecoregions: Inland Siskiyous, Umpqua Cascades, and Umpqua Interior Foothills.

The Roman numeral of the ecoregion classification denotes the scale and detail of the ecoregion description. For the Level I Ecoregion, the coarsest level, North America was divided into fifteen ecological regions. At the Level III Ecoregion, the continental United States was divided into 98 regions. The Level IV Ecoregions are a further division of the Level III Ecoregions

(Omernik, 1998). These ecoregions cover several watersheds, therefore the descriptions are broad and not always fully applicable to the Deer Creek Watershed. Following is a description of the Level IV Ecoregions which occur in the Deer Creek Watershed.



Map 1:4. Ecoregions in the Deer Creek Watershed

The Inland Siskiyous ecoregion (37% of the watershed) is considered mountainous. Granitic and sedimentary rocks underlie the ecoregion and distinguish it from the volcanic mountains of the Cascades. Greater fire frequency, less annual precipitation, longer summer droughts, and a lack of tanoak (*Lithocarpus densiflorus*) differentiate it from the Coastal Siskiyous ecoregion (Omernik, 1998). The Deer Creek Watershed itself does not contain granitic rocks.

The Umpqua Cascades ecoregion (5% of the watershed) is a transitional zone between the lusher and moister forests of the Western Cascades Lowlands and Valleys and Western Cascades Montane Highlands ecoregions to the north, and the drier forests of the Southern Cascades and the Klamath Mountains to the south. Vegetation in the Umpqua Cascades ecoregion is characterized by a mix of grand fir (*Abies grandis*), white fir (*Abies concolor*), western hemlock (*Tsuga heterophylla*), Pacific silver fir (*Abies amabilis*), and Douglas-fir (*Pseudotsuga menziesii*), with Shasta red fir (*Abies magnifica*) also occurring, mostly to the south. Vegetation diversity in the Umpqua Cascades ecoregion is greater than in the Western Cascades Lowlands and Valleys, and Western Cascades Montane Highlands ecoregions (Omernik, 1998).

The Umpqua Interior Foothills ecoregion (58% of the watershed) is an intermingling of narrow valleys, terraces, and foothills. It contrasts with the terrain of the more mountainous Inland Siskiyous. A mix of oak woodlands, Douglas-fir, ponderosa pine (*Pinus ponderosa*), and Pacific madrone (*Arbutus menziesii*) intermingle with pastureland, vineyards, orchards, and row crops. Summers are hot and dry and, although the climate is transitional to both the Willamette and Rogue valleys, it is most similar to the Rogue Valley (Omernik, 1998).

Generalized Geology of the Deer Creek Watershed Area

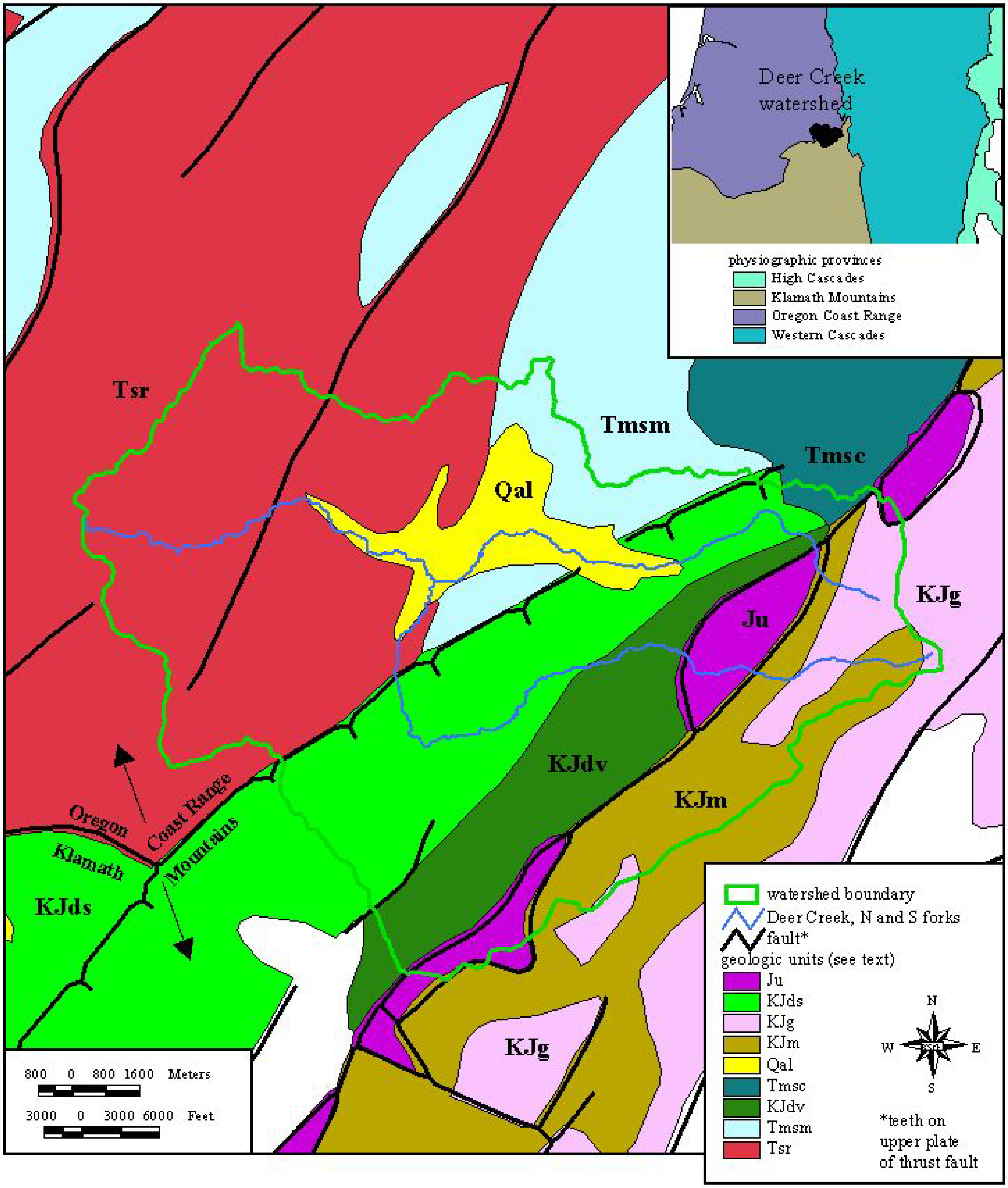
The northwest portion of the Deer Creek watershed lies in the Oregon Coast Range physiographic province (Map 1:5). The remaining portion of the watershed lies in the Klamath Mountains physiographic province. Each physiographic province is a region in which all parts are similar in geologic structure and rock assemblages, and whose pattern of relief features or landforms differs significantly from that of adjacent regions. The two provinces are separated by a major fault in the vicinity of the watershed (Map 1:5). The following geologic information is from Walker and MacLeod (1991) and Orr and Orr (1999). More detailed geologic mapping and interpretation of the area is available from Wells et al. (2000).

<u>Klamath Mountains Physiographic Province</u>

The Klamath Mountains are composed of slabs of oceanic volcanic rock with overlying sedimentary rocks. The slabs collided with, and were fused to the North American continent. As the slabs were fused to the continent, the succeeding slabs were thrust beneath each other like shingles on a roof, with the first to the southeast and the last to the northwest (imagine the Hawaiian islands thrust onto the Pacific Coast, followed by another island chain, which was shoved underneath, etc). Hence, each slab is separated by a major thrust fault. In addition, the tremendous pressures involved caused much folding and many faults within the slabs. That is, the various rock units that comprise an individual slab generally do not lie one on top of another, i.e., “layer cake” stratigraphy.

These fused rocks have been intruded by molten masses of granitic rock (KJg, Map 1:5). Map 1:5 shows the rock types present at the ground surface (bedrock) in the vicinity of the watershed. In general, only rock types present in the watershed are discussed in this report.

The oceanic rock in the Klamath Mountains is largely basalt flows and flow breccias (KJdv) and ultramafic rocks (Ju, Jop). Basalt is a black, very fine-grained volcanic rock. Ultramafic rocks are greenish black rocks from the Earth’s mantle that are extremely rich in iron and magnesium and low in silica. The overlying sedimentary rock (KJm, KJds) is mostly sandstone, shale and conglomerate. The latter is consolidated gravel composed of rounded particles ranging from silt to boulder size.



Map 1:5 Aerial Geology (after Walker and MacLeod, 1991).

The Klamath rocks are highly deformed (i.e., compacted, distinctly folded, and/or sheared) to the point where new rock textures and minerals have formed. For example, many of the grains in the sandstone rocks are partially fused and these rocks are most properly termed "metasandstone" (a sandstone that has not been completely changed to a new metamorphic rock, such as quartzite). Also, alteration of minerals in much of the dunite, harzburgite, and ultramafic rock has formed a yellowish green rock termed serpentinite. All Klamath rocks near the ground surface display various levels of yellow-brown-red iron stain, the result of weathering. In addition, abundant veins of quartz and calcite typically occur throughout the rocks.

Coast Range Physiographic Province

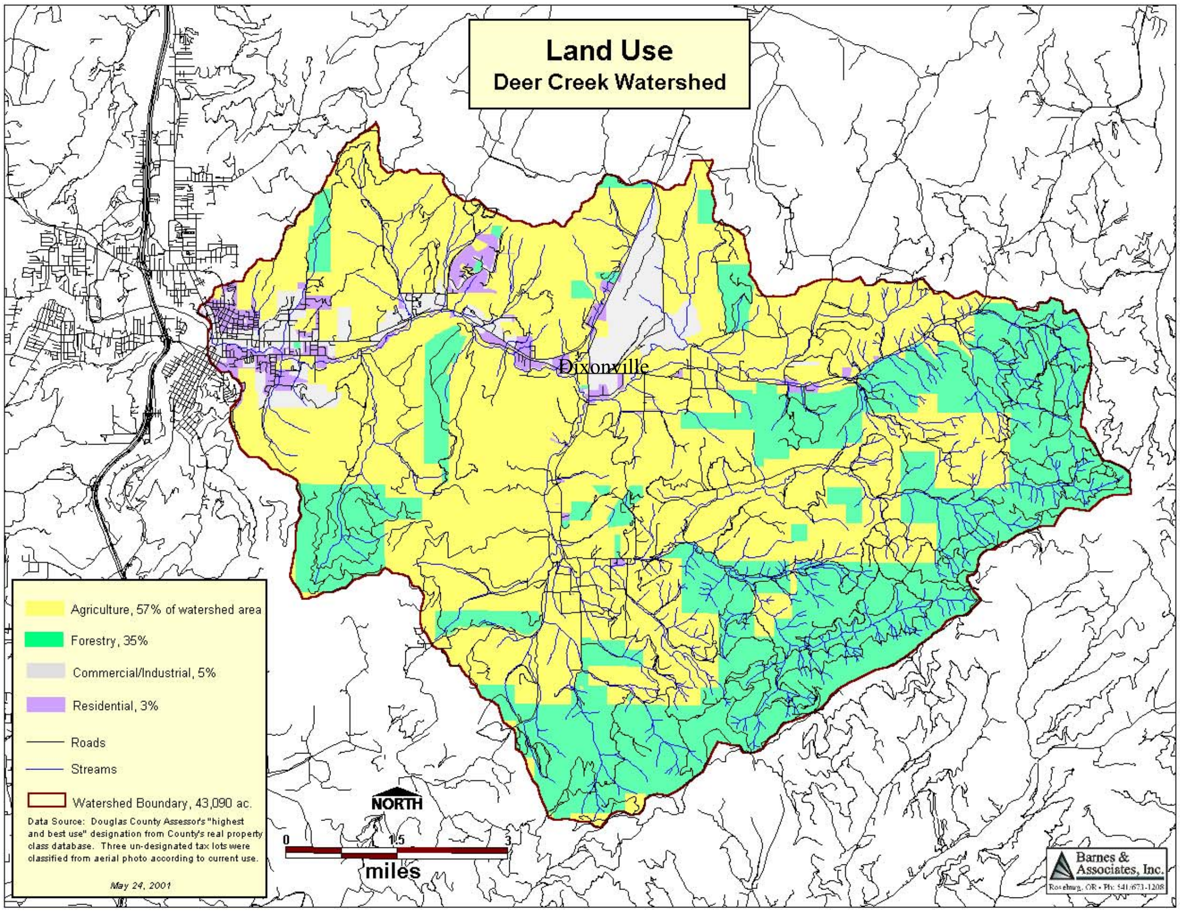
The Coast Range is composed of a basaltic basement overlain by thick layers of sediments. However, in contrast to the Klamath Mountains, Coast Range rocks are relatively undeformed with generally low relief. The overall trend of rock units and major faults in both the Klamath Mountains and Coast Range in the Deer Creek watershed is northeast-southwest (Map 1:5).

Coast Range rocks in the Deer Creek watershed are marine basalt (Tsr) and overlying marine sedimentary rocks of the Umpqua Formation (Tmsm, Tmsc). The basalt formed both underwater and above water. Outcrops in the vicinity of Roseburg are pillow basalt, a texture formed when lava cools under water. The sedimentary rocks consist of interbedded sandstone, siltstone, mudstone and conglomerate. The unit Tmsc appears to have been formed in shallow water, and contains abundant cobble and pebble conglomerate. In contrast, the unit Tmsm appears to have been formed in a deep sea fan setting (deep water), and contains minor conglomerate. Both the basalt and sedimentary rocks are in fault contact with Klamath rocks to the south. Stream deposits of sand, gravel and silt (Qal) are mapped over the basalt and sedimentary rocks in the low-lying area near the confluence of Deer Creek and the South Umpqua River.

Iron stain is present to some degree in all Coast Range rocks. In addition, the basalt has been slightly altered by regional low pressure and low temperature conditions. The result is that fractures and vugs in the basalt commonly are filled by minerals such as quartz, kaolinite (white clay), zeolite minerals (white hydrous silicate minerals) and chlorite (green clay).

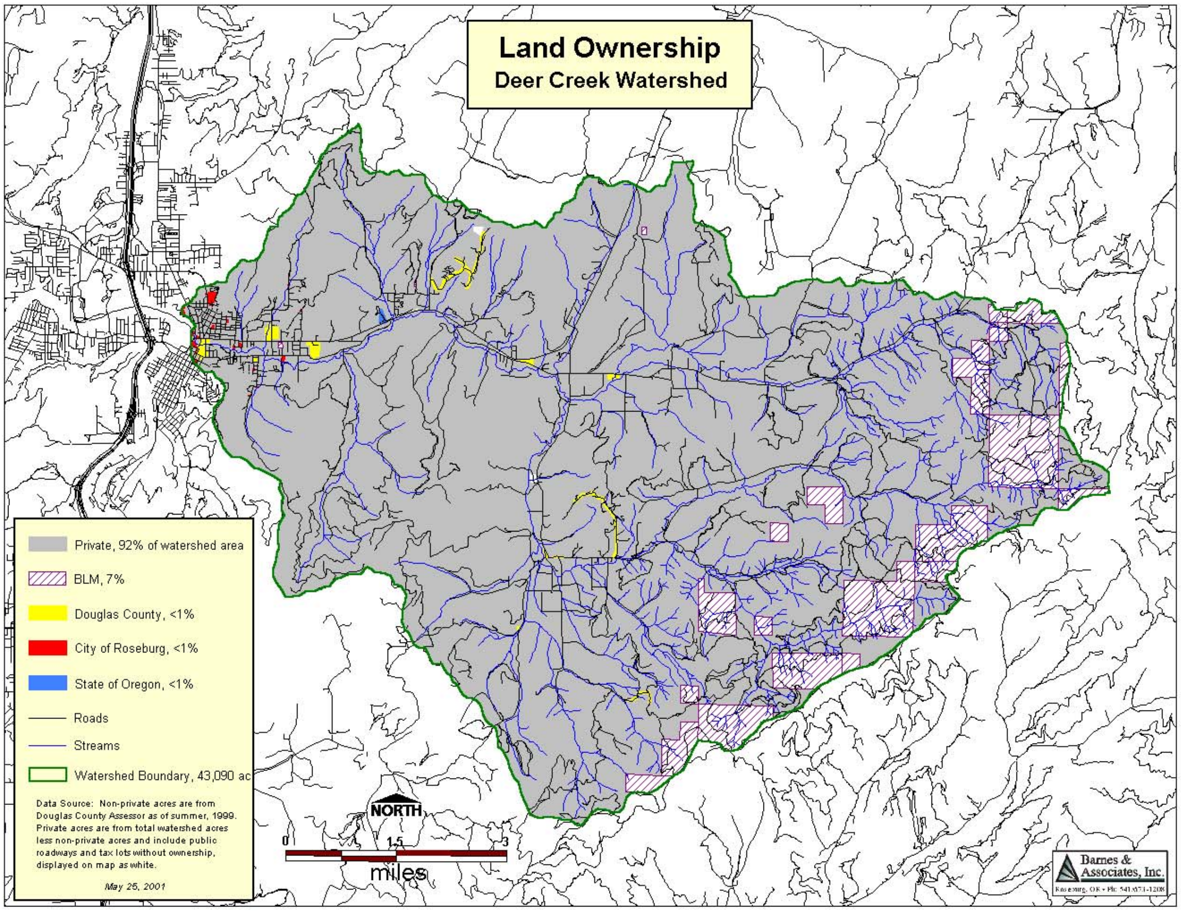
Deer Creek Land Ownership and Land Use

Deer Creek’s landscape diversity results in two distinct land use areas. In the Umpqua Interior Foothills, the landscape is a mosaic of agriculture uses such as pasturelands, crop land, and a few orchards, intermixed with urban areas, rural residential development, Christmas-tree farms, woodlands, and a small amount of coniferous forests. In the southeastern mountains of the Inland Siskiyous, coniferous forests characterize the ecoregions and therefore forestry is the dominant landuse, although with some areas are under agricultural production. These mountains are also an important regional water source for the lowland communities.



Map 1:6. Land Use in the Deer Creek Watershed

Map 1:7 shows total land ownership in Deer Creek and Map 1:6 shows land use distribution within the watershed. Land ownership within Deer Creek is consistent with the ecoregion landuse description. Almost all of the Umpqua Regional Foothills region is privately owned. Public lands are city, county, or state-owned and are primarily recreational facilities. The forested mountains of the Inland Siskiyous are both publicly and privately owned. All federal lands in this watershed are managed by the Bureau of Land Management.



Map 1:7. Land Ownership in the Deer Creek Watershed

Landuse Impacts

Today, settlement in the watershed includes the east end of Roseburg, subdivisions along parts of both North and South Forks, rural ownerships from one to two hundred acres, and many larger ranches.

From the Douglas County courthouse to the east end of Douglas Avenue, there are over 100 hundred homes and many business or industrial concerns within 300 feet of the creek. The vast majority of these use the municipal sewerage system.

There are approximately 70 homes or barns within 300 feet of Deer Creek between the east end of Douglas Avenue and the Dixonville store - all the homes are on individual septic systems.

From the Dixonville store east along North Fork there are approximately 60 homes or barns within 300 feet of the creek - all the homes are on individual septic systems.

From the Dixonville store south along South Fork there are approximately 35 homes or barns within 300 feet of the creek - all the homes are on individual septic systems.

This results in over 250 homes and dwellings along Deer Creek that impact the stream and the riparian areas. (Jim Harris, 2001)

1.3.2. Fish of the Deer Creek Watershed

Both anadromous (spawn in fresh water and spend a portion of their life in the ocean) and resident fish are present in the Deer Creek watershed. Fish species include salmonids (trout [*Salmo spp.*] and salmon [*Oncorhynchus spp.]*) and other native fish species such as dace (*Rhinichthys spp.*) and sculpin (*Cottus spp.*). Smallmouth bass (*Micropterus dolomieui*) have been introduced into the Umpqua River and probably reside in the lower portions of Deer Creek. There are five anadromous fish species that use this watershed: coho salmon (*O. kisutch*), winter steelhead trout (*O. mykiss*), fall chinook (*O. tshawytscha*), cutthroat trout (*S. clarki*) and Pacific lamprey (*Lampetra tridentata*). In 2001, fishing in Deer Creek opened again for trout fishing from May 26th until September 15th.

2. Past Conditions

The landscape of the Deer Creek watershed has changed dramatically since the time of European exploration and settlement in the 1800's. Native American use emphasized hunting and gathering, with the rivers and streams providing abundant food resources such as salmon, Pacific lamprey, and mussels. The people managed the land primarily by setting fires to create open areas for game and to maintain prairies for camas and other food plants (Robbins, 1997).

From the beginning of settlement in the 1840's, the population of Douglas County has steadily increased (Table 2-1). This population growth, with its associated land use activities of farming, industry, housing, and logging, and the change in the fire regimes, has had a dramatic impact on the watershed's present vegetation patterns and stream channels. These changes in the watershed's character have affected fish and wildlife habitat and populations. The suppression of wildfire, for example, has resulted in the conversion of areas that were once grasslands and open oak woodlands to conifer forests and pasture (Robbins, 1997).

Population Trends

Roseburg experienced its largest percent growth from 1900 to 1910 and its largest numeric growth from 1940 to 1950, during which time the National Forest was opened for logging. Roseburg was incorporated in 1872; thus, the population of Roseburg in 1860 is an estimate.

Year	Douglas County Population	Roseburg Population
1860	unknown	789
1880	unknown	821
1900	14,565	1,690
1910	19,674	4,738
1920	21,332	4,381
1930	21,965	4,362
1940	25,728	4,924
1950	54,549	8,390
1960	68,458	11,467
1970	71,743	14,461
1980	93,748	16,644
1990	94,649	17,069
2000	100,399	20,017

Table 2-1. Douglas County Population Trends (US Census Bureau).

2.1. Timeline of selected events and vegetation observations

This section gives a short selected list of observations and events in the Roseburg vicinity. Its purpose is to show how the area has changed over time.

1818 First recorded encounters between Umpqua Indians and white settlers (Bakken, 1970).

1840's Landscape is composed of prairies and woodlands, prairies occupy a greater portion, timber being principally along watercourses and on the bordering mountains (Robbins, 1997).

1841 "*Air is thick and smoky – the sun only seen occasionally. Principally oak trees with grass beneath"* (Robbins, 1997).
South Umpqua – "*camped on narrow prairie ground with very little vegetation or grass and that very dry and burnt, affording exceedingly scant allowance for animals"* (Robbins, 1997).
"*Hills surrounding valley 12 – 1500' in height with grass exceeding to summits, tops scattered with pines and oaks"* (Robbins, 1997).

1850 A dramatically altered landscape and ecology – within a decade the scattered oak openings and prairie grasslands had turned into farms and fenced pasture (Robbins, 1997).

1861 A flood destroyed Scottsburg on the lower river, washed away mills and bridges and halted mail and express shipments for a time. In the Lone Rock area (thought to be near the Little River Area), the rivers crested twice in eight days, spreading flood waters over farms and into Shrum's flat, later the site for the Forest Ranger Station at Glide. (Bakken, 1970)

1872 City of Roseburg is incorporated.

1900 Ranchers report black mud causing problems for livestock (Bakken, 1970).

1903 Roads of Roseburg rocked (Bakken, 1970).

1947 Substation set up in Dixonville; two lines each receiving 114,000 volts (Bakken, 1970).

1964 Flood.

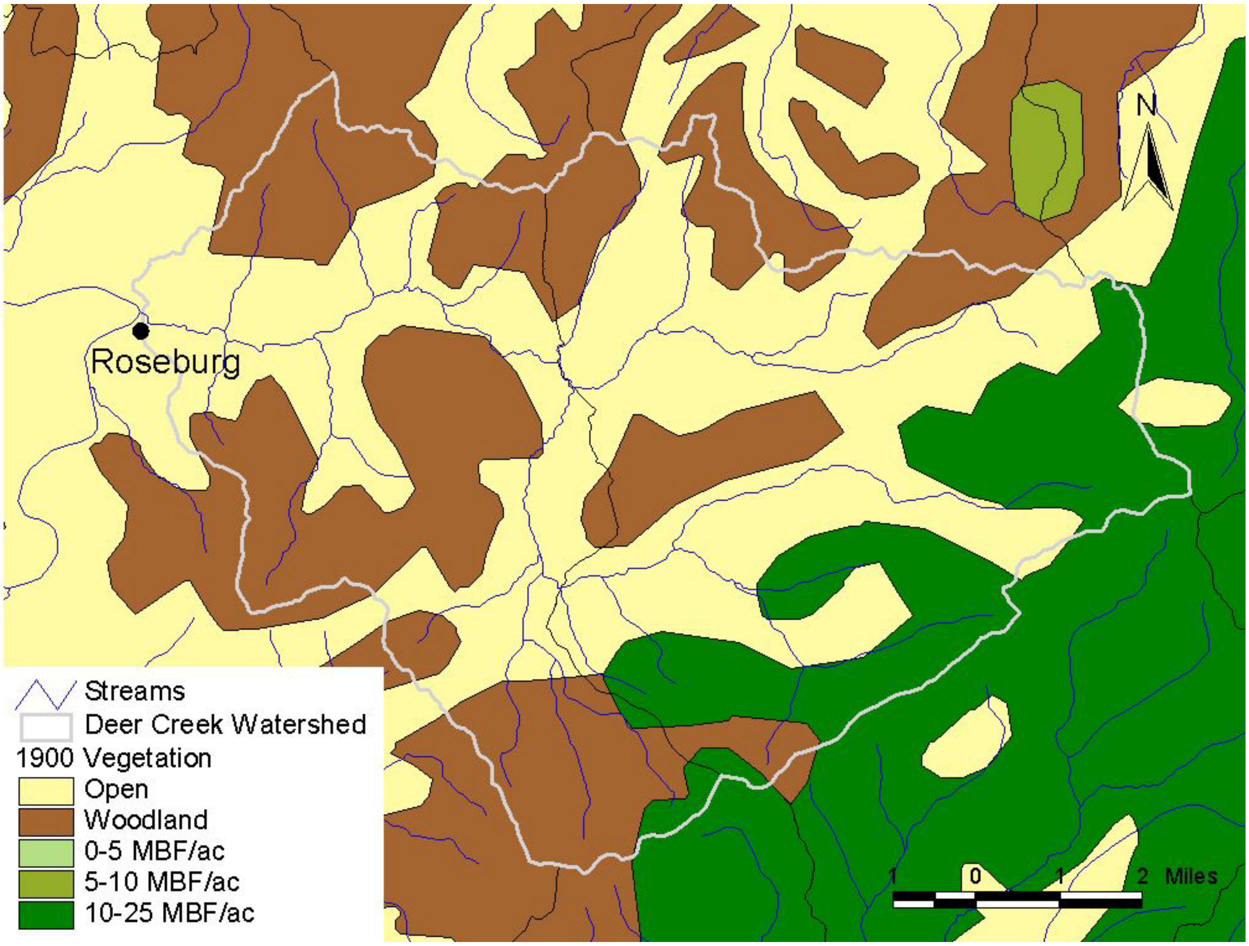
1990 Roseburg's population is 17,032; Estimated Deer Creek Watershed population is 6,170.

2000 Roseburg's population is 20,017; Douglas County's population is over 100,000.

2.2. Historical Vegetation

A vegetation map (Map 2:1) from 1900 (Gannett, 1902) illustrates vegetation patterns from that time period. This historical vegetation pattern depicts the management regimes of the 1800's, with fires happening frequently. In 1900, most of the landscape of the Deer Creek Watershed was either open or woodlands, with 0 board-feet[1] per acre. The uplands contained some forest zones, with 10 to 25 thousand board-feet (MBF) to the acre.

[1] A volume measure of merchantable trees to a certain top diameter; there may have been trees, but no merchantable timber.



Map 2:1. 1900 Vegetation in the Deer Creek Watershed

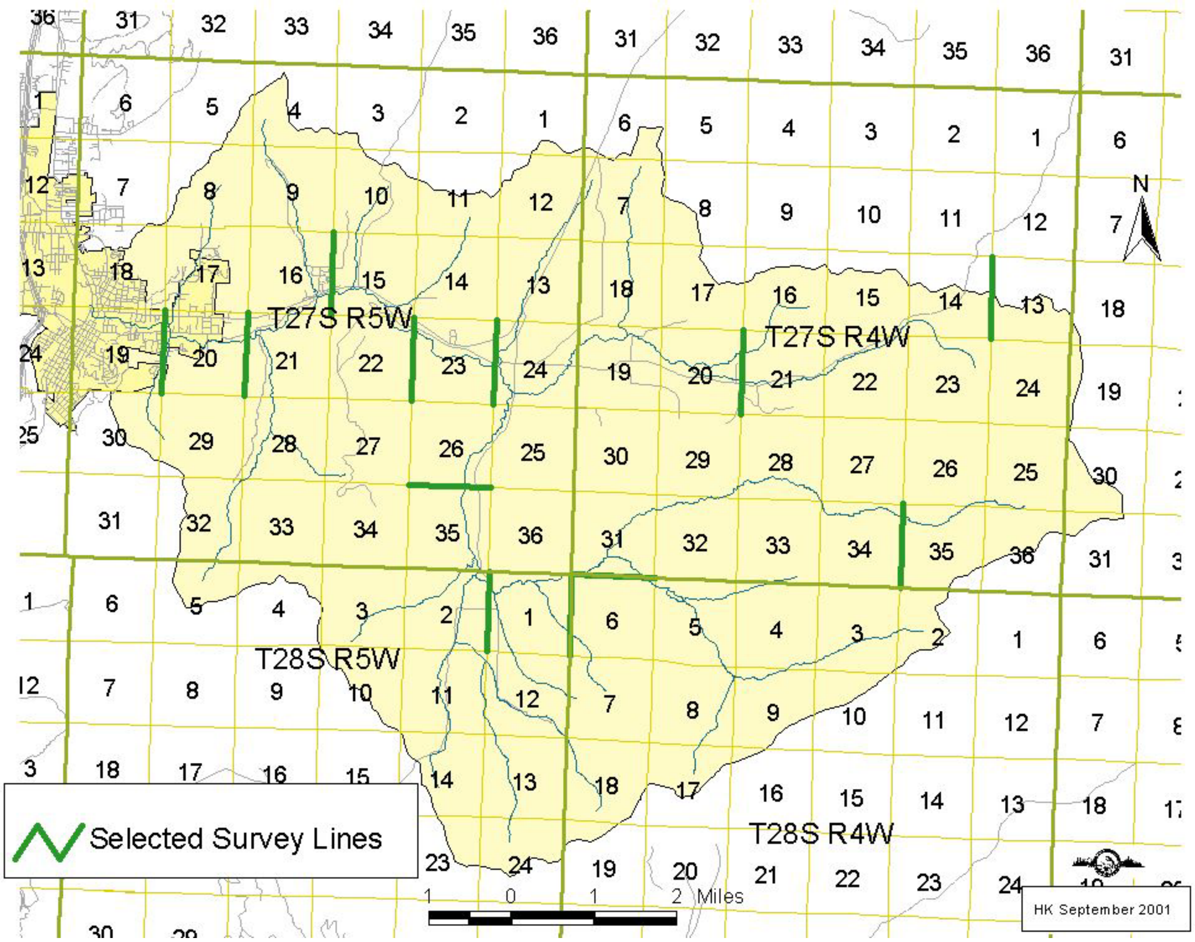
Government Land Office Public Land Surveys

Public Land surveys were conducted by the Government Land Office (GLO, now the Bureau of Land Management) between 1851 and 1854 in order to delineate Townships, Ranges, and Sections. As the surveyors walked and marked the lines, they took notes about different geologic and vegetation observations. Twelve section lines that cross Deer Creek and its tributaries were researched in order to learn about the vegetation in the area during this time period (Map 2:2). The surveys revealed that the landscape was mostly prairie and open woodland. The riparian areas documented consisted of brush and brushy timber, surrounded by prairie. A summary of the vegetation recorded for a sample of section lines is given in Table 2-2. All twelve selected surveys appear in Appendix C in their entirety.

Location	Vegetation Observations
Deer Creek:	
T27S R5W 19E T27S R5W 20E	Land mostly prairie with scattered pine and oak. Some brushy timber along Deer Creek.
T27S R5W 16E	Rolling prairies and hilly oak openings with scattered oak.
T27S R5W 22E	Mostly prairies with oak openings on hills. Brush along Deer Creek.

T27S R5W 23E	Land mostly high rolling prairie with scattered oak and ash, some timber and brush on hills.
North Fork Deer Creek:	
T27S R4W 20E	Prairie and timber of few scattered oak, laurel, and ash.
T27S R4W 14E	Timber of fir, oak, cedar, hemlock, ash, and laurel. Diameters of oak range from 12 to 22 inches.
South Fork Deer Creek:	
T27S R5W 35N	Part prairie, part oak openings and part brushy fir timber.
T28S R5W 2E	Land mostly prairie with scattered oak and pine. Some brushy timber along South Fork Deer Creek.
T28S R5W 1E	Land high hills with oak and fir timber.
T28S R4W 6N	Timber of fir and ash, with an undergrowth of brush oak.
T27S R4W 34E	Timber of fir, oak, cedar, madrone, and laurel.

Table 2-2. Vegetation Observations of 1850's Public Land Surveys.



Map 2:2. Public Land Survey Section Lines.

2.3. Resident Interviews: Historical Information

Interviews were conducted with long-time residents and people who worked in the Deer Creek Watershed. Those interviewed were familiar with Deer Creek within Roseburg, North Fork and

South Fork Deer Creeks. The following comments describe their memories of the Deer Creek Watershed.

Land Use

Dairies: Historically, there were five dairies on South Fork Deer Creek. The landowner remembers them all being situated within 200 yards of the creek.

Agriculture: About a century ago, grain was grown on these hills and most of it was used to feed the horses that harvested it. Later, the ground was tilled every year for farming and planted with oats or vetch. In 1949 the lands were put into permanent pasture with a mix of annual clover and perennial rye grass. This system produces more food per acre for the animals. The clover has nitrogen nodules which produce nitrogen for the rye grass, so only phosphate fertilizer is needed. As the fields are now in permanent pasture, annual tilling no longer occurs, reducing erosion. Most ranches are more concentrated than they used to be. Whereas with the tilling and growing of oats, a farmer could have one sheep to five acres, now he can have five sheep to one acre.

Sheep were once very prevalent in the watershed, but have declined as ranchers have converted to cattle due to predator problems and a declining market for sheep.

Currently very little grain is grown. It might be grown occasionally as a fallow crop so that the ground can be sprayed to eliminate unwanted grasses.

There were also many turkey farms in the Deer Creek Watershed (1930s and 1940s) and five turkey killing plants in Roseburg. Turkey farms were prominent, with numbers such as 2000 turkeys, many of which were sold at Thanksgiving time except for the laying hens, which were kept over winter.

In the 30's and the 40's there were many prune orchards and also some apple orchards. However, the quantities produced by these trees are less than by those in areas along the Columbia. Currently there is still some production of fruit, walnuts, and strawberries.

Logging: In the 40's through the mid 50's there were about 15 sawmills in the South Fork Deer Creek area. These people did not have any guidelines, just worked hard but probably caused damage. Families usually congregated near the sawmills, with up to ten houses per sawmill.

Mining: There has been little or no gold mining in the Deer Creek Watershed, although there has been gravel mining.

Railroads: The landowners are unaware of any railroads having been in the Deer Creek Watershed.

Irrigation Ditches: The landowners are unaware of any irrigation ditches having been in the Deer Creek Watershed.

Urbanization: *From Dixonville up the South Fork Deer Creek wells were not successful, so the creeks were the water sources, therefore, almost all houses were built close to the creek. Now they are supplied with city water. It is likely that old septic systems have failed, as much of upper South Fork Deer Creek is in black mud. Many systems have been repaired, and should be contributing less to the creek.*

There is less industry now in the rural part of the Deer Creek Watershed than in the past. Building is only sporadic, except for along the mainstem near the Urban Growth Boundary.

Native American Presence: *There was extensive fishing done in the Deer Creek Watershed by Native Americans. This is evidenced by the many weir weights found by landowners along South Fork Deer Creek. Many bowls and arrowheads have been found in the South Fork Deer Creek area, where there is supposedly also a burial ground. A special moss grows at the bend in the South Fork Deer Creek that was used as a sort of baby diaper.*

Landscape Vegetation

A landowner recalls that the south-facing oak and madrone hills are typical of historic vegetation, but the north slopes used to have patches of timber and at the turn of the century much pine could be found on the slopes. Many slopes have been cleared and converted to permanent pasture.

The Himalayan blackberries have proliferated in the last ten years, especially on the hills near South Fork Deer Creek. A landowner suspects that the sheep used to keep them under control.

Riparian Vegetation

Riparian trees are mostly alder and cottonwood trees and not many willows. People used to remove debris and sediment out the river with a cat and put the creek where they believed it to belong.

Stream channel/bank

Several properties have experienced erosion over time, losing up to 30 horizontal feet and leaving high vertical banks that continue to slough in high water events. Some properties have received intensive enhancement work, which included planting trees and native plants and filling in eroded areas where the bank has now accumulated dirt and widened.

One significant change a landowner has observed is the increase in gravel. South Fork Deer Creek had a bedrock bottom in the 1940's. Much gravel has been deposited in floods, but now the channel is getting deeper again. It is evident that the channel has moved much, because of the large amount of gravel found under the topsoil in many places outside of the current riparian area and stream channel.

Wood in stream

During large floods, a landowner has seen large pieces of wood floating down Deer Creek. In some areas wood in the stream causes problems as it deflects water into fields and therefore the landowners often cut the wood into smaller pieces, so that it will move down the system.

Flooding

Since 1950, the Douglas County Public Works Department has recorded Deer Creek being above flood stage thirteen times. But in the last few years Deer Creek has been experiencing a drought. According to stories passed along, there seem to have been more floods before 1950.

This was confirmed by another interview. The early 50's (1947 – 1953) had several years of flooding which washed out bridges for three consecutive years. These floods had a large effect on Deer Creek below the confluence with Tucker Creek, where the valley broadens. Above this point, the creek is bordered by steeper slopes and has not changed its position as much. In 1964 there was a large flood, where in one night six inches of rain fell.

Water Quality

One landowner recalled seeing mutated frogs in an unused pond that was believed to have arsenic in it. Water from a millpond used to be dumped directly into the North Fork Deer Creek, leaving suds one foot deep and rocks slippery with oil. Water from a log pond is still put into a different section of Deer Creek.

Wildlife – South Fork Deer Creek

According to landowners,there are many eagles, hasks, coyotes, owl, bobcats, cougars, otters, ringtail cats, and foxes, as well as signs of bear activity. Additionaly, it seems that the deer population has moved from the uplands to the low areas, pssible because of the predator problems in the hills. Predators, especially coyotes, have also been one reason fro some landowners to end their sheep raising operations.

There seems to have never been many beaver in the area, and the rodent population has also decreased. The duck and goose populations were never zero, but have increased dramatically.

Several landowners on South Fork Deer Creek have worked to accommodate wood ducks, mallards, and screech owls. The increase of ducks has also brought an increase of hawks and other predators.

According to local landowners, two species found in the Deer Creek Watershed that have created problems are the great blue heron and nutria. Predation by the great blue heron appears to have caused pond turtle populations to decline, while the nutria damage stream banks through burrowing. One nutria killed in the Deer Creek Watershed reportedly weighed over 45 pounds.

Non-native Species

Thistles have increased in the last 35 years, but a biological control is being sought. There have also been problems with Tansy ragwart, for which there is currently a biological control. The Himalayan blackberries have proliferated in the last ten years, especially on the hills near South Fork Deer Creek.

Land Enhancement Work

Some landowners have performed considerable enhancement work on their property. On such landowner has built twelve ponds for the cattle, which provides water for them away from the creek. He has built many feeding pads, which draw the cattle away from the creek and reduce run-off to it. Approximately 40 culverts have been installed where there used to be hardened crossings that produced sediment in the creek. He has also sloped the streambanks and rocked them at the cattle crossings, as well as rocking many roads.

Another landowner has significantly enhanced tree growth on his property and built wildlife habitat.

Landowner Project Ideas

When asked, landowners gave the flowing ideas for projects to enhance the watershed: build bridges, construct a dam, fix septic tanks, and manage road run-off.

2.4. Historical Fish Observations

There is very little documented information on fish use or habitat before the 1970's. In 1970 and in 1976, the Oregon Department of Fish and Wildlife (ODFW) conducted stream surveys in Deer Creek. The stream surveys were conducted for seven miles of Deer Creek, three miles of DaMotta Branch, six and one-half miles of North Fork Deer Creek, eleven miles of South Fork Deer Creek, and four miles of the South Branch of South Fork Creek. The stream survey information included observations of fish use, channel habitat, and water quality. These surveys documented estimates of adult spawning coho salmon and steelhead, maximum water temperature, miles of man-caused channel change, stream bank habitat modified, streambed silted, turbidity, and dry channels. In addition, the surveys described fish passage barriers, miles of fish habitat blocked, barriers to be removed, and miles of critical habitat.

Information from the 1970 surveys described pollution and modified habitat in the lower portion of Deer Creek. These observations stated that log ponds, oil and wash racks, septic tanks, drainfields, and garbage polluted the first two miles of Deer Creek. In the next four miles stream banks were washing away in high water, and for all seven miles of Deer Creek much of the gravel had been filled with silt. Furthermore, these same 1970 observations stated that the water of DaMotta Branch was consumed through water withdrawals.

According to the 1970 surveys, the North Fork Deer Creek contained a six-foot dam passable by fish at certain water levels. This dam now has a fish ladder. Altered stream banks that were washing badly characterized the first three miles of the North Fork; and in the first five miles about 20% of gravel had been filled with silt.

The 1970 surveys stated that the first seven miles of the South Fork Deer Creek had very low water. The survey noted that the first five miles of the South Fork had areas of stream bank erosion and loss of bank habitat, with about 20% of the gravel filled with silt. In the South Fork of South Fork Deer Creek, there were observations of limited water flows.

The following graph (Figure 2-1) shows the annual adult spawning (escapement) population in 1976[2]. The largest observed populations of spawning fish were found in the South Fork, followed by the North Fork.

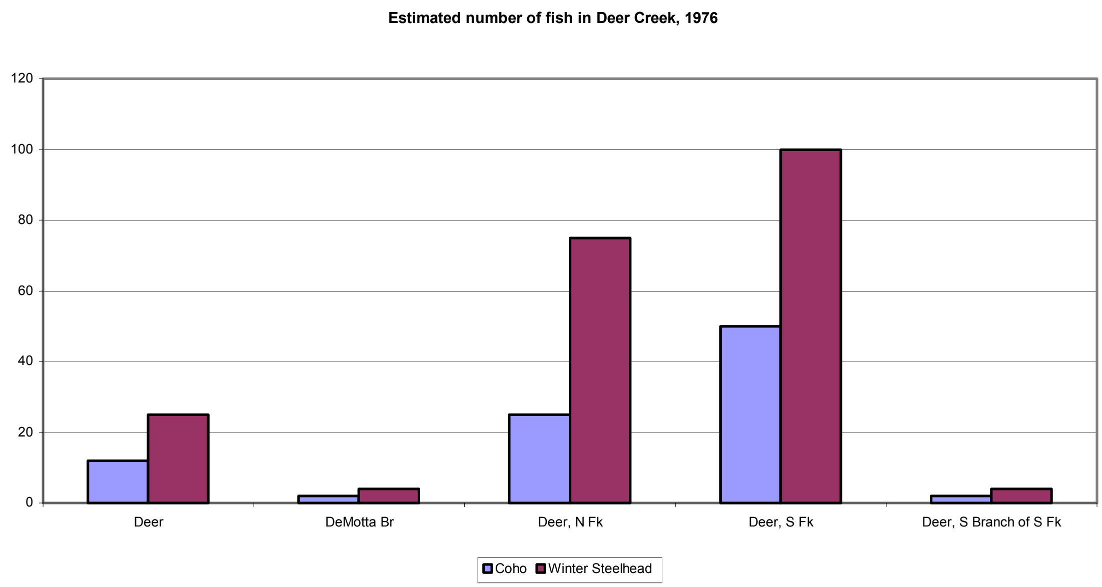


Figure 2-1. Estimated Number of Fish in Deer Creek, 1976

During the 1976 stream habitat surveys, which were conducted during the months of July and August, the maximum water temperatures ranged between 65 and 70° F. In addition, the 1976 observers recorded that the first two miles of Deer Creek were chemically polluted[3] during the months of May through October. During the summer, 1.5 miles of DaMotta Branch went dry.

According to the 1976 survey, the miles of streambank habitat modified[4] were: one mile of Deer Creek, 0.5 miles of North Fork Deer Creek, and one mile of South Fork Deer Creek. The miles of streambed silted were: two miles of Deer Creek, one mile of North Fork Deer Creek, and two miles of South Fork Deer Creek. Two miles of Deer Creek, three miles of North Fork Deer Creek, and seven miles of South Fork Deer Creek were observed to have moderate turbidity that interfered with angling.

Interviews

Interviews with landowners on North Fork and South Fork Deer Creeks revealed that there were once steelhead in the North Fork. In the last ten years, however, there have not been any steelhead observed. In contrast, the South Fork has steelhead every year. There have also been sea-run cutthroat trout in the South Fork every year for at least the past 22 years.

[2] The biologists were instructed to use their best estimates in the cases in which they did not have data, but did not keep records showing in which cases they made these estimates.
[3] The survey report did not specify method of determining chemical pollution.
[4] The survey report did not specify the cause of damage, or the extent of the modification.

Fish observed in the South Fork Deer Creek include sculpin, dace, and Pacific lamprey. The Pacific lamprey population in the past seems to have been larger than it is today. Historically, they composed a main staple in the Native American's diet.

Coho usually come into Deer Creek in November. There have been 60 to 100 per year in the past years. Coho do not need much water to get up the creek, and have been seen moving quickly through water that only reaches to half their height.

About 10 years ago hatchery fish (coho) were released in South Fork Deer Creek and three years later there were many fish in the creek. Fish are found in Tucker, Melton, and Hoot'n'Holler Creeks. Most of the tributaries to South Fork Deer Creek dry up in the summer and many fish do not survive in the ponds. Last spring the landowners observed many fish spawning in the creek.

3. Current Conditions

3.1. Stream Function

3.1.1. Stream Morphology – Fish Habitat

Stream Gradients

Deer Creek and its tributaries have been divided into three categories based on gradient. These categories fulfill different functions in the woody debris flow system and gravel movement. The steepest category (category III) contains all streams with a gradient greater than 30%, and is called the source area (where most of the wood and gravel enters the stream system), and is rated as poor in fish productivity. Category II, the transport zone, has slopes from 3% to 30%, is moderately productive for fish, and is a transitional area for large wood and gravel. Category I, deposition zone (where the wood and gravels become lodged for longer periods), has gradients less than 3%. The deposition zone is the most productive area for fish, containing primary spawning and rearing habitat, with deeper pools and complex habitat for fish to hide and feed in. (Montgomery and Buffington, 1993)

The miles of creek by gradient class are listed in Table 3-1. Almost the entire length of Deer Creek has a gradient less than three percent, as well as the lower three quarters of North Fork Deer Creek and of South Fork Deer Creek. There are only 0.21 miles with a gradient greater than 30%.

Gradient Class	Length (miles)
<=3%	41.75
>3%, <=30%	26.11
>30%	0.21

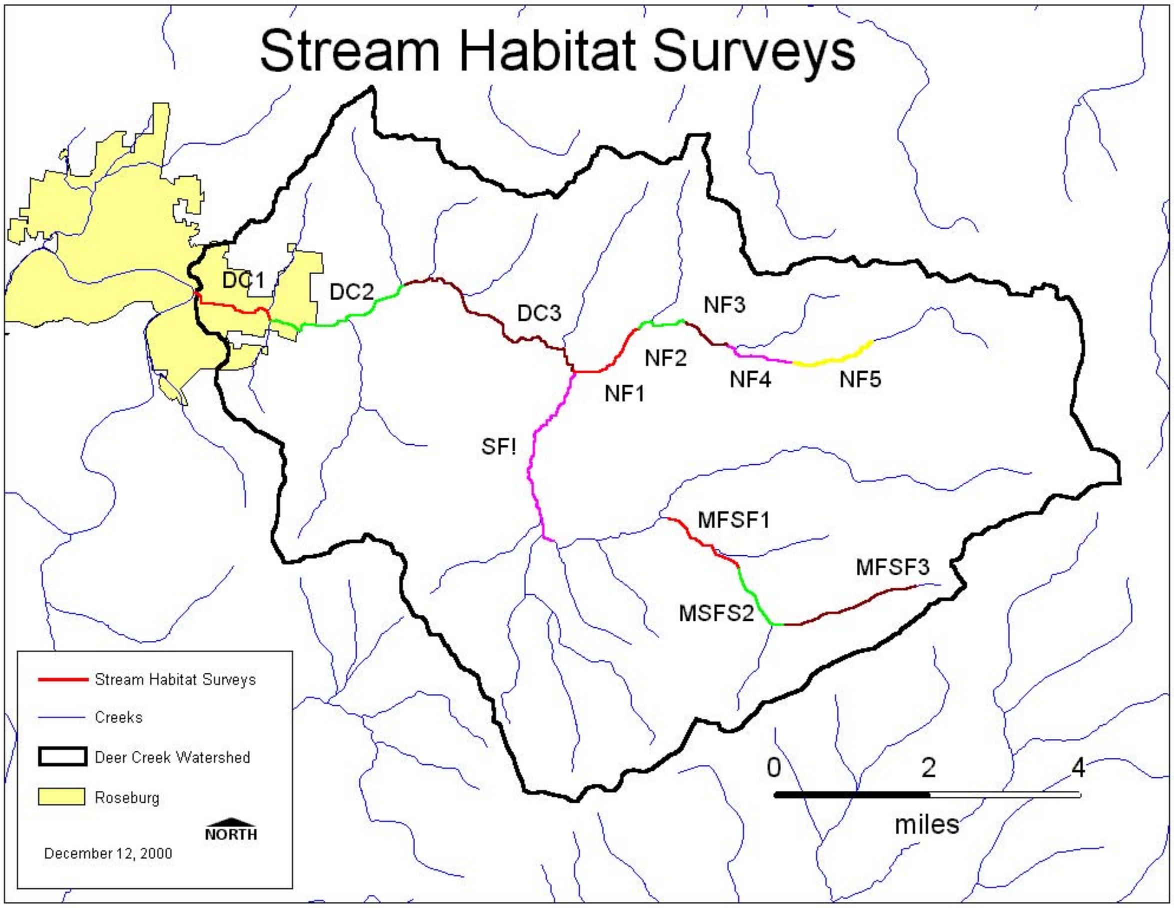
Table 3-1. Miles of Deer Creek by Gradient Class

The miles of creek were also divided based on gradient to describe the lengths of stream potentially open to different fish species (Map 3:8). Typically coho salmon inhabit streams with a gradient less than 4% which covers 48 miles of the watershed, and cutthroat trout, which often inhabit waters up to a gradient of 15%, have potential habitat in an additional 18 miles of the watershed. Two miles of stream have a gradient greater than 15% and are not suitable for fish habitat.

Stream Habitat Surveys

In 1993 and 1994[5], employees of ODFW performed stream habitat surveys along 6.4 miles of Deer Creek, 2.8 miles of South Fork Deer Creek, 4.2 miles along Middle Fork South Fork Deer Creek[6], and 4.9 miles along North Fork Deer Creek (See Map 3:1). For the purpose of these surveys, each of the sections surveyed were subdivided into “reaches.” A reach is a section of stream with similar channel and riparian habitat characteristics. The average reach length in Deer Creek is 1.5 miles.

[5] Stream conditions may have changed since 1994.
[6] Middle Fork South Fork Deer Creek is also known as Ingram Creek.



Map 3:1. Stream Habitat Surveys from 1993 and 1994.

The ODFW developed habitat benchmarks to interpret the values of the stream habitat measurements. This assessment includes nine measurements that were selected because they are important for fish habitat. These measurements have been grouped into four categories: Pools, riffles, riparian areas and large instream woody material. Table 3-2 provides the habitat measurements and parameters included in each category. The stream habitat benchmarks rate the values of the components of the survey in four categories: excellent, good, fair, and poor. For the purpose of this watershed assessment, "excellent" and "good" have been combined into one "good" category.

Habitat characteristic	Habitat measurements used to create the rating	Benchmark values		
		Good	**Fair**	**Poor**
Pools	1. **Percent area in pools:** percentage of the creek area that has pools 2. **Residual pool depth:** depth of the pool (m), from the bottom of the pool to the bottom of the streambed below the pool a) small streams b) large streams	1. > 30 2a. > 0.5 2b. > 0.8	1. 16-30 2a. 0.5 - 0.3 2b. 0.8 - 0.5	1. <16 2a. < 0.3 2b. < 0.5
Riffles	1. **Width to depth ratio:** width of the active stream channel divided by the depth at that width 2. **Percent gravel in the riffles:** percentage of creek substrate in the riffle sections of the stream that are gravel 3. **Percent sediments** (silt, sand, and organics) **in the riffles:** percentage of creek substrate in the riffle sections of the stream that are sediments	1. ≤ 20.4 2. ≥ 30 3. ≤ 7	1. 20.5-29.4 2. 16-29 3. 8-14	1. ≥ 29.5 2. ≤ 15 3. ≥ 15
Riparian	1. **Dominant riparian species:** hardwoods or conifers 2. **Percent of the creek that is shaded** a) for a stream with width < 12 m (39 feet) b) for a stream with width > 12m	1. large diameter conifers[7] 2a. > 70 2b. > 60	1. medium diameter conifers & hardwoods 2a. 60 – 70 2b. 50 – 60	1. small diameter hardwoods 2a. < 60 2b. < 50
Large Woody Material in the Creek	1. **Number of pieces of wood**[8] per 100m (328 feet) of stream length 2. **Volume of wood** (cubic meters) per 100m of stream length	1. > 19.5 2. > 29.5	1. 10.5-19.5 2. 20.5-29.5	1. < 10.5 2. < 20.5

Table 3-2. Stream Habitat Survey Benchmarks.

Pools are important because they provide resting places for fish and deep pools can be protective pockets of cool water during the hot season. Riffles provide salmonid spawning ground, and

[7] See Appendix D for a complete description.
[8] Minimum size is 6 inch diameter by 10 ft length or a root wad with at least a 6 inch diameter stem.

gravel is the preferred substrate for redds. High levels of sediment can bury eggs and suffocate the developing fry. The riparian habitat is important for large wood recruitment, which provides stream complexity, and shade. Large conifers and hardwoods are more valuable than small ones because they decompose more slowly and are less likely to be washed away. Shade can limit stream warming from solar radiation. Finally, in-stream wood increases stream complexity that provides food and cover. Instream wood can interact with the stream channel to form pools and add cover to pools, which protects the fish.

For this assessment, the UBWC developed a method to simplify the stream data by rating the habitat category by its most limiting factor. For example, there are two components that determine the "pools" rating: percent area in pools and residual pool depth. If a reach of a small stream had 50% of its area in pools, then according to Table 3-2, it would be classified as "good" for percent area in pools. If average pool depth on the same reach is 0.4 meters in depth, this reach would have "fair" residual pool depth. This reach's classification for the pools habitat category would be "fair". Most habitat categories need a combination of components to be effective, and therefore are rated by the most limiting factor, in this case pool depth.

The benchmark ratings should not be viewed as performance values, but as guides for interpretation and further investigation. Streams are dynamic systems that change over time, and the stream habitat surveys provide only a single picture of the stream. The benchmarks used to rate each parameter are based on "ideal" fish habitat conditions, and may not reflect what an individual stream reach can achieve. For each habitat variable, the historic and current events must be considered in order to understand the significance of the benchmark rating. Take, for example, a stream reach that is rated as "poor" for instream large wood. Closer investigation could uncover that this stream is located in an area that historically never had any large riparian trees. Failing to meet the benchmark for instream large wood may not be of concern if this is the stream's normal condition.

On the other hand, meeting a benchmark does not necessarily mean all is well. A stream reach with no riparian trees could meet its benchmark for large instream wood because of instream wood placement, which addresses the short-term problem, but not the long-term one if that stream reach has no natural sources of woody material.

It is also useful to consider the combinations and interactions of stream habitat features. For example, large wood within a stream will often interact with the channel to form pools. If a stream has poor large woody debris and poor pools, efforts to improve large woody debris may also improve pools.

In the case of Deer Creek Reach 1, 13% of the length of this reach is in pools. According to Table 3-2 this would receive a "poor" rating. The other component is residual pool depth, which in Deer Creek Reach 1 is 0.7 meters, which receives a "fair" rating. Thus, the combined pool rating for Deer Creek Reach 1 is "poor", because pools need a combination of the components to be effective and are therefore rated by the most limiting component. The ratings for all reaches surveyed are displayed in Table 3-3

Stream	Reach	Pools	Riffles	Riparian Area	LWM
DEER CREEK (DC1)	1	●	●	●●	●
DEER CREEK (DC2)	2	●●●	●	●	●
DEER CREEK (DC3)	3	●●●	●	●●	●
SOUTH FORK DEER CREEK (SF1)	1	●●	●	●●	●
MIDDLE FORK SOUTH DEER CREEK (MFSF1)	1	●	●●●	●	●
MIDDLE FORK SOUTH DEER CREEK (MFSF2)	2	●●	●●●	●	●
MIDDLE FORK SOUTH DEER CREEK (MFSF3)	3	●●	●●●	●	●
NORTH FORK DEER CREEK (NF1)	1	●●●	●●	●	●
NORTH FORK DEER CREEK (NF2)	2	●●●	●●●	●	●
NORTH FORK DEER CREEK (NF3)	3	●●●	●●●	●	●
NORTH FORK DEER CREEK (NF4)	4	●●●	●●●	●	●
NORTH FORK DEER CREEK (NF5)	5	●●	●●●	●	●

Table 3-3. Rating of Pools, Riffles, Riparian Area, and LWM in Deer Creek •••=Good , ••=Fair, •=Poor

Overview of Conditions

Several reaches of the mainstem and the forks have similar ratings of the stream habitat components.

- All of the reaches, with the notable exception of the last reach of Middle Fork South Fork are severely limited in the amount of large wood in the channel[9]. Large wood in the channel affects the number and depth of pools, which provide cover for fish.
- The North Fork is the only area that has good width to depth ratios. Deep, narrow channels tend to be cooler and provide better habitat than wide, shallow waters.
- The percent of sediment in the riffles is highest in the mainstem. This is typical for this type of creek, as the mainstem has the lowest gradient and the water often moves slowly, causing the sediment to fall out of suspension. Sediment in the riffles is detrimental to the redds, as it reduces the inter-gravel dissolved oxygen levels.
- The percent of gravel in the riffles is good for the entire system. It could be due to the lack of large wood in the channels, which would allow the gravel to travel freely. Gravels in the riffles are important for spawning beds.
- The amount of shade provided over the creek is good in the North Fork, except for the first reach located in Dixonville. The shade along the mainstem is rated as fair. Shade is important to limit increasing water temperatures by heat radiation.

Following is a detailed description of each reach.

Deer Creek – Reach 1

This reach is located within Roseburg and is primarily surrounded by urban land use. All stream habitat categories are rated as poor, except the riparian area which is rated as fair, with deciduous riparian trees of an average diameter of twelve inches. Figure 3-1 portrays the actual values of each component and how it is rated. Similar graphs for the other reaches can be found in Appendix A.

[9]Trees are the primary natural source of large woody material in streams. Historical vegetation records describe areas of the Deer Creek watershed as grassland with few trees. Therefore, lack of large woody debris may not be abnormal for some reaches of Deer Creek.

In Deer Creek Reach 1, the percent of the reach in pools is 13.6 and the residual pool depth is 0.7 meters (2.3 feet). According to the benchmarks, which are visually depicted behind the columns representing each component, the percent in pools is rated as "poor," and the residual pool depth is rated as "fair." The next three columns compose the gravel rating: width to depth ratio is rated as "fair," percent silt as "poor," and percent gravel as "good." Shade (67%) is depicted in the 6th column and is rated as "fair." There are few large woody material (LWM) pieces and little volume and therefore rated LWM is rated as "poor."

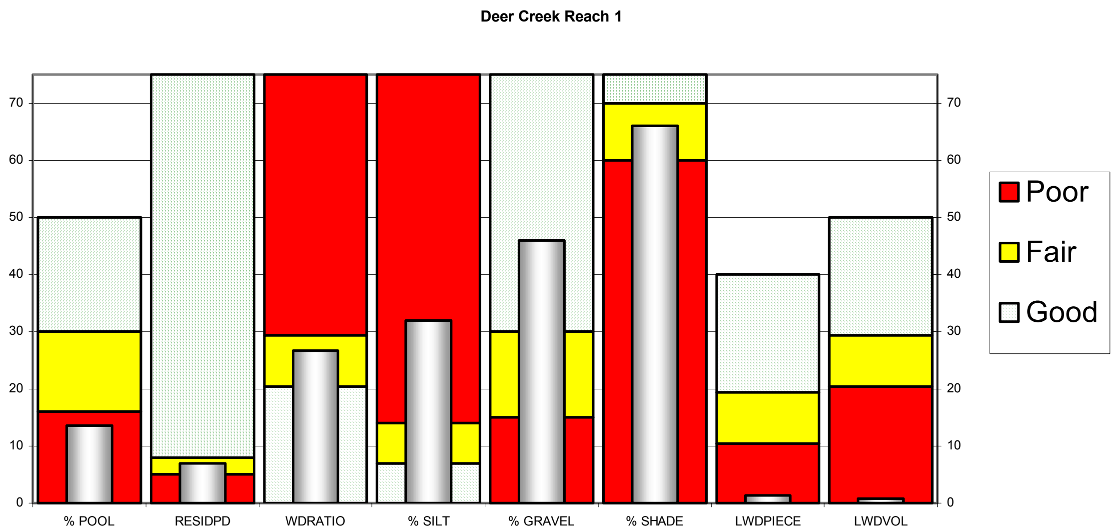


Figure 3-1. Stream Habitat Survey Components in Deer Creek Reach 1.

Deer Creek – Reach 2

Approximately one quarter of this reach is located within the Urban Growth Boundary of Roseburg. The creek is surrounded by urban, residential, rural residential, and agriculture land uses. All of the stream habitat components[10] are rated as poor (Appendix A, Figure 5-2). The only portion of this reach rated as fair is the composition of the riparian area, which fit in the category of 12-inch average diameter deciduous trees.

Deer Creek – Reach 3

Reach 3 is bordered by mostly agriculture and some rural residential properties. The large wood in the channels and riffles are rated as poor, the pools are rated as fair, and the shade from the riparian area slightly less than "good" (Appendix A, Figure 5-3). The trees in the riparian area are 12-inch average diameter deciduous trees, and are rated as fair.

[10] Stream habitat components are the combined values that evaluate pools, riffles, riparian areas, and large woody material.

South Fork Deer Creek

This reach is surrounded predominately by agriculture, along with a few residences. The riffles and the large wood in the channel are rated as poor, however, the riffle habitat is rated close to fair (Appendix A, Figure 5-4). The pools and riparian area are rated as fair.

Middle Fork South Fork Deer Creek – Reach 1

This reach is surrounded by agriculture and timberland. The pools and the large wood in the channel are rated as poor (Appendix A, Figure 5-5). In contrast, the riffles are rated as good. The trees in the riparian area provide good shade, however, they are deciduous trees and only about 1 inch in diameter and are thus rated as poor.

Middle Fork South Fork Deer Creek – Reach 2

Mostly lands used for grazing and some timberland surround this reach. The pools are in poor condition, but the riffles are rated as good (Appendix A, Figure 5-6). The large wood in the channel, usually associated with pool habitat, has a poor rating. The trees of the riparian area, which are mostly deciduous, provide fair shade, however, their size which averages six inches in diameter is rated as poor.

Middle Fork South Fork Deer Creek – Reach 3

Forest management with mostly young timber characterizes the land use in this portion of the creek. The pools, riparian area and large wood in the channel are rated as poor in this reach, while the riffles are rated as good (Appendix A, Figure 5-7). The trees in the riparian are composed of small (1.2 inches average diameter) mixed species, and thus are rated as poor.

North Fork Deer Creek – Reach 1

The primary land use surrounding North Fork Deer Creek is livestock grazing. This reach also contains a significant rural residential component. The pools and riffles are rated as fair, while the riparian shade and large wood in the channel are rated as poor (Appendix A, Figure 5-8).

North Fork Deer Creek – Reach 2

The land use along this reach is characterized by agriculture and some rural residential properties. Although the large wood in the channel is rated as poor, the pools in this reach are nearly rated as fair (Appendix A, Figure 5-9). The riparian shade is rated as fair, however, the trees, which are mostly six inch deciduous, are rated as poor.

North Fork Deer Creek – Reach 3

This reach is characterized primarily by agriculture land uses with some rural residential properties. The pools are rated as poor, with decreasing residual pool depth as the creek is followed upstream toward the headwaters (Appendix A, Figure 5-10). Large wood in the channel, usually associated with pool depth, is rated as poor. The riffles are rated as good. The riparian area is rated as poor with deciduous tree diameters averaging 5.9 inches.

North Fork Deer Creek – Reach 4

This reach is characterized primarily by agriculture land uses with some rural residential properties. The pools are rated as poor, with decreasing residual pool depth as the creek is followed upstream toward the headwaters (Appendix A, Figure 5-11). Large wood in the channel, usually associated with pool depth, is rated as poor. The riffles are rated as good. The riparian area is rated as poor with deciduous tree diameters averaging 5.9 inches.

North Fork Deer Creek – Reach 5

This reach is characterized primarily by agriculture land uses with some rural residential properties. The pools are rated as poor, with decreasing residual pool depth as the creek is followed upstream toward the headwaters (Appendix A, Figure 5-12). Large wood in the channel, usually associated with pool depth, is rated as poor. The riffles are rated as good. The riparian area is rated as fair with deciduous tree diameters averaging 12 inches.

Other Reaches

Stream Habitat Surveys were not conducted along all parts of Deer Creek and its tributaries. With missing stream habitat information, it is difficult to identify key limiting factors and thus prioritize these reaches for restoration activity.

Action Recommendations

- *Resurvey stream habitat surveys 20 years from last survey.*
- *Conduct stream habitat surveys on the unsurveyed reaches of South Fork Deer Creek.*
- *Enhance riparian areas with trees for a current source of shade and nutrients, and a future source of structure in the creek (see 3.3.2 Temperature).*
- *Consider adding wood to stream segments with an active channel less than 30 feet wide on a case-by-case basis. Stream segments with an active channel less than 30 feet wide include North Fork Deer Creek, Middle Fork of South Fork Deer Creek, parts of South Fork Deer Creek, and many tributaries.*

3.1.2. Connectivity – Passage barriers

Fish passage barriers can affect fish populations by "disconnecting" the stream network. Passage barriers can affect both anadromous and resident fish. Anadromous fish, such as salmon, cannot access spawning areas above the culvert. Resident fish, such as trout, are prevented from moving through the stream system, which can limit access to needed habitat, for example, tributaries with cool water during the summer.

Fish passage barriers cause significant reduction in useable stream habitat and associated fish production (John Runyon, Fish Passage Short Course 2000). Culverts can be barriers to fish passage if fish cannot enter culverts or fish cannot pass through culverts. Fish entering into culverts can be hindered if the jump from the water level to the culvert is too high, and/or if the pool preceding the culvert is not deep enough for the fish to gain sufficient momentum to jump. Generally a culvert drop of 2 feet is considered passable for adult salmon, and 0.5 feet for juvenile salmon, both with a pool depth of at least 2 feet. A culvert with a drop greater than 2 feet for adult salmon or 0.5 feet for juveniles, and with a pool depth of less than 2 feet does not necessarily constitute a barrier, but instead may be an obstacle for impediment. The presence of an obstacle means that some fish will still be able to pass, while others will expend so much energy entering or attempting to enter the culvert that they cannot reach their spawning grounds and die or are unable to spawn. Consequently, spawning success declines due to an obstacle.

Passage through the culvert can be too difficult for fish if water velocity is too high. Generally 1% is considered too steep if the bottom of the culvert is bare. Fish are able to pass through streams at higher velocities, but that is because water velocities decline near rocks and other structures where fish can rest. If the culvert is countersunk, a steeper gradient is acceptable, as the bottom of the culvert simulates a natural stream bottom and provides resting areas for fish. Finally, a drop in the water level into the culvert can also produce a velocity barrier to the fish exiting the culvert.

Other fish passage problems occur in temporary artificial diversions that lead to ditches. Fish enter the ditches in the summer, and when the diversion to the ditch is removed, the fish are stranded and die.

Very little information about culvert fish passability exists for the Deer Creek Watershed. Some data on connectivity was collected during the stream habitat surveys conducted in 1993 and 1994 on Deer Creek, North Fork Deer Creek, a section of South Fork Deer Creek, and Middle Fork South Fork Deer Creek. Most of the stream habitat surveys concentrated on the lower portions of Deer Creek where bridges are more common than culverts. Habitat surveys were not completed on the upper tributaries where culverts are more common than bridges. Therefore, the number of culverts in the Deer Creek watershed is underreported in the survey and the total impact of culverts on fish passage is unknown.

The survey results showed that on Deer Creek, North Fork Deer Creek, and South Fork Deer Creek all of the road/stream intersections are bridges. The surveyed portion of the Middle Fork South Fork Deer Creek has two culvert crossings. The survey did not indicate if these were passable to all lifestages of salmonids. On two occasions the survey indicated a step created by a structure (could be a culvert, weir, dam, etc.), and on one occasion it contained a step over logs. These areas could possibly be a passage barrier for small fish and juvenile salmon.

The surveys in 1976 did not record any natural or man-made barriers, with the exception of the six-foot dam on North Fork Deer Creek that now has a fish ladder.

Other information from ODFW revealed that there is a large culvert on South Fork Deer Creek that may not be passable in low water. At the time of this observation there were a good number of fish and redds seen below the survey area. There is also a barrier 0.1 miles East of Strader Bridge where there are a three foot high gabion with no jump pool and two four foot high concrete dams.

Several culverts under roads controlled by the Oregon Department of Transportation have been prioritized by the ODFW. Two of these are located on un-named tributaries of Deer Creek and have a medium priority for being replaced. The third culvert, near the mouth of Schick Creek, has a low priority.

Action Recommendations

- *Obtain permission from landowners to conduct culvert surveys on unsurveyed tributaries.*
- *Improve culverts for passability that have been found to have problems.*
- *Evaluate other barriers.*
- *Screen diversions.*

3.1.3. Stream Meandering - Modification

Channel modifications in Deer Creek include bank stabilization, roads constructed along streams, wetland drainage, and log placements. Riprap and road construction limit the creek's opportunity to meander. This forces streams to adjust to a new pattern, and has an effect of shortening the creek's length and increasing water velocities, which can cause downcutting, bank erosion, loss or accumulation of gravel deposits, and can reduce fish and wildlife habitat in loss of off-channel pools and secondary channels.

In 1988 the staff of the Douglas Soil and Water Conservation District (DSWCD) recorded all areas of channel modification and actively eroding banks along Deer Creek up to the confluence of the North and South Fork Deer Creeks. On the south bank of Deer Creek there were nine recorded riprap sites totaling 2,047 (6% of Deer Creek) feet in length, and eighteen sites on the north side totaling 4,649 feet (13%). Since then the DSWCD has records of two Christmas tree revetments[11], three instream wood placements, one log weir, and three wetland creations that cover an additional 570 (.02%) feet of the creek.

In the fall of 1995, Douglas County Public Works Department repaired eroding fill of a 50 ft wide shoulder of a road along South Fork Deer Creek. This project took approximately 500 cubic yards of pit run rock, and affected approximately 100 feet of stream bank.

High erosion areas are often the effect of modification to the stream channel upstream. Riprap installed without engineering designs often simply transfers the erosion problem further downstream.

Action Recommendations

- *Contact Douglas SWCD or UBWC to design streambank stabilization projects applicable for the site.*

3.2. Riparian Zone Function

The riparian area is the zone adjacent to the stream where the soil is wet and affected by the stream, for example, around springs, ponds, and streams. Trees along a stream shade the water, provide leaves that add nutrients to the system, and supply bank stability. When trees fall into the stream they provide structure that creates pools and cover for fish to hide. Conifers, oak, ash, maple, or cottonwood are species that take longer to decompose than other riparian tree species, providing a benefit to fish habitat for a longer period of time.

[11] Christmas tree revetments are bank stabilization projects using Christmas trees.

3.2.1. Riparian Zone Composition and Function

Non-native Plant Species

Himalayan blackberry is a strongly invasive noxious weed that dominates the riparian area in over 10 miles along Deer Creek and its tributaries. It also composes much of the understory under the hardwood riparian strips. Reed canary grass, which is generally found in the lower part of the watershed, can also be a problem as it competes with natural species, and hinders most any other vegetation from becoming established. These and other non-native species often become established in riparian areas and by their competition prevent the establishment of native plant communities.

In the Lower South Umpqua Watershed Analysis (2000), the BLM documented the occurrence of two other noxious weeds in the area around the Deer Creek Watershed: Yellow Starthistle (*Centaurea solstitialis*) and Rush Skeletonweed (*Chondrilla juncea*)[12].

Native plants are an important part of the local natural ecosystem. Unlike non-native plants which often cover large areas with one species (for example, Himalayan blackberry), native vegetation provides diverse habitats benefiting a variety of wildlife species. They also often have natural competitors and are easier to control.

Riparian Vegetation Analysis

Using aerial photos, the condition of the riparian areas along Deer Creek and 21 tributaries[13] was assessed. This process included identifying various aspects of the riparian area, such as vegetation type.

Each bank was classified separately, since the vegetation on opposite stream banks is often different. In the rest of this assessment, the separate stream banks are labeled as "left" and "right," as they would be if one were standing in the creek, looking downstream. The categories by which the riparian areas were categorized are listed in Table 3-4.

CATEGORY	ATTRIBUTES	AFFECTED RIPARIAN ZONE FUNCTIONS
Vegetation Type	• Conifers[14] • Hardwoods • Shrub/brush • Blackberries • Range/grass • Lawn • Pond • No vegetation (e.g., roads) • Infrastructure (e.g., in culvert, under bridge)	Different types of vegetation create diverse microclimates and provide various types of habitat, food, and canopy cover. Also, tree type is one of the determinations of the quality of large woody material (LWM).

[12] For further information about weeds contact Shelby Filley, the agriculture and livestock agent at the Douglas County Oregon State University Extension office.
[13] These are the same as the creeks depicted in Map 1:2 and include Deer Creek, North Fork Deer Creek, South Fork Deer Creek, and several tributaries.

Streamside Tree Status	• Majority non-tree species • 1 tree width[15] • 2 or more tree widths	Wider buffers have an increased microclimate cooling effect.
Tree Size Class	• Majority non-tree species • <20" diameter • >20" diameter	Tree size influences the longevity of LWM.
Canopy Cover over Stream	• No cover • <50% stream surface covered • >50% stream surface covered	Canopy cover provides shade to the stream, cooling the water.

Table 3-4. Riparian Area Classification

The following tables and figures show the results of the classification. The total length of creeks classified was approximately 67 miles. Hardwood trees dominated the riparian areas (Figure 3-2). The other most common riparian vegetation types were conifers, grass, and blackberries. Grass refers mostly to agriculture fields, but occasionally refers to reed canary grass. Table 3-5 shows the values for each side of the riparian area [16], while Figure 3-2 shows the values for the combined riparian areas.

Vegetation Type	Miles	
	Left Bank	Right Bank
Conifers	10.3 (15%)	7.8 (11%)
Hardwoods	37.1 (56%)	42.1 (63%)
Shrub/brush	1.9 (3%)	1.3 (2%)
Blackberries	5.7 (9%)	4.8 (7%)
Range/grass	9.8 (14%)	9.4 (14%)
Lawn	0.1 (0.2%)	0.04 (0.1%)
Pond	0.6 (1%)	0.6 (1%)
No vegetation (e.g., roads)	0.8 (1%)	0.6 (1%)
Infrastructure (e.g., in culvert, under bridge)	0.4 (1%)	0.4 (1%)

Table 3-5. Length of Riparian Area by Vegetation Type. [17]

[14] If trees cover over 50% of the riparian zone canopy, then vegetation is classified as either conifers or hardwoods based on the dominant tree type.
[15] One tree width is equal to the width of the canopy of one tree. Two or more tree widths describes a riparian area that is deeper than the canopy of one tree.
[16] Percents do not add up due to rounding.
[17] Percents do not add up to 100 due to rounding.

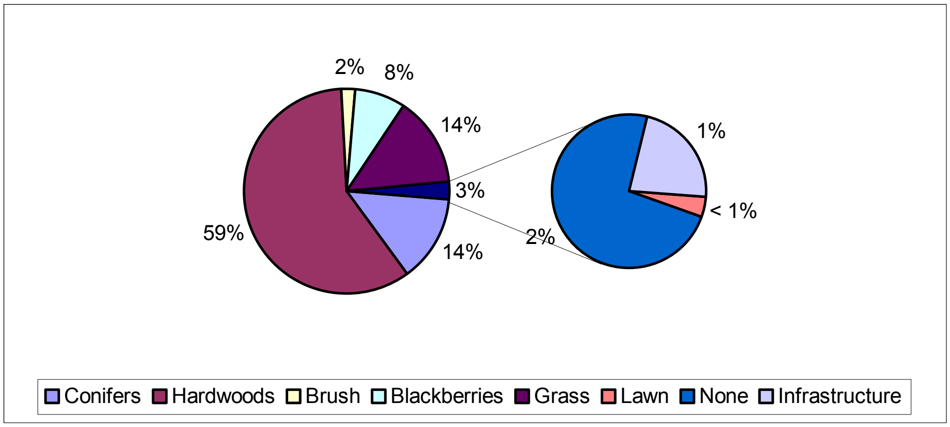
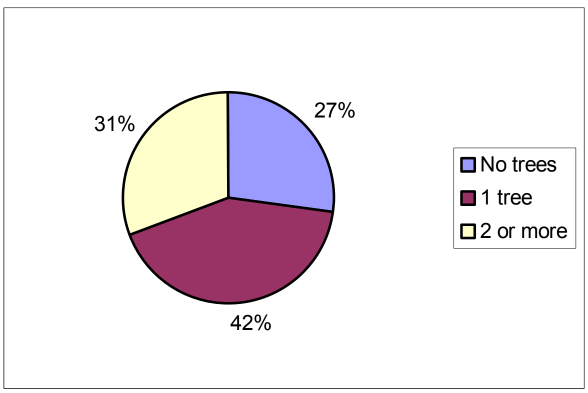


Figure 3-2. Percent Riparian Length by Vegetation Type.

The tables in Figure 3-3, Figure 3-4, and Figure 3-5 show the lengths of riparian areas by tree status, tree size class, and canopy cover separately for each side of the creek and the graphs show the combined values of both sides of the creek.

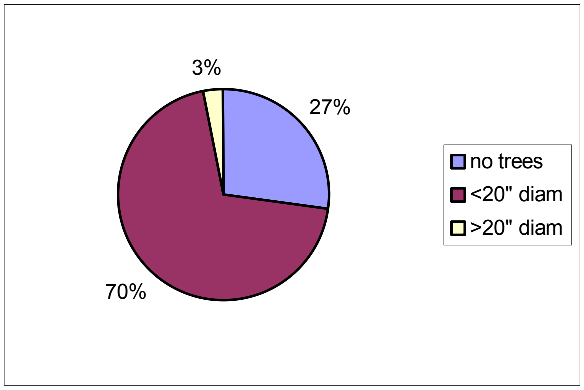


Streamside Tree Status	Miles	
	Left Side	Right Side
Majority non-tree species	19.4 (29%)	17.1 (25%)[18]
1 tree width	25.3 (38%)	31.0 (46%)
2 or more tree widths	22.1 (33%)	19.0 (28%)

Figure 3-3. Percent of Riparian Length by Streamside Tree Status.

The percent of riparian length by the three classes of streamside tree status are displayed in Figure 3-3. The riparian areas are fairly evenly split between zones with little or no trees, one tree wide, two or more trees wide, with a somewhat larger proportion in the one tree width category. The riparian areas with two tree widths or more are located mostly in the upper reaches of the forks and the left side of Deer Creek mainstem, where less housing and industry occur.

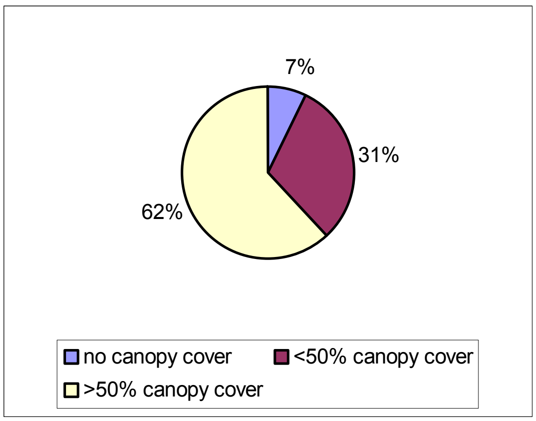
[18] Percents do not add up due to rounding.



Tree Size Class	Miles	
	Left Side	Right Side
Majority non-tree species	19.3 (29%)	17.1 (26%)
<20" diameter	45.6 (68%)	47.7 (71%)
>20" diameter	1.92 (3%)	2.18 (3%)

Figure 3-4. Percent of Riparian Length by Tree Size.

The trees in the riparian areas are predominately smaller than 20 inches in diameter and those that are larger are mostly conifers located in the headwaters (Figure 3-4).



Canopy Cover over Stream	Miles
No cover	4.84 (7%)
<50% stream surface covered	21.4 (32%)
>50% stream surface covered	40.8 (61%)

Figure 3-5. Percent of Riparian Length by Canopy Cover over the Stream.

Thirty-eight percent of the creeks are less than 50% shaded (Figure 3-5). This occurs when the riparian vegetation does not cover the creek on both sides, or when one bank has trees, but the other has vegetation that provides less shade, such as blackberries or grass, and thus there is no crown closure above the creek.

Field Verification

Twenty-nine random segments of the riparian areas that were assessed were field verified: ten segments of Deer Creek, ten segments of the North and South Forks, and nine segments of tributaries. The verification showed that vegetation interpretation from the aerial photos was generally consistent with the vegetation on the ground. The most common classification error occurred in the case where the riparian area consisted of grass with a narrow strip of blackberries along the creek. Sometimes these areas were classified as "grass" or "brush," other times as "blackberries."

There were some misinterpretations of the riparian width. Sometimes it proved difficult to determine one tree width versus two tree widths from the aerial photo; however, this problem did not exist when the riparian area was more than two trees wide.

The size class verification showed that small trees were classified accurately. Only one verification segment contained large trees; therefore, it is difficult to tell the accuracy of the large tree classification. The canopy cover verification also proved to be very accurate.

Analysis

Most of the trees are hardwoods. This is consistent with the historical context and the type of vegetation to be found in the low valleys of this ecoregion. There are also significant riparian areas that are dominated by shrubs/brush, grass, and blackberries. These are areas where removing the invasive plant species and replanting with native vegetation would benefit both fish and wildlife.

Twenty-seven percent of the riparian areas is dominated by non-tree species. According to the historical data there were areas of brush along Deer Creek and therefore these brush areas might reflect historical conditions. Thirty-one percent of the riparian areas are only one tree in width. Theoretically, riparian function would improve if these areas were widened.

The lack of conifers in the riparian areas has an effect on the amount of long-lasting coniferous down-wood, an integral part of fish habitat, in the creeks. The 40% of the creeks with less than 50% cover may contribute to rising water temperatures in Deer Creek.

Action Recommendations

- *Protect riparian areas that have a width of two or more trees from being reduced in width.*
- *Increase canopy cover by planting trees in predominately brush riparian areas. Avoid full-scale soil exposure during the process.*
- *Where feasible, establish conifers and other native vegetation in areas now dominated by blackberries, and other invasive plant species or no tall plants at all.*
- *Manage the riparian areas for tree crown growth.*
- *Manage livestock so that they are not intrusive to the riparian area.*
- *Plant native vegetation.*

3.2.2. Wetland Attributes[19]

Purpose of the Wetlands Assessment

The purpose of this analysis is the identification and evaluation of historical and current stream-associated wetlands and wetlands in uplands, present and potential negative impacts on wetlands, wetlands which are or may become at risk, and key potential restoration areas.

Process of the Wetlands Assessment

Selected wetland functions such as wildlife habitat, water quality (sediment trapping), and hydrologic control (storm water desynchronization and flood water storage) were analyzed, in

[19] This section was contributed by Loran Waldron, Land and Environmental Services. Wetlands are areas that contain wetland vegetation, which is able to live in saturated conditions at least part of its growing season.

addition to other factors. Some of these functions often continue to exist in limited fashion even in significantly degraded wetlands.

Types of Wetlands Present

Review of the U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps for the watershed indicate that the main channels and tributaries of Deer Creek, North Fork Deer Creek, and South Fork Deer Creek are classified as riverine (river) or palustrine (marsh) systems, permanently or seasonally flooded. Intermixed are some areas mapped as forested wetland and some adjacent emergent wetlands occurring on the flat portions of the valley floor.

Deer Creek – Indications of historical wetlands

It is evident from the National Wetlands Inventory (NWI) Maps and the Douglas County Soil Survey that much of the floodplain contained wetlands, closely associated with hydric soils. Some of these wetlands would have been dominated by shrubs and trees, but most were dominated by emergent vegetation such as rushes (*Juncus spp.*) and sedges (*Carex spp.)*. Further from the creek channel wet prairie habitats were more pronounced, dominated by wetland grasses such as tufted hair grass (*Deschampsia cespitosa*).

The Deer Creek valley is fairly narrow and most of the wetlands were closely linked or associated with the creek channel and floodplain. These wetlands would flood or become saturated seasonally, but would dry out completely during the summer season. Some side slope seeps and small isolated wetlands located in depressions containing hydric soil inclusions would have existed in the foothills.

The area near the confluence of Deer Creek and the South Umpqua River was settled early, and commercial and urban development spread east along Deer Creek with the growth of Roseburg. As development spread, wetlands were ditched, drained, or filled.

Deer Creek – Current wetland status

The majority of the wetlands that existed historically along Deer Creek and tributaries within the current Urban Growth Boundary (UGB) of the City of Roseburg have been filled or significantly altered by urbanization and commercial development. Outside the UGB impacts are the result of road building, rural development, prairie fire suppression, and conversion to agriculture and pasture.

The result of these impacts are generally a significant reduction, if not a complete elimination, of wetland function. Few, if any, unaltered wetlands remain in this portion of the watershed.

Deer Creek - Factors and activities that may continue to impact wetlands

Wetlands will continue to be lost or impacted as Roseburg grows east along Diamond Lake Blvd. and Highway 138. It is likely that wetland mitigation will occur for these impacts. Due to the lack of a wetland mitigation bank and the difficulty in acquiring good wetland mitigation property, these mitigation projects will not always be within the Deer Creek watershed.

Although the City of Roseburg enforces planning and development guidelines (such as a 50 foot setback along Deer Creek) and the state regulates wetland fills under the Removal-Fill Law, the lack of a comprehensive wetland conservation plan for Deer Creek places the remaining wetlands at risk. Wetlands currently impacted by agricultural activities may be filled as urbanization and commercial development spreads to include these areas.

Deer Creek – Potential restoration opportunities

There are currently a limited number of wetland restoration and wetland mitigation projects occurring in the Deer Creek drainage. Additional opportunities for restoration exist, mostly outside the UGB. Ramp Canyon, which has been proposed as a wetland mitigation bank in the past, is one example.

A few large areas of farmed wet pasture along Deer Creek and its tributaries that are currently being used for grazing and hay production could be restored to wet prairie. Deeply incised portions of Deer Creek can be reshaped to reestablish the hydrologic connection to the floodplain. Additional possibilities for enhancement or restoration immediately adjacent to the creek or elsewhere within the floodplain are likely to exist in locations yet to be identified. Restoration of forested wetland could take place in conjunction with riparian enhancement.

North Fork and South Fork – Indications of historical wetlands

As along the main stem of Deer Creek, much of the floodplain of the North and South Forks contained wetlands that would flood or become saturated seasonally, but would dry out completely during the summer season. Directly adjacent to the creek many wetlands were dominated by trees and shrubs, or emergent vegetation. Further from the creek channel, wet prairie was the dominant wetland type, with side slope seeps and isolated wetlands in depressions containing hydric soil inclusions located in the foothills. In the higher reaches, where the gradient increases and the floodplain narrows, significantly less wetland existed away from the immediate channel. The flat valley bottoms were settled, with much of the wet prairie being ditched and drained for conversion to agricultural land. Filling and grading of wetlands also occurred, but to a lesser extent.

North Fork and South Fork – Current wetland status

Unlike the main stem Deer Creek, little commercial or industrial development has taken place along the North and South Forks, with the notable exception of the town of Dixonville and the Roseburg Forest Products mill (currently closed and being torn down). The development has been primarily rural farmland.

Some relatively intact wetlands exist directly adjacent to the creek[20], including forested wetlands, dominated by Oregon ash (*Fraxinus latfolia*). Most of the remaining wetlands within the narrow valley floor have been converted to farmed wet pasture and are currently being used for grazing and hay production.

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[20] These are shown on the NWI maps.

North Fork and South Fork – Factors and activities that may continue to impact wetlands

Conversion of wetlands to agriculture and pasture has occurred, significantly altering and reducing wetland functions. Additional agricultural use or intensification of agricultural production, resulting in additional ditching, draining, and filling could further impact wetland functions, or eliminate those functions altogether.

Increasing pressure for residential home sites is also occurring and is likely to further impact remaining wetlands. It is not apparent at this time if additional commercial or industrial development is likely to occur in the near future.

North Fork and South Fork – Potential restoration opportunities

Much of the restoration opportunity along the North and South Forks and their tributaries consists of restoring farmed wet pasture to wet prairie. The best restoration of a wet prairie ecosystem occurs when a large contiguous area is restored within the floodplain. This could be accomplished by identifying and restoring the wettest, lowest value, and most difficult to maintain agricultural lands. Restoration would include filling and blocking ditches, removing or blocking drains, and removing fill to restore the micro-topography.

Another opportunity for riparian restoration is to plant a predominant number of ash trees in the wetter areas adjacent to the creek.

The millpond northeast of Dixonville, located on a small tributary to the North Fork, also presents a restoration opportunity. This impoundment was formed by construction of a large dike across a tributary. Additional study would be necessary to determine the most appropriate restoration approach, but many possibilities exist. Restoring the tributary and riparian zone including forested wetlands and wet prairie, creating several small ponds and marshes with mixed forest and uplands, or enhancing the wetlands around the edges of the existing pond are just a few possibilities.

3.2.3. Stream and Riparian Associated Wildlife[21]

The following Table 3-6 displays the wildlife found in streams and riparian areas of Deer Creek.

Native:

Prey

- Various mice
- Various voles
- Various chipmunks
- Various squirrels
- Cottontail & jack rabbits
- California (Valley) & mountain quail
- Blue grouse
- Ruffed grouse
- Pileated and other woodpeckers

Predator

- Great horned Owl
- North screech owl
- Saw-whet owl
- Pygmy owl
- Sharp-shinned hawk
- Cooper's hawk
- *Northern goshawk*
- Red-tailed hawk
- Grey fox

[21] This section was contributed by or was the result of interviews with Jim Harris, Land Improvement Co.

- Numerous neo-tropical birds
- Black-tail and white-tail deer
- Roosevelt elk
- Various amphibians
- Various reptiles
- Various mollusks
- Beaver
- Geese
- Wood ducks
- Mallards
- Western pond turtles
- Muskrat
- Band-tailed pigeons
- Mourning doves
- Coho and Chinook salmon
- Steelhead trout
- Cutthroat trout
- Dace
- Sculpin
- Eels
- Gophers
- Moles
- Flying squirrel
- Coyotes
- Ringtail cat
- Raccoon
- Weasels
- Otter
- Great blue heron
- Green heron
- Common merganser
- Black bear
- Cougar
- Bobcat
- Striped and spotted skunks
- Belted kingfishers
- Mink
- Shrews
- American kestrel

Non-native:

Prey

- Nutria
- Turkeys
- Pheasant

Predator

- Opossum
- Bull frogs
- Feral cats
- Red fox

Table 3-6. Stream and Riparian Associated Wildlife

ODF&W listed species: S. Oregon coho salmon, threatened; common kingsnake, vulnerable; northern red-legged frog, vulnerable; Pacific lamprey, vulnerable; pileated woodpecker, vulnerable.

Federally listed species: S. Oregon coho salmon, threatened; northern goshawk, species of concern; Pacific lamprey, species of concern.

Trends of selected wildlife populations

Many species of the wildlife population of the Deer Creek Watershed have decreased in the last decade. This includes the ringtail cat, which requires cavities in trees, which has declined due to shorter rotations and younger trees. Bears, bobcats, and red foxes have also declined, due in part to increased human activity in the Deer Creek watershed. Over 60% of the riparian areas in the Deer Creek Watershed are less than 100 feet wide. This has helped lead to a decline in the mink population, which require a wide riparian area in order to thrive. The crawdads and Pacific lamprey populations have also declined in the Deer Creek Watershed.

The western pond turtle population has also declined. Their reproduction has been hindered because of their need to lay their eggs in the banks of ponds. When there is no vegetation along the ponds, especially with the soils of high clay content in the Deer Creek Watershed, the soil is too dry, and the turtles are not able to lay their eggs. They urinate in the soil to increase the moisture for laying eggs, which easily marks the site for predators, which then eat the eggs. Bullfrogs and great blue herons also eat the newly hatched babies, further causing the population to decline.

The gray fox has adapted to the changing landscape and is thriving. The wood ducks and geese are using the South Fork area heavily and these populations have increased dramatically in the last twenty years. The opossums, which have been introduced into the Deer Creek Watershed in the last twenty years, have a broad diet and thus have increased greatly in number.

Effects of land practices

Wildlife of the Deer Creek Watershed has been affected by land use. Prior to the Forest Practices Act being implemented, some logging could at times be harmful to the wildlife. Practices such as high-grading, leaving no snags, down-wood, or wildlife trees were sometimes practiced. Often areas not replanted would be replaced with madrone stands.

Other land uses have affected wildlife populations as well. Activities such as field clearing and draining wetlands for rangeland and agriculture have reduced some key habitat areas.

Key Wildlife Habitats

Ordinarily edge habitats are second only to riparian habitats in importance to species diversity. In the case of the Deer Creek Watershed, the riparian habitat acts often as an edge habitat. This edge offers habitat to some wildlife.

Following are examples of how some species utilize the edges associated with Deer Creek:
Birds of Prey perch in edge trees to overlook the pastures for food such as mice, voles, rabbits, passerines, or reptiles, as well as watch for other predators. While in treeless areas, they must hover or "wait on" when searching for food below, expending energy. The surrounding forest areas offer food also, but the reduced visibility increases the difficulty of hunting. Some birds of prey, the accipiters, including sharp-shinned hawks, Cooper's hawks and goshawks, are well suited to forest hunting and dense riparian habitats with their short wings, and long tails. To them, the pasture's edge presents an opportunity to fly out of the narrow riparian habitat at low elevation and high speeds in hopes of surprising a rabbit or a group of passerine birds. At dusk or dark, owls, concealed in the limbs of the edge trees, wait for rodents and small mammals to venture into the pasture to feed.

Predators are seldom seen in the open, preferring instead to work the length of the riparian habitat, looking outward for signs of prey species activity. Once prey is located, an attack may follow. If successful, the predator will move its kill back to the security of the edge or further into the forest before eating. Because the cleared pastureland allows predators to see further than in the forest, they have an easier time spotting prey. Usually, the pasture inhabitants are unaware of the predator's presence because they are concealed by the edge. Predators that take advantage of these conditions include mink, bobcats, coyotes, red fox, grey fox, and weasels.

Deer and Elk prefer to feed on the grass of the pastures, but generally stay near the edge while they determine whether or not there is any danger. The remaining Oregon white oak along Deer Creek yield acorns in the fall and the myrtle trees provide myrtle nuts, both of which can be a major staple of deer and elk diet.

Rabbits, Tree Squirrels, and Chipmunks may have their homes in the riparian area, but rely on the cleared areas for some seeds, grasses, tubers, and bulbs. Being wary of the accipiters, these animals are seldom far from the protective edge, which they use for observation or escape.

Ground Squirrels, Field Mice and Meadow Voles generally prefer to live in and below the open pasture, but forage in the riparian habitat, using the edge for security and protection. These meadow dwellers add to the diversity of the local predators' food supply.

Passerine Birds thrive on the food the pastures offer, and find their safety in the riparian habitat. They fly back and forth from the edge trees to the pastures while being aware of predators. At the hint of danger they can disappear into the oaks or alders, only to reappear when the threat has passed.

Reptiles utilize the edge to regulate their body temperature by moving in and out of the sun while hunting for rodents, insects or other reptiles.

Amphibians find the creek and its route good habitat. They can also be found throughout the watershed and forested areas during the wet season and add to the food cycle of the ecological community.

Special Vegetation Concern: Himalayan Blackberry

The Himalayan Blackberry is a major issue in Deer Creek and throughout the Umpqua Basin. This exotic vine has invaded most of the watershed riparian areas. In the Deer Creek Watershed, more than twenty wildlife species use blackberries in some way. It is the favored habitat of the California/Valley Quail. Many species, from deer to squirrels, as well as numerous birds, use the berries and/or the leaves as a food source during the summer months. Blackberries provide cover, food, and streambank stabilization in the absence of native shrubs.

While these benefits do exist, there are several negative impacts as well. The Himalayan blackberries have taken over the riparian habitat to such an extent that, in many areas, a monoculture exists. A few, even numerous, managed patches could prove beneficial to the overall riparian habitat, but currently it is so rampant that it limits the natural vitality and viability of the ecological community.

When the native plants or trees are removed from the riparian area through actions such as grazing, logging, flooding, or other events, the opportunistic blackberries utilize the good soil and the available sunlight very effectively and efficiently. Once established, the blackberries prevent native plants, shrubs, and even trees from establishing themselves.

Strategies to Improve Riparian-Associated and Edge Wildlife Habitat

Planting groves of trees in open pastures would improve habitats used by birds of prey, passerines, mammals, reptiles and many others. Tree stands with multiple tree heights and diverse understory vegetation will improve habitat structure and diversity.

Planting lines or bands of trees will provide edge benefits to wildlife. Planting even one tree in an open pasture will provide habitat values, including shade in summer, shelter in winter, and food and nesting sites.

Moving fences away from the stream channel can sometimes widen riparian edges. Because of their regenerative capabilities, stream and riparian habitats often rehabilitate themselves quickly when left undisturbed. **Fencerows** can be used to create a wooded or vegetated strip to provide edge habitat to wildlife.

Clearing openings (where beneficial) can quickly diversify wildlife habitat at least in the short term. For example, in large expanses of Himalayan blackberries it is possible clear several openings with a small bulldozer, sow the desired seed and by spring have green openings that soon become key wildlife hot spots. This action provides food (the berries are still there), shelter within the surrounding blackberries, and improved access to the new openings with additional food resources provided by the grasses, legumes and grains.

Himalayan blackberries, because of their regenerative capabilities, are difficult to remove, requiring perseverance and extended maintenance. Controlling blackberries and establishing native trees and shrubs is most easily and effectively done by the use of herbicides. It is also possible to remove blackberries manually or with machinery and be able to get trees and shrubs established. However, this can be very labor intensive, and may take years of effort in order to get the natural vegetation to a point where it will out-compete the blackberries and thrive.

Action Recommendations to Improve Riparian-Associated Wildlife Habitat

- *Widen the riparian habitat wherever practical by: 1) Providing training programs that teach local landowners riparian restoration techniques that they can implement on their properties; 2) planting trees, preferably conifers near the stream to widen the habitat and eventually shade out the vast stands of Himalayan blackberries; and 3) adding or extending fence lines along stream channels.*
- *Plant groves of trees and associated native understory plant species in pasture areas between riparian corridors and upland forests to provide connection from the riparian area to forested areas.*
- *Create openings in large expanses of blackberries to add to short-term habitat complexity.*
- *Develop ponds or secondary ponds from seeps or small springs. A secondary pond can provide quality habitat if it retains water through May, after the end of the water-fowl breeding season. Supplying material at the edge of the pond, or softening edges, provides habitat where the western pond turtles can lay their eggs. Adding structure*

(branches, logs, stumps, etc.) to the pond benefits fish, amphibians, and aquatic insects. Installing platforms adds habitat and safety zones for animals. (Caution: these projects usually require permits and can also have negative impacts on ground water flow which adds high quality water to creeks.)

- *Putting up nest boxes increases habitat for nesters. Properly establishing brush piles can accommodate a variety of animals. Placing brush piles on platforms about eight feet above the ground gives birds safety from ground-dwelling predators.*
- *Consider leaving dead trees standing and logs on the ground.*

3.3. Water Quality

Streams are often the center of human populations and are used for various purposes. Some of the uses of Deer Creek are irrigation and swimming. The DEQ has classified these different uses (known as "designated beneficial uses") and has summarized them by basin. It is important to know the designated beneficial uses for Deer Creek because different water quality standards are used based on the most sensitive benefit from the creek for a given water quality parameter. The designated beneficial uses for the Umpqua Basin waters are shown in Table 3-7. Those practiced in Deer Creek are checked.

Beneficial Use	Deer Creek	Beneficial Use	Deer Creek
Public Domestic Water Supply		Private Domestic Water Supply	✔
Industrial Water Supply	✔	Irrigation	✔
Livestock Watering	✔	Boating	
Aesthetic Quality	✔	Anadromous Fish Passage	✔
Commercial Navigation and Transportation		Resident Fish and Aquatic Life	✔
Salmonid Fish Spawning	✔	Salmonid Fish Rearing	✔
Wildlife and Hunting	✔	Fishing	✔
Water Contact Recreation	✔	Hydro Power	

Table 3-7. Beneficial Uses in the Umpqua and Deer Creek as defined by ODEQ in OAR-340-41-322 Table 3.

Water quality standards have been established to assure the protection of the beneficial uses mentioned in Table 3-7. The DEQ has data that indicates that Deer Creek is not meeting bacteria standards during all seasons, temperature standards during the summer, dissolved oxygen in the winter, and habitat modification. This caused Deer Creek to be placed on the list 303(d) of the Clean Water Act.

Table 3-8 lists all possible water quality components for which a stream can be listed and whether or not Deer Creek is listed for that component. According to DEQ procedure the water quality of a stream is considered impaired if greater than 10% of the samples are beyond the limits of the most sensitive beneficial use for a parameter.

Parameters	303(d) List	Details from the 303(d) List
Temperature (Summer)	Yes	DEQ Data at river mile 0.2: 70% (16 of 23) Summer values exceeded temperature standard (64°F) with a maximum of 81.5°F and violations recorded in each year based on data collected between Water Year (WY[22]) 1986-1994.
Dissolved oxygen (June 1 – September 14)	No	
Dissolved oxygen (September 15 – May 31)	Yes	DEQ Data at river mile 0.2: 17% (6 of 36) September - May values were below the spawning dissolved oxygen standard (11.0 mg/l or 95% saturation) with a minimum of 7.5 mg/l between WY 1986-1996 (Cold water spawning, approx. Sept - May).
pH (Summer)	No	
pH (Fall – Winter – Spring)	No	
Nutrients	Need data	
Bacteria (Fall - Winter - Spring)	Yes	DEQ Data at river mile 0.2: 42% (18 of 43) FWS values exceeded fecal coliform standard (400) with a maximum value of 2400 between WY 1986-1995.
Bacteria (summer)	Yes	DEQ Data at river mile 0.2: 64% (14 of 22) Summer values exceeded fecal coliform standard (400) with a maximum value of 2400 between WY 1986-1995.
Sedimentation	Need data	
Flow modification	Need data	
Chlorophyll a (Summer)	No	Did not meet listing criteria
Habitat modification	Yes	Majority of the 2-5 order streams in the watershed do not meet either the Large Woody Debris Frequency (for 50% of the stream length 4 or more functional key pieces per 100 meters of stream) and/or Pool Frequency (60% of stream length there will be no more than 5-8 channel widths between pools) CSRI measures for habitat needs.

Table 3-8. 303(d) list (DEQ 1998) for Deer Creek, mouth to headwaters.

The following material is focused on the water quality parameters sediment, stream temperature, nutrients, dissolved oxygen, pH, toxics, and bacteria. A section for each parameter describes how it is measured, what the data shows for the Deer Creek Watershed, lists potential causes for not meeting the water quality parameter, summarizes the key findings, and lists action recommendations to address or prevent problems.

3.3.1. Sediment

Sediment is a natural part of every stream system. In water quality terms, sediment is particulate matter of any size, from a microscopic piece of clay to a large boulder. There is not a most

[22] Water year, defined as October 1 through September 30.

beneficial use designated for sediment. Because sediment is so variable, it is difficult to assign a numerical standard. Some water quality measures related to sediment are turbidity and total suspended solids. DEQ basis sediment listing on the following criteria:

"The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed." (OAR 340-041-0285(2)(J))

Some of the impacts of an imbalance in a stream's sediment regime include:

- the smothering of salmonid eggs and fry by excess fine sediments,
- eroding streambanks and widening of streams caused by larger sediment scouring the stream channel,
- filling of holes used by fish,
- clogging of water intakes, and
- increasing nutrient levels from phosphorus attached to soil particles.

In Deer Creek, fine sediment particles remain suspended in the water for long periods of time after a rain event. Large portions of the soil near the creek are "black mud," and have a high clay content. Of all the soils types, clay remains suspended for the longest amount of time because it has the smallest, lightest particles. This is one of the reasons why the water remains cloudy, or turbid, for a long period of time after substantial rain.

Sediment is difficult to measure, therefore, this assessment presents several themes that are linked to sediment, including turbidity of the water, and effects of burns, roads, and soils.

Turbidity

Turbidity is a measure of water clarity determining light penetration through water. It is an optical measurement and is expressed in terms of Nephelometric Turbidity Units (NTUs), where the greater the NTUs, the more turbid the water.

The water quality standard for turbidity is based on resident fish and aquatic life, water supply, and aesthetics. Salmonids are sight-feeders; if the water is too cloudy, they cannot obtain their food supply. Suspended sediment can also damage gill tissue. Drinking water systems need water with low suspended sediment to avoid clogging up the filtration system.

The DEQ standard requires that no more than a 10% cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity, unless a permit is obtained for emergency activities, dredging, construction, or other legitimate activities. In order to be listed as water-quality impaired for sediment based on turbidity, there must be a systematic or persistent increase (of greater than 10%) in turbidity due to an operational activity that occurs on a persistent basis (e.g. dam release or irrigation return, etc.).

This standard is mostly useful for point sources of sediment (clearly defined contributions, such as the end of a drainage pipe). The Oregon Watershed Assessment Manual recommends a measure of 50 NTUs as the level at which sight feeding of salmonids is adversely affected (Watershed Professionals Network, 1999).

The DEQ sampled turbidity near the mouth of Deer Creek 69 times between 1985 and 1994. The results ranged from 1 to 100 NTUs, and 66 (96%) of the samples were below 50 NTUs and three samples were above the 50 NTU standard (Figure 3-6). The reading of 65 NTUs on December 10, 1990, occurred on a high water day, after a dry period. On this day, the flow of Deer Creek increased from 8 cubic feet/second (cfs) to 96 cfs.

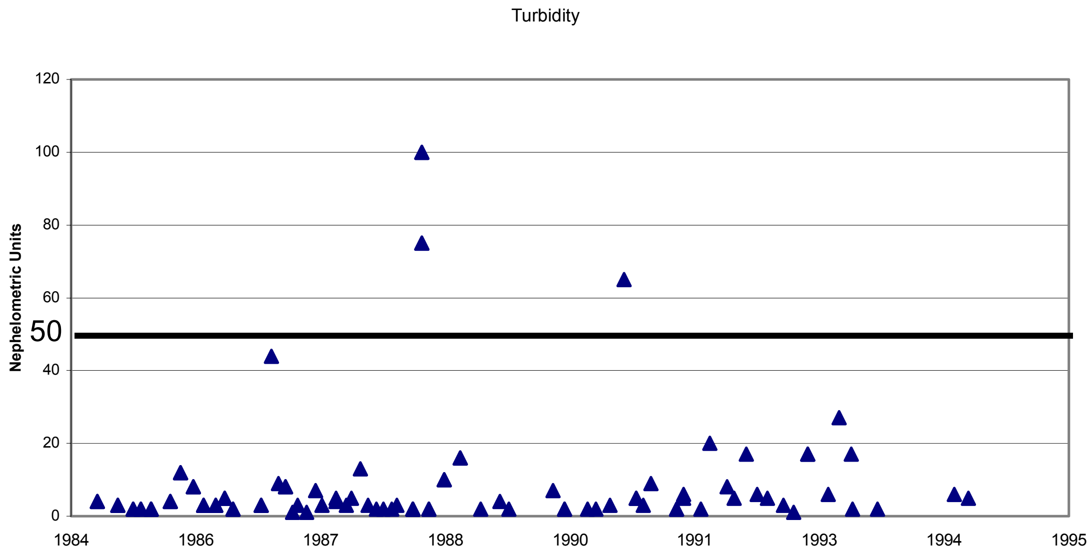


Figure 3-6. Turbidity Sampled near the Mouth of Deer Creek.

In the summer of 2000, the DSWCD and UBWC performed water quality sampling at ten sites in Deer Creek. Table 3-9 shows the results from this study. None of the samples were above the 50 NTU level at which sight feeding is impaired. None of the sampling days, nor the days directly preceding the sampling, had precipitation.

Location	7/13/00	7/27/00	8/10/00	8/24/00	9/7/00	9/21/00
Gage Height	2.16	2.11	2.05	2.03	2.15	2.09
Mainstem 1 (NTU)	4.57	13.60	6.99	6.78	4.67	4.49
Mainstem 2 (NTU)	3.59	3.27	3.33	6.57	3.39	3.48
Mainstem 3 (NTU)	1.21	1.43	1.28	2.31	1.60	1.39
Mainstem 4 (NTU)	1.44	1.43	1.60	0.78	1.05	0.88
North Fork 1 (NTU)	2.21	1.43	3.88	0.90	1.06	1.62
South Fork 1 (NTU)	1.07	0.95	0.80	0.80	0.63	0.73
South Fork 2 (NTU)	- [23]	0.90	0.99	0.87	0.63	1.18
Mid. So. Fork 1(NTU)	1.10	0.48	0.51	1.29	0.37	0.43
North Fork 2 (NTU)	0.84	1.34	1.74	1.29	3.68	2.80
North Fork 3 (NTU)	0.87	0.78	0.77	0.87	0.53	0.61

Table 3-9. Turbidity Sampled in Deer Creek.

[23] This site was not sampled on 7/13/00.

In many streams turbidity increases as flow increases. Consequently much higher turbidities are generally observed in the winter than in the summer. Soil material that ravels into the ditches and creeks during the summer is usually washed through the stream system during the winter with higher associated turbidities. Management practices that minimize the amount of soil material reaching the ditches and streams will reduce the winter turbidity levels. Also, maintaining the structural integrity of the stream channels will reduce channel erosion and the associated sedimentation.

Ground Disturbing Activities

Soil exposed during wet weather can easily be washed into a stream system, causing increased sedimentation. Construction typically exposes soil and, if improperly implemented, can cause sedimentation.

The Roseburg Drainage Master Plan of 1987 showed that 46% of the land within the Urban Growth Boundary had a possibility of being converted to a land use of single family, multi-family, or commercial/industrial. Table 3-10 displays the distribution of land uses in 1987 and the land available for future use.

Ground disturbance associated with construction activities can be a significant source of sedimentation and since there is potential for a large amount of construction activity in the watershed, it is important that good erosion control practices be required and implemented.

Land Use Types	Percent of land within UGB	
	Present	Future Buildout Potential
Single Family	16	30
Multi-Family	2	15
Commercial/Industrial	21	40
Public/Semi-Public	1	1
Open Space	60	14

Table 3-10. Land Use in the Deer Creek Watershed within the Roseburg Urban Growth Boundary.

Rural projects that expose bare soil can also increase the sediment reaching the streams. Example activities include road and building construction, drainage development, and plowing/grading operations. Trails developed for access and fire control may need to be water-barred in an appropriate manner to prevent erosion.

Burns

Considerable field burning occurs in the Deer Creek Watershed. According to the Douglas Forest Protective Association, permits were given to burn 1468 acres of farm/grazing land and 13 debris piles in 2001. It is not likely that much of the sediment reaches the water because the burning is generally not done close to the stream and the topography is relatively gentle. However, burns can result in exposed soil and associated sedimentation if the soil material is washed into a stream.

Roads

In Douglas County there are 1,100 miles of roads controlled by the county, 800 of which are open ditched roads. In an interview with Jim Alberding of Douglas County on August 14, 2000, he indicated that there are not many problem areas for roads in the Deer Creek Watershed. There is no new road construction planned for the Deer Creek Watershed, but a culvert will be installed on Melton Creek.

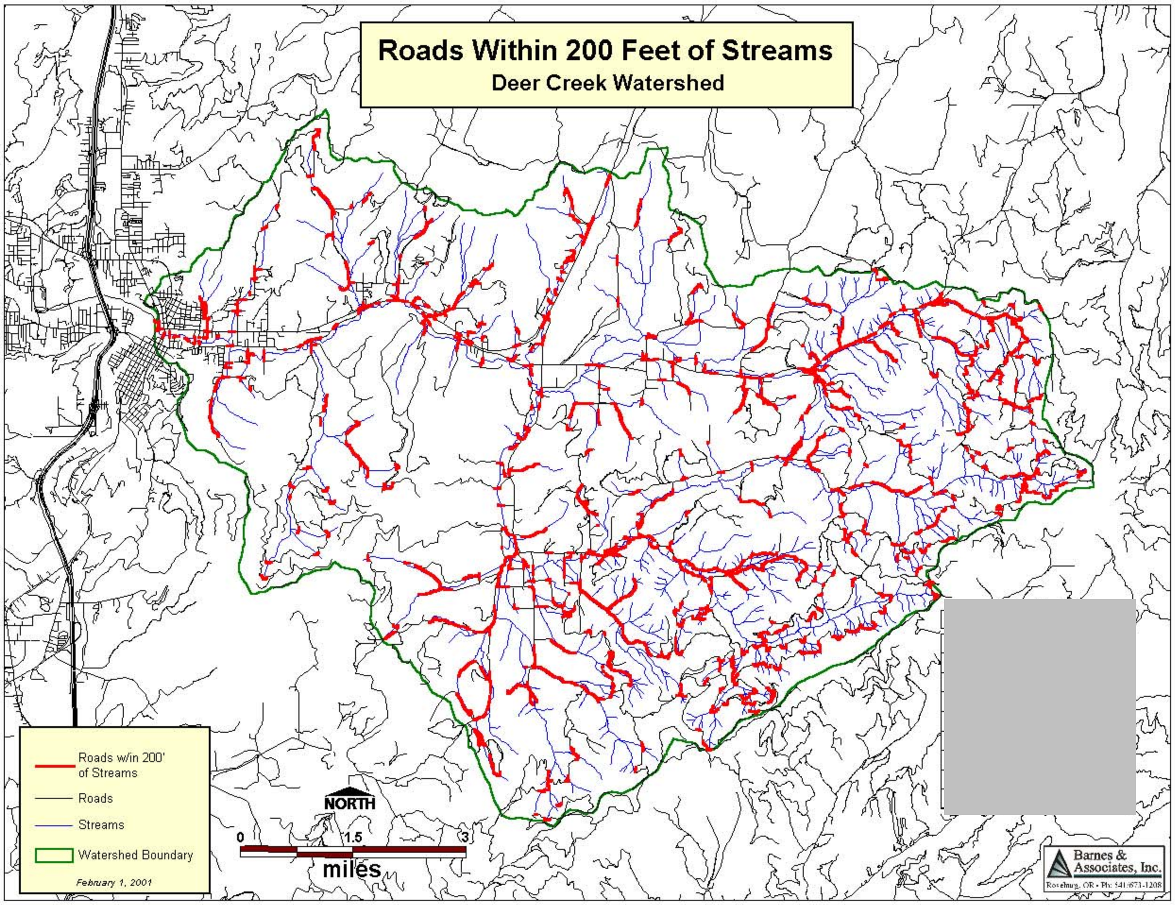
Ditch erosion and mass wasting associated with roads does not appear to be a problem in the Deer Creek Watershed. Douglas County has taken several measures to reduce the possibility of ditch erosion and associated road failure. These measures include placing 6-inch rock in the ditches and placing water bars in the ditches about every 20 feet on steep roads.

The only repair of a section of road along a creek was on a road along South Fork Deer Creek. In the fall of 1995, a 50 foot wide strip from the creek to the shoulder of the road was filled with approximately 500 cubic yards of pit run rock, and affected around 100 feet of stream bank.

Run-off from non-paved roads and cut-bank ravel can bring sediment material into the ditch system, and ditches that drain directly to a live stream can deliver the sediment material to the stream system. This concern is especially true with roads located near streams. Cross-drains that release the ditch water onto a hillside, rather than directly into the stream, filter water. This practice causes problems when done incorrectly, as the ditch water can erode the soil.

The following map displays the roads near streams in the Deer Creek Watershed (Map 3:2). Landowners who manage these roads need to be aware of the potential impact of their current management practices and adjust accordingly. The second map displays roads near streams on slopes over 50% (Map 3:3). These roads have even greater potential to impair water quality.

Roads within 200 feet of the stream are more likely to have ditches that divert directly into the creek. These pose the greatest challenge in keeping road related sediment from entering the creek. Roads that cross steep slopes have more soil accumulating in the road ditches. The more soil in the ditch, the greater chance of the ditch blocking, causing standing water and undermining the road surface integrity. In a worst case scenario this could cause the road to collapse.



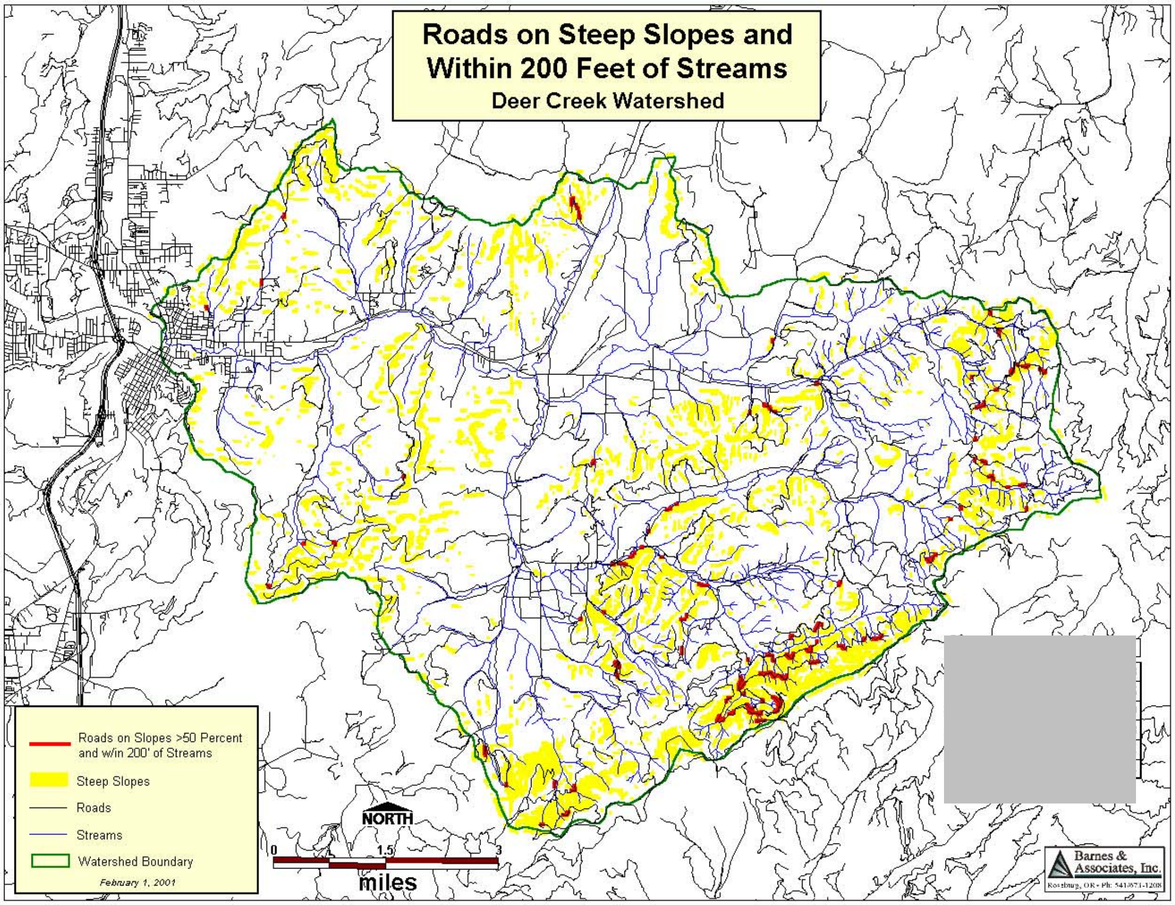
Map 3:2. Roads within 200 Feet of Streams.

The information displayed in Map 3:2 and Map 3:3 is summarized in the following table (Table 3-11). Over 100 miles of road in the Deer Creek Watershed lie within 200 feet of Deer Creek and its tributaries, and could be a source of sediment, toxins, and other inputs into the stream. About six miles of these roads were constructed across steep slopes and have a greater chance of failing and bringing material into the creek.

Road Surface Material	Miles of Road within 200 feet of a creek	Miles of Road within 200 feet of a creek and on a slope greater than 50%
Paved	17.22	0.18
Gravel	8.74	1.05
Non-surfaced or Unknown	77.87	4.7
Total	**103.83**	**5.93**

Table 3-11. Miles of Road Potentially Contributing to the Creek

Properly drained roads with cross drains decrease the impact of sediment to creeks. However, many of the roads along Deer Creek were constructed to deliver ditch water directly into the creek, without filtering it across a hillside. It is also likely that there are undersized culverts, which in a flood event could blow out and deliver sediment to the streams.



Map 3:3. Roads on Steep Slopes within 200 Feet of Streams.

Storm Drains

There are many land uses in the Deer Creek Watershed that influence water quality. These include residential, industrial, agriculture, and forestry. Two percent of the Deer Creek Watershed is within the city limits of Roseburg, where 72% of the Deer Creek Watershed population lives. This heavy population density affects the lower portion of Deer Creek in terms of high bacteria and sediment levels. It also narrows riparian habitats, which allows higher water temperatures. The eastern section of the City of Roseburg along Diamond Lake/Hwy 138 has 23 storm drains. Seventeen of these storm drains are on the final 1.25 miles of Deer Creek. One storm drain is on Rifle Range Creek, which is a minor Deer Creek tributary. Another storm drain feeds into a marshy area approximately 0.06 miles from Deer Creek. The 23 storm drains service most of eastern Roseburg, which is primarily residential and industrial lands. The total drainage area is 1,020 acres, with an average of 54 acres per storm drain. Water flows into the storm drains through drainage ditches and underground pipes. All of the storm drains have catch basins. In normal weather conditions, these basins allow sediment and debris to settle out of the storm water before entering Deer Creek. However, if there are bacteria from fecal matter, sediment, hydrocarbons, or heavy metals in suspension, these would continue to degrade water quality. The City of Roseburg cleans out the catch basins once a year. The streets of Roseburg are also swept once a year, and the leaves are picked up from the curbs once every two weeks in the fall. These practices reduce the debris entering Deer Creek.

Soil Erosion from Range Land

Soil erosion from rangeland occurs infrequently and is usually the result of intense rainfall. A dense grass root mass helps prevent erosion; therefore erosion most frequently occurs on heavily overgrazed lands. Erodability is defined for a given soil type by the K-factor. The K-factor indicates the susceptibility of the soil to sheet or rill erosion, both forms of surface soil erosion. The K-factors range from 0.01 to 1, the higher the value, the greater the susceptibility of the soil to erosion. Slope is another component of erosion with increased slopes accelerating erosion.

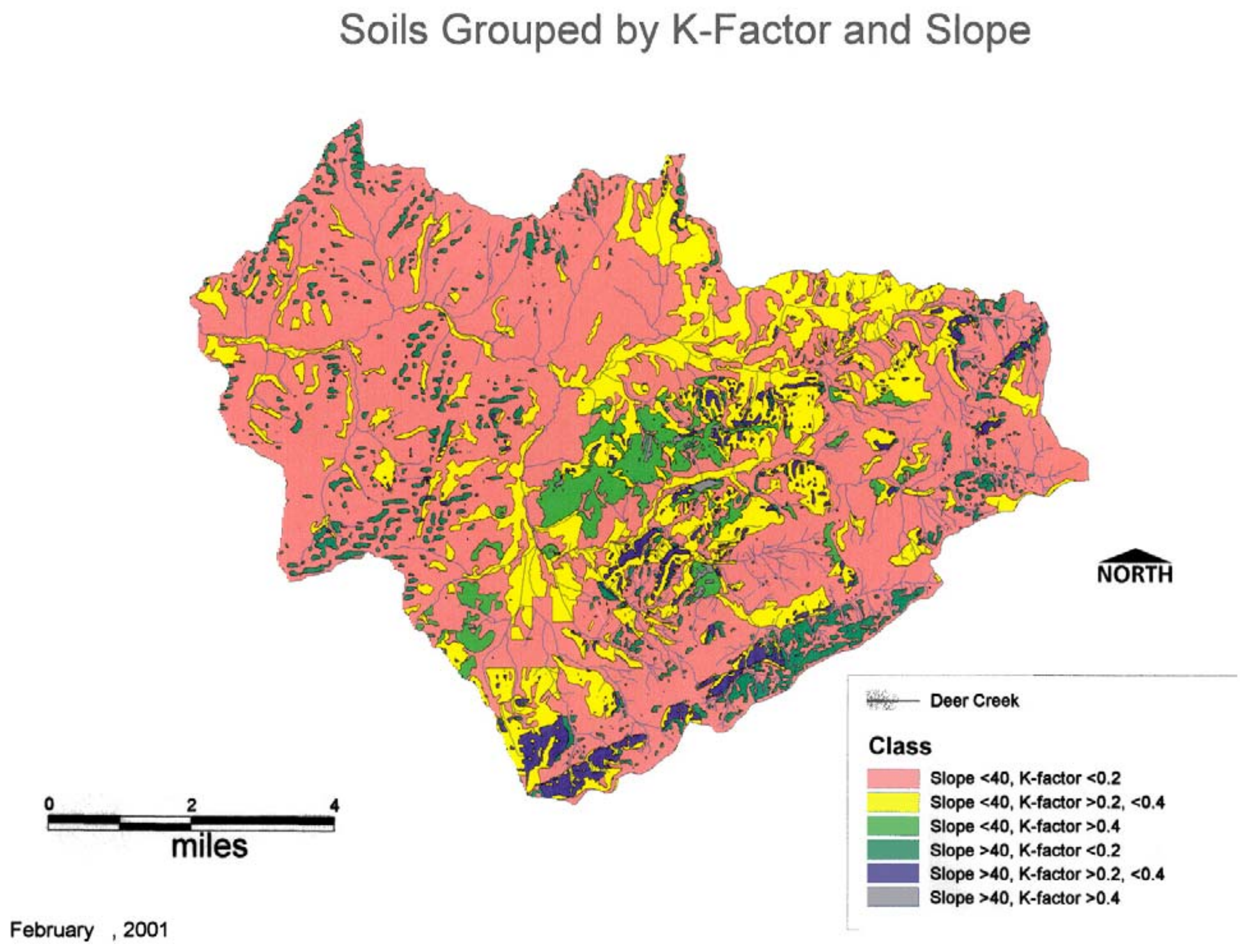
The Deer Creek Watershed was evaluated for erodibility and slope, to indicate areas with a higher risk for soil erosion. The soils were grouped according to K-factor and slope. The acreage can be sorted into three erosion groups: low (<0.2), moderate (0.2 – 0.4), and high (>0.4), and into two percent slope groups of <40% and >40% (Table 3-12).

SLOPE	K-FACTOR		
	LOW 0 - 0.2	MODERATE 0.2 - 0.4	HIGH 0.4 – 1
< 40%	28,014.4 (65.1%)	9,565.8 (22.2%)	1,713.0 (3.98%)
> 40%	2,379.2 (5.53%)	1,237.5 (2.87%)	137.4 (0.32%)

Table 3-12. Acres by K-factor and Slope.

Only four percent of the soils are in the category of highest erodibility. These soils are found in the central part of the watershed, southeast of Dixonville. North Fork Deer Creek and South Fork Deer Creek are flanked by the soils ranked in the middle erodibility category. The soils along mainstem Deer Creek have low erodibility risk (Map 3:4).

Management of grazing practices can control erosion and associated sedimentation. Generally, exposed soil has high potential for erosion and, in some cases, sediment may be delivered to a stream. Exposed soil near a stream generally has a higher probability of resulting in increased sedimentation.



Map 3:4. K-class by Slope Categories.

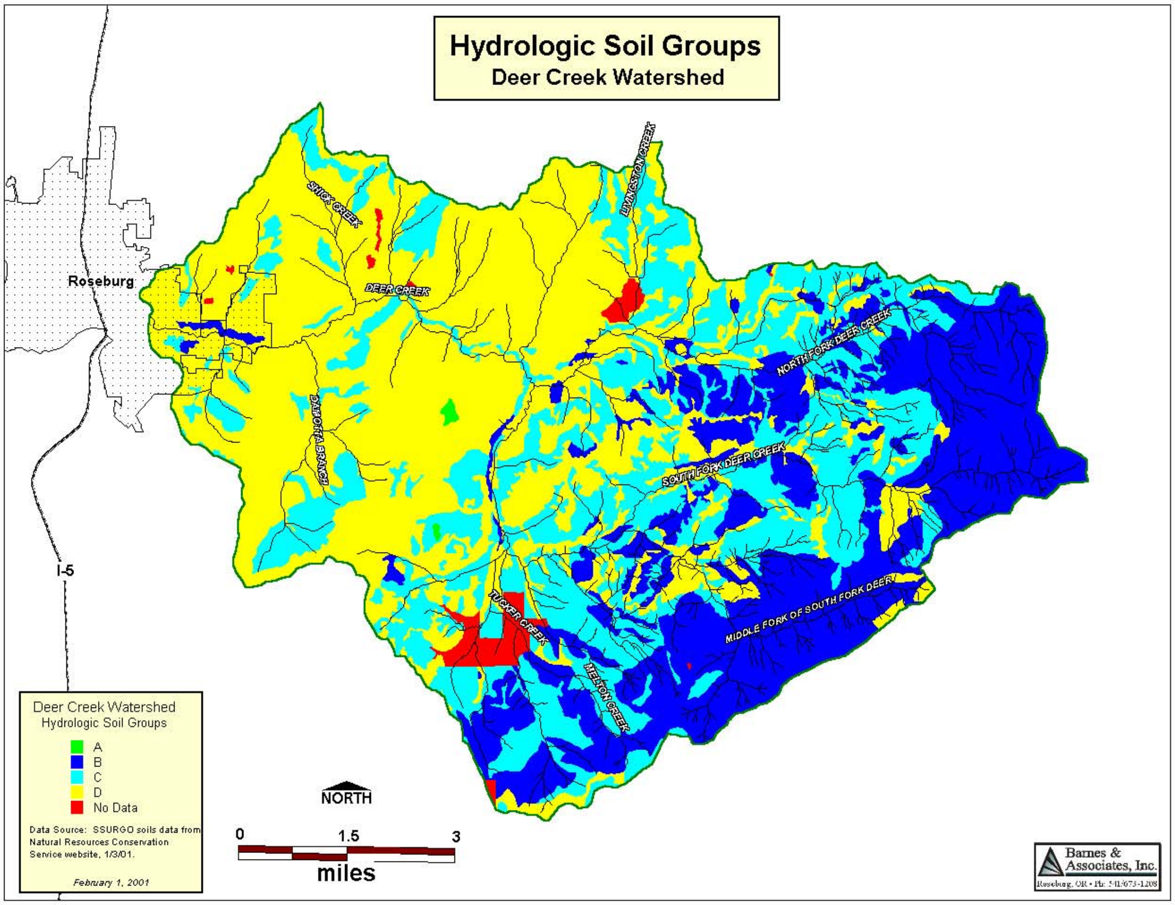
Infiltration and water run-off

When rain falls, soil types absorb the water at different rates. Using the Natural Resources Conservation Services classification of soils in the Deer Creek Watershed, it is possible to divide the soils into four hydrologic soil groups by similar infiltration rates. The soils are assigned an A, B, C, or D, where "A" represents soils that have the highest infiltration rates and "D" those with the lowest infiltration rates.

The soils in Deer Creek generally have low to moderate infiltration rates. The numbers of acres in the Deer Creek Watershed in each hydrologic soil group are shown in Table 3-13. The soils with the lowest infiltration rates are located mostly in the western part of the Deer Creek Watershed, the flatter, urban and rural residential area. The soils with the high infiltration rates are located near the headwaters of the North Fork and South Fork Deer Creeks, where there are also steeper slopes, more timberland, and less residences. Map 3:5 displays these groups in the Deer Creek Watershed.

Hydrologic Soil Group	Acres	Hydrologic Soil Group	Acres
A	39 (.09%)	C	12,393 (29%)
B	11,087 (26%)	D	18,897 (45%)

Table 3-13. Acres by Hydrologic Soil Groups.



Map 3:5. Deer Creek Watershed Hydrologic Soil Groups

Key Findings

- From 1985 to 1995 and in the summer of 2000, the turbidity levels were of minimal concern in Deer Creek.
- There is a potential for housing, business, and industry construction in the watershed, which can result in increased sediment inputs to streams.
- There are 104 miles of road (87 miles of which are not paved) within 200 feet of the creeks. These types of road have a higher probability of delivering sediment into a creek.
- Six miles of roads are within 200 feet of the creeks on ground with slopes greater than fifty percent. These types of roads have a higher chance of road failure.
- Four percent of the Deer Creek Watershed is characterized by highly erodible soils and 0.32% of those are on steep slopes.

- The soils with the lowest infiltration rates compose 45% of the Deer Creek Watershed. These are mostly located in the western part of the watershed.

Action Recommendations

- *Increase vegetated buffer strips along creeks to filter sediment.*
- *Provide sediment filtration mechanisms at construction sites or projects involving exposed soil to keep sediment from entering the creeks.*
- *Encourage seeding and water-barring of fire trails and temporary roads to keep freshly exposed soil from being washed into the creeks when it rains.*
- *Encourage landowners to inspect their roads and ditches for erosion problems. This is especially important for those roads that are dirt or gravel and are within 200 feet of a stream.*
- *Minimize ditch flow to active streams by using relief culverts.*
- *Encourage more winter turbidity monitoring.*
- *Manage grazing areas for a minimum of exposed soil, particularly near streams.*

3.3.2. Temperature

The most temperature sensitive use of Deer Creek to temperature is salmonid fish rearing during summer months. The DEQ water quality criterion for temperature states that the seven-day moving average of the maximum daily water temperature should not exceed 64°F. In the winter the temperatures are low and are not harmful to the most sensitive beneficial use, salmonid spawning and incubation.

The pattern of stream temperature during a season can be very complicated and difficult to describe, therefore there are several different ways to summarize the temperature. One is the seasonal maximum, which is the highest stream temperature reached during a season. Another is the seven-day moving average of the maximum daily temperatures. For this measure, the average is computed of the maximum temperatures reached during an interval of seven days. Commonly, the seven-day moving average is 2°F less than the seasonal maximum (Smith, personal communication).

Aquatic life is sensitive to water temperature. Cold-water salmonid fish and some amphibians are highly sensitive to temperature. In particular, coho salmon and spring chinook (that occur in the South Umpqua River) are among the most temperature sensitive of the cold-water fish species.

Stresses induced by high temperatures result in fish injury or mortality. This is due to a combination of factors which result from high temperatures:

- decreased or lack of energy for feeding,
- negative changes in growth or reproductive behavior,
- increased exposure to pathogens (viruses, bacteria and fungus),
- decreased food supply (impaired macroinvertebrate [aquatic insect] populations),
- and increased competition from warm water-tolerant species.

This mode of thermally induced stress and/or mortality, termed indirect or sublethal, is delayed, and may occur weeks to months after the onset of elevated temperatures.

Several temperature studies have been conducted in the Deer Creek Watershed. In 1998, a resident of Deer Creek sampled at 6 sites along Deer Creek, North Fork and South Fork. In 1999, as a part of the Umpqua Stream Temperature Characterization Project of the UBWC, 6 sites were sampled along Deer Creek, North Fork, and South Fork. Both studies used thermisters that recorded the temperature every 30 minutes.

In 1998, a resident of Deer Creek measured temperature, which revealed that on the day with the warmest water temperatures (July 25th), the seven-day moving average was above 64°F at every sample point measured in the watershed (Figure 3-7). On one of the days with the highest temperatures, two sites on the mainstem had a water temperature of 78.0°F and 76.8°F, on North Fork 75.6°F, and at South Fork 2 79.2°F. At two of the sampling sites, the measurements of temperature did not begin until August 10th. At these sites, South Fork 1 and Ingram 1, the warmest water temperatures were on August 13th, with temperatures respectively of 70.7°F and 67.8°F.

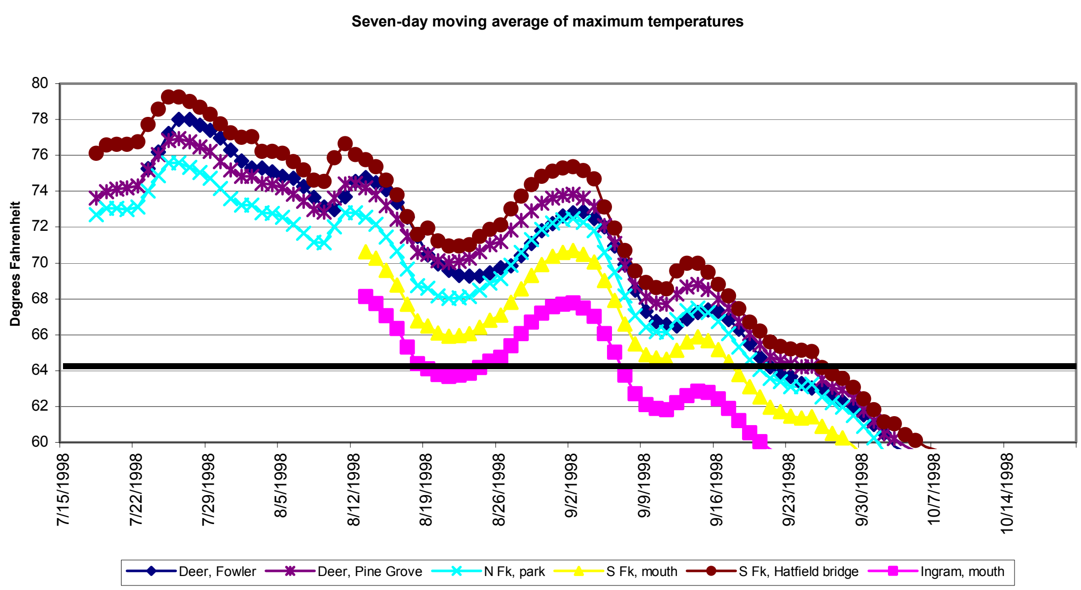


Figure 3-7. Seven-Day Moving Average of Maximum Temperatures, Deer Creek, 1998

In 1999, the seven-day moving average reached above 64°F at every sample location in the watershed. The lowest temperature measured was recorded at the sample point where North Fork Deer Creek crosses Buckhorn Rd, however, it still reached above the standard for a portion of the summer. The warmest water temperatures occurred on August 25th. On this day, the maximum seven-day average temperatures at two sites on the mainstem were 73.1° and 75.7°F, on North Fork Deer Creek 70.0°F and 66.3°F and on South Fork Deer Creek 71.7°F and 75.6°F.

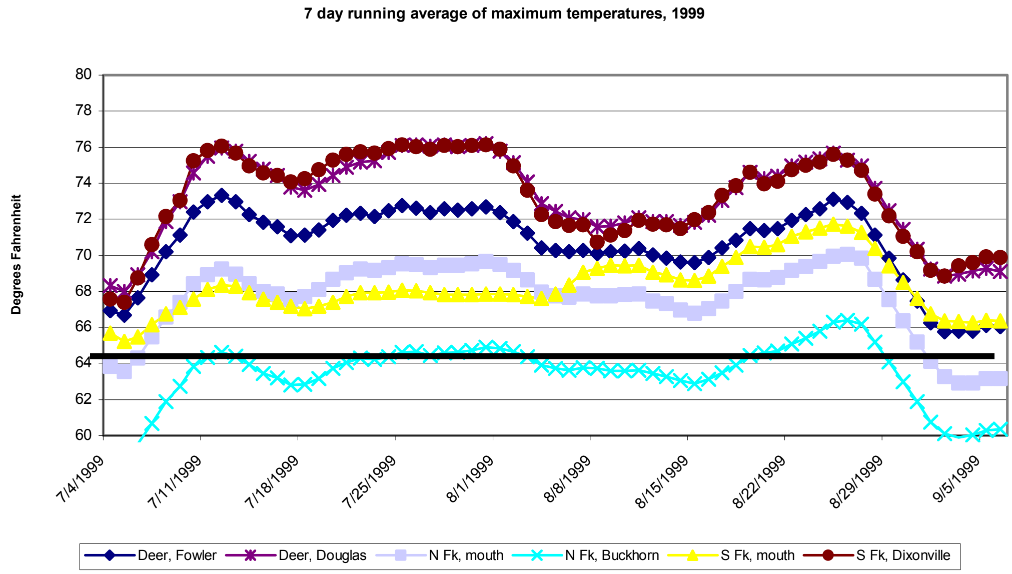


Figure 3-8. Seven-Day Moving Average of Maximum Temperatures, Deer Creek, 1999

Possible Causes of High Stream Temperatures

Many factors affect stream temperatures. Some of them (latitude, aspect, climate, daily temperatures, and precipitation) are beyond human control. Floods can wash out riparian areas and change the width and depth of a channel. Human influences include heated discharges, removal or planting of vegetation that intercepts solar radiation, the level of flow (withdrawals), and channel complexity (removal or addition of wood from streams).

Key Findings

- Stream temperatures in most of Deer Creek exceed 64°F for extended periods during the summer months. This condition is detrimental to some key aquatic species including salmonids.
- Improving the effective shade and the channel conditions could lower the temperatures.
- Any improvement in stream temperature would be beneficial to the aquatic resource. Improving even a short section of a warm stream can create an "oasis" that could be a welcome refuge for cold-water dependent aquatic life.

Action Recommendations

- *Establish a tall and dense shade wall along the streams.*
- *Use selective thinning to encourage full crowns.*
- *Establish trees in open and brushy areas along the stream.*

3.3.3. Nutrients

Nutrients can have an impact on water quality. High levels of nitrogen and phosphorus can over-stimulate algae and plant growth, raising pH levels and lowering dissolved oxygen levels.

There are no specific Oregon state numerical standards for the amounts of nutrients in the water of the Umpqua tributaries. There is a standard for aquatic weeds and algae such that any level that has a deleterious effect on stream bottoms, fish, or other aquatic life, or that causes injury to health, recreation, or industry is not allowed (DEQ, 1999).

The Oregon Watershed Assessment Manual recommends using a benchmark of 0.30 mg/L for total nitrates as an indicator of water quality (Watershed Professionals Network, 1999). For total phosphorus, a benchmark of 0.10 mg/L is recommended in order to prevent eutrophication nuisances (e.g., algal blooms) (USEPA Quality Criteria for Water, 1986). These benchmarks are to be applied to streams that do not discharge directly to a lake or reservoir, which is the case with Deer Creek.

Between 1984 and 1995 DEQ measured 68 samples for nitrates/nitrites at river mile 0.2 of Deer Creek. Of the 68 samples, 19 samples were greater than the 0.30 mg/L benchmark, with the highest sample measuring at 2.4 mg/L. The DEQ has also sampled 9 nitrate samples between 1973 and 1975. The samples ranged from 0.01 mg/L to 0.45 mg/L.

There were 55 measurements of phosphate from 1986 to 1995 by the DEQ at River Mile 0.2. Most of the results of the testing showed phosphate values less than 0.3 mg/L (0.1 mg/L Phosphorus [P]). On three occasions the values are above the benchmark: 0.68 mg/L (0.22 mg/L P), 0.69 mg/L (0.23 mg/L P), and 0.95 mg/L (0.31 mg/L P).

The DEQ also sampled for phosphorus between 1985 and 1989. Of the 18 samples, 15 were 0.07 or lower. Three samples were above the benchmark of 0.1 mg/L at 0.12mg/L, 0.114 mg/L, and 0.106 mg/L.

Possible Sources of Nutrients

Possible sources of nutrients include animal manure, commercial and home-use fertilizers, decaying organic matter, and inadequate and failing septic systems. Erosion and run-off from construction sites, recent burns, stream banks and other slopes can also be a source of phosphorus, because it is an element that clings strongly to soil particles. Traces of phosphorus can also come from the weathering of rocks.

Key Findings

- There are elevated levels of nitrogen degrading the water quality in Deer Creek.
- There are phosphorus levels above the benchmark and indicate a problem with phosphorus in Deer Creek.

Action Recommendations

- *Provide a training program that teaches landowners practical means of monitoring and controlling nutrient contamination, and encourages implementation of these techniques on private land.*
- *Maintain vegetated buffer strips to intercept pollutants in runoff.*
- *Construction site erosion control to limit the transfer of sediment (a likely source of nutrients) from the site into storm drains and creeks.*

- *Fixing failing septic tanks that contribute nutrients to the creeks.*
- *Manage livestock so animal wastes do not contaminate the riparian area or the stream.*

3.3.4. Dissolved Oxygen

Dissolved oxygen is essential for aquatic life, but can have an especially significant effect at the early life stages of salmonids. The redds containing the salmonid eggs are in the gravels and the survival of these eggs is affected by the level of dissolved oxygen within the gravels. The most sensitive time for dissolved oxygen is during the salmonid spawning season, which in Deer Creek occurs during the fall, winter, and spring. According to the DEQ, during this time the minimum level of dissolved oxygen (DO) needed for survival of the eggs is 11.0 mg/L. Where conditions of barometric pressure, altitude, and temperature preclude the attainment of 11.0 mg/L, the criterion is 95% of saturation at the ambient conditions during which the water sample was taken (barometric pressure, altitude, and temperature at the time and place of the sampling). The DEQ sampled DO 36 times at the mouth of Deer Creek, during the spawning period in the years from 1986 to 1995, and 6 times (17%) the DO was below the minimum criteria. Therefore, in the fall, winter, and spring, Deer Creek is considered DO impaired, because it does not at all times provide sufficient dissolved oxygen for salmonid fish spawning. Five of the six instances when the DO was below the water quality criteria occurred either in October and May. During the times of high water flow, the amount of DO in the water does not pose a problem for fish.

During the summer, the most sensitive user of dissolved oxygen is the cold-water aquatic life, with the criterion of a minimum of 8.0 mg/L DO. Where conditions of barometric pressure, altitude, and temperature preclude the attainment of 8.0 mg/L, the criterion is 95% of saturation at the ambient conditions. The DEQ sampled 18 times (1973 – 1994) during the summer and only one sample (5.6%) was below the criteria. According to these data, there is generally a sufficient amount of DO at the mouth of Deer Creek in the summer for cold-water aquatic life.

In the summer of 2000, the DSWCD and UBWC performed water quality sampling at ten sites in the Deer Creek Watershed (Figure 3-9). The results showed that three sites attained the DO standard for cold water aquatic life for the entire sampling period. Although the data taken at the mouth of Deer Creek by the DEQ showed sufficient dissolved oxygen to support cold-water aquatic life in the summer, the testing performed in the summer of 2000 showed inadequate dissolved oxygen levels to support salmonid fish rearing at various times and places in the watershed.

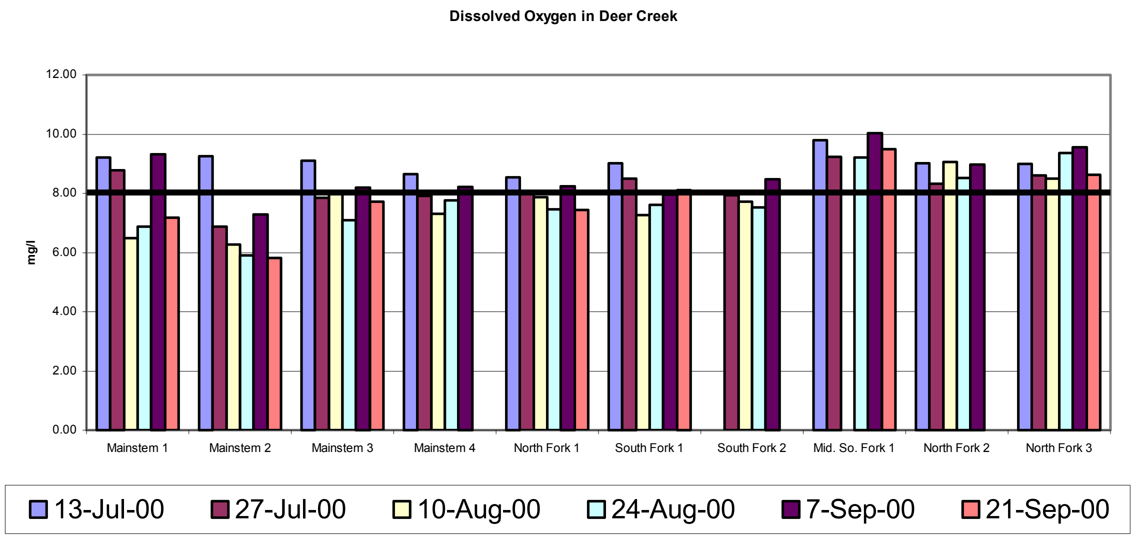


Figure 3-9. Summer Dissolved Oxygen in Deer Creek, 2000

Possible Causes of Dissolved Oxygen Impairment

As discussed in Section 3.3.2, stream temperatures in Deer Creek during the summer are significantly above the state water quality standard. Stream temperature has a major impact on the amount of dissolved oxygen the water can hold: cold water can hold more dissolved oxygen than warm water. Thus one reason for low DO readings is that the water temperature is too high. If water temperature is reduced, the dissolved oxygen content will rise.

There is also a relationship between dissolved oxygen and nutrients. At high levels of nutrients in a stream, algae blooms deplete the dissolved oxygen through respiration.

Additionally, there is a relationship between DO and sediment. The dissolved oxygen within gravels is lower when the pores of the gravel beds contain a high percentage of fine sediment.

Key Findings

- Most of the winter the dissolved oxygen levels support cold-water aquatic life.
- The levels of dissolved oxygen were insufficient to support salmonid fish rearing from July through September in 2000.

Action Recommendations

- *Protect the creeks from sediment so that riffles are not filled with sediment, and the dissolved oxygen level in the gravels can be higher.*
- *Decrease the temperature of the water by improving riparian areas so that the water can hold more dissolved oxygen.*
- *Reduce amounts of phosphorus to prevent algal blooms by filtering sediments entering the creek.*

3.3.5. pH

pH is the measure of the number of hydrogen ions in a substance, and is measured in Standard Units (SU) from 1 to 14, with 7 being neutral. Values below 7 are considered acidic, while values above 7 are considered basic.

Many chemical and biological processes in a stream are affected by pH. The standard for pH values indicates the lower and upper limits that protect most aquatic species in western Oregon. Values outside this range result in toxic effects to resident fish and aquatic life (EPA 1986).

For purposes of protecting aquatic species the pH needs to be between 6.5 and 8.5. During the years 1986 to 1995 there were 43 samples taken in the fall, winter, and spring, and 23 samples taken during the summer. Only one sample (4%) in the summer (value of 8.9) was above the maximum pH criteria, thus, the water of Deer Creek does not seem to have pH problems.

During the DSWCD and UBWC water quality sampling in Deer Creek, none of the values exceeded the upper limit of 8.5 pH. However, many of the samples were taken in the morning when pH tends to be lowest, so the data is not conclusive.

Possible Causes of pH Values beyond the Desired Range

Elevated nutrient inputs from fertilizers, poorly sited or faulty septic systems, and sewage treatment system discharges promote algae growth which elevate pH levels. Chemical fertilizers applied to commercial forestlands, agricultural areas and residential yards may be non-point sources of nutrients, which also raise pH levels. Most fertilizers increase biological activity of algae, and the photosynthesis by the algae uses up the carbon dioxide in the water faster than the contributions from the atmoshphere. This reduction in carbon dioxide results in an increase in pH.

Key Findings

- The data collected indicate that pH levels are sufficient to provide for fish and aquatic life.

Action Recommendations

- *Keep measuring periodically for pH levels at several different sites.*

3.3.6. Toxics

The DEQ has a list of concentrations of toxic substances that are harmful to aquatic life and human health. Of the ones listed, only two have been sampled in Deer Creek: chlorides and nitrates/nitrites. All samples have been taken near the mouth of Deer Creek.

There are two criteria for chloride that are for protection of aquatic life. The fresh water acute (one sample) maximum is 860 mg/L and the fresh water chronic (average of several samples over time) criteria maximum is 230 mg/L. There were 14 samples taken of chloride at river mile 0.2 between 1973 and 1987. During this time all samples were well below the fresh water chronic criteria, the highest sampled value being 130 mg/L.

The criterion of a maximum of 10 mg/L of nitrates/nitrites is for protection of human health through water and fish ingestion. There were 68 nitrates/nitrites samples taken at river mile 0.2 between 1985 and 1994. During this time all samples were below the human health criteria, the highest sampled value being 2.4 mg/L.

Key Findings

- Of the toxics sampled in Deer Creek (chloride and nitrogen), there are no concerns.
- There has been very little data collected for this component in Deer Creek. Four miles of Deer Creek are located within an industrial area and monitoring is needed to determine if toxic chemicals are entering Deer Creek.

Action Recommendations

- *Perform systematic monitoring and sampling for toxics of concern.*
- *Participate in the Clean Umpqua Project (Clean-up), an educational program for how to dispose of toxic wastes.*

3.3.7. Bacteria

The water quality standard for bacteria is designed to protect human health during water contact recreation. The standard is based on the number of *E. coli* colonies in a sample. *E. coli* is a fecal coliform bacteria and is used as an indicator of bacteria and pathogens from warm-blooded animals that are harmful to humans.

Sampling for bacteria on Deer Creek was done by the Collilert method, which uses statistics to provide the Most Probable Number (MPN) of bacteria in the sample. This number represents the number of *E. coli* colonies per 100ml of water. The water quality standard is that a 30-day log mean, based on a minimum of 5 samples, shall not exceed 126 *E. Coli* per 100 ml, and that no single sample shall exceed 406 *E. Coli* organisms per 100 ml.

The DSWCD and UBWC performed water quality testing in the summer of 2000, sampling 10 sites throughout the watershed. The bacteria data are displayed in Figure 3-10, and they show that the counts of bacteria peaked at several sites in the watershed. The sample sites in Figure 3-10 refer to the bacteria sample sites found on Map 3:6. One site on Deer Creek had consistently low numbers, while several other sites had consistently high bacteria counts.

There are several reasons why bacteria numbers can decrease in direction of stream flow. One is the rate at which bacteria die in water. Pathogens do not survive when the temperature of the water is much lower than that of their host. Two other effects that decrease bacteria counts are travel and dilution. Bacteria are not spread uniformly throughout the water, therefore, as bacteria travel further from the site where they entered the water, it is less likely they will end up in the sample. Dilution occurs as more water enters the stream, and the bacteria are less concentrated.

The summer bacteria data reveals several areas of concern where water contact recreation is unsafe due to consistently high bacteria counts. These sites are on North Fork Deer Creek, South Fork Deer Creek, and Deer Creek. The bacteria testing does not reveal the source of the bacteria, but because there was no rain on the days of the sampling, it can be assumed that there are direct means by which the bacteria entered Deer Creek. According to the DEQ, when bacteria counts are not linked to rain events and are consistently high, the source of the bacteria is often failing septic systems. When rain events are linked to high bacteria counts, the source of the *E. coli* is generally considered to be coming overland. Random high bacteria events could be linked to other sources, such as dead animals in the water.

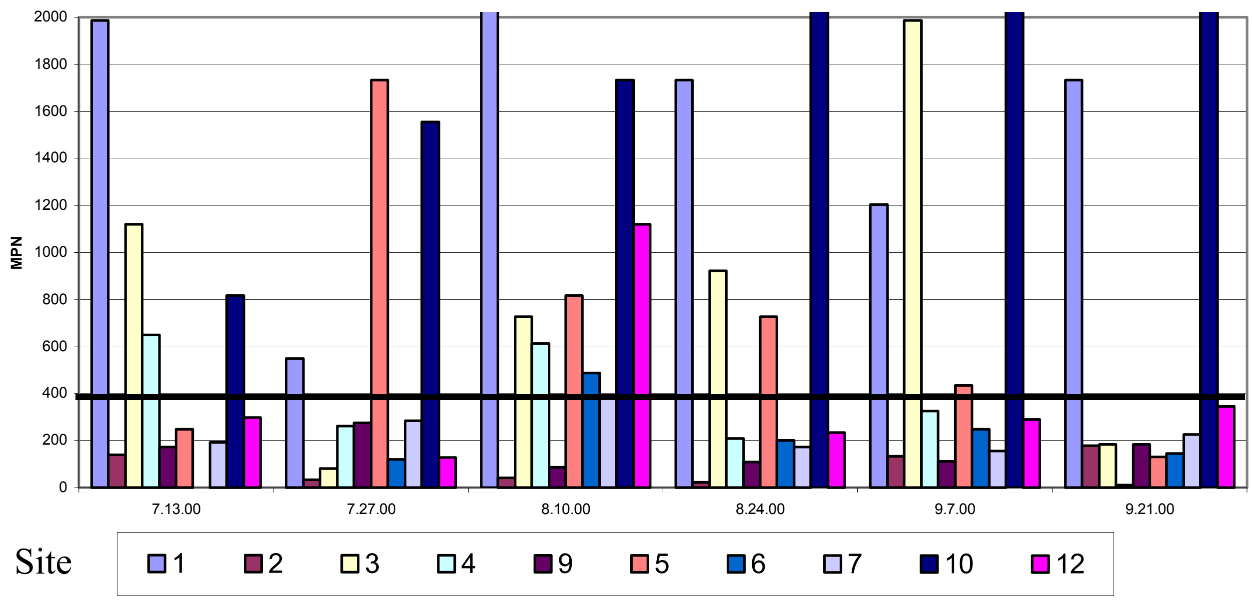
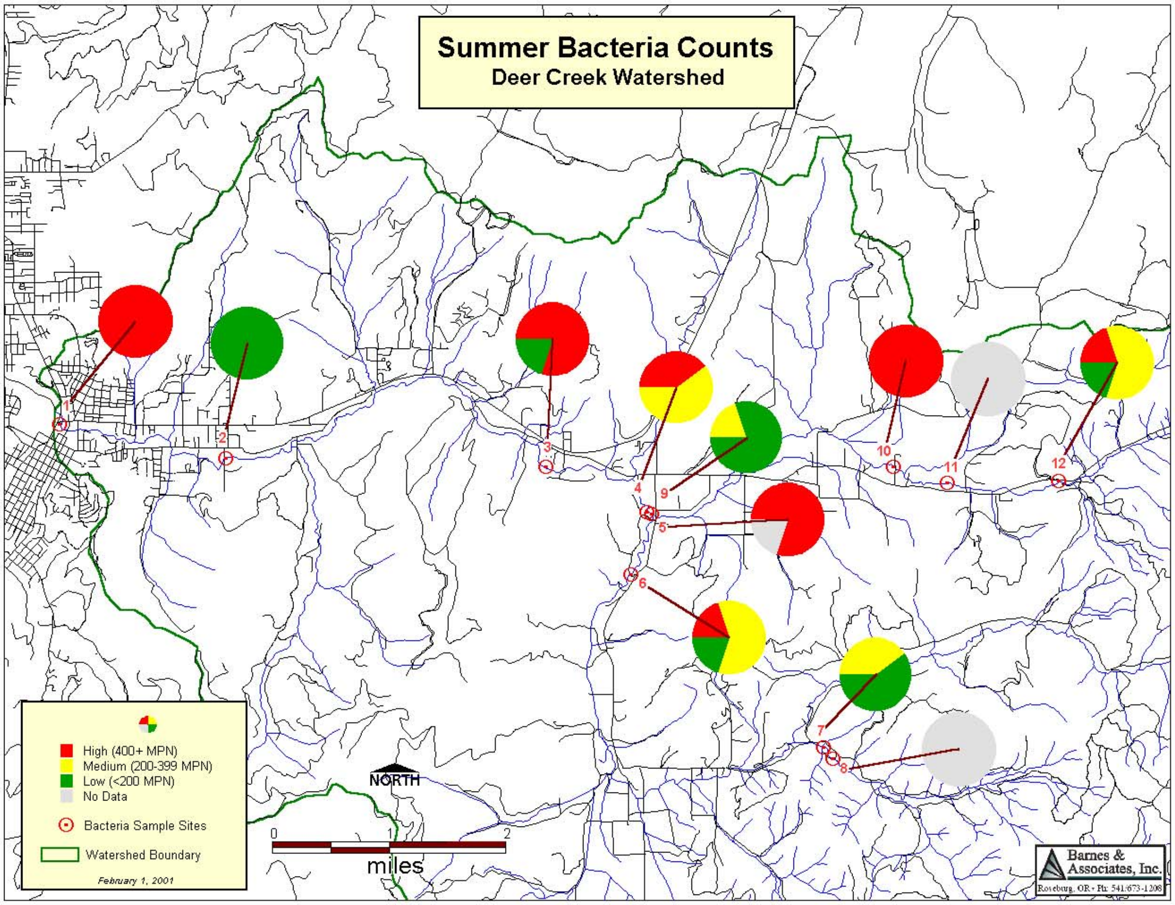


Figure 3-10. *E. coli* Bacteria in Deer Creek, Summer 2000.



Map 3:6. Summer Bacteria Testing Results.

Map 3:6 gives an overview of the bacteria sampling results in Deer Creek based on the summer data. The pies are divided into the proportion of the six sampling events that correspond to the bacteria counts. Each slice is colored based on a high (red), medium (yellow), or low (green) number of bacteria colonies

The UBWC continued the bacteria sampling during the winter of 2001. Three of the five sampling days revealed bacteria counts that were above the bacteria standard (Figure 3-11, Map 3:7). These sampling days were preceded by rain, which implies that the rain was delivering additional bacteria into Deer Creek.

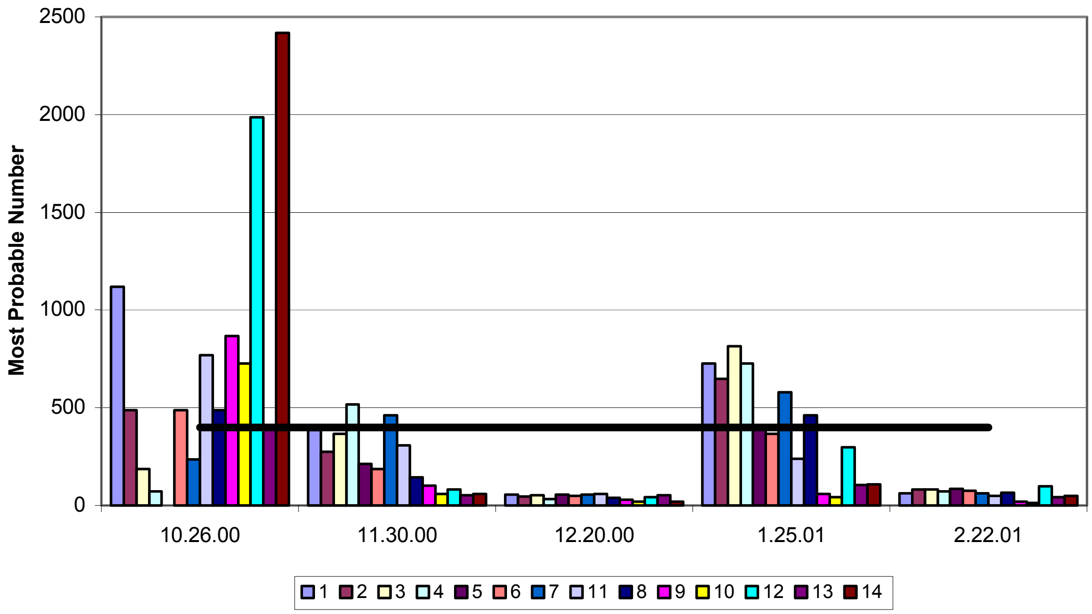
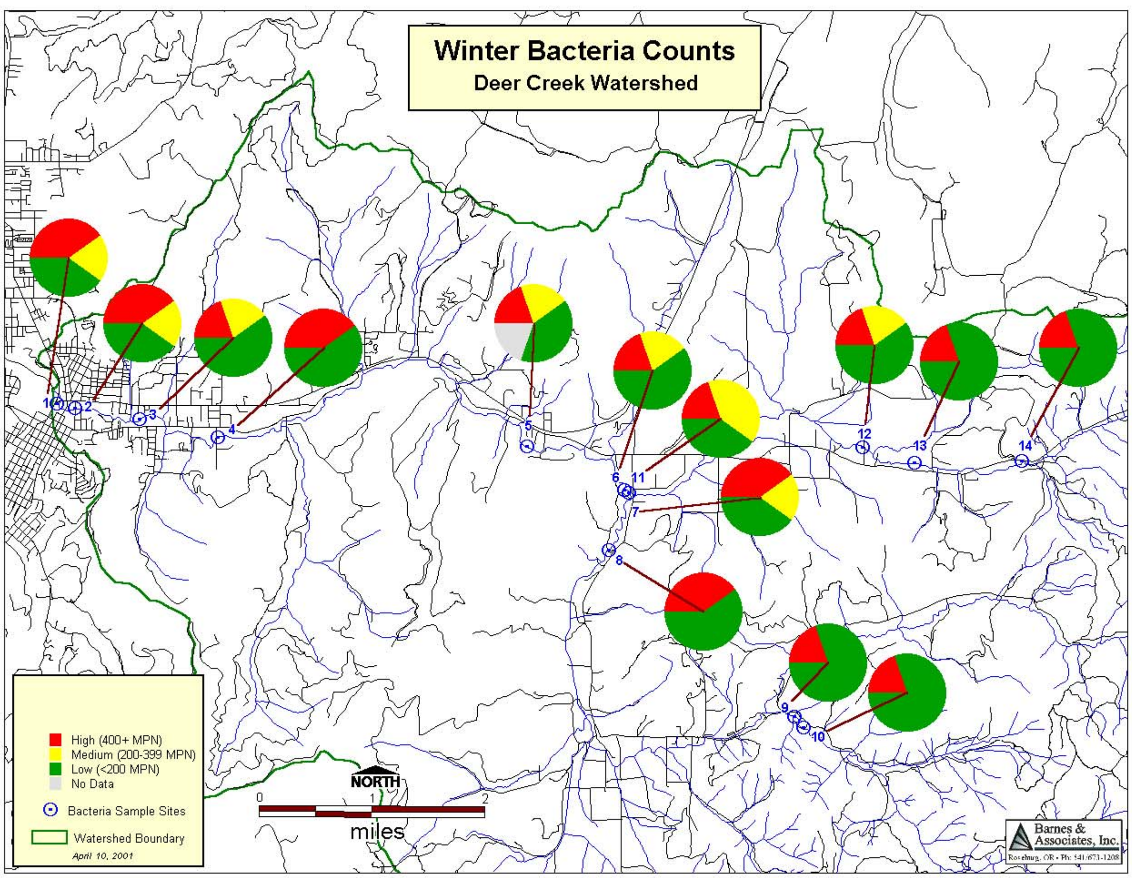


Figure 3-11. ***E. coli*** **Bacteria in Deer Creek, Winter 2001.**



Map 3:7. Winter Bacteria Testing Results

Using a different standard and sampling for general fecal coliform, the DEQ from 1984 to 1994 sampled 67 times at a site located near the mouth of Deer Creek. Twenty samples (30%) exceeded the fecal coliform standard of 400 organisms/100ml, with the maximum limit of 2400 organisms/100ml being reached seven times.

Potential Sources of Bacteria

There are a variety of activities in the watershed which have the potential for delivering bacteria to streams, including livestock manure, inadequate or failing septic systems, pet feces in runoff, wild animal feces, and animal carcasses in the streams. The high variability of the samples both from site to site and from date to date suggests that there are a variety of bacteria sources in the watershed.

Action Recommendations

- *Use off-channel watering for livestock to keep the livestock from defecating near or in the stream.*
- *Fence areas along the streams to keep the livestock from defecating near or in the stream.*
- *Check septic tanks and drainfields.*
- *Remove pet waste by collecting and properly disposing it.*
- *Maintain buffer strips along streams which filter water entering the creek (although buffer strips alone cannot remove all bacteria from a large source).*

3.3.8. Habitat Modification

Habitat modification is a concern because it can adversely affect resident fish and aquatic life as well as salmonid fish spawning and rearing. Conditions that harm fish and other aquatic life, affect the palatability of game fish or shellfish, or affect the potability of drinking water are not allowed at any time of the year. Also, stream water levels must be remain high enough all year to support resident fish and other aquatic life and not cause a detrimental change to the resident biological communities. If habitat modification affects fish or aquatic life, then water quality is considered limited.

To determine if habitat conditions diminish fish or other aquatic life, the Oregon Department of Environmental Quality (ODEQ) requires recent (since 1987) documentation about the aquatic life or aquatic habitat. Water quality will be considered impaired if:

1. Data indicates that resident fish and aquatic life or salmonid fish spawning and rearing have been impaired. One indication of impairment is if the aquatic communities, especially the numbers of species of insects and crustaceans, are 60% or less than what would be expected in a similar reference area. Another indication is if fishery data on redd counts, fish populations, etc. show that fish species have declined due to water quality conditions; or
2. If research-based documents such as watershed analyses and published reports indicate that habitat conditions are limiting fish or other aquatic life. The critical habitat conditions are those that relate to channel morphology and instream habitat, including pools, large woody material, and riffles.

Deer Creek is listed because a "majority of the 2-5 order streams in the watershed do not meet either the Large Woody Debris Frequency (for 50% of the stream length 4 or more functional key pieces per 100 meters of stream) and/or Pool Frequency (60% of stream length there will be no more than 5-8 channel widths between pools) CSRI measures for habitat needs (DEQ, 1998)."

3.4. Water Quantity

3.4.1. Water Availability

Data from the Oregon Water Resources Department has been used to determine water availability in Deer Creek. This is based on the average flow and the water rights of record. The Oregon Water Resources Department has divided the Deer Creek Watershed into two portions: mainstem Deer Creek plus North Fork Deer Creek, and South Fork Deer Creek. The following figures describe water availability in Deer Creek (Figure 3-12, Figure 3-13).

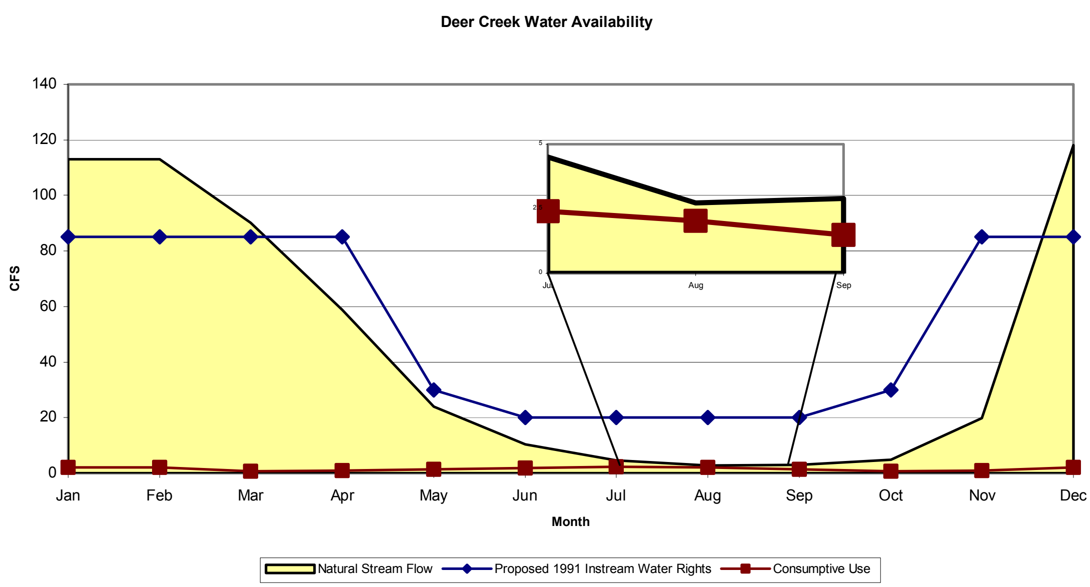


Figure 3-12. Monthly Net Water Available in Deer Creek and North Fork Deer Creek

As demonstrated in Figure 3-12 and Figure 3-13, water availability is a concern in the Deer Creek Watershed. During the month of August there is not enough natural stream flow in South Fork Deer Creek to meet the consumptive use demands. Consumptive use water rights have priority dates ranging from the 1870s to the 1990s.

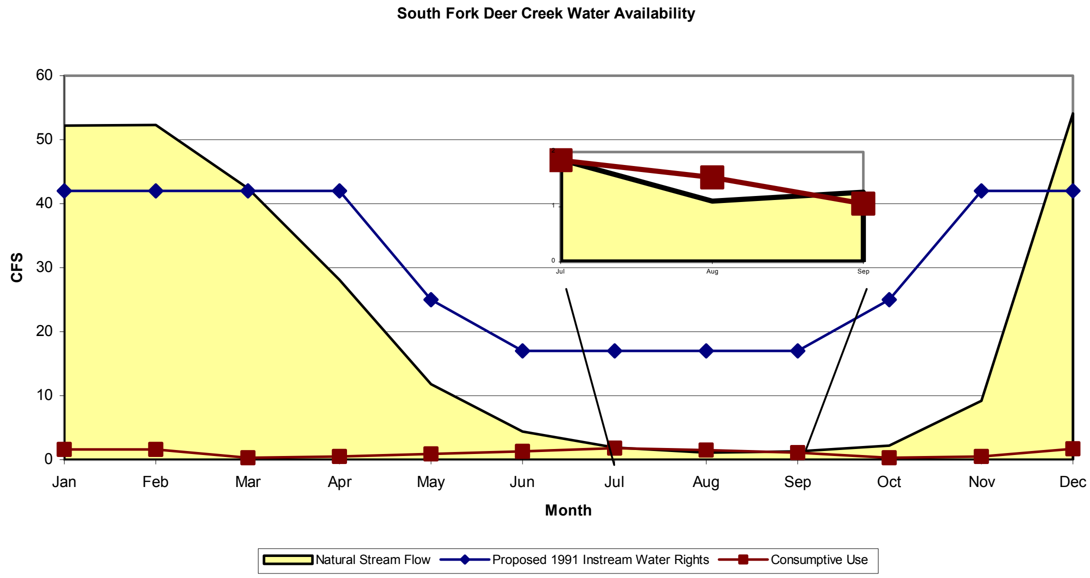


Figure 3-13. Monthly Net Water Available in South Fork Deer Creek

Oregon law provides a mechanism for temporarily changing the type and place of use for a certificated water right by leasing the right to an instream use. The stream benefits by leaving the leased water instream while the water right holder benefits by not having to pay pumping costs. Because the lease is a beneficial use of the water right, the right is protected from the five-year nonuse forfeiture statue. Another benefit to the water right holder is that upon expiration of the water lease, the five-year forfeiture period starts from zero. Instream leasing and purchases of rights are both useful ways of enhancing aquatic habitat during critical low flow periods. Increased flow provides fish habitat, dilutes the concentration of bacteria, and dissipates heat energy.

Water Rights by Use

The following table shows consumptive uses by category in the Deer Creek Watershed. The largest use of water is for irrigation, which averages 63% (range 33% to 99%) of the water rights of the mainstem and all tributaries (Table 3-14).

LOCATION	CFS					
	Total	Irrigation	Agriculture	Industry	Domestic	Recreation
Tributaries to North Fork Deer Creek	0.41	0.39	0.01	0	0.01	0
North Fork Deer Creek	3.69	1.75	0.03	1.75	0.16	0
Middle Fork South Fork Deer Creek	0.72	0.69	0	0	0.01	0.02
Tributaries to South Fork Deer Creek	0.37	0.28	0.03	0	0.06	0
South Fork Deer Creek	3.05	3.01	0.02	0	0.02	0
Tributaries to Deer Creek	0.03	0.01	0.01	0	0.01	0
Deer Creek	5.42	2.52	0.02	2.86	0.03	0
Total:	13.69	8.65	0.12	4.61	0.3	0.02

Table 3-14. Water Rights by Category and Creek

Action Recommendations

- *Secure water right leases or purchase water rights for conversion to instream use.*
- *Improve irrigation efficiency.*

3.4.2. Flashiness of the System – Flooding

Stream flow gages have been operated for two periods on Deer Creek: from 1956 to 1975 on mainstem Deer Creek near Roseburg, and from 1990 to 1999 on South Fork Deer Creek near Dixonville. The information from the gage in the mainstem of Deer Creek is shown in the following graphs (Figure 3-14, Figure 3-15). The highest peak event recorded during the first period occurred in 1966, while the highest total amount of water in a year occurred in 1956, which shows that the highest peak flow does not necessarily correlate with the highest annual flow.

The low flows for the same years show that in good and bad water years, it is possible to have no surface flow in Deer Creek. For example, in 1968, a low flow year, there was a period of zero flow, while in 1965, a year with higher flows, there was also zero flow. The graphs showing the data for the South Fork Deer Creek are found in Appendix B.

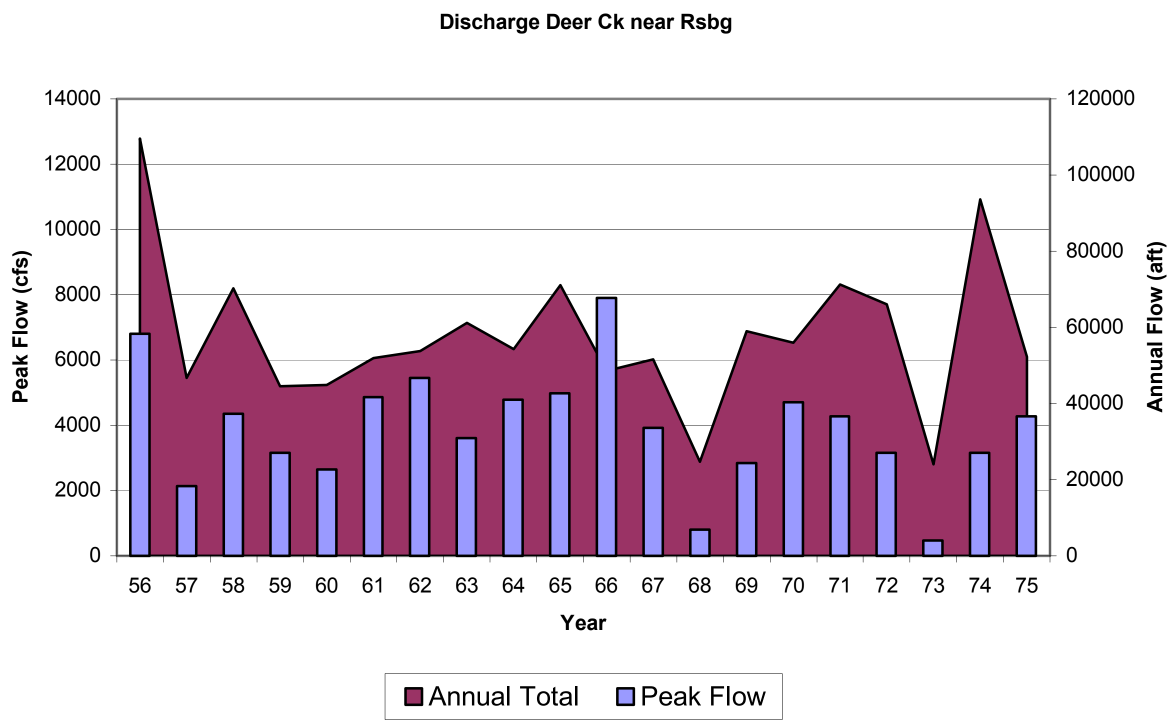


Figure 3-14. Annual and Peak Flows in Deer Creek

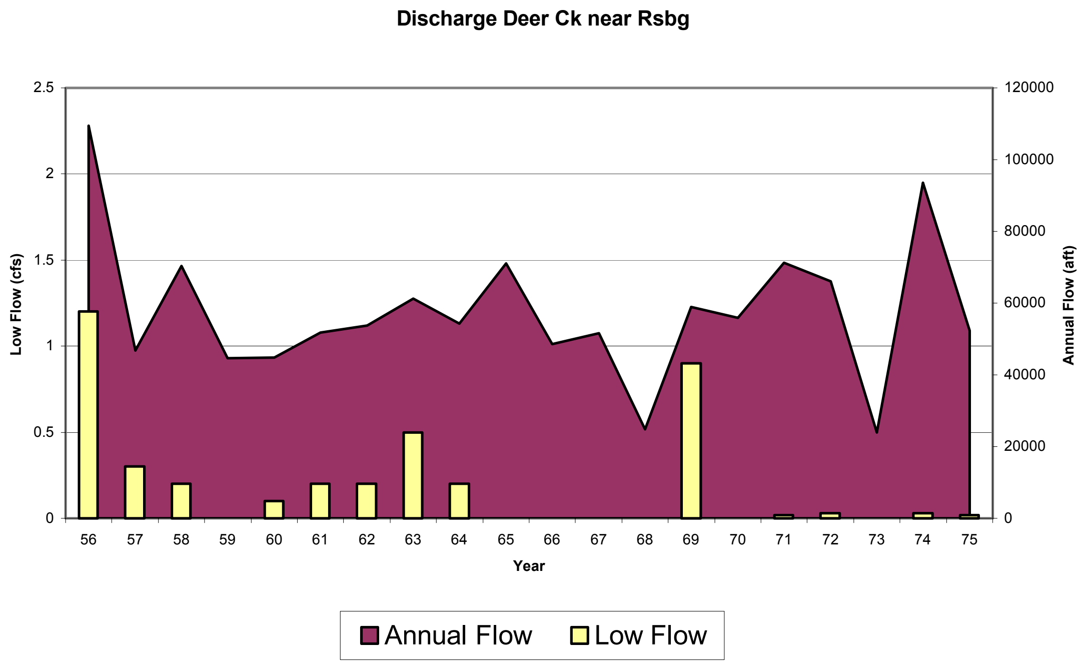


Figure 3-15. Annual and Low flows in Deer Creek

3.5. Fish

Anadromous salmonids present in the Deer Creek Watershed include coho salmon, fall Chinook salmon, cutthroat trout and winter steelhead. Other fish species present include sculpin, dace, and Pacific lamprey. The fish species are listed in Table 3-15.

Native Species		Non-native Species	
Common Name	*Scientific Name*	*Common Name*	*Scientific Name*
Winter steelhead	*Oncorhynchus mykiss*	Bluegill	*Lepomis macrochirus*
Coho salmon	O. kisutch	Brown bullhead	*Ameiurus nebulosus*
Fall chinook salmon	*O. tshawytscha*		
Cutthroat trout	*O. clarkii*		
Brook lamprey	*Lampetra spp.*		
Pacific lamprey	*Lampetra tridentata*		
Umpqua dace	*Rhinicthys cataractae*		
Sculpin	*Cottus sp.*		
Redside shiner	*Richardsonius balteatus*		
Speckled dace	*Rhinicthys osculus*		
Umpqua pikeminnow	*Ptychocheilus umpquae*		
Largescale sucker	*Catostomus macrocheilus*		

Table 3-15. Fish in the Deer Creek Watershed

Other warmwater species such as largemouth bass and green sunfish are released voluntarily and accidentally from basin farm ponds. These species may be present for a short time and then disappear. Smallmouth bass may be year-long residents in some reaches, but this has not been confirmed.

Rock Creek Hatchery Fish

The ODFW has released hatchery coho salmon in the mainstem, North Fork and South Fork of Deer Creek. Table 3-16 describes the numbers and the places of these releases.

Year	Mainstem Deer Creek	North Fork Deer Creek	South Fork Deer Creek
1983	38,000		
1985		14,000	10,000
1986		37,000	44,000
1987		12,000	31,000
1988	7,000	10,000	8,000
1989	4,000		
1992	15,000		
1993	16,000		
1994	15,000		
1995	14,000		
1996	10,000	5,000	
1998	1,000		
2000	14,000		
2001	8,000		

Table 3-16. Coho released in Deer Creek.

Deer Creek Fish Presence

Unfortunately, it is difficult to access precise data about fish species location within Umpqua Basin streams and rivers. Fish presence surveys and known habitat preferences have been used to determine the streams and reaches that support salmonid and non-salmonid game fish species within the Deer Creek watershed. Although non-salmonid, non-game fish species are important as well, there is insufficient accessible data on the location of these types of fish and their distribution was not included in this assessment.

The Oregon Department of Forestry and the Oregon Department of Fish and Wildlife conduct fish presence surveys on private lands throughout the Umpqua Basin. At this time, fish presence surveys on private lands are done in response to landowner permit applications for certain management practices, such as timber harvests. Therefore, not all streams have been surveyed.

A stream that has "fish use" means that a stream is "inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the federal or state Endangered Species Act[24]." Streams that have fish use are classifieds as "Type F" streams. When conducting fish presence surveys, the surveyors only indicate fish

[24] From Oregon Department of Forestry, 2000.

presence when an anadromous salmonid, game fish, or threatened or endangered fish species is present. A stream with fish that do not fall into one of these categories, such as largescale suckers, would not be classified as having “fish presence”.

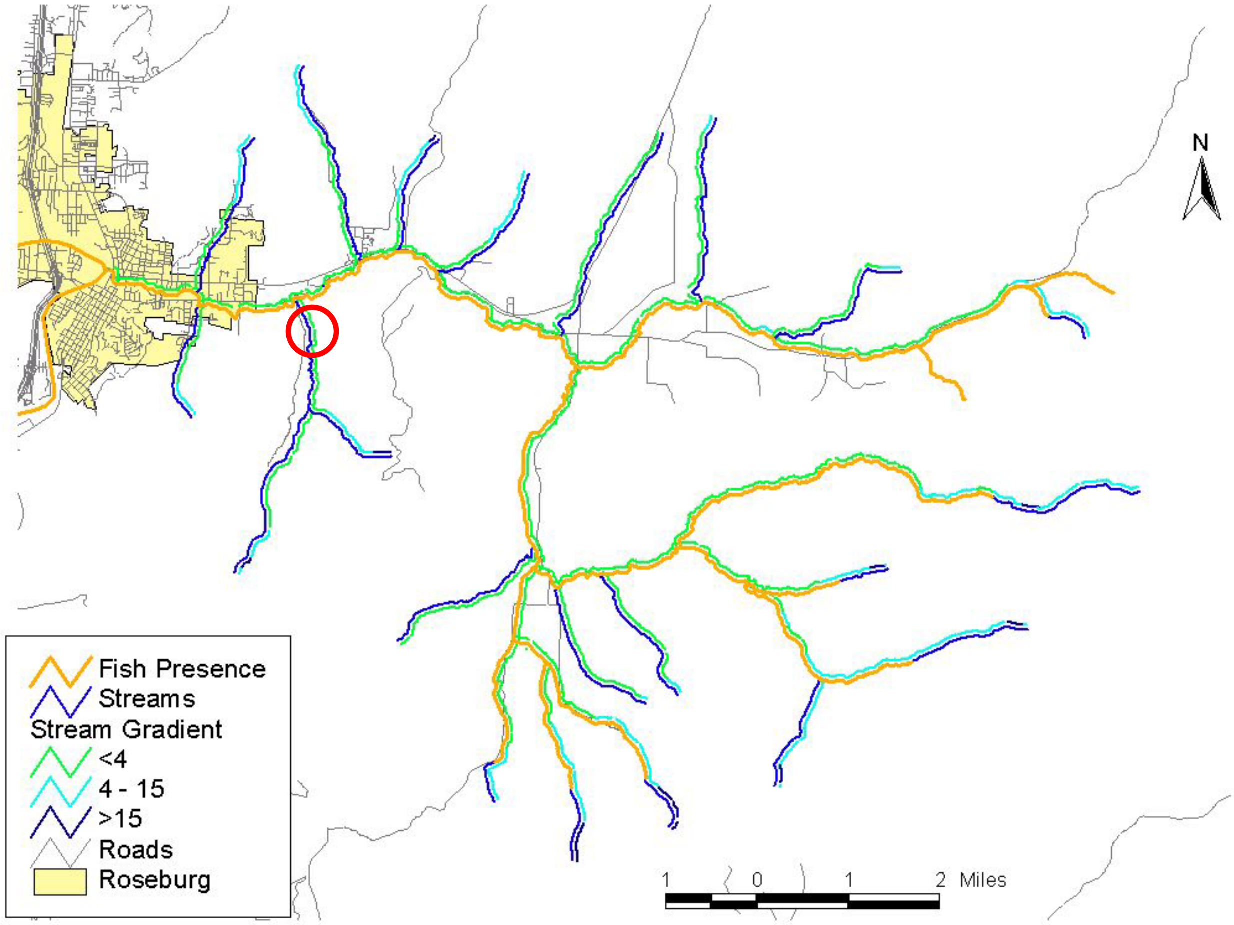
There are no threatened or endangered non-salmonid fish in the Umpqua Basin, although the Pacific lamprey is a federally listed species of concern. The only non-salmonid game species are the smallmouth and largemouth bass, which are warmwater species. Smallmouth bass can be found in the Main and the South Umpqua rivers and their major tributaries[25]. This species may be year-long residents in some Deer Creek reaches, but this has not been confirmed. Largemouth bass are released voluntarily and accidentally from basin farm ponds. This species may be present for a short time and then disappear.

In general, streams become warmer as they flow from their headwaters to the mouth[26]. Water that is close to its source, such as found in small tributaries, is usually too cold to support bass. Although Deer Creek may support year-round populations of smallmouth bass, the surveyed Deer Creek tributaries would be too cold, and therefore fish presence in these streams can be assumed to be evidence of salmonids.

Steelhead, coho, and chinook, the anadromous salmonid species, prefer reaches with a gradient of approximately 0-4%. Cutthroat trout can be found in reaches with a 4-15% gradient. Gradients greater than 15% are generally too steep for salmonid fish. Streams with fish presence and a gradient that is more than four percent indicate cutthroat trout presence. Where the stream gradient is less than four percent, fish presence is most likely an indication of anadromous salmon presence.

In the Deer Creek Watershed, surveys have been completed on Deer Creek, North Fork Deer Creek, South Fork Deer Creek, Tucker Creek, the western tributary of Tucker Creek, Melton Creek, Middle Fork South Fork Deer Creek, and an eastern tributary of Middle Fork South Fork Deer Creek. Map 3:8 shows fish presence in the surveyed streams and the gradient for each reach. The mainstem of Deer Creek most likely supports smallmouth bass and intermittent populations of largemouth bass. Anadromous salmon are most likely found in both the mainstem of Deer Creek as in the tributaries with a 0-4% gradient. Fish presence for the higher gradients is an indication of cutthroat trout.

[25] In vary rare cases, smallmouth bass can be found in the lowest reaches of the North Umpqua river.
[26] Current research by Kent Smith of InSight consultants has suggested that groundwater infiltration can alter or even reverse this trend. It is unknown at this time if this trend has been found within the Deer Creek watershed.



Map 3:8. Fish Presence

There are limitations to the fish presence map. Notice the stream length within the red circle. The gradient level of this stream would seem to indicate that fish could be found there, but there is no fish presence indicated. There are three potential reasons for this. First, as stated earlier, fish presence surveys have not been conducted in all of the Umpqua Basin. It is possible that this length of stream has not been surveyed, therefore it is unknown if fish are found there. Secondly, there could be a fish passage barrier, such as a culvert, dam, or waterfall, that prevents fish from accessing this habitat, and so there are no fish in that reach. Thirdly, the fish might have access to the stream reach but for unknown reasons do not inhabit that reach.

Coho Spawning Surveys

Coho spawning surveys are conducted yearly by the ODFW. During the months of October to January a reach of a creek is sampled, and the number of coho and redds are recorded. Eleven of these surveys have been performed in the Deer Creek Watershed since 1990 (Figure 3-16). More coho have been found in the North Fork of Deer Creek than in the mainstem. There is no systematic survey for steelhead in Deer Creek.

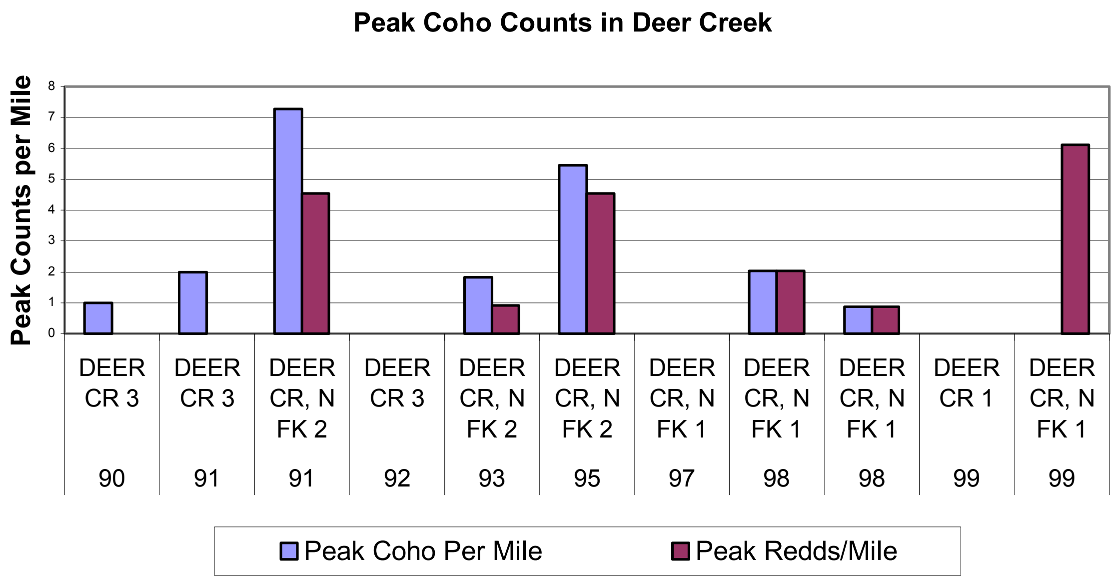


Figure 3-16. Peak Coho Counts in Deer Creek.

In Deer Creek the maximum number of coho observed per mile ranged from 0 (1992, 1999) to 2 (1991), and there have never been any redds observed in Deer Creek during the surveys. In North Fork Deer Creek the maximum number of coho per mile observed ranged from 0 (1997, 1999) to 7.2 (1991), and the number of redds per mile ranged between 0 (in 1997) and 6.1 (in 1999). In 1999 no Coho adults were seen during the surveys, but presence of a significant number is documented by the occurrence of 6.1 redds per mile in North Fork Deer Creek.

Action Recommendations

- *Survey fish rearing areas in September to establish presence/absence of salmonids and to use for prioritization of areas needing stream enhancements.*
- *Complete presence/absence electroshocking surveys in the spring in areas where fish presence/absence is unknown.*

4. Future Conditions

4.1. Residential, Industrial, and Urban Growth

Roseburg

The direction of growth of Roseburg in the Deer Creek Watershed will likely extend East along Highway 138 to incorporate the new park on Oregon State Highway 138. The current build-out potential is displayed in Table 4-1. The required setback for structures outside of the Urban Growth Boundary along Deer Creek is 50 feet. The land use and development ordinance of the city of Roseburg requires a 50-foot setback in industrial areas and a 25-foot setback in residential zones. This setback applies to structures, as well as any physical development such as parking lots, retaining walls, channel alterations, etc. unless there is an allowance for a reduction in this setback by the Director after consultation with ODFW. Mature ground cover and trees and wildlife habitats are to be maintained in this zone. Recent developments within the city limits have parking lots close to creeks and removal of riparian vegetation. More land near the creek will be covered, producing impervious surfaces and increased run-off, or, in the case of a residential house, a lawn might be established to the edge of the creek, decreasing bank stability, wildlife habitat, and the riparian vegetation, and increasing the opportunity for fertilizers and pet feces, etc. to enter the waterway.

Zone	Acres
Commercial	99.55
Industrial	31.01
Multi-Family Residential	210.37
Mixed Use	11.81
Professional Office	5.44
Public Reserve	56
Single Family Residential	459.71
Total	873.89

Table 4-1. Vacant Acres in Roseburg by Zoning

The growth rate of the population within Urban Growth Boundary of Roseburg is projected to be 2.3%. The population estimate of 2000 was 20,955, with the projected population for 2010 at 25,364, and for 2020 at 30,918. These projections, if true, will bring more pressure to the Deer Creek Watershed through housing developments and increased business needs.

According to the Douglas County Comprehensive Plan (1997), there are four sites in Douglas County delineated as potential water impoundment sites to serve the future water resources needs of the county. One of these sites is located on Middle Fork South Fork Deer Creek at the size of around 10,000 acre-feet which would be similar in size to Ben Irving Reservoir.

Action Recommendations

- *Create Best Management Practices for construction.*
- *Develop zoning policy that restricts the establishment of parking lots within the setback.*
- *Develop zoning policy that encourages an effective riparian shade buffer that is tall and dense, and leaves appropriate channel structure.*

- *Improve current riparian areas.*

4.2. Strategy

As a part of the Oregon Salmon Plan, a center has been established in Corvallis to record restoration activities performed in Oregon. Although such activities have occurred in the Deer Creek Watershed, there are no records of restoration activities at this center.

Action Recommendations

- *Encourage reporting of enhancement activities to the Umpqua Basin Watershed Council.*

5. Action Plan

Activities within the action plan *are suggestions for voluntary projects and programs*. The action plan should neither be interpreted as landowner requirements nor as a comprehensive list of all possible restoration opportunities.

5.1. Summary of Action Recommendations

Stream Morphology – Fish Habitat Action Recommendations

- *Resurvey stream habitat surveys 20 years from last survey.*
- *Conduct stream habitat surveys on the unsurveyed reaches of South Fork Deer Creek.*
- *Enhance riparian areas with trees for a current source of shade and nutrients, and a future source of structure in the creek (see 3.3.2 Temperature).*
- *Consider adding wood to stream segments with an active channel less than 30 feet wide on a case-by-case basis. Stream segments with an active channel less than 30 feet wide include North Fork Deer Creek, Middle Fork of South Fork Deer Creek, parts of South Fork Deer Creek, and many tributaries.*

Connectivity – Passage Barriers Action Recommendations

- *Obtain permission from landowners to conduct culvert surveys on unsurveyed tributaries.*
- *Improve culverts for passability that have been found to have problems.*
- *Evaluate other barriers.*
- *Screen diversions.*

Stream Meandering – Modification Action Recommendations

- *Contact DSWCD or UBWC to design streambank stabilization projects applicable for the site.*

Riparian Zone Composition and Function Action recommendations

- *Protect riparian areas that have a width of two or more trees from being reduced in width.*
- *Increase canopy cover by planting trees in predominately brush riparian areas. Avoid full-scale exposure during the process.*
- *Where feasible, establish conifers and other native vegetation in areas now dominated by blackberries, and other invasive plant species or no tall plants at all.*
- *Manage the riparian areas for tree crown growth.*
- *Manage livestock so that they are not intrusive to the riparian area.*
- *Plant native vegetation.*

Stream and Riparian Associated Wildlife Action Recommendations

- *Widen the riparian habitat wherever practical by: 1) Providing training programs that teach local landowners riparian restoration techniques that they can implement on their properties; 2) planting trees, preferably conifers near the stream to widen the habitat and eventually shade out the vast stands of Himalayan blackberries; and 3) adding or extending fence lines along stream channels.*

- *Plant groves of trees and associated native understory plant species in pasture areas between riparian corridors and upland forests to provide connection from the riparian area to forested areas.*
- *Create openings in large expanses of blackberries to add to short-term habitat complexity.*
- *Develop ponds or secondary ponds from seeps or small springs. A secondary pond can provide quality habitat if it retains water through May, after the end of the water-fowl breeding season. Supplying material at the edge of the pond, or softening edges, provides habitat where the western pond turtles can lay their eggs. Adding structure (branches, logs, stumps, etc.) to the pond benefits fish, amphibians, and aquatic insects. Installing platforms adds habitat and safety zones for animals. (Caution: these projects usually require permits and can also have negative impacts on ground water flow which adds high quality water to creeks.)*
- *Putting up nest boxes increases habitat for nesters. Properly establishing brush piles can accommodate a variety of animals. Placing brush piles on platforms about eight feet above the ground gives birds safety from ground-dwelling predators.*
- *Consider leaving dead trees standing and logs on the ground.*

Sediment Action Recommendations

- *Increase vegetated buffer strips along creeks to filter sediment.*
- *Provide sediment filtration mechanisms at construction sites or projects involving exposed soil to keep sediment from entering the creeks.*
- *Encourage seeding and water-barring of fire trails and temporary roads to keep freshly exposed soil from being washed into the creeks when it rains.*
- *Encourage landowners to inspect their roads and ditches for erosion problems. This is especially important for those roads that are dirt or gravel and are within 200 feet of a stream.*
- *Minimize ditch flow to active streams by using relief culverts.*
- *Encourage more winter turbidity monitoring.*
- *Manage grazing areas for a minimum of exposed soil, particularly near streams.*

Temperature Action Recommendations

- *Establish a tall and dense shade wall along the streams.*
- *Use selective thinning to encourage full crowns.*
- *Establish trees in open and brushy areas along the stream.*

Nutrients Action Recommendations

- *Provide a training program that teaches landowners practical means of monitoring and controlling nutrient contamination, and encourages implementation of these techniques on private land.*
- *Maintain vegetated buffer strips to intercept pollutants in runoff.*
- *Construction site erosion control to limit the transfer of sediment (a likely source of nutrients) from the site into storm drains and creeks.*

- *Fixing failing septic tanks that contribute nutrients to the creeks.*
- *Manage livestock so animal wastes do not contaminate the riparian area or the stream.*

Dissolved Oxygen Action Recommendations

- *Protect the creeks from sediment so that riffles are not filled with sediment, and the dissolved oxygen level in the gravels can be higher.*
- *Decrease the temperature of the water by improving riparian areas so that the water can hold more dissolved oxygen.*
- *Reduce amounts of phosphorus to prevent algal blooms by filtering sediments entering the creek.*

pH Action Recommendations

- *Keep measuring periodically for pH levels at several different sites.*

Toxics Action Recommendation

- *Perform systematic monitoring and sampling for toxics of concern.*
- *Participate in the Clean Umpqua Project (Clean-up), an educational program for how to dispose of toxic wastes.*

Bacteria Action Recommendations

- *Use off-channel watering for livestock to keep the livestock from defecating near or in the stream.*
- *Fence areas along the streams to keep the livestock from defecating near or in the stream.*
- *Check septic tanks and drainfields.*
- *Remove pet waste by collecting and properly disposing it.*
- *Maintain buffer strips along streams which filter water entering the creek (although buffer strips alone cannot remove all bacteria from a large source).*

Water Availability Action Recommendations

- *Secure water right leases or purchase water rights for conversion to instream use.*
- *Improve irrigation efficiency.*

Fish Action Recommendations

- *Survey fish rearing areas in September to establish presence/absence of salmonids and to use for prioritization of areas needing stream enhancements.*
- *Complete presence/absence electroshocking surveys in the spring in areas where fish presence/absence is unknown.*

Residential, Industrial, and Urban Growth Action Recommendations

- *Create Best Management Practices for construction.*
- *Develop zoning policy that restricts the establishment of parking lots within the setback.*

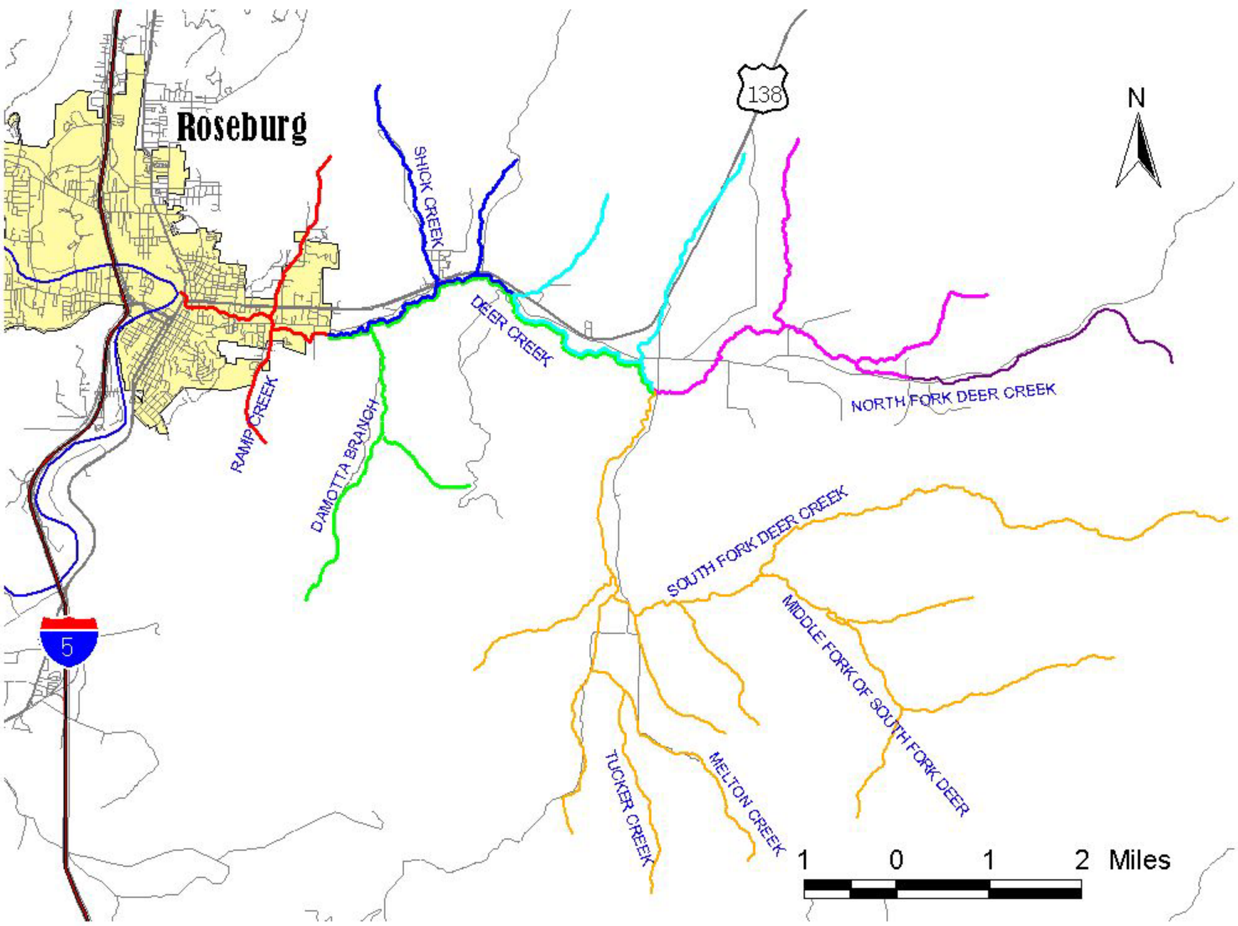
- *Develop zoning policy that encourages an effective riparian shade buffer that is tall and dense, and leaving appropriate channel structure.*
- *Improve current riparian areas.*

Strategy Action Recommendations

- *Encourage reporting of enhancement activities to the UBWC.*

5.2. Enhancement Activities

In this section, specific potential enhancement activities are listed by different sections of the Deer Creek Watershed, which can be located on Map 5:1.



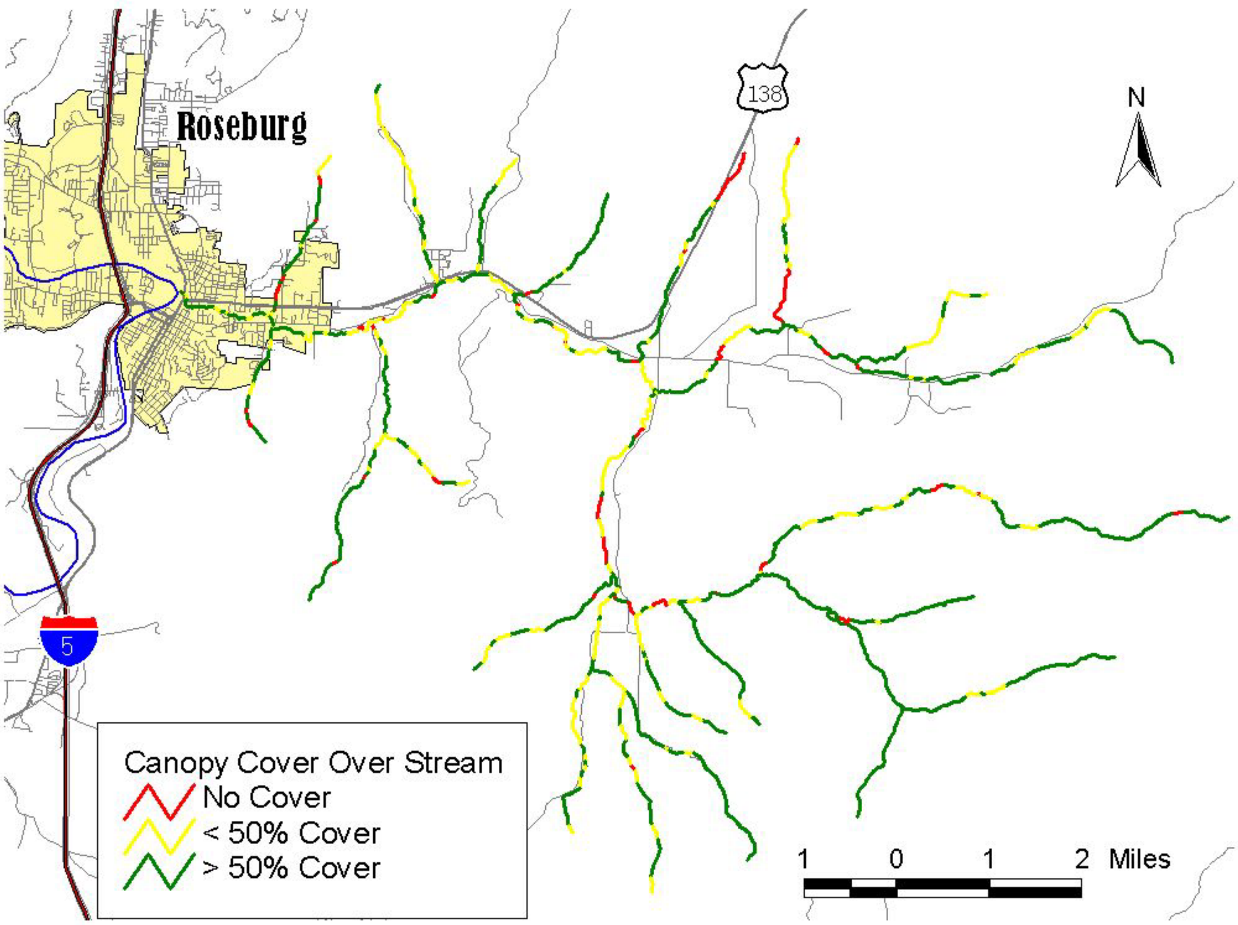
Map 5:1. Action Plan Sections

Deer Creek, Roseburg (12 miles of riparian area)

- Check point sources for bacteria and toxics.
- Plant trees and shrubs in riparian areas where there is less than 50% canopy cover[27] (4 miles of riparian area).

[27] See Map 5:2.

- Conduct non-evasive blackberry removal and interplant with trees (1 mile of riparian area).
- Eastwood school: remove gravel area by creek and restore.
- Enhance riparian area at Eastwood Park and use as a demonstration site of riparian health with before/after displays.
- Enhance riparian area on Ramp Creek before it is converted into development and develop wetlands.
- Check for fish passage along Ramp Creek and correct passage problems if any are found.
- Restore meanders on Ramp Creek.
- Remove fill and concrete from Deer Creek streambanks.
- Require fish passing culverts in further developments.
- Purchase greenway easement along Deer Creek.



Map 5:2. Canopy Cover over Deer Creek and its Tributaries.

South Side of Deer Creek, from the Urban Growth Boundary to the forks (14.5 miles of riparian area)

- Concentrate tree planting on sections with less than 50% cover (5.5 miles of riparian area).
- Much of this section is already fenced, enhance those riparian areas.

- Establish conifers and other native vegetation in areas now dominated by blackberries (1 mile of riparian area).
- Several fields on DaMotta Branch have opportunities for livestock management, cattle crossings, off-channel watering, riparian planting and/or spring grazing lots.
- Increase riparian areas on DaMotta Branch on poor agricultural lands as wetlands and flood control.
- Evaluate channel modification and adjust.

North Side of Deer Creek, from the Urban Growth Boundary to Buckhorn Road (11 miles of riparian area)

- Sample for toxics.
- Check fish passage on Shick Creek.
- Enhance extensive areas along Shick Creek that are currently blackberry or rangeland with trees (2 miles of riparian area).
- Enhance created wetlands on Shick Creek and past restoration activities on Shick Creek
- Enhance riparian areas in abandoned mill site.
- Pursue livestock management opportunities in three major tributary drainages, including off-channel watering and shade.
- Concentrate tree planting on sections with less than 50% cover (7 miles of riparian area).
- Evaluate channel modification and adjust.

North Side of Deer Creek, Buckhorn Road to the forks (11.5 miles of riparian area)

- Pursue livestock management opportunities, concentrate on moving feeding areas away from the creek and unstable areas, and education.
- Enhance riparian areas with tree planting.
- Promote confidential program to dye-test near-stream septic systems to check for failure.
- Mitigate effects of past riprap.

North Fork Deer Creek, mouth to Strader Road (17 miles of riparian area)

- Pursue developing log pond and wetlands area, plantings of wet meadows and native prairie, and combine with livestock management.
- Focus riparian planting on areas with less than 50% cover (9 miles of riparian area).
- Establish trees and other native vegetation in areas now dominated by blackberries (2.5 miles of riparian area).
- Enhance riparian area at O. C. Brown Park and use as a demonstration site for riparian health.
- Perform livestock management with riparian fencing, cattle crossings, off-channel watering, off-channel provision of shade, and cross fencing.
- Place large woody material in the stream (low priority).
- Evaluate channel modification and adjust.

North Fork Deer Creek, Strader Road to headwaters (7 miles of riparian area)

- Place large woody material in the stream (higher priority).
- Establish vegetation in areas where blackberries have been removed.

- Perform livestock management with riparian fencing, cattle crossings, off-channel watering, off-channel provision of shade and cross fencing.
- Promote confidential program to dye-test near-stream septic systems to check for failure (especially in the winter).
- Plant steep uplands with trees.

South Fork Deer Creek (68.5 miles of riparian area)

- Perform livestock management with riparian fencing, cattle crossings, off-channel watering, off-channel provision of shade, and cross fencing.
- Promote confidential program to dye-test near-stream septic systems to check for failure (especially in the winter).
- Establish trees and other native vegetation in areas now dominated by blackberries (2.5 miles of riparian area).
- Perform streambank erosion control emphasizing bioengineering techniques.
- Increase riparian areas on poor agricultural lands, that are often wet and cause foot diseases for livestock, or are borderline for hay production, as wetlands and flood control.
- Place large woody material in the stream on Middle Fork South Fork Deer Creek or South Fork Deer Creek above the confluence of Middle Fork South Fork Deer Creek.
- Evaluate channel modification and adjust.
- Plant steep uplands with trees.
- Encourage landowners to meter water intakes.

5.3. Outreach Programs

- Collaborate with local citizens and groups to develop volunteer-based fish habitat and water quality monitoring teams that would evaluate current local conditions and post-project success, identify critical salmonid spawning and rearing habitat, and work with private landowners to determine restoration opportunities.
- Implement public information and educational programs about the problems associated with culverts and other fish passage barriers, ways of identifying barriers, and opportunities to replace or retrofit problem culverts and other barriers.
- Cooperate with local citizen's groups and agencies to conduct public information and education programs about the importance and benefits of a healthy riparian habitat. Emphasize the potential funding sources for stock water management, riparian fencing, and riparian planting and conversions to encourage landowner participation.
- Develop public information and educational programs that focus on the public health hazards associated with bacteria and toxins in surface water and groundwater, common sources of toxins and bacteria, and methods to improve conditions at the local level.
- Through public information programs, encourage landowner participation in the Oregon Department of Environmental Quality's free, anonymous septic system testing service.

Riparian Plants

Generally suggested plant species for riparian areas in the Deer Creek Watershed:

- Douglas-fir
- incense cedar

- western redcedar
- ponderosa pine
- red alder
- bigleaf maple
- Oregon white oak,
- Oregon ash
- willows
- red alder
- white alder
- cascara buckthorn
- snowberry
- red-osier dogwood
- mock orange
- Pacific serviceberry
- ninebark
- sedges
- rushes

Smolt Trap

- Coordinate possible smolt trap monitoring at Eastwood School with science classes to educate and involve students with smolt counts, water quality, etc.

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Acronyms

BLM	Bureau of Land Management
CFS	Cubic Feet Per Second
DEQ	Oregon Department of Environmental Quality
DSWCD	Douglas Soil and Water Conservation District
LWM	Large Woody Material
MBF	Thousand Board-Feet
NTU	Nephelometric Turbidity Unit
NWI	National Wetlands Inventory
ODFW	Oregon Department of Fish and Wildlife
PIEC	Provincial Interagency Executive Committee
UBWC	Umpqua Basin Watershed Council

Appendices

Deer Creek – Reach 1[28]

The trees in the riparian area were categorized as deciduous with average diameter of 12 inches.

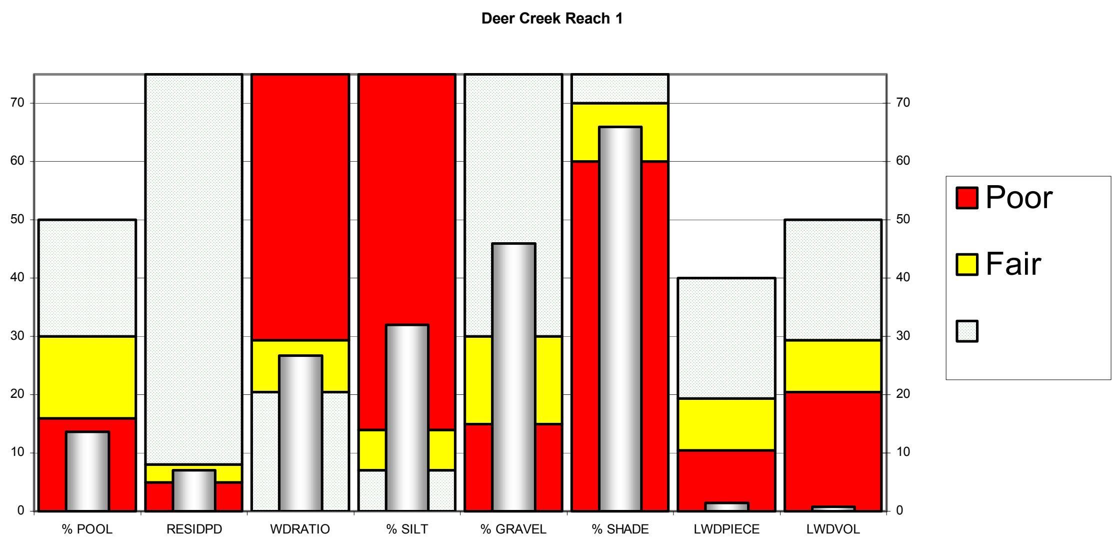


Figure 5-1. Stream Habitat Survey Components in Deer Creek Reach 1.

Deer Creek – Reach 2

The trees in the riparian area were categorized as deciduous with average diameter of 12 inches.

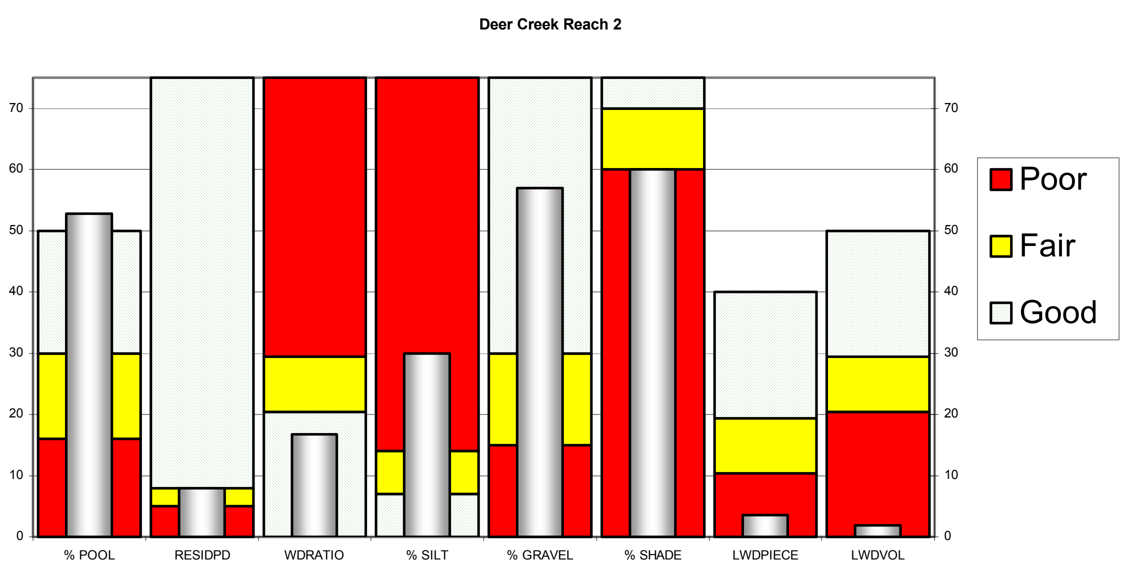


Figure 5-2. Stream Habitat Survey Components in Deer Creek Reach 2.

[28] Data described in Table 3-3.

Deer Creek – Reach 3

The trees in the riparian area were categorized as deciduous with average diameter of 12 inches.

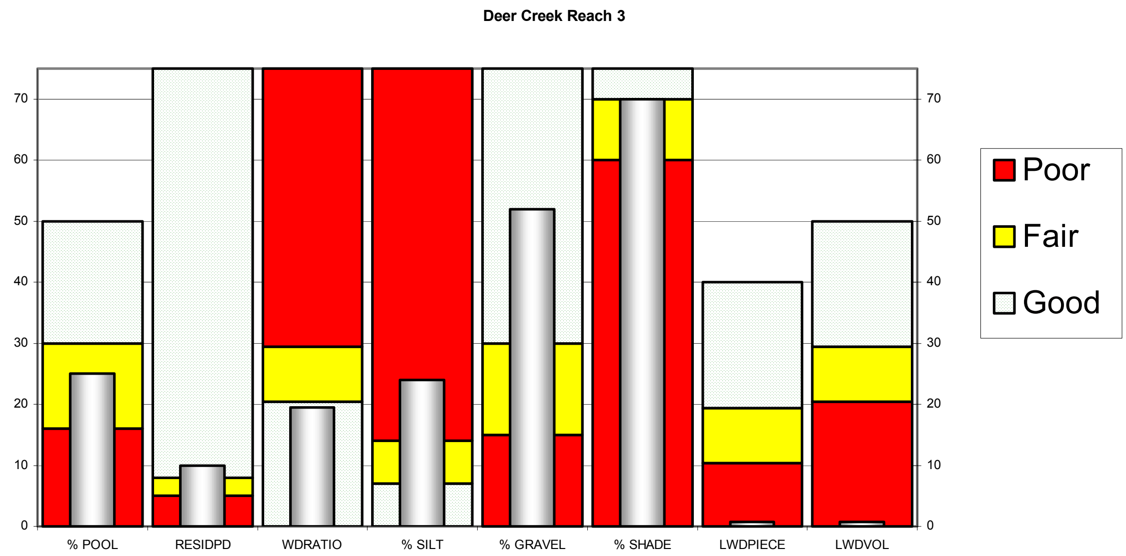


Figure 5-3. Stream Habitat Survey Components in Deer Creek Reach 3.

South Fork Deer Creek – Reach 1

The trees in the riparian area were categorized as deciduous with average diameter of 12 inches.

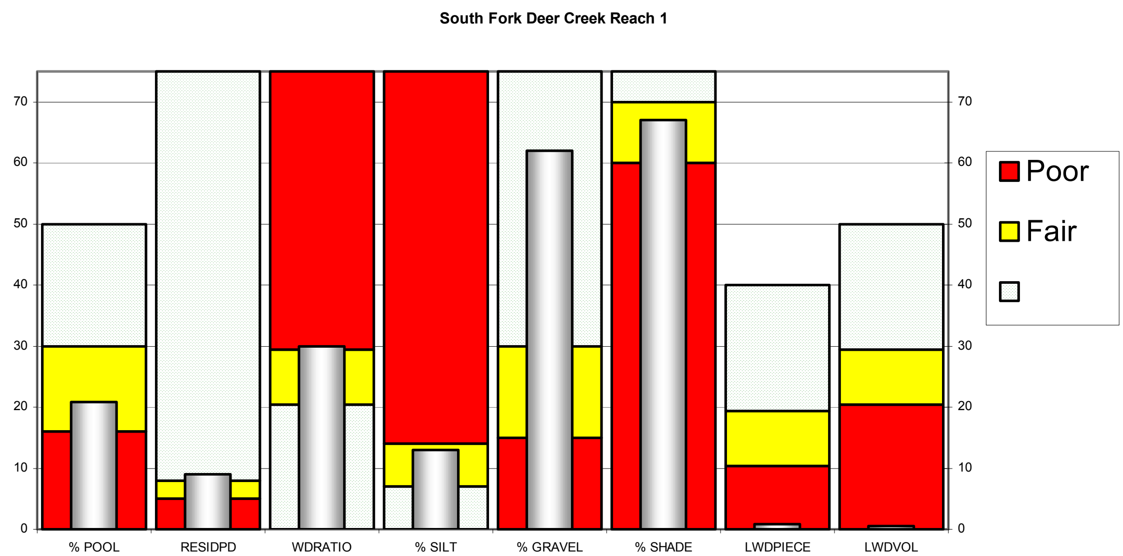


Figure 5-4. Stream Habitat Survey Components in South Fork Reach 1.

Middle Fork South Fork Deer Creek – Reach 1

The trees in the riparian area were categorized as deciduous with average diameter of 1.2 inches.

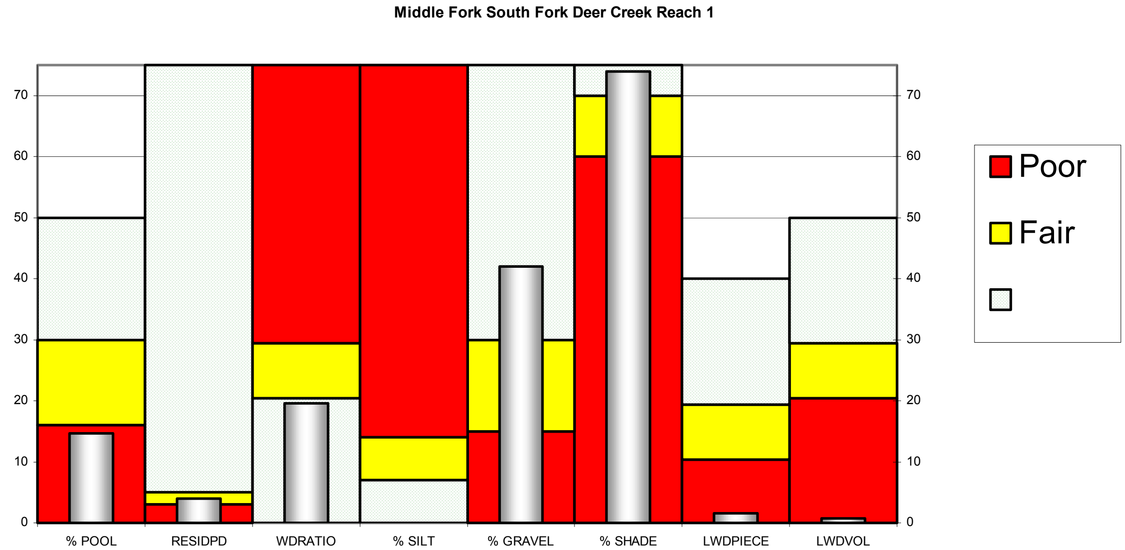


Figure 5-5. Stream Habitat Survey Components in Middle Fork South Fork Reach 1.

Middle Fork South Fork Deer Creek – Reach 2

The trees in the riparian area were categorized as deciduous with average diameter of 5.9 inches.

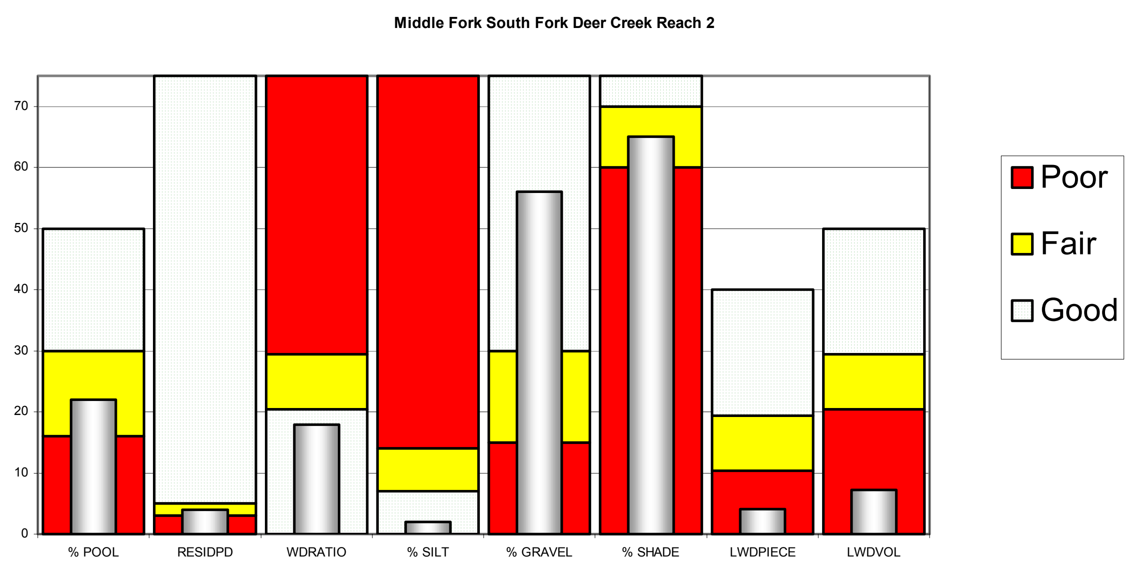


Figure 5-6. Stream Habitat Survey Components in Middle Fork South Fork Reach 2.

Middle Fork South Fork Deer Creek – Reach 3

The trees in the riparian area were categorized as mixed with average diameter of 1.2 inches.

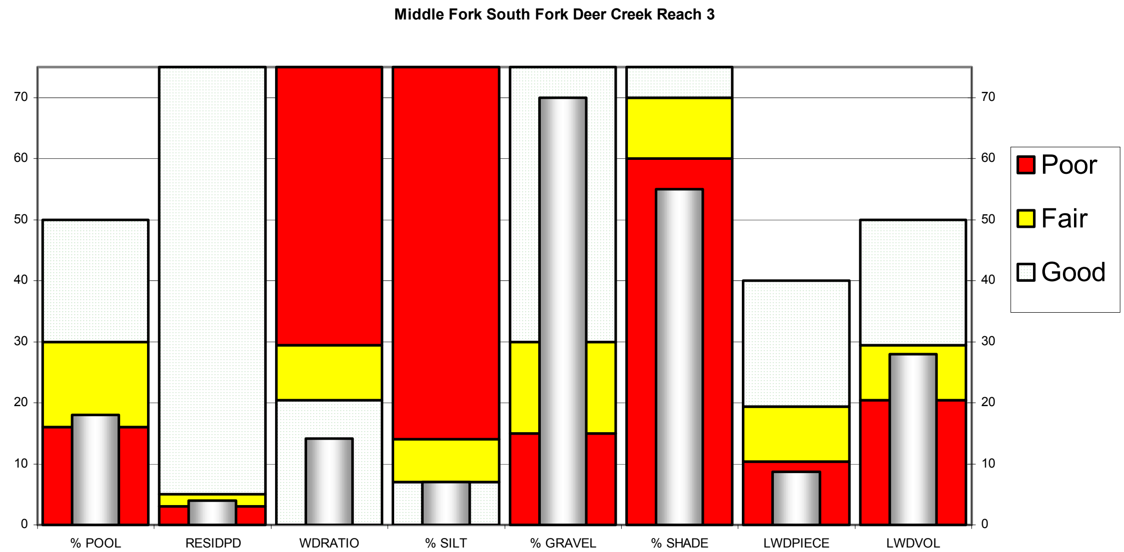


Figure 5-7. Stream Habitat Survey Components in Middle Fork South Fork Reach 3.

North Fork Deer Creek – Reach 1

The trees in the riparian area were categorized as deciduous with average diameter of 5.9 inches.

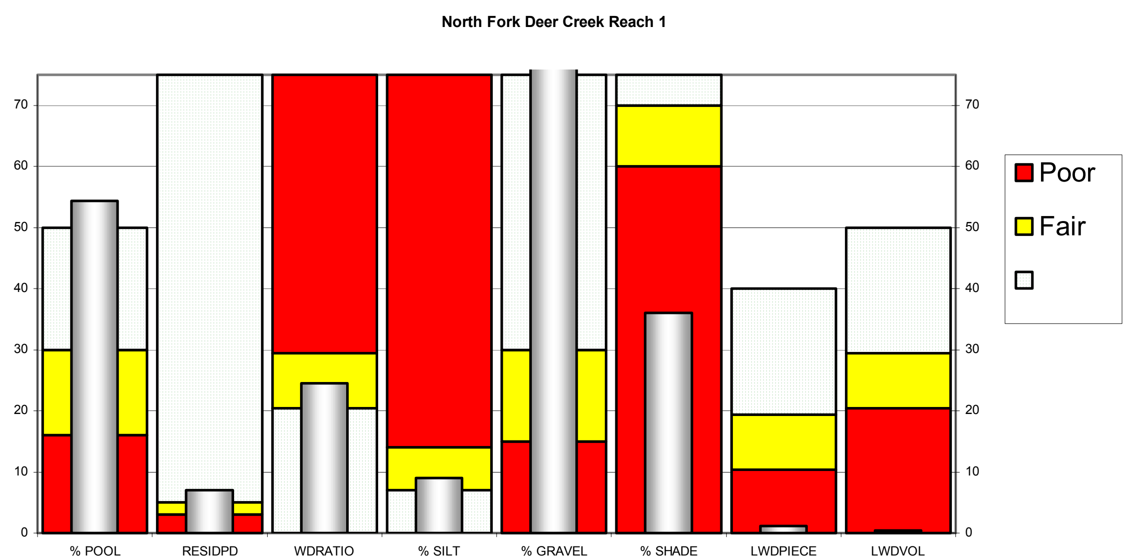


Figure 5-8. Stream Habitat Survey Components in North Fork Reach 1.

North Fork Deer Creek – Reach 2

The trees in the riparian area were categorized as deciduous with average diameter of 5.9 inches.

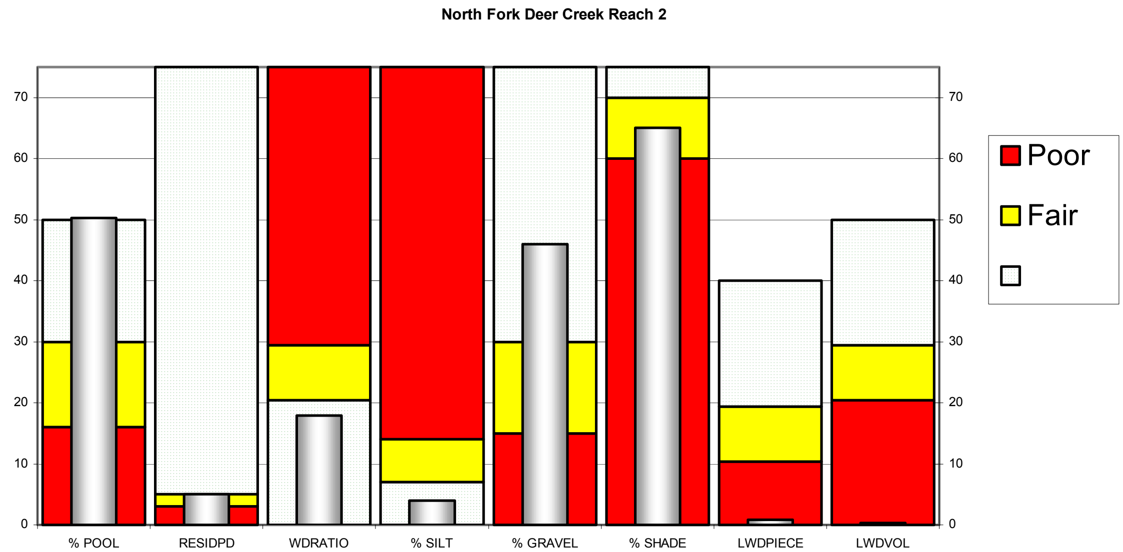


Figure 5-9. Stream Habitat Survey Components in North Fork Reach 2.

North Fork Deer Creek – Reach 3

The trees in the riparian area were categorized as deciduous with average diameter of 5.9 inches.

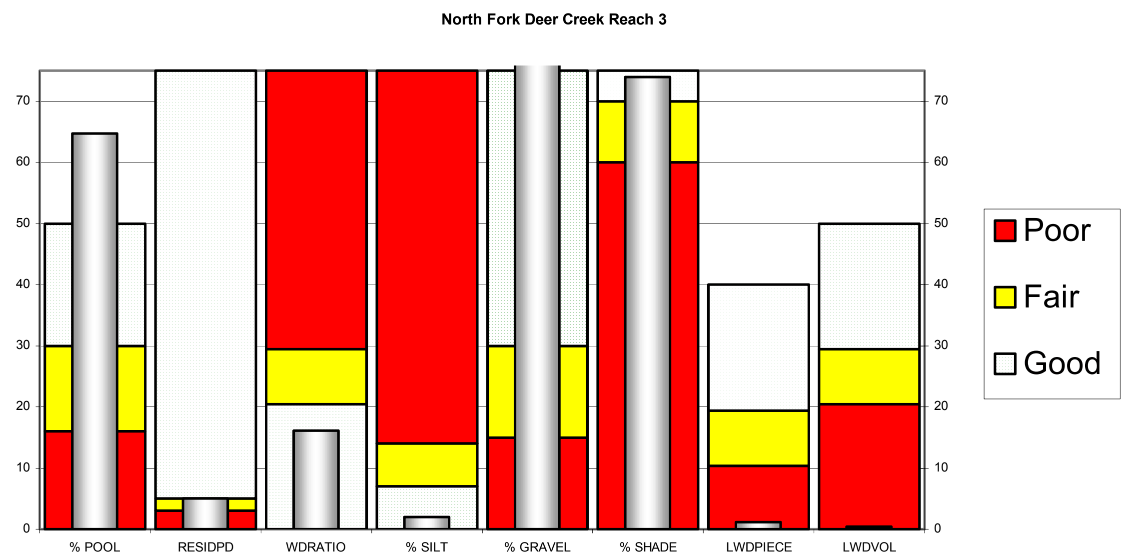


Figure 5-10. Stream Habitat Survey Components in North Fork Reach 3.

North Fork Deer Creek – Reach 4

The trees in the riparian area were categorized as deciduous with average diameter of 5.9 inches.

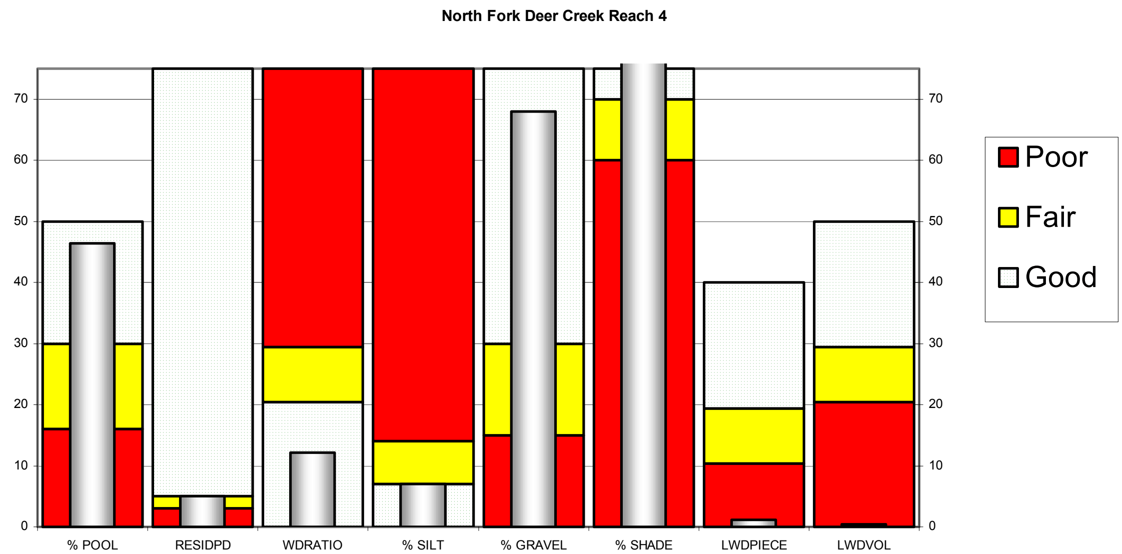


Figure 5-11. Stream Habitat Survey Components in North Fork Reach 4.

North Fork Deer Creek – Reach 5

The trees in the riparian area were categorized as deciduous with average diameter of 12 inches.

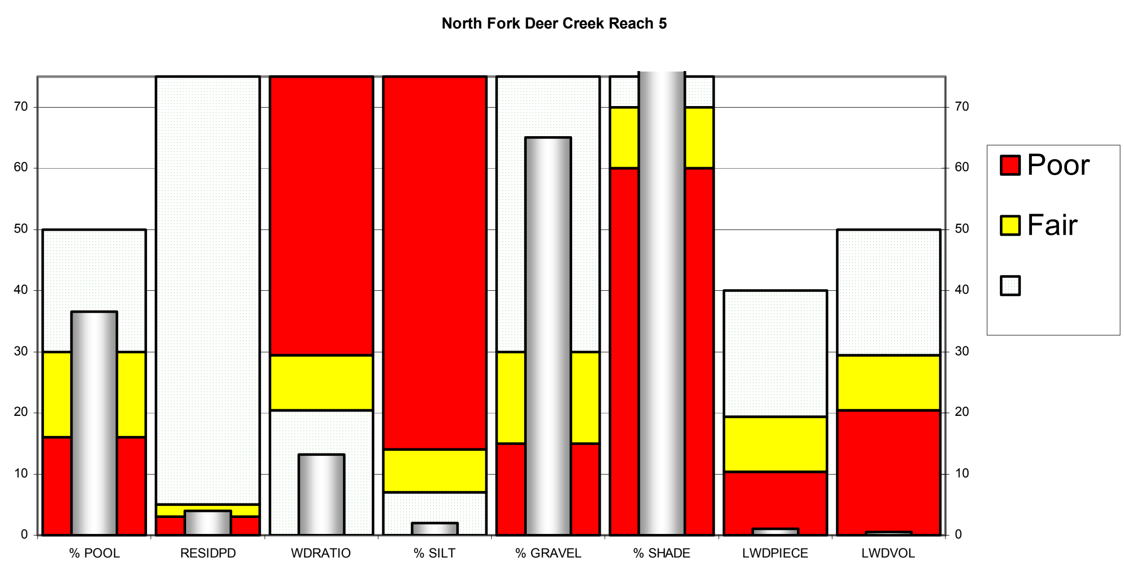
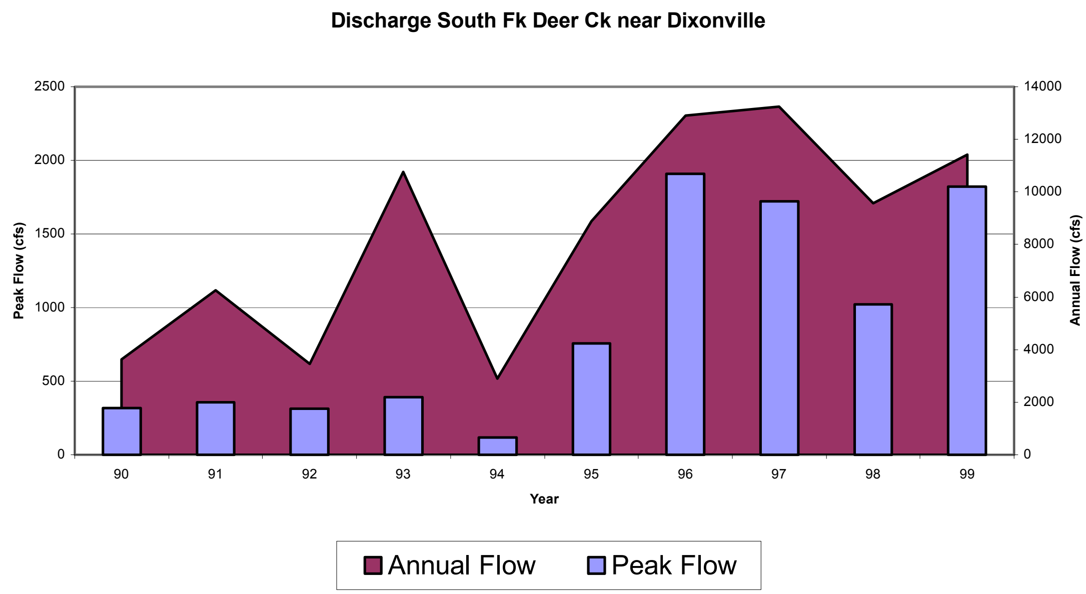
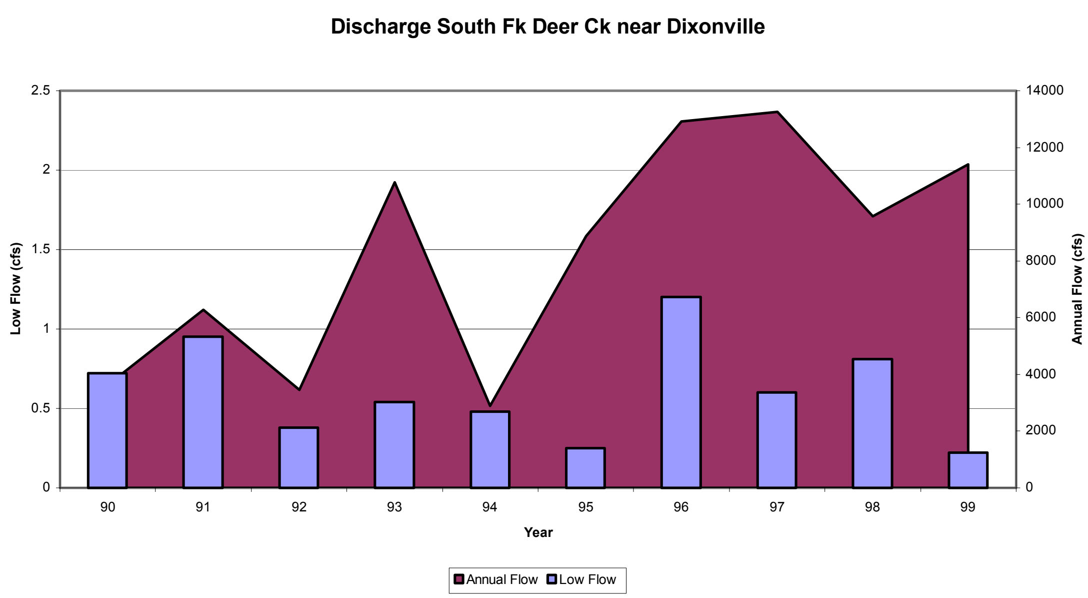


Figure 5-12. Stream Habitat Survey Components in North Fork Reach 5.

Appendix B. Flow in Deer Creek

Data was also collected in 1990 through 1999. The following data displays total, peak, and low flows in South Fork Deer Creek.





Appendix C. Oregon Cadastral Field Notes (Public Land Survey) for Deer Creek

T27S R5W 16 E 1853.

21.50	In Deer Creek 25 links wide.
23.50	A trail, close to Israel Cackveis' house.
40.00	Set quarter section post from which a white oak 15 inches in diameter is 412 links away, and a white oak 18 inches in diameter is 545 links away, close to Saul Hackness and G Murphy houses.
45.00	Leave prairie and enter oak openings.
76.00	Top of hill.
78.00	Leave oak openings and enter prairie.
80.00	Set post from which an oak 15 inches in diameter is 228 links away, an oak 20 inches in diameter is 488 links away, an oak 14 inches in diameter is 97 links away, and an oak 16 inches in diameter is 135 links away.

35 chains gently rolling prairie in Deer Creek Valley. Soil 1st rate. Balance hilly oak openings 2nd rate.

T27S R5W 19 E 1853.

8.00	Leave brush enter oak openings.
9.00	Top of ascent.
13.00	Leave oak openings and enter prairie.
20.00	Foot of descent.
23.50	A drain, nearly dry.
40.00	Set quarter section post from which a pine 8 inches in diameter is 569 links away, and an ash 16 inches in diameter is 403 links away. A house at 20 chains distance.
58.00	Leave prairie and enter oak openings.
66.00	In Deer Creek 20 links wide.
66.50	Leave brushy timber and enter prairie.
70.00	A road.
80.00	Set post from which a pine 14 inches in diameter is 1316 links away, a white oak 28 inches in diameter is 1357 links away, and a white oak 10 inches in diameter is 920 links away. No tree near in section.

Land mostly prairie. Soil 1st and 2nd rate. Some brushy timber on creek.

T27S R5W 20 E 1853.

38.27	A sugar pine 18 inches in diameter.
40.00	Set quarter section post from which a white oak 8 inches in diameter is 11 links away, and a fir 12 inches in diameter is 23 links away.
55.00	Foot of hill.
57.00	In Deer Creek 30 links wide.
59.50	Leave brushy timber and enter prairie, a road and a house nearby.
77.15	A trail.
80.00	Set post from which an oak 16 inches in diameter is 843 links away, an ash 10 inches in diameter is 322 links away, and a white oak 28 inches in diameter is 144 links away. No other trees near.

Land South of creek mostly E slope of hill, crossing numerous spent trenching. N of creek 1st rate gently rolling prairie.

T27S R5W 22 E

38.00	A spring at foot of hill.
40.00	Set quarter section post from which a white oak 7 inches in diameter is 240 links away, and a white oak 10 inches in diameter is 265 links away. Leave oak openings enter prairie.
64.00	Leave prairie enter brush.
67.75	In Deer Creek 40 links wide.
71.00	Leave brush enter prairie.
80.00	Set post from which an ash 12 inches in diameter is 312 links away, an ash 13 inches in diameter is 334 links away, and an ash 15 inches in diameter is 1007 links away.

South half oak openings. The line runs along west slope of hill. Soil good 2nd rate. North half mostly prairie, soil 1st rate.

T27S R5W 23 E. 1853

22.00	Top of ascent on E slope of hill.
35.00	In Deer Creek 50 links wide, comes west, the forks of the creek are about 1 chain above.
39.40	A road course E.
40.00	Set quarter section post from which an oak 16 inches in diameter is 267 links away, and an ash 14 inches in diameter is 395 links away.
44.00	Top of small hill.
47.00	Foot of hill.
53.00	Begin ascent of hill.
57.70	Top of ascent.
64.00	A trail.
80.00	Set post from which a white oak 12 inches in diameter is 965 links away, and a white oak 12 inches in diameter is 721 links away.

Land mostly high rolling prairie, some timber and brush on hills

T27S R5W 35 N. 1853.

24.00	In Deer Creek 40 links wide.
27.50	Leave valley and begin ascent.
39.90	Set quarter section post from which a white oak 9 inches in diameter is 241 links away, and a white oak 10 inches in diameter is 704 links away.
45.00	Leave prairie, enter oak opening.
68.00	Top of hill, leave oak openings and enter brush, fir timber.
79.81	Intersect corner.

This mile part prairie, a part oak openings and part brushy fir timber. Soil 2nd rate.

T27S R4W 14 E going N. 1855

17.50	Brook 6 links wide.
40.00	Set quarter section post from which a white oak 20 inches in diameter is 30 links away,

	and a white oak 22 inches in diameter is 24 links away.
80.00	Set post of corner 11,12,13,14 from which a black oak 15 inches in diameter is 341 links away, a black oak 15 inches in diameter is 82 links away, a black oak 10 inches in diameter is 14 links away, and a black oak 12 inches in diameter is 32 links away.

Soil 3rd rate, Timber fir, oak, cedar, hemlock, ash, and laurel.

T27S R4W 20 E going N. 1855

28.75	Road. Enter prairie.
31.00	Road.
32.75	Brook 6 links wide.
37.00	Brook 6 links wide.
40.00	Set quarter section post from which a white oak 25 inches in diameter is 420 links away and an ash 24 inches in diameter is 384 links away.
52.00	Enter improvement.
57.00	Leave improvement.
80.00	Set post with mound built around it.

Land 2nd rate. Timber of few scattering oak, laurel, and ash.

T27S R4W 34 E going N. 1855.

40.00	Set quarter section post from which a willow 3 inches in diameter is 24 links away, and a red fir 18 inches in diameter is 60 links away.
62.25	Brook 5 links wide.
67.00	Brook 15 links wide.
80.00	Set post of sections 34,35,26,24 from which a laurel 12 inches in diameter is 62 links away, a laurel 10 inches in diameter is 3 links away, a black oak 4 inches in diameter is 59 links away, and a black oak 2 inches in diameter is 72 links away.

Land 3rd rate. Timber fir, oak, cedar, madrone, and laurel.

T28S R5W 2 E. 1853.

9.50	Leave prairie, enter brush.
10.75	In Deer Creek 25 links wide.
10.75	Leave brushy timber and enter prairie.
36.59	Set quarter section post from which a white oak 8 inches in diameter is 930 links away, and no other trees near. The NE corner of Boon’s house and the SE corner of M Adams claims here. J.W. Barkin’s house near.
74.75	Enter Jack P Gilmour fields.
80.00	Set post from which a pine 14 inches in diameter is 1316 links away, a white oak 28 inches in diameter is 1357 links away, and a white oak 10 inches in diameter is 920 links away, no trees near Section corner.

Land mostly prairie. Soil 1st and 2nd rate. Some brushy timber on creek.

T28S R5W 1 E going S. 1851.

1.25	Stream 25 links wide.
3.50	A trail.

10.00	Begin to ascend hill.
30.00	To south.
40.00	Set quarter section post from which a black oak 10 inches in diameter is 46 links away, and a black oak 6 inches in diameter is 108 links away.
58.50	Creek 8 links wide, ravine.
59.00	Begin to ascend hill.
74.58	A fir 24 inches in diameter.
77.00	Summit of hill.
78.00	Begin to descend hill.
80.00	Set post from which a black oak 18 inches in diameter is 20 links away, a black oak 12 inches in diameter is 20 links away, and a black oak 12 inches in diameter is 25 links away.

Land high hills, 3rd rate.

T28S R4W 6 N going E 1854.

6.00	South branch of Deer Creek 15 links wide.
20.00	Left bottom to ascend hill.
37.00	Top of sharp ridge.
40.00	Set quarter section post from which a black oak 6 inches in diameter is 100 links away and a red fir 10 inches in diameter is 180 links away.
49.30	A red fir 24 inches in diameter.
54.00	Foot of hill.
76.00	A small stream 10 links wide, entered bottom.
80.00	Set post of sections 5,6 from which a red fir 8 inches in diameter is 37 links away, and a red fir 10 inches in diameter is 60 links away.

Intermediate soil. Timber fir, ash. Undergrowth brush oak.

Appendix D: Dominant Riparian Species

The following table shows the rating of the riparian area by species composition and average diameter.

Species Composition	Average Diameter (inches)				
	1.2	**6**	**12**	**20**	**35**
Deciduous	Poor	Poor	Fair	Fair	
Mixed	Poor	Fair	Good	Good	Good
Coniferous	Poor	Good	Good	Good	Good

EPA 319 nonpoint source project funds were used as match for the Deer Creek Watershed Assessment and Action Plan. Partnership was described in section 1.2.