SECTION 10

TIETON RIVER SUB-BASIN
SHORELINE INVENTORY AND ANLYSIS
DISK #5

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TIETON SUB-BASIN CONTEXT SUMMARY

Portions of the following text have been primarily taken, in whole or in part, from the following reports: (USFS, 1996).

TIETON SUB-BASIN OVERVIEW

The Tieton River is a major right-bank tributary to the Naches River, entering at RM 17.6. The Tieton sub-basin covers about 180 square miles (115,296 acres) of primarily forested lands, small portions of which have been developed for residential and recreational uses. Most of the land in the Tieton River drainage basin lies within the Wenatchee National Forest. Some of the uppermost portions of the watershed lie within designated wilderness areas. Approximately 16.4 square miles (10,479 acres) of the Tieton River watershed are in private and state ownership, with Plum Creek Timber, Boise Cascade Corporation, and the Washington State Department of Natural Resources being the major owners (United States Forest Service [USFS], 1996). (Figs. T3 and 4).

The drainage includes the communities of Rimrock Retreat and Rimrock, the Oak Creek Wildlife Recreation Area Headquarters and Tieton Ranger Station, as well as numerous developed and undeveloped campgrounds and campsites, often located adjacent to the rivers throughout the sub-basin.

The Tieton River SMP jurisdiction consists of two parts: the Tieton River from its confluence with the Naches River to Rimrock Lake, and the South Fork Tieton River from Rimrock Lake to near its headwaters. The Tieton River is formed by the confluence of the North and South Fork Tieton Rivers. The original confluence has been submerged by the waters of Rimrock Lake since completion of Tieton Dam in 1924. From the base of dam (RM 21.1) at an elevation of 2720 feet, the river flows, generally, northeast throughout the majority of its course, entering the Naches River at RM 17.6. The Tieton River exhibits an overall gradient of 1.0% (54 ft/mi), which is fairly uniform throughout.

While the gradient of the Tieton River is, generally, uniform, the degree of floodplain confinement varies greatly, and the natural flow regime has been dramatically altered by historic development. With changes in confinement and sediment sourcing are the expected changes in channel form, activity, and response (USFS, 1996).

The headwaters of the South Fork Tieton River and its tributaries reside within the Wenatchee National Forest on the Cascade Mountains at elevations over 6000 feet. The upper terminus of the South Fork Tieton SMP jurisdiction is at an elevation of 4010 feet. This river flows northeast to Rimrock Lake. The South Fork Tieton River exhibits an overall gradient of 1.4%, with the segment below Bakeoven Flats being decidedly steeper (2.6% - 140 ft/mi.) than the upper segment (0.8% - 40.0 ft/mi.)

GEOLOGY

Bedrock geology in the Tieton River watershed includes Tertiary and Quaternary volcanic and/or pyroclastic units, and pre-Tertiary metamorphic bedrock (Fig. T1). Numerous landslides have been mapped. Landslides have been the result of glacial and periglacial processes and/or occurrence of bedrock minerals that weather to clays (USFS, 1996).

Folding and faulting of bedrock in the Tieton River watershed has influenced landform and geomorphic processes. Broad folding of the bedrock occurs primarily in the Fife's Peak and Grande Ronde basalts. Bethel Ridge, the mainstem of the Tieton River, and its unnamed bounding ridges and Weddle Canyon generally follow these gentle east-west to northeast trending folds. A series of north to northwest trending faults extends from Divide Ridge north to Bethel Ridge. Evidence of faulting may have been obscured by subsequent landsliding in the Soup Creek and Wildcat Creek areas (USFS, 1996).

Structural complexity and intensity is reflected in landform shape, topographic relief, and drainage density. Large-scale landslides in this area were most likely influenced by the effects of fracturing and weathering of the bedrock and/or seismic activity related to geologic structure (USFS, 1996).

Geomorphology

The Tieton River watershed has been stratified into geomorphic terranes based on the dominant geomorphic expression of the landscape. The two terranes constituting the SMP jurisdiction are the Glacial Trough (South Fork Tieton River) and the Mainstem Corridor (Tieton River from Tieton Dam to mouth) (USFS, 1996).

Glaciation has been the dominant landforming process in the South Fork Tieton drainage. the upper basin is defined by U-shaped glacial troughs with till deposits and oversteepened upper side slopes. Till and landslide deposits are favorable for high subsurface water storage capacity. This terrane is important for stream flow and water temperature regulation. High surface runoff from extremely steep upper rocky slopes concentrates on lower slopes, increasing the mass-wasting hazard. Mass wasting contributes high sediment input into channels. Slumps and alluvial fans confine channels causing ponding of water and expanded riparian zones. Potential recruitment of large woody debris is high (USFS, 1996).

Within the mainstem valley, broad folds are the primary structural control. This terrain is defined by a broad, flat-floored valley with steep side-slopes capped by convex ridges. The broad valley buffers the channel from surface runoff and sediment delivery. Alluvial fans have developed at the mouths of major and minor tributaries. A system of side-channels is important for buffering the effects of peak flow events and as refugia for fisheries (USFS, 1996).

VEGETATION

Within the Tieton River watershed, the natural vegetation is generally distributed along a gradient of moisture and temperature. Four major vegetation groups can be described: the dry

forest vegetation group, the mesic forest group, the wet forest vegetation group, and the non-forest vegetation group. Of these, the mesic forest group and non-forest group predominate within the SMP jurisdiction. North aspects, riparian areas, and mid-elevations support mesic forest vegetation consisting of wet grand fir and Western hemlock plant series. These communities comprise approximate 23 percent (26,647 acres) of the Naches River watershed. Approximately 24 percent (27,406 acres) of the watershed is comprised of non-forest vegetation types that include the mesic, wet, and wet shrub meadows, and the deciduous and gravel bar riparian communities (USFS, 1996) (Fig. T2).

Riparian

The Tieton River watershed supports 750 acres of riparian community type. Riparian communities occur on the banks and shorelines of rivers, creeks, and ponds. Riparian communities are significantly influenced by perennial or intermittent water, high water-tables, and associated soils. Hydrology, solar exposure, and air temperature and humidity are key factors associated with this ecosystem. Four riparian types have been identified within the Tieton River watershed: deciduous, gravel bar, terrace, and delta (USFS, 1996). Of these, the deciduous and gravel bar riparian communities are most likely to occur in the SMP jurisdiction.

The deciduous riparian type (498 acres) is characterized by mountain alder, black cottonwood, red-osier dogwood, prickly currant, blue elderberry, Wood's rose, and willow. The gravel-bar riparian type (47 acres) occurs along and within rivers and large streams, and is one of constant change. Willow, black cottonwood, quaking aspen, mountain alder, several species of sedge, and various grasses characterize the natural vegetation of this community (USFS, 1996).

Proposed, Endangered, Threatened, and Sensitive (PETS) Plants

Documented, systematic surveys for PETS plants have been conducted in the Tieton River watershed since 1988. However, as of 1996, only an estimated 5 percent or less of the watershed had been included in these surveys. A significant portion of these surveys were conducted in coniferous forest habitats, but several surveys were conducted in riparian habitat along the Tieton River, generally in areas influenced by humans within and adjacent to campgrounds, summer homes, and roadside construction. Those PETS plants most likely to occur within the SMP jurisdiction are *Cypripedium fasciculatum* (clustered lady's-slipper), which is commonly found in moist to dry woods and coniferous forests, *C. montanum* (mountain lady's-slipper), which is common along benches above streams, *Epipactis gigantea* (giant helleborine), which is commonly found along streambanks, pond margins, springs, and seeps, and *Luina stricta* (strap-leaf luina) which is commonly found in mesic to wet meadows at higher elevations (USFS, 1996).

The diversity of habitat conditions present within the Tieton River watershed provides potentially suitable habitat for several sensitive plant species not presently documented to occur within the watershed (USFS, 1996).

Noxious Weeds

The State of Washington describes weeds as "any plant which, when established, is highly destructive, competitive, or difficult to control by cultural or chemical practices." In general, they are either introduced or early seral native species that become established on sites that have

experienced ground-disturbing activities. Noxious weed surveys in the Tieton River basin are extremely limited. Reconnaissance has been, for the most part, incidental along roadway from vehicles. Noxious weed species of primary concern within, on the approach to, or threatening the Bumping River watershed that are most likely to occur within the SMP jurisdiction include: *Acroptilon repens* (Russian star-thistle), *Artemesia absinthium* (absinth wormwood), *Centaurea diffusa* (diffuse knapweed) and *C. maculosa* (spotted knapweed), *Chrysanthumum leucanthumum* (oxeye daisy), *Cichorum intybus* (chicory), *Cirsium vulgare* (bullthistle) and *C. arvense* (Canada thistle), *Hypericum perforatum* (St. Johnswort), *Hypocharis radicata* (spotted cat's-ear), *Linnaria dalmatica* (dalmation toadflax), *Senecio jacobaea* (tansy ragwort), and *Verbascum thapsus* (common mullein) (USFS, 1996).

WILDLIFE

Regarding solely the SMP jurisdiction, riparian areas constitute the predominance of wildlife habitat types. Riparian areas are the most critical wildlife habitats, as seen by the disproportionate use of them as compared to other habitat types by wildlife. There is also greater wildlife species diversity in riparian habitat as compared to other habitat types (USFS, 1996).

Some of the characteristics that make riparian areas important to wildlife are: 1) access to food, cover, water, and space (riparian areas always afford water, and often all four components), 2) increased diversity of plant species and structural diversity within the community, 3) linear shape (maximizes the development of edge, which is quite productive in terms of wildlife use), 4) micro-climates that differ from surrounding areas (wildlife are attracted to these areas and some are dependent on it), and 5) provide migration routes, travel corridors, and connectivity between habitat types (USFS, 1996).

The acres of historic habitat availability was most likely similar to existing conditions. Construction of roads, past harvest activities, livestock and big game grazing, and noxious weed invasion has reduced the effectiveness of this habitat (USFS, 1996).

Proposed, Endangered, Threatened, and Sensitive (PETS) Wildlife Species

Five wildlife species, either currently inhabiting or with the potential to inhabit the Tieton River watershed, are federally-listed as either threatened or endangered (American peregrine falcon, Northern spotted owl, gray wolf, Northern bald eagle, and American grizzly bear). Of the five species, three (American peregrine falcon, Northern spotted owl, and Northern bald eagle) are known to occur within the Tieton River watershed. Habitat is present for all five species.

The Northern bald eagle was federally listed as threatened in Washington, Oregon, Minnesota, Wisconsin, and Michigan in 1978. At the same time, bald eagles were listed as endangered in the remaining coterminous 48 states, due to population declines resulting from DDT use, shooting, poisoning, habitat alteration, changes/declines in prey base, and human disturbance. In 1995, the status of the Bald eagle was re-classified to threatened throughout the lower 48 states. In 1999, the U.S. Fish and Wildlife Service proposed removing the bald eagle from the Endangered Species Act list. A decision is pending.

Nesting habitat for this species consists of mature to old-growth stand conditions, usually within 0.5 miles of large bodies of water that are ice-free in the spring (breeding season) and support and abundant fishery. Nests are built in large, open trees with heavy lateral limbs, and are used year after year. Snags are also needed to provide perch and roost sites. Bald eagle feed primarily on fish during the summer months. Historically, there were approximately 23,766 acres of nesting habitat within 0.5 miles of Rimrock Lake (formerly Tieton River before dam construction), Tieton River, and the South Fork Tieton River. The acres of available nesting habitat currently available are similar to historic acres, although the quality of that habitat has been reduced. The available nesting habitat along Rimrock Lake has been reduced by approximately 75 percent by human disturbance (roads, recreationists, resorts, and summer homes); along the Tieton River by 35 percent by housing development and campgrounds; and along the South Fork Tieton River by 15 percent by campers. There is one active bald eagle territory within the Tieton River watershed (in the Rimrock Lake area), fledging 16 young since 1983. Three additional potential territories have been identified within the watershed.

In addition to nesting habitat, wintering bald eagle habitat, both roosting and foraging, must also be present to support existing populations and allow for increases in the populations and recovery of the species. Winter habitat consists of ice-free bodies of water with an abundant fishery and/or large winter waterfowl populations. Winter habitat also includes big game winter ranges where winter-kill carrion provides a food source. Snags are needed for perch and day-time roost sites, and contiguous mature to old-growth stands are needed for nocturnal roosts. Approximately 8322 acres of winter habitat along the Tieton River was historically available, and current available winter habitat is similar to historic acres, although the quality of that habitat has been decreased. Wintering habitat, both foraging and roosting, primarily exists within the lower Tieton River, and its use by bald eagles has been documented for a number of years.

The gray wolf was federally listed in 1978. As the pre-eminent predator of large ungulates, the gray wolf is more dependant on availability of its prey species than on any specific habitat type. The level of human access is an important consideration in the assessment of wolf habitat. Roads alone do not impede wolf activity; rather, it is the deliberate, accidental, and incidental human-caused mortality associated with road access that impacts wolf survival. U.S. Forest Service personnel have conducted informal wolf surveys in the Tieton River watershed in 1992. As of 1996, there were no known Class 1 (confirmed gray wolf observations within the watershed, however, there were several confirmed sightings on adjacent lands (Packwood and Cle Elum Ranger Districts). There had been numerous Class 2 (highly reliable) gray wolf observations within the Tieton River watershed.

The grizzly bear was federally listed as threatened in 1975 due to declining populations as the result of habitat loss and overhunting. Grizzly bears require large, wild, mountainous areas rich in food (high elevation meadows, shrubfields, avalanche chutes, lowland meadows, and marshes). Denning habitat, used from late fall through March, is often located in high elevations on steep slopes with deep snow accumulations. Spring emergence habitat is lower elevations containing drainages with avalanche chutes and ungulate winter ranges. In late spring to early summer, grizzly bears follow plant phenology to higher elevations. Pre-denning habitat, used in late summer and fall, finds grizzlies transitioning to fruits and nuts as well as other herbaceous material. Essential grizzly bear habitat includes all the components of denning, spring emergence, summer and pre-denning habitat, along with isolation from human disturbance. The

Tieton River watershed contains habitat suitable for grizzly bears, however, it is ineffective due to human disturbance caused from extensive road development and numerous residences, and human activity. While there are no known confirmed sightings within the Tieton River watershed, grizzly bears have been confirmed as occurring within the Wenatchee National Forest to the north (USFS, 1996).

Numerous other threatened or sensitive wildlife species that are either known to occur within the Tieton River watershed, or for which the watershed provides suitable habitat, are of concern to a variety of state and federal management agencies (USFS, 1996).

FLOW

Tieton River and South Fork Tieton River flow derives from snowmelt and rainfall on the eastern slopes of the Cascade Mountains. Precipitation in the Tieton drainage ranges from 20 inches per year near the eastern National Forest boundary up to 100 inches at higher elevations of the South Fork Tieton River. The average annual yield for the Tieton River below Tieton Dam is approximately 358,000 acre-feet, or 494 cubic feet per second (cfs), for the period of record. The South Fork Tieton River contributes 36 percent of the total flow, and the North Fork Tieton River, Clear Creek, and Indian Creek contribute a sum of 47 percent of the total flow (USFS, 1996).

Tributaries to the Tieton River include Oak Creek on the left bank (RM 2.3), Milk Creek on the right bank (RM 18.2), and Wildcat Creek on the left bank (RM 20.6). Three smaller tributaries (Pine, Hause, and Soup creeks) are left bank tributaries that join the river near the Tieton Ranger Station (17.8-18.4). Except for Oak Creek, tributaries to the Tieton River downstream of Tieton Dam are small, flow through shrub-steppe, and sometimes go dry in the summer. These tributaries are all unregulated and may contribute significant flows, particularly during spring runoff or rain-on-snow events.

Historically, average flows were highest during April, May, and June as a result of spring snowmelt runoff. However, peak flood flows typically occurred during the winter and were associated with warm temperatures and rain-on-snow events, particularly if soils were saturated or frozen.

Stream flows are currently gauged in the Tieton River just below the Tieton Canal headworks (RM 14.4). Historic flow records immediately below Tieton Dam exist, but this station ceased operating in 1978. The record provided by the operating gauging station provides flows representative of the lower 14 miles of the Tieton River, but do not reflect the water diverted into the Yakima-Tieton Irrigation canal. Flows from Tieton Dam to the diversion are approximately 350 cfs higher during the irrigation season (USFS, 1996).

Average monthly regulated flows released from Tieton Dam have varied from a low of 70 cfs in December to a high of 1600 cfs during peak irrigation releases in September (USFS, 1996). The following flow summary (given in cfs) for the Tieton River at the Yakima-Tieton Irrigation Diversion is based on flow records covering the period 1994 to 1999.

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.
398	144	385	304	502	399	614	678	629	521	401	1502

If the dry year of 1994 is deleted from the average:

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.
367	160	455	357	596	466	729	800	747	605	419	1577

Flows in the Tieton River are dramatically different from the natural flow regime by storage, reservoir release scheduling, and one main diversion. The flow regime of the Tieton River downstream from Tieton Dam (RM 21.1) is highly choreographed in a management scenario known as "flip-flop." The retention of waters in Rimrock Lake until late in the irrigation season (early September) is followed by the release of waters from this lake to provide water needed to support the Wapato and Sunnyside diversions for the remainder of the irrigation season in order to mitigate disturbance to salmon redds in the upper Yakima River (USFS, 1996).

September flows now average 1600 cfs, with peaks in the 2000 – 2200 cfs range, for approximately three weeks. These levels are approximately twice the natural river discharge. Low winter flows are much lower than those experienced previous to flip-flop operations or to even natural flow levels. Major alterations of the frequency of bankfull discharge levels have also occurred as a result of flip-flop. Compared to 2 days per year (July or August) under pre-flip-flop operations and 3 days per year (May or June) under natural, unregulated conditions, flip-flop operations result in bankfull discharge being exceeded on the average of 8 days per year, mostly in the month of September (USFS, 1996).

The operation of Tieton Dam has also significantly reduced the incidence and magnitude of floods in the Tieton River. Natural peak flood events naturally occurred in the December through February period during rain-on-snow events, but peaks are now reduced due to flood-control storage at Rimrock Reservoir. An analysis of the data for the period of record (71 years) reveal that there have been approximately 26 events that would have produced flows greater than 2000 cfs in the December through February period (return frequency of once every 2-3 years). The 100-year regulated flood flow is approximately 4500 cfs, while the conditions without the dam would produce an unregulated flow of 9100 cfs (USFS, 1996).

The hydrograph in the South Fork Tieton remains unregulated, exhibiting only minor changes to historic flows possibly as a result of changes in land use (forest management), however, the data are considered insufficient. The USFS does cite compaction concerns related to tractor yarding which is linked with increased runoff, especially for areas that have experienced repeated harvest.

Hyporheic

Information on groundwater resources within the Tieton watershed is limited. The intense faulting within the Tieton River watershed has resulted in discontinuous bedding orientation and a chaotic arrangement of the various rocks present. This makes predicting subsurface water conditions difficult (USFS, 1996).

It is probable that water from the Tieton basin plays an important role in recharge of groundwater aquifers utilized for domestic and irrigation water in the Yakima Valley. The Tieton watershed is included in the Naches-Cowiche groundwater subbasin of the upper Yakima Basin. Some of the groundwater sourced from the Tieton basin likely re-enters and augments surface waters in the lower Naches River (USFS, 1996).

The majority of domestic water use in the basin comes from wells, the majority of which are relatively shallow and probably utilize riparian aquifers (USFS, 1996).

Irrigation

Within the Tieton basin, there are 20 points of surface water or spring water diversion for domestic use. There are 26 spring developments for stock water. Most of these diversions are for minor amounts of less than 0.1 cfs (USFS, 1996).

Flows from the Tieton River were first diverted about 1908, when the first diversion dam was built on this river. Tieton Dam was started during World War I and completed in 1924. Rimrock Lake, created by the dam, has storage capacity of 198,000 acre feet. Tieton Dam is operated by the U.S. Bureau of Reclamation as part of the Yakima Project.

Water diversion from Tieton River is associated with irrigation uses. Within the lower Tieton, approximately 350 cfs is diverted at the Yakima-Tieton Irrigation District diversion (RM 14.4). The District has contracts allowing it to divert up to 114,000 acre-feet of water annually to irrigate 27, 271 acres in the Tieton and West Yakima areas, subject to proration in water-short years. Additional storage water from Rimrock Lake is utilized at downstream diversion points for irrigation in the lower Yakima Valley (USFS, 1996).

There are other diversions from the Tieton River and tributaries, some of which are upstream of Tieton Dam. These involve small water volumes (generally less than 0.1 cfs) and are related to summer homes, camps, and recreational facilities (USFS, 1996).

SALMON

Fish Distribution

Salmonids are present in the Tieton River and its tributaries. The Tieton River historically supported spring chinook, coho, and steelhead, as well as a number of resident salmonid species and non-salmonids, below Tieton Dam (USFS, 1996).

Occasionally, a spring chinook carcass is found in or along the Tieton River, showing that there are still a few of these fish that migrate up the river. These fish may be strays from elsewhere in the Naches basin, and it is unclear if these individuals successfully spawn. Native coho were last seen within the Yakima River basin in 1979. Juvenile coho were reintroduced into Oak Creek in 1995 by the Yakama Nation (USFS, 1996).

bull trout occur in the Tieton River, Bear Creek (South Fork Tieton River), the South Fork Tieton River, and the mouths of several tributaries. It is reported that Bull trout were present in

Oak Creek in the early 1970s. The majority of bull trout spawning within the Tieton watershed occurs in the South Fork Tieton River, from Minnie Meadows (RM 10.0) to the falls (RM 13.7), and within the lower one-mile of Bear Creek (USFS, 1996).

The Tieton River and its tributaries also supports nine types of resident fish: Westslope cutthroat, Rainbow, Brook, and Bull trout; Mountain whitefish; sculpin; Speckled and Longnose dace; and suckers (USFS, 1996).

Passage

Construction of Tieton Dam, which is unladdered, has fragmented the Tieton system by eliminating upstream migration past the dam, affecting bull trout as well as anadromous fish. Water from the Tieton River is diverted into the Cowiche Creek drainage for irrigation purposes. False attraction problems occur on Cowiche Creek causing delay in fish migration. The Yakima-Tieton diversion dam is a barrier to fish passage during low flows. Kokanee stocked in Rimrock Lake were noted as often being killed in passage over or through Tieton Dam. There is also a concern regarding bull trout being killed by passage over or through Tieton Dam during flip-flop.

Barrier waterfalls occur on the South Fork Tieton River just upstream of Discovery Creek (RM 13.7) (USFS, 1996).

SALMON HABITAT

Channel Condition

The condition of stream channels is influenced by upstream channels, because inputs (runoff, large woody debris, fine sediment, and coarse sediment) from upstream channels help shape channels downstream. The condition of stream channels is also influenced by upslope condition and processes. Channel segments respond to inputs based on confinement and gradient. Based on confinement and gradient combinations and the resulting characteristics, stream segments can be divided into four channel-response types. The response type implies the role each segment plays in the channel network. The categories of response types include: source, transport, response/transport, and response (USFS, 1996).

The vast majority of the mainstem Tieton and South Fork Tieton rivers, within the SMP jurisdiction, consists of response channels. Response channels occur in valleys constructed from alluvial deposition, have well-developed floodplains, have a channel slope of less than or equal to 2%, have a riffle/pool bedform morphology, and are responsive to upstream channel changes (change in input of coarse or fine sediment, change in input of large woody debris, or change in flows). Response channels provide important spawning and rearing habitat for trout and salmon.

The Tieton drainage is characterized by glacial troughs on erosion-prone sideslopes and broader mainstem valley reaches with steep-sided canyons. Primary site characteristics that contribute to high mass-wasting hazards include steep terrain, deep soils, and moderate to high subsurface water storage capacity. Forest road development and timber harvest within the Tieton drainage are considered to be the dominant management activities that increase sediment sourcing and

delivery to surface waters. Those areas that exhibit broader floodplain development are somewhat buffered from sediment delivery during runoff periods. The effects of increased susceptibility of the watershed to mass wasting and erosion are not manifested in the Tieton River as any increased sediment supply in the upper watershed is mostly retained in Rimrock Lake.

Source material for the Tieton River, below Tieton Dam, is primarily contributed from tributaries below the dam. All source channels below the dam, except those in the Hause Creek, Pine Creek, and Jumpoff Creek subwatersheds, have the potential to be high contributors of fine sediment to the Tieton River. Prior to construction of the Tieton Dam and Clear Lake Dam, this channel received input factors from areas above the dam. With construction of these dams, the recruitment of large woody debris (LWD), coarse sediment, and much fine sediment was essentially eliminated. A lack of spawning gravel and in-channel LWD is expected in this situation, and stream survey results confirmed this, showing embedded cobble and small boulders as dominant substrate and only 3-4 pieces of LWD per mile. Various areas throughout the Tieton River below Tieton Dam have experienced scour, bank erosion, and sediment deposition (USFS, 1996).

When the U.S. Forest Service surveyed the Tieton River in 1935, gradients were considered moderate (±50 ft/mi.), and occasional good, deep, resting pools and numerous riffles were noted, although with large rubble. Fair spawning areas were found. Today, the Tieton River consists solely of response segments, exhibiting a well-developed floodplain, channel slopes of less than two percent, a riffle/pool bedform morphology, and are responsive to upstream changes to input of coarse or fine sediment and large woody debris, or changes in flow. Response-type channels provide important spawning and rearing habitat for trout and salmon. These segments are dominated by the riparian vegetation group (USFS, 1996).

Most, if not all, of the tributary channels entering the South Fork Tieton River have the potential to be high contributors of fine sediment to the system. The areas of primary concern for fine sediment in the South Fork Tieton River are Conrad Creek, Bear Creek, Corral Creek, and the tributaries flowing in from the right bank downstream of Tenday Creek to and including Short and Dirty Creek. The area of the South Fork Tieton River in which material coming from the tributary source and transport channels will be deposited is dependant on confinement, gradient, and channel roughness (USFS, 1996).

Dispersed recreation, cattle grazing, and off-road vehicle use has destroyed riparian vegetation and compacted soils on the South Fork Tieton River, increasing fine sediment to spawning areas. Some of the impacted areas are adjacent to important Bull trout habitat. Areas of particular concern include Minnie Meadows, Bakeoven Flats, Grey Creek campground, and Conrad Meadows. The presence of cutbanks all along the South Fork Tieton River are due to natural instability (USFS, 1996).

Grazing allotment modification and improvements have almost eliminated cattle utilization on the South Fork Tieton riparian areas. In addition, watershed restoration projects are being implemented at ORV use areas, eliminating fords, restoring riparian meadows, and improving

trail conditions. Although there is an abundance of large woody debris in the South Fork Tieton River, fine sediment distribution is a concern.

Riparian

The Tieton River and its floodplain have been affected by the location of the White Pass Highway (US 12) and other development within the riparian zone. US 12 is located in close proximity to the Tieton River for its entire length from its mouth to Tieton Dam, with many locations where the road is directly next to the river, with heavy armoring and total lack of riparian vegetation. There are numerous areas of dispersed and developed camping and recreational access, and some areas of residential development of the river bank. There are a total of approximately 20 miles of roads within 300 feet of the 14.5 total miles of the Tieton River. A conservative estimate identifies approximately 153 acres (14.5%) of the total area within 300 feet of each side of the Tieton River has been disturbed by human development including roads, structures, and campgrounds. The construction of Tieton Dam has resulted in a change in flows in the Tieton River. The shift of bankfull-discharge timing from May or June under natural conditions to mid-September has had unknown effects on riparian vegetation, but could be linked to the decline in cottonwood species. Cumulatively, these result in impaired riparian function through much of this reach (USFS, 1996).

Riparian conifer stands in the lower portions of the tributaries downstream of Tieton Dam tend to be dense stands of small grand firs. Few large trees are present, and those are predominantly Grand fir. The natural floodplain function of the Tieton River and South Fork Tieton River has been eliminated in the area now submerged by Rimrock Lake since construction of Tieton Dam. Cattle grazing and off-road vehicle use has destroyed riparian vegetation on the South Fork Tieton River, increasing fine sediment to spawning areas.

In 1996, the U.S. Forest Service rated riparian condition on a representative sampling (21.3%) of the 111 miles of perennial streams in the Tieton watershed. The ratings indicated that 47.2% were properly functioning, 49.4% were rated as functional risk, and 3.5% were rated as non-functional. These results are likely indicative of the watershed in its entirety.

Large Woody Debris

Large woody debris is woody material derived from tree limbs, boles, and roots, in various stages of decay. The production and accumulation of large woody debris is dependent on several factors, including: plant association, successional stage, insect and disease activity, weather events (e.g., relative to blowdown), fire return intervals, decay rates, and vegetative management activities (Graham et al. 1994 in USFS, 1996).

Several segments of the Tieton and South Fork Tieton rivers were surveyed for large woody debris (LWD) by the U.S. Forest Service. The inventory protocol identified LWD/mile, streambank armoring, and substrate as evaluation parameters. Large woody debris/mile is a good indicator of habitat quality. (Peterson et al. 1992, Wash. Forest Practices Board, 1993 in USFS, 1996)

The Wenatchee National Forest Plan calls for at least 100 pieces (80% > 12” diameter, 20% > 20” diameter and 50 feet long) of LWD per mile. Most of the Bumping River below Bumping Dam met, or was very close to meeting the Forest Plan standard. (USFS, 1996).

Large woody debris is an important input factor for stream channels within forested vegetative types. Large woody debris for streams in the Bumping River watershed is primarily contributed from debris flows. Once LWD is in the channel, it slows water velocities, resulting in fine and coarse sediment sorting and deposition. Therefore, the presence or absence of LWD determines how a channel will respond to inputs of fine and coarse sediment and runoff. (USFS, 1996).

Prior to construction of the Tieton Dam and Clear Lake Dam, the Tieton River received input factors from areas above the dam. With construction of these dams, the recruitment of large woody debris (LWD), coarse sediment, and much fine sediment was essentially eliminated. A lack of spawning gravel and in-channel LWD is expected in this situation, and stream survey results confirmed this, showing cobble and small boulders as dominant substrate, only 3-4 pieces of LWD per mile, and reduced pool-riffle development (USFS, 1996).

Riparian conifer stands in the lower portions of the tributaries downstream of Tieton Dam tend to be dense stands of small grand firs, making for poor LWD recruitment potential. Few large trees are present, and those are predominantly grand fir, which decay more rapidly than other conifers once they fall into the stream channel.

Upstream from Rimrock Lake, there are generally high levels of LWD, and pool frequency and quality are generally rated as good. Overall, the South Fork Tieton River has adequate LWD accumulations (150-300 pieces per mile). The segment from Jayhawk Flat (RM 3.3) to Bakeoven Flats (RM7.3), but this segment exhibits a channel type characterized by the transport of LWD. The upper reaches of the South Fork Tieton are considered pristine (USFS, 1996).

Water Quantity

The value of the Tieton River has been greatly reduced below Rimrock Lake due to control of the streamflow at the dam. The local impact of water releases from Tieton Dam on fish is considered serious by the Department of Fish and Wildlife (DFW) and other resource agencies. The DFW reports that high and turbid water conditions during irrigation releases from Rimrock Lake contribute to decreased bull trout production by scouring redds and deposition of sediments on spawning gravels.

Flows downstream of Tieton Dam are lower in winter when the reservoir is refilling, and September releases of water from the dam (during "flip-flop") reportedly flush rearing salmonids downstream to the Naches River.

Flow fluctuations in the Tieton River have been identified as a concern relating to stranding of rearing juveniles and impacts to the food web. Lake-level fluctuation and drawdown of Rimrock Lake likely reduce production of phytoplankton, zooplankton, and aquatic insects, reducing the food-web base for bull trout and kokanee residing in the lake. Fluctuations in river flows associated with USBR Yakima Project operations have been identified as a concern to rearing juveniles and the food web.

Peak flows are altered by compaction in lowland meadow areas due to grazing and recreation activities. Flows from Tieton Dam released during September/October are significantly higher than normal dry-season flows. These high flows scour the channel, destroy spring chinook redds, and flush subyearling steelhead from the system. High flows, coupled with the retention of large woody debris and bedload in Rimrock Lake have degraded spawning and rearing habitat in the Tieton River.

Water Quality

The Tieton River is considered a Class AA "Extraordinary" water body. Based on these standards, the highest designated beneficial use for the basin is "salmonid spawning and rearing habitat." Although none of the waters within the Tieton River basin have been designated as "water quality limited," this statement must be considered in light of the very limited amount of water quality data that have been collected in the watershed. The state water-quality standards that are most applicable to the Tieton River include fecal coliform, dissolved oxygen, temperature, and turbidity (USFS, 1996).

Dissolved oxygen levels below state standards were found at sampling sites below Tieton Dam. The low oxygen levels were attributed to water releases from the deeper levels of Rimrock Lake (USFS, 1996).

Erosion of streambanks in the lower Tieton drainage, contributing to fine-sediment inputs to the Tieton River, is attributed to overgrazing of meadow areas. Surface erosion problems are also associated with meadow areas due to compaction and rutting by recreation vehicles. Timber harvest areas have been compacted by tractor yarding causing increased runoff and erosion. High sediment levels are known to occur in selected tributaries including Wildcat Creek (tributary to the Tieton River at RM 20.6) and the South Fork Tieton drainage. The Tieton River experiences some erosion problems such as bank erosion and sedimentation.

A considerable amount of data has been collected on stream water temperature in the Tieton watershed. Water temperature exceedences are not noted on the Ecology 303(d) list for drainages in the Tieton basin. However, the USFS found the temperature standard for Class AA waters (61°F) was exceeded on 49 days in 1992, 11 days in 1993, and 0 days in 1995. The standard was exceeded in the lower Tieton River for 31 days in 1995. The Wenatchee Forest Plan standard for average seven-day maximum temperatures (providing an indicator of sustained stream temperatures) is 58°F. This standard has been exceeded at ten of the twenty measuring sites. The Tieton River and South Fork Tieton River have exceeded both of the temperature standards (61°F daily maximum and 58°F seven-day average maximum), along with the following tributaries: Milk Creek, Soup Creek, Thunder Creek, and Wildcat Creek (USFS, 1996).

No specific nutrient-related problems are known other than the general concern over a lack of salmon carcasses that is widespread in the watershed due to the low numbers of spawning fish.

No toxicant problems are known, although streambed sediment samples from the Goat Rocks area (above Rimrock Lake) were found to have high levels of several minor elements (copper,

cobalt, iron, titanium, vanadium, and zinc). The presence of these minerals were attributed to the high levels of these elements in the volcanic geologic materials in the area (USFS, 1996).

Action Recommendations

The following ranked salmonid habitat restoration actions are recommended for the Tieton River:

- Review effects of flip-flop on Tieton River habitat and fish resources; restore "normative" flow regime (SOAC 1999) downstream of Tieton Dam
- Correct fish passage impairments at Yakima- Tieton Diversion Dam
- Assess feasibility and potential habitat benefits from supplemental of gravel recruitment in the Tieton below Rimrock Dam
- Restore riparian function where impaired, including removal/relocation of roads located within floodplain (where practicable)
- Restore adult and juvenile anadromous fish passage over Tieton Dam; install juvenile fish screening
- Develop and implement a short- term LWD strategy to provide LWD presence and retain available spawning gravels until riparian function is restored

TIETON RIVER SUB-BASIN REACH DESCRIPTIONS

The Tieton River SMP is divided in to four distinct reaches (Fig. T5; Table T1). The divisions of the reaches were made based on gradient and landforms. **Reach 1** represents the lower (5.4 mi.) portion of the stream from its connection to the larger Naches River to RM 5.4, a point approximately 0.35 mile above a footbridge across the Tieton River. Throughout this entire reach, the Tieton River is confined to the northwest by the Tieton Highway (US 12) isolating substantial portions of the floodplain. Although the channel is actively migrating within this segment of the river, due to confinement, the stream channel exhibits only a slight degree of meandering. **Reach 2** commences at RM 5.4 and flows for 8.3 miles to the western end of the community of Rimrock. This reach is confined by U.S. 12 along its entirety, predominantly to the northwest, restricting river access to portions of its floodplain. The river exhibits a moderate amount of meandering within the lower 3 miles of this reach. **Reach 3** is a 7.4 mile segment of the Tieton River that extends from the western end of the community of Rimrock to the base of Tieton Dam. Throughout this reach, the river is narrowly confined by steep canyon walls and exhibits a narrow floodplain. Portions of the floodplain have been isolated by U.S. 12. Several developed campgrounds are located within the floodplain of this reach. **Reach 4** represents the lower 14.4 miles of the South Fork Tieton River, beginning at Rimrock Lake, a reservoir impounded by Tieton Dam. This reach is confined to varying degrees by the steep canyon walls of Divide Ridge to the east and Pinegrass Ridge to the north.

REACH 1

General Description

Reach 1 is a 5.4 mile segment of the Tieton River that extends from RM 5.4 on the Tieton River (a point approximately 0.35 mile above a footbridge across the river) at an elevation of 1860 feet to its confluence with the Naches River (RM 17.6 on the Naches River) at an elevation of 1590 feet. The average gradient of this reach is 0.95% (50 ft/mi.).

ABIOTIC - See Tieton Physical map and Tieton Physical (soil characteristics) map *(Tieton_Physical.pmf and Tieton_Soil_Characteristics.pmf)*

Geology/Landform (Table T2)

Reach 1 occupies a southwest-to-northeast trending valley. The floodplain of this reach is narrowly confined by the flanks of Bethel Ridge to the northwest and Divide Ridge to the southeast. Both ridges are composed of basalt flows. The canyon walls along the narrow river valley rise abruptly (in places as cliffs) for 600-1000 feet before adopting a more gradual, yet remaining steep, angle to elevations several hundreds of feet higher. Throughout this SMP jurisdiction of this reach, the surficial geology is one of basalt (Washington State Department of Natural Resources [WDNR], 2000).

There are extensive areas of geologic hazards noted along the northwestern side of Reach 1(Yakima County, 2003c). Throughout the middle 2.5 miles of the reach where the stream directly abuts the flanks of Bethel Ridge, the majority of SMP jurisdiction includes, or directly abuts areas rated as High Risk due to oversteepened slopes and unstable materials presenting the possibility for rock fall and creep. Approximately 80% of the reach is within the 100 year floodplain.

Soil and Soil Properties (Table T3)

According to the available geology data, Reach 1 is dominated (94.8%) by basalt flows, with alluvial deposits comprising the remainder (5.2%) of the surficial geology (USDA Natural Resources Conservation Service [NRCS], 2003). However, based on the geomorphology and gradient of this reach, along with the apparent delivery of sediments from the numerous side canyons, these values are suspect. The soils within the SMP jurisdiction are predominately clay loams and rock outcrop. Within this reach, 68.5% of the soils are aquic, a direct reflection of stream and hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Based on the amount of aquic soils, this likely provides a better estimate of the amount of alluvium present in the SMP jurisdiction of this reach. Soil permeability is primarily rapid, runoff is generally classed as slow, and the hazard of erosion is rated as slight.

Stream Type/ Channel Form (Table T4)

Channel form throughout Reach 1 is currently classified as pool-riffle.

This reach exhibits the most extensive floodplain development of the Tieton River, with widths ranging from 400 feet to 1900 feet. While the majority of sinuosity is dictated by canyon geology, within its floodplain of this reach, the river has maintained a degree of meandering.

However, the White Pass highway (US 12) has substantially restricted the river's ability to access large portions of its former floodplain along the entire left bank.

This is a depositional/transport reach in which energy is dissipated. Reduction in velocity and volume through lateral movement (channel migration), braiding/distributaries (multiple channels), and percolation into the alluvial substrate resulted in a depositional environment. It is expected that the majority of the SMP jurisdiction of Reach 1 is underlain by, likely deep, deposits of alluvium. Although somewhat confined to a portion of its former floodplain, the channel remains free to migrate, and likely has, throughout most of this reach.
The loss of bedload and large woody debris sourcing from the upper basin since the construction of Tieton Dam, combined with the alteration of flow regimes associated with flip-flop, has likely resulted in a reduction in stream complexity throughout this reach. It is likely that the channel complexity of this segment of the river was once substantially more complex than it is presently.

Approximately 0.6% of the reach has been identified as having a high potential for being in the channel migration zone (Yakima County, n.d.b).

Stream Flow
The flow regime is atypical of that of streams throughout the region, which generally exhibit lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer. Due to "flip-flop," the lower Tieton witnesses rapidly increased flows during late fall. Diversion of flow at the Yakima-Tieton diversion reduces flows substantially during the irrigation season.

Hyporheic Flow
Given the geology, geomorphology, and gradient of this reach, the supplying of sediments from side canyons, and the high proportion of the SMP jurisdiction and much greater floodplain underlain by aquic soils, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Ground water/surface water interactions occur throughout Reach 1 as evidenced by the presence of ponds (Tim Ponds) in close proximity to the channel.

Water from the Tieton basin is believed to be important for recharge of shallow ground waters in the Yakima Valley. Tieton watershed groundwater is also believed to augment flows in the lower Naches River.

BIOTIC - See Tieton Biological map *(Tieton Biological.pmf)*

Natural Vegetation (Tables T5 and T7)
<u>Upland</u>
GAP analysis data estimates that the vegetation community in Reach 1 is dominated by central arid steppe vegetation (97.6%) with a smaller area of oak (2.4%) (Washington Department of Fish and Wildlife [WDFW], 2004a).

Riparian
Estimates of the SMP jurisdiction area covered by riparian vegetation range from 13.2% to 40.2% (WDFW, 2004b and Yakima County, 2003b).

Wetlands
Wetlands occupy 18.2% of the SMP jurisdiction (United States Fish and Wildlife Service [USFWS], 2003).

Wildlife
Aquatic (Table T6)
Reach 1 has been identified as spawning habitat for summer steelhead, and spring chinook may be present (WDFW, 2004c). Adequate habitat is expected for 9 species of resident fish species in this reach, including rainbow trout, eastern brook trout, and mountain whitefish.

Avian (Tables T5 and T8)
GAP analysis data indicates that portion of Reach 1 may provide habitat for some species of concern, including principally the sage sparrow (15.5%) and the sage thrasher (15.5%) (WDFW, 2004a).

Terrestrial (Tables T5 and T8)
GAP analysis data indicates that portions of Reach 1 may provide habitat for four species of concern, including principally the Townsend's big eared bat (100%), as well as smaller portions for the black tailed jack rabbit (15.5%), Townsend's ground squirrel (15.5%) and the Western Gray Squirrel (2.4%) (WDFW, 2004a).

CULTURAL - See Tieton Cultural map *(Tieton_cultural_jurisdictional.pmf and Tieton_Cultural_Modifications.pmf)*

Contemporary Land Use
Zoning (Table T10)
Current zoning within the SMP jurisdiction of Reach 1 is entirely Forested watershed (100%)(Yakima County, 2004b). The entire jurisdiction is also designated as Conservancy.

Land Use (Table T9)
Of the SMP jurisdiction lands along Reach 1, 92.5% remain vacant or natural land (Yakima County, 2004a). Of the remaining 7.5% of SMP jurisdiction lands, 7.4% is in industrial/transportation and 0.1% is classified as government school/work camp. Approximately 7.4% of the SMP jurisdiction is greater than 25% impervious. The Washington Department of Fish and Wildlife is the major public owner of land within the SMP jurisdiction, holding title to 94.1% of the land.

Transportation (Table T11)
Roadways occupy 1.9 miles of SMP jurisdiction land in this reach (Yakima County, n.d.a). There are no railroads (Washington State Department of Transportation [WDOT], 1997) or bridge crossings along this reach (WDOT, 2004).

Revetments (Table T11)
Reach 1 has 1.8 miles of roadway impinging upon and confining the river (Central Washington University [CWU], 2002).

Cultural Resources (Table T12)
There is one known cultural site noted in the SMP jurisdiction of Reach 1 (Washington State Historic Preservation Office [WSHPO], 2004.).

DOE Sites/facilities and 303(d) Listings (Table T12)
There are no DOE sites/facilities or 303(d) listed facilities found in the SMP jurisdiction of Reach 1 (Washington Department of Ecology [WDOE], 1998).

ECOLOGICAL FUNCTION SUMMARIES

Reach 1 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 9.9% High erosion soils: 1.3% High soil runoff: 1.3% High channel migration: 0.6% High soil permeability: 69.8% 100-Year Floodplain: 80%	Wetlands: 18.2% Riparian cover: 40.2% Undeveloped: 92.5% Priority habitats: 7 Species of concern: 6 Anadromous habitat: 2 mi Total fish species: 12	Public land: 99.1%	Principal land use: Vacant/natural >10% Imperviousness: 7.4% Roads: 1.9 mi Revetments: 1.8 mi Bridge Crossings: 1

Ecological functions along Reach 1 are principally impaired by industrial-transportation development, which covers 7.4% of the jurisdiction. These land uses, in addition to the 1.9 miles of roads, account for the majority of the estimated 7.4% of the reach that is greater than 10% impervious. Upland vegetation has been removed and replaced with buildings and roads, which can promote increased runoff and nonpoint source pollution. The Tieton River has also been heavily diverted and extensive areas have lost floodplain connectivity, including approximately 1.8 miles of revetments within the jurisdiction. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 40.2% of the reach. Much of the reach is presently undeveloped (92.5%), while 18.2% is covered by wetlands. The reach provides habitat for six species of concern, as well as seven priority habitats and aquatic habitat for 12 fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES - See Tieton Ecological Protection opportunities map *(Tieton_Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for the Tieton River.

1) Rationale: Riparian buffer and anadromous spawning area. Suggested action: Protect riparian buffer and cultural site area.

2) Rationale: Riparian buffer and anadromous spawning area in an area with high soil erosion potential. Suggested action: Protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES - See Tieton Ecological Restoration opportunities map *(Tieton_Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for the Tieton River.

1) Rationale: Marginal riparian buffer, high erosion and anadromous spawning area. Suggested Action: Work with private landowners to establish a larger riparian buffer.

REACH 2

General Description

Reach 2 is a 3.4 mile segment of the Tieton River that extends from the western end of the community of Rimrock Retreat to a point approximately 0.35 mile above a footbridge across the river. The average gradient of this reach is 1.1% (60 ft/mi.) Reach 2 is dominated by Divide Ridge to the southeast and an unnamed extension of Bethel Ridge to the northwest.

ABIOTIC - See Tieton Physical map and Tieton Physical (soil characteristics) map *(Tieton_Physical.pmf and Tieton_Soil_Characteristics.pmf)*

Geology/Landform (Table T2)

Reach 2 occupies a southwest-to-northeast trending valley. The floodplain of this reach is narrowly confined by the flanks of Divide Ridge to the southeast and an unnamed extension of Bethel Ridge to the northwest. Both ridges are composed of basalt flows. Throughout the majority of this reach, the stream abuts the confining walls of the valley. Throughout this SMP jurisdiction of this reach, the surficial geology is one of basalt and andesite flows (WDNR, 2000).

There are extensive areas of geologic hazards noted along the northwestern side of Reach 2. Throughout the upper 6.3 miles of the reach where the stream directly abuts the flanks of Bethel Ridge, the majority of SMP jurisdiction includes, or directly abuts areas rated as High Risk due to oversteepened slopes and unstable materials presenting the possibility for rock fall and creep. The SMP jurisdiction does not extend to the southwestern side of the floodplain. This side of the canyon exhibits High Risk potential for rock fall and creep along its entire length. Approximately 71.1% of the reach is within the 100 year floodplain.

Soil and Soil Properties (Table T3)

According to the available geology data, the entirety of Reach 2 is underlain by basaltic and andesitic lava flows, with no alluvial deposits. However, based on the geomorphology and gradient of this reach, along with the apparent delivery of sediments from the numerous side canyons, these values are suspect. The soils within the SMP jurisdiction are predominately very stony loams and rock outcrop. Within this reach, 62.1% of the soils are aquic, a direct reflection of stream and hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Based on the amount of aquic soils, this likely provides a better estimate of the amount of alluvium present in the SMP jurisdiction of this reach. Soil permeability is rapid, runoff is classed as slow, and the hazard of erosion is rated as slight (NRCS, 2003).

Stream Type/ Channel Form (Table T4)

Channel form throughout Reach 2 is currently classified as pool-riffle.

This reach, generally, is narrowly confined between steep canyon walls. The floodplain in the upper 5.7 miles of the reach is approximately 250 feet in width, widening to 850 feet in the lower 2.6 miles of the reach. The majority of sinuosity in this reach is dictated by canyon geology, with only a slight amount of meandering within the lower 2.6 miles of the reach. The White Pass highway (US 12) has restricted the river's ability to access portions of its former floodplain along

the entire left bank except for a 1200-foot area (Windy Point) where the roadway restricts floodplain access along the right bank.

While the narrowly-confined upper segment is a transport reach in which stream energies are concentrated and maintained, the lower segment is a depositional/transport reach in which energy is dissipated. Reduction in velocity and volume through lateral movement (channel migration), braiding/distributaries (multiple channels), and percolation into the alluvial substrate resulted in a depositional environment. It is expected that the majority of the SMP jurisdiction of Reach 2 is underlain by, likely deep, deposits of alluvium (see comments under "Soils/Soil Properties" above). Although somewhat confined to a portion of its former floodplain, the channel remains free to migrate, and likely has, throughout most of this reach.

The loss of bedload and large woody debris sourcing from the upper basin since the construction of Tieton Dam, combined with the alteration of flow regimes associated with flip-flop, has likely resulted in a reduction in stream complexity throughout this reach. It is likely that the channel complexity of the lower 2.6-mile segment of the river was once somewhat more complex than it is presently.

Stream Flow
The flow regime is atypical of that of streams throughout the region, which generally exhibit lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer. Due to "flip-flop," the lower Tieton witnesses rapidly increased flows during late fall. Diversion of flow at the Yakima-Tieton diversion reduces flows substantially during the irrigation season.

Hyporheic Flow
Given the geology, geomorphology, and gradient of this reach, the supplying of sediments from side canyons, and the high proportion of the SMP jurisdiction and much greater floodplain underlain by aquic soils, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Ground water/surface water interactions are expected to occur throughout Reach 2 as evidenced by the presence of side-canyon streams becoming intermittent as they flow across their terminal alluvial fans.

BIOTIC - See Tieton Biological map *(Tieton Biological.pmf)*

Natural Vegetation (Tables T5 and T7)
<u>Upland</u>
GAP analysis data estimates that the vegetation community in Reach 2 is dominated by oak vegetation (82.5%) with a smaller area of central arid steppe (17.5%) (WDFW, 2004a).

<u>Riparian</u>
Estimates of the SMP jurisdiction area covered by riparian vegetation is 34.7% (Yakima County, 2003b.).

Wetlands
Wetlands occupy 18.4% of the SMP jurisdiction (USFWS, 2003). An additional 0.8 acres of wetland may be classified as associated wetlands within the final SMP jurisdiction, either intersecting the draft SMP jurisdiction boundary directly or being located in the 100-year floodplain. An additional 0.8 acres of wetland may be classified as associated wetlands within the final SMP jurisdiction, either intersecting the draft SMP jurisdiction boundary directly or being located in the 100-year floodplain.

Wildlife
Aquatic (Table T6)
Reach 2 has been identified as spawning habitat for summer steelhead, and spring chinook may be present along this reach (WDFW, 2004c.). Adequate habitat is expected for 11 species of resident fish species in this reach, including rainbow trout, eastern brook trout, and mountain whitefish.

Avian (Tables T5 and T8)
GAP analysis data indicates that portion of Reach 2 may provide habitat for some species of concern, including principally the sage sparrow (13.9%) and the sage thrasher (13.9%) (WDFW, 2004a).

Terrestrial (Tables T5 and T8)
GAP analysis data indicates that portions of Reach 2 may provide habitat for four species of concern, including principally the Townsend's big eared bat (100%), as well as smaller portions for the black tailed jack rabbit (13.9%), Townsend's ground squirrel (13.9%) and the Western gray Squirrel (82.5%).

CULTURAL - See Tieton Cultural map *(Tieton_cultural_jurisdictional.pmf and Tieton_Cultural_Modifications.pmf)*

Contemporary Land Use
Zoning (Table T10)
Current zoning within the SMP jurisdiction of Reach 2 is predominantly Forested watershed (99.4%) with a smaller area of agriculture (0.6%). The entire jurisdiction is also designated as Conservancy.

Land Use (Table T9)
Of the SMP jurisdiction lands along Reach 2, 93.4% remain vacant or natural land (Yakima County, 2004a). Of the remaining 6.6% of SMP jurisdiction lands, 5.5% is in industrial/transportation, 0.7% is classified as agriculture and 0.4% is classified as government school/work camp. Approximately 5.5% of the SMP jurisdiction is greater than 25% impervious. The Washington Department of Fish and Wildlife is the major public owner of land within the SMP jurisdiction, holding title to 92.2% of the land. The US Bureau of Reclamation holds title to a smaller area public land (5.0%) along this reach.

Transportation (Table T11)
Roadways occupy 3.0 miles of SMP jurisdiction land in this reach (Yakima County, n.d.a). There are no railroads along this reach but there is one bridge crossings along this reach.

Revetments (Table T11)
Reach 2 has 0.7 miles of roadway impinging upon and confining the river (CWU, 2002).

Cultural Resources (Table T12)
There is one known cultural site noted in the SMP jurisdiction of Reach 2 (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings (Table T12)
No DOE sites/facilities or 303(d) listed facilities are found in the SMP jurisdiction of Reach 2 (WDOE, 1998).

ECOLOGICAL FUNCTION SUMMARIES

Reach 2 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 40.2% High erosion soils: 13.7% High soil runoff: 13.8% High soil permeability: 62.7% 100-Year Floodplain: 71.1%	Wetlands: 18.4% Riparian cover: 34.7% Undeveloped: 93.4% Priority habitats: 5 Species of concern: 6 Natural Heritage Sites: 1 Anadromous habitat: 3.5 mi Total fish species: 14	Public land: 97.2%	Principal land use: Vacant/natural >10% Imperviousness: 5.5% Roads: 3 mi Barriers: Passable, Diversion Dam Revetments: 0.7 mi Bridge Crossings: 1

Ecological functions along Reach 2 are principally impaired by industrial-transportation and agricultural development, which covers only 6.2% of the jurisdiction. These land uses, in addition to the 3 miles of roads, account for the majority of the estimated 5.5% of the reach that is greater than 10% impervious. In addition, 1 bridge crossing and one passable diversion dam occur along the reach. Upland vegetation has been removed and replaced with crops, buildings and roads, which can promote increased runoff and nonpoint source pollution. The Tieton River has also been heavily diverted and extensive areas have lost floodplain connectivity, including approximately 0.7 miles of revetments within the jurisdiction. Riparian vegetation, which is a buffer for nonpoint pollution, covers approximately 34.7% of the reach. Much of the reach is presently undeveloped (93.4%), while 18.4% is covered by wetlands. The reach provides habitat for six species of concern, as well as five priority habitats, one natural heritage site for harlequin ducks, and aquatic habitat for 14 fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES - See Tieton Ecological protection opportunities map *(Tieton_Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for the Tieton River.

1) Protect cultural site area.
2) Rationale: Riparian buffer and anadromous spawning area. Suggested action: Protect riparian buffer.
3) Rationale: Riparian buffer and anadromous spawning area. Suggested action: Protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES - See Tieton Ecological Restoration opportunities map *(Tieton_Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for the Tieton River.

1) Rationale: Marginal riparian buffer, high erosion and anadromous spawning area. Suggested Action: Work with private landowners to establish a larger riparian buffer.

REACH 3

General Description

Reach 3 is a 7.4 mile segment of the Tieton River that extends from the base of Tieton Dam (RM 21.1) at an elevation of 2720 feet to the western end of the community of Rimrock Retreat (RM 13.7) at an elevation of 2360 feet. The average gradient of this reach is 0.9% (48.6 ft/mi.). Reach 3 is dominated by Bethel Ridge to the north and Divide Ridge to the south.

ABIOTIC - See Tieton Physical map and Tieton Physical (soil characteristics) map *(Tieton_Physical.pmf and Tieton_Soil_Characteristics.pmf)*

Geology/Landform (Table T2)

Reach 3 occupies the upper 7.4 miles of the Tieton River. The river here flows easterly. The canyon is narrowly confined by the abrupt flanks of Bethel Ridge to the north and Divide Ridge to the south through the lower 4.4 miles of this reach (RM 13.7 – 18.1). Both ridges are composed of basalt flows. The upper 2.7 miles (RM 18.1 – 20.8) is less-confined by the more gradual slopes of the Tieton Basin to both the north and south. The geology of the Tieton Basin is Miocene and older volcanic rocks. Throughout this SMP jurisdiction of this reach, the surficial geology is predominantly one of alluvium (64.6%) and basalt and andesite flows (32.3%) (WDNR, 2000). The remainder of the SMP jurisdiction of this reach contains areas of mass-wasting deposits – mostly landslides.

There are extensive areas of geologic hazards noted along the northern side of Reach 3 where the majority of the SMP jurisdiction includes, or directly abuts areas rated as High Risk due to oversteepened slopes and unstable materials presenting the possibility for rock fall and creep (Yakima County, 2003c). Additionally, approximately 3000 feet of the northern side of this reach is rated as High Risk for landslides due to the presence of landslides, debris flows, or slumps. The SMP jurisdiction only infrequently extends to the southern side of the floodplain. This side of the canyon exhibits High Risk potential for rock fall and creep along much of its length. Approximately 41.2% of the reach is within the 100 year floodplain.

Soil and Soil Properties (Table T3)

Reach 3 is dominated by (64.6%) by alluvial deposits. Within this reach, 40.4% of the soils are aquic, a direct reflection of stream and hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Soil permeability is rapid to moderately slow, runoff is generally classed as slow to rapid, and the hazard of erosion is rated as slight to high (NRCS, 2003).

Stream Type/ Channel Form (Table T4)

Channel form throughout the lower 7.0 miles of Reach 4 is currently classified as pool-riffle, with the upper 0.4 mile being classed as step-pool.

This reach, generally, is narrowly confined by steep canyon walls. The floodplain of this reach ranges from 500-1000 feet in width. The majority of stream sinuosity is dictated by canyon geology, with only a slight amount of meandering within its floodplain. The White Pass highway (US 12) has restricted the river's ability to access portions of its former floodplain along much of the left bank.

It is likely that the channel throughout this reach was once much somewhat more complex than it is currently. This is principally a transport reach in which stream energies are concentrated and maintained, moving materials sourced from above to lower reaches. Both velocity and volume are maintained as a result of the inability for the stream to move laterally (channel migration), develop multiple channels, reduce gradient (via meandering), or percolate into the alluvial substrate. The majority of the SMP jurisdiction of Reach 3 is underlain by varying depths of deposits of alluvium. Although somewhat confined to a portion of its former floodplain, the channel remains free to migrate somewhat within its floodplain, and likely has, throughout most of this reach.

The loss of bedload and large woody debris sourcing from the upper basin since the construction of Tieton Dam, combined with the alteration of flow regimes associated with flip-flop, has likely resulted in a reduction in stream complexity throughout this reach. It is likely that the complexity of the lower segment of the river was once somewhat more complex than it is presently.

Stream Flow
The flow regime is atypical of that of streams throughout the region, which generally exhibit lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer. Due to "flip-flop," the lower Tieton witnesses rapidly increased flows during late fall. Diversion of flow at the Yakima-Tieton diversion reduces flows substantially during the irrigation season.

Hyporheic Flow
Given the geology, geomorphology, and gradient of this reach, the supplying of sediments from side canyons, and the high proportion of the SMP jurisdiction and much greater floodplain underlain by aquic soils, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Ground water/surface water interactions are expected to occur throughout Reach 3. It is likely that this reach has suffered the loss of hyporheic function as a result of the loss of sourcing of upstream sediments (now trapped in Rimrock Lake) as well as the flushing of former sediments during periods of high flow (flip-flop).

BIOTIC - See Tieton Biological map *(Tieton Biological.pmf)*

Natural Vegetation (Tables T5 and T7)
<u>Upland</u>
GAP analysis data estimates that the vegetation community in Reach 3 is dominated by oak vegetation (54.3%) with smaller areas of ponderosa pine (45.2%) and central arid steppe (0.5%) (WDFW, 2004a).

<u>Riparian</u>
Estimates of the SMP jurisdiction area covered by riparian vegetation is 30.4% (Yakima County, 2003b).

Wetlands
Wetlands occupy 21.1% of the SMP jurisdiction (USFWS, 2003). An additional 12 acres of wetland may be classified as associated wetlands within the final SMP jurisdiction, either intersecting the draft SMP jurisdiction boundary directly or being located in the 100-year floodplain.

Wildlife
Aquatic (Table T6)
Reach 3 has been identified as spawning habitat for summer steelhead (WDFW, 2004c). Adequate habitat is expected for 15 species of resident fish species in this reach, including rainbow trout, eastern brook trout, and mountain whitefish.

Avian (Tables T5 and T8)
GAP analysis data indicates that portion of Reach 3 may provide habitat for some species of concern, including principally the sage sparrow (0.5%) and the sage thrasher (0.5%) (WDFW, 2004a).

Terrestrial (Tables T5 and T8)
GAP analysis data indicates that portions of Reach 3 may provide habitat for a particular species of concern, the Townsend's big eared bat (100%), as well as smaller portions for the Western gray Squirrel (99.5%), the black tailed jack rabbit (0.5%), and the Townsend's ground squirrel (0.5%).

CULTURAL - See Tieton Cultural map *(Tieton_cultural_jurisdictional.pmf and Tieton_Cultural_Modifications.pmf)*

Contemporary Land Use
Zoning (Table T10)
Current zoning within the SMP jurisdiction of Reach 3 is predominantly Forested watershed (97.0%) with a smaller area of rural settlement (3.0%). The entire jurisdiction is also designated as Conservancy.

Land Use (Table T9)
Of the SMP jurisdiction lands along Reach 3, 87.3% remain vacant or natural land (Yakima County, 2004a). Of the remaining 12.7% of SMP jurisdiction lands, 10.9% is in industrial/transportation, 0.2% is classified as commercial logging, 0.2% is classified as commercial retail, 0.1% of the reach is multi family residential, and 1.3% of the reach is single family residential. Approximately 13.6% of the SMP jurisdiction is greater than 25% impervious. The US Forest Service is the major public owner of land within the SMP jurisdiction, holding title to 34.7% of the land. The Washington Department of Fish and Wildlife holds title to a smaller area public land (14.0%) along this reach.

Transportation (Table T11)
Roadways occupy 5.5 miles of SMP jurisdiction land in this reach (Yakima County, n.d.a). There are no railroads along this reach but there are two bridge crossings along this reach.

Revetments (Table T11)
There are no revetments along this reach impinging upon and confining the river (CWU, 2002).

Cultural Resources (Table T12)
There is one known cultural site noted in the SMP jurisdiction of Reach 3 (WSHPO, 2004).

303(d) Listings (Table T12)
No DOE sites/facilities or 303(d) listed facilities are found in the SMP jurisdiction of Reach 3 (WDOE, 1998).

ECOLOGICAL FUNCTION SUMMARIES

Reach 3 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 21.5% High erosion soils: 23% High soil runoff: 23% High soil permeability: 40.4% 100-Year Floodplain: 41.2%	Wetlands: 21.1% Riparian cover: 30.4% Undeveloped: 87.3% Priority habitats: 7 Species of concern: 6 Natural Heritage Sites: 5 Anadromous habitat: 7.9 mi Total fish species: 17	Public land: 66.4%	Principal land use: Vacant/natural >10% Imperviousness: 15.4% Roads: 5.5 mi Barriers: Passable dam Bridge Crossings: 2

Ecological functions along Reach 3 are principally impaired by industrial-transportation development, which covers 10.9% of the jurisdiction. These land uses, in addition to the 5.5 miles of roads, account for the majority of the estimated 15.4% of the reach that is greater than 10% impervious. In addition, 2 bridge crossings occur along the reach. Upland vegetation has been removed and replaced with buildings and roads, which can promote increased runoff and nonpoint source pollution. Riparian vegetation, which is a buffer for nonpoint pollution, covers approximately 30.4% of the reach. Much of the reach is presently undeveloped (87.3%), while 21.1% is covered by wetlands. The reach provides habitat for six species of concern, as well as seven priority habitats and aquatic habitat for 17 fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES - See Tieton Ecological protection opportunities map *(Tieton_Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for the Tieton River.

1) Protect cultural site area.
2) Rationale: Riparian buffer and anadromous spawning area. Suggested action: Protect riparian buffer.
3) Rationale: Riparian buffer and anadromous spawning area. Suggested action: Protect riparian buffer.

4) Rationale: Riparian buffer and anadromous spawning area in an area with high soil erosion potential. Suggested action: Protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES - See Tieton Ecological Restoration opportunities map *(Tieton_Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for the Tieton River.

1) Rationale: Marginal riparian buffer and anadromous spawning area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
2) Rationale: Marginal riparian buffer and anadromous spawning area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
3) Rationale: Marginal riparian buffer, high erosion and anadromous spawning area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
4) Rationale: Marginal riparian buffer, high erosion and anadromous spawning area. Suggested Action: Work with private landowners to establish a larger riparian buffer.

REACH 4

General Description

Reach 4 is a 14.2 mile segment of the South Fork Tieton River that extends from Conrad Meadows (RM 16.4) at an elevation of 4020 feet to the high-water level of Rimrock Lake (RM 2.0 of the now inundated terminal portion of the river) at an elevation of 2930 feet. The overall gradient of this reach is 1.4% (75.7 ft/mi.). However, the reach exhibits two distinct morphologies. The lower 5.4 miles of the river (Rimrock Lake (RM 2.0) – Bakeoven Flats (RM 7.4) exhibits a gradient of 2.6% (140 ft/mi.), while the upper 9 miles (Bakeoven Flats (RM 7.4) – Conrad Meadows (RM 16.4), exhibits a gradient of 0.8% (40 ft/mi). Reach 4 is dominated by Pinegrass Ridge to the northwest and Divide Ridge to the southeast.

ABIOTIC - See Tieton Physical map and Tieton Physical (soil characteristics) map *(Tieton_Physical.pmf and Tieton_Soil_Characteristics.pmf)*

Geology/Landform (Table T2)

Reach 4 occupies the lower 14.4 miles of the South Fork Tieton River. The river here flows generally northeasterly. At Rimrock Lake, the river flows through basalt flows. Within the lower 11 miles of this reach, the geology is composed of marine sedimentary rocks. The upper, approximately 3.5 miles flows through Miocene and older volcanic rocks, at higher elevations, younger Quaternary/Pliocene volcanic rocks. Within the lower, steep-gradient portion of this reach below Bakeoven Flats, the river is narrowly confined by steep canyon walls. Through the upper, low-gradient portion above Bakeoven Flats, the floodplain alternates between zones of narrow confinement and areas exhibiting a degree of floodplain development (500-1000 feet width).

Overall, the surficial geology of this SMP jurisdiction is predominantly one of alluvium (42.5%) and marine sedimentary rocks (41.9%) (WDNR, 2000). A total of 5.7% of the SMP jurisdiction of this reach are areas of mass-wasting deposits – mostly landslides.

There are extensive areas of geologic hazards noted along both sides of Reach 4 where the majority of the SMP jurisdiction includes, or directly abuts areas rated as High Risk and, to a lesser extent, Intermediate Risk due to oversteepened slopes and unstable materials presenting the possibility for rock fall and creep (Yakima County, 2003c). Small areas along this reach are rated as High Risk for landslides due to the presence of landslides, debris flows, or slumps.

Soil and Soil Properties (Table T2)

A large proportion (42.5%) of Reach 4 exhibits alluvial deposits. The soils within the SMP jurisdiction are predominately of silt loams. Within this reach, only 1.5% of the soils are aquic (Yakima County, n.d.c). However, given the amount of the SMP jurisdiction overlain by alluvium, and following a review the geomorphology, gradient, and soil characteristics, particularly within the upper, low-gradient, portion of the river, this assessment is questioned. Soil permeability is moderately rapid and the hazard of erosion is rated as slight (NRCS, 2003).

Stream Type/ Channel Form (Table T4)
The upper 9.0 miles of the reach represents a glacially carved valley and alternates between zones of narrow confinement and areas exhibiting some floodplain development, ranging from 500-1000 feet in width. Within this segment of the reach, the river exhibits a high degree of meandering and some areas of channel bifurcation. The lower 5.4 miles of the reach is typified by extremely steep canyon walls which narrowly confine the stream. Within this segment of the reach, the river is quite linear, with the majority of sinuosity being dictated by canyon geology. The roadway that parallels the river along its left bank is located generally above the floodplain.

The unconfined upper-segment of the reach is a depositional/transport reach in which energy is dissipated. Reduction in velocity and volume through lateral movement (channel migration), braiding/distributaries (multiple channels), and percolation into the alluvial substrate resulted in a depositional environment. It is expected that the majority of the SMP jurisdiction of the upper segment of Reach 4 is underlain by, likely deep, deposits of alluvium derived from glacial outwash and subsequent fluvial erosion/deposition. The channel remains free to migrate, and does, throughout most of this reach, the exceptions being those zones of narrow confinement.

The narrowly-confined lower segment is a transport reach in which stream energies are concentrated and maintained, moving materials sourced from above to lower reaches. Both velocity and volume are maintained as a result of the inability for the stream to move laterally (channel migration), develop multiple channels, reduce gradient (via meandering), or percolate into the alluvial substrate. It is expected that the majority of the lower segment of Reach 4 is underlain by, likely thin, deposits of alluvium.

With the exception of the loss of widespread beaver activity in the upper segment of this reach, it is unlikely that the channel throughout this reach was ever more complex than it is currently. The beaver-meadow complexes that once existed are largely gone today; however, the stream has not begun to entrench significantly. The headwaters of the South Fork Tieton River have been described as pristine and this river has not suffered the loss of bedload and large woody debris sourcing as have those reaches below Tieton Dam, and since this river is unregulated, remains unaffected by the alteration of flow regimes associated with flip-flop.

Stream Flow
The flow regime is expected to be typical of that of unregulated, high mountain streams throughout the region, which generally exhibit lowest flows in late fall and early winter, rapidly ascending flows commencing in early Spring, and gradually declining flows throughout late Spring and Summer.

Hyporheic Flow
Given the high proportion of the SMP jurisdiction and much greater floodplain underlain by alluvium, the hyporheic zone is expected to be extremely widespread, particularly throughout the upper, 9-mile segment of the reach. The glacial-trough valley of the upper reach is likely underlain by extensive glacially-derived alluvial deposits. Further, the floodplain of this reach was once extensively utilized by beaver, the dams of which served to capture sediments sourced from headwater and side-canyon streams. The nature of the deposits likely makes hyporheic flow extremely complex.

BIOTIC - See Tieton Biological map *(Tieton Biological.pmf)*

Natural Vegetation (Tables T5 and T7)
Upland
GAP analysis data estimates that the vegetation community in Reach 4 is dominated by subalpine fir (49.4%) and interior Douglas fir (47.8%) with smaller areas of Western hemlock (2.6%) and grand fir (0.1%) (WDFW, 2004a).

Riparian
There are no estimates of the SMP jurisdiction area covered by riparian vegetation (Yakima County, 2003b.).

Wetlands
Wetlands occupy 15.6% of the SMP jurisdiction (USFWS, 2003). An additional 62.1 acres of wetland may be classified as associated wetlands within the final SMP jurisdiction, either intersecting the draft SMP jurisdiction boundary directly or being located in the 100-year floodplain.

Wildlife
Aquatic (Table T6)
Adequate habitat is expected for 4 species of resident fish species in this reach, including rainbow trout, kokanee salmon, and mountain whitefish (WDFW, 2004c).

Avian (Tables T5 and T8)
GAP analysis data indicates that portions of Reach 4 may provide habitat for some species of concern, including principally the spotted owl (34.5%) (WDFW, 2004a).

Terrestrial (Tables T5 and T8)
GAP analysis data indicates that portions of Reach 4 may provide habitat for a particular species of concern, the Townsend's big eared bat (50.6%).

CULTURAL - See Tieton Cultural map *(Tieton_cultural_jurisdictional.pmf and Tieton_Cultural_Modifications.pmf)*

Contemporary Land Use
Zoning (Table T10)
Current zoning within the SMP jurisdiction of Reach 4 is entirely Forested watershed (100%). The entire jurisdiction is also designated as Conservancy.

Land Use (Table T9)
Of the SMP jurisdiction lands along Reach 4, 61.9% remain vacant or natural land (Yakima County, 2004a). Of the remaining 38.1% of SMP jurisdiction lands, 37.3% is in forestry, 0.2% is in industrial/transportation, and 0.5% of the reach is single family residential. Approximately 0.2% of the SMP jurisdiction is greater than 25% impervious. The US Forest Service is the major public owner of land within the SMP jurisdiction, holding title to 92.3% of the land.

Transportation (Table T11)
Roadways occupy 1.9 miles of SMP jurisdiction land in this reach (Yakima County, n.d.a). There are no railroads along this reach or bridge crossings along this reach.

Revetments (Table T11)
There are no revetments along this reach impinging upon and confining the river (CWU, 2002).

Cultural Resources (Table T12)
There are three known cultural sited noted in the SMP jurisdiction of Reach 4 (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings (Table T12)
No DOE sites/facilities are found in the SMP jurisdiction of Reach 4, however, 1.1 miles of stream are listed as 303(d) (WDOE, 1998).

ECOLOGICAL FUNCTION SUMMARIES

Reach 4 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 15.4% High erosion soils: 25.73% High soil permeability: 40.14%	Wetlands: 15.6% Undeveloped: 61.9% Priority habitats: 2 Species of concern: 2 Natural Heritage Sites: 4 Total fish species: 5	Public land: 100%	Principal land use: Vacant/natural >10% Imperviousness: 0.2% Roads: 1.9 mi

Ecological functions along Reach 4 are principally impaired by forestry practices, which cover 37.3% of the jurisdiction. This land use, in addition to the 1.9 miles of roads, account for the majority of the estimated 0.2% of the reach that is greater than 10% impervious. Some upland vegetation has been removed through forestry practices, which can promote increased runoff and nonpoint source pollution. There are 1.1 miles of 303(d)-listed stream segments and no DOE sites/facilities found in the SMP jurisdiction. Much of the reach is presently undeveloped (61.9%), while 15.6% is covered by wetlands. The reach provides habitat for two species of concern, the Townsend's big-eared bat and the spotted owl, as well as two priority habitats for marten and osprey, and aquatic habitat for five fish species.

ECOLOGICAL PROTECTION OPPORTUNITIES - See Tieton Ecological protection opportunities map *(Tieton_Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for the Tieton River.

1) Rationale: Riparian buffer/Natural vegetation and anadromous spawning area adjacent to creek. Suggested action: Protect riparian buffer.
2) Protect cultural site area.

3) Protect cultural site area.
4) Rationale: Riparian buffer/Natural vegetation and anadromous spawning area adjacent to creek. Suggested action: Protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES - See Tieton Ecological Restoration opportunities map *(Tieton_Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for the Tieton River.

1) Rationale: Marginal riparian buffer and anadromous spawning area. Suggested Action: Work with Forest Service to establish a larger riparian buffer.

RIMROCK LAKE

General Description

ABIOTIC - See Tieton Physical map and Tieton Physical (soil characteristics) map *(Tieton_Physical.pmf and Tieton_Soil_Characteristics.pmf)*

Geology/Landform (Table T2)
Throughout the SMP jurisdiction of Rimrock Lake, the surficial geology is predominantly one of marine sedimentary rocks (41.9%) with smaller areas of quartz diorite (13.4%) and a combination of a number of other types of lithology (WDNR, 2000).

There are extensive areas of geologic hazards noted along Rimrock Lake (Yakima County, 2003c). The reach has an area of 16.9% that is rated as High Risk due to the potential of rock fall or creep from over-steepened slopes, as well as 6.3% that is rated as an intermediate risk for oversteepened slopes and 3.5% that is rated as High Risk due to landslides. Smaller areas contain the risks of landslides as well as alluvial fan flash flooding.

BIOTIC - See Tieton Biological map *(Tieton Biological.pmf)*

Natural Vegetation (Tables T5 and T7)
Upland
GAP analysis data estimates that the vegetation community in Rimrock Lake is dominated by interior Douglas fir (100%) (WDFW, 2004a).

Riparian
There are no estimates of the SMP jurisdiction area covered by riparian vegetation (Yakima County, 2003b.).

Wetlands
Wetlands occupy 16.2% of the SMP jurisdiction (USFWS, 2003).

Wildlife
Aquatic (Table T6)
Adequate habitat is expected for 9 species of resident fish species in this reach, including rainbow trout, eastern brook trout, and mountain whitefish (WDFW, 2004c). The Tieton Dam is impassable to summer steelhead.

Avian (Tables T5 and T8)
There are no estimates for avian species in the Rimrock Lake area based on GAP data.

Terrestrial (Tables T5 and T8)
GAP analysis data indicates that Rimrock Lake may provide habitat for a particular species of concern, the Townsend's big eared bat (100%).

CULTURAL - See Tieton Cultural map *(Tieton_cultural_jurisdictional.pmf and Tieton_Cultural_Modifications.pmf)*

Contemporary Land Use

Zoning (Table T10)

Current zoning within the SMP jurisdiction of Rimrock Lake is entirely Forested watershed (100%). The entire jurisdiction is also designated as Conservancy.

Land Use (Table T9)

Approximately 18.7% of the SMP jurisdiction is greater than 25% impervious. The US Forest Service is the major public owner of land within the SMP jurisdiction, holding title to 95.6% of the land.

Transportation (Table T11)

Roadways occupy 6.1 miles of SMP jurisdiction land in this jurisdiction (Yakima County, n.d.a). There are no railroads along this reach but there is one bridge crossing along this reach.

Revetments (Table T11)

There are no revetments along this reach impinging upon and confining the lake (CWU, 2002).

DOE Sites/facilities and 303(d) Listings (Table T12)

No DOE sites/facilities are found in the SMP jurisdiction of Rimrock Lake, and there are no 303(d) listings (WDOE, 1998).

ECOLOGICAL FUNCTION SUMMARIES

Rimrock Lake Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 21.5% High erosion soils: 23% High soil runoff: 23% High soil permeability: 40.4%	Wetlands: 16.2% Undeveloped: 86.1% Priority habitats: 3 Species of concern: 1 Natural Heritage Sites: 4	Public land: 100% Boat Launches: 5	Principal land use: Vacant/natural >10% Imperviousness: 35.3% Roads: 6.1 mi Barriers: Impassable dam Bridge Crossings: 1

Ecological functions along Rimrock Lake are principally impaired by industrial-transportation, governmental, and residential development, which covers 7.3% of the jurisdiction. These land uses, in addition to the 6.1 miles of roads, account for the majority of the estimated 35.3% of the reach that is greater than 10% impervious. In addition, 1 bridge crossings and one impassable dam occur along the reach. Upland vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Much of the reach is presently undeveloped (86.1%), while 16.2% is covered by wetlands. The reach provides habitat for one species of concern, the Townsend's big-eared bat, four natural heritage sites, and three priority habitats.

ECOLOGICAL PROTECTION OPPORTUNITIES - See Tieton Ecological protection opportunities map *(Tieton_Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for Rimrock Lake.

1) Rationale: Wetlands are present. Suggested action: Work to protect wetlands.

ECOLOGICAL RESTORATION OPPORTUNITIES - See Tieton Ecological Restoration opportunities map *(Tieton_Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for Rimrock Lake.

1) Rationale: Marginal natural vegetation buffer and anadromous spawning area. Suggested Action: Work with Forest Service to establish a larger natural vegetation buffer.
2) Rationale: Marginal natural vegetation buffer and anadromous spawning area. Suggested Action: Work with Forest Service to establish a larger natural vegetation buffer.

APPENDIX

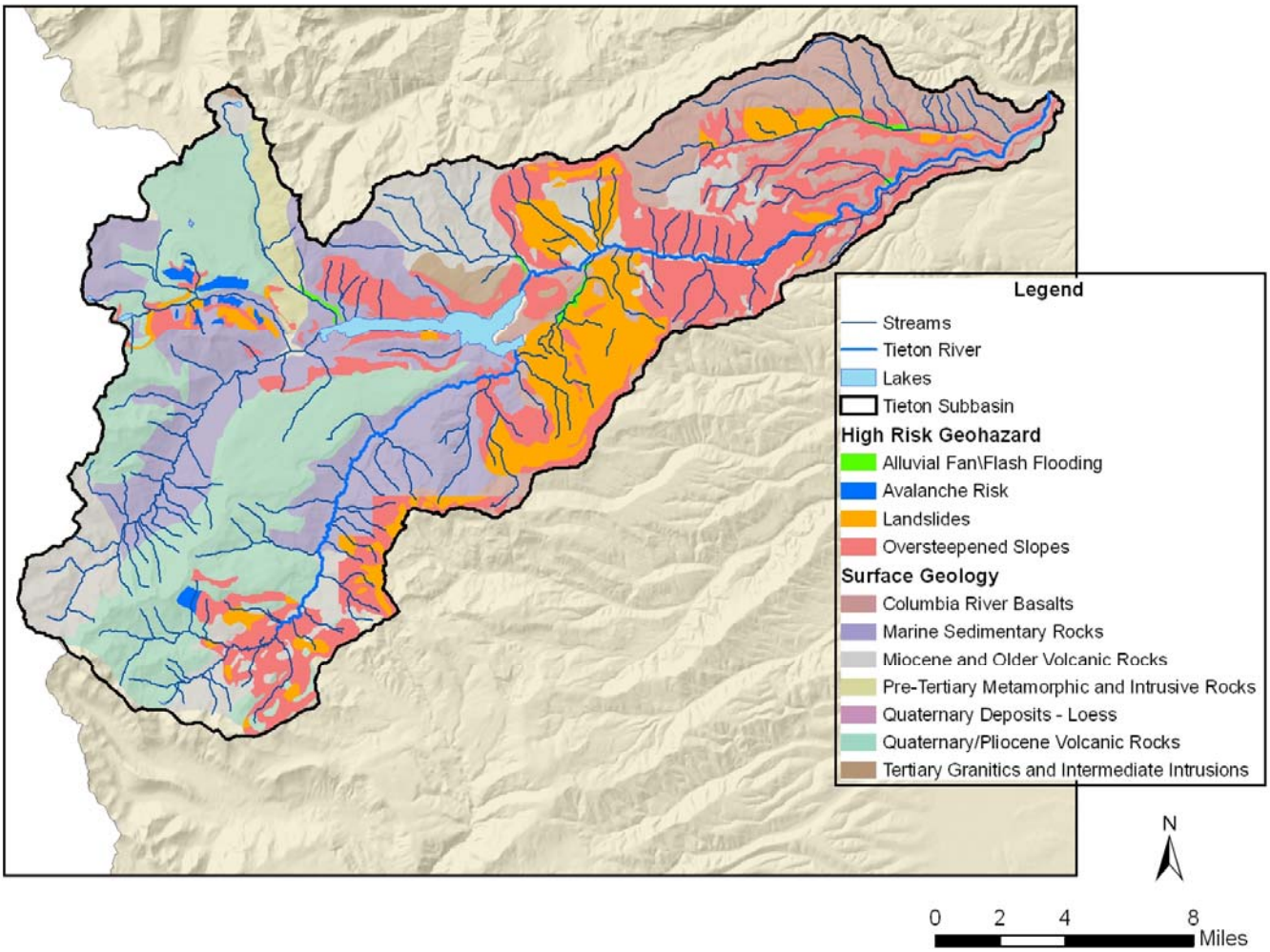

Figure T1. Geology and Geohazards in the Tieton River Basin.

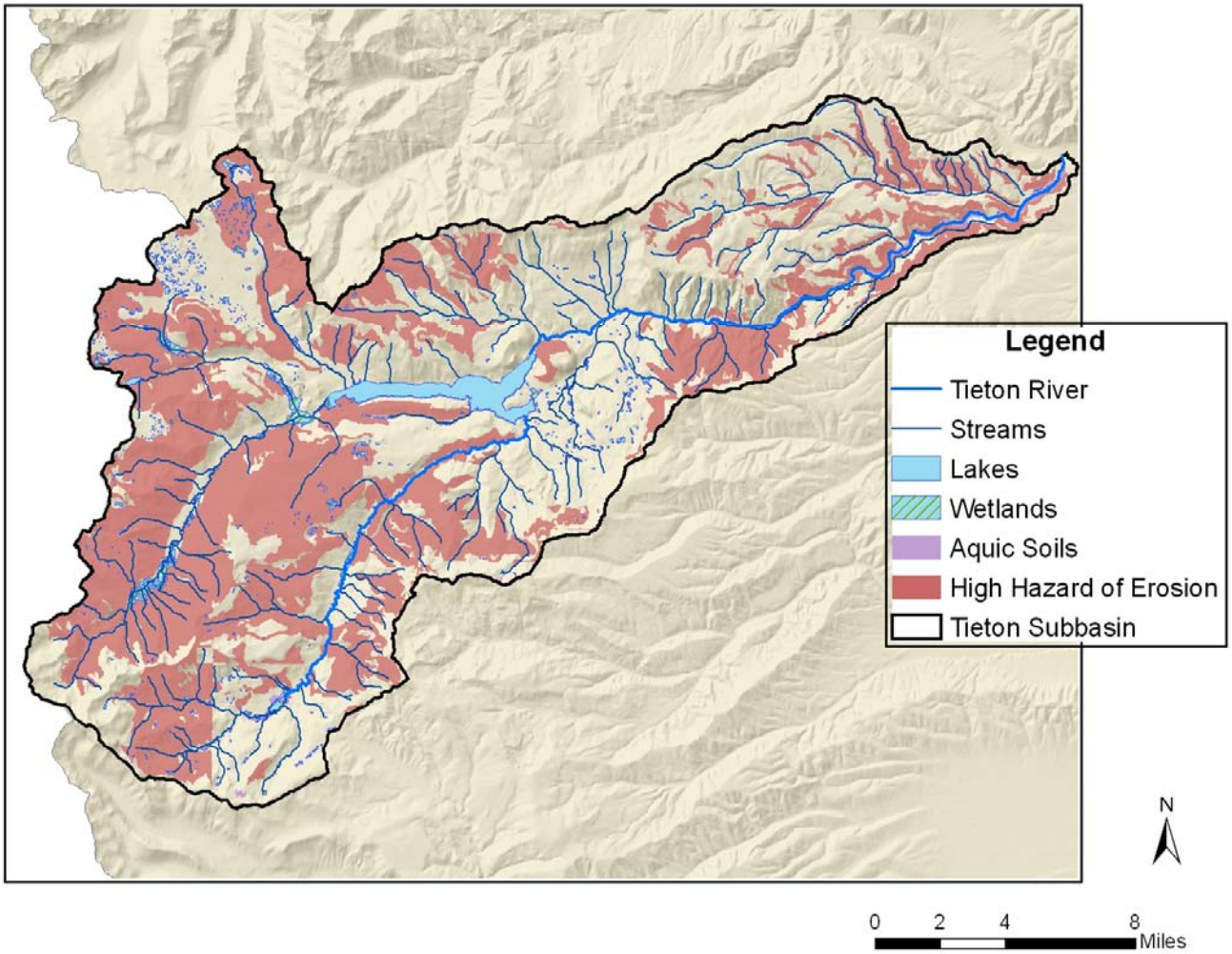

Figure T2. Wetlands and Soil Characteristics in the Tieton River Basin

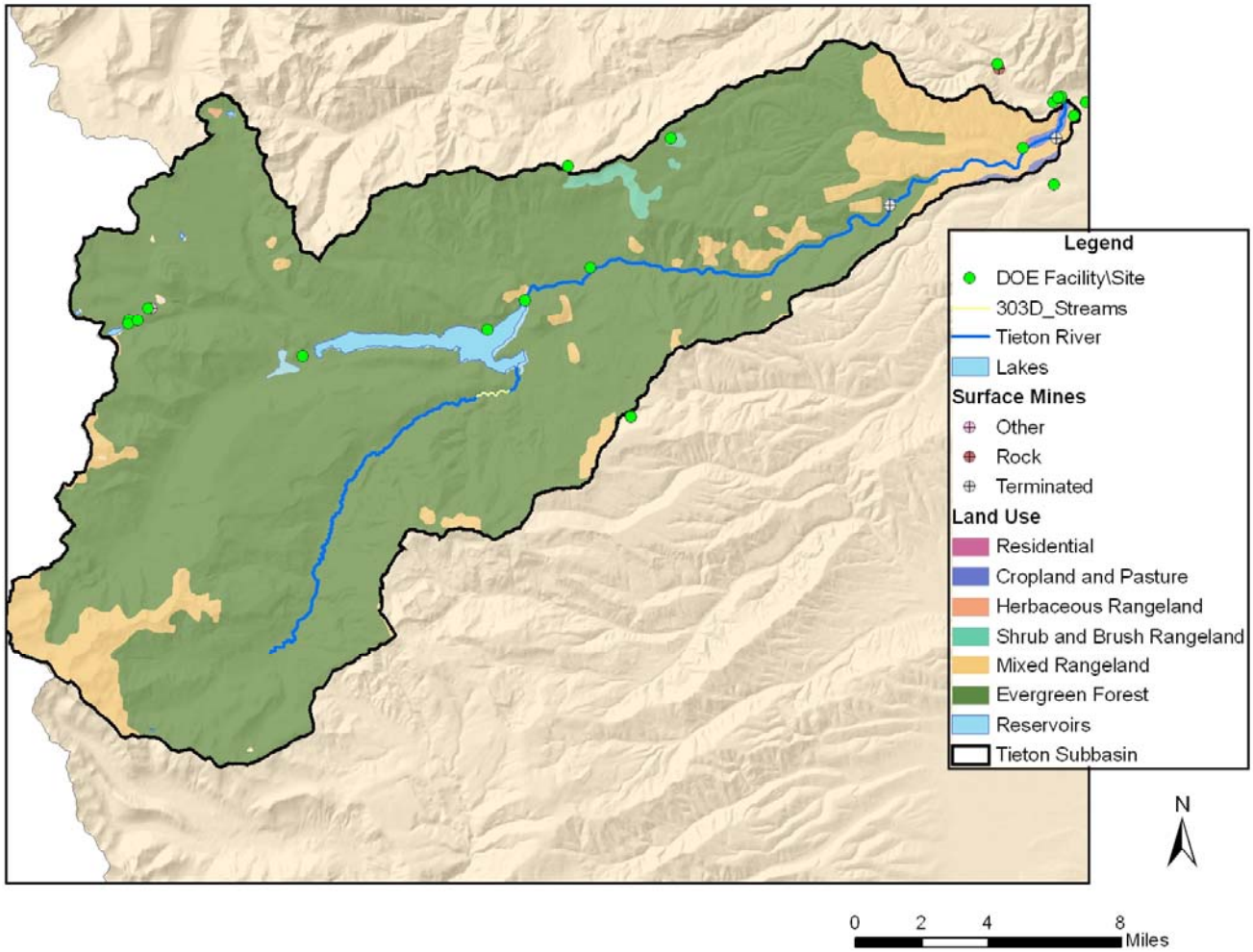

Figure T3. Cultural Modifications in the Tieton River Basin.

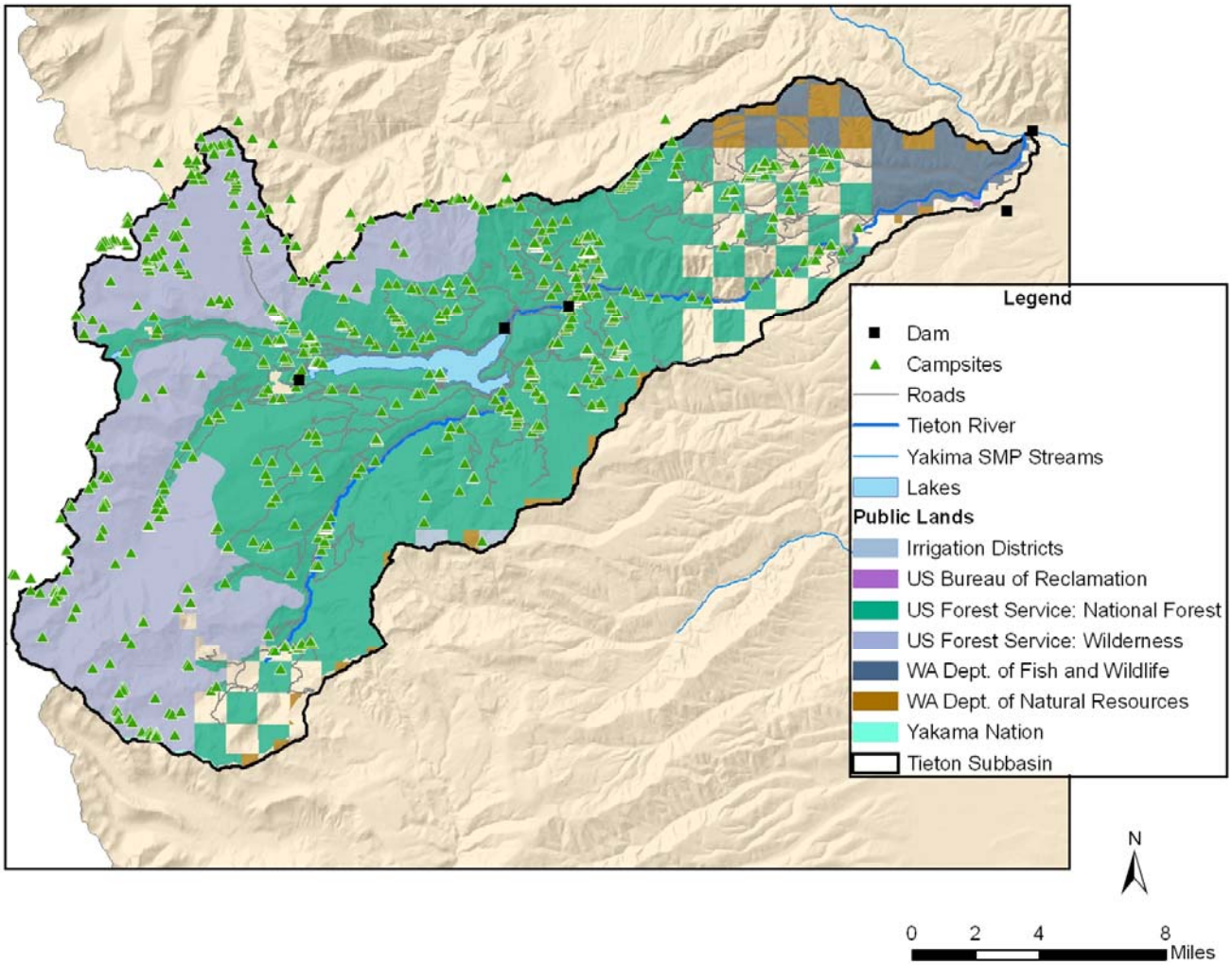

Figure T4. Public Resources and Access in the Tieton River Basin.

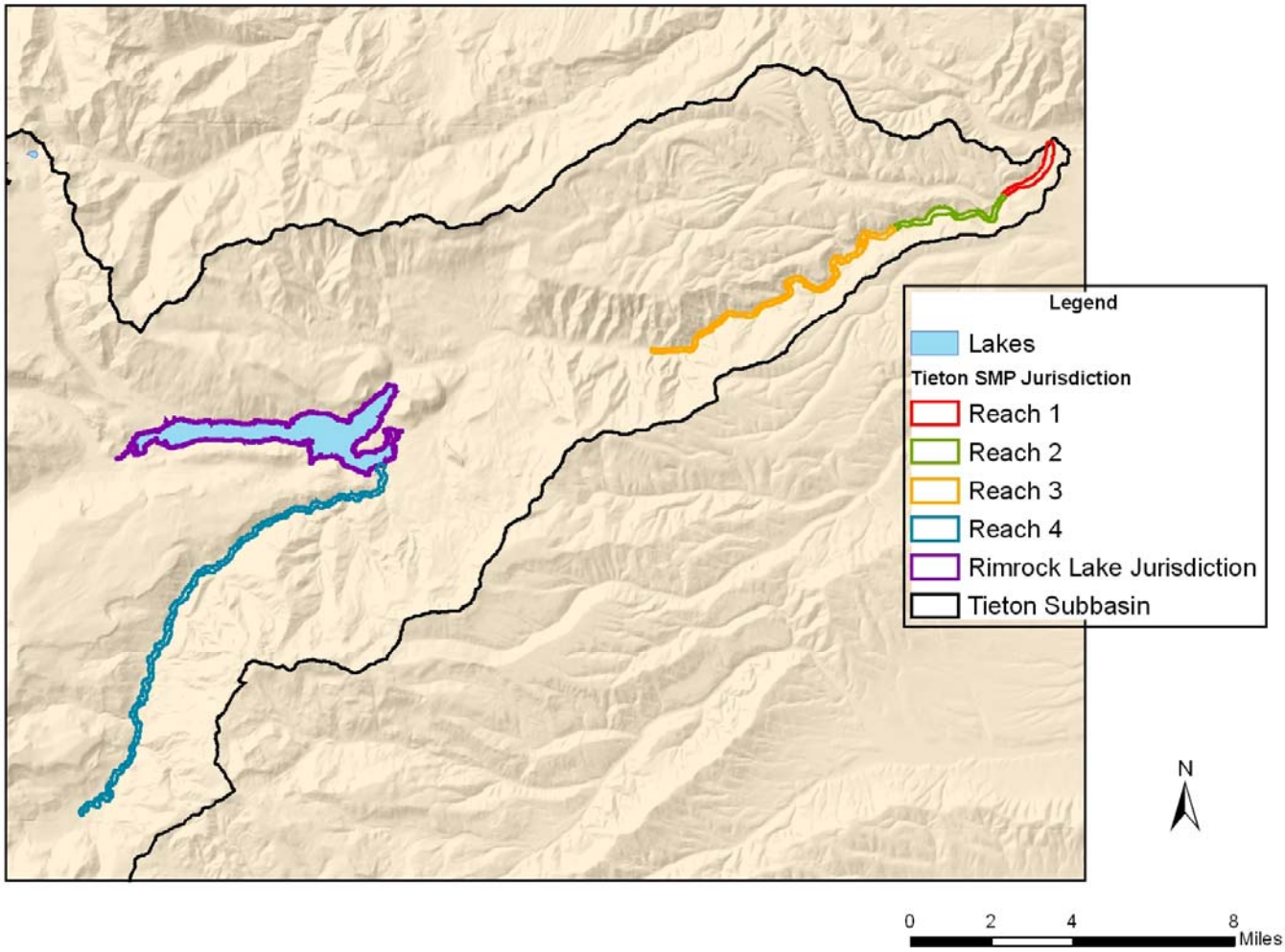

Figure T5. SMP Jurisdiction Breaks for the Tieton River Basin.

Table T1. SMP Reach Breaks for Inventory and Analysis, Tieton River Basin.

Reach	Length	Start	Reach Break Justification	End
1	2.0 Miles	NE¼, SE¼, S35, T15N, R16E	Geomorphic: Confluence with Naches.	SW¼, SE¼, S3, T14N, R16E
2	3.4 Miles	SW¼, SE¼, S3, T14N, R16E	Landuse: Changes from mixed rangeland to cropland and pasture	NE¼, SE¼, S7, T14N, R16E
3	7.9 Miles	NE¼, SE¼, S7, T14N, R16E	Landuse: Changes form evergreen forest to mixed rangeland.	West line of S29, T14N, R15E
4	14.2 Miles	NW¼, SW¼, S7, T13N, R14E	Geomorphic: Confluence with Rimrock Lake.	South line of S23, T12N, R12E

Table T2. Geology and Geohazard Characteristics for the Tieton River.

REACH	Geology		Geohazard	
	Lithology	**Area (%)**	**Geohazard**	**Area (%)**
1 Area: 180.6 Acres	Alluvium Basalt Flows (GrandeRondeBasalt, upper flows of norm.mag.pol.)	5.2 94.8	Oversteepened Slopes (High Risk) 100-Year Floodplain	9.9 80
2 Area: 256.5 Acres	Andesite Flows Basalt Flows (GrandeRondeBasalt,upper flows of norm.mag.pol.)	19.9 80.1	Oversteepened Slopes (High Risk) 100-Year Floodplain	40.2 71.1
3 Area: 534.0 Acres	Alluvium Andesite Flows Basalt Flows (GrandeRondeBasalt,upper flows of norm.mag.pol.) Basalt Flows (GrandeRondeBasalt,upper flows of rev.mag.pol.) Mass-Wasting Deposits, Mostly Landslides	64.6 8.5 10.8 13.0 3.1	Alluvial Fan/Flash Flooding (Intermediate Risk) Landslides (Intermediate Risk) Landslides (High Risk) Oversteepened Slopes (High Risk) 100-Year Floodplain	0.4 0.8 1.4 21.5 41.2

REACH	Geology		Geohazard	
	Lithology	**Area (%)**	**Geohazard**	**Area (%)**
4	Alluvium	42.5	Landslides (High Risk)	0.7
	Alpine Glacial Drift, Pre-Fraser	0.7	Oversteepened Slopes (Intermediate Risk)	3.4
Area: 936.7 Acres	Basalt Flows	3.2	Oversteepened Slopes (High Risk)	12.0
	Chert-Rich Marine Sedimentary Rocks	6.2		
	Continental Sedimentary Deposits or Rocks	1.6		
	Marine Sedimentary Rocks	34.1		
	Mass-Wasting Deposits, Mostly Landslides	5.7		
	Quartz Diorite	2.3		
	Rhyolite Flows	0.6		
	Tuffs and Tuff Breccias	1.0		
	Volcaniclastic Deposits or Rocks	0.5		
	Water	1.4		
Rimrock Lake	Alluvium	7.5	Alluvial Fan Flash Flooding (Intermediate Risk)	0.0
	Alpine Glacial Till, Fraser-age	1.7	Alluvial Fan Flash Flooding (High Risk)	0.1
Area: 530.0 Acres	Artificial fill, including modified land	0.5	Landslides (Intermediate Risk)	0.9
	Basalt Flows	2.7	Landslides (High Risk)	3.5
	Chert-Rich Marine Sedimentary Rocks	7.5	Oversteepened Slopes (Intermediate Risk)	6.3
	Intrusive andesite	4.2	Oversteepened Slopes (High Risk)	16.9
	Marine Sedimentary Rocks	41.9		
	Mass-Wasting Deposits, Mostly Landslides	2.1		
	Quartz Diorite	13.4		
	Tuffs and Tuff Breccias	1.7		
	Water	16.9		

Table T3. Soil Characteristics for the Tieton River.

REACH	Soil Characteristics*						Aquic Soils
	Permeability	**Area (%)**	**Runoff**	**Area (%)**	**Hazard of Erosion**	**Area (%)**	**Area (%)**
1	rapid	69.8	rapid	1.3	high	1.3	
	moderately rapid	8.2	slow	84.1	moderate	0.2	
Area: 180.6 Acres	moderately slow	0.2	N/A	14.6	slight	83.8	68.5
	moderate	7.1			N/A	14.6	
	N/A	14.6					
2	rapid	62.7	medium	3.2	high	13.3	
	moderately rapid	4.2	rapid	13.8	very high	0.4	
Area: 256.5 Acres	moderately slow	10.7	slow	66.9	moderate	3.2	62.1
	moderate	6.3	N/A	16.2	slight	66.9	
	N/A	16.2			N/A	16.2	
3	rapid	40.4	medium	10.7	high	23.0	
	moderately rapid	3.0	rapid	23.0	moderate	10.7	
Area: 534.0 Acres	moderately slow	10.2	slow	43.7	slight	43.3	40.4
	moderate	23.9	N/A	22.5	slight to moderate	0.4	
	N/A	22.5			N/A	22.5	
4	moderate	16.9			moderate	14.36	
	moderately rapid	27.5			slight	48.29	
Area: 936.7 Acres	rapid	25.4	N/A	N/A	severe	25.73	1.5
	very rapid	14.74			N/A	14.36	
	slow	0.50					
	very slow	0.51					
	N/A	14.36					

REACH	Soil Characteristics*						Aquic Soils
	Permeability	**Area (%)**	**Runoff**	**Area (%)**	**Hazard of Erosion**	**Area (%)**	**Area (%)**
Rimrock Lake Area: 530.0 Acres	moderate moderately rapid rapid very slow N/A	44.9 38.6 2.9 5.0 8.5	N/A	N/A	moderate severe slight N/A	68.5 7.2 15.8 8.5	N/A

Table T4. Stream Channel Characteristics for the Tieton River.

REACH	Stream Lengths		Channel Migration	
	Total Streams (Miles)	**SMP Stream (Miles)**	**Potential**	**Area (%)**
1 Length: 2.0 Miles	2.0	2.0	high	0.6
2 Length: 3.4 Miles	3.5	3.4	No Data	No Data
3 Length: 7.9 Miles	8.6	7.9	No Data	No Data
4 Length: 14.2 Miles	15.3	14.2	No Data	No Data
Rimrock Lake	N/A	N/A	No Data	No Data

Table T5. Habitat Characteristics for the Tieton River.

REACH	Wildlife Heritage Locations Common Name	Wildlife Heritage Locations (#)	Wetlands Area (%)	Riparian Areas Area (%)	Priority Species & Habitats		Barriers	
					Habitat	Area (%)	Type	Species Blocked
1 Area: 180.6 Acres	0	0	18.2	40.2	Bald Eagle Cliffs/Bluffs Elk Mule and Black-Tailed Deer Oak Woodland Riparian Zones Wood Duck	13.2 0.5 4.6 8.1 85.1 13.2 13.6	N/A	N/A
2 Area: 256.5 Acres	Harlequin Duck	1	18.4	34.7	Cliffs/Bluffs Elk Mule and Black-Tailed Deer Oak Woodland Wood Duck	4.1 95.6 129.5 88.9 0.7	Passable, Diversion Dam	N/A

REACH	Wildlife Heritage Locations Common Name	Wildlife Heritage Locations (#)	Wetlands Area (%)	Riparian Areas Area (%)	Priority Species & Habitats		Barriers	
					Habitat	Area (%)	Type	Species Blocked
3 Area: 534.0 Acres	Harlequin Duck Western Gray Squirrel Marten Northern Goshawk	2 1 1 1	21.1	30.4	Cliffs/Bluffs Elk Mule and Black-Tailed Deer Oak Woodland Meadows Rocky Mountain Elk Oak Woodland	1.5 65.2 109.2 12.1 2.8 25.6 12.1	N/A	N/A
4 Area: 936.7 Acres	Marten Osprey	2 2	15.6	No Data	Meadows Rocky Mountain Elk	1.6 14.6	N/A	N/A
Rimrock Lake Area: 530.0 Acres	Osprey Bald Eagle	2 2	16.2	No Data	Cliffs/Bluffs Waterfowl Concentrations Talus Slopes	0.3 1.7 0.0	Impassable Dam	Summer Steelhead

Table T6. Fish Characteristics for the Tieton River.

REACH	Anadromous Fish						Bulltrout		Resident Fish	
	Presence		Spawning		Rearing					
	Species	Length (Miles)	Species	Length (Miles)	Species	Length (Miles)	Presence	Length (Miles)	Species	Length (Miles)
1 Length: 2.0 Miles	Spring Chinook Summer Steelhead	2.0 2.0	Summer Steelhead	2.0	N/A	N/A	Currently Occupied	2.0	Bridgelip Sucker Eastern Brook Trout Longnose Dace Mountain Whitefish Northern Squawfish Rainbow Trout Redside Shiner Sculpin Speckled Dace	2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0
2 Length: 3.4 Miles	Spring Chinook Summer Steelhead	0.3 3.5	Summer Steelhead	3.5	N/A	N/A	Currently Occupied	3.5	Bridgelip Sucker Chiselmouth Eastern Brook Trout Longnose Dace Mountain Whitefish Northern Squawfish Rainbow Trout Redside Shiner Sculpin Speckled Dace Starry Flounder	3.4 0.0 3.5 3.4 3.4 3.4 3.5 3.4 3.4 3.4 0.0

REACH	Anadromous Fish						Bulltrout		Resident Fish	
	Presence		Spawning		Rearing					
	Species	Length (Miles)	Species	Length (Miles)	Species	Length (Miles)	Presence	Length (Miles)	Species	Length (Miles)
3 Length: 7.9 Miles	Summer Steelhead	7.9	Summer Steelhead	7.9	N/A	N/A	Currently Occupied	7.9	Bridgelip Sucker Chiselmouth Eastern Brook Trout Lamprey Largescale Sucker Longnose Dace Mountain Whitefish Northern Squawfish Peamouth Rainbow Trout Redside Shiner Sculpin Shiner Perch Speckled Dace Starry Flounder	7.9 5.7 7.9 5.6 5.6 7.9 7.9 7.9 5.6 7.9 7.9 7.9 5.6 7.9 5.7
4 Length: 14.2 Miles	N/A	N/A	N/A	N/A	N/A	N/A	Currently Occupied	12.5	Kokanee Salmon Mountain Whitefish Rainbow Trout Westslope Cutthroat	14.2 14.2 14.2 3.9

Table T7. Ecological Analysis of SMP Jurisdiction for Tieton River.

REACH	Spotted Owl Habitat		Forest Type/Series		Successional Stage		Forest Harvest Between 1994 - 2004	
	Suitability	**Area (%)**	**Plant Series**	**Area (%)**	**Forest Type Stage**	**Area (%)**	**Harvest Method/Year**	**Area (%)**
1 Area: 180.6 Acres	No Data	No Data	Riparian Water	0.3 0.2	Nonforested	0.4	No Data	No Data
2 Area: 256.5 Acres	No Data	No Data	Ponderosa Pine Douglas Fir Riparian Rock Shrubland Water	3.4 9.6 19.8 5.6 5.3 16.9	Ponderosa Pine - Mid Douglas fir- Mid Nonforested	3.4 9.6 47.6	No Data	No Data
3 Area: 534.0 Acres	Suitable Non Suitable No Data	1.0 78.8 20.2	Hardwood Lithosol Ponderosa Pine Douglas Fir Oregon White Oak Riparian Rock Shrubland Water	1.3 0.2 0.7 50.0 2.4 11.9 11.0 5.4 17.0	Ponderosa pine- Mid Douglas fir - Early Douglas fir- Mid Oregon white oak- Early Oregon white oak- Mid Nonforested	0.7 2.1 47.9 1.4 1.1 46.8	No Data	No Data

REACH	Spotted Owl Habitat		Forest Type/Series		Successional Stage		Forest Harvest Between 1994 - 2004	
	Suitability	**Area (%)**	**Plant Series**	**Area (%)**	**Forest Type Stage**	**Area (%)**	**Harvest Method/Year**	**Area (%)**
4	Suitable	27.9	Grand Fir	79.6	Grand fir- Early	4.7	No Data	No Data
	Non Suitable	72.1	Landslide	1.4	Grand fir- Mid	62.3		
Area: 936.7 Acres			Meadow	3.6	Grand fir- Late	12.6		
			Douglas Fir	1.0	Subalpine fir	0.2		
			Riparian	13.0	Douglas fir- Mid	0.8		
			Rock	0.5	Douglas fir- Late	0.2		
			Subalpine fir	0.2	Nonforested	19.2		
			Water	0.7				
Rimrock Lake	Suitable	11.1	Grand Fir	50.2	Grand Fir- Early	0.7	No Data	No Data
	Non Suitable	88.9	Meadow	1.0	Grand Fir- Mid	42.5		
			Douglas Fir	31.7	Grand Fir- Late	7.1		
			Riparian	4.3	Douglas Fir- Mid	31.5		
			Rock	2.4	Douglas Fir-Late	0.2		
			Shrubland	1.3	Western Hemlock- Mid	2.7		
			Western Hemlock	2.7	Nonforested	15.3		
			Water	6.3				

Table T8. GAP Analysis of SMP Jurisdiction for the Tieton River.

REACH	GAP Analysis					
	Mammals		Birds		Vegetation	
	Type	Area (%)	Type	Area (%)	Type	Area (%)
1 Area: 180.6 Acres	Black-Tailed Jack Rabbit Townsend's Big-Eared Bat Townsend's Ground Squirrel Western Gray Squirrel	15.5 100.0 15.5 2.4	Sage Sparrow Sage Thrasher	15.5 15.5	Central Arid Steppe Oak	97.6 2.4
2 Area: 256.5 Acres	Black-Tailed Jack Rabbit Townsend's Big-Eared Bat Townsend's Ground Squirrel Western Gray Squirrel	13.9 100.0 13.9 82.5	Sage Sparrow Sage Thrasher	13.9 13.9	Central Arid Steppe Oak	17.5 82.5
3 Area: 534.0 Acres	Black-Tailed Jack Rabbit Townsend's Big-Eared Bat Townsend's Ground Squirrel Western Gray Squirrel	0.5 100.0 0.5 99.5	Sage Sparrow Sage Thrasher	0.5 0.5	Central Arid Steppe Oak Ponderosa Pine	0.5 54.3 45.2
4 Area: 936.7 Acres	Townsend's Big-Eared Bat	50.6	Spotted Owl	34.5	Interior Douglas Fir Grand Fir Western Hemlock Subalpine Fir	47.8 0.1 2.6 49.4
Rimrock Lake Area: 530.0 Acres	Townsend's Big-Eared Bat	100.0	N/A	N/A	Interior Douglas Fir	100.0

Table T9. Land-use Characteristics for the Tieton River.

REACH	Land Use		Land Use Type on Rapid Runoff Soil		Impervious Surface	
	Type	**Area (%)**	**Type**	**Area (%)**	**Range**	**Area (%)**
1	Government (School/Work Camp)	0.1	Industrial - Transportation	4.9	0	77.2
	Industrial - Transportation	7.4	Vacant/Natural	37.4	1-10	15.5
Area: 180.6 Acres	Vacant/Natural	92.5			11-25	0.0
					26-50	0.0
					51-75	0.0
					76+	7.4
2	Agriculture - Pasture/Grazing	0.7	N/A	0.0	0	92.2
	Government (School/Work Camp)	0.4			1-10	2.3
Area: 256.5 Acres	Industrial - Transportation	5.5			11-25	0.0
	Vacant/Natural	93.4			26-50	0.1
					51-75	0.0
					76+	5.4
3	Commercial - Lodging	0.2	Industrial - Transportation	0.7	0	64.0
	Commercial - Retail	0.2	Residential - Single Family	0.3	1-10	20.7
Area: 534.0 Acres	Industrial - Transportation	10.9	Vacant/Natural	15.8	11-25	1.8
	Residential - Multi-Family	0.1			26-50	2.5
	Residential - Single Family	1.3			51-75	0.3
	Vacant/Natural	87.3			76+	10.8
4	Forestry	37.3	Forestry	1.5	0	33.0
	Industrial - Transportation	0.2			1-10	66.9
Area: 936.7 Acres	Residential - Single Family	0.5			11-25	0.0
	Vacant/Natural	61.9			26-50	0.0
					51-75	0.0
					76+	0.2

REACH	Land Use		Land Use Type on Rapid Runoff Soil		Impervious Surface	
	Type	**Area (%)**	**Type**	**Area (%)**	**Range**	**Area (%)**
Rimrock Lake Area: 530.0 Acres	Government-(School/Work Camp) Residential-Single Family Transportation Vacant/Natural	3.1 1.2 9.6 86.1	N/A	0.0	0 1-10 11-25 26-50 51-75 76+	49.5 15.1 16.6 13.4 0.2 5.1

Table T10. Cultural Jurisdiction Characteristics for the Tieton River.

REACH	Zoning		Public Land Ownership		Environmental Designation (1981)	
	Type	**Area (%)**	**Owner**	**Area (%)**	**Designation**	**Area (%)**
1 Area: 180.6 Acres	Forested Watershed	100.0	Blank WA Dept. of Fish and Wildlife	5.0 94.1	Conservancy	100.0
2 Area: 256.5 Acres	Agriculture Forested Watershed	0.6 99.4	US Bureau of Reclamation WA Dept. of Fish and Wildlife	5.0 92.2	Conservancy	100.0
3 Area: 534.0 Acres	Forested Watershed Rural Settlement	97.0 3.0	Blank US Forest Service: National Forest WA Dept. of Fish and Wildlife	17.7 34.7 14.0	Conservancy	100.0
4 Area: 936.7 Acres	Forested Watershed	100.0	Blank US Forest Service: National Forest	7.7 92.3	Conservancy	100.0
Rimrock Lake Area: 530.0 Acres	Forested Watershed	100.0	Blank US Forest Service: National Forest	4.4 95.6	Conservancy	100.0

Table T11. Transportation Characteristics for the Tieton River.

REACH	Length of Revetments		Total Road Length (Miles)	Length of Railroads		Bridge Crossing (#)
	Type	Length (Miles)		Active (Miles)	Abandoned (Miles)	
1 Length: 2.0 Miles	Bridge Road	0.0 1.8	1.9	0.0	0.0	0
2 Length: 3.4 Miles	Road	0.7	3.0	0.0	0.0	1
3 Length: 7.9 Miles	N/A	0.0	5.5	0.0	0.0	2
4 Length: 14.2 Miles	N/A	0.0	1.9	0.0	0.0	0
Rimrock Lake	N/A	0.0	6.1	0.0	0.0	1

Table T12. Cultural Modification for the Tieton River.

REACH	Boat Launches (#)	Campsites (#)	Known Cultural Sites (#)	DOE Sites/facilities and 303(d)-Stream Listings	
				Sites/facilities (#)	Stream (Miles)
1 Area: 180.6 Acres Length: 2.0 Miles	0	0	1	0	0.0
2 Area: 256.5 Acres Length: 3.4 Miles	0	0	1	0	0.0
3 Area: 534.0 Acres Length: 7.9 Miles	0	5	1	0	0.0
4 Area: 936.7 Acres Length: 14.2 Miles	0	20	3	0	1.1
Rimrock Lake	5	9	N/A	0	0.0