SECTION 3

AHTANUM CREEK SUB-BASIN
SHORELINE INVENTORY AND ANALYSIS
DISK #1

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AHTANUM SUB-BASIN CONTEXT SUMMARY

Portions of the following text have been primarily taken, in whole or in part, from the following reports: DOE (2005); Golder (2004); Haring (2001, 2000).

Ahtanum Sub-basin Overview

Ahtanum Creek is a right-bank tributary to the Yakima River, entering at RM 106.9. Ahtanum Creek enters the Yakima River immediately upstream of Ahtanum Ridge anticline (Union Gap). The Ahtanum sub-basin covers about 181 square miles (116,000 acres) of forested and range land, portions of which have been developed for agricultural and urban/suburban uses (Haring, 2001).

The headwaters of Ahtanum Creek and its tributaries reside within the Wenatchee National Forest and Yakama Reservation at an elevation of 5600 feet. The North Fork of Ahtanum Creek descends rapidly through the first 9.8 miles of its course to an elevation of 3120 feet. This uppermost reach of the stream exhibits a gradient of 5% (264 ft./mi.) At this point, which marks the uppermost boundary of the SMP jurisdiction (RM 27), the North and Middle Forks of Ahtanum Creek join, and the gradient lessens significantly (1.8%, 96 ft./mi.).

For the purposes of this overview, the Ahtanum Creek watershed will be discussed in terms of three broad reaches: lower, middle, and upper. The lower reach consists of that portion of the watershed extending from the mouth of Ahtanum Creek upstream to Wiley City. The middle reach is that portion of the mainstem of Ahtanum Creek extending from Wiley City upstream to Tampico, and the upper reach is that portion extending from Tampico upstream, including both the North Fork and South Fork of Ahtanum Creek.

The Ahtanum Creek watershed, upstream of the juncture of the North and South Forks, includes federal and state-owned lands and commercial timber company holdings (Haring, 2001). Lower reaches of the sub-basin include orchards, irrigated agriculture, and grazing and encroaching urban development, as well as the communities of Tampico, Ahtanum, and Wiley City, in addition to urbanized areas with the Cities of Yakima and Union Gap (Haring, 2001).

The gradient of the lower reaches of Ahtanum Creek that lie within the SMP jurisdiction exhibit varying gradients, but, generally, decrease gradually with decreasing elevation. With changes in gradient are the expected changes in stream substrate, which ranges from cobbles and gravels in the uppermost reaches to sands and silts nearer the mouth. Large woody debris is sparse to non-existent on the mainstem and is quite limited in the North and South Forks. Beaver dams are noted in the upper reaches and were likely once abundant throughout the system.

The mainstem and South Fork of Ahtanum Creek form the northern boundary of the Yakama Reservation. Surface water uses include domestic water supply, irrigation, frost protection, stock watering, fish propagation, and recreation and beautification. Diversions from Ahtanum Creek are mainly associated with irrigation uses (Haring, 2001).

GEOLOGY

The Ahtanum Creek watershed straddles two very different physiographic and geologic provinces: the Cascade Mountains in the western (higher elevation) part of the watershed, and the Columbia Plateau to the east (lower elevation) (Golder, 2004)(Fig. A1). East to west trending, rounded or flat-topped ridges characterize the upper Ahtanum Creek and tributary watersheds. Here, deep, steep-walled canyons cut into the eastern foothills of the Cascade Mountains. The valleys and floodplains widen in the middle portion of the watershed near the confluence of the North Fork and South Fork with the mainstem. The valley continues to widen as Ahtanum Creek flows eastward to the Yakima River.

The geology of the Ahtanum Creek watershed is dominated by Columbia River basalts, which underlie a large portion of the watershed and control much of its topographic character (Golder, 2004). After the multiple flows had been laid down, the north to south trending Cascade mountain range developed, tilting and uplifting the basalt flows into a series of east to west trending folds that formed ridges along the eastern slopes of the Cascade Mountains. The basalt flows overlap a wide variety of rocks and structures along the northwestern margin of the basalt, including several large, fault-bounded basins. Between eruptions, lakes and streams deposited blankets of fine sediment that were buried by subsequent basalt flows. The sedimentary rock and cemented gravel thicken from west to east. Alluvium covers the floor of the lower Ahtanum Valley, and cemented sand and gravel form the ridges and upland terraces north of Ahtanum Road.

Geomorphology

Recurring cycles of Pleistocene alpine glaciation in the Cascade Mountains with the upper Ahtanum Creek watershed created glacial cirques in the heads of some tributary drainage basins (Golder, 2004). Differential erosion of individual basalt flows developed a cliff-bench or stair-stepped profile along canyon walls of the upper and middle portions of the watershed. Numerous catastrophic floods during the Pleistocene inundated the lowlands of the watershed, modifying the topography and depositing fine to coarse unconsolidated materials (Dames and Moore, 1999 in Ahtanum Creek Watershed Restoration Program, 2005). These flood deposits extend through the lower watershed and define much of the wide floodplain in this area (Golder, 2004 in Ahtanum Creek Watershed Restoration Program, 2005).

The geomorphology of the lands surrounding Ahtanum Creek as it flows through the SMP jurisdiction are characterized by a broad valley and wide floodplain (Golder, 2004). Loess deposits can be found throughout the lower watershed on top of major geologic formations. This unconsolidated, silt-sized, basalt rich sediment was deposited by wind and varies in depth from 0 feet on exposed ridges to over 20 feet on protected slopes. The source of most of the loess is considered to be the Glacial Lake Missoula Flood sediments, which were deposited by wind over the past 20,000 years. The modern soil and most of the farmlands are developed on these loess deposits. Drainage of the various soil types varies from excessively well-drained to poorly drained. The erosion potential of these soils is slight to moderate. These soils are also subject to periodic flooding.

VEGETATION

The Ahtanum Creek watershed encompasses two plant community zones: the ponderosa pine zone and the sagebrush-steppe zone (Golder, 2004). Historically, the ponderosa pine zone occupied the lower eastern slopes of the Cascade Mountains from elevations of approximately 1800 feet to 3000 feet. This zone currently extends from the headwaters to approximately the confluence of the North Fork and South Fork of Ahtanum Creek. The sagebrush-steppe zone was historically found in the lower elevations, extending from the confluence of the North Fork and South Fork to the mouth of the Ahtanum Creek.

Prior to settlement, the ponderosa pine zone was dominated by its namesake in a climax forest (Golder, 2004). Other tree species included grand fir, Western larch, douglas fir, quaking aspen, Western white pine, and lodgepole pine. Common understory species included grasses such as Idaho fescue and bluebunch wheatgrass, and shrubs such as antelope bitterbrush and snowberry. The sagebrush-steppe plant association was historically dominated by antelope bitterbrush and Idaho fescue in a climax state. This association is a shrub and meadow community with significant amounts of grasses and forbs. Shrub species found in lesser amounts in this association include green rabbitbrush and gray rabbitbrush. Understory associates include sandberg's bluegrass, arrow-leaf balsamroot, and mule's ear.

The vegetation communities in the Ahtanum Creek watershed have been disturbed by human activities to various degrees throughout the lower, middle, and upper reaches of the watershed (Golder, 2004). Little of the native vegetation, especially of the sagebrush-steppe association, remains. The scale of human disturbance decreases across a continuum from the lower to higher elevations, with cropland and higher-density urban and rural development prevalent in the lower watershed and forested areas dominant in the upper watershed.

In riparian areas, black cottonwood, pacific willow, quaking aspen, and red alder dominate the tree component, with red-osier dogwood as the dominant tall-shrub, and wood's rose and snowberry dominating the low-shrub component of the understory vegetation (Golder, 2004).

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

Spiranthes diluvialis (Ute ladies-tresses), an orchid species, is federally listed as a threatened species: Washington State lists this plant as endangered (Golder, 2004). Although the SMP jurisdiction likely contains suitable habitat for Spiranthes species, it is unlikely to be located in the Ahtanum Creek watershed because of the disturbed condition of the native vegetation. The plant is currently known to occur only in Chelan and Okanogan counties.

WILDLIFE

Wildlife species observed and likely to occur in the Ahtanum Creek watershed include beaver, muskrat, meadow vole, seer mouse, short-horned lizard, California quail, red-tailed hawk, Northern harrier, American kestrel, barn owl, black-billed magpie, violet-green swallow, American robin, black-capped chickadee, and Western meadowlark (Golder, 2004). Wildlife use in the upper portion of the Ahtanum Creek watershed is likely to be more varied and include more forest-dependant species than the lower and middle reaches.

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

The bald eagle is federally listed as threatened (Golder, 2004). No bald eagle nesting or roosting habitat is available, and foraging habitat is limited, in the Ahtanum Creek watershed. Communal roost sites are located along the Yakima River a few miles northeast and southeast of Ahtanum Creek, and a wintering area is located along the Naches River, a few miles north of the Ahtanum Creek watershed. Bald eagles typically nest and roost in large, old trees near open water away from human habitation. Open water in the watershed is limited to several small streams, and large trees are limited to the upper reach of the watershed. Foraging opportunities for bald eagles are limited to small numbers of waterfowl, fish, small mammals, and carrion.

FLOW

Stream flow in the Ahtanum Creek watershed is typically characterized by the occurrence of high stream flows during the late spring and early summer and low flows during late summer and early fall (Golder, 2004). Stream flow through the upper watershed is influenced primarily by snowmelt and rainfall. Precipitation varies from less than 10 inches a year in the lower watershed near the Yakima River, to more than 40 inches a year in the higher elevations of the upper watershed. A significant portion of the precipitation falls over the upper watershed as winter snow. High stream flows during the late spring and early summer are primarily due to snowmelt runoff from the upper watershed. Although one source suggests the magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper watershed, another source indicates that long-term and seasonal hydrograph responses from the upper watershed do not suggest that significant hydrologic changes have occurred since streamflow data became available in 1913 (Department of Ecololgy [DOE], 2005). Streamflows through the middle and lower reaches of the watershed are influenced by flows from the upper watershed, diversions for irrigation, and interaction between surface water and groundwater.

In the middle reach, the stream transitions to wider, more gently-sloping channels. Because of the gentle slope and broad floodplain that characterizes the lower reach, surface water flows through a network of natural, “distributary” stream channel, including Bachelor and Hatton creeks.

Historical stream flow data for the upper watershed have been gathered by gages operated by the U.S. Geological Survey (USGS) for water years 1911 to 1978, by the Wapato Irrigation Project (WIP) for water years 1979 to 1992, and by the Ahtanum Irrigation District (AID) for water years 1993 to 1998 on both the North Fork and South Fork of Ahtanum Creek (Golder, 2004).

These gages are located above the irrigation diversions, so the flows measured represent naturally-occurring stream flow conditions. Analysis of flow records indicated that the mean monthly stream flow for the North Fork ranges from a low of approximately 20 cubic feet per second (cfs) in September and October to a high of approximately 190 cfs in May. Mean monthly stream flows on the South Fork range from a low of approximately 7 cfs in September and October to a high of approximately 46 cfs in May. The mean monthly flow in May on the North Fork for the driest year was approximately 28 cfs, or 162 cfs less than the historical mean for that month. Peak flows during flooding have been as high as 1580 cfs on the North Fork and 1230 cfs on the South Fork, both occurring in January, 1974.

Historical flow data for the mainstem of Ahtanum Creek are available from gaging stations operated by the USGS near Tampico (water years 1909 to 1968), just below the confluence of the North Fork and South Fork, and at Union Gap near the mouth of Ahtanum Creek (water years 1904 to 2003) (Golder, 2004). Flow records indicate that the mean monthly steam flow at Union Gap ranges from approximately 16 cfs in August to approximately 169 cfs in May. The highest peak flows during flooding were approximately 3100 cfs in January, 1974, and approximately 2660 cfs in February, 1996. Historical flow conditions are unknown (DOE, 2005). The effect of diversions of stream flow into the AID and WIP canals is clearly shown in the hydrograph at Carson Road. Anecdotal evidence indicates that Ahtanum Creek routinely was dry below the diversions during the summer. Low flows are still prevalent in early summer, but recent changes in diversion amounts by the WIP have improved summer streamflow after July 10. Since 2001, a continuous flowing reach has been established below the diversions with flows on the order of 8 to 10 cfs.

Peak flows and baseflows in the lower watershed are very similar in magnitude to flows in the upper watershed at Tampico (DOE, 2005). This is unusual since the contributing area to the gage at Union Gap is significantly larger than the contributing area to the upper watershed. while diversions may play some role, it is likely that the similarity in flows is the result of the overall structure of the watershed. Flows are absorbed by the alluvial deposits and distributed through perched stream channels of the mainstem and Bachelor/Hatton channels in the upper and middle watershed. These flows are returned to the mainstem in the lower watershed as a result of groundwater upwelling and return flow.

Flows with a recurrence interval of approximately 1.5 to 2 years have been identified as “channel-forming” flows, or flows that have statistically been determined to be most active in forming the channel and transporting sediment (Golder, 2004). The channel-forming flow for Ahtanum Creek was determined to be in the range of 350 to 400 cfs. Flow durations for these flow magnitudes of 18 to 27 days over a 5-year period are considered targets for maintaining channel form and function (DOE, 2005).

Hyporheic

Based on soil permeability studies, surficial recharge potential is thought to be high in the western, higher portion of the sub-basin and a mixture of moderate and high in the remainder of the sub-basin. Ground water/surface water interactions occur along lower Ahtanum Creek where return flows resurface down gradient of dry reaches. Upper reaches of Ahtanum Creek are fed

by springs that help maintain cool water temperature. At RM 12, groundwater and irrigation returns recharge the stream. The resulting flow of 5-10 cfs persists to the mouth.

Stream aquifer interactions are important in the middle portion of the watershed and can be observed in stream gauging records below the WIP/AID diversions (DOE, 2005). The AID conveys water to users through the natural distributary channels of Bachelor and Hatton creeks, and the WIP conveys water to users through two, mostly unlined, irrigation canals. It appears that significant seepage occurs in these conveyance channels, however, there are limited data to establish a reliable characterization (Golder, 2004). There appears to be a persistent year-round infiltration of streamflow into the alluvial aquifer between Carson Road and American Fruit Road. Below American Fruit Road, infiltration appears to occur primarily during the summer. During higher flows, infiltration from above American Fruit Road appears to flow back into Ahtanum Creek below American Fruit Road (DOE, 2005).

Groundwater in the Ahtanum Creek watershed flows within three distinct hydrostratigraphic units (aquifers) that control the quantity, quality, surface-water recharge, and groundwater supply to wells (Golder, 2004). The depositional and structural history of the geologic units determine the aquifer characteristics (permeability and orientation) that control groundwater flow direction within the aquifers. The hydraulic conditions that control rate and direction of groundwater discharge vary with location and depth, the seasonal and long-term variations in precipitation in the watershed, and the artificial transfer and use of groundwater and surface water in the watershed.

The three water-bearing hydrostratigraphic units based on distinct geologic and hydraulic characteristics identified include: a basalt aquifer system consisting of confined porous and fractured zones between massive lava flows; a system of sedimentary aquifers consisting of unconfined to confined porous sand and gravel layers in the Upper Ellensburg Formation and Thorp Gravels; and the alluvial aquifer consisting of unconfined, unconsolidated sand and gravel lenses and layers (Golder, 2004).

The majority of the water entering the basalt aquifer system enters along valley walls and in the upper Ahtanum Creek watershed above the North Fork and South Fork confluence. Groundwater in the basalt aquifer system ultimately discharges laterally out of the Ahtanum Creek watershed into the Yakima River near Union Gap (Golder, 2004). The upper layers of basalt are fractured and porous along the middle reach (below North Fork and South Fork confluence) Stream gage data indicate that Ahtanum Creek loses water in this reach.

The sedimentary aquifer system extends east from the confluence of the North Fork and South Fork confluence to the confluence of Ahtanum Creek with the Yakima River (Golder, 2004). Low permeability zones at the top of the sedimentary aquifer system impedes vertical groundwater flow to the deeper basalt aquifer system. However, fractures and joints in the sedimentary rocks may create vertical conduits for groundwater to flow into the underlying basalt aquifer system, and also into overlying alluvial aquifer system. Precipitation recharges the sedimentary aquifer system. Recharge from underlying and adjacent basalt contributes some additional recharge, primarily in the lower reaches of the Ahtanum Valley. Precipitation and irrigation water percolating into the Thorp Gravel north of Ahtanum Road and into the alluvium

south of Ahtanum Road locally recharges the upper member of the sedimentary aquifer system. Groundwater in the sedimentary aquifer system ultimately discharges out of the Ahtanum Creek watershed into the Yakima River near Union Gap.

Vertical hydraulic gradients within the sedimentary aquifer system indicate the potential for upward leakage of groundwater into the overlying alluvial aquifer and subsequent discharge to surface water. The alluvial aquifer extends from above the confluence of the North Fork and South Fork, spreading throughout the middle and lower portions of the Ahtanum Valley (Golder, 2004). The coarse-grained layers of the alluvial aquifer readily store and transmit groundwater. Groundwater within the alluvial aquifer occurs at depths of less than 10 feet. Groundwater within the alluvial aquifer is derived primarily from precipitation, infiltrating surface water (from Ahtanum, Bachelor, and Hatton creeks), and irrigation water. The sedimentary aquifer system appears to contribute additional recharge at the east end of the Ahtanum Valley. Recharge to the alluvial aquifer appears widespread in the middle reach of the Ahtanum Creek watershed. Declining stream flow between stream gages along the middle reaches of the mainstem of Ahtanum Creek suggest that the creek (and tributaries) west of American Fruit Road generally lose water to recharge the alluvial aquifer. East of American Fruit Road, stream flow generally increases, most likely from groundwater discharging from the alluvial aquifer and from irrigation return flow. Groundwater from the alluvial aquifer ultimately discharges out of the Ahtanum Creek watershed into the Yakima River near Union Gap.

Irrigation

Ahtanum Creek water is used extensively for irrigation. Diversions from Ahtanum Creek are insufficient to met the water demand for the crops grown in the watershed. Ahtanum Creek has numerous channels and tributary side-channels, but flow is deficient for effective utilization of these waterways during the irrigation season. The state's first irrigation diversion, which is still active, is located at the St. Joseph Mission (Golder, 2004).

Most of the irrigated lands in the Ahtanum Creek watershed are located within the Ahtanum Irrigation District (AID) (Golder, 2004). The total area with the AID jurisdictional boundary is 16.1 square miles (10,321 acres). The AID currently supplies approximately 5470 acres with water. The Ahtanum Irrigation District (AID) diverts water from the mainstem of Ahtanum Creek through a diversion structure to Bachelor and Hatton creeks, which are used to distribute surface water to customers north of the mainstem of Ahtanum Creek. The AID currently diverts water for irrigation until July 10. In 2002, the average rate of diversion ranged from 14 cfs in March to 30 cfs in May.

The Wapato Irrigation Project (WIP) diversions from Ahtanum Creek are operated by the Bureau of Indian Affairs in coordination with the Yakama Nation to provide water to Yakama Nation Reservation lands (Golder, 2004). The WIP diverts water from the mainstem of Ahtanum Creek at two locations. The upper diversion is located just upstream of the AID diversion to Bachelor and Hatton creeks near RM 19.6). The lower diversion is located upstream of the Hatton Creek return near RM 9.9. The upper WIP diversion formerly diverted all or most of the stream flow during the irrigation season, resulting in the loss of surface flow downstream for 7-8 miles (to approximately RM 12) At RM 12, groundwater and irrigation returns recharge the stream. The resulting flow of 5-10 cfs persisted to the lower WIP diversion where it was diverted. The WIP

currently diverts surface water primarily during the late spring and summer. In 2002, the average rate of diversion ranges from approximately 56 cfs in June to less than 4 cfs in September.

Flows have not historically been monitored along the mainstem of Ahtanum Creek between Tampico and Union Gap below the AID and WIP diversions (Golder, 2004). However, anecdotal evidence suggests that Ahtanum Creek has often been dry below the AID and WIP diversions during the summer. Recent changes in the amount and scheduling of surface water diversions have resulted in continuous flow in the creek. A 10 cfs minimum instream flow has been in effect in this portion of the river since 2001 and has been enforced vigilantly since 2002.

There are three diversions on North Fork Ahtanum, all within the lower 3 miles that, combined, withdraw over 15 cfs. The John Cox ditch, the major diverter of North Fork Ahtanum Creek water, is a private irrigation system (Golder, 2004).

Studies have been conducted regarding the potential construction of an irrigation water reservoir on Pine Hollow Creek.

SALMON

Fish Distribution

The Ahtanum Creek watershed has historically been an important area for salmon, steelhead, and resident salmonids (Golder, 2004). Fish numbers have declined in the watershed because of degraded channel conditions, reduced stream flows, and fish passage blockages. Two fish species in the watershed are currently listed as threatened under the federal Endangered Species Act – Summer steelhead and Bull trout.

Salmonids are present in the South Fork and North Fork of Ahtanum Creek and tributaries (Haring, 2001). Ahtanum Creek supports spring chinook, coho, summer steelhead, and bull trout, as well as other resident salmonid species and non-salmonids.

Historically, substantial numbers of salmon (most likely spring chinook, returned several miles up both the North Fork and South Fork of Ahtanum Creek to spawn (Golder, 2004). Current spring chinook use of the Ahtanum Creek watershed is limited to rearing and migration in the lower several miles of the mainstem. Although several stocks of chinook salmon throughout Washington State are listed under the Endangered Species Act (ESA), the population in Ahtanum Creek is not part of an ESA-listed Ecologically Significant Unit.

Not all of the fish distribution information sources cited steelhead presence for spawning in these creeks, but those that do generally agree that these fish use all the mainstem, a significant segment of the North and South Forks of Ahtanum Creek, and tributaries (Golder, 2004). Redd surveys conducted in 2002 indicate that steelhead redds were concentrated primarily below the confluence of the North and South fork of Ahtanum Creek. Except for passage and flow problems associated with water diversions from Tampico downstream, Ahtanum Creek would likely be a major steelhead producer. The National Marine Fisheries Service (NMFS) has

identified the desire to restore salmonid access and rearing in the historic side-channels of Bachelor and Hatton creeks, now being utilized to convey irrigation water.

Coho salmon historically used the upper Ahtanum watershed (Golder, 2004). Native coho salmon were extirpated from the Ahtanum Creek watershed in the early 1980s. Hatchery-reared coho, outplanted as smolts, were reintroduced by the Yakama Nation. Hatchery-origin coho currently utilize the mainstem of Ahtanum Creek, North Fork and South Fork, and the lower portions of the Middle Fork and Nasty Creek. Coho naturally-spawn and rear in the lower 7 miles of Ahtanum Creek.

Historically, bull trout used all of Ahtanum Creek (Golder, 2004). Bull trout are currently known to occur in the mainstem of Ahtanum Creek, the North, Middle, and South forks, Nasty Creek, and headwater tributaries. Both resident and fluvial life-stages are likely to occur in Ahtanum Creek, however, the resident form is the primary population present in the watershed. Currently, the lower reaches of the mainstem are used mainly for migration purposes by fish seeking access to the Yakima River. Historically, the middle and lower reaches of Ahtanum Creek probably provided summer and winter rearing habitat for bull trout as well. Bull trout are present in the mainstem Ahtanum Creek below Tampico, however, they are probably more abundant in the upper portion of the drainage. Bull trout abundance appears to be at an extremely low level.

Resident rainbow and westslope cutthroat trout were reported in the North Fork Ahtanum in the 1935 stream survey. Cutthroat trout are common currently in the upper reaches, and are the most widely-dispersed resident fish species in the watershed.

Generally, summer rearing habitat is acceptable in the upper reaches of Ahtanum Creek, however, winter rearing habitat provide limited refuge during flood events due to deficient LWD and lack of pool cover. The mouth of Ahtanum Creek merges with the Yakima River and provides off-channel rearing opportunities for juvenile fish seeking to elude high-velocity flows in the mainstem Yakima River.

The Ahtanum Creek watershed also provides habitat for a number of resident, native non-salmonid species, including: peamouth chub, sculpin, redside shiner, mountain whitefish, speckled dace, lamprey, Northern pikeminnow, and bridgelip sucker (Golder, 2004).

Passage

The diversions into Bachelor and Hatton Creeks were merged in 1994 and the new diversion structure was screened (Haring, 2001). Further, both channels have barriers at the downstream end to prevent anadromous salmonids from entering the channels.

There are numerous irrigation diversion structures along Ahtanum Creek that are impassable during low flow. Adult passage is typically only possible from November (when winter storm runoff begins) through May (when irrigation diversions are activated and spring runoff subsides). The Lower Wapato Irrigation Project diversion (RM 9.8) near the community of Ahtanum, is a total passage barrier to migrating adult salmonids. No barriers are known to currently exist in the lower South Fork Ahtanum. Beaver dams are noted in the North Fork and were once likely

more extensively present throughout the system but are not thought to represent barriers to migration.

The operation of the AID and WIP diversions presented total passage barriers for adult salmonids and precluded access to high quality spawning habitat upstream. A 10 cfs minimum instream flow has been in effect through the lower portion of the Ahtanum Creek (from mouth to upper-WIP diversion at RM 19.6) since 2001 and has been enforced vigilantly since 2002.

There are 13 unscreened diversions on Ahtanum Creek, many of them along the lower reaches of the creek. The Yakima Tributary Access and Habitat Program (YTAHP), a program to screen unscreened diversions, provide fish passages at man-made barriers, and provide assistance and information to landowners interested in improvements to water quality, water reliability, and habitat, has provided funding to screen pump intakes in the Ahtanum Creek Watershed and to replace a gravity diversion with a pump and pump screen (Golder, 2004). Additional diversion screening, removal of fish passage barriers, and on-farm irrigation improvements will be undertaken in the future as part of this program.

SALMON HABITAT

Channel

The lower mainstem Ahtanum Creek flows through a wide valley with an extensive floodplain (Golder, 2004). The channel through the lower watershed is low gradient and moderately sinuous, and the floodplain increases in width downstream of the confluence of the North and Middle forks of Ahtanum Creek. Glacial Lake Missoula Flood deposits underlie much of the wide floodplain in the lower watershed. The channel through the lower watershed exhibits high stream powers during peak flow events and is very sensitive to inputs of sediment.

The Northwest Power Planning Council described conditions in Ahtanum (1990) and credited the stream with many miles of good to excellent habitat for anadromous fish that were unused due to fish passage problems which were considered easily correctable. Ahtanum Creek flows through forested lands where fish habitat is generally disconnected from the lower mainstem by barriers and low flows. Lower Ahtanum Creek has numerous channels and tributary side-channels is that are severely flow-depleted, reducing opportunities for pool/riffle habitats. Upper reaches of Ahtanum Creek have generally adequate pools, but pools are affected by floods due to lack of LWD and are subject to sedimentation. Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

Generally, summer rearing habitat is acceptable in the upper reaches of Ahtanum Creek, however, winter rearing habitat provide limited refuge during flood events due to deficient LWD and lack of pool cover. The mouth of Ahtanum Creek merge with the Yakima River and provide off-channel rearing opportunities for juvenile fish seeking to elude high-velocity flows in the mainstem Yakima River. Channel incision and bank erosion have increased sediment loads, which affect the quality of salmonid spawning habitat.

Ahtanum Creek habitats were degraded in the lower nine miles where gradients are slight to moderate. Bank sloughing form overgrazing was considered responsible for deposition of mud and sand in the creek bottom. Direct trampling of bull trout redds by cattle in the stream has been a problem in the lower 8-9 miles of Ahtanum Creek.

The upper reaches of North Fork Ahtanum had good riffles with suitable spawning area. Lower elevation riparian areas are easily accessible and roads were built close to streams and some riparian areas were logged. South Fork Ahtanum gradient is fairly uniform with many small riffles. A moderate level of impairment in the South Fork Ahtanum Creek probably corresponds to land disturbances associated with logging practices, road construction activities, or grazing. Beaver dams are noted in the North Fork and were once likely more extensively present throughout the system.

Riparian

Historically, riparian areas below 3000 feet were dominated with conifers with some large hardwoods along the streams. Along the banks, if sufficient open canopy existed, shrubby species were found along the streams (Haring, 2001). Periodically, beaver ponds widened the riparian area, allowing for an abundance of hardwood growth. Conifers have been removed from these areas, resulting in an increase in hardwoods. Riparian condition is poor to fair downstream of Tampico, and good to excellent in the 10-20 miles of tributaries upstream of Tampico.

Plant communities in the reaches of Ahtanum Creek surveyed by Golder (2003), exhibited a diverse species composition and age-class distribution and exhibited high vigor. The presence of pockets of late-seral Black cottonwood stands in some reaches are likely reflective of historic vegetation. These areas, however, exhibited high amounts of dead and decadent material, indicating a downward trend in this vegetation type. This is likely a result of limited floodplain inundation in these areas. A mid-seral Pacific willow habitat type, now dominates the majority of Ahtanum Creek's riparian community. Pacific willow provides significant canopy cover and thermal regulation value, and in areas where the channel is not highly incised, Pacific willow also provides bank and soil stabilization.

The type and structure of plant communities appeared to be related to channel shape and entrenchment (DOE, 2005). Black cottonwood and Pacific willow occur in areas where the stream has full access to its floodplain. In areas where the channel is disconnected from its floodplain, more upland-dependant plant species, such as Wood's rose, are the dominant vegetation type. Throughout the watershed, there is a high occurrence of invasive plant species, such as Reed canarygrass, which represents a significant problem unrelated to water or channel management.

The dominance of mid-seral Pacific willow is indicative of historic disturbance in the riparian areas of the creek. These disturbances included a range of activities including land use practices, vegetation removal, and disturbance to channel morphology and floodplain access due to diking. The functioning conditions rating for the reaches surveyed by Golder (2003) was generally moderate to poor.

There is significant residential/non-commercial hobby farms development upstream of Tampico on North Fork Ahtanum (to the DNR boundary) and on South Fork Ahtanum (to the YIN reservation boundary). Riparian condition in this area is generally fair to poor. The North Fork, in the vicinity of Tampico Park has been largely denuded of riparian vegetation due to extensive floodplain agricultural developed. Excessive off-road vehicle use within riparian corridors is also a problem in some areas on the North Fork Ahtanum.

Riparian shade is suboptimal in the lower reaches of Ahtanum Creek. Riparian condition in the lower 8-9 miles (downstream from Tampico) exists on the south side of the creek, but is generally poor with some remnant patches of functional riparian vegetation; severely impacted by grazing and residential encroachment. The north side of this reach has been severely impacted by grazing. Riparian condition downstream of the Wapato Irrigation Project diversion (RM 19.6) is further impaired by the lack of instream flow, which does not provide support for riparian vegetation growth during the hot, dry summer months.

Large Woody Debris

Reaches vary, but large woody debris (LWD) is generally deficient (Haring, 2001). Upper forested reaches of Ahtanum Creek are deficient in LWD in riparian areas. LWD is lacking throughout the mainstem channel in the Ahtanum. LWD abundance has been lowered by selective removal of large diameter trees for the riparian zone and removal of in-channel LWD by floods or man.

Historically, LWD provided greater stability in the lower gradient spawning areas and retained suitable gravel size for spawning bull trout. LWD deficiency reduces the channel's ability to dissipate energy during flood events. Lack of LWD has affected pool habitats in upper Ahtanum Creek. The deficiency in LWD presence has increased the risk of debris torrents that scour the channel, removing gravel from spawning areas. Pool margins and gravels have been negatively affected by fine sediments.

Substrate

Fine-sediment deposition in stream channels is perhaps the greatest limiting factor on fish production in the Ahtanum Creek watershed. Sediment routing and delivery to channels is caused by different factors in different portions of the watershed. Streamside roads, particularly roads within 200 feet of streams, are the major cause of sediment in the upper watershed. Bank erosion and channel incision are the principal sources of sediment in the middle and lower watershed, particularly along Ahtanum Creek. As a result, the sediment issues in the mainstem of Ahtanum Creek are attributable to both the movement of material from upstream sources and local sources associated with bank erosion and confinement. There are several specific areas in lower Ahtanum Creek where both fine- and coarse-grained sediments are causing a variety of problems with water and bedload conveyance, channel form, and channel-forming processes, all of which are leading to aquatic habitat changes (Golder, 2004)

Substrate condition is highly variable throughout Ahtanum Creek due to stream-gradient changes and to chronic sources of sediment from roads and logging in the upper watershed, and grazing and residential development in the lower watershed (Haring, 2001). In addition, there is a large

amount of bedload movement. Spawning gravel quantity was rated as infrequent or absent through every survey segment surveyed in the Ahtanum Watershed Analysis.

Spawning gravels are generally excellent in the upper reaches of Ahtanum Creek, however, spawning areas are damaged by scour during floods. Gravel recruitment is a concern in upper Ahtanum Creek. Observations of the channel banks, floodplains, and headwater tributaries indicate an abundant supply of spawning-sized gravel (<3" diameter) within the system. However, these particle classes have very short residence times through transport reaches due to the lack of LWD.

Naturally-occurring dam break flood effects have been exacerbated by increased fine and coarse sediment inputs sourced from roads, road crossings at stream, and grazing activity. Culverts have failed due to large volumes of road fill that were washed away. Documented livestock grazing concerns range from overgrazing in meadows, stream bank instability and instream damage by cattle to spawning areas. Chronic fine sediment and excessive sedimentation has negatively affected spawning areas.

The lower 8-9 mile segment experiences bank sloughing from overgrazing and has caused the deposition of a large amount of sand and mud.

Sediment delivery originating from the upper watershed causes problems in downstream areas (DOE, 2005). Within the upper watershed area itself, the North Fork Ahtanum Creek, near the John Cox diversion and highway bridge, is particularly affected by sediment conditions. Many miles of good to excellent habitat are present in the upper watershed, but have been historically unused because of passage problems in the lower watershed.

Water Quality

Ahtanum Creek is designated as Class A (excellent) waters (Haring, 2001). Water quality is fair downstream of Tampico, and good upstream. Point sources of pollution include a crop-preparing facility (design flow 0.104 MGD) and a facility permitted to discharge a maximum of 0.29 MGD to Bowman Ditch.

Irrigation return flows and urban drainage affect Ahtanum Creek and are known sources of nitrogen and phosphorous. The USGS has documented moderately high pesticide levels in Ahtanum Creek. The condition of invertebrate communities in Ahtanum Creek was ranked as unimpaired and as one of the highest quality sites in the watershed for benthic invertebrates. Values for disturbance and pesticides for Ahtanum Creek are also among the lowest in the agriculturally affected portion of the Yakima watershed. These observations are somewhat surprising, as the intensity of agriculture (mostly hay and pasture) in Ahtanum Creek is at least 6 times that in other ranking sites. For some reason, the invertebrate community in Ahtanum Creek appears to be highly resilient. However, because of its proximity to the cities of Yakima and Union Gap, the entire Ahtanum valley floor is experiencing high suburban/rural development pressures. The Ahtanum Creek invertebrate community condition could be at risk if agricultural intensity, urbanization, or pesticide contamination were to increase further, even by relatively small amount.

The upper forested areas of Ahtanum Creek experience chronic sedimentation from road runoff and road encroachment on stream channels which accelerate erosion rates during peak flow events. Grazing and residential development contribute sediments in the lower watershed.

No water quality standards violations have been confirmed, although a temperature exceedance was reported for Ahtanum Creek. Elevated water temperatures are cited as impacting fish populations in both the upper (WDNR, 1977) and lower portions of the Ahtanum Creek watershed (Golder, 2004). Prolonged high water temperatures occur in the lower floodplain areas where shade canopy is reduced. Temperatures in the upper headwater reaches of Ahtanum Creek are kept cool by inflow of cool spring water sources. Ahtanum Creek is at least partially under control of the Yakama Nation and sovereignty issues may affect judgments concerning compliance with state water quality standards.

Violations of dissolved oxygen standards have been reported in Ahtanum Creek where prolonged high temperature occur in the floodplain areas here shade canopy has been reduced.

LAND USE

The drainage includes the communities of Tampico, Ahtanum, and Wiley City, in addition to urbanized areas with the Cities of Yakima and Union Gap. The primary land use in the lower Ahtanum (downstream of Tampico) is agriculture (Haring, 2001)(Fig. A3). There are hobby farms and considerable housing and industrial development in the lower part of the Ahtanum drainage. Predominant land uses in the upper watershed include forestry, livestock grazing, and outdoor recreational activities. There is significant residential/non-commercial hobby farms development upstream of Tampico on North Fork Ahtanum (to the DNR boundary) and on South Fork Ahtanum (to the YIN reservation boundary). The upper watershed of Ahtanum Creek above the forks includes state DNR lands and commercial timber company holdings. Predominant land uses in this area include forestry, livestock grazing, and outdoor recreational activities. Excessive off-road vehicle use is noted in some areas on the North Fork Ahtanum.

DISTURBANCE

Overall, habitat conditions in the Ahtanum watershed are in a disturbed state, although some stable, healthy channel segments or reaches can be found in the North Fork Ahtanum. The presence of these stable sections provides examples for recovery potential of disturbed channels

Lower Ahtanum Creek is heavily diverted, diked, and straightened (Haring, 2001). Stream channels on lower Ahtanum Creek have been altered to accommodate agricultural development and associated irrigation delivery. Extensive areas along lower Ahtanum Creek have been diked. Most of the moderate and steep gradient mainstem channels are artificially confined or moderately confined. Several reaches are confined by fills associated with agricultural activities, and several reaches of lower Ahtanum Creek have lost floodplain connectivity. Bank sloughing form overgrazing was considered responsible for deposition of mud and sand in the creek bottom of lower Ahtanum Creek.

Disturbances in riparian areas was patchy but significant. Residential development, logging, excessive off-road recreational vehicles use, logging and roadways, in the channel migration zone and riparian area, have resulted in significant impacts to bank stability, riparian vegetation, and sedimentation upstream of Tampico on both the North and South Forks of Ahtanum Creek, confining channels and resulting in the failure of channels to natural respond to recovery form channel disturbances. Debris flows and dam-break floods have occurred in the Ahtanum (in the last 30 years there have been 16 debris torrents in upper North Fork Ahtanum, 4 in lower North Fork Ahtanum) and most often been associated with extreme runoff events. Naturally–occurring dam break flood effects have been exacerbated by increased fine and coarse sediment input provided from roads constructed within the floodplain. Accelerated erosion rates also associated with peak flow events. Livestock grazing concerns range from overgrazing in meadows, stream bank instability and instream damage by cattle to spawning areas.

Irrigation return flows and urban drainage affect Ahtanum Creek and are known sources of nitrogen and phosphorous.

CHANNEL CONDITION

The following channel concerns have been identified in the Ahtanum Creek watershed:

1) extensive bank erosion
2) reduction and fragmentation of mature conifer overstories in riparian vegetation
3) an increase in floodplain residential development (particularly on NR)
4) an increase in logging of forested riverine wetlands
5) relative stability of channel position on the floodplain
6) use of the stream channels as logging skid trails

ACTION RECOMMENDATIONS

The following ranked salmonid habitat restoration actions are recommended for Ahtanum Creek:

- Prioritize and correct identified fish passage barriers and install fish screens on unscreened water diversions
- Restore instream flows downstream of the upper WIP Diversion dam (RM 19.6)
- Develop and implement stable flow regimes for channels downstream of irrigation diversions; re-establish adult and juvenile fish access
- Assess protection/restoration potential of alluviated floodplain reach from confluence of North Fork and South Fork downstream for ± 10 km
- Ensure that channel effects and pesticide contamination from agriculture (primarily non- commercial) and residential development are not increased within the watershed
- Restore riparian function throughout watershed
- Implement a comprehensive grazing program to protect riparian vegetation and streambank stability (particular areas of concern include downstream of Tampico and in forested riparian areas)
- Develop an implement road management plans for the upper watershed that reduces fine sediment delivery and accelerated water delivery during storm events
- Develop and implement a short-term LWD strategy for the North Fork, to provide LWD presence and habitat diversity until riparian function is restored.

AHTANUM CREEK SUB-BASIN REACH DESCRIPTIONS

The Ahtanum Creek SMP jurisdiction is divided into six distinct reaches (Fig. A5; Table A1). Reach delineation was made based on gradient, landforms, and land use. **Reach 1** represents the lower (15.9 mi.) portion of the stream from its connection to the larger Yakima River to the mouth of Ahtanum Canyon and the distributaries of Hatton Creek and Bachelor Creek. This reach is dominated by irrigated agriculture and increasing urban/suburban development. Ahtanum Creek, through this reach, exhibits a highly meandering form. **Reach 2** represents the lower (3.9 mi.) of Ahtanum Canyon, commencing at the opening of this canyon onto the broader Yakima Valley. Land use in this reach is dominated by irrigated, hay, agriculture. The stream exhibits a moderately meandering form as it traverses this relatively confined canyon-bottom. **Reach 3** is a 1.3 mile-long reach that terminates at the junction of the North and South Forks of Ahtanum Creek. This reach represents the distinctive landscape created by the coalescence of the waters of the North and South Forks of Ahtanum Creek combined with the constriction of the valley walls. This reach exhibits little in the way of residential development. The creek exhibits a meandering form with braiding of the channel. **Reach 4** commences at the junction of the North and South Forks of Ahtanum Creek and follows the North Fork for 3.3 miles upstream to a residential cluster and the diversion headworks for John Cox and Shaw Knox ditches. The lower segment of this reach is dominated by the intermingling of North and South Fork waters across a broad alluvial landscape. **Reach 5** Represents the most-headwater reach of Ahtanum Creek for the purposes of this report. This reach is largely reflected by a narrowing of the canyon bottom between steeply-rising canyon walls. **Reach 6** represent the lower 1.3 miles of the South Fork of Ahtanum Creek from its juncture with the North Fork. This reach is typified by a gradual restricting of the canyon walls between the steeply-sloping Ahtanum Ridge to the south and the more gradually sloping Sedge Ridge to the north.

REACH 1

General Description

Reach 1 comprises the lower 15.9 miles of Ahtanum Creek, from its confluence with the Yakima River to the St. Joseph Mission. The average gradient of this reach is 0.6% (34 ft/mi.). Reach 1 is dominated by Ahtanum Ridge to the south and the broad Ahtanum Valley to the north.

ABIOTIC- See Ahtanum Physical Map and Ahtanum Physical (Soil Characteristics) Map *(Ahtanumm_Physical.pmf)*

Geology/Landform (Table A2)
Reach 1 generally, is located against the flanks of Ahtanum Ridge, which lies to the south. The loess-covered ridge rises abruptly from the valley floor to elevations over 2000 feet. Along the upper 4 miles of this reach, the stream is bounded on the south (mostly out of the SMP jurisdiction) by Thorp gravels deposited during the Pliocene. To the north, the Ahtanum Valley broadens progressively downstream, from about 1200 feet in width at its western end to approximately 1.7 miles in width about 8.5 miles from the Yakima River. From this point, the Ahtanum Creek alluvial fan intermingles with those of other streams to form an ever-more expansive alluvial slope. Throughout this reach, the surficial geology is one of alluvium (Washington State Department of Natural Resources [WDNR], 2000).

Three areas of geologic hazards are noted in Reach 1, all within the lower mile and all along the right bank of the stream (Yakima County, 2003c). The hazard areas are all relatively small, and consist of an area rated High Risk due to the potential for rock fall or creep from over-steepened slopes; an area of High Risk due to potential landsliding; and an Intermediate Risk area that has some potential for flash flooding. Approximately 57.5% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table A3)
Reach 1 is dominated by alluvial deposits (98.5%) (WDNR, 2000). The soils within the SMP jurisdiction are predominately silt loams. Within this reach, 47.5% 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). Soil permeability is primarily moderate, runoff is classed as slow to very slow and the hazard of erosion is predominantly slight (USDA Natural Resources Conservation Service [NRCS], 2004).

Stream Type/Channel Form (Table A4)
Channel form throughout Reach 1 is currently classified as pool-riffle. Upon exiting the confining canyon at the upper end of this reach, the stream flows through a broadening and ever-less confining alluvial fan. The stream is quite meandering throughout and numerous distributary channels diverge and re-converge within this reach. Several of the natural distributaries have been converted into irrigation ditches.

It is highly likely that the channel form of this reach was once more complex. Though now confined to a single channel, it was once clearly more migratory. This is a dispersal 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. Over 98% of the SMP jurisdiction of Reach 1 is underlain by, likely deep, deposits of alluvium (WDNR, 2000). Though currently confined in many places, there existed the opportunity for flood waters to spread, shifting channel locations and alternately eroding and depositing materials. As a result, this reach has a potential for increased channel complexity. Approximately 7.2% of the reach has been identified as having a high potential for being in the channel migration zone, with another 12.4% having a moderate potential (Yakima County, n.d.b).

Stream Flow

Stream discharge for Ahtanum Creek has been gauged by USGS at three locations. Records are not continuous for any of these locations. The location most germane to this reach is at Union Gap where flow has ranged from 12 to 45 cfs, with spring runoff flows of 125 to 175 cfs. The flow regime is typical of that of streams throughout the region, exhibiting lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer.

The "typical" hydrograph exhibits an alteration to this pattern in late spring as a result of irrigation diversions. Lower water levels and higher water temperatures are annual occurrences in this reach. Diversions from the south side of the creek provide irrigation waters for agricultural lands within the Yakama Reservation. The flow of lower Ahtanum Creek has been highly modified. Irrigation headworks diverted flow into previous distributary channels on the left bank, which now serve as irrigation conduits for the Ahtanum Irrigation District during the irrigation season. The upper Wapato Irrigation Project formerly diverted all or most of the stream flow during the irrigation season, resulting in the loss of surface flow downstream for 7-8 miles (to approximately RM 12). At RM 12, groundwater and irrigation returns recharge the stream. The resulting flow of 5-10 cfs persists to the mouth. A 10 cfs minimum instream flow has been in effect in this portion of the river since 2001 and has been enforced vigilantly since 2002.

The magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper water shed.

Hyporheic Flow

Based on soil permeability studies, surficial recharge potential is thought to be a mixture of moderate and high in this reach. Given the high proportion of the SMP jurisdiction and much greater floodplain underlain by alluvium, 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 along lower Ahtanum Creek where return flows resurface down gradient of dry reaches. Examination of aerial photographs and topographic maps reveal numerous springs in the surrounding lands.

Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

BIOTIC- See Ahtanum Biological Map *(Ahtanum_Biological.pmf)*

Natural Vegetation

Upland

Historic vegetation is non-forest (as designated by ICBEMP). Potential natural vegetation is primarily sagebrush-steppe.

Riparian (Table A5)

Estimates of the SMP jurisdiction area covered by riparian vegetation range from 32.8% to 54.2% (Washington Department of Fish and Wildlife [WDFW], 2004b and Yakima County, 2003b). However, this vegetation is largely restricted to a narrow corridor along the stream banks, is sparse in most areas, and is non-existent in several segments of this reach.

Wetlands (Table A5)

Wetlands occupy 8.7% of the SMP jurisdiction today (USFWS, 2003). It is likely that numerous wetlands have been lost as a result of historic agricultural and more recent urban development. An additional 17.1 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 A6)

Anadromous fish, once abundant in Ahtanum Creek, are now present in severely suppressed populations. The mouth of Ahtanum Creek is protection and rearing habitat for spring Chinook (Washington Department of Fish and Wildlife [WDFW], 2004c). The lower 2.4 miles of this reach are used by spring Chinook for rearing and migration. Steelhead utilized the entirety of Ahtanum Creek, with the first half-mile from the mouth primarily used for migration. Bull trout are present in the mainstem of Ahtanum Creek in this reach, however, they are probably more abundant in the upper portion of the drainage. Resident rainbow trout are present in the Ahtanum watershed. Coho salmon are also present in the Ahtanum, potentially spawning throughout the reach. Other resident fish species found in the reach include mountain whitefish and Northern pike minnow.

Avian (Table A7)

GAP analysis data indicates that portions of Reach 1 may provide habitat for four species of current concern, including principally the burrowing owl (99.3%), as well as smaller portions for the Ferruginous hawk, sage sparrow, and sage thrasher (2.6% each) (WDFW, 2004a). This reach may provide raptor nesting (including Osprey) and bald eagle wintering (anadromous fish run) habitat (WDFW, 2004b). Waterfowl may also utilize this area for over-wintering.

Terrestrial (Tables A5 and A7)
GAP analysis data indicates that portions of Reach 1 may provide habitat for three species of current concern, including principally the Townsend's big-eared bat (100%), as well as smaller portions for the black-tailed jack rabbit (2.6%) and Townsend's ground squirrel (2.6%) (WDFW, 2004a). The entire riparian zone is listed as priority habitat (WDFW, 2004b). This reach represents big game summer range (mule deer) and habitat for furbearers.

CULTURAL MODIFICATIONS- See Ahtanum Cultural Modifications Map *(Ahtanum_Cultural_Modifications.pmf)*

Land Use (Table A8)
Of the SMP jurisdiction lands along Reach 1, 32% remain vacant (Yakima County, 2004a). Of the remaining 68% of SMP jurisdiction lands, 47.8% is in agricultural production, 16.8% is under residential development, 2.1 is occupied by transportation development, 1.5% is commercial, and 0.2% is an RV park. Approximately 2.3% of the SMP jurisdiction is greater than 25% impervious. The Yakama Nation and school districts are the only public owners of land within the SMP jurisdiction, holding title to 45.4% and 1.6%, respectively (WDNR, 2003).

Transportation (Table A10)
Roadways occupy 2.7 miles of SMP jurisdiction land in this reach (Yakima County, n.d.a), along with 0.4 mile of active and 0.3 mile of abandoned railroad (Washington State Dept. of Transportation [WDOT], 1994). In addition, 5 bridge crossings occur along the reach (WDOT, 2004).

Revetments (Table A10)
Lower Ahtanum Creek is heavily diverted and extensive areas have been diked . Several reaches are confined by fills associated with agricultural activities, and several segments of this reach have lost floodplain connectivity.

CULTURAL JURISDICTIONS- See Ahtanum Cultural Jurisdiction Map *(ahtanum_cultural_jurisdictional.pmf)*

Zoning (Table A9)
Current zoning within the SMP jurisdiction of Reach 1 is predominantly Tribal (31.5), Agricultural (28.5%), and Light Industrial (24.4%) (Yakima County, 2004b). Minor portions of the jurisdiction are zoned Valley Rural (7.1%), Single-Family Residential (6.5%), Suburban Transitional (1.3%), and Rural Transitional (0.6%). Approximately 78.5% of the reach is designated as Rural by the current SMP, with the other 21.5% are designated as Conservancy.

Cultural Resources
There are no Archeological Site Form records of cultural sites with in the SMP jurisdiction of Reach 1 on file with the Washington State Historic Preservation Office (Washington State Historic Preservation Office [WSHPO], 2004).

DOE Sites/facilities and 303(d) Listings
Two DOE sites/facilities are found in the SMP jurisdiction of Reach 1: a crop preparation service (emergency/hazardous chemical report), and a plastic materials and resins user (hazardous waste generator) (Washington State Dept. of Ecology [WDOE], 1998). There are no 303(d)-listed stream segments in Reach 1.

ECOLOGICAL FUNCTION SUMMARY

Reach 1 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
High erosion soils: 0.3% Steep slopes: 1% High channel migration: 7.2% High soil permeability: 2.5% 100 year floodplain: 57.5%	Wetlands: 8.7% Riparian cover: 32.8% Undeveloped: 32% Priority habitats: 1 Species of concern: 7 Anadromous habitat: 15.9 mi Total fish species: 6	Public land: 47%	Principal land use: Vacant/natural >10% Imperviousness: 3.7% Roads: 2.7 mi Barriers: Passable dam DOE sites/facilities: 2 Bridge crossings: 5

Ecological functions along Reach 1 are principally impaired by agricultural and residential development, which covers 64.6% of the jurisdiction. These land uses, in addition to the 2.7 miles of roads and 0.7 miles of active and abandoned railroad, account for the majority of the estimated 3.7% of the reach that is greater than 10% impervious. In addition, 5 bridge crossings and one passable dam occur along the reach. Upland vegetation has been removed and replaced with crops, buildings and lawns, which can promote increased runoff and nonpoint source pollution. Lower Ahtanum Creek has also been heavily diverted and extensive areas have been diked or filled, losing floodplain connectivity. Two DOE sites/facilities are also found in the SMP jurisdiction, though there are no 303(d)-listed stream segments. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 32.8% of the reach, though tends to be largely restricted to a narrow corridor along the stream banks, sparse in most areas, and non-existent in several segments. Much of the reach is presently undeveloped (32%), while 8.7% is covered by wetlands. The reach provides habitat for seven species of concern and aquatic habitat for six fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Opportunity for Protection Map *(Opp_Protection.pmf)*

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

1) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning and rearing habitat in an area with high soil erosion potential. Suggested Action: Work with private landowners to protect riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.

2) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands.
3) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning and rearing habitat. Suggested Action: Work with private landowners to protect riparian buffer.
4) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands.
5) Rationale: Existing riparian buffer on privately owned residential and agricultural land protecting a recognized anadromous spawning and rearing habitat. Suggested Action: Work with private landowners to protect riparian buffer.
6) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands.
7) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning and rearing habitat in an area with high soil erosion potential. Suggested Action: Work with private landowners to protect riparian buffer.
8) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands.
9) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.
10) Rationale: Existing riparian buffer on privately owned residential land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.
11) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Opportunity for Restoration Map *(Opp_Restoration.pmf)*

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

1) Rationale: Railroad grade in floodplain acting as levee, restricting floodplain processes. Suggested Action: Remove abandoned railroad grade to expand active floodplain.
2) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat. Suggested Action: Establish a larger riparian buffer.
3) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
4) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat. Suggested Action: Establish a larger riparian buffer.

5) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat in an agricultural area with high soil erosion potential. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
6) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat. Suggested Action: Work with school district to establish a larger riparian buffer.
7) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer.
8) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in a residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
9) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in an agricultural area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
10) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in a residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
11) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in an agricultural area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
12) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
13) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in a residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer.
14) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
15) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
16) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
17) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.

REACH 2

General Description

Reach 2 is a 3.9 mile segment of Ahtanum Creek immediately upstream from St. Joseph Mission. The average gradient of this reach is 1.0% (52 ft./mi.). Reach 2 is dominated by Ahtanum Ridge to the south and a closely-confining ridge to the north.

ABIOTIC- See Ahtanum Physical Map and Ahtanum Physical (Soil Characteristics) Map *(Ahtanumm_Physical.pmf)*

Geology/Landform (Table A2)
Reach 2 generally, is located in a relatively narrow, hourglass-valley between Ahtanum Ridge to the south and the lower tableland of the terminal flanks of Pine Mountain to the north. The floodplain width is constricted through the middle segment of this reach before widening again at the head of the Ahtanum Valley. The floodplain averages approximately 1200 feet in width. Throughout this reach, the surficial geology is one of alluvium (WDNR, 2000).

One area of geologic hazard is noted in Reach 2. This area consists of approximately 1500 feet along the left bank of Ahtanum Creek beginning approximately 2.3 miles upstream from St. Josephs Mission and continuing upstream (Yakima County, 2003c). This area is categorized as Intermediate Risk due to the potential for rock fall or creep from over-steepened slopes. Approximately 30.5% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table A3)
Reach 2 is dominated by alluvial deposits (97.5%) (WDNR, 2000). The soils within the SMP jurisdiction are predominately silt loams. Within this reach, 11.8% of the soils are Aquic, a direct reflection of little hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Soil permeability is primarily rapid, runoff is classed as predominately slow, and the hazard of erosion is primarily slight (NRCS, 2003).

Stream Type/Channel Form (Table A4)
Channel form throughout Reach 2 is currently classified as pool-riffle. The stream is moderately meandering and exhibits mid-channel and point bars throughout.

It is highly likely that the channel form of this reach was once more complex. Though now confined to a single channel, was once clearly more migratory. This is a dispersal 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. Indeed, over 97% of the SMP jurisdiction of Reach 2 is underlain by, likely deep, deposits of alluvium (WDNR, 2000). Throughout this reach, there existed the opportunity for flood waters to spread, shifting channel locations and alternately eroding and depositing materials. As a result, this reach has a potential for increased channel complexity. Approximately 14.7% of the reach has been identified as having a high potential for being in the channel migration zone, with another 36.0% having a moderate potential (Yakima County, n.d.b).

Stream Flow
Stream discharge for Ahtanum Creek has been gauged by USGS at three locations. Records are not continuous for any of these locations. The flow regime is typical of that of streams throughout the region, exhibiting lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer.
The "typical" hydrograph exhibits an alteration to this pattern in late spring as a result of irrigation diversions. Lower water levels and higher water temperatures are annual occurrences in this reach. The magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper watershed.

Hyporheic Flow
Based on soil permeability studies, surficial recharge potential is thought to be a mixture of moderate and high in this reach. Given the high proportion of the SMP jurisdiction and much greater floodplain underlain by alluvium, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Examination of aerial photographs and topographic maps reveal numerous springs in the surrounding lands.

Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

BIOTIC- See Ahtanum Biological Map *(Ahtanum_Biological.pmf)*

Natural Vegetation
Upland
Historic vegetation is non-forest with an area of hardwood – alder/ash/maple (as designated by ICBEMP). Potential natural vegetation is sagebrush-steppe.

Riparian (Table A5)
Estimates of the SMP jurisdiction area covered by riparian vegetation range from 37.2% to 66.6% (WDFW, 2004b and Yakima County, 2003b). However, this vegetation is largely restricted to a narrow corridor along the stream banks, is sparse in most areas, and is non-existent in several segments of this reach.

Wetlands (Table A5)
Wetlands occupy 13.8% of the SMP jurisdiction today (USFWS, 2003). It is likely that many wetland areas have been reduced in size or lost altogether as a result of historic agricultural and more recent urban development. An additional 24.0 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 A6)

Anadromous fish, once abundant in Ahtanum Creek, are now present in severely suppressed populations. Steelhead utilized the entirety of Ahtanum Creek, with redds concentrated in the segment below the confluence of the North and South Forks (WDFW, 2004c). Bull trout are present in the mainstem of Ahtanum Creek in this reach, however, they are probably more abundant in the upper portion of the drainage. Cutthroat trout are present in the Ahtanum watershed as are resident rainbow trout. Coho salmon are present in the Ahtanum, potentially spawning throughout the reach, though may be blocked by an otherwise passable dam. Other resident fish species found in the reach include mountain whitefish and Northern pike minnow.

Avian (Table A7)

GAP analysis data indicates that portions of Reach 2 may provide habitat for three species of current concern, including principally the burrowing owl and sage thrasher (10.5%), as well as a small portion for the sage sparrow (WDFW, 2004a). This reach may provide raptor nesting (including Osprey) and bald eagle wintering (anadromous fish run) habitat (WDFW, 2004b). Waterfowl may utilize this area for over-wintering.

Terrestrial (Tables A5 and A7)

GAP analysis data indicates that portions of Reach 2 may provide habitat for three species of current concern, including principally the Townsend's big-eared bat (100%), as well as smaller portions for the black-tailed jack rabbit and Townsend's ground squirrel (WDFW, 2004a). The entire riparian zone is listed as priority habitat (WDFW, 2004b). This reach represents big game summer range (Mule deer) and habitat for furbearers.

CULTURAL MODIFICATIONS- See Ahtanum Cultural Modifications Map *(Ahtanum_Cultural_Modifications.pmf)*

Land Use (Table A8)

Of the SMP jurisdiction lands along Reach 2, 12.1% remain vacant (Yakima County, 2004a). Of the remaining 87.9% of SMP jurisdiction lands, 86.4% are in agricultural production, 1.3% is occupied by transportation development, and 0.7% is under residential development. Approximately 2.1% of the SMP jurisdiction is greater than 25% impervious. The Yakama Nation is the only public owner of land within the SMP jurisdiction, holding title to 48% (WDNR, 2003).

Transportation (Table A10)

Roadways occupy 0.4 miles of SMP jurisdiction land in this reach (Yakima County, n.d.a).

Revetments (Table A10)

Although there are no formal revetments within Reach 2, lower Ahtanum Creek is heavily encroached upon by agricultural activities, and several segments of this reach have lost floodplain connectivity (CWU, 2002).

CULTURAL JURISDICTIONS- See Ahtanum Cultural Jurisdiction Map *(ahtanum_cultural_jurisdictional.pmf)*

Zoning (Table A9)
Current zoning within the SMP jurisdiction of Reach 2 is predominantly Valley Rural (71.8%) and Tribal (17.4%), plus an additional 8.1% classified as Yakama Nation Closed Area (Yakima County, 2004b). Minor portions of the jurisdiction are zoned Agriculture (2.6%). Currently 92.9% of the reach is designated as Conservancy by the current SMP, with the other 7.0% designated as Natural.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 2 on file with the Washington State Historic Preservation Office (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings
One DOE site/facility is found in the SMP jurisdiction of Reach 2: the Bachelor Creek irrigation diversion structure (WDOE, 1998). There are no 303(d)-listed stream segments in Reach 2.

ECOLOGICAL FUNCTION SUMMARY

Reach 2 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 5% High soil permeability: 38% High channel migration: 14.7 % 100 year floodplain: 30.4%	Wetlands: 13.8% Undeveloped: 12.1% Riparian cover: 37.2% Priority habitats: 1 Species of concern: 6 Anadromous habitat: 3.9 mi Total fish species: 6	Public land: 48%	Principal land use: Agriculture >10% Imperviousness: 2.1% Roads: 0.4 mi Barriers: Passable dam DOE sites/facilities: 1

Ecological functions along Reach 2 are principally impaired by agricultural and industrial development, which covers 87.7% of the jurisdiction. These land uses, in addition to the 0.4 miles of roads, account for the majority of the estimated 2.1% of the reach that is greater than 10% impervious. In addition, one passable dam occurs along the reach. Upland vegetation has been removed and replaced with crops, buildings and lawns, which can promote increased runoff and nonpoint source pollution. Lower Ahtanum Creek has also been heavily diverted and extensive areas have been diked or filled, losing floodplain connectivity. One DOE site/facility is also found in the SMP jurisdiction, though there are no 303(d)-listed stream segments. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 37.2% of the reach, though tends to be largely restricted to a narrow corridor along the stream banks, sparse in most areas, and non-existent in several segments. Much of the reach is presently undeveloped (48%), while 13.8% is covered by wetlands. The reach provides habitat for six species of concern and aquatic habitat for six fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Opportunity for Protection Map *(Opp_Protection.pmf)*

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

1) Rationale: Existing riparian buffer on privately owned land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.
2) Rationale: Wetlands on private property. Suggested Action: Work with landowner to protect wetlands.
3) Rationale: Existing riparian buffer on privately owned land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.
4) Rationale: Wetlands on private property. Suggested Action: Work with landowner to protect wetlands.
5) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Opportunity for Restoration Map *(Opp_Restoration.pmf)*

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

1) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat in an agricultural area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
2) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat in an agricultural area. Suggested Action: Work with private landowners to establish a larger riparian buffer.

REACH 3

General Description

Reach 3 is a 1.3 mile segment of Ahtanum Creek that terminates at the confluence of the North and South Forks of Ahtanum Creek. The average gradient of this reach is 1.1% (60 ft./mi.). Reach 3 is dominated by Ahtanum Ridge to the south and the closely-confining flanks of Pine Mountain to the north.

ABIOTIC- See Ahtanum Physical Map and Ahtanum Physical (Soil Characteristics) Map *(Ahtanumm_Physical.pmf)*

Geology/Landform (Table A2)
Reach 3 generally, is located in a moderately narrow valley that gradually constricts downstream between Ahtanum Ridge to the south and a lower tableland to the north. The floodplain width averages 2000 feet in width. Throughout this reach, the surficial geology is one of alluvium, bounded to both the north and south by basalt flows (largely outside of the SMP jurisdiction) (WDNR, 2000).

Only a small area of known geologic hazards is noted in Reach 3, consisting of an area of Intermediate Risk due to the potential for flash flooding (Yakima County, 2003c). Approximately 58.5% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table A3)
Reach 3 is dominated by alluvial deposits (100%) (WDNR, 2000). The soils within the SMP jurisdiction are silt loams. Within this reach, 24.2% of the soils are Aquic, a direct reflection of restricted hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Soil permeability is rapid, runoff is classed as slow, and the hazard of erosion is slight (NRCS, 2003).

Stream Type/Channel Form (Table A4)
Channel form throughout Reach 3 is currently classified as plane-bed. The stream is highly meandering and exhibits a braided network of side-channels.

It is highly likely that the channel form of this reach was once more complex. Though now confined to a single channel, was once clearly more migratory. Within this reach, Ahtanum Creek is adjusting to the combining of flows from the North and South Forks. This is a dispersal 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. Almost the entirety of the SMP jurisdiction of Reach 3 is underlain by, likely relatively deep, deposits of alluvium (WDNR, 2000). Throughout this reach, there existed the opportunity for flood waters to spread, shifting channel locations and alternately eroding and depositing materials. As a result, this reach has a potential for increased channel complexity. Approximately 46.9% of the reach has been identified as having a high

potential for being in the channel migration zone, with another 30.0% having a moderate potential (Yakima County, n.d.b).

Stream Flow
Stream discharge for Ahtanum Creek has been gauged by USGS at three locations. Records are not continuous for any of these locations. The flow regime is typical of that of streams throughout the region, exhibiting lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer.

The "typical" hydrograph likely exhibits an alteration to this pattern in late spring as a result of irrigation diversions. Lower water levels and higher water temperatures are annual occurrences in this reach. The magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper watershed.

Hyporheic Flow
Based on soil permeability studies, surficial recharge potential is thought to be a mixture of moderate and high in this reach. Given the high proportion of the SMP jurisdiction and much greater floodplain underlain by alluvium, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Examination of aerial photographs and topographic maps reveal numerous springs in the surrounding lands and the lands downstream of this reach.

Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

BIOTIC- See Ahtanum Biological Map *(Ahtanum_Biological.pmf)*

Natural Vegetation
Upland
Historic vegetation is non-forest (as designated by ICBEMP). Potential natural vegetation is sagebrush-steppe.

Riparian (Table A5)
Estimates of the SMP jurisdiction area covered by riparian vegetation range from 50.7% to 85.8% (WDFW, 2004b and Yakima County, 2003b). However, this vegetation is largely restricted to a narrow corridor along the stream banks.

Wetlands (Table A5)
Wetlands occupy 5.3% of the SMP jurisdiction today (USFWS, 2003). The amount of wetland area reduced in size or lost altogether as a result of historic agricultural is difficult to estimate in this reach. An additional 0.1 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 A6)

Anadromous fish, once abundant in Ahtanum Creek, are now present in severely suppressed populations. Steelhead utilized the entirety of Ahtanum Creek, with redds concentrated in the segment below the confluence of the North and South Forks (WDFW, 2004c). Bull trout are present in the mainstem of Ahtanum Creek in this reach, however, they are probably more abundant in the upper portion of the drainage. Cutthroat trout are present in the Ahtanum watershed as are resident rainbow trout. Other resident fish species found in the reach include mountain whitefish and Northern pike minnow.

Avian (Table A7)

GAP analysis data indicates that small portions of Reach 3 may provide habitat for two species of current concern, including the burrowing owl and sage thrasher (2.2%) (WDFW, 2004a). This reach may also provide raptor nesting and bald eagle wintering (anadromous fish run) habitat (WDFW, 2004b).

Terrestrial (Tables A5 and A7)

GAP analysis data indicates that portions of Reach 3 may provide habitat for three species of current concern, including principally the Townsend's big-eared bat (100%), as well as smaller portions for the black-tailed jack rabbit and Townsend's ground squirrel (WDFW, 2004a). The entire riparian zone is listed as priority habitat (WDFW, 2004b). This reach represents big game summer range (elk, mule deer, and black-tailed deer) and habitat for furbearers.

CULTURAL MODIFICATIONS- See Ahtanum Cultural Modifications Map *(Ahtanum_Cultural_Modifications.pmf)*

Land Use (Table A8)

Of the SMP jurisdiction lands along Reach 3, 57.2% remain vacant (Yakima County, 2004a). The remaining 42.8% of SMP jurisdiction lands are in agricultural production. None of the SMP jurisdiction is greater than 25% impervious. The Yakama Nation is the only public owner of land within the SMP jurisdiction, holding title to 46% (WDNR, 2003).

Transportation (Table A10)

No roadways are found in the SMP jurisdiction land in Reach 3 (Yakima County, n.d.a).

Revetments (Table A10)

Although there are no formal revetments within Reach 3, lower Ahtanum Creek is heavily encroached upon by agricultural activities, and several segments of this reach have lost floodplain connectivity (CWU, 2002).

CULTURAL JURISDICTIONS- See Ahtanum Cultural Jurisdiction Map *(ahtanum_cultural_jurisdictional.pmf)*

Zoning (Table A9)
Current zoning within the SMP jurisdiction of Reach 3 is Yakama Nation Closed Area (57.2%) and Valley Rural (42.8%) (Yakima County, 2004b). Currently all of the reach is designated as Conservancy by the current SMP.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 3 on file with the Washington State Historic Preservation Office (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings
No DOE sites/facilities are found in the SMP jurisdiction of Reach 3 (WDOE, 1998). There are no 303(d)-listed stream segments in Reach 3.

ECOLOGICAL FUNCTION SUMMARY

Reach 3 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
High soil permeability: 53.2% High channel migration: 46.9 % 100 year floodplain: 58.5%	Wetlands: 5.3% Undeveloped: 57.2% Riparian cover: 50.7% Priority habitats: 3 Species of concern: 5 Anadromous habitat: 1.3 mi Total fish species: 5	Public land: 46%	Principal land use: Vacant/natural

Ecological functions along Reach 3 are principally impaired by agricultural development, which covers 42.8% of the jurisdiction. Upland vegetation has been removed and replaced with crops, buildings and lawns, which can promote increased runoff and nonpoint source pollution. Lower Ahtanum Creek has also been heavily diverted and extensive areas have been diked or filled, losing floodplain connectivity. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 50.7% of the reach, though tends to be largely restricted to a narrow corridor along the stream banks. Much of the reach is presently undeveloped (57.2%), while 5.3% is covered by wetlands. The reach provides habitat for five species of concern, as well as three priority habitats and aquatic habitat for five fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Opportunity for Protection Map *(Opp_Protection.pmf)*

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

1) Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Opportunity for Restoration Map *(Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration map for Ahtanum Creek.

1) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat in an agricultural area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.

REACH 4

General Description

Reach 4 is a 3.3 mile segment of the North Fork of Ahtanum Creek that extends from the confluence of the North and South Forks to the residential cluster near the irrigation diversions into John Cox and Shaw Knox ditches. The average gradient of this reach is 1.3% (71 ft./mi.). Reach 4 is bounded to the north by the flanks of Pine Mountain and to the south, sequentially, by Ahtanum Ridge, the alluvial fan of the South Fork of Ahtanum Creek, and by the terminal slopes of Sedge Ridge.

ABIOTIC- See Ahtanum Physical Map and Ahtanum Physical (Soil Characteristics) Map *(Ahtanumm_Physical.pmf)*

Geology/Landform (Table A2)

Reach 4 generally, is located in a rapidly broadening valley that is the result of the coalescence of alluvial deposits derived from both the North and South Forks. Approximately halfway down this reach, the North Fork Ahtanum begins to distributary and North Fork waters disperse across the fan, some flows mingling with South Fork distributaries upstream of the confluence of the main forks. The floodplain width varies, at the head of the reach spanning approximately 900 feet while at the lower end spanning approximately 3200 feet. Throughout this reach, the surficial geology is predominately one of alluvium (89.3%), bounded to both the north and south by basalt flows and Pliocene Thorp gravels (largely outside of the SMP jurisdiction) (WDNR, 2000).

Geologic hazards are noted in Reach 4. A small area at the downstream end of this reach is rated as Intermediate Risk due to the potential for flash flooding (this area extends into a small area of Reach 3) (Yakima County, 2003c). Two relatively small areas are rated as Intermediate Risk due to the potential for rock fall or creep from over-steepened slopes. Approximately 81% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table A3)

Reach 4 is dominated by alluvial deposits (89.3%) (WDNR, 2000). The soils within the SMP jurisdiction are predominately silt loams. Within this reach, 44.2% 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, runoff is classed as slow, and the hazard of erosion is slight (NRCS, 2003).

Stream Type/Channel Form (Table A4)

Channel form throughout Reach 4 is currently classified as plane-bed. The stream is somewhat meandering but is best characterized as being distributary, exhibiting a braided network of side-channels that coalesce in the downstream segment of this reach.

It is highly likely that the channel form of this reach was once more complex. Though now largely confined to a single channel, was once clearly more migratory. Within this reach,

Ahtanum Creek is adjusting to the combined sediment loads from the North and South Forks. This is a dispersal 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. Almost the entirety of the SMP jurisdiction of Reach 4 is underlain by, likely relatively deep, deposits of alluvium (WDNR, 2000). Throughout this reach, there exists the opportunity for flood waters to spread, shifting channel locations and alternately eroding and depositing materials. As a result, this reach has a great potential for increased channel complexity. Approximately 22.7% of the reach has been identified as having a high potential for being in the channel migration zone, with another 17.9% having a moderate potential (Yakima County, n.d.b).

Stream Flow

Stream discharge for Ahtanum Creek has been gauged by USGS at three locations. Records are not continuous for any of these locations. The flow regime is typical of that of streams throughout the region, exhibiting lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer.

The "typical" hydrograph likely exhibits an alteration to this pattern in late spring as a result of irrigation diversions. There are three diversions on North Fork Ahtanum, all within this reach. Combined, these diversions withdraw over 15 cfs. The magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper watershed.

Hyporheic Flow

Based on soil permeability studies, surficial recharge potential is thought to be high in this reach. Given the high proportion of the SMP jurisdiction and much greater floodplain underlain by alluvium, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Examination of aerial photographs and topographic maps reveal numerous distributary channels from both the North and South Forks that "sink" as well as numerous springs in the lands downstream of this reach.

Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

BIOTIC- See Ahtanum Biological Map *(Ahtanum_Biological.pmf)*

Natural Vegetation

<u>Upland</u>

Historic vegetation is non-forest (as designated by ICBEMP). Potential natural vegetation is sagebrush-steppe.

Riparian (Table A5)
Estimates of the SMP jurisdiction area covered by riparian vegetation range from 55.2% to 73.3% (WDFW, 2004b and Yakima County, 2003b).

Wetlands (Table A5)
Wetlands occupy 6.8% of the SMP jurisdiction today (USFWS, 2003). It is likely that this reach once supported a great deal of beaver activity. The amount of wetland area reduced in size or lost altogether as a result of historic agricultural is difficult to estimate in this reach. An additional 4.4 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 A6)
Anadromous fish, once abundant in Ahtanum Creek, are now present in severely suppressed populations. Steelhead utilized the entirety of Ahtanum Creek, with redds concentrated in the segment below the confluence of the North and South Forks (WDFW, 2004c). Bull trout are present in the mainstem of Ahtanum Creek, however, they are probably more abundant in the upper portion of the drainage. Cutthroat trout are present in the Ahtanum watershed as are resident rainbow trout. Mountain whitefish is also listed as a resident fish in the reach.

Avian (Table A7)
GAP analysis data indicates that small portions of Reach 4 may provide habitat for three species of current concern, including principally the sage thrasher (10.2%) and sage sparrow (9.1%), as well as the burrowing owl (1.2%) (WDFW, 2004a). This reach may provide raptor nesting and bald eagle wintering (anadromous fish run) habitat (WDFW, 2004b).

Terrestrial (Tables A5 and A7)
GAP analysis data indicates that portions of Reach 4 may provide habitat for three species of current concern, including principally the Townsend's big-eared bat (100%), as well as smaller portions for the black-tailed jack rabbit and Townsend's ground squirrel (WDFW, 2004a). The entire riparian zone is listed as priority habitat (WDFW, 2004b). This reach represents big game summer range (elk, mule deer, and black-tailed deer) and habitat for furbearers.

CULTURAL MODIFICATIONS- See Ahtanum Cultural Modifications Map
(Ahtanum_Cultural_Modifications.pmf)

Land Use (Table A8)
Of the SMP jurisdiction lands along Reach 4, 51.2% remain vacant (Yakima County, 2004a). Of the remaining 48.4% of SMP jurisdiction lands, 19% are in agricultural production, 28.6% is under residential development, and 1.1% is occupied by roadways. Approximately 8.5% of the SMP jurisdiction is greater than 25% impervious. The Yakama Nation and Bureau of Land Management are the only public owners of land within the SMP jurisdiction, holding title to 8% and 6.9% respectively (WDNR, 2003).

Transportation (Table A10)
Roadways occupy 0.4 miles of SMP jurisdiction land in Reach 4 (Yakima County, n.d.a).

Revetments (Table A10)
Although there are no formal revetments within Reach 4, lower Ahtanum Creek is heavily encroached upon by agricultural activities and residential development, and several segments of this reach have lost floodplain connectivity (CWU, 2002).

CULTURAL JURISDICTIONS - See Ahtanum Cultural Jurisdiction Map *(ahtanum_cultural_jurisdictional.pmf)*

Zoning (Table A9)
Current zoning within the SMP jurisdiction of Reach 4 is predominantly Valley Rural (74.1%) and Yakama Nation Closed Area (20.2%) (Yakima County, 2004b). Minor portions of the jurisdiction are zoned Remote/Extremely Limited (5.7%). The entire reach is designated as Conservancy by the current SMP.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 4 on file with the Washington State Historic Preservation Office (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings
No DOE sites/facilities are found in the SMP jurisdiction of Reach 4 (WDOE, 1998). There are no 303(d)-listed stream segments in Reach 4.

ECOLOGICAL FUNCTION SUMMARY

Reach 4 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 6.1% High soil permeability: 74% High channel migration: 22.7% 100 year floodplain: 81%	Wetlands: 6.8% Undeveloped: 51.2% Riparian cover: 55.2% Priority habitats: 3 Species of concern: 6 Anadromous habitat: 3.3 mi Total fish species: 4	Public land: 14.9%	Principal land use: Vacant/natural >10% Imperviousness: 28.7% Roads: 0.4 mi Barriers: Passable, insufficient flow, dam

Ecological functions along Reach 1 are principally impaired by agricultural and residential development, which covers 47.6% of the jurisdiction. These land uses, in addition to the 0.4 miles of roads, account for the majority of the estimated 28.7% of the reach that is greater than 10% impervious. In addition, one passable dam occurs along the reach. Upland vegetation has been removed and replaced with crops, buildings and lawns, which can promote increased runoff and nonpoint source pollution. Lower Ahtanum Creek has also been heavily diverted and

extensive areas have been diked or filled, losing floodplain connectivity. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 55.2% of the reach. Much of the reach is presently undeveloped (51.2%), while 6.8% is covered by wetlands. The reach provides habitat for six species of concern, as well as three priority habitats and aquatic habitat for four fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Opportunity for Protection Map *(Opp_Protection.pmf)*

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

1) Rationale: Existing riparian buffer on privately owned land protecting a recognized anadromous spawning habitat potential. Suggested Action: Work with private landowners to protect riparian buffer.
2) Rationale: Existing riparian buffer on residential land protecting a recognized anadromous spawning habitat in an area with high soil erosion potential. Suggested Action: Work with private landowners to protect riparian buffer.
3) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands.
4) Rationale: Existing riparian buffer on privately owned land protecting a recognized anadromous spawning habitat in an area. Suggested Action: Work with private landowners to protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Opportunity for Restoration Map *(Opp_Restoration.pmf)*

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

1) Marginal riparian buffer protecting an anadromous spawning or rearing habitat in an agricultural area with high soil erosion potential. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.

REACH 5

General Description

Reach 5 is an 8.1 mile segment of the North Fork of Ahtanum Creek that extends from the residential cluster near the irrigation diversions into John Cox and Shaw Knox ditches to the confluence of the North and Middle Forks. The average gradient of this reach is 2.0% (103 ft/mi.). However, this reach exhibits two distinctly different segments in terms of gradient. The lower (1.8 mi.) segment has a gradient of 3.8% (200 ft/mi.) while the upper (6.8 mi.) segment has a gradient of 1.5% (78 ft/mi.). Reach 5 is bounded to the north by the flanks of Pine Mountain for the lower 2 miles and an un-named ridge for the remainder and by Sedge Ridge on the south.

ABIOTIC - See Ahtanum Physical Map and Ahtanum Physical (Soil Characteristics) Map *(Ahtanumm_Physical.pmf)*

Geology/Landform (Table A2)

Reach 5, generally, is located in a narrowly-confined canyon bottom with steep slopes on both sides. The floodplain width of the upper, lower-gradient segment of this reach is generally uniform and averages 600 feet. The width of the floodplain of the lower, higher-gradient segment of this reach broadens, from 600 feet at the upper end to approximately 900 feet at the lower end. The surficial geology for the lower 8300 feet (1.6 mi.) of this reach is one of alluvium, transitioning to flow basalts for the remainder (WDNR, 2000).

Numerous areas of geologic hazards are noted throughout Reach 5. Along the 8.1 mile-long reach, a total of 7000 feet (1.3 mi.) and 29,000 feet (5.5 mi.) are rated Intermediate Risk and High Risk, respectively, due to the potential for rock fall or creep from oversteepened slopes (Yakima County, 2003c). An additional 3500 feet (0.7 mi.) of Intermediate Risk area abuts directly upon the SMP jurisdiction. A small area of High Risk is also noted due to the potential for flash flooding. Approximately 49.9% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table A3)

Reach 5 is dominated by basalt flows (78.6%), with 21.3% consisting of alluvial deposits (Washington Dept. of Natural Resources, 2000). The soils within the SMP jurisdiction are predominately fine sandy loams. Within this reach, only 0.3% of the soils are Aquic, a direct reflection of extremely little stream and hyporheic flow across and through much of the floodplain and, perhaps, the shallowness of the alluvial deposits (Yakima County, n.d.c). Soil permeability is very rapid with some areas that are moderate, runoff is classed as generally slow, but containing areas of medium and rapid, and the hazard of erosion is slight (NRCS, 2003).

Stream Type/Channel Form (Table A4)

Channel form throughout Reach 5 is currently classified as plane-bed. The stream exhibits sinuosity, but little meandering and exhibits some areas of channel bifurcation and channel coalescence throughout.

It is likely that the channel form of this reach was once somewhat more complex. Though now largely confined to a single channel, the stream was once clearly more migratory. The upper segment of Reach 5 is both a confining reach and a gaining reach, both of which function to maintain the concentration of flows. It would appear that the upper segment is an erosional/transport reach, sourcing a variety of sediment classes to lower reaches. Alternately, the lower segment is a dispersal reach in which energy is dissipated. Reduction in velocity and volume through lateral movement (channel migration) or braiding/distributaries (multiple channels), have resulted in a transport/depositional environment. A relatively small proportion (21.3%) of the SMP jurisdiction of Reach 5 is overlain by alluvium; the majority is likely a thin veneer overlying flood basalts (WDNR, 2000). Throughout this reach, there exists some opportunity, albeit limited, for flood waters to spread, shifting channel locations and alternately eroding and depositing materials. As a result, this reach has a slight potential for increased channel complexity. Approximately 2.4% of the reach has been identified as having a high potential for being in the channel migration zone, with another 1.2% having a moderate potential (Yakima County, n.d.b).

Stream Flow

Stream discharge for Ahtanum Creek has been gauged by USGS at three locations. Records are not continuous for any of these locations. The flow regime is typical of that of streams throughout the region, exhibiting lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer.

In the lower portion of its course, the North Fork Ahtanum begins to lose flow from distributaries to the South Fork. There are no irrigation diversions noted in this reach, however, a review of aerial photographs indicates that, at the very least, groundwater is being used to irrigate landscaping and limited pasturage. If these wells were shallow, they may have an impact on instream flows, however, no data is available to substantiate these impressions.

The magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper watershed.

Hyporheic Flow

Based on soil permeability studies, surficial recharge potential is thought to be high in this reach (NRCS, 2003). However, given the limited proportion of the SMP jurisdiction and floodplain underlain by alluvium, and the likely limited depth of the alluvial deposits, the hyporheic zone is expected to be restricted. The nature of the deposits in the lower segment of this reach likely makes hyporheic flow extremely complex.

Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

BIOTIC- See Ahtanum Biological Map *(Ahtanum_Biological.pmf)*

Natural Vegetation

Upland

Historic vegetation over approximately one-half is non-forest, and over the remainder as ponderosa pine – large and small stand (as designated by ICBEMP). Potential natural vegetation is predominately sagebrush-steppe with the remainder western ponderosa pine forest.

Riparian (Table A5)

Estimates of the SMP jurisdiction area covered by riparian vegetation range from 4.0% to 16.3% (WDFW, 2004b and Yakima County, 2003b). A review of aerial photography shows several areas on riparian communities that have been heavily disturbed, likely as a result of off-road vehicle use.

Wetlands (Table A5)

Wetlands occupy 8.7% of the SMP jurisdiction today (USFWS, 2003). It is likely that this reach once supported a great deal of beaver activity. The amount of wetland area reduced in size or lost altogether as a result of historic land use activities (logging, agriculture, residential, recreational) is difficult to estimate in this reach. An additional 3.5 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 A6)

Anadromous fish, once abundant in Ahtanum Creek, are now present in severely suppressed populations. Steelhead utilized the entirety of Ahtanum Creek, with redds concentrated in the segment below the confluence of the North and South Forks (WDFW, 2004c). Bull trout are present in the mainstem of Ahtanum Creek, however, they are probably more abundant in the upper portion of the drainage. Cutthroat trout are present in the Ahtanum watershed as are resident rainbow trout. Eight other resident fish species are also found in the reach, dominated by mountain whitefish.

Avian (Table A7)

GAP analysis data indicates that small portions of Reach 5 may provide habitat for two species of current concern, including the sage sparrow and sage thrasher (0.8% each) (WDFW, 2004a). This reach may provide raptor nesting and bald eagle wintering (anadromous fish run) habitat (WDFW, 2004b).

Terrestrial (Tables A5 and A7)

GAP analysis data indicates that portions of Reach 5 may provide habitat for three species of current concern, including principally the Townsend's big-eared bat (100%), as well as smaller portions for the black-tailed jack rabbit and Townsend's ground squirrel (0.8% each) (WDFW, 2004a). The entire riparian zone is listed as priority habitat (WDFW, 2004b). Oak woodland coverage ranges from 6.0% to 21.8% of the habitat type of the SMP jurisdiction. The entire SMP jurisdiction is noted as mule deer and black-tailed deer habitat, and 86.9% is noted as elk habitat.

CULTURAL MODIFICATIONS- See Ahtanum Cultural Modifications Map
(Ahtanum_Cultural_Modifications.pmf)

Land Use (Table A8)
Of the SMP jurisdiction lands along Reach 5, 54.6% remain vacant (Yakima County, 2004a). Of the remaining 45.4% of SMP jurisdiction lands, 17.8% is in forestry, 15.3% is under residential development, 6.5% is in agriculture, and 5.3% is occupied by roadways. Approximately 5.6% of the SMP jurisdiction is greater than 25% impervious. The Washington State Department of Natural Resources is the only public owner of land within the SMP jurisdiction, holding title to 13.3% (WDNR, 2003).

Transportation (Table A10)
Roadways occupy 5.6 miles of SMP jurisdiction land in Reach 5 (Yakima County, n.d.a).

Revetments (Table A10)
No revetments are found in the SMP jurisdiction land in Reach 5 (Yakima County, 2003a).

CULTURAL JURISDICTIONS- See Ahtanum Cultural Jurisdiction Map
(ahtanum_cultural_jurisdictional.pmf)

Zoning (Table A9)
Current zoning within the SMP jurisdiction of Reach 5 is predominantly Forested Watershed (68.2%) and Remote/Extremely Limited (22.3%) (Yakima County, 2004b). Minor portions of the jurisdiction are zoned Valley Rural (9.4%). The entire reach is designated as Conservancy by the current SMP.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 5 on file with the Washington State Historic Preservation Office (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings
No DOE sites/facilities are found in the SMP jurisdiction of Reach 5 (WDOE, 1998). There are no 303(d)-listed stream segments in Reach 5.

ECOLOGICAL FUNCTION SUMMARY

Reach 5 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 81.2% High erosion soils: 15.4% High soil permeability: 60.5% High soil runoff: 15.4% High channel migration: 2.4% 100 year floodplain: 49.9%	Wetlands: 8.7% Undeveloped: 54.6% Riparian cover: 4% Priority habitats: 5 Species of concern: 5 National Heritage site: 1 Anadromous habitat: 8.3 mi Total fish species: 11	Public land: 13.3%	Principal land use: Vacant/natural >10% Imperviousness: 10.9% Roads: 5.6 mi Barriers: Passable, insufficient flow, dam

Ecological functions along Reach 5 are principally impaired by agricultural and residential development, which covers 21.8% of the jurisdiction. These land uses, in addition to the 5.6 miles of roads, account for the majority of the estimated 10.9% of the reach that is greater than 10% impervious. In addition, one passable dam occurs along the reach. Upland vegetation has been removed and replaced with crops, buildings and lawns, which can promote increased runoff and nonpoint source pollution. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 4% of the reach, though a review of aerial photography shows several areas on riparian communities that have been heavily disturbed, likely as a result of off-road vehicle use. Much of the reach is presently undeveloped (54.6%), while 8.7% is covered by wetlands. The reach provides habitat for five species of concern, as well as five priority habitats, one national heritage site for Western bluebirds, and aquatic habitat for eleven fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Opportunity for Protection Map *(Opp_Protection.pmf)*

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

1) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning habitat adjacent to an upland area with high soil erosion potential. Suggested Action: Work with private landowners to protect riparian buffer.
2) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands
3) Rationale: Good elk and deer habitat in riparian zone. Suggested Action: Protect deer and elk habitat from encroachment.
4) Rationale: Wetlands on private property. Suggested action: Work with landowner to protect wetlands.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Opportunity for Restoration Map *(Opp_Restoration.pmf)*

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

1) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat in a residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
2) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer.
3) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat. Suggested Action: Work with private landowners to establish a larger riparian buffer.
4) Rationale: Marginal riparian buffer protecting an anadromous spawning habitat in an area with high soil erosion potential. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.

REACH 6

General Description

Reach 6 is the lower 1.3 mile segment of the South Fork of Ahtanum Creek that extends from the confluence of the North and Middle Forks. The average gradient of this reach is 1.8% (96 ft./mi.). Reach 6 is bounded to the northwest by Sedge Ridge and to the southeast by Ahtanum Ridge.

ABIOTIC- See Ahtanum Physical Map and Ahtanum Physical (Soil Characteristics) Map *(Ahtanumm_Physical.pmf)*

Geology/Landform (Table A2)
Reach 6 generally, is located in progressively-widening canyon bottom with relatively steep slopes on the southeast and gentle slopes on the northwest sides. The width of the floodplain is approximately 600 feet wide at the uppermost end of this reach, widening to 900 feet at the mouth of the South Fork canyon. From the mouth of the canyon to the juncture of the North and South Forks, the South Fork Ahtanum flows across its alluvial fan, this coalesces with that of the North Fork Ahtanum. The floodplain widens here to approximately 3200 feet. The surficial geology of this reach is one of alluvium (WDNR, 2000).

One rather extensive area of geologic hazard is noted in Reach 6. The upper 2500 feet (0.5 miles) is rated Intermediate Risk due to the potential for rock fall or creep from over-steepened slopes (Yakima County, 2003c). Approximately 70.1% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table A3)
Reach 6 is comprised of a mix of sedimentary deposits (43.4%) and alluvial deposits (55.9%) (WDNR, 2000). Basalt flows constitute 0.7%. The soils within the SMP jurisdiction are predominately silty or sandy loams (NRCS, 2003). Within this reach, only 5.7% of the soils are Aquic, a direct reflection of extremely little stream and hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Soil permeability is mostly rapid, runoff is classed as slow, and the hazard of erosion is slight (NRCS, 2003).

Stream Type/Channel Form (Table A4)
Channel form throughout Reach 6 is currently classified as plane-bed. The stream exhibits sinuosity, but little meandering and exhibits some areas of channel bifurcation and channel coalescence within the lower, 9000 foot (1.7 mi.) segment as it flows across the alluvial fan. Upon leaving the mouth of its canyon, the stream has been confined to the south by the alluvial depositions of the North Fork Ahtanum.

It is likely that the channel form of this reach was once somewhat more complex. Though now largely confined to a single channel, the stream was once clearly more migratory. This reach is a dispersal reach in which energy is dissipated. Reduction in velocity and volume through lateral movement (channel migration) or braiding/distributaries (multiple channels), and percolation

into the underlying alluvium have resulted in a transport/depositional environment. A large proportion (55.9%) of the SMP jurisdiction of Reach 6 that is overlain by alluvium, is likely relatively deep (WDNR, 2000). Throughout this reach, there exists the opportunity for flood waters to spread, shifting channel locations and alternately eroding and depositing materials. As a result, this reach has a great potential for increased channel complexity. Approximately 15.4% of the reach has been identified as having a high potential for being in the channel migration zone, with another 19.9% having a moderate potential (Yakima County, n.d.b).

Stream Flow

Stream discharge for Ahtanum Creek has been gauged by USGS at three locations. Records are not continuous for any of these locations. The location most germane to this reach is at the South Fork Ahtanum, immediately upstream of this reach, where flow has ranged from 5 to 20 cfs, with spring runoff flows of 90 cfs. The flow regime is typical of that of streams throughout the region, exhibiting lowest flows in late fall and early winter, rapidly ascending flows commencing in early spring, and gradually declining flows throughout late spring and summer.

In the lower portion of its course, the South Fork Ahtanum begins to gain flow from distributaries from the North Fork. There are no irrigation diversions noted in this reach, however, a review of aerial photography indicates the diversion of stream flow for irrigation uses is occurring throughout the upper portion of this reach.

The magnitude and frequency of peak flow events is likely increased by road runoff and timber harvest in the upper watershed.

Hyporheic Flow

Based on soil permeability studies, surficial recharge potential is thought to be high in this reach (NRCS, 2003). Given the high proportion of the SMP jurisdiction and much greater floodplain underlain by alluvium, the hyporheic zone is expected to be extremely widespread. The nature of the deposits likely makes hyporheic flow extremely complex. Examination of aerial photographs and topographic maps reveal numerous distributary channels, as well as numerous springs and re-surfacing streams in the lands within and downstream of this reach.

Approximately half of the reaches of Ahtanum Creek do not have a floodplain that is regularly inundated. This is reflected in the general channel incisement in many reaches limiting floodplain connectivity. Other reaches experience significant flooding of off-channel areas.

BIOTIC- See Ahtanum Biological Map *(Ahtanum_Biological.pmf)*

Natural Vegetation

<u>Upland</u>

Historic vegetation over approximately one-half is non-forest, and over the remainder as ponderosa pine – large and small stand (as designated by ICBEMP). Potential natural vegetation is predominately sagebrush-steppe with the remainder western ponderosa pine forest.

Riparian (Table A5)
Estimates of the SMP jurisdiction area covered by riparian vegetation range from 48.5% to 51.1% (WDFW, 2004b and Yakima County, 2003b).

Wetlands (Table A5)
Wetlands occupy 6.9% of the SMP jurisdiction today (USFWS, 2003). It is likely that this reach once supported a great deal of beaver activity. The amount of wetland area reduced in size or lost altogether as a result of historic agriculture is difficult to estimate in this reach. An additional 0.2 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 A6)
Anadromous fish, once abundant in Ahtanum Creek, are now present in severely suppressed populations. Steelhead utilized the entirety of Ahtanum Creek, with redds concentrated in the segment below the confluence of the North and South Forks (WDFW, 2004c). Bull trout are present in the mainstem of Ahtanum Creek, however, they are probably more abundant in the upper portion of the drainage. Cutthroat trout are present in the Ahtanum watershed as are resident rainbow trout and mountain whitefish.

Avian (Table A7)
GAP analysis data indicates that portions of Reach 6 may provide habitat for three species of current concern, including principally the sage thrasher (18.5%) and sage sparrow (14.3%), as well as the burrowing owl (4.2%) (WDFW, 2004a). This reach may provide raptor nesting and bald eagle wintering (anadromous fish run) habitat (WDFW, 2004b).

Terrestrial (Tables A5 and A7)
GAP analysis data indicates that portions of Reach 6 may provide habitat for four species of current concern, including principally the Townsend's big-eared bat (100%), as well as smaller portions for the Western gray squirrel (30.0%), black-tailed jack rabbit (18.5%), and Townsend's ground squirrel (18.5%) (WDFW, 2004a). The entire riparian zone is listed as priority habitat (WDFW, 2004b). 51% of the SMP jurisdiction is noted as elk, mule deer, and black-tailed deer habitat.

CULTURAL MODIFICATIONS- See Ahtanum Cultural Modifications Map *(Ahtanum_Cultural_Modifications.pmf)*

Land Use (Table A8)
Of the SMP jurisdiction lands along Reach 6, 36.8% remain vacant (Yakima County, 2004a). Of the remaining 63.2% of SMP jurisdiction lands, 31.0% is in agriculture, 30.5% is under residential development, and 1.7% is occupied by roadways. Approximately 1.7% of the SMP jurisdiction is greater than 25% impervious. The Yakama Nation and the U.S. Bureau of Land Management are the only public owners of land within the SMP jurisdiction, holding title to 47.3% and 4.8%, respectively (WDNR, 2003).

Transportation (Table A10)
Roadways occupy 0.4 miles of SMP jurisdiction land in Reach 6 (Yakima County, n.d.a).

Revetments (Table A10)
No revetments are found in the SMP jurisdiction land in Reach 6 (CWU, 2002).

CULTURAL JURISDICTIONS- See Ahtanum Cultural Jurisdiction Map *(ahtanum_cultural_jurisdictional.pmf)*

Zoning (Table A9)
Current zoning within the SMP jurisdiction of Reach 6 is Yakima Nation Closed Area (57.0%), Remote/Extremely Limited (21.8%), and Valley Rural (21.2%) (Yakima County, 2004b). The entire reach is designated as Conservancy by the current SMP.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 6 on file with the Washington State Historic Preservation Office (WSHPO, 2004).

DOE Sites/facilities and 303(d) Listings
No DOE sites/facilities are found in the SMP jurisdiction of Reach 6 (WDOE, 1998). There are no 303(d)-listed stream segments in Reach 6.

ECOLOGICAL FUNCTION SUMMARY

Reach 6 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep slopes: 15.2% High soil permeability: 36.5% High channel migration: 15.4% 100 year floodplain: 70.1%	Wetlands: 6.9% Undeveloped: 36.8% Riparian cover: 48.5% Priority habitats: 3 Species of concern: 7 Anadromous habitat: 1.7 mi Total fish species: 4	Public land: 52.1%	Principal land use: Vacant/natural >10% Imperviousness: 1.7% Roads: 0.4 mi

Ecological functions along Reach 6 are principally impaired by agricultural and residential development, which covers 61.5% of the jurisdiction. These land uses, in addition to the 0.4 miles of roads, account for the majority of the estimated 1.7% of the reach that is greater than 10% impervious. Upland vegetation has been removed and replaced with crops, buildings and lawns, which can promote increased runoff and nonpoint source pollution. Riparian vegetation, which is both a priority habitat and buffer for nonpoint pollution, covers approximately 48.5% of the reach. Much of the reach is presently undeveloped (36.8%), while 6.9% is covered by wetlands. The reach provides habitat for seven species of concern, as well as three priority habitats, and aquatic habitat for four fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Opportunity for Protection Map *(Opp_Protection.pmf)*

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

1) Rationale: Existing riparian buffer on privately owned agricultural land protecting a recognized anadromous spawning habitat in an area. Suggested Action: Work with private landowners to protect riparian buffer.
2) Rationale: Wetlands on private property. Suggested Action: Work with landowner to protect wetlands.
3) Rationale: Good elk and deer habitat in the riparian zone with wetlands. Suggested Action: Protect elk and deer habitat, riparian buffer, and wetlands.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Opportunity for Restoration Map *(Opp_Restoration.pmf)*

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

1) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in an residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.
2) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing habitat in an agricultural area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion and runoff controls and reduction of chemical applications.

APPENDIX

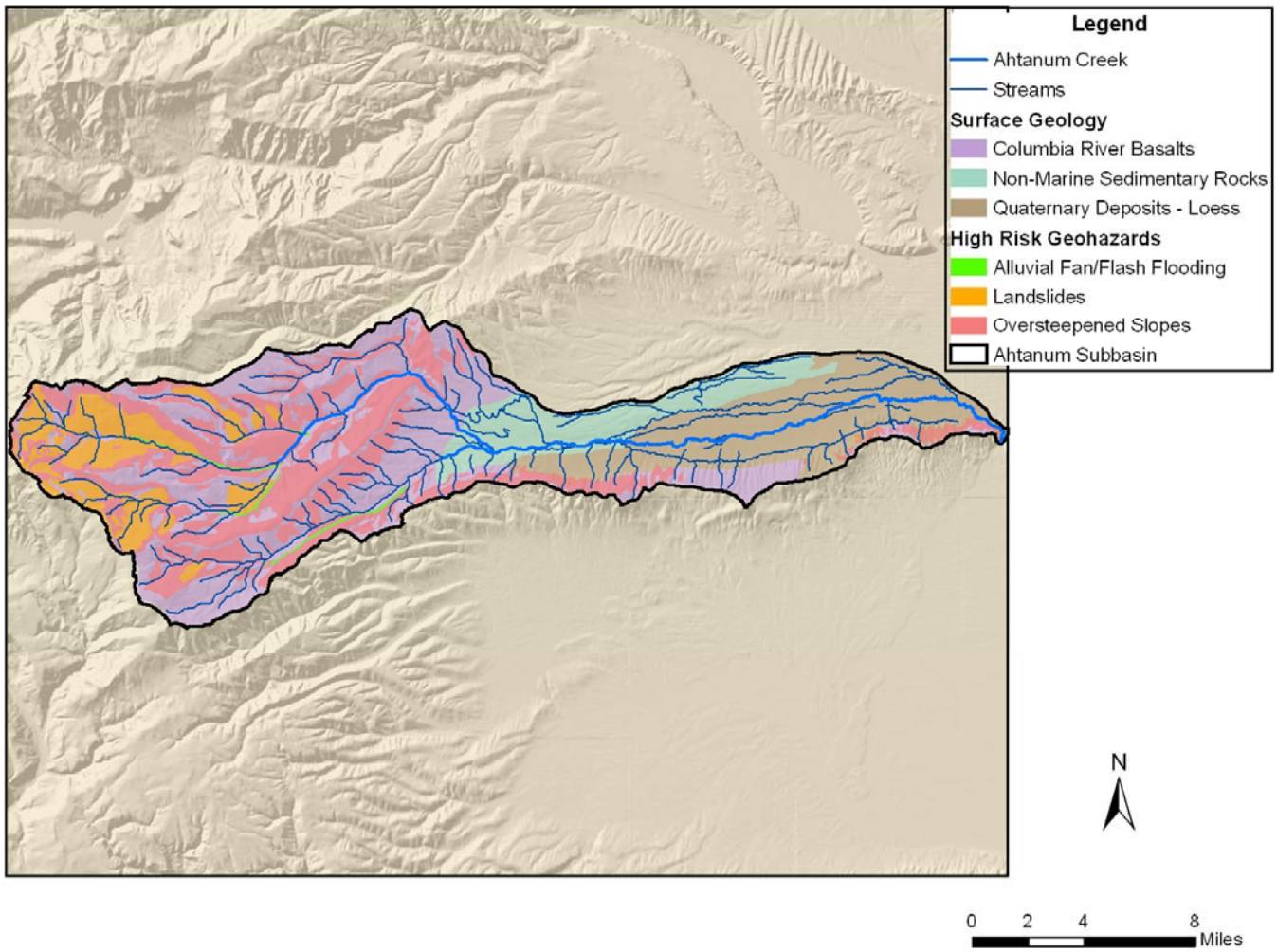

Figure A1. Geology and Geohazards in the Ahtanum Creek Sub-basin.

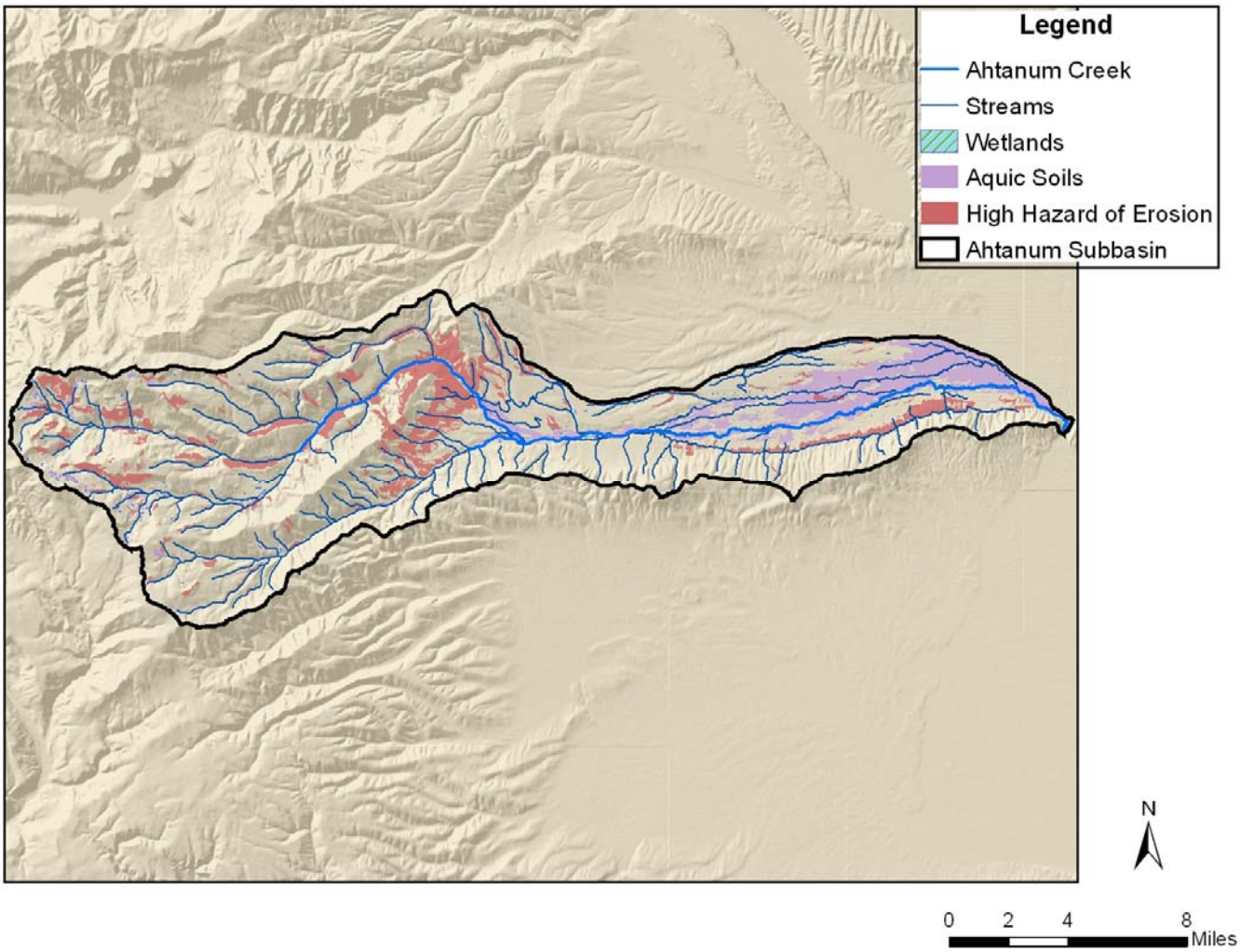

Figure A2. Wetlands and Soil Characteristics in the Ahtanum Creek Sub-basin.

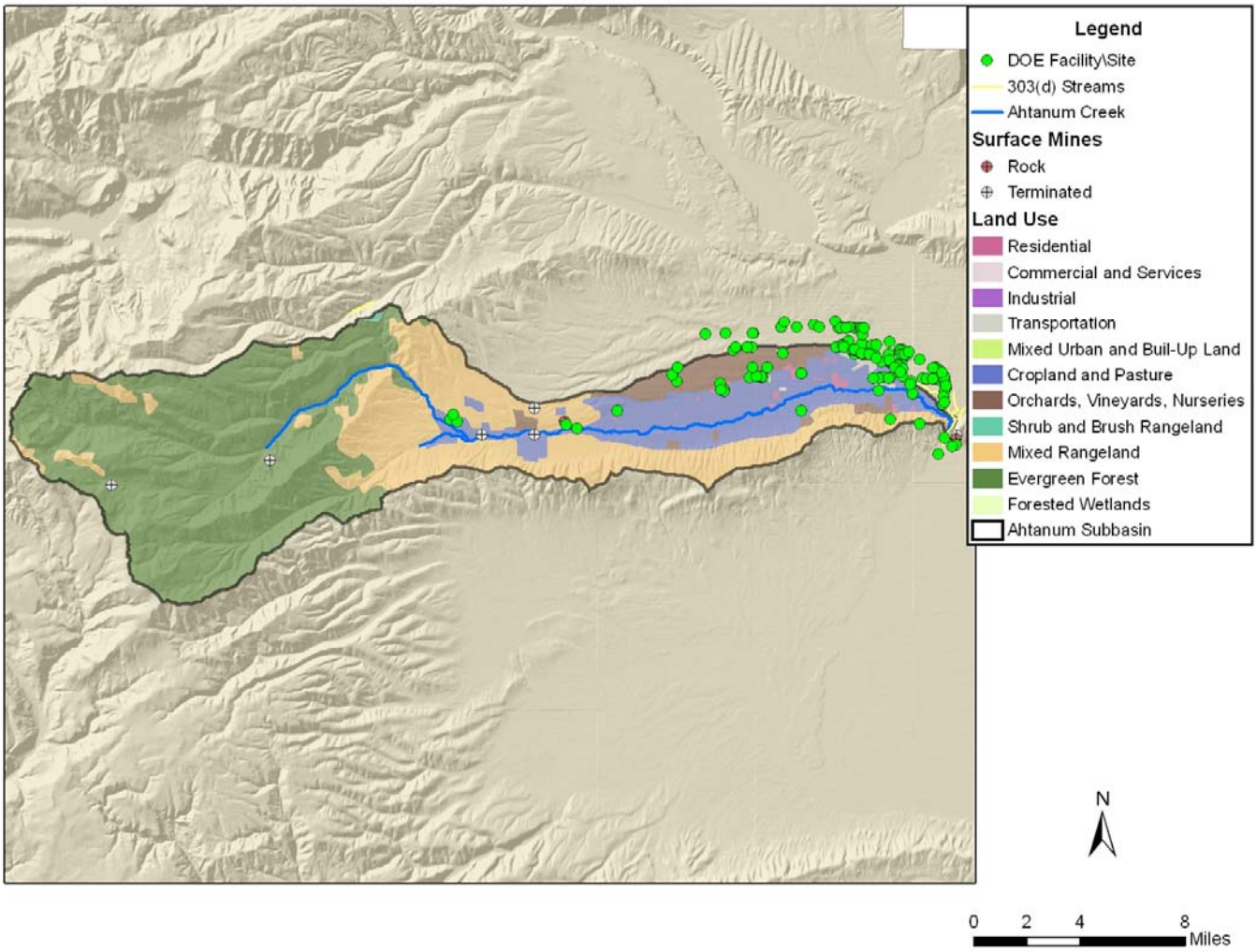

Figure A3. Cultural Modifications in the Ahtanum Creek Sub-basin.

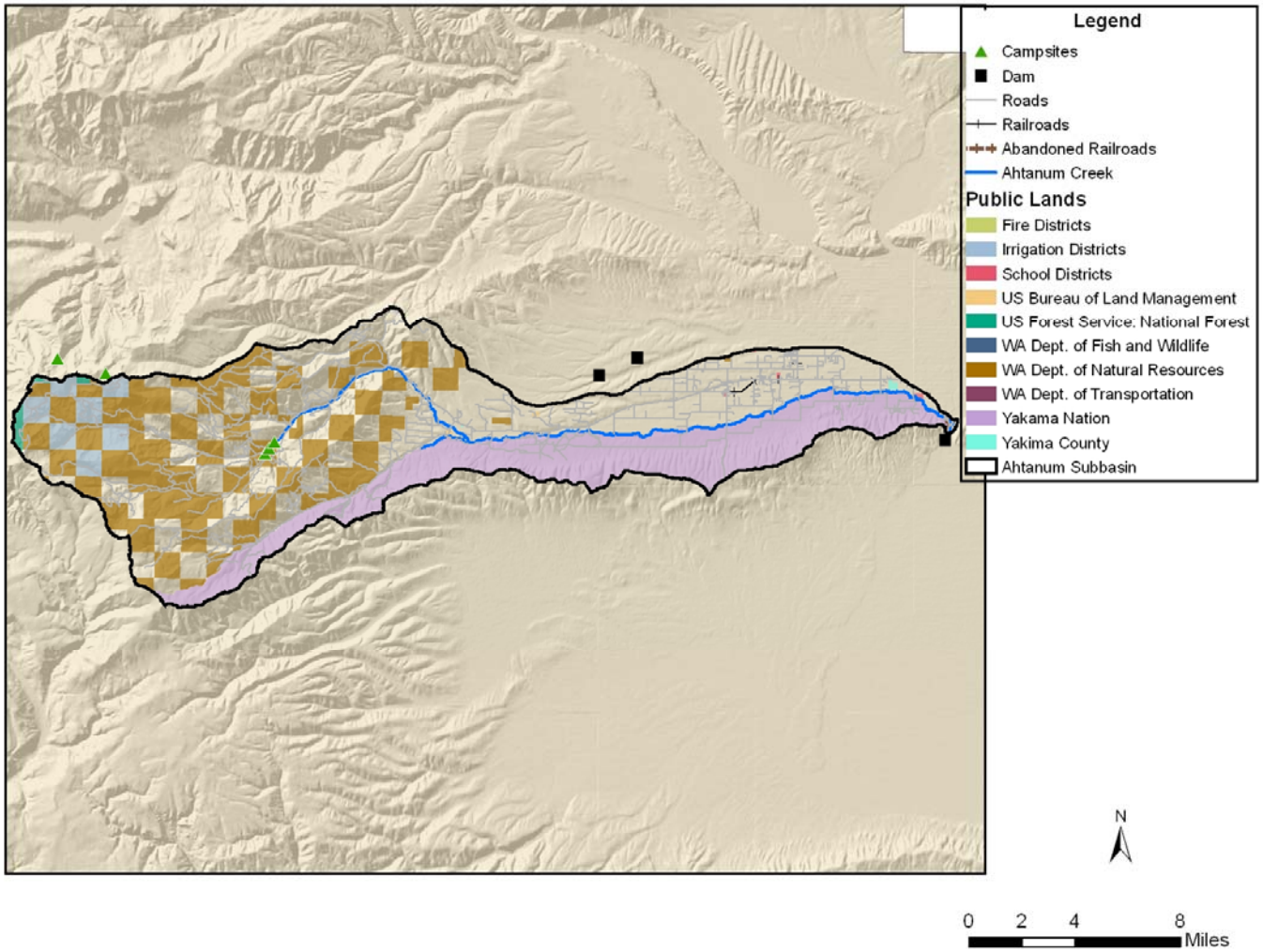

Figure A4. Public Resources and Access in the Ahtanum Creek Sub-basin.

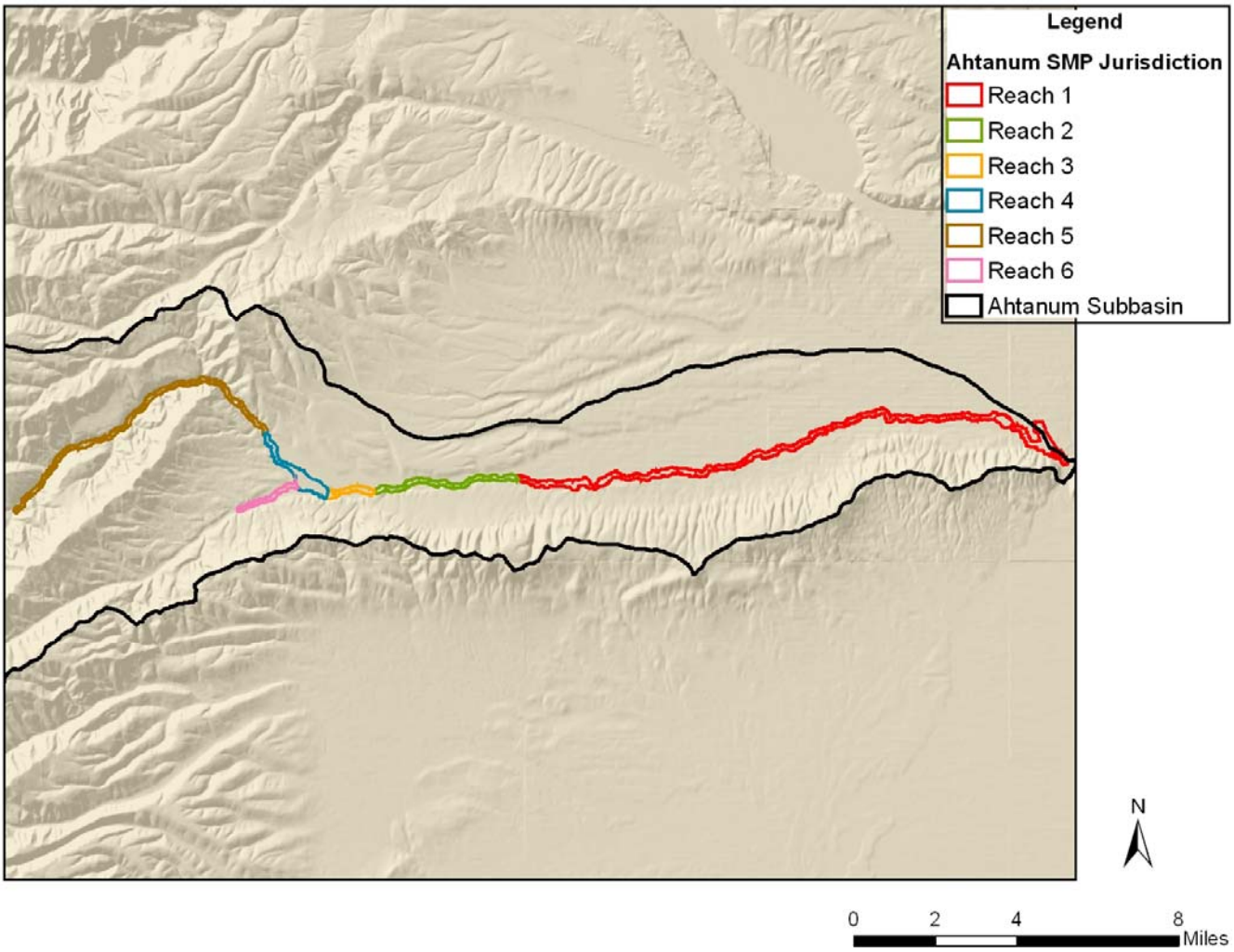

Figure A5. SMP Jurisdiction Reach Breaks for the Ahtanum Creek Sub-basin.

Table A1. SMP Reach Breaks for Inventory and Analysis, Ahtanum Creek Sub-basin.

Reach	Length	Start	Reach Break Justification	End
1	15.9 Miles	NE¼,NW¼ S17, T12N, R19E	Geomorphic: Confluence with Yakima River.	NW¼, SW¼, S18, T12N, R17E
2	3.9 Miles	NW¼, SW¼, S18, T12N, R17E	Landuse: Increase in agriculture land. Geomorphic: Floodplain becomes less confined.	West line of east half of S16, T12N, R16E
3	1.3 Miles	West line of east half of S16, T12N, R16E	Geomorphic: Point of constriction in the floodplain.	Confluence of Ahtanum and S.F. Ahtanum (S17, T12N, R16E)
4	3.3 Miles	SE¼, NE¼, S12, T12N, R15E	Land use: Increase in residential land use. Geomorphic: Near confluence of Ahtanum S.F. with main channel. Foodplain becomes more confined downstream of confluence (Ahtanum).	SE¼, NE¼, S12, T12N, R15E
5	8.1 Miles	Confluence of Ahtanum Creek N. F. and Ahtanum Creek Middle Fork(S24, T12N, R14E)	Landuse: Changes from forest to mixed range, crop, and pasture. Geomorphic: Floodplain widens above confluence.	Confluence of Ahtanum Creek N. F. and Ahtanum Creek Middle Fork(S24, T12N, R14E)
6	1.3 Miles	NW¼, SE¼ S18, T12N, R16E	Geomorphic: Near confluence of South Fork with main channel. Floodplain becomes confined (South Fork Ahtanum).	Confluence of unnamed creek and Ahtanum Creek S. F. (S24, T12N, R15E)

Table A2. Geology and Geohazard Characteristics for the Ahtanum Creek Sub-basin.

REACH	Geology		Geohazard	
	Lithology	**Area (%)**	**Geohazard**	**Area (%)**
1 Area: 1317.7 Acres	Alluvial Fan Deposits Alluvium Basalt Flows Continental Sedimentary Deposits or Rocks, Conglomerate Mass-Wasting Deposits, Mostly Landslides	0.3 98.5 0.1 0.3 0.8	Alluvial Fan/Flash Flooding (Intermediate Risk) Landslides (High Risk) Oversteepened Slopes (High Risk) 100-Year Floodplain	0.8 0.6 1.0 57.5
2 Area: 267.6 Acres	Alluvium Basalt Flows	97.5 2.5	Oversteepened Slopes (Intermediate Risk) 100-Year Floodplain	5.0 30.5
3 Area: 104.4 Acres	Alluvium	100.0	Alluvial Fan/Flash Flooding (Intermediate Risk) 100-Year Floodplain	0.4 58.5
4 Area: 284.4 Acres	Alluvium Basalt Flows Continental Sedimentary Deposits or Rocks, Conglomerate	89.3 3.4 7.3	Alluvial Fan/Flash Flooding (Intermediate Risk) Oversteepened Slopes (Intermediate Risk) 100-Year Floodplain	0.3 6.1 81
5 Area: 508.5 Acres	Alluvium Basalt Flows	21.3 78.6	Alluvial Fan/Flash Flooding (High Risk) Oversteepened Slopes (Intermediate Risk) Oversteepened Slopes (High Risk) 100-Year Floodplain	0.9 16.1 65.1 49.8
6 Area: 105.9 Acres	Alluvium Basalt Flows Continental Sedimentary Deposits or Rocks, Conglomerate	55.9 0.7 43.4	Oversteepened Slopes (Intermediate Risk) 100-Year Floodplain	15.2 70.1

Table A3. Soil Characteristics for the Ahtanum Creek Sub-basin.

REACH	Soil Characteristics*						Aquic Soils Area (%)
	Permeability	Area (%)	Runoff	Area (%)	Hazard of Erosion	Area (%)	
1	moderate	83.9	medium	11.2	moderate	6.9	47.5
	moderately rapid	4.0	slow	45.9	none to slight	12.1	
Area: 1317.7 Acres	moderately slow	8.9	sow to medium	0.2	slight	59.5	
	rapid	1.8	very rapid	0.3	slight to moderate	11.3	
	very rapid	0.7	very slow	30.8	very severe	0.3	
	N/A	0.0	very slow to ponded	10.8	N/A	9.3	
2	moderate	2.4	medium	1.6	moderate	1.6	11.8
	moderately rapid	7.3	slow	47.7	slight	47.4	
Area: 267.6 Acres	moderately slow	2.4	very slow	0.7	N/A	1.0	
	rapid	38.0					
3	moderate	0.4	slow	53.9	slight	53.9	24.2
	moderately rapid	0.4					
Area: 104.4 Acres	rapid	53.2					
4	moderately rapid	17.2	medium	0.6	moderate	0.6	44.2
	moderately slow	0.6	slow	91.2	slight	91.2	
Area: 284.4 Acres	rapid	74.0	N/A	0.3	N/A	0.3	
	N/A	0.3					
5	moderate	23.5	medium	9.6	high	15.4	0.3
	moderately rapid	14.4	rapid	15.4	moderate	9.6	
Area: 508.5 Acres	moderately slow	1.4	Slow	74.9	slight	74.9	
	rapid	0.8	N/A	0.1	N/A	0.1	
	slow	0.0					
	very rapid	59.7					
	N/A	0.1					

REACH	Soil Characteristics*						Aquic Soils Area (%)
	Permeability	**Area (%)**	**Runoff**	**Area (%)**	**Hazard of Erosion**	**Area (%)**	
6 Area: 105.9 Acres	moderate moderately slow rapid	10.5 3.0 36.5	medium slow	3.0 46.9	moderate slight	3.0 46.9	5.7

Table A4. Stream Channel Characteristics for the Ahtanum Creek Sub-basin.

REACH	Stream Lengths		Channel Migration	
	Total Streams (Miles)	**SMP Stream (Miles)**	**Potential**	**Area (%)**
1 Area: 1317.7 Acres Length: 15.9 Miles	16.2	15.9	high moderate low	7.2 12.4 7.9
2 Area: 267.6 Acres Length: 3.9 Miles	4.8	3.9	high moderate low	14.7 36.0 2.2
3 Area: 104.4 Acres Length: 1.3 Miles	1.3	1.3	high moderate low	46.9 30.0 0.8
4 Area: 284.4 Acres Length: 3.3 Miles	4.0	3.3	high moderate	22.7 17.9
5 Area: 508.5 Acres Length: 8.1 Miles	9.0	8.1	high moderate	2.4 1.2
6 Area: 105.9 Acres Length: 1.3 Miles	1.8	1.3	high moderate low	15.4 19.9 4.6

Table A5. Habitat Characteristics for the Ahtanum Creek Sub-basin.

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: 1317.7 Acres	0	0	8.7	32.8	Riparian Zones	54.2	Passable Dam	N/A
2 Area: 267.6 Acres	0	0	13.8	37.2	Riparian Zones	66.6	Passable Dam	Coho
3 Area: 104.4 Acres	0	0	5.3	50.7	Elk Mule and Black-Tailed Deer Riparian Zones	41.5 41.5 85.8	N/A	N/A
4 Area: 284.4 Acres	0	0	6.8	55.2	Elk Mule and Black-Tailed Deer Riparian Zones	92.1 92.1 73.3	Passable, Insufficient Flow, Dam	N/A
5 Area: 508.5 Acres	Western Bluebird	1	8.7	4.0	Cliffs/Bluffs Elk Mule and Black-Tailed Deer Oak Woodland Riparian Zones	0.4 86.9 117.7 21.8 16.3	Passable, Insufficient Flow, Dam	N/A
6 Area: 105.9 Acres	0	0	6.9	48.5	Elk Mule and Black-Tailed Deer Riparian Zones	50.8 50.8 51.1	N/A	N/A

Table A6. Fish Characteristics for the Ahtanum Creek Sub-basin.

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: 15.9 Miles	Coho Spring Chinook Summer Steelhead	15.9 2.4 15.9	Coho Summer Steelhead	15.9 15.8	Spring Chinook	2.4	Potentially Occupied	15.9	Mountain Whitefish Northern Pike Minnow Rainbow Trout	11.6 16.1 11.5
2 Length: 3.9 Miles	Coho Summer Steelhead	0.8 3.9	Coho Summer Steelhead	0.8 3.9	N/A	N/A	Currently Occupied Potentially Occupied	3.3 0.7	Mountain Whitefish Northern Pike Minnow Rainbow Trout	4.0 4.0 4.0
3 Length: 1.3 Miles	Summer Steelhead	1.3	Summer Steelhead	1.3	N/A	N/A	Currently Occupied	1.3	Mountain Whitefish Northern Pike Minnow Rainbow Trout	1.3 1.3 1.3
4 Length: 3.3 Miles	Summer Steelhead	3.3	Summer Steelhead	3.3	N/A	N/A	Currently Occupied	3.3	Mountain Whitefish Rainbow Trout	3.3 3.3

REACH	Anadromous Fish						Bulltrout		Resident Fish	
	Presence		Spawning		Rearing					
	Species	Length (Miles)	Species	Length (Miles)	Species	Length (Miles)	Presence	Length (Miles)	Species	Length (Miles)
5 Length: 8.1 Miles	Summer Steelhead	8.3	Summer Steelhead	6.8	N/A	N/A	Currently Occupied Potentially Occupied	8.3 0.0	Brown Trout Largescale Sucker Mountain Sucker Mountain Whitefish Northern Pike Minnow Rainbow Trout Redside Shiner Speckled Dace Westslope Cutthroat	0.1 0.1 0.1 8.3 0.1 8.3 0.1 0.1 0.2
6 Length: 1.3 Miles	Summer Steelhead	1.7	Summer Steelhead	1.7	N/A	N/A	Currently Occupied	1.7	Mountain Whitefish Rainbow Trout	1.7 1.7

Table A7. GAP Analysis of SMP Jurisdiction for the Ahtanum Creek Sub-basin.

REACH	GAP Analysis					
	Mammals		Birds		Vegetation	
	Type	Area (%)	Type	Area (%)	Type	Area (%)
1	Black-Tailed Jack Rabbit	2.6	Burrowing Owl	99.3	Central Arid Steppe	99.3
	Townsend's Big-Eared Bat	100.0	Ferruginous Hawk	2.6	Oak	0.7
Area: 1317.7 Acres	Townsend's Ground Squirrel	2.6	Sage Sparrow	2.6		
			Sage Thrasher	2.6		
2	Black-Tailed Jack Rabbit	10.5	Burrowing Owl	10.5	Central Arid Steppe	10.5
	Townsend's Big-Eared Bat	100.0	Sage Sparrow	0.2	Oak	89.5
Area: 267.6 Acres	Townsend's Ground Squirrel	10.7	Sage Thrasher	10.5		
3	Black-Tailed Jack Rabbit	2.2	Burrowing Owl	2.2	Central Arid Steppe	2.2
	Townsend's Big-Eared Bat	100.0	Sage Thrasher	2.2	Oak	97.8
Area: 104.4 Acres	Townsend's Ground Squirrel	2.2				
4	Black-Tailed Jack Rabbit	10.2	Burrowing Owl	1.2	Central Arid Steppe	10.2
	Townsend's Big-Eared Bat	100.0	Sage Sparrow	9.1	Oak	89.8
Area: 284.4 Acres	Townsend's Ground Squirrel	10.2	Sage Thrasher	10.2		
5	Black-Tailed Jack Rabbit	0.8	Sage Sparrow	0.8	Central Arid Steppe	0.8
	Townsend's Big-Eared Bat	100.0	Sage Thrasher	0.8	Oak	6.0
Area: 508.5 Acres	Townsend's Ground Squirrel	0.8			Ponderosa Pine	93.3
6	Black-Tailed Jack Rabbit	18.5	Burrowing Owl	4.2	Central Arid Steppe	18.5
	Townsend's Big-Eared Bat	100.0	Sage Sparrow	14.3	Oak	81.5
Area: 105.9 Acres	Townsend's Ground Squirrel	18.5	Sage Thrasher	18.5		
	Western Gray Squirrel	30.0				

Table A8. Land-use Characteristics for the Ahtanum Creek Sub-basin.

REACH	Land Use		Land Use Type on Rapid Runoff Soil		Impervious Surface	
	Type	**Area (%)**	**Type**	**Area (%)**	**Range**	**Area (%)**
1	Agriculture - Hay	21.6	Agriculture- Pasture/Grazing	0.3	0%	77.1
	Agriculture - Orchard/Vineyard	4.3			1-10%	19.8
Area: 1317.7 Acres	Agriculture - Pasture/Grazing	21.9			11-25%	1.4
	Commercial - Wholesale/Warehouse	1.5			26-50%	1.1
	Forestry	0.3			51-75%	0.1
	Industrial - Transportation	2.1			76+%	1.1
	Recreation - RV Parks	0.2				
	Residential - Multi-Family	0.5				
	Residential - Single Family	16.3				
	Vacant/Natural	32.0				
2	Agriculture - Hay	11.9	N/A	N/A	0%	94.0
	Agriculture - Orchard/Vineyard	7.8			1-10%	4.7
Area: 267.6 Acres	Agriculture - Pasture/Grazing	66.7			11-25%	0.0
	Forestry	0.4			26-50%	0.8
	Industrial - Transportation	1.3			51-75%	0.0
	Residential - Single Family	0.7			76+%	1.3
	Vacant/Natural	12.1				
3	Agriculture - Pasture/Grazing	42.8	N/A	N/A	0%	100.0
	Vacant/Natural	57.2			1-10%	0.0
Area: 104.4 Acres					11-25%	0.0
					26-50%	0.0
					51-75%	0.0
					76+%	0.0

REACH	Land Use		Land Use Type on Rapid Runoff Soil		Impervious Surface	
	Type	**Area (%)**	**Type**	**Area (%)**	**Range**	**Area (%)**
4	Agriculture - Pasture/Grazing	19.0	N/A	N/A	0%	54.3
	Industrial - Transportation	1.1			1-10%	17.0
Area: 284.4 Acres	Residential - Other	0.4			11-25%	20.2
	Residential - Single Family	28.2			26-50%	7.4
	Vacant/Natural	51.2			51-75%	0.0
					76+%	1.1
5	Agriculture - Pasture/Grazing	6.5	Agriculture-Pasture/Grazing	1.3	0%	61.3
	Forestry	17.8	Forestry	3.0	1-10%	27.9
Area: 508.5 Acres	Industrial - Transportation	5.8	Residential-Single Family	1.2	11-25%	5.3
	Recreation - Parks	0.3	Transportation	0.7	26-50%	0.7
	Residential - Single Family	15.3	Vacant/ Natural	9.7	51-75%	1.2
	Vacant/Natural	54.6			76+%	3.7
6	Agriculture - Pasture/Grazing	31.0	N/A	N/A	0%	78.2
	Industrial - Transportation	1.7			1-10%	20.1
Area: 105.9 Acres	Residential - Other	4.2			11-25%	0.0
	Residential - Single Family	26.3			26-50%	0.0
	Vacant/Natural	36.8			51-75%	0.0
					76+%	1.7

Table A9. Cultural Jurisdiction Characteristics for the Ahtanum Creek Sub-basin.

REACH	Zoning		Public Land Ownership		Environmental Designation (1981)	
	Type	**Area (%)**	**Owner**	**Area (%)**	**Designation**	**Area (%)**
1 Area: 1317.7 Acres	Agriculture Light Industrial Single Family Residential Rural Transitional Suburban Transitional Tribal Valley Rural	28.5 24.4 6.5 0.6 1.3 31.5 7.1	School Districts Yakama Nation	1.6 45.4	Conservancy Rural	21.5 78.5
2 Area: 267.6 Acres	Agriculture Yakama Nation Closed Area Tribal Valley Rural	2.6 8.1 17.4 71.8	Yakama Nation	48.0	Conservancy Natural	92.9 7.0
3 Area: 104.4 Acres	Yakama Nation Closed Area Valley Rural	57.2 42.8	Yakama Nation	46.0	Conservancy	99.9
4 Area: 284.4 Acres	Yakama Nation Closed Area Remote/Extremely Limited Valley Rural	20.2 5.7 74.1	Yakama Nation US Bureau of Land Management	8.0 6.9	Conservancy	100.0
5 Area: 508.5 Acres	Forested Watershed Remote/Extremely Limited Valley Rural	68.2 22.3 9.4	WA Dept. of Natural Resources	13.3	Conservancy	99.9
6 Area: 105.9 Acres	Yakama Nation Closed Area Remote/Extremely Limited Valley Rural	57.0 21.8 21.2	Yakama Nation US Bureau of Land Management	47.3 4.8	Conservancy	99.9

Table A10. Transportation Characteristics for the Ahtanum Creek Sub-basin.

REACH	Length of Revetments		Total Road Length (Miles)	Length of Railroads		Bridge Crossing (#)
	Type	Length (Miles)		Active (Miles)	Abandoned (Miles)	
1 Length: 15.9 Miles	n/a	0.0	2.7	0.4	0.3	5
2 Length: 3.9 Miles	n/a	0.0	0.4	0.0	0.0	0
3 Length: 1.3 Miles	n/a	0.0	0.0	0.0	0.0	0
4 Length: 3.3 Miles	n/a	0.0	0.4	0.0	0.0	0
5 Length: 8.1 Miles	n/a	0.0	5.6	0.0	0.0	0
6 Length: 1.3 Miles	n/a	0.0	0.4	0.0	0.0	0