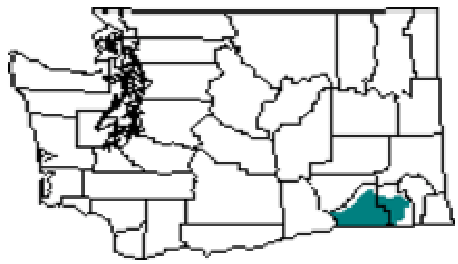
Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington:

2005 Annual Report

(From March 1, 2005 to March 1, 2006)



By

Glen Mendel, Jeremy Trump, and Mike Gembala
Washington Department of Fish and Wildlife
Fish Program - Fish Management Division
529 West Main Street, Dayton, WA 99328

For

U.S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
P.O. Box 3621
Portland, OR 97208

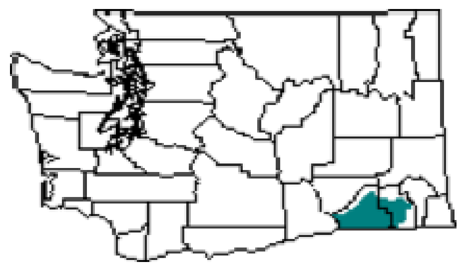
Project Number 199802000
Contract Number 00021599

November 2006

Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington:

2005 Annual Report

(From March 1, 2005 to March 1, 2006)



By

Glen Mendel, Jeremy Trump, and Mike Gembala
Washington Department of Fish and Wildlife
Fish Program - Fish Management Division
529 West Main Street, Dayton, WA 99328

For

U.S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
P.O. Box 3621
Portland, OR 97208

Project Number 199802000
Contract Number 00021599

November 2006

Acknowledgments

Many people and organizations contributed to this project. First we would like to thank the Bonneville Power Administration (BPA) for funding this project, and Jamie Swan (BPA) for her patience and assistance.

We appreciate the assistance from the Washington Department of Fish and Wildlife (WDFW) Snake River Lab (SRL) in sharing equipment for this project. Other Fish Management personnel also provided valuable assistance: Chris Fulton, Derek Gloyn, Larabee Miller, Mark Lambert, and Steve Jeffers assisted with data collection as well as data entry and data summarization.

Bill Neve and John Covert, with the Washington Department of Ecology (WDOE), provided valuable assistance both establishing and operating the constant recording stream flow monitors. We thank them all.

Perhaps most importantly, we would like to thank all of the private landowners who granted permission for field activities to be carried out on their property. Without access to the streams on private property, this study would not have been possible.

Table of Contents

List of Tables

List of Figures

Executive Summary

This study began in 1998 to assess salmonid distribution, relative abundance, genetic characteristics (stock status and trends), and the condition of salmonid habitats in the Walla Walla River Subbasin within Washington.

Stream flows in the Walla Walla Subbasin continue to show a general trend that consists of a decline in discharge in late June, followed by low summer flows and then an increase in discharge in fall and winter. Stream flows in the Walla Walla River have shown substantial increases in some areas in recent years. The increase is apparently associated with a 2000 settlement agreement between the U.S. Fish and Wildlife Service (USFWS) and the Irrigation Districts to leave minimum flows in the Walla Walla River.

Stream temperatures in 2005 in the Walla Walla Subbasin were similar to those in 2004. Upper montane tributaries maintained maximum summer temperatures below 65°F, while sites in the middle and lower Touchet and Walla Walla rivers frequently had daily maximum temperatures well above 68°F (high enough to inhibit migration in adult and juvenile salmonids, and to sharply reduce survival of their embryos and fry). High temperature is possibly the most critical physiological barrier to salmonids in the Walla Walla Subbasin, but other factors (available water, turbidity or sediment deposition, cover, lack of pools, etc.) also play a part in salmonid survival, migration, and breeding success. Increased flows in the Walla Walla River from the USFWS/Irrigation Districts settlement agreement, have not produced consistent improvements to stream temperatures.

Rainbow/steelhead trout (*Oncorhynchus mykiss*) represent the most common salmonid in the subbasin. Other salmonids including; bull trout (*Salvelinus confluentus*), chinook salmon (*Oncorhynchus tshawytscha*), and mountain whitefish (*Prosopium williamsoni*) had low densities and limited distribution throughout the subbasin.

Steelhead spawning surveys were conducted on four streams in the Walla Walla Subbasin in 2005. Surveyors found 80 redds on Mill Creek and 44 redds on the Coppei Creek system (22 on the South Fork Coppei, five on the North Fork Coppei, and 17 on the Mainstem Coppei Creek). Bull trout spawning surveys in the upper Touchet River tributaries found a total of 74 redds and 51 live fish (57 redds and 36 live fish in the Wolf Fork, 2 redds and 2 live fish in the Burnt Fork, and 15 redds and 13 live fish on the North Fork Touchet). Spring chinook spawning surveys were conducted in portions of the North Fork Touchet, Wolf Fork, and mainstem Touchet River in 2005, because five adults were observed at the adult trap in Dayton, plus redds were observed during bull trout spawning surveys. Surveyors found two redds and six live fish on the North Fork Touchet, 11 redds and seven fish (six live and one dead) on the Wolf Fork, and four redds and four fish (three live and one dead) on the Touchet River.

Recommendations for assessment activities in 2006 include:

1) summarize temperature and stream flow data from this project and what affects it has on salmonid migration.
2) continue to summarize steelhead spawning survey data

3) continue to monitor Mill Creek and Coppei Creek Watershed for steelhead spawning, and evaluate Yellowhawk Creek for steelhead spawning and summer rearing
4) continue bull trout spawning surveys in the upper Touchet River Watershed
5) summarize all data on whitefish in the Walla Walla Subbasin
6) complete genetic analysis and include results in the next annual report
7) develop joint BPA proposals with CTUIR and others for habitat and fish monitoring that will improve coordination and ensure collaborative, effective research, monitoring and evaluation (RM&E) within the subbasin.

Introduction

Concerns about the decline of native salmon and trout populations have increased among natural resource managers and the public in recent years. As a result, a multitude of initiatives have been implemented at the local, state, and federal government levels. These initiatives include development and implementation of management plans and actions intended to protect and restore salmonid fishes and their habitats.

In 1998 bull trout (*Salvelinus confluentus*) were listed under the Endangered Species Act (ESA) as "Threatened" for the Walla Walla Subbasin. Steelhead (*Oncorhynchus mykiss*) were listed as "Threatened" in 1999 for the mid-Columbia River and its tributaries (which includes the Walla Walla Subbasin). These ESA listings and uncertainty regarding stock status and trends emphasize the need for information about these threatened salmonid populations and their habitats.

The Washington Department of Fish and Wildlife (WDFW) is entrusted with "the preservation, protection, and perpetuation of fish and wildlife...[and to] maximize public recreational or commercial opportunities without impairing the supply of fish and wildlife (WAC 77.12.010)." In consideration of this mandate, the WDFW submitted a proposal in December 1997 to the Bonneville Power Administration (BPA) to assess salmonid distribution, relative abundance, genetics, and the condition of salmonid habitats in the Walla Walla River Subbasin. This project was initiated in 1998 and continues to collect information regarding fish and habitat conditions in the Walla Walla Subbasin.

This WDFW project, Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington (project # 199802000) is one of two salmonid and habitat monitoring projects funded by the BPA in the Walla Walla Subbasin. The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) is conducting steelhead and chinook radio telemetry and smolt trapping studies, as well as other monitoring and evaluation activities in the subbasin (Contor and Sexton 2003, Schwartz et al. 2005) with the Walla Walla Basin Natural Production Monitoring and Evaluation Project (project # 200003900). In early 2006, WDFW, CTUIR and others worked together to combine these efforts into two proposals: 1) a collaborative habitat assessment/monitoring project proposal and 2) a fish assessment/monitoring project proposal, for implementation in 2007-2009. This collaborative effort is intended to improve coordination, planning and implementation of the status and trend monitoring for habitat and fish conditions in the subbasin, as well as to improve capabilities for conducting effectiveness monitoring and implementation of a regionally standardized research, monitoring and evaluation (RM&E) program that can be rolled up to the larger units or scales: evolutionarily significant unit (ESU) for steelhead, Distinct Population Segment (DPS) for bull trout, or at State or Regional scales.

The primary purposes of this project are to collect baseline, or status and trend, biological and habitat data to identify major data gaps and to draw conclusions whenever possible. The study reported herein details the findings of the 2005 field season (March to December, 2005). All WDFW reports for this project are available on the BPA and WDFW websites. They can be found on the BPA website at: www.efw.bpa.gov/searchpublications/ type in Mendel for the author's last name. They are also found on the WDFW website at: wdfw.wa.gov/fish/papers/se_wash_reports/index.htm with other fish monitoring reports from southeast Washington.

Background

The Walla Walla River and its major tributaries including the Touchet River and Mill Creek comprise a subbasin of 1,758 square miles (USACE 1997), including 2,454 stream miles in the larger streams and tributaries (Knutson et al. 1992). The majority of the watershed (73%) lies within the State of Washington (USACE 1992 and 1997), with the upper Walla Walla River Watershed and a small portion of the Mill Creek Watershed in Oregon (Figure 1). Approximately 15% of the subbasin is comprised of forestland, and 82% is used for cropland and grazing. Over 90% of the subbasin in Washington is privately owned. The primary physiographic features of the subbasin are the steep, lightly timbered Blue Mountains in the southeast, the rolling foothills, the Palouse Prairie throughout much of the rest of the landscape, and the incised valleys of area rivers and streams. The main streams in the subbasin include Mill Creek, and the Touchet and Walla Walla Rivers, plus many smaller tributaries (Figure 1). The Walla Walla River Watershed, including the Walla Walla River and Mill Creek, originates from a fine network of deeply incised streams on the western slopes of the Blue Mountains. The Touchet River Watershed originates from similar streams on the northwestern slopes of the Blue Mountains, and also from seasonal streams draining Palouse hillsides to the north. The Touchet River drains into the Walla Walla River just west of the town of Touchet, Washington. The Walla Walla River drains into the Columbia River near Wallula Gap, about 21 miles above McNary Dam and 6 miles from the Oregon border.

Historically the subbasin probably produced substantial runs of both spring chinook (*Oncorhynchus tshawytscha*) and summer steelhead. The last substantial run of wild chinook took place in 1925; thereafter chinook populations continued a precipitous decline, and the species is considered extirpated in the subbasin (Nielson 1950, ACOE 1997). Anecdotal accounts and reports of historic fisheries in adjacent subbasins, indicate that chum (*Oncorhynchus keta*) and coho (*Oncorhynchus kisutch*) could have occurred in substantial numbers in the Walla Walla Subbasin (Pirtle 1957), but little written documentation exists. Endemic steelhead persist throughout much of the study area. Populations of steelhead in the Washington portion of the Walla Walla River Watershed (including Mill Creek) were considered depressed in 1992 and unknown in 2002, and populations in the Touchet River Watershed were considered depressed in both 1992 and 2002 (WDF and WDW 1993, WDFW 2002). Recently as many as 300,000, and presently up to 185,000, non-endemic hatchery steelhead (Lyons Ferry stock) and 50,000 endemic steelhead have been released annually in the middle Touchet and lower Walla Walla rivers under the Lower Snake River Compensation Program (LSRCP) to provide harvest mitigation for the four lower Snake River dams (Bumgarner et al. 2003).

Not all native salmonids in the subbasin are anadromous. Mountain whitefish (*Prosopium williamsoni*), bull trout and rainbow/redband (*Onchorhynchus mykiss*) trout exist within the subbasin. However, only rainbow/redband trout retain a wide distribution. Whitefish are not common in the Walla Walla Subbasin and appear to have a clustered distribution. In the past,

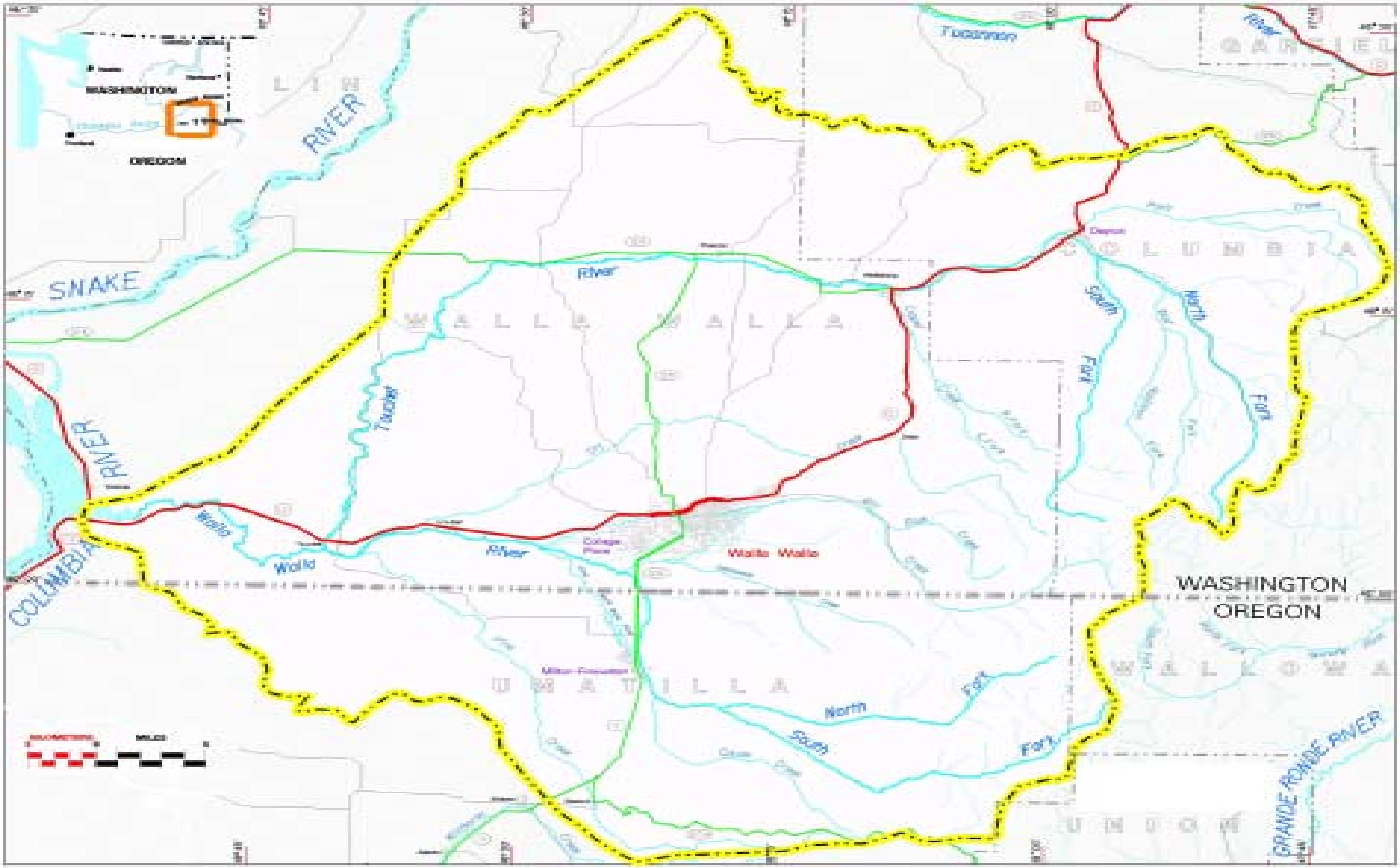


Figure 1. Walla Walla watershed (modified from map courtesy of USACE, Walla Walla District).

bull trout are thought to have been abundant and widely distributed in the subbasin. Currently, bull trout distribution is generally limited to montane upper tributaries of the Touchet River, Walla Walla River, and Mill Creek (Mongillo 1993, USFWS 2002, USFWS 2004). However, bull trout are known to migrate into the middle or lower reaches of these rivers during winter months. Many factors have led to the decline of bull trout in southeast Washington. Damaged riparian vegetation, increased sedimentation, and decreased water flows have resulted in elevated water temperatures beyond the tolerance of this cold water species (Mongillo 1993). Introduced rainbow trout and brown trout (*Salmo trutta*) may have increased competition or predation for bull trout.

Several non-native fish species have been introduced to support recreational fishing, or have strayed into the subbasin. The Washington Department of Game (now WDFW) began stocking brown trout in the Touchet River in July 1965. Stocking of brown trout was discontinued in 1999 due to concerns about competition, hybridization, and predation with native bull trout, and steelhead, or rainbow/redband trout. Common Carp (*Cyprinus carpio*) were introduced as early as 1884 (Walla Walla Daily Journal 1884). Channel catfish (*Ictalurus punctatus*), smallmouth bass (*Micropterus dolomieu*), and bluegill (*Lepomis macrochirus*) are some of the warm water fish that now occur in the lower reaches of the subbasin. Additionally, since 1999, three-spine stickleback (*Gasterosteus aculeatus*) have been found in the Walla Walla River and some of its lower tributaries by WDFW personnel involved with this project.

Historic and contemporary land-use practices have had a profound impact on salmonid species abundance and distribution in the subbasin. Fish habitat in area streams has been severely degraded by urban and agricultural development, grazing, tilling, irrigation, logging, road building and maintenance, recreational activities and flood control. Agricultural diversions have severely impacted stream flows in the Walla Walla River since the 1880's (Nielson 1950). Nearly all (99%) of the surface water diversions within Washington are for the purpose of irrigation (Pacific Groundwater Group 1995). The reduced stream flows created by irrigation withdrawals adversely impact salmonid abundance, survival and distribution within the subbasin. Additionally, many unscreened or partially screened diversions and fish passage barriers existed within the subbasin, although most diversions have been screened recently. Additional limiting factors for fish include loss of riparian habitat and function and poor fish passage conditions, as well as detrimental changes in hydrology, sediment transport, stream channel stability and summer water temperatures caused by local land use activities. Many habitat restoration projects are underway in both the Washington and Oregon portions of the subbasin under State or federal funding to address these habitat problems.

Out-of-basin manmade impacts to local fish populations have also been substantial. Salmon and steelhead migrating to or from the ocean must pass through four dams (Bonneville, The Dalles, John Day, and McNary) and reservoirs in the Columbia River before reaching their destination. Juvenile and adult salmonid mortalities occur as they pass through each reservoir and dam. Other out-of-basin impacts include over-harvest, habitat destruction in the lower Columbia River and estuary, predation, and industrial pollution. In addition, natural environmental fluctuations (droughts, floods, and ocean productivity) have significantly affected local fish populations.

WDFW fish management efforts in the Washington portion of the Walla Walla Subbasin are focused on protection and restoration of dwindling naturally produced steelhead and bull trout, assessment of the status and trends of indigenous salmonid stocks, implementation and evaluation of a large mitigation program for steelhead and resident trout under the LSRCP, and providing recreational fishing opportunities. Accurate estimates of natural adult escapement and juvenile production, as well as survival rates by life stage, are needed for adequate stock status and trend monitoring, ESA recovery planning and implementation, and for effectiveness monitoring. This information is needed before further planning and implementation of hatchery supplementation occurs in the subbasin. Because of the complex life history of steelhead, further data describing survival rates by age class and eventual smolt production estimates by brood year will be necessary to fully understand population dynamics. Estimates of smolt-to-adult and adult-to-adult survival for these wild steelhead populations will complete the data set needed to evaluate whether within-basin or out-of-basin factors are most significantly limiting production in these subbasins. Once these data are available, efforts to stabilize and rebuild the populations (whether through habitat improvement, hatchery intervention or both) can be effectively directed to ensure maximum success.

The WDFW habitat and salmonid assessment project (199802000) has been underway since the summer of 1998 to collect basic field data about habitat conditions such as summer water flows and temperatures, and to determine salmonid distributions and relative abundance levels. This project was originally scheduled to conclude after 2001, but in 2000 we determined that steelhead escapement, production, and survival information was necessary to complete the evaluation of the status of steelhead stocks in the subbasin, and evaluate their need for modified management or hatchery enhancement. We also recognized the need for modifying our broad scale sampling approach after four years, while maintaining some level of continued baseline monitoring, such as bull trout and steelhead spawning surveys. Unfortunately, BPA would not allow modification of any tasks or objectives in our project even though the Independent Science Review Panel (ISRP) and the fishery co-managers approved our 2001 modified proposal. Our current project continues assessment and monitoring for steelhead use in the mainstem Walla Walla River and tributaries in Washington, and for bull trout distribution and abundance in the Touchet River system. Over the past several years we have documented stream flows, temperatures and salmonid use in stream reaches that have been typically dewatered to leave stream channels dry or with very low flows in Washington. In 2000, a settlement agreement between irrigators and the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) that included maintaining stream flows at minimal levels for operation of fish ladders in portions of the Walla Walla River. We were able to collect stream flow, temperature and fish use data to compare with previous measurements from the same locations. The settlement agreement was renegotiated in 2001 to increase stream flow requirements for subsequent years. Therefore, we have a unique opportunity to evaluate the benefits for salmonids and their habitats by adding or maintaining water to these, and adjacent, stream reaches in the Walla Walla Subbasin.

Rationale and Significance to Regional Programs

The Walla Walla Subbasin may represent a unique opportunity to implement portions (measures 3.2C, 4.1, 4.1A, 4.2A, 7.0A, 7.1C, 7.3, 7.6C, 7.8G, 10.5A), of the Northwest Power Planning

Council's (NWPPC) Fish and Wildlife Program (FWP, NWPPC 1994, NWPPC 2000). The FWP calls for monitoring the status of naturally spawning populations (7.1C, 7.1C3) of steelhead, salmon and bull trout (10.5A). Significant portions of the upper subbasin in both Oregon and Washington retain spawning populations of wild steelhead and bull trout. These populations have shown a resiliency to habitat degradation and a persistence of moderate abundance and productivity during recent years when other steelhead and bull trout populations have been forced toward extinction. Because the subbasin lies above only the four lower Columbia River dams, these populations may be able to persist under moderate survival and habitat conditions and possibly rebuild themselves under improved habitat conditions. The 1995 FWP identifies the need to "halt (the) decline and rebuild populations to sustainability" (Sect. 4.1), and promote the funding of projects directed at critical unknowns or uncertainties (3.2 C, 4.1 A, 4.2 A). Some of the critical uncertainties that exist within the subbasin include: 1) spawning escapements and productivity levels for native salmonids, 2) are populations of steelhead and bull trout within the Walla Walla Subbasin above, or at, replacement, and if not; 3) how best can managers intervene to rebuild steelhead and bull trout populations that appear to be on the edge of viability in the Walla Walla Subbasin? A full understanding of Walla Walla River steelhead and bull trout life history and their productive capacity is needed to ensure that actions which are proposed, whether watershed type habitat improvements (4.1 A), hatchery supplementation (7.0 A, 7.3), or both, are correctly directed to achieve maximum benefit for the fish (4.1). More detailed information regarding the habitat conditions and spring chinook abundance and distribution would be useful to guide the spring chinook reintroduction efforts by CTUIR and natural chinook repopulation occurring in the Touchet River Watershed.

The Walla Walla Subbasin Plan (Walla Walla Watershed Planning Unit and the Walla Walla Basin Watershed Council, 2004) and the draft Walla Walla Hatchery Master Plan (CTUIR 2004) recommend using hatcheries for supplementing or increasing steelhead for harvest or natural production, and reintroduction of spring chinook salmon in the Walla Walla Subbasin. The Northwest Power Planning Council FWP (NWPPC 1994) calls for regular updating of Subbasin Plans (7.0C) and collection of population status, life history and other data on naturally spawning (wild) populations (7.1C and 7.1C.3), which includes bull trout (10.5A). It also calls for improved hatchery production, or developing new hatchery supplementation programs, while proceeding with extreme caution to avoid damaging remaining naturally spawning populations (7.2). The FWP recommends developing, implementing and evaluating supplementation plans and risk assessments (7.3, 7.3B.1, 7.4A). It also requires writing a hatchery production Master Plan (7.4B, 7.4L) that includes identification of factors limiting production and setting project goals and objectives. A watershed assessment, and coordination of habitat planning efforts is recommended (7.6C). The FWP also states that instream flow needs should be established and protected (7.8G). The Independent Scientific Review Panel (ISRP 1997) recommended that watershed assessments precede implementation of restoration projects (III.B.11). The NWPPC in its Annual Implementation Work Plan for Fiscal Year 1998 (NWPPC 1997) concurred with the ISRP's recommendation that watershed assessments that describe habitat conditions, as well as needs and opportunities for habitat restoration for fish stocks inventoried in that subbasin, precede implementation of restoration activities.

The current existence of the CTUIR spring chinook reintroduction program using non-endemic Carson stock chinook, and the WDFW managed LSRCP hatchery steelhead mitigation efforts within the subbasin raises additional questions: 1) can hatchery mitigation programs be used to increase or maintain harvest opportunities and protect or increase natural production without adversely affecting natural production; 2) should mitigation releases of non-endemic hatchery steelhead continue, or should new broodstocks be developed to reduce the potential for deleterious impacts to ESA listed fish or to potentially supplement endemic natural production, and 3) can natural populations within the subbasin be used for hatchery broodstock development without serious damage to, or for enhancement of, natural production. Answers to these questions must be obtained and integrated into existing management plans if managers are to make informed decisions that benefit (or at least not harm) natural populations. More fish data are needed to effectively meet requirements outlined in the FWP, by the ESA, Washington's Wild Salmonid Policy (WDFW 1997), in the Walla Walla River Basin Hatchery Master Plan (CTUIR 2004) and the Snake River Salmon Recovery Plan for Southeast Washington (SRSRB 2005).

The Walla Walla Subbasin Plan (WWC 2004) outlines a suite of priority actions to be employed in priority geographic areas and to address imminent threats. It goes on to describe a collaborative approach to research monitoring and evaluation that will empower local and regional agencies and authorities. Specifically, the Subbasin Plan describes the subbasin measurements of abundance, productivity, spatial structure, and diversity that are needed to 1) describe status and trends, 2) evaluate project/program performance, and 3) facilitate continued prescriptive and predictive modeling and updates to the Walla Walla Subbasin Plan. Many aspects of the priority elements of the monitoring and evaluation needs identified in the Subbasin Plan are part of this WDFW monitoring and evaluation project.

Relationships to Other Projects

Many aquatic habitat enhancement projects have been implemented with state or federal funds in the subbasin in the past 10-15 years. The Northwest Power Conservation Council (NPCC) and BPA have approved and funded several habitat enhancement projects with the CTUIR, WDFW and the Walla Walla and Columbia Conservation Districts. The Walla Walla Basin Watershed Council has implemented habitat restoration projects in the Oregon portion of the subbasin, some with Oregon Watershed Enhancement Board (OWEB) funding, and the Walla Walla Watershed Alliance, Tri-State Steelheaders, WDFW, conservation districts and others have completed restoration projects on the Washington side of the subbasin with both state and other federal funding. The Columbia County Conservation District (CCCD) has used state funding for instream flow and water quality studies in the Touchet River. WDFW and the Washington Department of Ecology (WDOE) have used both state and BPA funding for Instream Flow Incremental Methodology (IFIM) flow monitoring studies in parts of the Walla Walla River and Mill Creek. WDOE and Oregon Water Resources have used state and federal funding for Total Maximum Daily Load (TMDL) studies for the Walla Walla River and these projects are still ongoing in the Washington portion. There is a current effort to develop a bi-state agreement to conserve and protect instream water and develop a Habitat Conservation Plan (HCP) between local governments and citizens and the USFWS and NMFS. The BPA, Washington legislature and Washington's Salmon Recovery Funding Board (SRFB) have funded hundreds of water intake screening and other fish passage restoration efforts throughout the subbasin. The Subbasin Plan (WWC 2004) and a draft Hatchery Master Plan (CTUIR 2004) have recently been completed for the subbasin. Hatchery and Genetics Management Plans (HGMP) for the use of Lyons Ferry stock steelhead (WDFW 2005a) and for Touchet endemic steelhead (WDFW 2005b) have been completed for the LSRCP hatchery program in the subbasin. WDFW conducts LSRCP hatchery monitoring and evaluation within the Touchet and Walla Walla rivers. The U.S. Forest Service (USFS) and the Oregon Department of Fish and Wildlife (ODFW) are conducting spawning surveys and a radio telemetry study for bull trout in Mill Creek. The CTUIR, ODFW, Irrigation Districts, WDFW and the Walla Walla Watershed Council have collaborated on additional bull trout, steelhead and chinook radio telemetry studies in Walla Walla and Touchet rivers. The U.S. Geological Survey (USGS), Utah State University and the USFWS are conducting intensive long term bull trout studies in the Walla Walla River within Oregon. All these efforts in the Walla Walla Subbasin are for planning or implementing watershed and fish stock restoration programs, collecting additional habitat or fish information, or for providing and protecting instream flows and maintaining or enhancing salmonids.

The WDFW project (199802000) continues on-going watershed habitat and salmonid fish stock assessment in that portion of the Walla Walla Subbasin within Washington State. This project continues to assess the habitat conditions (particularly stream flows and water temperatures) that affect steelhead and bull trout passage and use in the lower portion of the subbasin, as well as the potential for adult and juvenile passage of spring chinook salmon, which have been recently reintroduced through an experimental reintroduction project undertaken by CTUIR within the South Fork Walla Walla River and Mill Creek. Habitat and fish stock assessment in the middle and upper subbasin within Washington contributes to evaluation of the amount of potential rearing and spawning habitat available for restoring chinook salmon. Our assessment activities evaluate habitat conditions, limiting factors, and habitat use, as well as distribution, density, abundance and genetic stock characterization of existing natural populations of steelhead and bull trout.

This project has been an integral part of the expanding assessment, planning and recovery efforts funded by state, federal and private monies for listed salmonids in the Walla Walla Subbasin. This project has contributed substantial amounts of data to numerous planning and recovery efforts including: Washington Conservation Commission’s Limiting Factors Analysis (Kuttle 2002), the Draft Umatilla/Walla Walla Basin Bull Trout Recovery Plans (USFWS 2002, USFWS 2004), and BPA/CTUIR’s Draft Walla Walla Watershed Plan (not completed), the Walla Walla Subbasin Summary (CTUIR 2001) and the Walla Walla Subbasin Plan for the NPCC (WWC 2004), and finally for the Snake River Salmon Recovery Plan for Southeast Washington (SRSRB 2005). We have worked cooperatively with subbasin managers and irrigators in providing flow and temperature data that resulted in a cooperative agreement to increase instream flows for salmonids, and with managers and planners to prioritize stream reaches for habitat improvements funded by Washington’s SRFB to benefit salmonids. Water temperature data and fish distribution data collected by WDFW under this project have contributed to the Walla Walla River TMDL (WDOE 2006 – DRAFT) and the recent efforts to revise water temperature standards for the Walla Walla Subbasin by the Environmental Protection Agency (EPA).

The WDFW project complements the CTUIR project (Walla Walla Basin Natural Production Monitoring and Evaluation - 200003900) in the Washington portion of the subbasin. The WDFW project also assists the CTUIR monitoring and evaluation project by providing information regarding adult spring chinook returns to the Touchet River or resulting from an experimental reintroductions effort in the Walla Walla River and upper Mill Creek. We have discovered several passage problems with our project that we have identified for CTUIR and other projects to implement repairs and improvements. Therefore, this project could aid CTUIR's habitat enhancement project (#199604601). Our flow and fish distribution data can be used to guide all of the CTUIR's passage projects (#199601100, 199601200 and 200003800) and our flow data have been incorporated into several of the annual reports for the CTUIR's passage operations projects. Our project provides the opportunity to have concurrent, complimentary projects on-going within different sections of the subbasin. The funding and implementation of our BPA project ensures involvement by WDFW in a full assessment of the subbasin within both Oregon and Washington that is completed in a timely manner.

Project History

This project (Assessment of Habitat and Salmonids in the Walla Walla Watershed in Washington) began in late spring of 1998. It has changed project numbers several times, but the title and intent has not changed since its inception. The project number in 1998 was 98-020-00. In 1999 BPA changed the project number to 199901100, and then changed it to 199802000, where it currently remains. In 2001 during the provincial review process, WDFW proposed modifying and expanding the project to focus more on fish monitoring and less on stream flow and temperature measurements. We proposed improving adult escapement estimates by implementing adult trapping in Mill Creek (Bennington Dam) and improving and operating the adult trap at Dayton Dam in the Touchet River. We intended to estimate total redds in the Washington portion of Mill Creek and the Touchet River and the smolt production, and survival rates for steelhead in those drainages. We proposed installing and operating a smolt trap in the Touchet River and one for Mill Creek if ODFW did not install one. We intended to implant passive interrogation tags (PIT tags) in bull trout at the Dayton Dam to evaluate age/growth and obtain relative survival estimates for migrants. Unfortunately, BPA would not fund any modifications or additions to projects during that provincial review and we were forced to continue monitoring activities similar to those of the first 4 years of the project. Past costs of this project to BPA have varied from about $100,000 to $185,000 per year.

The goal of the project has been to collect baseline field data concerning fish habitat conditions and salmonid status information that are needed for planning, guiding or evaluating numerous state and federal watershed and fish protection or restoration planning efforts within the subbasin. We are about to begin our 8th year of data collection in 2006 (annual project renewal date and initiation of field data collection is 1 March). The subbasin is so large that we have had to adjust our area of data collection emphasis each year to adequately sample the entire subbasin within Washington. Our project has continued to collect valuable information regarding habitat conditions and salmonid status.

We have obtained detailed stream flow and water temperature data from most of the streams in the subbasin within Washington State. The WDOE assisted us with the water flow monitoring as a subcontractor and they are now expanding and supplementing our stream flow monitoring. We collect water temperature information from approximately 50-60 temperature monitors deployed in most of the mainstem and tributary reaches of the subbasin within Washington. We worked with WDOE to increase water quality monitoring by that agency early in this project. Many previously undocumented passage barriers have been found and reported by this project. In some cases these barriers have precluded salmonids from spawning and rearing in nearly entire streams (e.g. Mud Creek a tributary to Dry Creek, Lewis Creek a tributary to the North Fork Touchet River, Russell Creek a tributary to Yellowhawk Creek, etc.). We worked with WDOE to initiate instream flow modeling in several sections of the Walla Walla Subbasin to recommend minimum instream flows. WDOE and the recently formed Watershed Council for understanding stream discharge and managing water have expanded that effort.

This project has enabled us to provide a greatly increased understanding of salmonid and non-salmonid distribution and aquatic community composition. We have greatly increased knowledge regarding salmonid abundance for both adults and juveniles. Our sampling efforts have included conducting spawning ground surveys for steelhead, bull trout and spring chinook, and completing summer electrofishing or snorkel surveys in most Washington streams to determine salmonid distribution and relative abundance. These surveys have also provided information about introduced brown trout distribution and abundance, and some presence and distribution data for spring or fall chinook salmon. Further, the surveys have provided some information about the distribution of native non-salmonids and introduced species within the subbasin. Our sampling efforts have documented steelhead and bull trout spawning or rearing in areas previously only suspected of supporting these fish and in areas where they were not suspected or known to exist. For example, a new population or group of bull trout was discovered spawning and rearing in the upper Burnt Fork, a tributary of the South Fork Touchet River, where only a few sub-adults had been documented in the past. We have documented large numbers of steelhead spawning and rearing in Coppei Creek where we previously suspected only low-level use by steelhead.

Our habitat and fish distribution/abundance data has been in high demand from WDFW and other resource managers with state or federal funding for planning and habitat implementation efforts within the subbasin. As an example, the Washington Conservation Commission used much of our data to compile and describe all known or suspected habitat limiting factors and salmonid distribution information into a report for the Walla Walla Subbasin, with emphasis on the Washington portion of the subbasin. Additionally, the preparation of the draft Umatilla/Walla Walla Bull Trout Recovery Plan (USFWS/ODFW) has substantially relied on our bull trout, temperature and habitat data. Much of our habitat and salmonid data has been incorporated into a draft Walla Walla Watershed Plan that was funded by BPA through the CTUIR, with additional funds by the Columbia County Conservation District and others. Our data has been used in the prioritization of stream reaches and types of habitat projects to fund for the state SRFB selection of projects. Data collected for this project by WDFW was instrumental in completing the NPCC Subbasin Summary, populating the Ecosystem Diagnosis and Treatment (EDT) model and compiling the 2004 Subbasin Plan, and for the recently completed Snake River Salmon Recovery Plan for Southeast Washington. Our goal has been to provide our summarized data to other resource managers in the subbasin and elsewhere as rapidly as possible. We have provided in-season (near real time) data summaries to the Irrigation Districts, USFWS and others to meet their court settlement instream flow monitoring needs to retain water in the mainstem Walla Walla for fish, and to the many other restoration planning or implementation efforts for habitat and fish protection or enhancement. Our annual reports have been printed and copies widely distributed within the subbasin. They are also posted on the BPA and WDFW websites.

Our sampling of stream flows, temperatures and fish use in the Walla Walla River, and other dewatered or low flow stream segments (such as the Mill Creek flood channel and the previously dry "Settlement Agreement" portion of the mainstem Walla Walla River), has provided a unique opportunity to help determine the benefits of supplementing low summer stream flows in the subbasin. Our project has contributed to monitoring the benefits of adding water to the mainstem Walla Walla River in a collaborative effort with local irrigators and the Walla Walla Basin Watershed Council. We played a key monitoring role in a test to add summer water flows to the flood channel in Mill Creek and to understand the complexities of this highly altered stream reach (Mendel et al. 2002).

Our project has coordinated with ODFW, USFS, CTUIR and others to collect genetic samples from adult steelhead and bull trout at existing trap facilities within the subbasin. We have also collected juvenile steelhead genetic (allozyme and DNA) samples from several streams in the Touchet River Watershed, and elsewhere. These samples can be combined or compared with samples from juvenile steelhead that were collected in the Touchet and other portions of the Walla Walla Subbasin by CTUIR. We now have enough samples to begin to analyze and attempt to determine the genetic characteristics of bull trout and steelhead from various drainages within the subbasin, and to help identify the number of stocks and their relationships within and outside the subbasin.

WDFW's data collection for this project has enabled WDFW staff to play a crucial role in all planning and management efforts in the Walla Walla Subbasin and other local or regional planning efforts. WDFW has provided large amounts of funding for fish management personnel engaged in collaboration, cooperation and planning for this subbasin. WDFW has contributed substantial amounts of time and funding to oversight and participation in this project and use of the resulting information for local and regional status reviews and restoration planning.

Project History by Year

Year One: FY98.

Initiated the project and secured access to private lands. Monitored stream flows (12 sites) and temperatures (18 sites) in many reaches, conducted electrofishing (36 quantitative sites) and snorkel surveys (13 sites) for salmonid distribution and abundance, conducted bull trout spawning surveys in Wolf Fork (16.5 miles), coordinated genetic tissue sampling and began analysis.

Year Two: FY99.

Documented many new barriers, collected allozyme and DNA genetic samples, collected IFIM data in lower Mill Creek and part of Walla Walla River, assisted with fish salvage in Oregon on the Walla Walla River, began steelhead spawning surveys (54.4 miles), completed the 1998 annual report. We also continued monitoring stream flows (33 sites), temperatures (36 sites), and conducted electrofishing (63 quantitative sites and 24 qualitative sites), snorkeling (38 sites), and bull trout spawning surveys (24.6 miles).

Year Three: FY2000.

Found an unknown population of bull trout in the Burnt Fork (multiple age classes and spawning), discovered more potential fish passage barriers, summarized data used in limiting factors, Watershed Resource Inventory Area (WRIA) 32 and subbasin summaries, completed the 1999 annual report. We also continued monitoring stream flows (51 sites), temperatures (39 sites), and conducted electrofishing (78 quantitative sites and 90 qualitative sites), snorkeling (8 sites), bull trout spawning surveys (26.0 miles), and steelhead spawning surveys (99.1 miles).

Year Four: FY01.

Conducted a collaborative test to evaluate increased stream flows through the Mill Creek Flood control channel, began monitoring the effects of the Walla Walla Settlement Agreement on flows, temperature, and salmonid populations. Continued spawning surveys and juvenile sampling efforts. Completed the modeling for the IFIM flow study. Completed the 2000 annual report. We also continued monitoring stream flows (56 sites), temperatures (74 sites), and conducted electrofishing (38 quantitative sites and 64 qualitative sites), snorkeling (53 sites), bull trout spawning surveys (66.1 miles), steelhead spawning surveys (65.1 miles), and began spring chinook spawning surveys (18.5 miles).

Year Five: FY02.

Began multiple years of sampling on Whiskey Creek to monitor affects on salmonid populations from the removal of a barrier near the mouth. Continued spawning surveys and juvenile sampling efforts for distribution and abundance. Increased data compilation and database entries. Completed the 2001 annual report. We also continued monitoring stream flows (57 sites), temperatures (66 sites), and conducted electrofishing (32 quantitative sites and 90 qualitative sites), bull trout spawning surveys (61.3 miles), and steelhead spawning surveys (44.4 miles).

Year Six: FY03.

Continued monitoring of temperature (67 sites), stream flow (49 manual flow sites and 6 continuous flow monitors), fish distribution and abundance by electrofishing (71quantitative sites and 132 qualitative sites) and snorkeling (10 sites). Completed 2002 annual report. We also continued bull trout spawning surveys (78.2 miles) and steelhead spawning surveys (48.8 miles).

Year Seven: FY04.

Completed design of a habitat survey protocol and began testing it on several small streams, coordinated and lead a large fish salvage effort on Mill Creek from Roosevelt St. up to the Yellowhawk Creek diversion. Completed 2003 annual report. We also continued monitoring stream flows (61 sites), temperatures (70 sites), and conducted electrofishing (49 quantitative sites and 64 qualitative sites), bull trout spawning surveys (69.0 miles), steelhead spawning surveys (115.0 miles), and spring chinook spawning surveys (15.8 miles).

Year Eight: FY05.

We continued to monitor effects of the Walla Walla Settlement Agreement on temperatures and flows in the Walla Walla River. Completed the 2004 Walla Walla annual report. We also continued monitoring stream flows (41 sites), temperatures (54 sites), and conducted electrofishing (7 quantitative sites and 26 qualitative sites), bull trout spawning surveys (48.8 miles), steelhead spawning surveys (53.2 miles), and spring chinook spawning surveys (31.5 miles).

The purpose of the WDFW Project (Assessment of Habitat and Salmonids in the Walla Walla Watershed in Washington – 199802000) has been to provide status and trend information for habitat conditions and salmonids in the Washington portion of the Walla Walla Subbasin. This project also provides technical support for salmonid and habitat planning and management.

Project objectives for the Washington portion of the Walla Walla Subbasin, as reflected in our 2005 BPA Statement of Work, were to: 1) Assess habitat conditions for anadromous and resident salmonids, 2) Determine salmonid distribution and relative abundance, 3) Identify and characterize genetic stocks of steelhead and bull trout, and 4) Compile and disseminate results and conclusions to guide fish management and subbasin planning.

To date, this project has met its contractual obligations regarding project objectives and statement of work deliverables. Data summaries, compiled into annual reports from current and previous project efforts, have been submitted to BPA and are available at the BPA and WDFW websites.

Project History by Objective

Objective 1: Assess habitat conditions for anadromous and resident salmonids.

- This project initiated and assisted WDOE and WDFW flow specialists with implementation of IFIM flow modeling studies in lower Mill Creek and reaches in the mainstem Walla Walla River. These studies were later expanded by WDOE/WDFW with other funding and further expanded by Walla Walla County and Columbia County (with WDOE funding) for use in setting minimum stream flows in various reaches of the Walla Walla River, Touchet River, and Mill Creek.
- This project annually deployed, operated and summarized data from up to 74 temperature monitors throughout the Washington portion of the Walla Walla Subbasin. These data substantially improved our understanding and identification of distribution of suitable and unsuitable salmonid spawning and summer rearing areas and why these areas are or are not used. These temperature data also aided us in determining the timing, frequency and duration of potential thermal blocks to migrating salmonids in lower river areas during late spring, early summer and fall.

- WDFW and WDOE collaboratively deployed and summarized data from continuous stream flow monitoring gauges at up to six sites per year. WDFW took periodic manual stream flow measurements at these gauge sites as calibration flows as well as up to 61 other sites throughout the subbasin in Washington to provide information on water availability throughout the low flow period (late spring, summer and fall each year). This information substantially improved knowledge of where and when reaches were water limited. We also participated in "seepage runs" with other partners to account for all tributary or spring inflows and water use, or loss, for the mainstem Walla Walla River from Milton-Freewater, Oregon to the mouth of the river. This was completed during late spring and summer when irrigation demands are highest. Several of our flow monitoring sites are now used by WDOE for year round flow monitoring. Our data and other flow data have been used by agencies and local participants to set flow management points, as well as to establish minimum stream flow requirements in Washington State regulations, and for recommended flow targets.
- This project discovered and reported frequent chemical fish kills in lower Mill Creek caused by inappropriate chlorine use and uncoordinated government regulations. These regulations were changed and WDOE increased monitoring requirements, thereby substantially reducing or eliminating chemical fish kills in lower Mill Creek.
- Habitat conditions were inventoried and documented in Coppei Creek, the Washington portion of East Little Walla Walla, and lower Titus Creek to provide empirical data and a better understanding of habitat conditions.
- More than a dozen permanent and seasonal fish barriers that were previously undocumented have been identified by this project since 1998. We opened seasonal barriers to allow passage and reported them to appropriate habitat or enforcement staff for long term resolution. Permanent barriers were reported to others for removal or modification to provide adequate fish passage. For example, a barrier dam was located on lower Lewis Creek (North Fork Touchet River tributary). It was then removed by Columbia County Conservation District. Another dam was located in lower Whiskey Creek. WDFW removed that dam with other funding. In both cases, this project was able to locate these barriers and have them removed. This project has been documenting how successful these removal projects have been by monitoring steelhead and bull trout reestablishment in Lewis Creek, and recent steelhead use of upper Whiskey Creek.
- Our understanding of salmonid distribution, fish kills, water availability and water quality issues have been substantially improved in the Mill Creek Flood Control Channel. We provided fish and habitat data summaries for a multiple agency test of adding water flows during summer to benefit fish in the flood channel. Results showed that adding up to 10 cfs to the flood channel during summer actually caused fish kills in the lower concrete channel where fish were surviving in cool ground water. Overland flows from the wide, shallow weir section of the channel reached nearly 90^{o}F before entering the concrete channel that has groundwater inputs of about 55^{o}F.
- A settlement agreement was reached between the USFWS and irrigators that added water to a dewatered reach of the mainstem Walla Walla River. We have been fortunate to collect pre and post treatment data for stream flows, water temperatures and fish use in the Washington reaches affected by this agreement. Stream flows have increased near the Washington/Oregon state line, but water temperatures have not improved

substantially because warm overland flow is mixing with cooler groundwater that was the only water available before the settlement agreement. Salmonid use and distribution has improved because of more water, with greater surface area and volume, even though water temperatures are marginal.

Objective 2: Determine salmonid distribution and relative abundance.

- Field sampling during summer and fall has substantially improved knowledge of bull trout distribution and relative abundance in the Touchet River and its tributaries. We expanded annual spawning survey distribution and increased the number of surveys per year. We discovered bull trout in previously undocumented areas such as Lewis Creek (North Fork Touchet tributary) and Burnt Fork (South Fork Touchet tributary). Previously, bull trout had not been documented spawning in the South Fork Touchet River Watershed. We have been able to add to the known spawning distribution and abundance of bull trout in the Wolf Fork of the Touchet River (approximately 5 miles) and refine it further in the North Fork Touchet (approximately 2.5 miles). The North Fork spawning population appears to be declining whereas the Wolf Fork population was increasing until recently.
- After many years of absence, spring chinook have periodically been documented entering the Touchet River since 1997. We have been able to document timing, distribution, relative abundance and frequency of periodic spring chinook returns to the Touchet River Watershed during trapping at the Dayton Dam (mostly under LSRCP funding), summer electrofishing and snorkel surveys, and by conducting spawning surveys when appropriate. These fish are generally unmarked and presumably from out-of-basin but they appear to be potentially reestablishing a natural spring chinook population in the Touchet River Watershed.
- WDFW coordinated a Mill Creek Flood Channel fish salvage effort with several other agencies and organizations. The salvage area covered approximately 2 miles of channel and captured and transported just over 600 salmonids. WDFW has participated as necessary in several other fish salvage efforts since 1998 in the Walla Walla Subbasin to try to move fish from dewatered stream reaches to suitable habitat.
- WDFW has been able to document steelhead spawning and relative abundance in many reaches or tributaries where they were not known to spawn, or where they spawn in higher numbers than expected. For example, we have documented up to 47 steelhead redds in Coppei Creek Watershed where we previously thought only a few steelhead spawned each year.
- Summer electrofishing and snorkel surveys (usually 50-135 sites per year) have enabled WDFW to estimate juvenile steelhead summer rearing densities and population abundance for all areas of the Washington portion of the Walla Walla Subbasin (included in the Subbasin Plan). This information was useful for determining priority protection and restoration areas for the Subbasin Plan and the Snake River Salmon Recovery Plan in Southeast Washington. These sampling efforts also improved knowledge regarding distribution and relative abundance for other salmonid species.
- This project has monitored steelhead spawning in Mill Creek upstream of Bennington Dam, a U.S. Army Corps of Engineers (USACE) flood control dam. After few steelhead

redds or fish were found the first couple years of surveys WDFW approached the USACE and worked with them and others to improve operation of the fishway and low flow channel at the dam and to coordinate temporary modifications to the fish ladder entrance to improve passage. Steelhead passage appears to be improved as reflected by substantially more redds and fish documented after fishway modification. WDFW is now working with the USACE as a sponsor of an 1135 project to modify the dam or fishway to provide fish passage that meets current state and federal passage criteria.

- WDFW has been monitoring reestablishment of bull trout and steelhead after Lewis Creek dam was removed, and steelhead reestablishment in Whiskey Creek after a small dam was modified to improve fish passage. Both of these passage improvement projects appear to have been successful at allowing reestablishment of salmonid populations in many miles of streams that had been blocked.
- Our summer electrofishing and snorkeling sampling efforts have enabled us to determine non-salmonid fish distribution, species composition and relative abundance throughout much of the Washington portion of the subbasin.

Objective 3: Identify and characterize genetic stocks of steelhead and bull trout.

- We have collected tissue samples from adult steelhead at traps in the Walla Walla River in Oregon (from ODFW sampling), Mill Creek (from USFS sampling), and the Touchet River (WDFW SRL sampling), as well as from juvenile steelhead in Washington streams, to genetically characterize population structure. These samples were combined with other samples from CTUIR and analyzed and published by Narum et al. in 2004. They were combined with other WDFW (LSRCP funded) sampling and analyses and reported in WDFW annual reports. Touchet River steelhead and Walla Walla steelhead are genetically different and NMFS now recognizes these as two separate populations. WDFW has a manuscript in draft that will be submitted for publication later this year that further evaluates the genetic composition and stability of steelhead in the Walla Walla Subbasin and elsewhere in southeast Washington.
- We have collected tissue samples from numerous migrating bull trout captured in each of the 3 major drainages (Walla Walla River through ODFW sampling, Mill Creek through USFS sampling, and Touchet River through WDFW SRL sampling) in the Walla Walla Subbasin for multiple years. We have also collected genetic samples from juvenile bull trout in each of the spawning areas of the Touchet River drainage. Our WDFW genetics lab will assist us by analyzing these samples in 2006 to genetically characterize these different groups and enable us to evaluate the fine scale population structure and reproductive interactions of bull trout within several areas of the Walla Walla Subbasin. The results are expected to be included in our next annual report in 2007.
- WDFW has collected tissue samples from spring chinook adults returning to the Touchet River and archived them for possible later analysis.

Objective 4: Compile and disseminate results and conclusions to guide fish management and subbasin planning.

- This project has completed eight annual reports. We have shared these reports in hardcopy and electronic files with the large number of management entities or interested parties in the Walla Walla Subbasin, and elsewhere. These reports are posted on the BPA and WDFW websites.
- We have contributed genetic samples used in a journal article published by Narum et al. 2004. WDFW is including genetic samples and data from this project in a manuscript being prepared for publication regarding steelhead genetics in several portions of southeast Washington.
- This project has contributed data and summary information for the draft Bull Trout Recovery Plan, Subbasin Summary for the NPCC, Subbasin Plan, Washington State Limiting Factors Report for the Walla Walla Basin, and the Snake River Salmon Recovery Plan for Southeast Washington (includes the Walla Walla Subbasin), as well as other planning efforts such as the WDOE Watershed Planning Effort and the TMDL planning process, or WDFW's Salmonid Stock Inventory (SaSI) stock inventory process.

Study Purpose and Objectives

The purpose of this study is to assess steelhead and bull trout distribution, densities, habitat, and genetic composition in the Walla Walla Subbasin. In addition we wanted to document fish passage, rearing, and spawning conditions for steelhead and to examine environmental factors to guide reintroduction of chinook salmon. Specific objectives and tasks were outlined in WDFW's original proposal and statement of work in 1997/1998 to BPA (Project #199802000). Some tasks had to be scaled back or postponed. Attempts by WDFW to modify the objectives and tasks in 2001 to enable this project to evolve and meet the needs in the subbasin were denied by BPA due to lack of funds and restrictions on any new objectives or tasks. Multi-year study objectives include:

1. Assess baseline habitat conditions for salmonids in the Washington portion of the Walla Walla Subbasin;

2. Determine salmonid distribution and relative abundance in the Washington portion of the Walla Walla Subbasin; and

3. Identify genetic stocks of steelhead and bull trout in the Walla Walla Subbasin.

Our objectives and tasks were:

- Establish constant recording temperature and flow data loggers in the Walla Walla Subbasin, to identify available water, as well as temperature limitations for salmonid passage, spawning and rearing;

- Conduct biweekly manual stream flow and temperature measurements to calibrate the instream monitor data outputs, and to provide data for reaches that did not have instream discharge monitors in place;

- Monitor water quality by sampling dissolved oxygen, pH, turbidity, and conductivity (This task has been deferred);

- Conduct electrofishing to determine salmonid distribution, and abundance;

- Conduct snorkel surveys during the spring and summer to supplement electrofishing data and for seasonal density comparisons;

- Conduct general habitat surveys in portions of the stream with potential for salmonid use to quantify habitat conditions and identify limiting factors;

- Conduct steelhead and bull trout spawning surveys to determine spawn timing and distribution, and to establish an index of relative abundance; and

- Collect tissue samples from bull trout and steelhead for genetic analyses.

Methods

Study Area

The study area encompasses the Walla Walla Subbasin within Washington State (Figure 1). The Walla Walla River, the Touchet River, and Mill Creek are the major watersheds within the subbasin.

Stream Reaches

Representative stream reaches were identified based on general physical characteristics and readily identifiable landmarks. General physical characteristics included: slope, width, depth, and temperature; as well as, predominant adjacent land use. Landmarks included towns, roads, and bridges.

Individual Site Selection

Most of the study streams are in private ownership; therefore it was necessary to obtain permission from landowners to access sample sites. Owners of property bordering the study streams were identified from county assessment records and contacted in person or by telephone. For convenience, public land was utilized whenever possible. Study sites were distributed to comprehensively cover the study area, and sites are listed and identified in order from upstream to downstream (Appendix A).

River miles were calculated using Maptech's Terrain Navigator (version 5.03) or Terrain Navigator Pro (version 6.04a). River miles were determined by measuring the distance between the confluence of each stream, or a noted landmark if the confluence was in question, and the study site. Within these programs the track tool was used to trace streams and calculate river miles. The track tool measures in miles and feet, which we converted to miles and tenths of miles. Many of the sites had an associated global positioning system (GPS) location measured in D.D° with a Garmin GPS II plus, in WGS 84 datum. These GPS locations were plotted on the map and used for calculating river miles. These locations should be considered approximate due to the limited precision of this method.

Electrofishing sites were selected randomly from access areas. Selections of top and bottom net locations were also randomized. Site lengths sometimes had to be modified to avoid unsuitable stream features that affected the adequacy of data collection or surveyor safety (such as deep pools, rapids, or multiple channels).

Habitat Assessment

Stream Flows

Stream discharge was measured using two methods. Manual flow measurements were taken at selected sites according to standard techniques (Armour and Platts 1983) using a Swoffer model 2100 flow meter. Discharge was calculated in cubic feet per second (cfs) with Microsoft Excel spreadsheets. The calculated manual discharge measurements (cfs) were put into table format by site for the report (Appendix B). The second method involved the use of continuous flow data loggers (Unidata America, Model KB/DSP 128K). The monitors collect stream discharge (water stage (based on pressure)) data every 15 seconds and stores the data every hour as averages. The monitors were placed at one site on the Walla Walla River, one site on Yellowhawk Creek, one site on East Little Walla Walla, and two sites on Titus Creek (Appendix A). WDFW collaborated with WDOE staff to maintain the monitors and collect the data. Manual flow measurements were taken approximately every two weeks by WDFW near each of the flow monitors to correlate the discharge and stage readings recorded by the monitors. An index site was a location where discharge measurements were taken approximately every two weeks, compared to periodic flow sites where flow measurements were taken occasionally (Appendix A).

Stream Temperatures

We used three methods to collect water temperatures. Water temperature (°F) was measured manually at each site using standard field thermometers. The second method involved the use of temperature data loggers (Onset Corporation, Optic StowAway, or TidbiT Temp Data Logger®), which were set to continuously measure temperatures in °F at 30 minute intervals. The monitors were placed at sites throughout the Walla Walla Subbasin (Appendix A). WDFW maintained the temperature monitors and downloaded the data using an Optic Stowaway Shuttle®. Temperature data was downloaded from the shuttle into BoxCar® Pro 4.0 software. BoxCar® Pro 4.0 was used to calculate daily minimum, maximum, and mean temperatures, which were exported to Microsoft Excel spreadsheets. Data in Microsoft Excel was organized and transferred to Microsoft Word where it was used to make graphs showing minimum, maximum, and mean temperatures (Appendix C). The third method involved the use of continuous flow and temperature data loggers (Unidata America, Model KB/DSP 128K), which took hourly temperature measurements. The monitors were used to collect temperature as a substitute for the stowaway temperature loggers at their respective sites (Appendix A). The accuracy of field thermometers and data loggers was evaluated, both before and after field deployment, using a laboratory calibrated thermometer (Kessler Instrument).

Limiting Factor Identification

One of the study goals was to identify and document physical barriers to salmonid passage, spawning and rearing. Field personnel noted the presence of potential barriers and provided the information to local biologists to coordinate habitat restoration efforts. The activity of two major irrigation diversion structures, Hofer Dam on the Touchet River, and Burlingame Diversion on the Walla Walla River, were also noted throughout the season.

Physiological barriers to salmonid passage and survival, in the form of excessive temperatures, inadequate flows, and degraded habitat were also identified by examining tables and graphs of data collected by instream monitors and manual sampling. Maximum temperatures, as well as the number of days with temperatures exceeding 75°F (lethal to salmonids if prolonged), and presence or absence of salmonid fishes at study sites, were factors taken into consideration.

Fish Stock Assessment

Distribution and Abundance

Electrofishing

A Smith-Root Model 11A or 12B electrofishing backpack unit was used to collect fish at various study sites in the Walla Walla Subbasin. We used pulse DC (direct current) between 200 and 600 volts. Two different types of electrofishing surveys (quantitative and qualitative) were used during our sampling.

Quantitative Electrofishing

Quantitative electrofishing sites were delimited by placing block nets, spanning the channel, approximately 30 to 50 meters apart. Block nets prevented fish from entering or leaving the site, so that estimates of salmonid populations and densities could be calculated (Platts et al. 1983). The operator usually began at the upstream net and worked downstream, covering the entire wetted width. In sites with heavy sedimentation the operator would begin at the bottom net and work upstream to maintain enough water clarity to efficiently capture fish. One “pass” was completed when the net opposite the start was reached. All sites received at least two sequential passes. A 60% reduction was required between the first and second passes for each salmonid species and estimated age class. If the 60% reduction was not met, a third pass was conducted. Stunned fish were collected with dip nets and held separately in buckets by sampling “pass” until they could be measured and recorded. Collected fish were anesthetized with FINQUEL® (MS-222 tricane methane sulfonate). Once anesthetized the following information was collected; identification (genus or species), fork length (mm), scale and/or genetic samples, and any notation about any marks or tags.

Fork lengths collected during quantitative electrofishing were used to create length frequency histograms. The histograms were used to determine age classes of 0+ and 1+ fish (Mendel et al. 1999, Figure 2). Legal size fish were defined as any fish over 200mm in length. Age class groupings were specific for each stream or stream reach, and were checked against results from scale samples taken during electrofishing.

A removal-depletion software program developed by the USFS (Van Deventer and Platts 1983) was used to calculate population densities (#/100m^2) for each salmonid species, by age class. The area sampled was determined by multiplying site length by the average of four or more site width measurements. A brief description of the riparian vegetation, bank stability, substrate, sedimentation, pool/riffle/run ratio, and the presence of large woody debris (LWD) were recorded for each site.

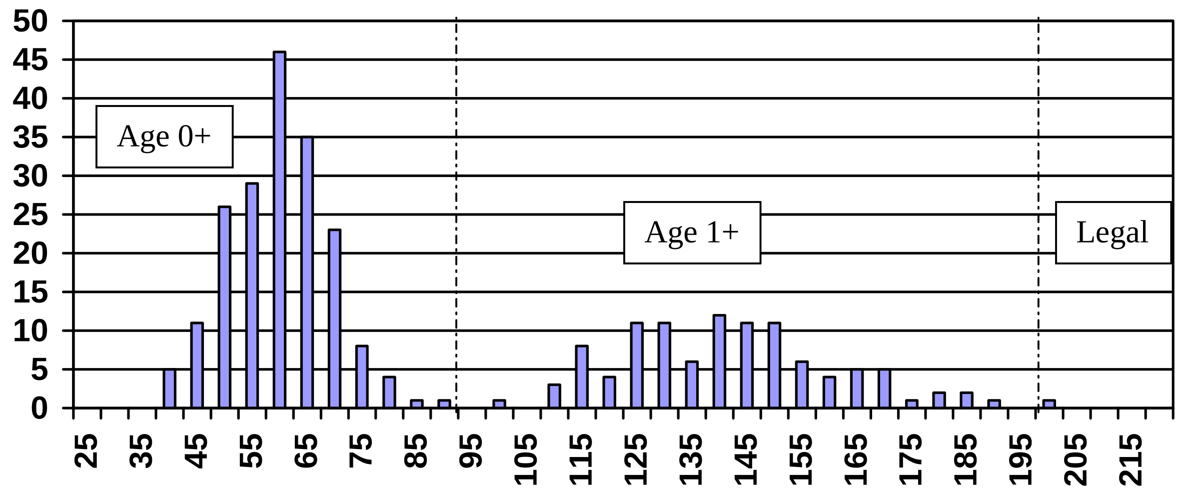


Figure 2. Length frequency and age class delineations for Dry Creek, from just below the town of Dixie, WA to just above the mouth. Data is from 294 fish that were collected at nine sites in 2004.

Qualitative Electrofishing

We also conducted qualitative electrofishing surveys at several sites in the Walla Walla Subbasin. These surveys enabled us to cover larger areas relatively quickly as they did not entail the use of block nets or repeat sampling passes. We electrofished at these sites by moving upstream and capturing fish to determine species presence, size of fish (age class) and their relative abundance. The length and average width of area sampled were recorded as well as a brief description of the riparian vegetation, bank stability, substrate, sedimentation, pool/riffle/run ratio, and the presence of LWD. This method supplemented our more intensive quantitative electrofishing surveys to provide a more complete view of fish distribution and abundance.

Fish identification for both quantitative and qualitative electrofishing sites included genus and species for all *Salmonidae* (salmonids) and *Cyprinidae* (minnows); and genus only for *Cottidae* (sculpins), *Catostomidae* (suckers), and *Petromyzontidae* (lamprey). Our sampling protocol was to collect and measure 10-20 of each non-salmonid species at each site. Non-salmonid species were assigned a relative abundance ranking value based on general observations made during electrofishing (Table 1). Relative abundance for non-salmonid species were treated semi-quantitatively and varied based on the method of electrofishing used. For each species at each site, a relative abundance was determined (Table 1). Ranked values were averaged to determine a relative abundance for each species per designated stream or stream reach. Relative abundance data were tabulated to provide qualitative comparisons between reaches and species (Appendix F).

Table 1. Categories of relative abundance (per site) for non–salmonids during electrofishing surveys.		
Category	**Count (individuals seen)**	**Ranking Value**
Absent	0	0
Rare	1-3	1
Uncommon	4-10	2
Common	11-100	3
Abundant	100+	4

Spawning Surveys

WDFW conducted spawning surveys for steelhead, bull trout, and spring chinook in the Walla Walla Subbasin in 2005. Spawning surveys were conducted in the same manner for steelhead, bull trout, and spring chinook. Surveyors generally walked downstream and visually identified spawning fish and/or redds (nests). Redds were usually readily identified, characterized by an area of clean gravel with a large depression and mound. Each redd observed was assigned a two-part identification (ID) code representing the survey number and the redd number. A flag was hung in adjacent vegetation, and marked with the ID code, the date, and the surveyor's initials, so the same redd would not be counted again in subsequent surveys. Each redd was recorded in a notebook with the date, time, ID code, description of the redd size, score of its observability and its location. Redd size was measured, in feet, for both the bowl and mound on every other redd. The redd score of observability was a measurement that we use to calculate redd life, or how long a redd would be visible (Table 2). Counts were tallied for each designated stream reach. Global Positioning System (GPS) coordinates were recorded for each surveyors beginning and ending locations for spawning surveys.

During steelhead spawning surveys we attempted to capture, with dip nets, adult steelhead that were not actively spawning. These fish and any carcasses located were sampled for length, sex, marks (to determine wild or hatchery origin), tags, scales, and DNA fin clips.

We also attempted to sample adult spring chinook carcasses. Each carcass was sampled for scales, DNA (fin clips), fork length, checked for tags and marks, and determination of gender. Since spring chinook are considered extirpated within the Walla Walla Subbasin (SRSRB 2005) we also collected heads, from carcasses, for any coded wire tags (CWT) that may indicate the origin of these fish (e.g. Tucannon River or Umatilla River).

Table 2. Criteria for scoring the observability of a redd.	
Score	**Criteria for scoring**
1	New Redd—very clean substrate and very distinct redd features (bowl and mound) and would be called a new redd on any survey.
2	Intermediate Redd—starting to color-up and may have begun to flatten out, but still would be noted as a new redd if it was the first survey through that section.
3	Old Redd—very colored up with poor features, may not be visible anymore, and would not be counted as a redd if encountered the first time in this condition.

Genetic and Scale Sampling

Sampling of salmonid tissues was undertaken by WDFW personnel for later genetic analyses. Fin clips or opercle punches were obtained from adult steelhead, juvenile rainbow/steelhead trout, and bull trout. Tissue samples were preserved in 100% ethanol, labeled and retained or transported to the WDFW Genetics Stock Identification Lab in Olympia. Fin clips provide sufficient DNA material for genetic analysis, without killing the fish (Olsen et al. 1996). A non-lethal method of genetic sampling was preferred due to the current ESA listings for bull trout and wild steelhead in the Walla Walla Subbasin.

Scale samples were also collected during electrofishing or spawning surveys in 2005. These samples were taken to verify the age class distributions that we created from length frequency histograms (Figure 2). Scale samples were placed on scale cards with the following information; stream of collection, date collected, species being sampled, fork length, and DNA vial number (if DNA was also collected from that fish). The information was entered into a database at our office, and then the samples were sent to Olympia to be aged. Once aged, the cards were returned to us and we were able to verify our estimated age breaks (based on length-frequency histograms) to the actual age from the scales.

Results and Discussion

Habitat Assessment

Stream Flows

The number and distribution of manual stream flow (discharge) measurement sites were reduced for 2005 due to increased monitoring, by WDOE, with continuous flow monitors, and the fact that this project has several years of flow data for many different reaches in the Walla Walla Subbasin. In 2004, we had 63 sites of which 43 were index flow sites, while in 2005, we had 41 flow sites of which 24 were index sites. Index flow sites were those where manual flows measurements were taken every two weeks from early June through mid October. Non-index flows sites were discontinued after the first round of measurements or consisted of measurements at sites to assist the Walla Walla Basin Watershed Council conduct a seepage run in the Walla Walla Subbasin to try and account for all inflow and outflow along the mainstem Walla Walla River (Figure 3).

Stream flows in the Walla Walla Subbasin generally follow a pattern consisting of a rapid decline in discharge in late June, followed by low summer flows, and increased discharge in the fall and winter. The reduced flows in late June generally represent the end of the spring runoff, activation of water diversions for agricultural irrigation, and the usual lack of summer precipitation in the subbasin. The recharge in the fall is usually generated because of fall precipitation and after most water diversions are discontinued or reduced. However, sites in proximity to major irrigation facilities exhibited more erratic stream flow patterns (Appendix B). Irrigation withdrawals included pumps, “push-up” dams for gravity diversions and irrigation district dams and canals.

Stream flow gauges were placed at five sites in 2005; one on the Walla Walla River, one on Yellowhawk Creek, one on East Little Walla Walla, and two on Titus Creek. The monitor at Detour Road shows a fairly normal spring to fall hydrograph through the first of October. The sharp decline in flows after the first of October is most likely attributed to large irrigation diversions (e.g. Gardena Farms Burlingame Diversion) beginning withdrawals in the fall after being shutdown for most of the summer (Figure 4). The monitor in Yellowhawk Creek was very erratic in the spring and fall, but is affected by the diversion from Mill Creek (Figure 5). The logger on East Little Walla Walla was deployed earlier and removed later than the other monitors because this small, regulated stream has a fairly constant flow, between 5 and 20 cfs, and the risk of losing the monitor in high flows is minimal (Figure 6). The two monitors on Titus Creek show very different flows for most of the year (Figure 7 and 8). The upper site (TC-1, Figure 7) is on the main upper part of Titus Creek, while the lower site (TC-2, Figure 8) is in a branch below an irrigation diversion (that is located just above Five Mile Rd.) that flows back into Mill Creek. Presence of a beaver dam at the lower Titus Creek site affected data logger collection until the middle of August.

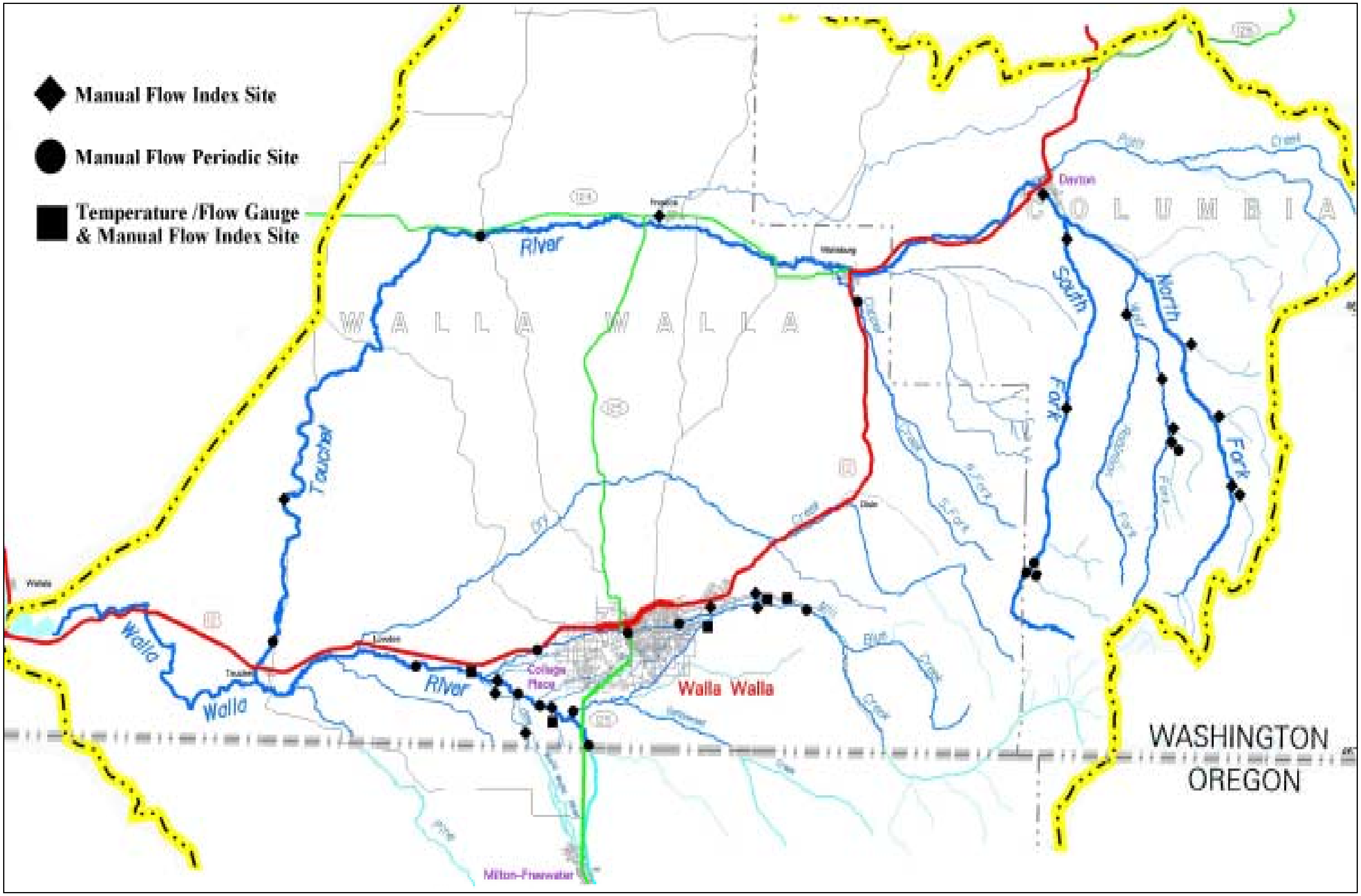


Figure 3. Relative locations of WDFW flow monitoring sites in the Walla Walla Subbasin, 2005.

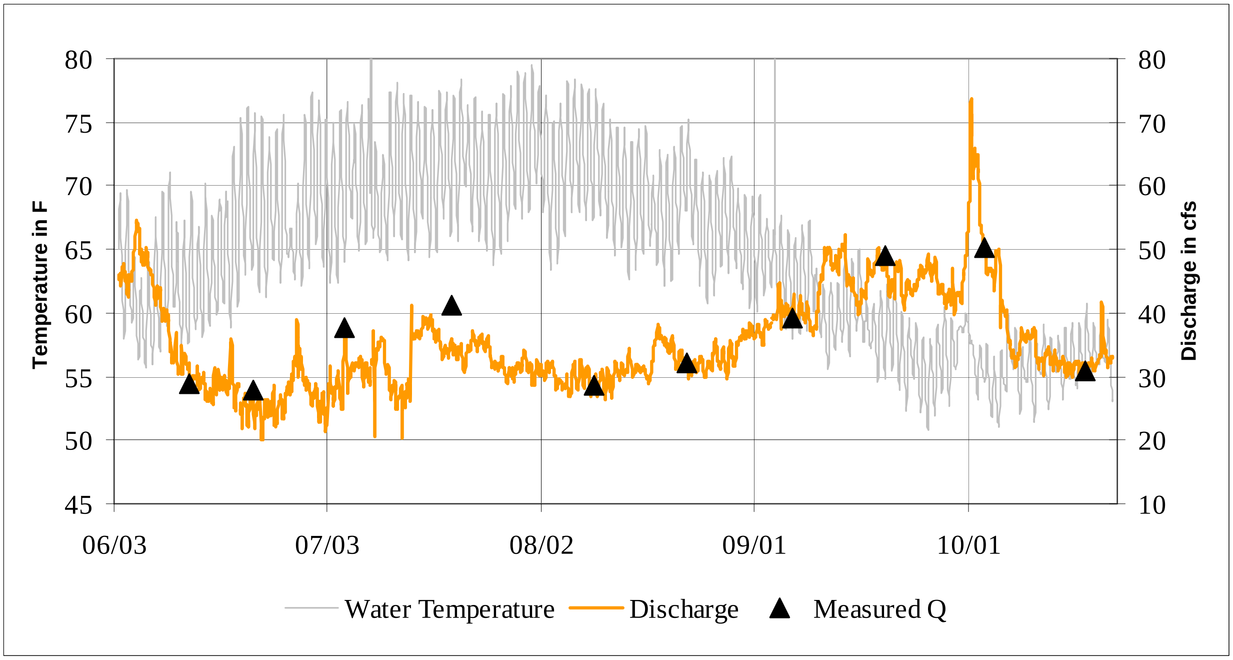


Figure 4. Walla Walla River stream discharge (cfs) and hourly temperatures (°F) ~0.5 miles above Detour Rd. bridge (WW-7), 2005. (Measured Q = manual stream discharge measurements)

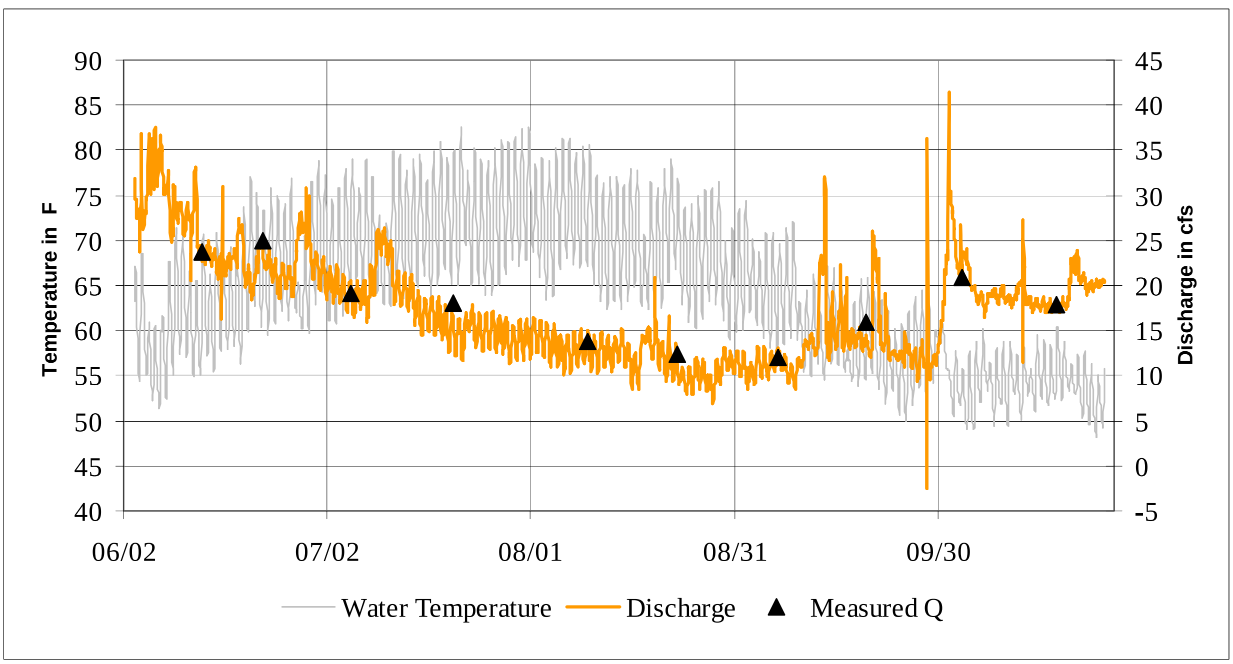


Figure 5. Yellowhawk Creek stream discharge (cfs) and hourly temperatures (°F) ~25 meters below diversion (YC-1), 2005. (Measured Q = manual stream discharge measurements)

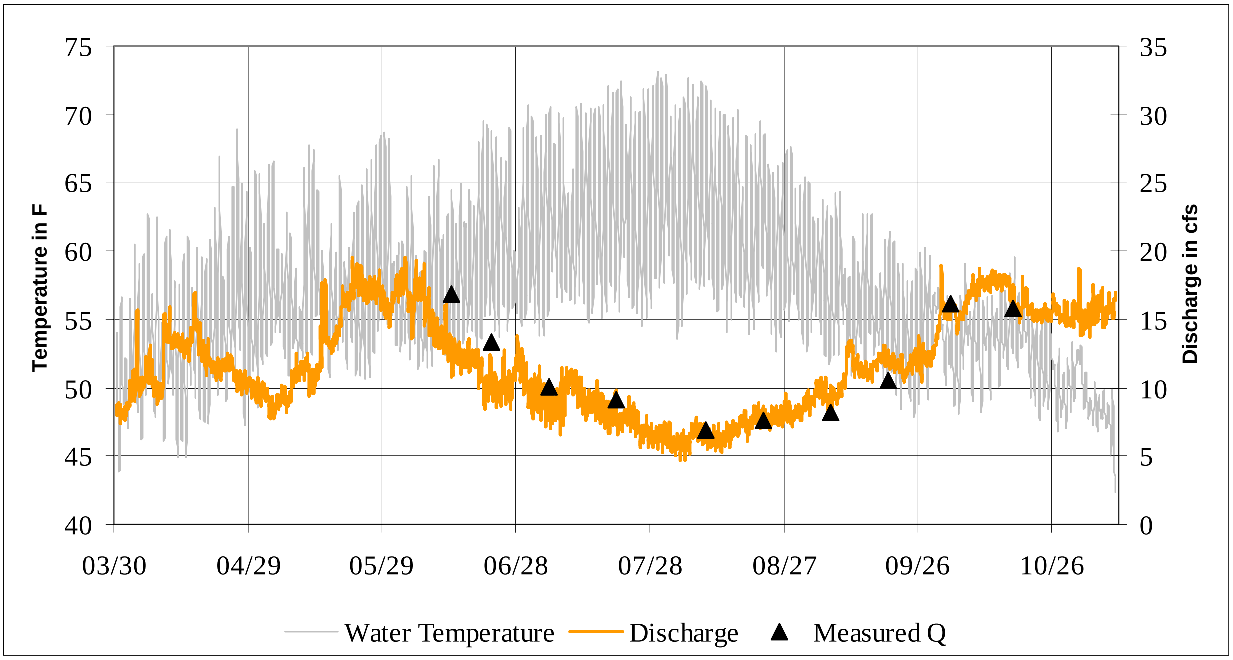


Figure 6. East Little Walla Walla stream discharge (cfs) and hourly temperatures (°F) ~0.3 miles above mouth (ELW-3), 2005. (Measured Q = manual stream discharge measurements)

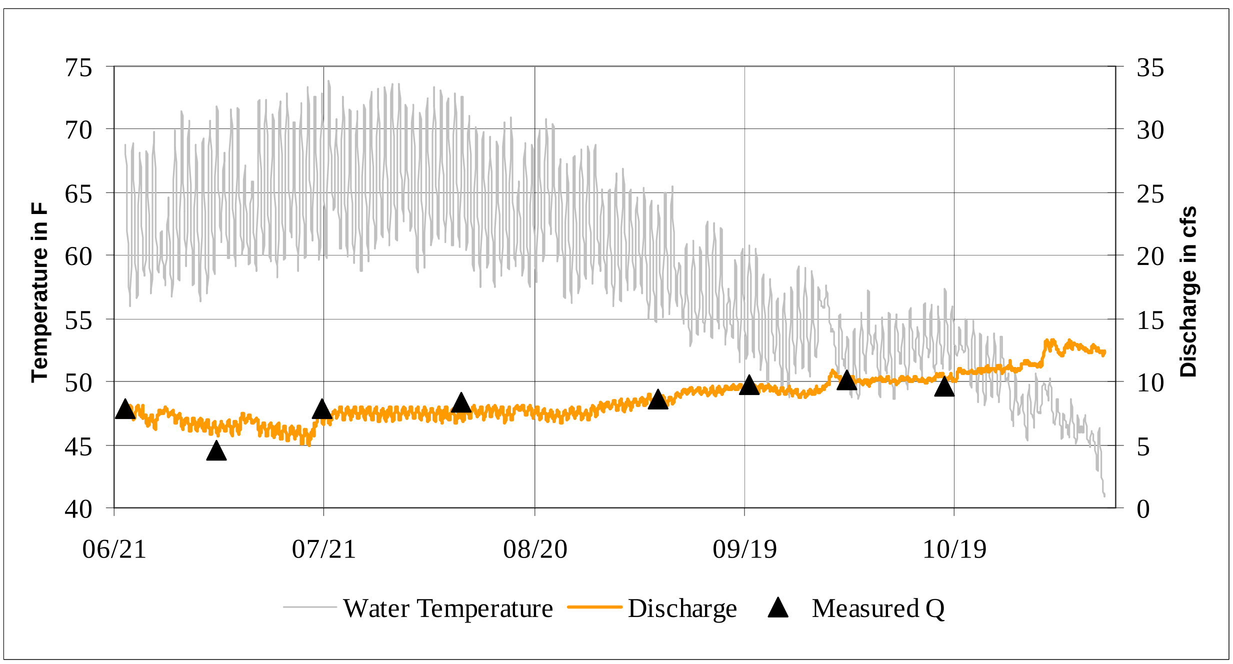


Figure 7. Titus Creek stream discharge (cfs) and hourly temperatures (°F) ~1.4 miles above Five Mile Rd. (TC-1), 2005. (Measured Q = manual stream discharge measurements)

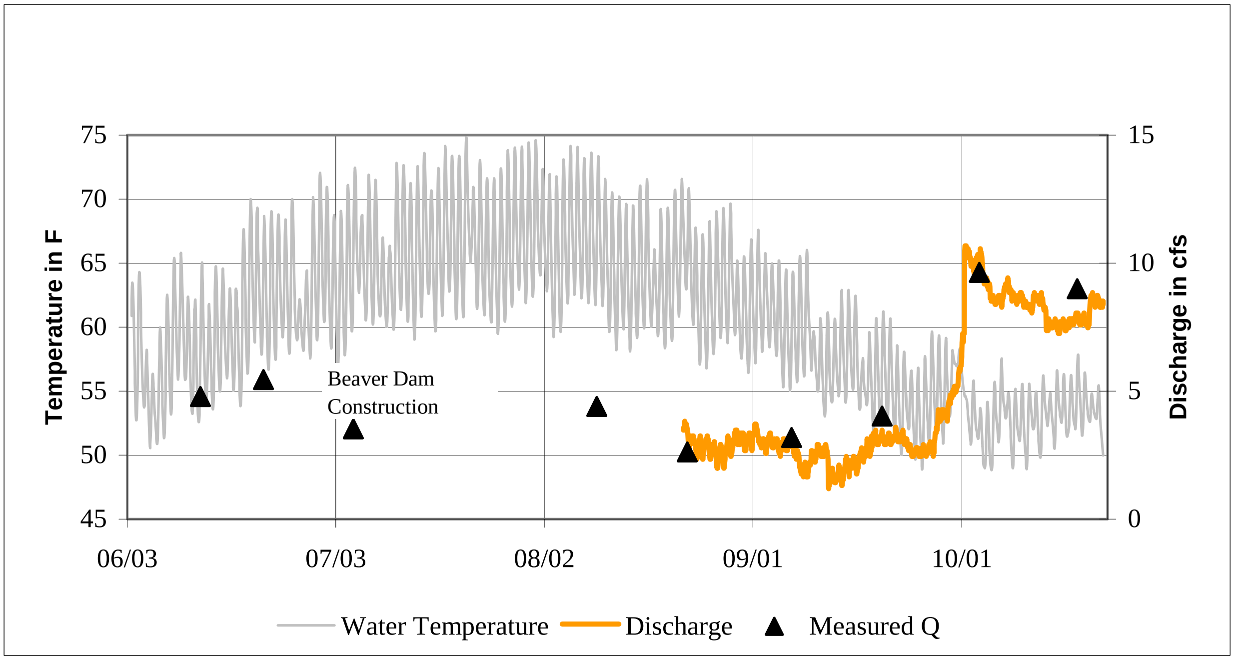


Figure 8. Titus Creek stream discharge (cfs) and hourly temperatures (°F) Covered bridge above Five Mile Rd. (TC-2), 2005. (Measured Q = manual stream discharge measurements)

Walla Walla Settlement Agreement

In 2000, under a settlement agreement with the USFWS, two irrigation districts in Oregon maintained a minimum instream flow of 13 cfs at Nursery Bridge in Milton-Freewater, Oregon. Nursery Bridge is approximately four miles upstream of the Washington/Oregon state line. The minimum instream flow at Nursery Bridge was increased to 18 cfs in 2001, and then increased again to 25 in 2002. From 2003 to 2005, the minimum flow increased to 27 cfs through June 30th and then went back to 25 cfs for the remainder of the year. The additional water, in 2000, made an immediate impact in Oregon by considerably reducing the historic dewatered area from Nursery Bridge downstream to below Tumalum Bridge, near the state line. With the additional water available in 2001 the Walla Walla River saw continuous overland flow from Nursery Bridge to the Washington/Oregon state line for the first time in decades. Manual stream flow measurements taken at Pepper Rd. bridge (just below the Washington/Oregon state line) showed little or no increase in stream flows until July-September 2001 when flows increased 300 - 400% over summer flows documented the previous three years. In 2002, manual flows at Pepper Rd. bridge again showed increases of 110-185% from July through September (Appendix E). In 2005, drought conditions produced some of the lowest flows, from July through September, since the Settlement Agreement was initiated (Appendix E). Also, under the auspices of the settlement agreement, Gardena Farms Irrigation District, in Washington, maintained at least a 10 cfs stream flow past Burlingame Dam (just above Mojonnier Rd.) during the spring, early summer, and fall irrigation season of 2000. In 2001, this 10 cfs was increased to 14 cfs, and then increased again to 18 cfs in 2002. From 2003 to 2005, the minimum flow increased to 19 cfs through June 30th and then went back to 18 cfs for the remainder of the year. Flows have shown a general increase from 1999 to 2001 at continuous flow monitoring sites near Mojonnier and Detour roads (Appendix F), especially in July and August, but this has not been consistent from 2002 to 2005.

Stream Temperatures

Temperature logger sites in 2005 had similar (wide spread) distribution as those in 2004, but we only deployed 54 loggers in 2005 versus 70 in 2004. There were two main reasons for reducing the number of monitoring sites in 2005. First, we have collected several years of data at many of our sites, and second, the batteries in many of our loggers have failed in the last year or two so the total number available has decreased (Figure 9).

Water temperatures in 2005 were similar to water temperatures in 2004 throughout the Walla Walla Subbasin (Appendix C, Mendel et al. 2005). Sites where maximum water temperatures were less than or equal to 65°F during summer months were generally located in upper tributaries associated with the Blue Mountains; North Fork Touchet (NFT-4, 8), Spangler Creek (SC-1), Lewis Creek (LC-8), Whitney Creek (WH-1), and Coates Creek (C-1). Maximum daily temperatures at some instream monitoring sites routinely exceeded temperatures that can be lethal for salmonids (75-84°F, Bjornn and Reiser 1991). This generally occurred during mid-summer, when the photoperiod is long and evening cooling is brief. Sites with maximum water temperatures greater than 75°F included; South Fork Touchet (SFT-4), Touchet River (TR-3, 5, 6, 7, 8), Coppei Creek (CO-1), Yellowhawk Creek (YC-1), Walla Walla River within Washington (WW-3, 6, 8, 9, 10, 11, 12), Blue Creek (BLC-1), Mill Creek below Bennington Lake diversion dam (MC-5, 7, 8, 11, 12, 14), and Dry Creek (DRC-3). Sites in the mid and lower Touchet and Walla Walla Rivers frequently had daily temperatures that were high enough (above 68°F) to inhibit migration of adults and young, and to sharply reduce survival of embryos and fry (Bjornn and Reiser 1991, Appendix C). However, at night, temperatures would usually decrease to within reasonable physiological limits for steelhead/rainbow trout (<65-68°F).

Maximum temperatures in the lower Walla Walla Subbasin; including the Touchet River below Waitsburg, Dry Creek below Dixie, Mill Creek below Five Mile Road, and the Walla Walla River below Burlingame Diversion appear to be high enough during certain times of the year to limit, block, or impede the migration of adult salmonids. Steelhead would likely enter the Walla Walla Subbasin from September through June of the next year in preparation for spawning, with the key temperature restrictions likely from September through October, and May through June. September through October is also the primary time for downstream migration of adult bull trout after spawning, while May through early July temperatures could affect adult spring chinook returning to spawning grounds.

Hicks (2002) estimated that to fully protect (with no detrimental effect) adult steelhead and chinook migration the 7-day average maximum temperatures should not exceed 17.0-19.0°C (62.6-66.2°F), and that a barrier to migration appears when 7-day average maximum temperatures reach 20.1-24.6°C (68.1-76.3°F) (Table 3). We also reviewed McCullough (1999) and Bjornn and Reiser (1991), and USEPA (2003) found similar temperature ranges that impaired chinook or steelhead lifestages consistent with those in Hicks (2002, Table 3).

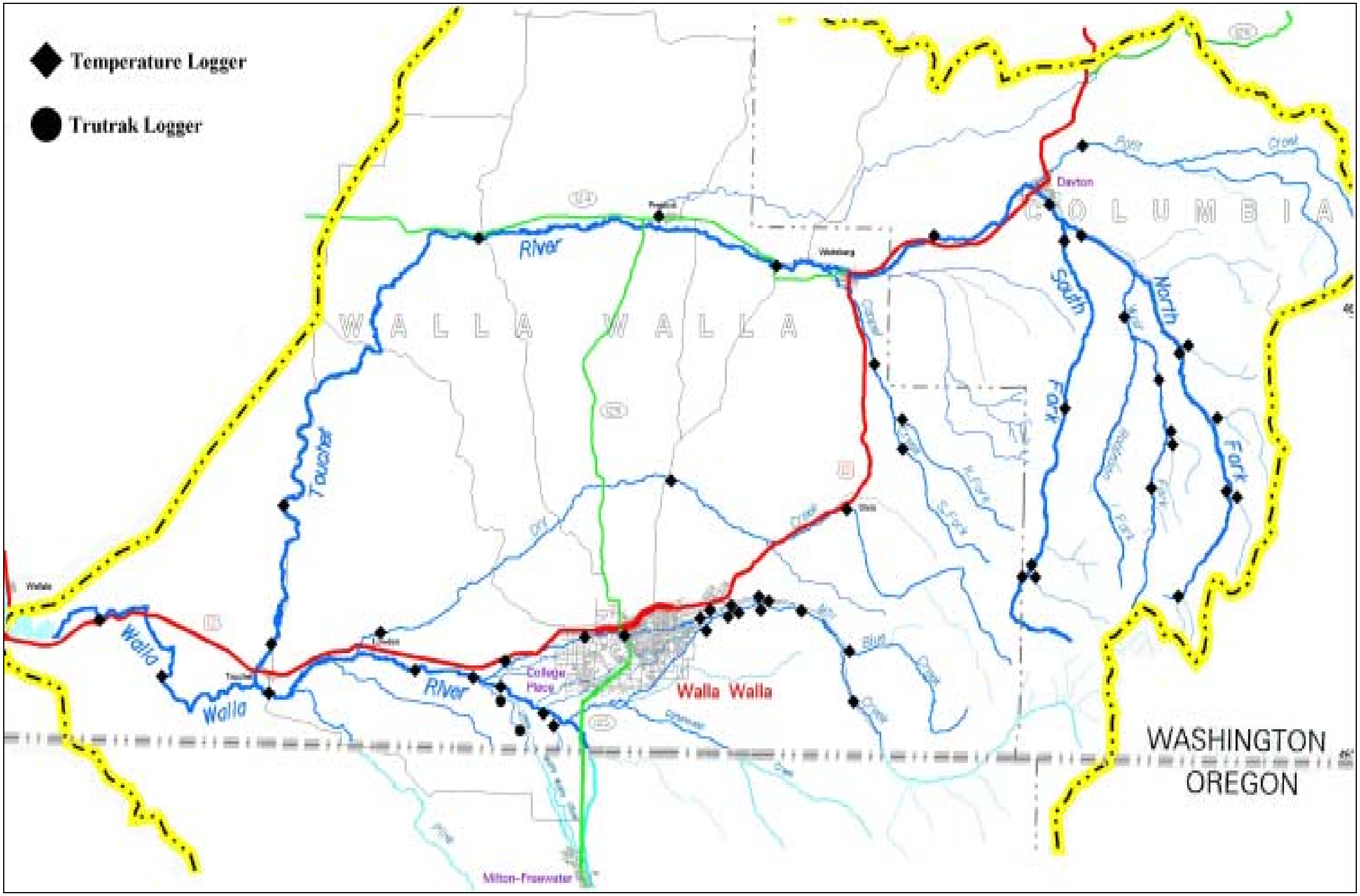


Figure 9. Relative locations of WDFW temperature logger sites in the Walla Walla Subbasin, 2005

Bull trout data summarized from Hicks (2002) shows that adult migration occurs between 10.0-14.0°C (50.0-57.2°F) (Table 3). This temperature range should be considered a very rough estimate, because of lack of information on temperature preferences and requirements of migratory bull trout (Hicks 2002).

Table 3. Ranges of temperatures likely to fully protect specific species and lifestages. (Taken from Hicks 2002 Table 4.25, and USEPA 2003)

Species/Lifestage	7-day avg. daily maximum temperature °C (°F) from Hicks 2002	7-day avg. daily maximum temperature °C (°F) from USEPA 2003	Recommended 7-day avg. daily maximum temperature °C (°F) from USEPA 2003
Steelhead/rainbow trout			
Juvenile rearing	15.18-18.05 (59.32-64.49)	10.00-18.00 (50.00-64.40)	16.00-18.00 (60.80-64.40)
No Detrimental impacts to adult migration	17.00-19.00 (62.60-66.20)		≤20.00 (68.00)
Barrier to adult migration	20.05-24.60 (68.09-76.28)	21.00-22.00 (69.80-71.60)	>20.00 (68.00)
Spawning	12.55-13.92 (54.59-57.06)	4.00-14.00 (39.20-57.20)[a]	13.00 (55.40)
Lethality (7-day exposure)	21.09-23.36 (69.96-74.05)	23.00-26.00 (73.40-78.8)[b]	
Upper lethal temperature (adults)	21.00-26.00 (69.80-78.80)[c]	21.00-22.00 (69.80-71.60)	
Bull trout			
Juvenile rearing	12.61-13.96 (54.70-57.13)	12.00-13.00 (53.60-55.40)[d]	12.00 (53.60)
Adult migration	10.00-14.00 (50.00-57.20)[e]		
Spawning	7.31-8.32 (45.16-46.98)	6.00-8.00 (42.80-46.40)[b]	9.00 (48.20)
Lethality (7-day exposure)	20.73-21.88 (69.31-71.38)	22.00-23.00 (71.60-73.40)	
Upper lethal temperature	24.00-26.00 (75.20-78.80)		
Chinook salmon			
Juvenile rearing	15.18-18.05 (59.32-64.49)	10.00-18.00 (50.00-64.40)	16.00 (60.80)
No Detrimental impacts to adult migration	17.00-19.00 (62.60-66.20)		≤20.00 (68.00)
Barrier to adult migration	20.05-24.60 (68.09-76.28)	21.00-22.00 (69.80-71.60)	>20.00 (68.00)
Spawning	12.55-13.92 (54.59-57.06)	4.00-14.00 (39.20-57.20)[a]	13.00 (55.40)
Lethality (7-day exposure)	21.09-23.36 (69.96-74.05)	23.00-26.00 (73.40-78.8)[b]	
Upper lethal temperature (adults)	21.00-26.00 (69.80-78.80)[c]	21.00-22.00 (69.80-71.60)	

[a] Temperature range for daily average temperature, 4.00-12.00°C for constant temperature, and 6.00-10.00°C is optimal temperature.
[b] Temperature range for constant temperatures.
[c] Temperature range was estimated from data summarized in Hicks 2002 and McCullough 1999.
[d] Temperature range based on daily maximum temperatures.
[e] Temperature range was estimated from within the text of Hicks 2002, and not taken from Table 4.25. This range should be considered a rough estimate, based on only a few studies.

Based on temperature data collected during the 2005 field season thermal barriers to steelhead migration were likely present in the lower Touchet River, Dry Creek, Mill Creek, and the Walla Walla River. In the spring, detrimental temperatures to adult steelhead migration occur by late May and thermal barriers to passage appeared by the first or second week in June. In the fall, thermal barriers and detrimental impacts to migration appear through early September depending on location (Table 4). Spring chinook entering the Walla Walla Subbasin in the spring meet the same temperature problems as steelhead from May through the middle of July. While the literature supports the temperatures in Table 3 as being barriers to adult migration, all the reports we reviewed above reference Bell (1973, 1986) showing that temperatures for spring chinook migrations should be between 3.3-13.3°C (37.94-55.94°F). The levels that Bell (1973, 1986) suggests would adversely affect migration into the Walla Walla Subbasin by no later than May 1st. While observed temperatures decrease in the fall they likely negatively affect, or create thermal barriers to, downstream migration of bull trout in the Walla Walla Subbasin. Bull trout downstream migration in the fall through the end of October appears to be blocked above Bolles Bridge on the Touchet River (TR-5), between Five Mile Rd. (MC-4) and above the cold return (MC-5) on Mill Creek, and between Burlingame Diversion (WW-3) and Swegle Rd. (WW-6) on the Walla Walla River (Table 4). Lack of May temperature data in 2005 is apparent in Table 4. This project has experienced difficulty in the past in obtaining springtime temperature data because of high stream flows. These high flows make it difficult to place, maintain and download temperature monitors, and keep the monitors from being washed away (considering many times these are channel changing flows). WDFW has many years of temperature data for these areas and is planning to compile multiple years of data for comparison in our next annual report. We will also be compiling WDOE continuous flow/temperature monitor data in areas where WDOE monitors exist in lower river reaches.

Walla Walla Settlement Agreement

Increases in stream flow did not consistently improve water temperatures during summer months from 1998 through 2005 (Table 5). We documented little or no change in temperatures at Pepper Rd. Bridge even though stream flows increased several fold since 2001, compared to previous years. We documented some decreases in mean and maximum temperatures in August and September at Mojonnier Rd. from 1998-2002, but temperatures were higher in 2003-2005 than in 2002 at this site. Average and maximum temperatures at Swegle Rd. and Detour Rd. have shown no consistent changes (Table 5).

Table 4. Seven day average maximum temperatures from May 1st –July 16th and September 1st –November 2nd for the lower portions of the Touchet River, Dry Creek, Mill Creek, and the Walla Walla River, 2005 (listed from downstream to upstream for each stream).

	Touchet River @ Cummins Rd. (TR-8)	Touchet River @ WDFW access (TR-7)	Touchet River @ Harvey Shaw Rd. (TR-6)	Touchet River @ Bolles brg (TR-5)	Dry Creek @ Talbott Rd. (DRC-3)	Dry Creek @ Lower Waitsburg Rd. (DRC-2)	Mill Creek @ Swegle Rd. (MC-14)	Mill Creek @ Gose St. (MC-12)	Mill Creek @ 9th Ave. (MC-11)	Mill Creek @ Tausick Way (MC-8)
May 1-7	65.85[a]	64.87[a]		59.27[a]			63.80[a]			
May 8-14	66.17	65.02		60.70			63.59			
May 15-21	64.41	62.70		58.97			61.57			
May 22-28	70.13	68.92		64.65			66.42			
May29-June 4	72.72	72.66	69.53[b]	67.43	68.01[b]	63.13[c]	70.14	68.75[b]	69.30[c]	66.11[b]
Max Temp for May	**78.31**	**78.46**		**72.52**			**73.99**			
Min of Max Temp for May	**60.06**	**58.55**		**54.37**			**58.79**			
June 5-11	69.83	69.72	69.61	64.77	67.82	62.56	66.64	67.73	68.13	65.18
June 12-18	71.19	71.28	71.86	66.99	68.56	64.40	67.81	67.83	69.62	67.16
June 19-25	77.50	78.33	79.75	74.27	74.56	69.87	71.67	70.19	74.15	73.32
June 26-July 2	77.02	77.15	78.39	73.45	73.10	70.19	71.72	70.94	72.89	72.38
Max Temp for June	**80.54**	**80.37**	**81.97**	**77.15**	**77.09**	**72.83**	**73.68**	**73.97**	**77.21**	**76.12**
Min of Max Temp for June	**66.44**	**66.93**	**62.11**	**57.71**	**62.21**	**57.41**	**63.94**	**63.64**	**63.15**	**60.78**
July 3-9	78.45	79.19	79.94	75.69	75.44	71.62	73.25	71.86	73.89	74.89
July 10-16	78.86	80.20	81.32	76.36	75.85	72.14	74.00	72.29	74.69	76.98
Max Temp for July	**80.54**	**81.33**	**83.62**	**78.40**	**77.40**	**74.04**	**74.92**	**73.66**	**76.27**	**78.93**
Min of Max Temp for July	**75.80**	**75.33**	**75.07**	**70.72**	**72.17**	**68.64**	**72.48**	**69.17**	**69.87**	**71.84**
Sept. 1-7	67.58	70.38		69.89	65.56	61.60	66.77	69.26	68.62	68.66
Sept. 8-14	64.90	67.43		65.45	61.93	58.91	63.98	67.63	66.11	64.96
Sept. 15-21	62.82	65.13		63.30	60.33	57.26	62.67	66.23	64.36	62.90
Sept. 22-28	58.75	60.92		60.15	55.59	53.87	60.13	64.34	62.66	61.51
Sept. 29-Oct. 5	59.04	59.17		57.88	55.51	54.94	59.07	61.77	59.90	58.72
Max Temp for Sept.	**69.10**	**73.79**		**73.13**	**68.88**	**62.54**	**68.60**	**70.96**	**71.07**	**69.75**
Min of Max Temp for Sept.	**57.49**	**59.98**		**59.13**	**54.32**	**52.95**	**59.07**	**63.64**	**61.15**	**59.93**
Oct. 6-12	59.08	59.41		57.55	54.88	54.63	58.71	61.72	59.76	58.42
Oct. 13-19	59.56	58.62[d]		57.84	54.72	55.31	59.07	61.60	60.46	58.26
Oct. 20-26	58.91[e]			55.34[e]	60.71[e]	53.35[e]	58.51[e]	62.50[e]	61.88[e]	60.79[e]
Max Temp for Oct.	**60.92**	**60.55**		**59.70**	**66.26**	**56.85**	**59.93**	**63.93**	**64.02**	**64.21**
Min of Max Temp for Oct.	**57.49**	**56.58**		**53.25**	**54.04**	**51.28**	**57.38**	**59.64**	**56.62**	**56.27**

[a] No data before May 6th.
[b] No data before June 1st.
[c] No data before June 2nd.
[d] No data after October 17th.
[e] No data after October 21st.

Table 4. (Cont.) Seven day average maximum temperatures from May 1st –July 16th and September 1st –November 2nd for the lower portions of the Touchet River, Dry Creek, Mill Creek, and the Walla Walla River, 2005 (listed from downstream to upstream for each stream).

	Mill Creek @ Below cold return (MC-7)	Mill Creek @ Above cold return (MC-5)	Mill Creek @ Five Mile Rd. (MC-4)	Walla Walla River @ RV Park (WW-12)	Walla Walla River @ Byerley Rd. (WW-11)	Walla Walla River @ Touchet Gardena Rd. (WW-10)	Walla Walla River @ McDonald Rd. (WW-9)	Walla Walla River @ Detour Rd. (WW-8)	Walla Walla River @ Swegle Rd. (WW-6)	Walla Walla River @ below Burlingame diversion (WW-3)
May 1-7			56.62[a]	65.12[a]	65.13[a]		63.60[a]			58.88[a]
May 8-14			57.74	66.13	64.74		63.65			59.86
May 15-21			55.13	62.37	62.20		59.72			57.23
May 22-28			61.58	67.21	66.00		65.97			62.95
May29-June 4	59.21[b]	64.78[b]	63.38	70.75	71.33	69.88[c]	71.50	67.92[b]	66.33[b]	65.37
Max Temp for May			**67.05**	**75.90**	**77.08**		**74.97**			**69.11**
Min of Max Temp for May			**51.47**	**58.21**	**58.28**		**57.49**			**53.99**
June 5-11	62.29	64.40	61.58	69.02	69.77	70.92	70.69	66.90	65.19	63.16
June 12-18	65.14	66.12	62.59	71.43	70.25	71.54	73.19	68.86	67.13	65.03
June 19-25	70.73	71.72	68.04	77.29	76.15	78.57	78.54	74.95	73.02	70.64
June 26-July 2	71.06	71.71	67.56	76.80	75.55	77.92	77.36	74.03	72.27	70.42
Max Temp for June	**74.84**	**75.23**	**70.88**	**79.35**	**78.01**	**81.60**	**80.61**	**77.44**	**75.20**	**73.91**
Min of Max Temp for June	**55.35**	**59.68**	**57.03**	**65.99**	**66.59**	**65.48**	**66.94**	**62.83**	**61.06**	**59.02**
July 3-9	72.93	73.54	69.36	78.27	79.55	79.65	79.17	75.48	73.54	72.40
July 10-16	73.98	74.54	70.55	79.04	78.56	80.69	79.89	75.93	74.42	73.57
Max Temp for July	**75.46**	**76.16**	**72.38**	**79.99**	**82.14**	**82.25**	**81.25**	**77.75**	**76.14**	**74.83**
Min of Max Temp for July	**68.80**	**69.49**	**65.89**	**75.27**	**73.99**	**76.55**	**75.59**	**72.21**	**70.36**	**69.11**
Sept. 1-7	67.52	68.33	64.35	70.19	70.81	69.28	71.44	66.89	66.05	66.41
Sept. 8-14	62.84	64.80	61.24	67.25	66.92	66.45	67.53	63.54	62.99	62.98
Sept. 15-21	60.09	62.21	58.84	64.95	64.93	64.69	66.07	61.65	61.07	61.38
Sept. 22-28	59.55	60.21	56.52	61.60	61.89	60.76	63.17	58.76	58.39	59.19
Sept. 29-Oct. 5	57.02	57.46	55.05	60.05	59.60	59.22	60.60	58.00	57.23	56.94
Max Temp for Sept.	**70.29**	**70.99**	**66.18**	**73.41**	**74.29**	**71.66**	**74.35**	**68.93**	**68.01**	**68.52**
Min of Max Temp for Sept.	**57.85**	**58.82**	**55.64**	**60.50**	**59.98**	**59.74**	**61.17**	**57.71**	**57.38**	**57.89**
Oct. 6-12	56.58	56.90	54.01	59.65	59.90	58.80	61.46	58.15	57.34	56.18
Oct. 13-19	56.78	57.10	54.20[d]	59.36	60.74	59.25	62.44	58.10[d]	58.26	57.46
Oct. 20-26	60.20[e]	62.16[e]		59.36[e]	59.56[e]	62.62[e]	59.76[e]		62.83[e]	55.66[e]
Max Temp for Oct.	**65.89**	**67.45**	**56.75**	**61.93**	**61.69**	**66.07**	**64.61**	**59.41**	**67.14**	**59.31**
Min of Max Temp for Oct.	**54.51**	**55.48**	**52.86**	**58.50**	**57.72**	**57.19**	**57.49**	**56.32**	**55.15**	**54.27**

[a] No data before May 6th.
[b] No data before June 1st.
[c] No data before June 2nd.
[d] No data after October 17th.
[e] No data after October 21st.

Table 5. Average monthly and mean maximum temperatures (°F and standard deviation) from temperature monitors at Pepper Rd., Mojonnier Rd., Swegle Rd., and Detour Rd. in the Walla Walla River, 1998-2005 (listed from upstream to downstream).

	1998[a]		1999		2000		2001		2002		2003		2004		2005	
	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)
Pepper Rd.																
April							46.38 (2.957)	50.26 (3.929)								
May					54.40 (3.425)	57.56 (4.264)	53.72 (4.877)	59.32 (6.177)			54.51 (3.624)	58.88 (4.134)	50.52 (1.253)	53.47 (2.312)		
June			59.19 (3.861)	65.04 (5.361)	58.71 (4.539)	64.22 (5.636)	60.62 (2.773)	66.15 (4.209)			63.53 (2.358)	69.27 (2.885)	58.60 (5.430)	63.43 (6.642)		
July			66.68 (2.562)	73.92 (3.276)	67.14 (1.960)	73.16 (2.191)	66.25 (2.047)	77.19 (3.466)	69.67 (1.228)	74.76 (0.795)	68.72 (2.018)	74.51 (2.569)	67.73 (1.307)	73.61 (1.584)		
Aug.			68.03 (2.280)	73.40 (3.042)	66.68 (2.273)	71.88 (2.576)	66.76 (1.659)	72.07 (2.213)	65.35 (1.206)	70.41 (1.878)	67.21 (1.397)	71.75 (1.933)	66.90 (2.220)	71.63 (3.310)		
Sept.			60.68 (1.999)	64.84 (2.564)	60.36 (2.604)	63.74 (2.923)	61.37 (2.329)	65.12 (2.754)	59.74 (2.747)	63.32 (3.225)	60.76 (2.610)	64.07 (2.974)	60.33 (1.701)	63.81 (2.149)		
Oct.			53.21 (2.560)	55.64 (2.810)	51.20 (2.496)	53.64 (2.755)	51.53 (2.592)	53.79 (3.193)	50.81 (3.832)	53.31 (4.178)	54.31 (3.061)	56.40 (3.407)	53.84 (2.925)	55.95 (3.703)		
Mojonnier Rd.																
April							47.34 (3.079)	50.71 (3.875)								
May					55.91 (3.019)	59.34 (3.631)	54.63 (4.440)	59.03 (4.955)			56.11 (3.968)	60.04 (4.216)	51.62 (1.265)	54.47 (2.273)	56.97 (3.419)	60.77 (4.311)
June			62.81 (2.304)	68.64 (2.666)	59.46 (4.156)	64.22 (4.759)	60.03 (3.184)	63.71 (4.382)	62.16 (2.812)	66.28 (2.915)	64.37 (2.769)	69.13 (3.208)	60.05 (5.621)	64.37 (6.262)	62.05 (2.951)	66.52 (3.920)
July	71.97 (2.056)	78.23 (2.669)	66.82 (3.177)	74.78 (3.445)	66.76 (2.500)	72.35 (3.086)	66.70 (2.591)	71.83 (3.660)	68.21 (2.769)	73.25 (3.059)	69.36 (2.394)	74.90 (2.948)	68.57 (1.739)	73.88 (2.087)	68.44 (1.562)	74.34 (2.111)
Aug.	69.72 (0.646)	75.17 (2.589)	68.28 (2.947)	74.77 (3.313)	65.52 (2.951)	70.97 (3.132)	67.16 (2.259)	71.66 (2.170)	65.40 (1.526)	70.57 (1.991)	67.34 (1.577)	71.88 (1.936)	67.12 (2.413	71.41 (3.444)	67.27 (2.280)	72.82 (2.708)
Sept.	64.63 (6.673)	71.21 (3.004)	59.28 (2.698)	64.61 (2.951)	58.19 (3.330)	61.21 (3.647)	60.72 (2.411)	64.56 (2.956)	59.41 (2.934)	62.80 (3.416)	60.48 (3.040)	63.58 (3.505)	59.64 (1.970)	62.48 (2.315)	58.71 (2.679)	62.27 (3.030)
Oct.	49.61 (2.681)	51.48 (2.987)	51.52 (2.730)	54.48 (2.983)	51.87 (2.249)	53.76 (2.422)	51.98 (2.021)	53.73 (2.580)	50.31 (4.211)	52.72 (4.392)	54.04 (3.550)	55.99 (3.808)	53.80 (2.842)	55.57 (3.308)	54.48 (1.295)	56.53 (1.286)

[a] Temps were not collected at Pepper Rd. or Detour Rd. due to lack of time and resources available in the first year of the project. The 1998 data was collected on continuous temp and flow monitors that took reading every 15 seconds and stores the data every four hours as averages.

Table 5. (Cont.) Average monthly and mean maximum temperatures (°F and standard deviation) from temperature monitors at Pepper Rd., Mojonnier Rd., Swegle Rd., and Detour Rd. in the Walla Walla River, 1998-2005 (listed from upstream to downstream).

	1998[a]		1999		2000		2001		2002		2003		2004		2005	
	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)	Avg. Temp. (SD)	Mean Max. Temp. (SD)
Swegle Rd.																
April			50.32 (1.757)	53.91 (2.753)			47.80 (3.364)	51.40 (4.204)								
May			52.54 (2.683)	55.99 (2.880)	57.74 (3.885)	61.06 (4.218)	54.57 (4.022)	58.79 (4.114)			57.23 (4.232)	60.88 (4.297)	52.36 (1.286)	54.46 (2.178)		
June	69.22 (2.199)	75.46 (4.256)	62.38 (4.929)	67.95 (5.792)	61.31 (5.058)	66.12 (5.831)	61.80 (4.547)	66.33 (5.501)	66.00 (3.409)	70.75 (3.719)	66.08 (2.757)	71.21 (3.163)	60.88 (5.961)	64.36 (7.393)	63.41 (3.024)	68.68 (3.928)
July	73.41 (2.032)	79.61 (2.289)	68.83 (2.865)	75.13 (3.132)	69.18 (2.227)	74.45 (2.252)	68.22 (2.796)	72.73 (3.543)	69.79 (2.709)	74.53 (2.650)	70.99 (2.453)	75.91 (2.822)	69.86 (1.819)	74.72 (2.022)	69.49 (1.367)	74.75 (1.537)
Aug.	71.09 (2.990)	76.23 (3.351)	69.70 (3.282)	74.68 (3.675)	67.59 (3.077)	71.44 (3.434)	68.23 (2.352)	72.68 (2.699)	66.33 (1.533)	70.05 (1.705)	68.74 (1.704)	72.67 (2.012)	68.46 (2.639)	72.39 (3.356)	68.09 (2.349)	72.45 (2.647)
Sept.	64.23 (3.978)	68.20 (4.469)	59.90 (2.739)	64.00 (3.170)	59.36 (3.578)	62.23 (3.818)	60.51 (2.408)	64.36 (2.814)	60.16 (3.019)	62.40 (3.166)	61.36 (3.222)	64.41 (3.522)	60.60 (1.986)	63.35 (2.280)	59.04 (2.829)	61.93 (3.082)
Oct.	52.97 (3.580)	55.98 (3.789)	51.41 (2.868)	54.19 (2.793)	51.38 (2.758)	53.94 (2.900)	50.62 (2.503)	53.64 (2.823)	51.95 (3.018)	53.16 (3.196)	54.71 (3.620)	56.80 (3.843)	54.56 (4.006)	57.11 (3.607)	55.24 (1.179)	57.96 (2.406)
Detour Rd.																
April							48.18 (3.503)	51.62 (4.283)								
May					59.03 (3.414)	62.56 (3.619)	57.19 (5.919)	62.53 (7.637)			59.53 (4.659)	62.99 (4.857)	55.19 (1.874)	58.16 (2.322)		
June			66.12 (2.327)	71.53 (2.920)	62.38 (4.910)	66.97 (5.875)	63.70 (3.295)	68.79 (4.409)	66.44 (3.379)	71.44 (4.067)	66.85 (2.696)	72.40 (3.071)	63.03 (6.034)	67.29 (6.597)	64.84 (2.938)	70.43 (4.011)
July			69.22 (2.783)	75.73 (2.803)	69.76 (2.148)	75.60 (2.270)	68.84 (2.925)	73.89 (3.836)	70.77 (2.720)	76.16 (2.703)	71.50 (2.465)	76.65 (2.802)	70.25 (1.751)	75.14 (1.899)	70.65 (1.282)	76.28 (1.426)
Aug.			70.18 (3.047)	75.36 (3.424)	68.13 (3.142)	72.57 (3.442)	68.61 (2.335)	73.12 (2.760)	67.36 (1.727)	71.96 (2.039)	69.22 (1.721)	73.25 (2.039)	68.78 (2.458)	72.17 (3.212)	69.02 (2.351)	73.26 (2.844)
Sept.			60.27 (2.632)	64.18 (3.036)	59.89 (3.595)	62.79 (3.801)	61.81 (2.600)	64.86 (2.865)	60.57 (3.292)	63.67 (3.656)	61.84 (3.187)	64.94 (3.515)	60.92 (2.038)	62.68 (2.254)	59.80 (2.842)	62.49 (3.243)
Oct.			51.71 (2.814)	54.32 (2.743)	52.91 (2.448)	54.79 (2.612)	52.45 (2.296)	54.48 (2.851)	50.98 (4.229)	53.49 (4.416)	55.31 (3.259)	57.38 (3.646)	55.05 (2.461)	56.15 (2.749)	55.92 (0.933)	57.93 (0.868)

[a] Temps were not collected at Pepper Rd. or Detour Rd. due to lack of time and resources available in the first year of the project. The 1998 data was collected on continuous temp and flow monitors that took reading every 15 seconds and stores the data every four hours as averages.

Limiting Factors Identification

A number of barriers or impediments to salmonid migration and rearing have been identified by this project since 1998 (Mendel et al. 1999, 2000, 2001, 2002, 2003b, 2004, 2005). A portion of those barriers were physical (e.g. structures or dewatered streambeds) that physically blocked salmonid movement (see Mendel et al. 2003b), others were physiological barriers or limiting factors (e.g. temperature, sediment, lack of pools, etc.). WDFW personnel found several physical barriers in 2005. These barriers included; approximately 10 beaver dams on lower Coppei Creek found during steelhead spawning surveys, approximately seven temporary man-made dams on the North Fork Touchet River found on the first spawning survey for bull trout, several temporary man-made dams were found on the lower 0.25 miles of Corral Creek during summer electrofishing and again during bull trout spawning surveys, one temporary man-made dam was found on the Touchet River behind the Golf Course while surveying for spring chinook redds, and one temporary man-made dam was discovered in Mill Creek at Wickersham bridge. Physiological barriers and impediments to salmonid migration and rearing were extensive in terms of stream miles affected. The primary physiological factor affecting fish in the Walla Walla Subbasin was water temperature. Temperature possibly represents the most critical physiological barrier to salmonids, particularly for migration or rearing. Seasonal temperature related barriers for salmonids generally occur in lower areas of the Touchet River, Mill Creek, Dry Creek and the Walla Walla Rivers and their tributaries. Stream reaches with mean water temperatures exceeding 75°F during the summer are associated with low densities of salmonids (Mendel et al. 1999). Most of the salmonids in these marginal thermal areas are age 0+ rainbow/steelhead trout. We have documented temperatures of 70°F or higher in many lower mainstem reaches and in some tributaries during summer as might be expected, but also in mid to late May and June and again in early September when they may affect migration of salmonids. These temperatures likely adversely affect migrating juvenile salmonids, adult steelhead and spring chinook in the spring, and adult steelhead returning in September. Turbidity, sedimentation, lack of pools and cover, and other habitat factors, may also present challenges to migrating, breeding and rearing salmonids.

Low stream flows often prevent steelhead from ascending the lower Walla Walla and Touchet Rivers until November or later in some years. Diversion of up to 100 cfs is usually initiated by Gardena Farms Irrigation District at Bulingame Diversion about the first of October each year. This large diversion may affect bull trout and steelhead migration each fall.

Fish Stock Assessment

Distribution and Abundance

Densities of two salmonid species were calculated from quantitative electrofishing sites in the Walla Walla Subbasin, and four salmonid species were seen during qualitative electrofishing (Table 6 and 7). Identified salmonid species included: rainbow/steelhead trout, bull trout, mountain whitefish, and chinook salmon. Additional data collected by the WDFW SRL, in the Touchet River and its tributaries (often included in our previous annual reports) will appear in their LSRCP annual report (eg. see Bumgarner et al. 2004).

Rainbow/steelhead trout represent the most common salmonid found in the Walla Walla Subbasin. Age 0+ rainbow/steelhead densities are typically higher than for older age classes for most sites, but quantitative estimates were compiled in upper drainages where Age 1+ rainbow/steelhead dominate. Age 1+ rainbow/steelhead trout predominated in the following sites; Wolf Fork (WF- 2, 3, 4, 5, 6) (Table 6). Legal size (≥ 200mm) rainbow trout densities represent wild or unknown origin trout unless noted.

Other salmonid species had a limited distribution from sampling conducted in 2005 (Table 6 and 7). Bull trout distribution was greatest in the North Fork and the Wolf Fork of the Touchet River. Low densities of bull trout were found in Corral Creek, Lewis Creek, Burnt Fork, and Mill Creek. Juvenile chinook salmon were only found at one site in 2005, a fish salvage on upper Mill Creek. The presence of chinook salmon in the Walla Walla and Mill Creek Watersheds are primarily associated with the outplanting of adult spring chinook by the CTUIR. These fish have been released and allowed to spawn freely in the upper portion of Mill Creek, and the South Fork of the Walla Walla River. Releases occurred from 2000 to present in the South Fork of the Walla Walla River, and 2000 through 2002 in upper Mill Creek. Juveniles now seen in upper Mill Creek are from adults returning to this portion of the stream. We have documented few whitefish in all our sampling efforts in 2005, or in previous years.

The limited distribution of salmonids in 2005 may be a result of limited sampling in the Walla Walla Subbasin (Figure 10) compared to previous years (Mendel et al. 1999, 2000, 2001, 2002, 2003b, 2004, 2005). Spatial distribution and number of electrofishing sites varies from year to year, allowing us to place emphasis on different areas in the subbasin. This may also cause variation in the apparent distribution and abundance in salmonid populations. We intend over the next year to compile all electrofishing that has been conducted in this project to show a more complete picture of distribution and abundance in the Walla Walla Subbasin.

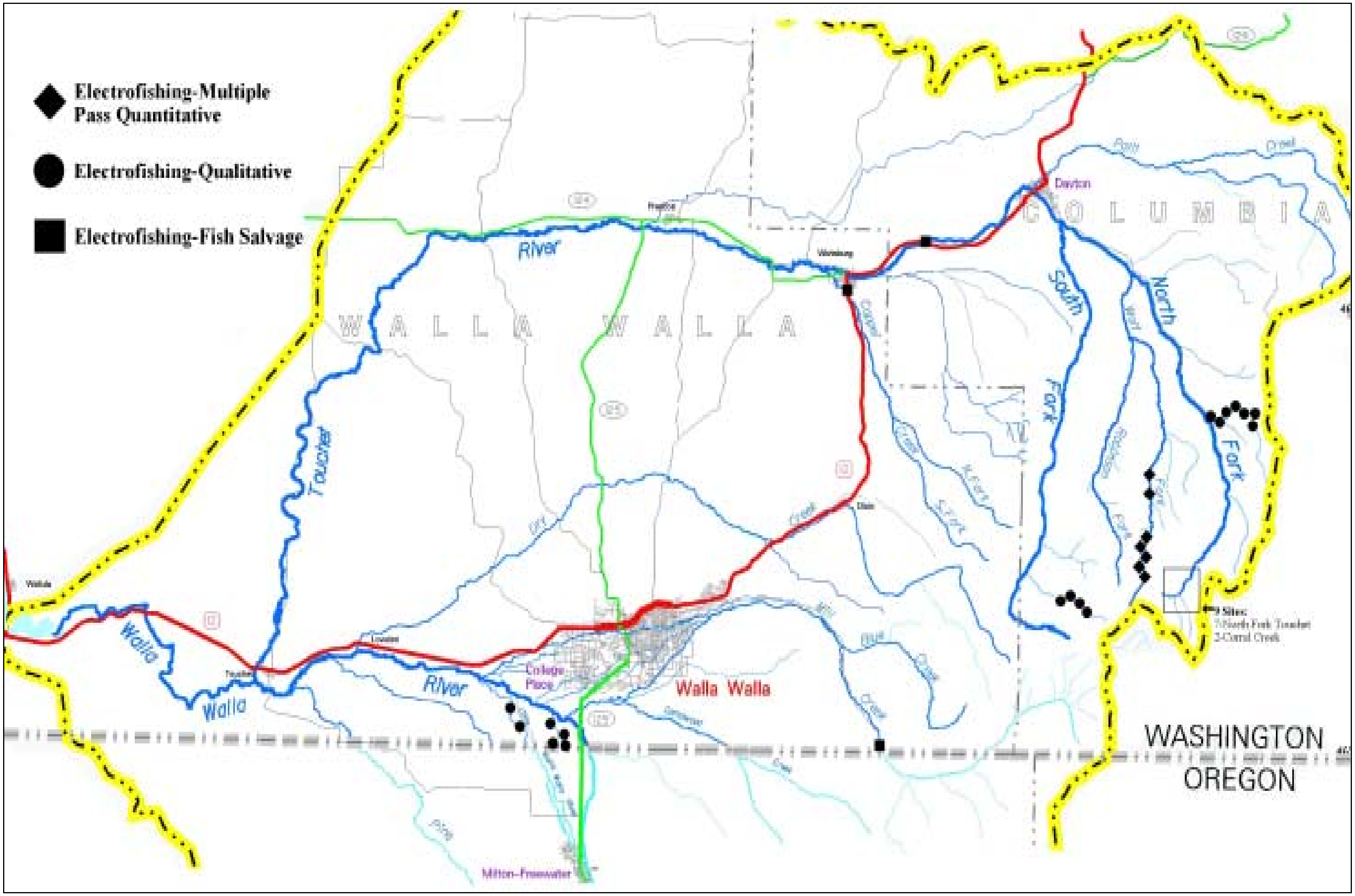


Figure 10. Relative locations of WDFW electrofishing sites in the Walla Walla Subbasin, 2005

Electrofishing

Quantitative Electrofishing

Quantitative electrofishing was conducted on one stream in 2005. The surveys were conducted on the Wolf Fork in mid-July and produced densities of rainbow/steelhead trout ranging from 0 to 32.52 fish per 100 m^2 (Figure 10 and Table 6). Yearling (Age 1+) rainbow/steelhead were most abundant in most sites, which is common in tributaries and upper mainstem (Mendel et al. 2005), with densities between 0 and 11.56 fish per 100 m^2. Sub-yearling (Age 0+) rainbow/steelhead were found at one site and were dominant there with a density of 21.0 fish per 100 m^2 (Table 3). Legal size rainbow/steelhead were not found in any of the quantitative sites in 2005. Densities of bull trout ranged from 0 to 21.93 with yearling fish (Age 1+) dominating most of the sites (Table 6).

Table 6. Densities of salmonids from multiple pass quantitative electrofishing sites in the Walla Walla Subbasin, 2005

					Densities (#/100m²)							
					rainbow/steelhead							
Stream Reach	Date	Site Length	Mean Width	Area	Age/Size					Age/Size		
Site Name	(mm/dd)	(m)	(m)	(m²)	0+	1+	≥8 in	Total	Other Species[a]	0+	1+	≥8 in
Wolf Fork												
WF1	07/13	30	2.54	76.2	0.0	0.0	0.0	0.0	BT	0.0	1.31[b]	1.31[b]
WF2	07/13	30	3.80	114.0	0.0	1.75	0.0	1.75	BT	7.02	14.91	0.0
WF3	07/13	30	3.80	114.0	0.0	7.02	0.0	7.02	BT	8.77	2.63	0.0
WF4	07/13	30	3.50	105.0	0.0	7.62	0.0	7.62	BT	0.95	6.67	0.0
WF5	07/13	30	3.46	103.8	0.0	11.56[b]	0.0	11.56	BT	3.85	8.67	0.0
WF6	07/14	35	4.94	172.9	0.0	2.31	0.0	2.31	BT	4.63	10.41	0.0
WF7	07/14	30	4.92	147.6	21.0	11.52	0.0	32.52				

[a] BT=bull trout
[b] Calculated using the sum of the passes, due to poor reduction between successive passes.

Qualitative Electrofishing

Qualitative electrofishing surveys were conducted on 10 streams within the Walla Walla Subbasin in 2005 (Figure 10). While most of the surveys were completed from middle of July through early September, surveys on East Little Walla Walla, Big Spring Branch, and West Little Walla Walla were conducted in early March (Table 7). The qualitative surveys during the summer months were used to supplement the more intensive quantitative electrofishing surveys, to examine areas where quantitative surveys may not be feasible, and to assess streams where fish presence or use has little or no documentation.

Qualitative surveys on the North Fork Touchet (NFT-1, 2, 3, 4, 5, 6, 7) were conducted to monitor the population of bull trout in this stream after a road project produced heavy sedimentation into the stream in an area where bull trout were spawning in the fall of 2004, and also to determine the upper end of bull trout distribution. Corral Creek, Lewis Creek, and the Burnt Fork were all surveyed to determine distribution and abundance of bull trout. Bull trout were found in all three of these streams, but in very low numbers (Table 7).

East Little Walla Walla, Big Spring Branch, and West Little Walla Walla are ongoing monitoring efforts to determine fish use and distribution in the Little Walla Walla System. Monitoring of this system will help to guide future management of the system. The intent of the early surveys was to return to these streams during the summer and the fall and look at the difference in distribution and abundance throughout the year, but this was not accomplished because of scheduling conflicts.

The three other streams that were surveyed were the Touchet River, Coppei Creek, and Mill Creek. All the surveys conducted on these three streams were fish salvage efforts. The Touchet River salvage and the Coppei Creek salvage were conducted for the Department of Transportation at bridge sites (the Touchet River site was for repairs, and the Coppei Creek site was a bridge replacement). The Mill Creek salvage was in conjunction with a dam removal project being conducted by the Tri-State Steelheaders (Table 7).

Table 7. Relative abundance of fish from qualitative electrofishing sites in the Walla Walla Subbasin, 2005.

Stream	Site #	Date	Site Length	Avg. Width	Relative Abundance[a]	Comments
NF Touchet River	NFT-1 0.5 miles above Bluewood Rd.	7/12	30	1.3	No fish found	Moderate intensity
	NFT-2 0.2 miles above Bluewood Rd.	7/12	33	1.5	Three age 1+ BT's (124-135mm)	Moderate intensity
	NFT-3 ~45 meters below Bluewood culvert	7/12	30	2.1	Five age 0+ BT's (38-40mm), Three age 1+ BT's (109-127mm)	Moderate intensity
	NFT-4 Directly below Bluewood culvert	7/12	30	3.2	Nine age 0+ BT's (25-44mm), Five age 1+ BT's (104-135mm), TF-rare	Moderate intensity
	NFT-5 Above Corral Creek	7/12	30	3.1	Five age 0+ BT's (28-34mm), Seven age 1+ BT's (113-130mm)	Moderate intensity
	NFT-6 Below Corral Creek	7/12	30	3.7	Five age 0+ BT's (32-41mm), 16 age 1+ BT's (82-165mm)	Moderate intensity
	NFT-7 0.7 miles below Corral Creek mouth	7/12	30	3.1	Three age 0+ BT's (39-57mm), Six age 1+ BT's (85-156mm), TF-rare	Moderate intensity
Corral Creek	CC-1 ~0.4 miles above mouth	7/12	30	1.4	No salmonids found, TF-rare	Moderate intensity
	CC-2 ~0.3 miles above mouth	7/12	30	1.5	11 age 0+ BT's (37-43mm)	Moderate intensity
Lewis Creek (Above Forest Service Line)	LC-1 1.5 miles above Forest Service Line	8/16	35	2.4	Six age 0+ RBT's (65-79mm), Nine age 1+RBT's (96-165mm), TF-common	High intensity

[a] RBT=rainbow trout, BT=bull trout, MTW=mountain whitefish, WCH=chinook, SD=speckled dace, LND=longnosed dace, SCP=sculpin, BLS=bridgelip suckers, NPM=northern pikeminnow, TF=tailed frogs, LPY=lamprey.
Rare=≤3, Uncommon=4-10, Common=11-100, and Abundant=≥101

Table 7. Cont. Relative abundance of fish from qualitative electrofishing sites in the Walla Walla Subbasin, 2005.

Stream	Site #	Date	Site Length	Avg. Width	Relative Abundance[a]	Comments
Lewis Creek (Cont. Above Forest Service Line)	LC-2 1.2 miles above Forest Service Line	8/16	30	2.3	Five age 0+ RBT's (75-80mm), Seven age 1+ RBT's (93-140mm), TF-uncommon	High intensity
	LC-3 0.8 miles above Forest Service Line	8/16	30	2.8	One age 0+ RBT (66mm), Four age 1+ RBT's (106-145mm), Three age 1+ BT's (96-142mm), TF-uncommon	High intensity
	LC-4 0.3 miles above Forest Service Line	8/16	30	3.1	Seven age 1+ RBT's (111-172mm), One age 1+ BT (104mm), TF-common, MSC-common	High intensity
Lewis Creek (Below Forest Service Line)	LC-5 0.2 miles below Forest Service Line	8/18	30	2.7	Four age 0+ RBT's (52-58mm), Two age 1+ RBT's (119-135mm), MSC-common	High intensity
	LC-6 0.5 miles below Forest Service Line	8/18	33	3.4	13 age 0+ RBT's (43-55mm), 12 age 1+ RBT's (76-185mm), One legal RBT (210mm), PSC-common, MSC-uncommon, Crayfish-present	High intensity
	LC-7 1.0 miles below Forest Service Line	8/18	30	3.2	Three age 0+ RBT's (49-62mm), 10 age 1+ RBT's (103-158mm), MSC-common, PSC-common, Crayfish-present	High intensity
Burnt Fork	BF-1 River Mile 3.3	8/11	33	3.2	Five age 1+ RBT's (94-137mm), TF-common	Moderate intensity
	BF-2 River Mile 2.8	8/11	47	2.9	13 age 1+ RBT's (82-162mm), TF-common, SCP-uncommon	Moderate intensity
	BF-3 River Mile 2.2	8/11	30	3.0	20 age 1+ RBT's (74-182mm), SCP-common	Moderate intensity
	BF-4 River Mile 1.6	8/11	43	3.9	Four age 0+ RBT's (31-38mm), 25 age 1+ RBT's (70-195mm), One adult BT (340mm), TF-common, SCP-common	Moderate intensity
Touchet River	TR-2 Hwy 12 bridge below LC State Park	8/29	30	N/A	Age 0+ RBT's-common, age 1+ RBT's-common, SD-abundant, RSS-common, SCP-rare	High intensity, Salvage
	TR-2 Hwy 12 bridge below LC State Park	8/30	30	N/A	Age 0+ RBT's-rare, age 1+ RBT's-rare, SD-abundant, RSS-common, SCP-rare	High intensity, Salvage
	TR-2 Hwy 12 bridge below LC State Park	9/7	30	N/A	Age 0+ RBT's-rare, age 1+ RBT's-rare, SD-abundant, RSS-uncommon	High intensity, Salvage

[a] RBT=rainbow trout, BT=bull trout, MTW=mountain whitefish, WCH=chinook, SD=speckled dace, LND=longnosed dace, SCP=sculpin, BLS=bridgelip suckers, NPM=northern pikeminnow, TF=tailed frogs, LPY=lamprey.

Rare=≤3, Uncommon=4-10, Common=11-100, and Abundant=≥101

Stream	Site #	Date	Site Length	Avg. Width	Relative Abundance[a]	Comments
Table 7. Cont. Relative abundance of fish from qualitative electrofishing sites in the Walla Walla Subbasin, 2005.						
Coppei Creek	CO-3 Hwy 12 bridge in Waitsburg	7/15	52.3	3.0	One age 1+ RBT (162mm), SD-abundant, SCP-common, NPM-common, RSS-uncommon	High intensity, Salvage
East Little Walla Walla	ELW-1 River Mile 1.6	3/9	96	1.7	Nine age 1+ RBT's (82-182mm), Two legal RBT's (205-233mm), SCP-common, SD-common, RSS-common	Moderate intensity
	ELW-2 River Mile 0.6	3/9	15	3.1	One age 1+ RBT (127mm), One legal RBT (204mm), SCP-common, SD-common, BLS-uncommon	Moderate intensity
Big Spring Branch (Branch of East Little Walla Walla)	BSB-1 River Mile 0.5	3/9	133.5	4.9	15 age 1+ RBT's (98-165mm), One legal RBT (267mm), One age 1+ MTW (168mm), Two adult MTW (210-232mm), SCP-common, SD-common, RSS-common, NPM-common, BLS-common, LPY-rare	Moderate intensity
	BSB-2 River Mile 0.2	3/9	186	3.5	12 age 1+ RBT's (105-197mm), Three legal RBT's (202-231mm), SCP-common, SD-common, BLS-common, NPM-uncommon, LPY-rare	Moderate intensity
Mill Creek	MC-1 Kooskooskie Dam Salvage	8/8	N/A	N/A	Age 0+ RBT's-common, age 1+RBT's-common, legal RBT's-common, WCH-common, LPY-common, MSC-common, LND-uncommon	High intensity, Salvage
	MC-1 Kooskooskie Dam Salvage	8/17	N/A	N/A	RBT-abundant, BT-rare, WCH-abundant, SCP-abundant, LND-common, LPY-uncommon, Crayfish-present	High intensity, Salvage
West Little Walla Walla	WLW-1 1.1 miles below State line Rd.	3/9	76	2.3	No salmonids found, SCP-abundant, SD-uncommon	Moderate intensity
	WLW-2 Just above Swegle Rd.	3/9	82	1.8	No fish found	Moderate intensity

[a] RBT=rainbow trout, BT=bull trout, MTW=mountain whitefish, WCH=chinook, SD=speckled dace, LND=longnosed dace, SCP=sculpin, BLS=bridgelip suckers, NPM=northern pikeminnow, TF=tailed frogs, LPY=lamprey.
Rare=≤3, Uncommon=4-10, Common=11-100, and Abundant=≥101

Non-Salmonid Species Abundance and Distribution

Speckled dace (*Rhinichthys osculus*) and sculpin (*Cottus sp.*) were the most common non-salmonids found at most of our sampling sites (Appendix D). Speckled dace generally did not exist at upper sites where water temperatures were relatively cool. Longnose dace (*Rhinichthys cataractae*) were observed during electrofishing surveys in Mill Creek. Sculpin are found throughout the subbasin except in the lower sections of the mainstem Walla Walla and Touchet

Rivers, and in cold headwater sites. Northern pikeminnow (*Ptychocheilus oregonesis*) were found in moderate densities in only a couple of streams. Tailed frogs/tadpoles (*Ascaphus truei*) were found only in upper sites in cold, clean water. During our efforts we have generally found bull trout where tailed frogs were present, but we have also found tailed frogs in headwater areas where bull trout are not present.

Spawning Surveys

In 2005, spawning surveys were conducted for steelhead, bull trout, and spring chinook salmon. Steelhead spawning surveys occurred during the spring in two streams (Mill Creek and Coppei Creek), while bull trout and spring chinook surveys were conducted in the upper Touchet River system in the fall (Figure 11).

Steelhead

Steelhead spawning surveys were conducted in Coppei Creek drainage (Coppei Creek, South Fork Coppei, and North Fork Coppei) and Mill Creek in 2005 between late March and the end of April (Table 8 and 9). Surveys on Coppei Creek were in conjunction with the operation of an adult trap (not funded by this project) during the winter of 2004 and spring of 2005. Mill Creek was surveyed for the fifth consecutive year (Figure 12). We are monitoring this population closely, because improvements to fish passage at Bennington Dam and to Yellowhawk Creek (another route fish can use to access upper Mill Creek) seem to be having a positive influence on the spawning population (Figure 12).

The lower 5.1 miles of the South Fork Coppei were surveyed two times and 22 redds and three live fish were observed. The lower 1.4 miles of the North Fork Coppei were also surveyed two times and five redds were observed. Coppei Creek was surveyed from the confluence of the North and South Fork Coppei down to the mouth (8.1 miles), all sections were surveyed at least two times, with one section being surveyed four times. Seventeen redds and 10 live fish were observed during these surveys (Table 8). The lower two sections of Coppei Creek, below the adult steelhead trap we were operating at river mile 3.3, were surveyed on March 11th and 24th for two reasons: 1) to see if steelhead use this section of Coppei Creek for spawning as we had not previously surveyed below Meinburg Rd. (river mile 2.2), 2) to see if there were any barriers to steelhead passage in the lower section because we had not seen any steelhead at our adult trap. During the first survey we documented 12 beaver dams from Meinburg Rd. downstream to the mouth. Low spring flows had made several of these dams migration barriers, and we subsequently got an Hydraulic Project Approval (HPA) permit through our agency to notch the dams enough for fish passage. The survey on March 24th was to continue to monitor this area for spawning and to reopen passage at any of the dams that had been rebuilt.

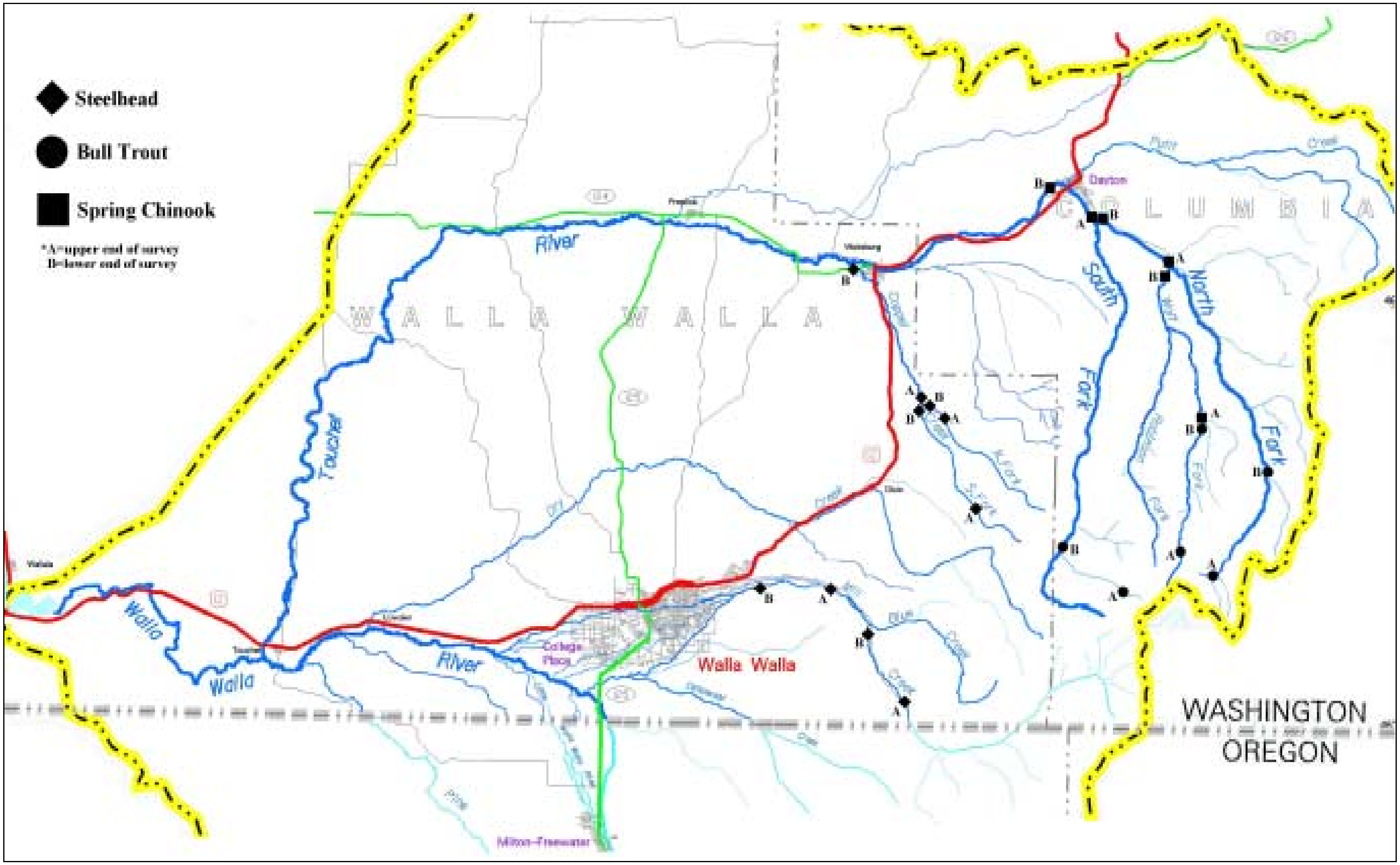


Figure 11. Relative locations of WDFW steelhead, bull trout, and spring chinook spawning survey areas in the Walla Walla Subbasin, 2005.

Table 8. Steelhead spawning survey summary for the Coppei Creek Watershed, 2005.

Reach/ Date	Survey	Stream Section[a]	Surveyed Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
SF Coppei						Live	Dead
4/12	1	(A) River mile 5.1 to river mile 2.5	2.6	3	1.2	1	0
4/12	1	(B) River mile 2.5 to river mile 0.0	2.5	9	3.6	0	0
4/28	2	(A) River mile 5.1 to river mile 2.5	2.6	8	3.1	0	0
4/28	2	(B) River mile 2.5 to river mile 0.0	2.5	2	0.8	2	0
		Total	**5.1**	**22**	**4.3**	**3**	**0**
NF Coppei							
4/13	1	(C) River mile 1.4 to river mile 0.0	1.4	5	3.6	0	0
4/28	2	(C) River mile 1.4 to river mile 0.0	1.4	0	0.0	0	0
		Total	**1.4**	**5**	**3.6**	**0**	**0**
Coppei Creek							
4/13	1	(D) River mile 8.1 to river mile 5.4	2.7	7	2.6	0	0
4/13	1	(E) River mile 5.4 to river mile 3.3	2.1	2	1.0	0	0
3/11	1	(F) River mile 3.3 to river mile 1.8	1.5	0	0.0	0	0
3/11	1	(G) River mile 1.8 to river mile 0.0	1.8	1	0.6	3	0
4/28	2	(D) River mile 8.1 to river mile 5.4	2.7	2	0.7	0	0
4/28	2	(E) River mile 5.4 to river mile 3.3	2.1	0	0.0	0	0
3/24	2	(F) River mile 3.3 to river mile 1.8	1.5	2	1.3	2	0
3/24	2	(G) River mile 1.8 to river mile 0.0	1.8	2	1.1	3	0
4/12	3	(F) River mile 3.3 to river mile 1.8	1.5	1	0.7	2	0
4/12	3	(G) River mile 1.8 to river mile 0.0	1.8	0	0.0	0	0
4/28	4	(F) River mile 3.3 to river mile 1.8	1.5	0	0.0	0	0
		Total	**8.1**	**17**	**2.1**	**10**	**0**

[a] A: 0.4 miles below Barns Ck to RM 2.5, B: RM 2.5 to mouth, C: RM 1.4 to mouth, D: Forks to McCowan Rd. bridge, E: McCowan Rd. bridge to RM 3.3, F: RM 3.3 to Orchard St. in Waitsburg, G: Orchard St. in Waitsburg to mouth.

We operated an adult fish trap (using other funding) as an attempt to determine the origin (hatchery vs. wild) and relative abundance of steelhead spawning in this stream. The trap was operated on weekdays beginning December 6th, 2004. The trap was operated until April 28th, 2005, with the exception an extreme cold spell in January (11th to the 24th) that created ice dams on the trap and weir, and a short period at the end of March (26th to 31st) when the trap was blown out by high stream flows. No fish were observed until March 22nd, 2005, the day after we notched 12 beaver dams (from the trap down to the mouth) to improve fish passage. A total of seven wild steelhead, four females and three males, were passed upstream through the trap. Two post spawn adult females, that had not been sampled going upstream, were found dead on the pickets, one contained a radio tag from the CTUIR telemetry project. No hatchery steelhead were observed at the trap. All steelhead were sampled for; lengths, origin (hatchery or wild), sex, marks (fin clips, etc.), DNA samples, scale samples, and were scanned for CWT and PIT tags. We also sampled one sculpin (75mm), five rainbow trout (85-106mm), and 145 bridgelip suckers (320-472mm). Results from operation of this trap were incomplete because of the impassable beaver dams downstream and the loss of the trap during high flows.

We completed three surveys on sections of upper Mill Creek where access was allowed from the state line down to 0.1 miles above Bennington Dam (6.4 miles surveyed) and 80 redds and one live fish were observed. We expanded the redd counts by applying redds/mile in surveyed areas to reaches where we were denied access (4.7 miles), to estimate total redds from the state line downstream to 0.1 miles above Bennington Dam (11.1 miles). The expanded estimate was 139 redds in this section (Table 9, Figure 12). This is the highest redd count on upper Mill Creek since we began surveys in 2001 (Table 10, Figure 12), and could be related to improved passage in the lower river making it easier for adult steelhead to access spawning areas. Spawning survey estimates in 2002 and 2003 were low, but could be attributed to limited number and distribution of surveys. These surveys were delayed or limited because of high, turbid stream flows that make accurate observations of fish and redds nearly impossible (Mendel et al. 2003b and 2004).

Table 9. Steelhead spawning survey summary for Mill Creek within Washington State, 2005.

Reach/ Date	Survey	Stream Section[a]	Surveyed Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
Mill Creek						Live	Dead
3/25	1	(A) River mile 21.6 to river mile 20.8	0.8	0	0.0	0	0
3/25	1	(B) River mile 20.8 to river mile 18.7	2.1	4	1.9	0	0
3/25	1	(C) River mile 15.9 to river mile 13.8	2.1	12	5.7	0	0
3/25	1	(D) River mile 13.8 to river mile 12.9	0.9	4	4.4	0	0
3/25	1	(E) River mile 12.9 to river mile 12.4	0.5	1	2.0	0	0
4/14	2	(A) River mile 21.6 to river mile 20.8	0.8	4	5.0	0	0
4/14	2	(B) River mile 20.8 to river mile 18.7	2.1	16	7.6	1	0
4/14	2	(C) River mile 15.9 to river mile 13.8	2.1	2	1.0	0	0
4/14	2	(D) River mile 13.8 to river mile 12.9	0.9	6	6.7	0	0
4/14	2	(E) River mile 12.9 to river mile 12.4	0.5	0	0.0	0	0
4/29	3	(A) River mile 21.6 to river mile 20.8	0.8	6	7.5	0	0
4/29	3	(B) River mile 20.8 to river mile 18.7	2.1	13	6.2	0	0
4/29	3	(C) River mile 15.9 to river mile 13.8	2.1	12	5.7	0	0
4/29	3	(D) River mile 13.8 to river mile 12.9	0.9	0	0.0	0	0
4/29	3	(E) River mile 12.9 to river mile 12.4	0.5	0	0.0	0	0
		Total	**6.4**	**80**	**12.5**	**1**	**0**
		Expanded Totals[b]	**11.1**	**139**			

[a] A: 0.8 miles above Wickersham bridge to Wickersham bridge, B: Wickersham bridge to 0.4 miles above Blue Creek mouth, C: Seven Mile Rd. to Five Mile Rd., D: Five Mile Rd. to 0.6 miles above Bennington Dam, E: 0.6 miles above Bennington Dam to 0.1 miles above Bennington Dam
[b] Expanded data was created by multiplying the total redds per mile (12.5) by the miles that we could not survey (4.7) and adding that number of redds to the total.

Table 10. Steelhead spawning survey summary, redd count (number of times surveyed), for Mill Creek, 2001-2005.

<table>
<tr><th rowspan="3">Year</th><th colspan="13">Reach Surveyed[a]</th><th rowspan="3">Total Redds</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>I</th><th>J</th><th>K</th><th>L</th><th>M</th></tr>
<tr><th>RM 23.5-21.6</th><th>RM 21.6-20.8</th><th>RM 20.8-18.7</th><th>RM 18.7-18.3</th><th>RM 18.3-18.0</th><th>RM 18.0-15.9</th><th>RM 15.9-13.8</th><th>RM 13.8-12.9</th><th>RM 12.9-12.4</th><th>RM 4.9-4.7</th><th>RM 4.7-3.0</th><th>RM 3.0-2.0</th><th>RM 2.0-0.0</th></tr>
<tr><td>2001</td><td colspan="2">4 (3)</td><td colspan="2">3 (3)</td><td colspan="2">9 (3)</td><td>3 (2)</td><td>2 (2)</td><td></td><td></td><td>0 (1)</td><td>0 (1)</td><td>1 (1)</td><td>22</td></tr>
<tr><td>2002</td><td colspan="2">0 (2)</td><td>1 (2)</td><td></td><td colspan="2">0 (2)</td><td>0 (2)</td><td>0 (2)</td><td></td><td colspan="3">0 (2)</td><td>0 (2)</td><td>1</td></tr>
<tr><td>2003</td><td></td><td>0 (2)</td><td>5 (2)</td><td></td><td colspan="2">2 (2)</td><td>2 (2)</td><td>0 (2)</td><td></td><td></td><td></td><td></td><td></td><td>9</td></tr>
<tr><td>2004</td><td></td><td>4 (5)</td><td>10 (5)</td><td></td><td></td><td>5 (5)</td><td>9 (5)</td><td>8 (5)</td><td></td><td></td><td></td><td></td><td></td><td>36</td></tr>
<tr><td>2005</td><td></td><td>10 (3)</td><td>33 (3)</td><td></td><td></td><td></td><td>26 (3)</td><td>10 (3)</td><td>1 (3)</td><td></td><td></td><td></td><td></td><td>80</td></tr>
</table>

[a] A: state line to 0.8 miles above Wickersham bridge, B: 0.8 miles above Wickersham bridge to Wickersham bridge, C: Wickersham bridge to 0.4 miles above Blue Creek mouth, D: 0.4 miles above Blue Creek mouth to Blue Creek mouth, E: Blue Creek mouth to 0.3 miles below Blue Creek mouth, F: 0.3 miles below Blue Creek mouth to Seven Mile Rd., G: Seven Mile Rd. to Five Mile Rd., H: Five Mile Rd. to 0.6 miles above Bennington Dam, I: 0.6 miles above Bennington Dam to 0.1 miles above Bennington Dam, J: Hussey St. to Campbell Rd., K: Campbell Rd. to Wallula Rd., L: Wallula Rd. to Last Chance Rd., M: Last Chance Rd. to Mouth.

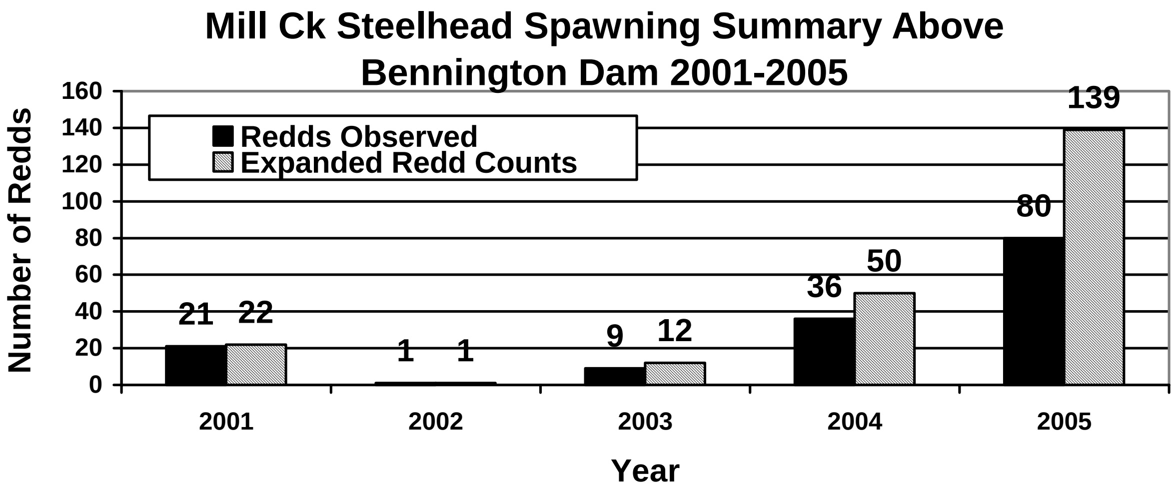


Figure 12. Steelhead spawning survey summary for redds observed and expanded redd counts in Mill Creek above Bennington Dam, 2001-2005.

Bull Trout

Bull trout spawning surveys were conducted in the upper tributaries of the Touchet River in 2005. The surveyed areas included the Wolf Fork, North Fork Touchet, and the Burnt Fork. Surveys were conducted at least two times in each of these streams with sections of the Wolf Fork and North Fork Touchet being surveyed four times. Redd counts are typically used to evaluate abundance and distribution of adult bull trout and trends in population size (Dunham et al. 2001, Hemmingsen et al. 2001, Starcevich et al. 2005, Mendel et al. 2006). Redd counts can be compared to other methods of estimating adult population abundance. Although redd counts for bull trout can have substantial sampling errors (Dunham et al. 2001, Hemmingsen et al. 2001, Starcevich et al. 2005), a strong relationship between the estimated number of mature fluvial bull trout females, or total mature adults, and the total number of redds observed has been documented in the South Fork Walla Walla River and elsewhere in northeast Oregon (Starcevich et al. 2005, Al-Chockhachy et al. 2005). Redd counts can have substantial bias in relation to abundance of resident bull trout because of the small size of redds and associated redd enumeration errors (Starcevich et al. 2005, Al-Chockhachy et al. 2005). WDFW biologists have found spawning surveys to be useful for determining spawn timing, distribution and relative abundance of redds or mature adults, particularly for fluvial (migratory) bull trout, as well as for monitoring abundance trends in southeast Washington (Mendel et al. 2004, 2005, 2006).

Bull trout spawning surveys in the upper Wolf Fork in 2005 produced a total of 57 redds and 36 live fish between river mile 7.7 and river mile 14.1 (Table 11). This was the second lowest total redd count since 1998, with similar distribution and number of surveys per year. While we have included data back to 1990, the data prior to 1998 was sporadic in both areas surveyed and the number of surveys completed in any given year and should not be compared directly to the surveys conducted after 1998. Since 1998, WDFW has tried to standardize surveys in this area so comparisons can be made from year to year (Table 12, Figure 13).

Table 11. Bull trout spawning survey summary for the Wolf Fork of the Touchet River, 2005.							
Reach/ Date	**Survey**	**Stream Section**[a]	**Surveyed Miles**	**Redds**	**Redds per mile**	**Fish Observed**	
Wolf Fork						Live	Dead
9/07	1	(A) River mile 14.1 to river mile12.3	1.8	0	0.0	0	0
9/07	1	(B) River mile 12.3 to river mile 10.9	1.4	2	1.4	3	0
9/07	1	(C) River mile 10.9 to river mile 10.0	0.9	9	10.0	22	0
9/07	1	(D) River mile 10.0 to river mile 8.9	1.1	4	3.6	2	0
9/07	1	(E) River mile 8.9 to river mile 7.7	1.2	0	0.0	0	0
9/22	2	(A) River mile 14.1 to river mile12.3	1.8	1	0.6	0	0
9/22	2	(B) River mile 12.3 to river mile 10.9	1.4	3	2.1	0	0
9/22	2	(C) River mile 10.9 to river mile 10.0	0.9	24	26.7	6	0
9/22	2	(D) River mile 10.0 to river mile 8.9	1.1	4	3.6	2	0
9/22	2	(E) River mile 8.9 to river mile 7.7	1.2	2	1.7	0	0
10/6	3	(B) River mile 12.3 to river mile 10.9	1.4	0	0.0	0	0
10/6	3	(C) River mile 10.9 to river mile 10.0	0.9	5	5.6	1	0
10/6	3	(D) River mile 10.0 to river mile 8.9	1.1	2	1.8	0	0
10/6	3	(E) River mile 8.9 to river mile 7.7	1.2	1	0.8	0	0
10/20	4	(C) River mile 10.9 to river mile 10.0	0.9	0	0.0	0	0
10/20	4	(D) River mile 10.0 to river mile 8.9	1.1	0	0.0	0	0
10/20	4	(E) River mile 8.9 to river mile 7.7	1.2	0	0.0	0	0
		Total	**6.4**	**57**	**8.9**	**36**	**0**

[a] A: RM 14.1 to Forest Service Line, B: Forest Service Line to mouth of Tate Ck, C: Mouth of Tate Ck. to RM 10.0, D: RM 10.0 to Old Cabin, E: Old Cabin to Whitney Ck mouth

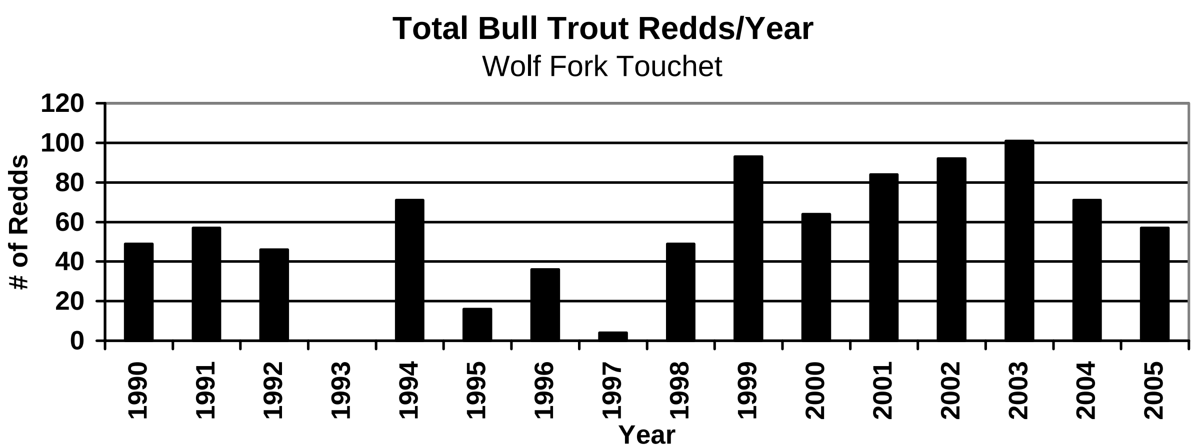


Figure 13. Bull trout redd counts for the Wolf Fork, 1990-2005.

Table 12. Bull trout spawning survey summary, redd count (number of times surveyed), for the Wolf Fork of the Touchet River, 1990-2005.								
	Reach Surveyed[a]							
	A	B	C	D	E	F	G	
Year	RM 14.5-14.1	RM 14.1-12.3	RM 12.3-10.9	RM 10.9-10.0	RM 10.0-8.9	RM 8.9-7.7	RM 7.7-7.1	Total Redds
1990[b]			18 (8)	31 (8)				49
1991[b]			20 (5)	37 (5)				57
1992[b]			46 (3)					46
1993[c]								0
1994[d]			71 (?)					71
1995[d]			16 (?)					16
1996[d]			36 (?)					36
1997[d,e]					4 (1)			4
1998[f]		11 (3)	7 (3)	18 (3)	12 (3)	0 (3)		48
1999[f]		32 (4)	14 (5)	34 (5)	11 (5)	2 (4)		93
2000[f]		3 (3)	17 (4)	33 (4)	7 (4)	4 (3)		64
2001[f]		15 (4)	19 (4)	36 (4)	11 (4)	2 (3)	1 (2)	84
2002[f]		25 (4)	15 (4)	39 (4)	8 (4)	5 (4)		92
2003[f]	3 (4)	19 (4)	21 (5)	41 (5)	12 (4)	5 (4)		101
2004[f]		11 (5)	25 (5)	25 (5)	10 (5)	0 (5)		71
2005[f]		1(2)	5(3)	38(4)	10(4)	3(4)		57

[a] A: RM 14.5 to RM 14.1 (2nd meadow), B: RM 14.1 (2nd meadow) to Forest Service line, C: Forest Service Line to Mouth of Tate Ck., D: Mouth of Tate Ck to RM 10.0 (stream ford), E: RM 10.0 (stream ford) to Old cabin, F: Old cabin to Mouth of Whitney Ck., G: Mouth of Whitney Ck. to First bridge below yellow gate.
[b] Surveys conducted by masters student (Martin et al. 1992 and Underwood et al. 1995)
[c] No survey.
[d] Surveys conducted by USFS
[e] Only one survey, late in October and too far downstream.
[f] Surveys conducted by WDFW

The North Fork Touchet River was surveyed four times with 15 redds and 13 live bull trout being observed (Table 13). This was the fourth straight year that the total number of redds was below 30, and the lowest number of redds seen since 1995 (Figure 14, Tables 13 and 14). The next two years of surveying will be very important to see if the population will rise again (possibly on a ten year cycle) or diminish further. Decreases in this population could be attributed to limited spawning and juvenile rearing area, as well as recent mortalities to bull trout (from USFS bridge work, radio telemetry studies, or chemical spills see Mendel et al. 2003a) or negative impact to their spawning habitat (severe sedimentation from USFS road construction project in 2004). Our surveys cover 5.4 miles, but the majority of the spawning occurs in the upper 2.6 miles of that section. Any decrease in water quality or fish habitat (chemical spills, sediment load, etc.) in that area that may be caused by high recreational use could have severe adverse impacts to the population.

Table 13. Bull trout spawning survey summary for the North Fork Touchet River and one of its tributaries, 2005.

Reach/ Date	Survey	Stream Section[a]	Surveyed Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
North Fork Touchet						Live	Dead
9/06	1	(A) River mile 19.7 to river mile 17.1	2.6	4	1.5	5	0
9/06	1	(B) River mile 17.1 to river mile 14.3	2.8	0	0	2	0
9/20	2	(A) River mile 19.7 to river mile 17.1	2.6	9	3.5	5	0
9/20	2	(B) River mile 17.1 to river mile 14.3	2.8	2	0.7	1	0
10/04	3	(A) River mile 19.7 to river mile 17.1	2.6	0	0	0	0
10/04	3	(B) River mile 17.1 to river mile 14.3	2.8	0	0	0	0
10/18	4	(A) River mile 19.7 to river mile 17.1	2.6	0	0	0	0
10/18	4	(B) River mile 17.1 to river mile 14.3	2.8	0	0	0	0
		Total	**5.4**	**15**	**2.8**	**13**	**0**

[a] A: Bluewood culvert to 2.6 miles below Bluewood culvert, B: 2.6 miles below Bluewood culvert to Stream ford below mouth of Spangler Ck.

Table 14. Bull trout spawning survey summary, redd count (number of times surveyed), for the North Fork Touchet River, 1994-2005.

	Reach Surveyed[a]		
	A	B	
Year	River Mile 19.7-17.1	River Mile 17.1-14.3	Total Redds
1994[b]	10 (2)	3 (2)	13
1995[b]	11 (2)	0 (1)	11
1996[b]	21 (2)	2 (2)	23
1997[b]	24 (2)	6 (1)	30
1998[b]	24 (3)	18 (2)	42
1999[b]	25 (2)	21 (2)	46
2000[c]	47 (2)	0 (1)	47
2001[d]	41 (4)	5 (4)	46
2002[d]	28 (4)	1 (4)	29
2003[d]	23 (4)	2 (4)	25
2004[d]	22 (5)	0(5)	22
2005[d]	13(4)	2 (4)	15

[a] A: Bluewood culvert to 2.6 miles below Bluewood culvert, B: 2.6 miles below Bluewood culvert to Stream ford below mouth of Spangler Ck.
[b] Surveys conducted by USFS
[c] Surveys conducted jointly by USFS and WDFW
[d] Surveys conducted by WDFW

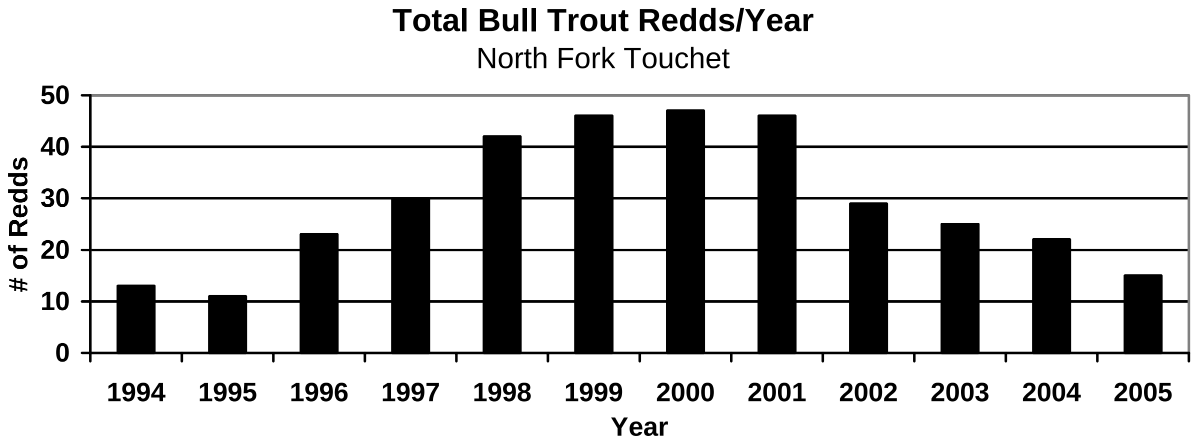


Figure 14. Bull trout redd counts for the North Fork Touchet, 1994-2005.

The Burnt Fork, a tributary to the upper South Fork Touchet, was surveyed twice in 2005. Two redds and two live bull trout were observed during the surveys (Table 15). These were the first redds seen since 2002 (Figure15, Table 16). Continued monitoring of this population in the next couple of years is essential to see if it will rebound or disappear.

Table 15. Bull trout spawning survey summary for the Burnt Fork of the South Fork Touchet River, 2005.

Reach/ Date	Survey	Stream Section[a]	Surveyed Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
Burnt Fk							
9/15	1	(A) River mile 3.3 to river mile 1.6	1.7	0	0	0	0
9/15	1	(B) River mile 1.6 to river mile 0.0	1.6	0	0	0	0
10/11	2	(A) River mile 3.3 to river mile 1.6	1.7	1	0.6	1	0
10/11	2	(B) River mile 1.6 to river mile 0.0	1.6	1	0.6	1	0
		Total	**3.3**	**2**	**0.6**	**2**	**0**

[a] A: Just above forks to RM 1.6, B: RM 1.6 to mouth of Burnt Fk.

Table 16. Bull trout spawning survey summary, redd count (number of times surveyed), for the Burnt Fork, 2000-2005.

Year	Reach Surveyed[a] A RM 3.5-3.3	Reach Surveyed[a] B RM 3.3-1.6	Reach Surveyed[a] C RM 1.6-0.0	Total Redds
2000[b]	0 (1)[c]	4 (3)	0 (1)	4
2001[b]	13 (4)		3 (4)	16
2002[b]	2 (3)		0 (3)	2
2003[b]	0 (3)		0 (3)	0
2004[b]	0 (2)		0 (2)	0
2005[b]	1(2)		1(2)	2

[a] A: River Mile 3.5 to Forks (RM 3.3), B: Forks (RM 3.3) to Forest Service Line, C: Forest Service Line to Mouth of Burnt Fork.
[b] Surveys conducted by WDFW Fish Management
[c] Survey this year actually went up to RM 3.6.

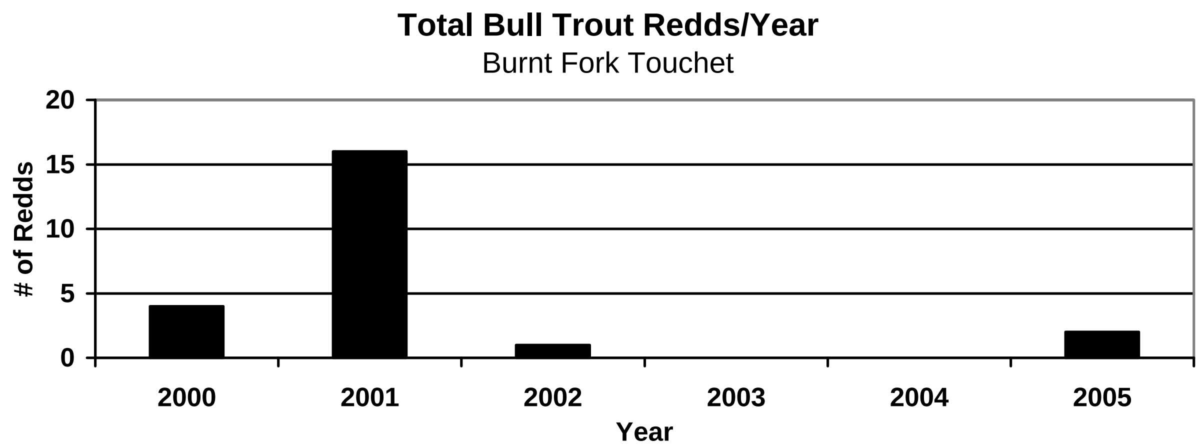


Figure 15. Bull trout redd counts for the Burnt Fork, 2000-2005.

Spawning surveys have been conducted by the ODFW and the USFS on Mill Creek since 1994 (Table 17), and on some of Mill Creek's upper tributaries since 1994 (Table 18). Surveys in Mill Creek in 1990-1992 were conducted by masters students Martin and Underwood in cooperation with WDFW. The tables and graphs in this report were derived from data provided by USFWS (Paul Sancovich personal communication), the USFS (Dave Crabtree personal communication), Martin et al. (1992), and Underwood et al. (1995). Since 1994 the number and distribution of surveys on Mill Creek and its tributaries has been fairly constant (Tables 17 and 18). This allows for annual comparisons of total redds for the Mill Creek system, with a peak of just over 220 redds in 2001 (Figure 16). In 2005, a total of 142 redds were seen in the Mill Creek system (Table 17 and 18, Figure 16). Eighty-seven redds were seen on Mill Creek from the forks down to the forestry boundary below the intake dam (Table 17) and 55 redds were found in the tributaries, with 43 of those redds in Low Creek (Table 18).

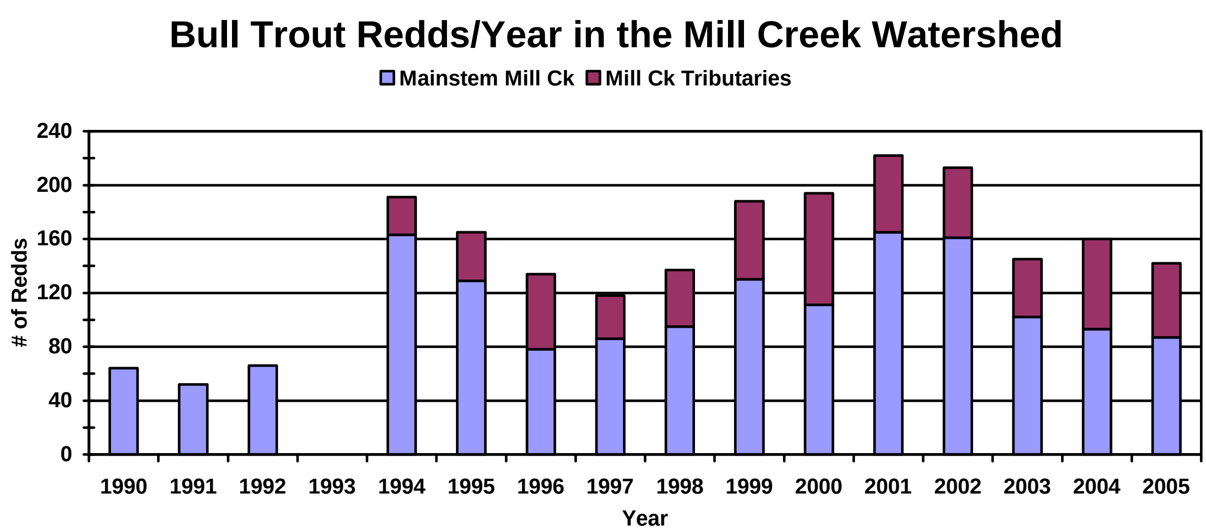


Figure 16. Bull trout redd counts for Mill Creek and its tributaries, 1990-2005.

Table 17. Bull trout spawning survey summary, redd count (number of times surveyed), for Mill Creek, 1990-2005.

Year	Reach Sureyed[a] A	B	C	D	E	F	G	H	I	Total Redds
1990[b]		48 (3)	15 (3)	1 (3)						64
1991[b]	10 (4)	14 (4)	17 (4)	11 (5)						52
1992[b]	6 (4)	9 (4)	51 (4)							66
1993[c]										
1994[d]	15 (1)	28 (2)	91 (5)	26 (1)		2 (2)	0 (1)	1 (1)	0 (1)	163
1995[d]	28 (2)	16 (2)	68 (3)	13 (2)	1 (2)	3 (1)	0 (1)	0 (1)	0 (1)	129
1996[d]	3 (2)	8 (2)	48 (2)	14 (2)	4 (2)	0 (1)	0 (1)	1 (1)	0 (1)	78
1997[d]	16 (4)	15 (4)	36 (4)	14 (4)		5 (4)	0 (4)	0 (4)		86
1998[d]	17 (4)	14 (4)	45 (4)	15 (4)		3 (4)	1 (4)	0 (4)		95
1999[d]	14 (4)	13 (4)	58 (5)	38 (4)		4 (4)	0 (4)	0 (4)	3 (1)	130
2000[d]	15 (4)	10 (4)	70 (4)	13 (4)		2 (4)	0 (4)	0 (1)	1 (4)	111
2001[d]	18 (3)	27 (4)	83 (4)	32 (4)		0 (2)	3 (3)	0 (2)	2 (1)	165
2002[d]	15 (3)	24 (3)	80 (3)	40 (3)		2 (2)	0 (2)	0 (2)		161
2003[d]	9 (3)	12 (3)	53 (3)	18 (3)		6 (3)	0 (2)	0 (2)	4 (2)	102
2004[d]	12 (3)	17 (3)	45 (3)	18 (3)		1 (3)	0 (3)	0 (3)		93
2005[d]	6 (3)	10 (3)	33 (3)	34 (3)		3 (3)	0 (3)	0 (3)	1 (3)	87

[a] A: Forks to Bull Ck., B: Bull Ck. to Deadman Ck., C: Deadman Ck. to North Fork Mill Ck, D: North Fork Mill Ck. to ½ way to Paradise Ck., E: ½ way to Paradise Ck. to Paradise Ck., F: Paradise Ck. to Broken Ck., G: Broken Ck. to Low Ck., H: Low Ck. to Intake dam, I: Intake dam to Forestry Boundary.
[b] Surveys conducted by masters student (Martin et al. 1992 and Underwood et al. 1995)
[c] No survey.
[d] ODFW, USFWS, and USFS data.

Table 18. Bull trout spawning survey summary, redd count (number of times surveyed), for tributaries to Mill Creek, 1994-2005.

Year	Reach Surveyed[a] A Bull Creek RM[b] 1.0[1] or 0.6[2] or 0.5[3]-0.0	B Green Fork RM 0.7-0.0	C Burnt Fork RM[b] 0.7[1] or 0.3[2]-0.0	D Deadman Creek RM[b] 1.2[1] or 0.4[2] or 0.3[3]-0.0	E N.F. Mill Creek RM[b] 0.9[1] or 0.5[2]-0.0	F Paradise Creek RM[b] 2.0[1] or 1.5[2] or 1.4[3]-0.0	G Broken Creek RM 1.5-0.0	H Low Creek RM[b] 2.0[1] or 1.3[2] or 1.0[3] or 0.5[4]-0.0	Total Redds
1994[c]	0 (1)[1]	4 (1)	2 (1)[1]	0 (1)[1]	9 (1)[2]	10 (1)[1]	0 (1)	3 (1)[3]	28
1995[c]	9 (1)[1]	1 (1)	3 (1)[1]	2 (1)[1]	12 (1)[2]	9 (1)[1]	0 (1)	0 (1)[4]	36
1996[c]	10 (2)[3]	0 (1)	12 (3)[1]	3 (1)[3]	5 (1)[2]	8 (1)[2]	0 (1)	18 (2)[1]	56
1997[c]	2 (4)[3]		4 (3)[2]	1 (4)[3]	3 (4)[2]	2 (4)[2]	0 (4)	20 (4)[1]	32
1998[c]	2 (4)[3]		2 (4)[2]	4 (4)[3]	6 (4)[2]	1 (1)[2]	0 (4)	27 (3)[1]	42
1999[c]	1 (4)[3]		4 (4)[2]	0 (4)[3]	6 (4)[2]	6 (2)[2]		41 (3)[1]	58
2000[c]	1 (4)[3]		14 (4)[2]	7 (4)[3]	17 (4)[1]	5 (4)[2]		39 (4)[1]	83
2001[c]	1 (3)[2]		3 (3)[2]	0 (2)[2]	17 (4)[1]	3 (4)[3]		33 (4)[2]	57
2002[c]	1 (3)[2]		2 (3)[2]	0 (2)[2]	12 (3)[1]	5 (3)[3]		32 (3)[2]	52
2003[c]	5 (3)	0 (1)	1 (3)	0 (?)	8 (?)	1 (2)		28 (3)	43
2004[c]	0 (3)		0 (1)		6 (3)	0 (1)		61 (3)	67
2005[c]	0 (2)		0 (2)	0 (2)	9 (3)	3 (3)		43 (3)	55

[a] A: RM 1.0, 0.6, or 0.5 to mouth, B: RM 0.7 to mouth, C: RM 0.7 or 0.3 to mouth, D: RM 1.2, 0.4, or 0.3 to mouth, E: RM 0.9 or 0.5 to mouth, F: RM 2.0, 1.5, or 1.4 to mouth, G: RM 1.5 to mouth, H: RM 2.0, 1.3, 1.0, or 0.5 to mouth.
[b] River Miles (RM) varied from year to year in some of the tributaries and are foot noted with numbers 1, 2, 3, or 4.
[c] ODFW, USFWS, and USFS data.

Spring Chinook

Spawning surveys for spring chinook were conducted on the North Fork Touchet, the Wolf Fork, and Touchet River in 2005. WDFW initiated these surveys in 2005 because 5 chinook had been seen at the Dayton Dam trap during the spring, plus spring chinook redds were observed while conducting bull trout spawning surveys. Surveys were conducted on the lower 3.8 miles of the North Fork Touchet, the lower 8.9 miles of the Wolf Fork, and the upper 2.8 miles of the mainstem Touchet River. Surveyors found two redds on the North Fork Touchet, 11 redds on the Wolf Fork, and four redds on the Touchet River (Tables 19, 20, 21 and 22). This is the third time that spring chinook surveys have been conducted in the last five years on these three streams, and while no definite conclusions can be made it appears that they prefer to spawn in the Wolf Fork (Tables 20, 21, and 22).

WDFW first initiated spring chinook spawning surveys in 2001 when 31 adult spring chinook were observed at the Dayton Dam trap, operated by the SRL. In 2002 and 2003, very few adults were seen at the Dayton Dam trap, therefore no surveys were conducted. Ten adult chinook were passed through the Dayton Dam trap in 2004 (Table 23), but no redds were found that fall (Tables 20, 21 and 22). In 2005, only five adult chinook were observed at the Dayton Dam trap, but spring chinook redds observed during bull trout spawning surveys prompting WDFW to conduct more extensive surveys (Table 23).

Since 1999, the SRL has collected 53 individual spring chinook at the Dayton Dam trap in Dayton. Of these 53 fish, 36 have been unmarked, 14 have had adipose fin clips, and three have had right red elastomer tags (Table 23). In 2001, SRL personnel collected seven CWT from fish at the Dayton Dam trap in an effort to determine the origin of fish returning to the Touchet River. Two of the tags were lost, but the other five were found to be Tucannon River 1997 Brood (3) and Tucannon River 1998 Brood (2). Since 2001, four CWT have been detected at the Dayton Dam trap, but none have been collected for analysis. The three right red elastomer tags that were observed in 2004 were Tucannon River endemic stock. It appears that most of the strays in the Touchet River are coming from the Tucannon River, but there are other stocks in the area that could also stray into the Touchet River including fish from the Umatilla River, and the newly introduced spring chinook into the upper Walla Walla River and Mill Creek (both are Carson stock, few of which are tagged with CWT). The loss of fish from the Tucannon River further diminishes production that is needed to help recover that stock.

Table 19. Chinook spawning survey summary for the Touchet River Watershed, 2005.

Reach/ Date	Survey	Stream section[a]	Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
North Fork Touchet							
9/21	1	(A) River mile 3.8 to river mile 2.3	1.5	2	1.3	2	0
9/21	1	(B) River mile 2.3 to river mile 0.0	2.3	0	0.0	4	0
9/29	2	(A) River mile 3.8 to river mile 2.3	1.5	0	0.0	0	0
9/29	2	(B) River mile 2.3 to river mile 0.0	2.3	0	0.0	0	0
		Total	**3.8**	**2**	**0.5**	**6**	**0**
Wolf Fork							
9/7	1	(C) River mile 8.9 to river mile 7.7	1.2	3	2.5	3	0
9/23	1	(D) River mile 7.7 to river mile 5.8	1.9	0	0.0	0	0
9/14	1	(E) River mile 5.8 to river mile 3.7	2.1	2	1.0	2	0
9/14	1	(F) River mile 3.7 to river mile 1.9	1.8	0	0.0	0	0
9/14	1	(G) River mile 1.9 to river mile 0.0	1.9	1	0.5	1	0
9/22	2	(C) River mile 8.9 to river mile 7.7	1.2	1	0.8	0	0
9/29	2	(E) River mile 5.8 to river mile 3.7	2.1	0	0.0	0	1
9/29	2	(F) River mile 3.7 to river mile 1.9	1.8	0	0.0	0	0
9/29	2	(G) River mile 1.9 to river mile 0.0	1.9	4	2.1	0	0
10/6	3	(C) River mile 8.9 to river mile 7.7	1.2	0	0.0	0	0
10/20	4	(C) River mile 8.9 to river mile 7.7	1.2	0	0.0	0	0
		Total	**8.9**	**11**	**1.2**	**6**	**1**
Touchet River							
9/21	1	(F) River mile 64.6 to river mile 61.8	2.8	4	1.4	3	1
9/29	2	(F) River mile 64.6 to river mile 61.8	2.8	0	0.0	0	0
		Total	**2.8**	**4**	**1.4**	**3**	**1**

[a] A: Mouth of Wolf Fk. to Vernon Lane bridge, B: Vernon Lane bridge to mouth, C: Old cabin to mouth of Whitney Ck, D: Mouth of Whitney Ck. to RM 5.8, E: River mile 5.8 to 2nd brg. on Wolf Fk. Rd., F: 2nd brg. on Wolf Fk. Rd. to Holmberg Rd. brg., G: Holmberg Rd. brg. to mouth, F: Confluence of the North and South Forks of the Touchet River to sewer treatment facility.

Table 20. Chinook spawning survey summary, redd count (number of times surveyed), for the North Fork Touchet, 2001-2005.

Year	Reach Surveyed[a] A River Mile 9.9-6.5	B River Mile 6.5-4.2	C River Mile 4.2-3.8	D River Mile 3.8-3.1	E River Mile 3.1-2.3	F River Mile 2.3-0.0	Total Redds
2001	1 (1)				2 (1)		3
2002[b]							0
2003[b]							0
2004		0 (1)	0 (1)			0 (1)	0
2005				2 (2)		0 (2)	2

[a] A: Mile Post 11 to RM 6.5, B: RM 6.5 to Wolf Fork Rd., C: Wolf Fork Rd. to Mouth of Wolf Fork, D: Mouth of Wolf Fork to 0.7 miles below the Wolf Fork Mouth, E: 0.7 miles below the Wolf Fork Mouth to Vernon Ln. bridge, F: Vernon Ln. bridge to confluence with the South Fork Touchet.
[b] No survey conducted

Table 21. Chinook spawning survey summary, redd count (number of times surveyed), for the Wolf Fork, 2001-2005.

	Reach Surveyed[a]											
	A	B	C	D	E	F	G	H	I	J	K	
Year	River Mile 10.0-8.9	River Mile 8.9-7.7	River Mile 7.7-7.1	River Mile 7.1-5.8	River Mile 5.8-4.7	River Mile 4.7-3.7	River Mile 3.7-3.0	River Mile 3.0-2.4	River Mile 2.4-1.9	River Mile 1.9-1.6	River Mile 1.6-0.0	Total Redds
2001	2 (4)	6 (3)	3 (1)	2 (1)	1 (1)	1 (1)		0 (1)	1 (2)	0 (2)	7 (1)	23
2002[b]												0
2003[b]												0
2004				0 (1)				0 (1)				0
2005		4 (4)	0 (1)		2 (2)		0 (2)			5 (2)		11

[a] A: RM 10.0 (stream ford) to old cabin, B: Old cabin to Mouth of Whitney Ck, C: Mouth of Whitney Ck to 1st bridge below yellow gate, D: 1st bridge below yellow gate to RM 5.8, E: RM 5.8 to 3rd bridge on Wolf Fork Rd., F: 3rd bridge on Wolf Fork Rd. to 2nd bridge on Wolf Fork Rd., G: 2nd bridge on Wolf Fork Rd. to Robinson Fork Rd. bridge, H: Robinson Fork Rd. bridge to 0.5 miles above Holmberg Rd., I: 0.5 miles above Holmberg Rd. to Holmberg Rd., J: Holmberg Rd. to 0.3 miles below Holmberg Rd., K: 0.3 miles below Holmberg Rd. to mouth of the Wolf Fork.

[b] No survey conducted.

Table 22. Chinook spawning survey summary, redd count (number of times surveyed), for the Touchet River, 2001-2005.

	Reach Suveyed[a]					
	A	B	C	D	E	
Year	River Mile 64.6-61.8	River Mile 61.8-58.6	River Mile 58.6-56.8	River Mile 56.8-54.6	River Mile 54.6-52.6	Total Redds
2001	6 (1)	0 (1)	0 (1)	0 (1)	0 (1)	6
2002[b]						0
2003[b]						0
2004	0 (1)					0
2005	4 (2)					4

[a] A: Confluence of North Fork and South Fork Touchet Rivers to Sewer Plant in Dayton, B: Sewer Plant in Dayton to Rose Gulch bridge, C: Rose Gulch bridge to Highway 12 bridge below Lewis and Clark State Park, D: Highway 12 bridge below Lewis and Clark State Park to Lower Hogeye Rd. bridge, E: Lower Hogeye Rd. bridge to Highway 12 bridge in Waitsburg.

[b] No survey conducted.

Table 23. Spring chinook observed at the Dayton Dam trap, 1999-2005 (from Joe Bumgarner-WDFW SRL)

Year	Dates Trap was in Operation	# of Marked Fish	# of Unmarked Fish	Total Fish Observed at Trap	Type of Marks Seen
1999	1/21/99-6/21/99	0	0	0	
2000	1/16/00-6/30/00	2	2	4	2 Ad clips
2001	3/19/01-6/17/01	7	24	31	7 Ad clips
2002	2/19/02-6/15/02	0	0		
2003	2/5/03-6/27/03	1	2	3	1 Ad clip
2004	2/2/04-7/2/04	6	4	10	3 Ad clip, and 3 right red elastomer
2005	2/14/05-6/10/05	1	4	5	1 Ad clip

Genetic and Scale Sampling and Analyses

WDFW Fish Management personnel collected 17 fin clips and 86 scale samples from salmonids in the Walla Walla Subbasin in 2005. Adult steelhead comprised the largest group sampled with 12 fin clips and eight scale samples. Four fin clip samples were from juvenile bull trout, and one sample (both fin clip and scale sample) was from an adult spring chinook.

All 12 adult steelhead samples were collected in the Coppei Creek System; 9 at the Coppei Creek trap (along with eight scale samples), two from the South Fork Coppei during steelhead spawning surveys, and one from the lower Coppei Creek (below Highway 124) during spawning surveys.

All four juvenile bull trout were sampled during electrofishing surveys on Lewis Creek.

The adult spring chinook was sampled (for both fin clip and scales) during a spring chinook spawning survey on the Touchet River.

The other 77 scale samples were collected during electrofishing surveys. One bull trout and 20 rainbow/steelhead trout were sampled in the Burnt Fork, and 36 bull trout and 20 rainbow/steelhead trout were sampled in the Wolf Fork.

Scale samples collected in 2004 and 2005 were aged in Olympia and returned to our office in 2005. The scale ages of juvenile fish from electrofishing surveys show that age classifications derived from length frequency histograms are fairly accurate. Scale ages do show some overlap in age classes. This is to be expected. If bell shaped curves were used for the age classes in the length frequency histograms the curved (and age/length) would overlap.

Recommendations

Information collected during this project has provided valuable baseline information and guidance for managers in the Walla Walla Subbasin. Continued monitoring will provide a more complete picture of salmonid population status and their habitat conditions. The following is our list of recommended evaluation activities for 2006.

- Continue to annually monitor steelhead spawning in Mill Creek between the state line and Bennington Dam.
- Continue to annually monitor steelhead spawning in Coppei Creek (mainstem Coppei Creek and South Fork Coppei Creek), and elsewhere as time allows.
- Evaluate Yellowhawk Creek for steelhead spawning (spring) and rearing (summer) and collect genetic samples.
- Continue to summarize all the steelhead spawning survey data collected during this project.
- Collect genetic samples and continue to monitor distribution and abundance of rainbow/steelhead trout and bull trout in Spangler Creek (qualitative electrofishing), Lewis Creek (qualitative electrofishing), and Burnt Fork (qualitative and/or quantitative electrofishing).
- Evaluate Griffin Fork for species distribution and abundance of rainbow/steelhead trout and bull trout, and collect genetic samples from all salmonids observed during qualitative and/or quantitative electrofishing.
- Sample Coates and Whitney Creek (tributaries to Wolf Fork) to assess rainbow/steelhead trout distribution and abundance, and collect genetic samples.
- Evaluate Patit Creek and South Fork Patit Creek for distribution and abundance of rainbow/steelhead trout, and collect genetic samples.
- Resample Whiskey Creek to look at distribution and abundance of rainbow/steelhead trout, and collect genetic samples.
- Sample upper Dry Creek, above Dixie, for densities (quantitative electrofishing) and to collect genetic samples.
- Continue to try and gain access to upper Titus Creek, above Five Mile Rd., to evaluate fish distribution and abundance in this section.
- Evaluate densities of salmonids in Mill Creek above Bennington Dam.
- Evaluate stream flows and fish distribution and abundance in lower Whetstone Creek from McKay/Alto Rd. to the mouth.
- Continue bull trout spawning surveys in Wolf Fork and North Fork Touchet, and depending on numbers of bull trout seen during electrofishing possibly survey Lewis Creek, Spangler Creek, Burnt Fork, and Griffin Fork.
- Continue to summarize temperature and stream flow information, and what effects it has on migration or rearing distribution of steelhead, spring chinook and bull trout in the Walla Walla Subbasin.
- Summarize all data on distribution and abundance of whitefish in the Walla Walla Subbasin.
- Complete analyses of genetic samples for steelhead and bull trout, and report results and conclusions of those analyses in the next annual report.
- Summarize scale aging and fork length comparisons.

- Continue to work with CTUIR and others to complete a comprehensive RM&E plan.
- Develop joint proposals with CTUIR and others for habitat and fish monitoring that will improve coordination and ensure collaborative, effective RM&E within the subbasin in 2007 and beyond.

Literature Cited

Armour, C.L. and W.S. Platts. 1983. Field methods and statistical analyses for monitoring small salmonid streams. US Fish and Wildlife Service. FWS/OBS-83/33. 200 pages.

Bjornn, T. and D. Reiser. 1991. Habitat Requirements of Salmonids in Streams. *In*: Influences of Forest and Rangeland on Salmonid Fishes and their Habitats. W. Meehan (editor). American Fisheries Society Special Publication 19: 83-138.

Bumgarner, J., M. Schuck, S. Martin, J. Dedloff, L. Ross. 2002. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report 2001 and 2002 run years. WDFW report to the USFWS Lower Snake River Compensation Plan Offices, Boise, ID.

Bumgarner, J.D., M. Schuck, L. Ross, J. Dedloff. 2002. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report-1998, 1999, 2000 run years. WDFW report to the USFWS Lower Snake River Compensation Plan Offices, Boise, ID.

Bumgarner, J.D., M.P. Small, L. Ross, J. Dedloff. 2003. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report 2001and 2002 run years. WDFW report to the USFWS Lower Snake River Compensation Plan Offices, Boise, ID.

Collier, M., R.H. Webb, and J.C. Schmidt. 1996. Dams and rivers: primer on the downstream effects of dams. US Geological Survey, Circular 1126. Tucson, AZ. 94 pages.

Confederated Tribes of the Umatilla Indian Reservation (CTUIR). 2004. Walla Walla Subbasin Spring Chinook Master Plan. Report to Northwest Power and Conservation Council.

Confederated Tribes of the Umatilla Indian Reservation (CTUIR). 2001. Walla Walla Subbasin Summary. Prepared for Northwest Power Planning Council.

Contor, C.R., A. Sexton, CTUIR (editors). 2003. The Walla Walla Basin Natural Production Monitoring and Evaluation Project. Progress Report 1992-2002 to BPA. Project No. 2000-039-00.

Hicks, M. 2002. Evaluating Standards for Protecting Aquatic Life in Washington's Surface Water Quality Standards-Temperature Criteria-Draft Discussion Paper and Literature Summary. Washington State Department of Ecology, Olympia, WA. Publication No. 00-10-070. www.ecy.wa.gov/biblio/0010070.html

Knutson, K.L., S. Jackson, T. Lovgren, M. Hunter, and D. McDonald. 1992. Washington Rivers Information System: resident and anadromous fish data, 1:100,000 scale update. WDFW. Olympia, WA. 25 pages plus extensive appendices.

Kuttle, M., Jr. 2002. Salmonid Habitat Limiting Factors Water Resource Inventory Areas 33 (Lower) and 35 (Middle) Snake Watersheds, and Lower Six Miles of the Palouse River. Washington State Conservation Commission. Olympia, WA. 190 pages plus appendices and maps.

Martin, S.W., M.A. Schuck, K.D. Underwood, and A.T. Scholz. 1992. Investigations of bull trout (*Salvelinus confluentus*), steelhead trout (*Onchorhynchus mykiss*), and spring chinook (*O. tshawytscha*) interactions in southeast Washington streams. 1991 Annual Report. Project No. 90-53, Contract No. De B179-91BP17758. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. 206 pages.

McCullough, D.A. 1999. A Review and Synthesis of Effects of Alterations to the Water Temperature Regime on Freshwater Life Stages of Salmonids, with Special Reference to Chinook Salmon. Report to the U.S. Environmental Protection Agency.

Mendel, G., V. Neaf, and D. Karl. 1999. Assessment of Salmonid Fishes and their Habitat Conditions in the Walla Walla River Basin—1998 Annual Report. Report to BPA. Project No. 98-20. Report # FPA 99-01. 94 pages.

Mendel, G., D. Karl, T. Coyle. 2000. Assessment of Salmonid Fishes and their Habitat Conditions in the Walla Walla River Basin of Washington—1999 Annual Report. Report to BPA. Project No. 98020-00. Report # FPA 00-18. 86 pages.

Mendel, G., D. Karl, T. Coyle. 2001. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin of Washington: 2000 Annual Report. Report to BPA. Project No. 199802000. 109 pages.

Mendel, G., J. Trump, D. Karl. 2002. Assessment of Salmonids and Their Habitat Conditions in the WallaWalla River Basin of Washington: 2001 Annual Report. Report to BPA. Project No. 199802000. 133 pages.

Mendel, G., C. Fulton, R. Weldert. 2003a. An Investigation Into the Migratory Behavior of Bull Trout (*Salvelinus confluentus*) in the Touchet River Basin. Report to Jim Uehara, WDFW Olympia, WA and Susan Martin, USFWS Spokane, WA.

Mendel, G., J. Trump, M. Gembala. 2003b. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington: 2002 Annual Report. Report to BPA. Project No. 199802000. 119 pages.

Mendel, G., J. Trump, M. Gembala. 2004. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington: 2003 Annual Report. Report to BPA. Project No. 199802000. 126 pages.

Mendel, G., J. Trump, M. Gembala. 2005. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington: 2004 Annual Report. Report to BPA. Project No. 199802000. 172 pages.

Mongillo, P.E. 1993. The distribution and status of bull trout/dolly varden in Washington State. WDFW. Olympia, WA. 45 pages.

Nielson, R.S. 1950. Survey of the Columbia River and its Tributaries, Part 5. USFWS, Scientific Report No. 38. 41 pages.

Northwest Power Planning Council. 1994. Columbia River Basin Fish and Wildlife Program. Northwest Power Planning Council, Portland, OR.

Northwest Power Planning Council. 2000. Columbia River Basin Fish and Wildlife Program. Northwest Power Planning Council, Portland, OR, document number 2000-19.

Olsen, J.B., J.K. Wenburg, and P. Benson. 1996. Semi-automated multilocus genotyping of Pacific salmon (*Oncorhynchus spp.*) Using microsatellites. Molecular. Marine Biol. and Biotech. 5: 259-272.

Pacific Groundwater Group. 1995. Draft Initial Watershed Assessment, Water Resources Inventory Area 32, Walla Walla Watershed—Open file Technical Report 95-11. Seattle, WA. 47 pages plus appendicies.

Pirtle, R. 1957. Field studies to establish the size and timing of runs of anadromous species of fish in the Columbia and Snake rivers and their distribution above the confluence of the Snake River. Final Report to the US Army Corps of Engineers and Idaho Fish and Game. Boise, ID. 49 pages plus appendices.

Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. USDA Forest Service. Ogden, UT. GTR.INT-138. 70 pages.

Snake River Salmon Recovery Board (SRSRB). 2005. Technical Document Snake River Salmon Recovery Plan for Southeast Washington. Report to Washington Governor's Salmon Recovery Office.

Schwartz, J.D.M., Kissner, P., Lambert, M., Mahoney, B.D., and Contor, C. 2005. Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report, 2003. Confederated Tribes of the Umatilla Indian Reservation, report submitted to Bonneville Power Administration, Project No. 2000-039-00.

Underwood, K.D., S.W. Martin, M.L. Schuck, and A.T. Scholz. 1995. Investigations of bull trout (*Salvelinus confluentus*), steelhead trout (*Onchorhynchus mykiss*), and spring chinook (*O. tshawytscha*) interactions in southeast Washington streams. 1992 Final Report. Project No. 90-53, Contract No. De B179-91BP17758. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. 206 pages.

U.S. Army Corps of Engineers (USACE). 1992. Walla Walla River Basin, Oregon and Washington: reconnaissance report. Walla Walla, WA. 43 pages plus appendices.

U.S. Army Corps of Engineers (USACE). 1997. Walla Walla River Basin, Oregon and Washington: reconnaissance report. Walla Walla, WA. 78 pages plus appendices.

U.S. Environmental Protection Agency. 2003. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA 910-B-03-002. Region 10 Office of Water, Seattle, WA.

U.S. Fish and Wildlife Service. 2002. Chapter 10, Umatilla-Walla Walla Recovery Unit, Oregon and Washington. 153 pages. *In*: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, OR.

U.S. Fish and Wildlife Service. 2004. Chapter 10, Umatilla-Walla Walla Recovery Unit, Oregon and Washington. 149 pages. *In*: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, OR.

VanDeventer, J.S. and Platts, W.S. 1983. Sampling and estimating fish populations from streams. Trans. N. Am. Wildl. And Nat. Res. Conf. 48: 349-354.

Walla Walla County (WWC) and Walla Walla Basin Watershed Council. 2004. Walla Walla Subbasin Plan. Report to Northwest Power and Conservation Council.

Walla Walla Daily Journal. 1884. Young carp: the arrival of a government fish car at Walla Walla.

Washington Department of Fisheries (WDF) and Washington Department of Wildlife (WDW). 1993. 1992 Washington State salmon and steelhead stock inventory: Columbia River stocks. Olympia, WA. 579 pages.

Washington Department of Fish and Wildlife (WDFW). 1997. Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids. Olympia, WA.

Washington Department of Fish and Wildlife (WDFW). 2002. 2002 Washington State Salmon and Steelhead Stock Inventory: Columbia River Stocks. http://wdfw.wa.gov/fish/sasi

Washington Department of Fish and Wildlife (WDFW). 2005a. WDFW Lyons Ferry Hatchery (LFH) Stock Summer Steelhead Walla Walla Basin Releases (Walla Walla River and Touchet River @ Dayton Acclimation Pond), Hatchery and Genetic Management Plan (HGMP). http://wdfw.wa.gov/hat/hgmp

Washington Department of Fish and Wildlife (WDFW). 2005b. WDFW Touchet River Endemic Stock Summer Steelhead-Touchet River Release, Hatchery and Genetic Management Plan (HGMP). http://wdfw.wa.gov/hat/hgmp

Washington State Department of Ecology. 2006-DRAFT. Walla Walla River Tributaries Temperature Total Maximum Daily Load Study. Project No. 06-03-020.

Wydoski, R.S. and R.R. Whitney. 1979. Inland Fishes of Washington. University of Washington Press. Seattle, WA. 220 pages.

Appendix A. Study Sites, 2005

Appendix A. Table 1. Study site locations for the Touchet River and tributaries, 2005.

Stream	Site #	RM[a]	Location (within sect. is listed as smallest qtr. sect. of qtr. sect.)	Sample Type[b]	GPS Coordinates[c] North	GPS Coordinates[c] West	Comments
NF Touchet River	NFT-1	20.2	T7N.R40E.Sect 7.SW¼.SW¼	EL	46.09268	117.86335	0.5 miles above Bluewood Rd.
	NFT-2	19.9	T7N,R40E,Sect 18,NE¼,NW¼	EL	46.09136	117.85727	0.2 miles above Bluewood Rd.
	NFT-3	19.7	T7N,R40E,Sect 18,NW¼,NE¼	EL	46.09118	117.85365	Directly above Bluewood culvert
	NFT-4	19.6	T7N,R40E,Sect 18,NW¼,NE¼	T[d],EL	46.09116	117.85281	45 meters below Bluewood culvert
	NFT-5	19.3	T7N,R40E,Sect 7,SE¼,SE¼	EL	46.09321	117.84755	Just upstream of Corral Ck. mouth
	NFT-6	19.3	T7N,R40E,Sect 7,SE¼,SE¼	EL	46.09399	117.84688	Just downstream of Corral Ck. mouth
	NFT-7	18.6	T7N,R40E,Sect 8,SW¼,NW¼	EL	46.10134	117.83941	0.7 miles below Corral Ck. mouth
	NFT-8	14.3	T8N,R40E,Sect 21,SE¼,SE¼	T[d],F[d,e]	46.15163	117.80641	~0.2 miles below Spangler Ck mouth
	NFT-9	7.9	T9N,R40E,Sect 30,SW¼,NE¼	T[d]	46.23104	117.85138	~20 feet above Jim Ck mouth
	NFT-10	1.4	T9N,R39E,Sect 4,NW¼,NE¼	T[d]	46.29235	117.93601	1.0 miles above Baileysburg brg
Corral Ck.	CC-1	0.4	T7N,R40E,Sect 18,NE¼ ,NE¼	EL	46.08865	117.84297	0.4 miles above mouth
	CC-2	0.3	T7N,R40E,Sect 18,NE¼,NE¼	EL	46.08984	117.84475	0.3 miles above mouth
Spangler Ck	SC-1	0.1	T8N,R40E,Sect 28,NE¼,NE¼	T[d],F[d,e]	46.14837	117.80556	0.1 miles above mouth
Lewis Ck	LC-1	2.6	T8N,R40E,Sect 10,SE¼,NE¼	EL	46.18765	117.78195	1.5 miles above Forest Service Line
	LC-2	2.3	T8N,R40E,Sect 10,NE¼,NE¼	EL	46.19157	117.78314	1.2 miles above Forest Service Line
	LC-3	1.9	T8N,R40E,Sect 3,SW¼,SE¼	EL	46.19594	117.78782	0.8 miles above Forest Service Line
	LC-4	1.4	T8N,R40E,Sect 3,NW¼,SW¼	EL	46.19715	117.79835	0.3 miles above Forest Service Line
	LC-5	0.9	T8N,R40E,Sect 4,SE¼,SE¼	EL	46.19349	117.80750	0.2 miles below Forest Service Line
	LC-6	0.6	T8N,R40E,Sect 4,SW¼, SE¼	EL	46.19277	117.81220	0.5 miles above NF Touchet Rd.
	LC-7	0.1	T8N,R40E,Sect 9,NW¼,NW¼	EL	46.19082	117.82257	0.1 miles above mouth
	LC-8	0.1	T8N,R40E,Sect 9,NW¼,NW¼	T[d],F[d,e]	46.19082	117.82332	~15 feet above NF Touchet Rd
Jim Ck	JC-1	0.1	T9N,R40E,Sect 30,SW¼,NE¼	T[d],F[d,e]	46.23128	117.85013	~50 meters below NF Touchet Rd
Wolf Fork	WF-1	14.1	T7N,R39E,Sect 12,NW¼,SW¼	EQ	46.09668[f]	117.88296[f]	1.8 miles above Forest Service Line
	WF-2	13.4	T7N,R39E,Sect 1,SE¼,SW¼	EQ	46.10647	117.88114	1.1 miles above Forest Service Line
	WF-3	12.8	T7N,R39E,Sect 1,SW¼,NW¼	EQ	46.11344	117.88226	0.5 miles above Forest Service Line
	WF-4	12.1	T8N,R39E,Sect 36,SE¼,SW¼	EQ	46.12362	117.87926	0.2 miles below Forest Service Line
	WF-5	11.6	T8N,R39E,Sect 36,SW¼,NE¼	EQ	46.12929	117.87546	0.9 miles above Green Fly Canyon
	WF-6	10.0	T8N,R39E,Sect 24,SW¼,SE¼	T[d],EQ	46.15100	117.87632	0.7 miles below Green Fly Canyon

[a] River Mile
[b] T-Temperature; F-Flow; EQ-Quantitative Electrofishing (density estimates); EL-Qualitative Electrofishing; G-Flow Gauge
[c] GPS were taken with Garmin II plus, in WGS 84 datum and in D.D^{o}
[d] Same as previous year
[e] Index discharge site
[f] GPS was made using Maptech's Terrain Navigator (version 5.03) program in WGS 84 datum

Appendix A. Table 1. Study site locations for the Touchet River and tributaries, 2005.

Stream	Site #	RM[a]	Location (within sect. is listed as smallest qtr. sect. of qtr. sect.)	Sample Type[b]	GPS Coordinates[c] North	GPS Coordinates[c] West	Comments
Wolf Fork (cont.)	WF-7	9.2	T8N,R39E,Sect 24,NW¼,NE¼	EQ	46.16292	117.87557	1.5 miles below Green Fly Canyon
	WF-8	4.7	T9N,R39E,Sect 36,NW¼NW¼	T[d],F[d,e]	46.22166	117.87495	3[rd] bridge on Wolf Fork Rd
	WF-9	1.9	T9N,R39E,Sect 23,NW¼,NW¼	T[d],F[d,e]	46.25063	117.90203	Holmberg Rd
Whitney Ck	WH-1	0.3	T8N,R40E,Sect 7,SE¼,SW¼	T[d],F	46.17834	117.85784	0.3 miles up Whitney Ck Rd
	WH-2	0.0	T8N,R40E,Sect 7,SW¼,SW¼	F[e,d]	46.18090[f]	117.86220[f]	~20 meters above Wolf Fk Rd
Coates Ck	C-1	0.0	T8N,R40E,Sect 7,NW¼,SW¼	T[d],F[e,d]	46.18335	117.86309	Directly below Wolf Fork Rd
Green Fk	GF-1	0.0	T7N,R39E,Sect 6,SE¼,SW¼	T,F[d]	46.10570[f]	117.98588[f]	~25 feet above mouth
Burnt Fk	BF-1	3.3	T7N,R39E,Sect 16,NE¼, SE¼	EL	46.08311	117.93210	RM 3.3
	BF-2	2.8	T7N,R39E,Sect 16,SE¼,NW¼	EL	46.08705	117.94134	RM 2.8
	BF-3	2.2	T7N,R39E,Sect 17,NE¼,NE¼	EL	46.08916[f]	117.95213[f]	RM 2.2
	BF-4	1.6	T7N,R39E,Sect 17,NE¼,NW¼	EL	46.09091[f]	117.96423[f]	RM 1.6
	BF-5	0.0	T7N,R39E,Sect 6,SE¼,SW¼	T,F[d]	46.10557[f]	117.98575[f]	~25 feet above mouth
SF Touchet River	SFT-1	15.9	T7N,R39E,Sect 6,SE¼,SW¼	F[d]	46.10601[f]	117.98543[f]	~30 feet below Burnt Fk mouth
	SFT-2	15.8	T7N,R39E,Sect.6,SE¼,SW¼	T[d]	46.10731[f]	117.98385[f]	0.1 miles below Burnt Fk. mouth
	SFT-3	8.3	T8N,R39E,Sect 5,NW¼,SE¼	T[d],F[d,e]	46.19956	117.95574	Directly under Camp Nancy Lee brg
	SFT-4	0.5	T9N,R39E,Sect 5,NW¼,NE¼	T[d],F[d,e]	46.29406	117.95795	Gephart Rd
Touchet River	TR-1	63.5	T10N,R39E,Sect 30,SE¼,SE¼	T[d]	46.31202	117.97318	~20 feet below SRL trap
	TR-2	63.0	T10N,R39E,Sect 30,NW¼,SE¼	F[d,e]	46.31640[f]	117.98044[f]	0.2 miles above HWY 12 brg in Dayton
	TR-3	57.2	T9N,R38E,Sect 4,SW¼,NW¼	T[d]	46.29052	118.07423	Behind the Lewis and Clark State Park
	TR-4	56.8	T9N,R38E,Sect 5,SW¼,NE¼	Fish Salvage	46.28922[f]	118.08083[f]	HWY 12 Bridge 0.4 miles below LCSP
	TR-5	48.1	T9N,R37E,Sect 8,SW¼,NW¼	T[d]	46.27396	118.22046	~40 meters above Bolles brg
	TR-6	31.5	T9N,R35E,Sect 6,NW¼,SW¼	T[d],F	46.28740	118.48840	Just below Harvey Shaw Rd
	TR-7	10.1	T8N,R33E,Sect 34,NE¼,NE¼	T[d],F	46.13560	118.66213	Public Access - WDFW Property
	TR-8	2.5	T7N,R33E,Sect 27,NE¼,SW¼	T[d],F[d]	46.05709	118.66883	Cummins Rd brg
Patit Ck	P-1	2.5	T10N,R39E,Sect 17,SE¼,SE¼	T[d]	46.34026	117.95202	1[st] brg on Patit Ck Rd
SF Coppei Ck	SFC-1	0.9	T8N,R38E,Sect 18,NE¼,NW¼	T[d]	46.17874	118.10679	2[nd] brg on SF Coppei Rd

[a] River Mile
[b] T-Temperature; F-Flow; EQ-Quantitative Electrofishing (density estimates); EL-Qualitative Electrofishing; G-Flow Gauge
[c] GPS were taken with Garmin II plus, in WGS 84 datum and in D.D°
[d] Same as previous year
[e] Index discharge site
[f] GPS was made using Maptech's Terrain Navigator (version 5.03) program in WGS 84 datum

Appendix A. Table 1. Study site locations for the Touchet River and tributaries, 2005.

Stream	Site #	RM[a]	Location (within sect. is listed as smallest qtr. sect. of qtr. sect.)	Sample Type[b]	GPS Coordinates[c] North	GPS Coordinates[c] West	Comments
NF Coppei Ck	NFC-1	0.1	T8N.R38E.Sect 7.NE¼.NW¼	T[d]	46.19028	118.10894	0.1 miles above mouth
Coppei Ck	CO-1	5.4	T9N,R37E,Sect 36,NE¼,NW¼	T[d]	46.22251	118.12860	McCowan Rd
	CO-2	3.3	T9N,R37E,Sect 23,SE¼,NE¼	STH Trap, F	46.24563[f]	118.14211[f]	RM 3.3
	CO-3	2.0	T9N,R37E,Sect 14,SW¼,NW¼	Fish Salvage	46.26223[f]	118.15312[f]	HWY 12 Bridge in Waitsburg
Whetstone	WS-1	0.6	T10N,R36E,Sect 32,SE¼,SE¼	T[d],F	46.29897	118.32849	HWY 124 Bridge

[a] River Mile
[b] T-Temperature; F-Flow; EQ-Quantitative Electrofishing (density estimates); EL-Qualitative Electrofishing; G-Flow Gauge
[c] GPS were taken with Garmin II plus, in WGS 84 datum and in D.D°
[d] Same as previous year
[e] Index discharge site
[f] GPS was made using Maptech's Terrain Navigator (version 5.03) program in WGS 84 datum

Appendix A. Table 2. Study site locations for the Walla Walla River and tributaries, 2005.

Stream	Site #	RM[a]	Location (within sect. is listed as smallest qtr. sect. of qtr. sect.)	Sample Type[b]	GPS Coordinates[c] North	GPS Coordinates[c] West	Comments
Walla Walla River	WW-1	41.1	T6N.R35E.Sect 13.SE¼.NW¼	F[d]	46.00078[f]	118.37795[f]	state line
	WW-2	37.9	T6N,R35E,Sect 39,SW¼,SE¼	F[e,d]	46.02195	118.41764	0.5 miles above Burlingame diversion
	WW-3	37.4	T6N,R35E,Sect 39,SW¼,NE¼	T	46.02349	118.42594	Just below Burlingame diversion
	WW-4	37.4	T6N,R35E,Sect 39,SW¼,NE¼	F	46.02376	118.42704	Mojonnier Rd Bridge
	WW-5	35.8	T6N,R35E,Sect 5,NE¼,NE¼	F[d]	46.03102	118.45102	Last Chance Rd
	WW-6	34.5	T7N,R35E,Sect 38,SE¼,SW¼	T[d],F[d,e]	46.03725[f]	118.47147[f]	Swegle Rd
	WW-7	33.7	T7N,R35E,Sect 31,east edge	G[d]	46.04034[f]	118.48330[f]	~0.4 mile above Detour Rd
	WW-8	33.2	T7N,R35E,Sect 31,SW¼,NW¼	T,F[e]	46.04295	118.49089	Detour Rd Bridge
	WW-9	29.6	T7N,R34E,Sect 34,NW¼,NW¼	T[d],F[d]	46.04792	118.55505	McDonald Rd Bridge
	WW-10	20.5	T7N,R33E,Sect 3,SE¼,NW¼	T[d]	46.02896	118.67083	Touchet Gardena Rd Bridge
	WW-11	12.8	T7N,R32E,Sect 35,SE¼,SE¼	T[d]	46.03785	118.76661	Byerley Rd
	WW-12	5.5	T7N,R32E,Sect 20,SE¼,SE¼	T	46.06846	118.82623	RV Park
Yellowhawk Ck	YC-1	8.9	T7N,R36E,Sect 23,NE¼,NW¼	T[d],F[d,e],G[d]	46.07479	118.27394	~25 meters below diversion
	YC-2	0.1	T6N,R35E,Sect 38,NE¼,NE¼	F[d,e]	46.01763	118.40032	~85 meters above mouth
East Little Walla Walla	ELW-1	1.6	T6N,R35E,Sect 14, NW¼,NW¼	EL	46.00495[f]	118.40955[f]	0.9 miles above Springdale Rd.
	ELW-2	0.6	T6N,R35E,Sect 38,NW¼,SW¼	EL	46.01362[f]	118.41241[f]	0.1 miles below Springdale Rd.
	ELW-3	0.3	T6N,R35E,Sect 38,SE¼,NW¼	T[d],F[d,e],G[d]	46.01698	118.41095	0.3 miles above mouth
Big Spring Branch	BSB-1	0.5	T6N,R35E,Sect 14,NW¼,NW¼	EL	46.00306	118.40478	0.5 miles up Big Spring Branch
	BSB-2	0.2	T6N,R35E,Sect 11,SW¼	EL[d]	46.00644	118.40526	0.2 miles up Big Spring Branch
Mill Ck	MC-1	23.1	T6N,R38E,Sect 7,SW¼,SW¼	Fish Salvage	46.00605[f]	118.11838[f]	Kooskooskie Dam Removal Site
	MC-2	20.8	T6N,R37E,Sect 2,NW¼,NE¼	T[d]	46.03179[f]	118.14432[f]	~15 meters below Wickersham brg
	MC-3	15.9	T7N,R37E,Sect 16,SE¼,SW¼	T,F[d]	46.08115	118.18974	Seven Mile Rd
	MC-4	13.8	T7N,R37E,Donation Land Claim	T[d],F[d,e]	46.08588	118.22847	Five Mile Rd
	MC-5	12.1	T7N,R36E,Donation Land Claim	T[d]	46.08004	118.25885	~45 meters above cold return
	MC-6	12.1	T7N,R36E,Donation Land Claim	T[d]	46.07992	118.25971	In cold return
	MC-7	12.0	T7N,R36E,Donation Land Claim	T[d]	46.07974	118.26049	~45 meters below cold return
	MC-8	10.9	T7N,R36E,Sect 23,NW¼,NW¼	T[d]	46.07609	118.28367	First weir above Tausick Way

[a] River Mile
[b] T-Temperature; F-Flow; EQ-Quantitative Electrofishing (density estimates); EL-Qualitative Electrofishing; D-Trutrak Logger; G-Flow Gauge
[c] GPS were taken with Garmin II plus, in WSG 84 datum and in D.D
[d] Same as previous year
[e] Index discharge site
[f] GPS was made using Maptech's Terrain Navigator (version 5.03) program in WSG 84 datum

Appendix A. Table 2. Study site locations for the Walla Walla River and tributaries, 2005.							
Stream	**Site #**	**RM[a]**	**Location (within sect. is listed as smallest qtr. sect. of qtr. sect.)**	**Sample Type[b]**	**GPS Coordinates[c]**		**Comments**
					North	**West**	
Mill Ck (cont)	MC-9	9.4	T7N,R36E,Sect 21,NW¼,SE¼	F[d]	46.06902[f]	118.31223[f]	~15 meters above Roosevelt St
	MC-10	7.4	T7N,R36E,Sect 19,SE¼,SE¼	F[d]	46.06589[f]	118.34981[f]	9th Ave.
	MC-11	7.3	T7N,R36E,Sect 19,SE¼,SE¼	T[d]	46.06563	118.35138	~110 meters below 9th Ave.
	MC-12	5.5	T7N,R35E,Sect 24,SW¼,SW¼	T[d]	46.06448	118.38821	First Weir above Gose St.
	MC-13	3.0	T7N,R35E,Sect 28,NE¼,SE¼	F[d]	46.05417[f]	118.43078[f]	~10 meters above Wallula Rd
	MC-14	0.5	T7N,R35E,Sect 38,SE¼,NW¼	T[d]	46.04163	118.47133	~20 meters below Swegle Rd
Blue Ck	BC-1	0.2	T7N,R37E,Sect 26,SE¼NW¼	T[d]	46.05994	118.15208	Under Mill Ck Rd brg
Titus Ck	TC-1	4.1	T7N,R37E,Sect 17,NE¼,SE¼	F[e],G	46.08496	118.20292	1.4 miles above Five Mile Rd
	TC-2	2.9	T7N,R37E,Sect 18,SW¼,NE¼	T[d],F[e],G	46.08639	118.22639	Covered bridge above Five Mile Rd
	TC-3	2.7	T7N,R37E,Sect 18,SW¼,NE¼	T[d],F[d,e]	46.08699[f]	118.22896[f]	Just above Five Mile Rd
	TC-4	0.3	T7N,R36E,Sect 14,SE¼,SW¼	T[d],F[d,e]	46.07870	118.27495	Behind WWCC Nursing Building
West Little Walla Walla	WLW-1	4.8	T7N,R35E,Sect 9,NE¼,SW¼	F[d,e],EL,D	46.01205	118.44140	1.1 miles below State line Rd
	WLW-2	3.6	T6N,R35E,Sect 5,SE¼,SE¼	EL	46.02057[f]	118.45202[f]	Downstream of Frog Hollow Rd
	WLW-3	0.9	T6N,R35E,Sect 37,north edge	D	46.03444[f]	118.47185[f]	~5 feet above Swegel Rd
	WLW-4	0.9	T6N,R35E,Sect 37,north edge	F[d,e]	46.03444	118.47196	~5 feet below Swegel Rd
Dry Ck	DRC-1	29.3	T8N,R37E,Sect 26,NW¼,SW¼	T[d]	46.14050	118.15467	Hwy 12 brg in Dixie
	DRC-2	18.6	T8N,R36E,Sect 21,NW¼,SE¼	T[d]	46.15451	118.31512	~40 meters above Lower Waitsburg Rd
	DRC-3	3.1	T7N,R34E,Sect 22,SW¼,SW¼	T[d]	46.06736	118.55013	Talbott Rd

[a] River Mile
[b] T-Temperature; F-Flow; EQ-Quantitative Electrofishing (density estimates); EL-Qualitative Electrofishing; D-Trutrak Logger; G-Flow Gauge
[c] GPS were taken with Garmin II plus, in WSG 84 datum and in D.D
[d] Same as previous year
[e] Index discharge site
[f] GPS was made using Maptech's Terrain Navigator (version 5.03) program in WSG 84 datum

Appendix B. Discharge Data, 2005

Appendix B. Table 1. Manual discharge (cfs) measurements 2005.

Stream	Site	Width	Date	cfs	Temp (F)	Time	Comments
Spangler Ck	SC-1	3.1	6/7	3.8	41.0	10:53	0.1 miles above mouth
		2.2	6/20	2.6	43.0	09:51	
		2.1	7/5	1.7	49.0	08:34	
		2.2	7/20	1.8	50.0	09:45	
		2.1	8/9	1.1	50.0	08:35	
		1.9	8/22	0.8	54.0	08:46	
		1.9	9/6	0.9	45.0	09:55	
		1.9	9/20	1.1	46.0	09:34	
		1.9	10/3	1.3	42.0	08:54	
		1.8	10/17	1.1	44.0	09:08	
NF Touchet River	NFT-8	5.8	6/7	11.4	42.0	11:08	0.3 miles below Spangler Ck mouth
		5.4	6/20	8.3	44.0	09:33	
		4.9	7/5	5.3	49.0	08:47	
		4.9	7/20	4.6	50.0	09:57	
		4.9	8/9	3.9	52.0	08:50	
		4.8	8/22	0.7	55.0	08:59	
		4.9	9/6	3.1	45.0	10:09	
		4.8	9/20	2.2	46.0	09:52	
		4.8	10/3	3.3	44.0	09:06	
		4.8	10/17	2.6	44.0	09:20	
Lewis Ck	LC-8	3.3	6/7	5.2	45.0	11:23	~15 feet above N. Fork Touchet Rd
		3.0	6/20	4.7	46.0	10:19	
		3.1	7/5	4.6	50.0	09:01	
		2.7	7/20	3.5	50.0	10:10	
		2.7	8/9	3.5	49.0	09:05	
		2.8	8/22	3.7	53.0	09:13	
		2.7	9/6	3.8	47.0	10:22	
		2.4	9/20	3.4	47.0	10:19	
		2.9	10/3	4.3	45.0	09:20	
		2.4	10/17	3.1	47.0	09:36	
Jim Ck	JC-1	2.6	6/7	1.8	49.0	11:37	~10 feet below N. Fork Touchet Rd
		2.5	6/20	0.9	51.0	10:38	
		2.5	7/5	0.8	55.0	09:14	
		2.4	7/20	0.7	56.0	10:25	
		2.5	8/9	0.6	55.0	09:19	
		2.4	8/22	0.2	59.0	09:27	
		2.3	9/6	0.7	50.0	10:38	
		2.4	9/20	1.0	48.0	10:35	
		2.5	10/3	0.7	45.0	09:35	
		2.4	10/17	0.9	49.0	09:51	
Whitney Ck	WH-2	2.4	6/7	4.6	47.0	12:08	~20 meters above mouth
		2.1	6/20	3.0	48.0	11:22	
		2.3	7/5	3.2	51.0	09:44	
		2.2	7/20	2.6	52.0	11:05	
		2.4	8/9	2.3	51.0	09:47	
		1.9	8/22	2.6	53.0	09:50	
		2.3	9/6	2.3	47.0	10:59	
		2.2	9/20	2.2	48.0	10:55	
		2.2	10/3	2.1	46.0	10:05	

Appendix B. Table 1. Manual discharge (cfs) measurements 2005.

Stream	Site	Width	Date	cfs	Temp (F)	Time	Comments
Whitney Ck	WH-1	3.5	10/17	2.0	49.0	10:29	0.3 miles above mouth
Coates Ck	C-1	3.1	6/7	2.5	46.0	12:20	Directly below Wolf Fork Rd
		2.6	6/20	1.8	48.0	11:37	
		2.8	7/5	1.6	52.0	09:54	
		2.6	7/20	1.1	54.0	11:18	
		2.5	8/9	1.4	51.0	09:58	
		2.7	8/22	0.7	54.0	10.05	
		2.4	9/6	1.5	48.0	11:14	
		2.3	9/20	1.3	48.0	11:04	
		2.7	10/3	1.4	46.0	10:14	
		2.7	10/17	1.2	48.0	10:48	
Wolf Fork	WF-8	6.9	6/7	28.5	49.0	12:39	~15 feet below 3rd bridge on Wolf Fk Rd
		6.4	6/20	25.8	51.0	12:02	
		6.5	7/5	19.3	51.0	10:12	
		6.1	7/20	20.5	54.0	11:30	
		6.1	8/9	19.8	51.0	10:15	
		6.1	8/22	18.1	54.0	10.22	
		6.3	9/6	18.0	49.0	11.32	
		5.9	9/20	18.1	49.0	11.39	
		6.2	10/3	20.1	46.0	10:32	
		6.1	10/17	17.0	49.0	11:18	
Wolf Fork	WF-9	9.2	6/7	30.0	54.0	12:57	Holmberg Rd bridge
		8.9	6/20	21.6	55.0	12:29	
		8.7	7/5	18.4	58.0	10:27	
		8.9	7/20	15.6	61.0	11:50	
		8.7	8/9	14.5	56.0	10:34	
		8.3	8/22	14.4	59.0	10:40	
		8.5	9/6	14.4	54.0	11:49	
		8.0	9/20	15.1	52.0	11:52	
		8.8	10/3	15.3	48.0	10:47	
		7.9	10/17	15.4	50.0	11:33	
Green Fork	GF-1	2.1	6/8	2.0	44.0	10:30	~25 feet above mouth
		N/A	8/11	N/A	N/A	14:40	
		N/A	9/15	N/A	55.0	15:00	
		3.6	10/11	0.1	46.0	13:28	
Burnt Fork	BF-5	6.7	6/8	7.9	41.0	10:35	~25feet above mouth
		5.7	8/11	1.8	61.0	14:45	
		4.4	9/15	1.0	55.0	14:30	
		5.5	10/11	2.1	46.0	13:30	
SF Touchet River	SFT-1	6.9	6/8	7.8	42.0	10:43	30feet below Burnt Fork mouth
		5.5	8/11	0.9	61.0	14:30	
		6.5	9/15	1.9	56.0	14:55	
		5.4	10/11	1.5	46.0	13:38	
SF Touchet River	SFT-3	6.7	6/7	15.7	58.0	13:39	Camp Nancy Lee bridge
		4.9	6/20	8.1	61.0	13:15	
		4.6	7/5	5.3	63.0	11:00	
		4.9	7/20	1.8	69.0	12:43	
		4.7	8/9	2.1	65.0	11:06	
		4.9	8/22	0.1	66.0	11:10	

Appendix B. Table 1. Manual discharge (cfs) measurements 2005.

Stream	Site	Width	Date	cfs	Temp (F)	Time	Comments
SF Touchet	SFT-3	4.9	9/6	1.0	63.0	12:20	Camp Nancy Lee bridge
River		5.2	9/20	2.0	61.0	12.36	
(Cont.)		5.0	10/3	4.7	53.0	11:17	
		5.0	10/17	2.4	56.0	12:11	
SF Touchet	SFT-4	10.3	6/7	18.6	60.0	14:07	Gephart Rd
River		9.1	6/20	8.4	65.0	13:45	
		8.9	7/5	3.2	66.0	11.22	
		1.7	7/20	0.7	71.0	12:58	
		N/A	8/9	0.0	N/A	N/A	No measurable flow
		N/A	8/22	0.0	61.0	11:27	No measurable flow
		N/A	9/6	0.0	64.0	12:41	No measurable flow
		4.2	9/20	0.2	62.0	13:04	
		9.2	10/3	4.9	56.0	11:42	
		8.3	10/17	1.5	59.0	12:35	
Touchet River	TR-2	17.6	3/22	65.9	43.0	11:45	0.2 miles above Hwy 12 brg in Dayton
		17.6	6/7	86.4	58.0	14:29	
		15.8	6/20	54.7	63.0	14:14	
		17.1	7/5	42.9	65.0	11.50	
		15.2	7/20	26.6	68.0	13:30	
		15.0	8/9	32.1	66.0	11:50	
		15.3	8/22	27.5	65.0	11:48	
		15.3	9/6	32.4	60.0	13:00	
		15.7	9/20	36.3	58.0	13:34	
		15.4	10/3	44.6	52.0	12:02	
		17.8	10/17	38.1	56.0	13:05	
Coppei Ck	CO-2	3.9	2/14	5.3	33.0	09:50	Adult Steelhead Trap (RM 3.3)
		3.9	2/28	4.4	35.0	09:20	
		3.9	3/11	4.5	46.0	11:44	
Whetstone Ck	WS-1	1.7	6/13	0.5	55.0	09:34	Hwy 124 bridge
		1.6	6/22	0.6	56.0	08:52	
		1.6	7/5	0.5	55.0	08:23	
		1.3	7/20	0.3	57.0	09:15	
		1.4	8/9	0.2	58.0	08:34	
		1.4	8/22	0.2	59.0	08:55	
		1.5	9/6	0.3	50.0	09:13	
		1.5	9/19	0.4	45.0	09:21	
		1.8	10/3	0.4	50.0	08:40	
		1.7	10/17	0.5	50.0	08:55	
Touchet River	TR-6	21.2	3/21	80.2	49.0	10:47	Just below Harvey Shaw Rd.
Touchet River	TR-7	14.4	3/21	73.3	50.0	11:28	Public Access below Simms Rd.
		19.7	6/13	58.6	59.0	10:30	
		16.2	6/22	38.3	66.0	09:56	
		11.1	7/5	18.8	69.0	09:22	
		11.4	7/20	17.1	72.0	09:59	
		10.9	8/9	6.7	72.0	09:25	
		11.0	8/22	9.8	71.0	09:42	
		10.9	9/6	13.3	60.0	09:55	
		11.6	9/19	24.5	55.0	10:09	
		11.7	10/3	34.8	55.0	09:27	

Appendix B. Table 1. Manual discharge (cfs) measurements 2005.							
Stream	**Site**	**Width**	**Date**	**cfs**	**Temp (F)**	**Time**	**Comments**
Touchet River (Cont.)	TR-7	11.8	10/17	30.7	57.0	10:00	Public Access below Simms Rd.
Touchet River	TR-8	14.8	3/21	45.3	50.0	11:53	Cummins Rd bridge
Walla Walla River	WW-1	15.4	3/21	26.3	48.0	13:37	state line
Yellowhawk Ck	YC-1	5.0	3/21	33.7	49.0	15:02	Below Diversion
		4.9	6/13	23.7	58.0	12:44	
		4.7	6/22	24.9	65.0	12:40	
		4.8	7/5	19.1	68.0	11:42	
		4.8	7/20	18.0	71.0	12:45	
		4.8	8/9	13.8	70.0	11:45	
		5.1	8/22	12.3	69.0	12:05	
		4.9	9/6	12.0	63.0	12:24	
		5.0	9/19	16.9	59.0	12:41	
		4.8	10/3	20.9	53.0	12:22	
		5.0	10/17	17.9	61.0	13:28	
Yellowhawk	YC-2	7.6	3/21	44.2	48.0	13:21	~85 meters above mouth
Walla Walla	WW-2	10.4	3/21	72.1	50.0	13:10	Above Burlingame Diversion
River		10.8	6/22	57.9	63.0	11:57	
		10.5	7/5	49.1	64.0	11:01	
		10.4	7/20	37.1	67.0	11:54	
		10.4	8/9	32.4	67.0	11:01	
		10.4	8/22	31.7	67.0	11:20	
		10.3	9/6	38.8	59.0	11:36	
		10.5	9/19	43.3	56.0	11:44	
		10.6	10/3	54.2	53.0	11:08	
		10.5	10/17	44.4	59.0	11:58	
East Little	ELW-3	3.9	6/13	16.8	54.0	12:01	0.3 miles above mouth
Walla Walla		3.8	6/22	13.3	59.0	11:27	
		3.6	7/5	10.1	58.0	10:41	
		3.3	7/20	9.2	59.0	11:34	
		3.6	8/9	6.9	62.0	10:41	
		3.5	8/22	7.6	58.0	11:00	
		3.9	9/6	8.2	55.0	11:16	
		3.8	9/19	10.5	N/A	N/A	No temp taken
		4.4	10/3	16.1	52.0	10:49	
		4.1	10/17	15.8	57.0	11:35	
Walla Walla	WW-4	10.1	3/21	30.1	50.0	12:58	Below Mojonnier Rd
River		12.7	6/13	20.3	55.0	11:53	
Walla Walla River	WW-5	7.7	7/21	33.2	68.0	12:10	Last Chance Rd
Walla Walla	WW-6	14.8	3/21	36.2	52.0	12:40	Swegle Rd bridge
River		12.0	7/20	37.1	68.0	10:53	
		13.8	8/22	30.5	70.0	13:47	
Mill Ck	MC-3	13.3	3/21	53.8	48.0	15:35	Seven Mile Rd
Mill Ck	MC-4	13.8	3/21	52.0	49.0	15:15	Five Mile Rd
		12.0	6/13	32.4	58.0	13:37	
		12.0	6/22	34.5	63.0	13:50	
		12.9	7/5	25.4	65.0	12:45	
		11.9	7/20	25.6	67.0	13:33	

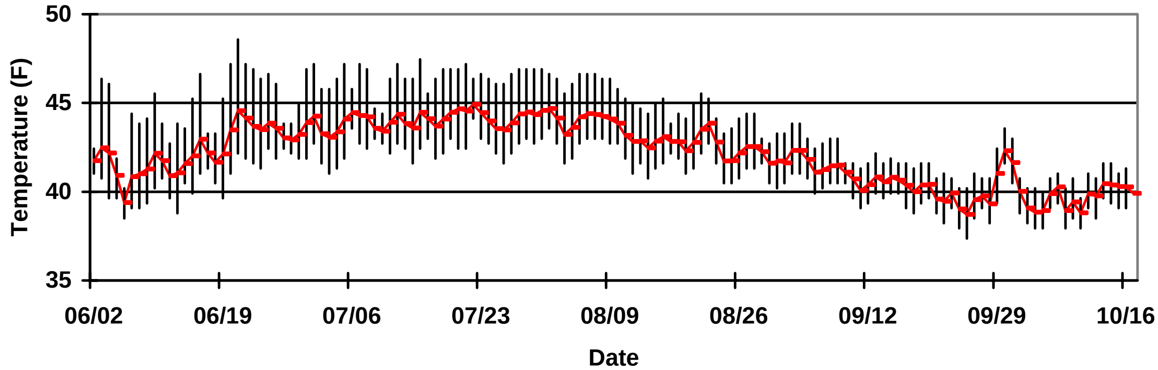
Appendix B. Table 1. Manual discharge (cfs) measurements 2005.

Stream	Site	Width	Date	cfs	Temp (F)	Time	Comments
Mill Ck (Cont.)	MC-4	13.4	8/9	25.1	66.0	12:25	
		12.0	8/22	19.7	65.0	12:55	Five Mile Rd
		11.9	9/6	23.6	60.0	13:03	
		11.7	9/19	23.5	57.0	13:20	
		11.9	10/3	33.5	52.0	13:18	
		11.9	10/17	32.4	58.0	14:10	
Titus Ck	TC-1	5.5	6/22	7.9	64.0	14:48	1.4 miles above Five Mile
		4.7	7/5	4.6	66.0	13:04	
		5.1	7/20	7.8	67.0	13:47	
		5.4	8/9	8.3	68.0	13:10	
		N/A	8/22	N/A	N/A	13:10	Guard dog outside no flow taken
		5.4	9/6	8.6	61.0	13:35	
		5.1	9/19	9.8	56.0	13:49	
		5.3	10/3	10.1	52.0	13:45	
		5.3	10/17	9.7	59.0	14:50	
Titus Ck	TC-2	3.1	6/13	4.8	54.0	13:25	Covered Bridge above Five Mile Rd
		3.8	6/22	5.4	60.0	13:33	
		3.1	7/5	3.5	62.0	12:32	
		3.0	7/20	4.6	65.0	13:19	
		4.1	8/9	4.4	66.0	12:41	
		4.0	8/22	2.6	62.0	12:44	
		4.0	9/6	3.2	59.0	13:20	
		3.9	9/19	4.0	55.0	13:31	
		4.7	10/3	9.6	52.0	13:05	
		4.5	10/17	9.0	58.0	14:27	
Titus Ck	TC-3	1.0	6/13	3.6	54.0	13:14	Five Mile Rd
		1.0	6/22	3.6	60.0	13:20	
		0.9	7/5	2.7	62.0	12:20	
		1.0	7/20	2.9	65.0	13:12	
		1.1	8/9	4.9	64.0	12:12	
		1.1	8/22	4.5	61.0	12:30	
		1.2	9/6	5.8	58.0	12:55	
		1.3	9/19	6.4	54.0	13:07	
		1.1	10/3	1.3	51.0	12:52	
		1.1	10/17	1.5	57.0	13:56	
Titus Ck	TC-4	2.7	6/13	1.6	54.0	12:59	Walla Walla Community College
		2.6	6/22	2.1	58.0	13:06	
		2.4	7/5	1.9	60.0	11:57	
		2.5	7/20	1.3	61.0	12:59	
		2.7	8/9	1.2	62.0	11:59	
		2.4	8/22	2.2	62.0	12:20	
		3.0	9/6	2.1	59.0	12:38	
		2.6	9/19	3.0	56.0	12:55	
		3.1	10/3	1.4	55.0	12:37	
		2.5	10/17	1.1	59.0	13:40	
Mill Ck	MC-9	2.8	3/21	8.6	55.0	14:53	Roosevelt
Mill Ck	MC-10	2.7	3/21	8.5	53.0	14:19	9th Ave
Mill Ck	MC-13	5.3	3/21	18.3	56.0	14:03	Wallula Rd bridge

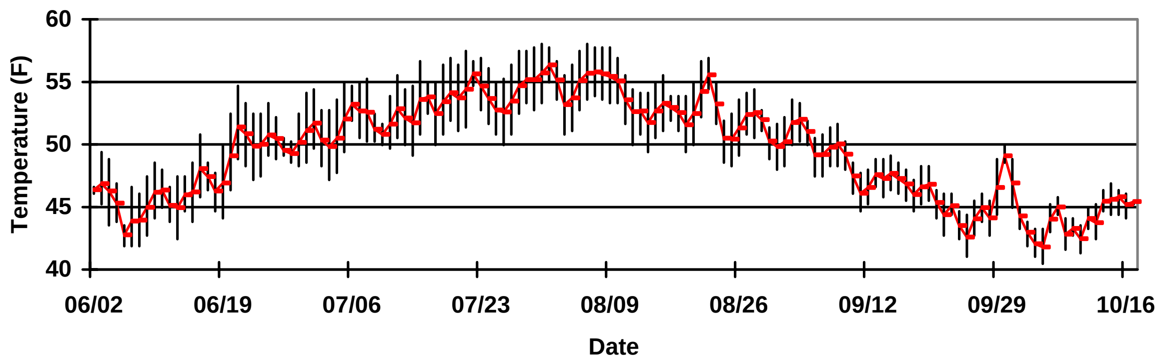
Appendix B. Table 1. Manual discharge (cfs) measurements 2005.							
Stream	**Site**	**Width**	**Date**	**cfs**	**Temp (F)**	**Time**	**Comments**
West Little Walla Walla	WLW-1	2.4	6/13	2.1	55.0	11:32	1.1 miles below State line Rd
		1.7	6/22	1.7	60.0	11:03	
		1.6	7/5	0.9	58.0	10:19	1.1 miles below State line Rd
		1.3	7/20	0.4	64.0	11:12	
		1.3	8/9	0.2	63.0	10:23	
		1.1	8/22	N/A	68.0	10:40	Actual flow was .04
		1.2	9/6	N/A	59.0	10:57	Actual flow was .02
		1.2	9/19	0.1	52.0	11:02	
		1.4	10/3	0.2	53.0	10:26	
		1.6	10/17	1.2	59.0	11:10	
West Little Walla Walla	WLW-4	0.8	6/13	0.2	58.0	11:15	Swegle Rd
		0.9	6/22	0.2	61.0	10:46	
		1.1	7/5	0.6	64.0	10:06	
		0.8	7/20	0.1	64.0	10:59	
		N/A	8/9	N/A	N/A	N/A	Dry
		N/A	8/22	N/A	N/A	N/A	Dry
		N/A	9/6	N/A	N/A	N/A	Dry
		N/A	9/19	N/A	N/A	N/A	Dry
		0.7	10/3	N/A	53.0	10:26	No measurable flow
		0.6	10/17	N/A	59.0	11:10	No measurable flow
Walla Walla River	WW-8	11.1	3/21	52.3	52.0	12:27	Above Detour Rd bridge
		10.0	6/13	28.8	58.0	11:06	
		9.5	6/22	27.8	65.0	10:35	
		11.2	7/5	37.6	67.0	09:56	
		10.5	7/20	41.2	68.0	10:34	
		9.7	8/9	28.7	69.0	09:59	
		11.0	8/22	32.2	68.0	10:17	
		10.5	9/6	39.2	60.0	10:36	
		11.6	9/19	48.9	55.0	10:43	
		11.6	10/3	50.4	54.0	09:59	
		9.8	10/17	30.9	59.0	10:40	
Walla Walla River	WW-9	10.6	3/21	32.1	51.0	12:15	Above McDonald Rd bridge

Appendix C. Stream Temperature Graphs (ºF), 2005

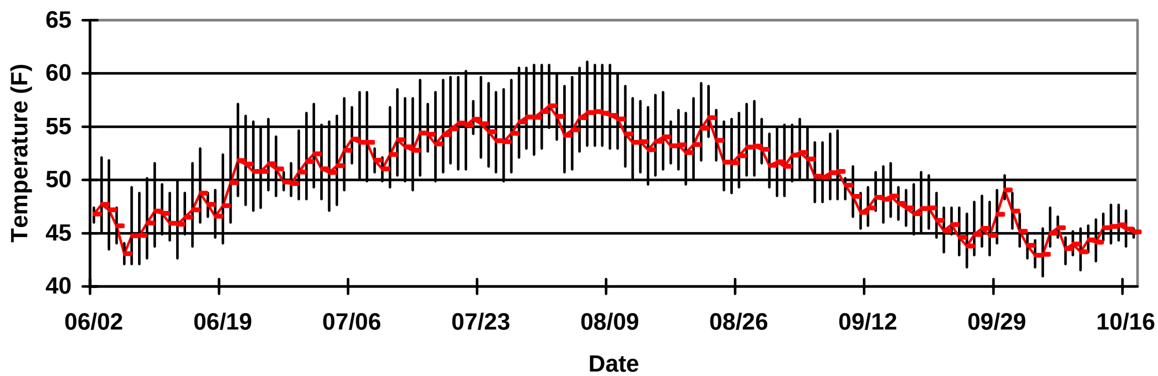
NF Touchet--Bluewood culvert (NFT-4)



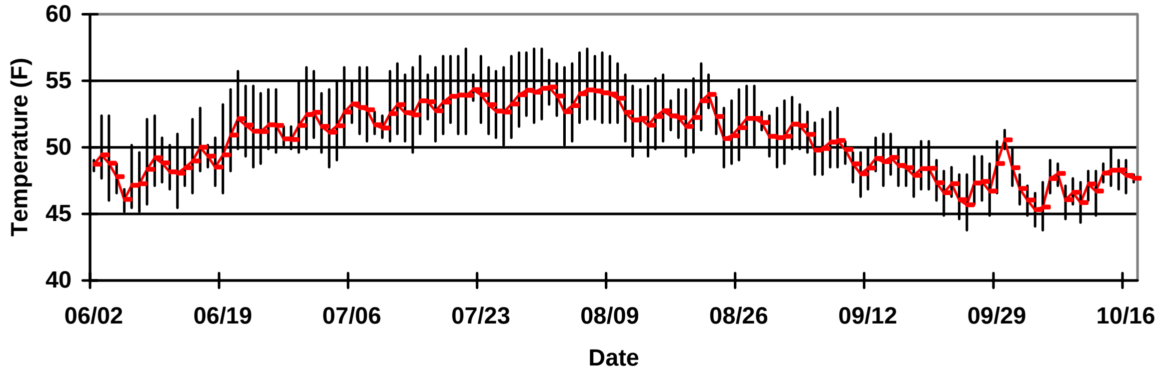
Spangler Ck--0.1 mi above mouth (SC-1)



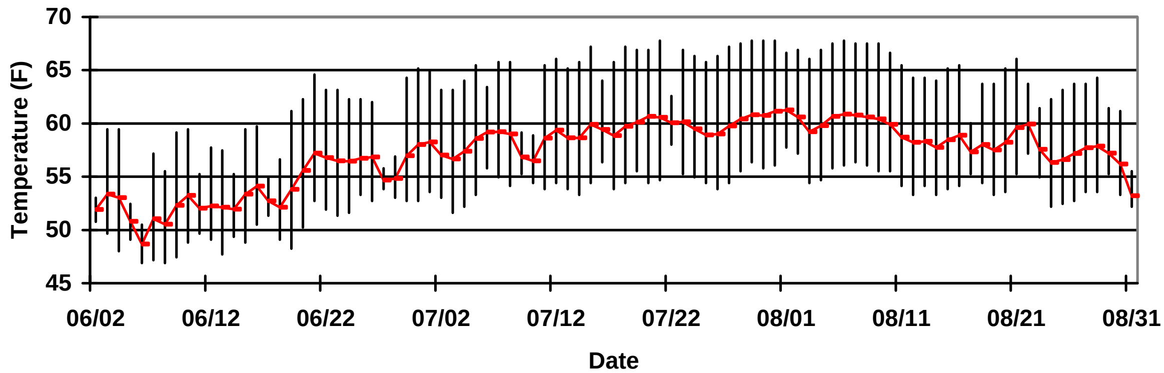
NF Touchet--below Spangler Ck (NFT-8)



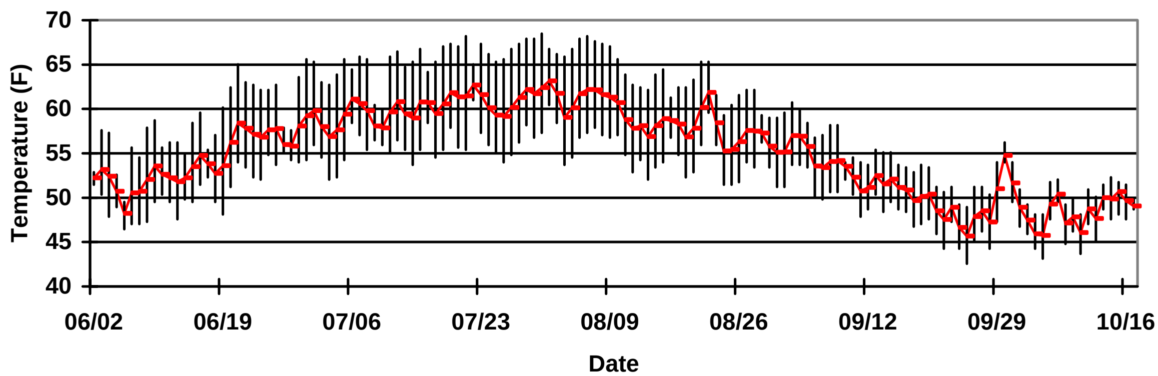
Lewis Ck--above NF Touchet Rd. (LC-8)



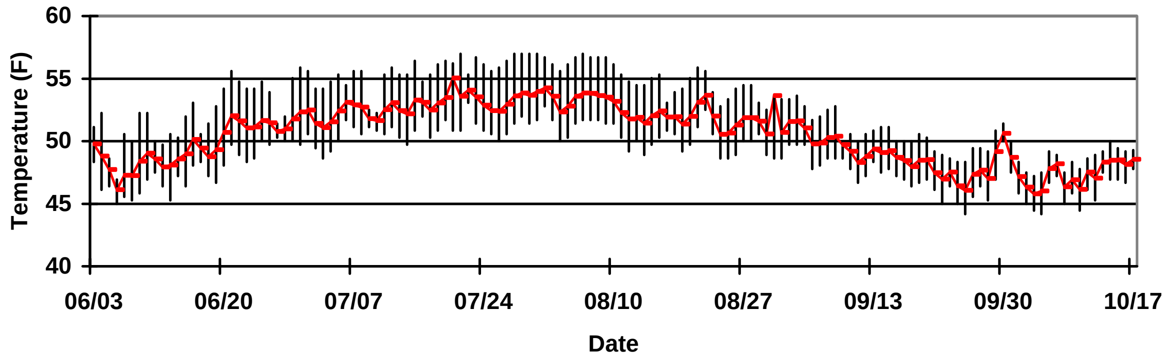
NF Touchet--above Jim Ck (NFT-9)



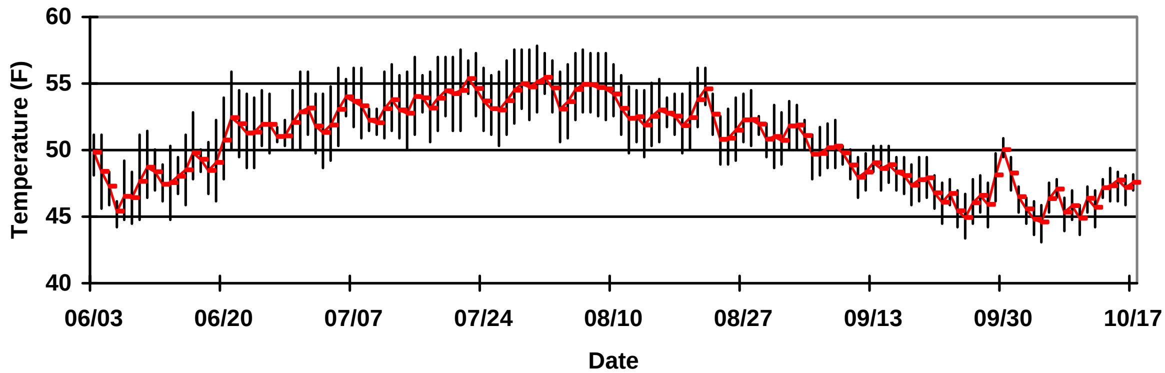
Jim Ck--below NF Touchet Rd. (JC-1)



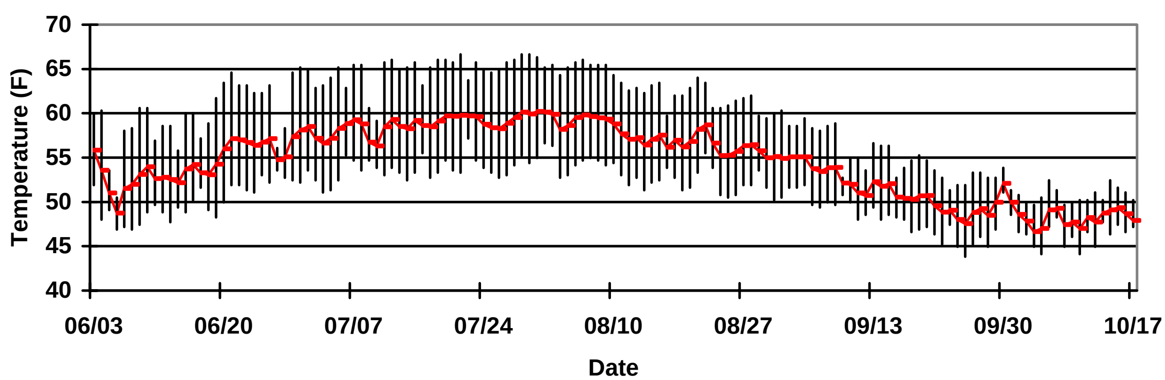
Whitney Ck--0.3 mi above mouth (WH-1)



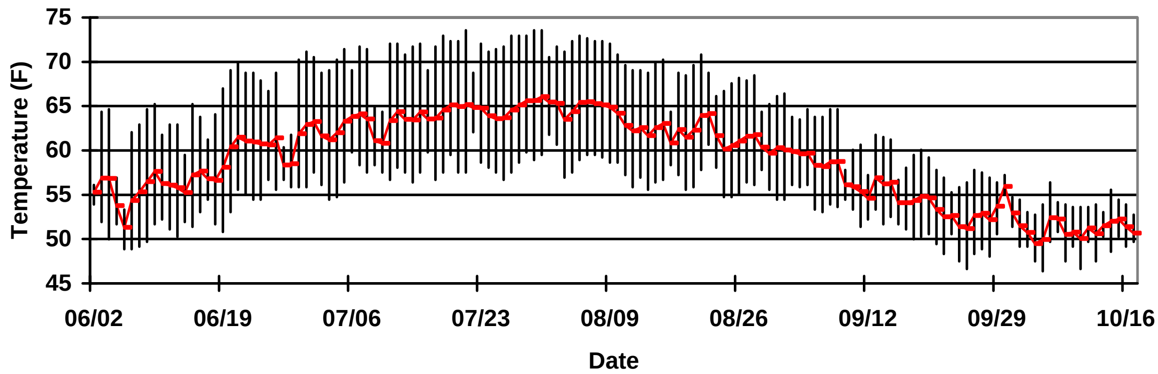
Coates Ck--below Wolf Fk Rd. (C-1)



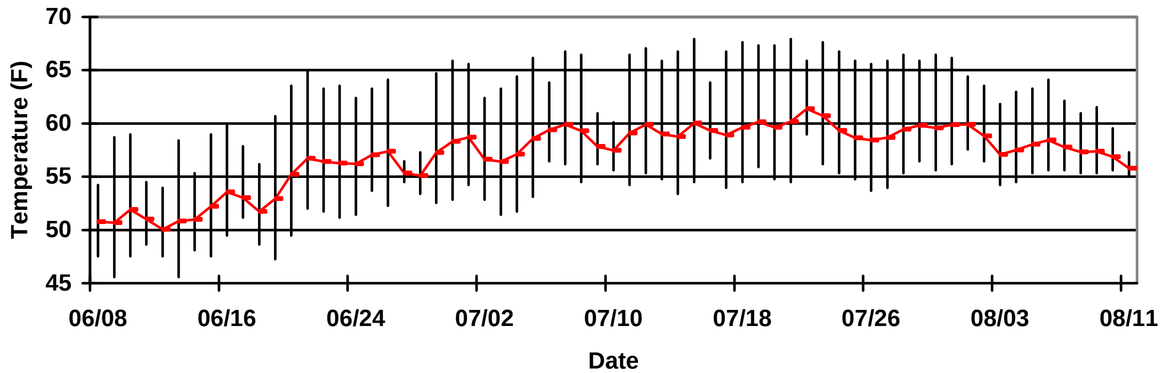
Wolf Fk--Holmberg Rd. (WF-9)



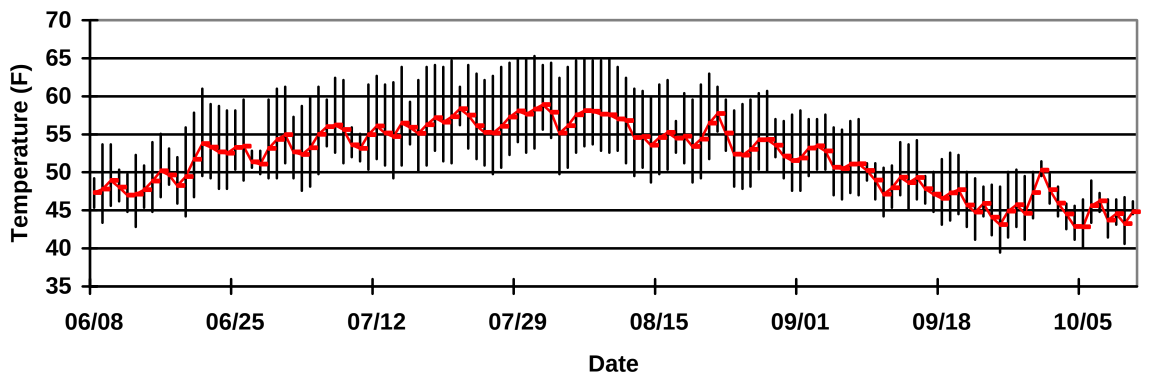
NF Touchet--above Baileysburg (NFT-10)



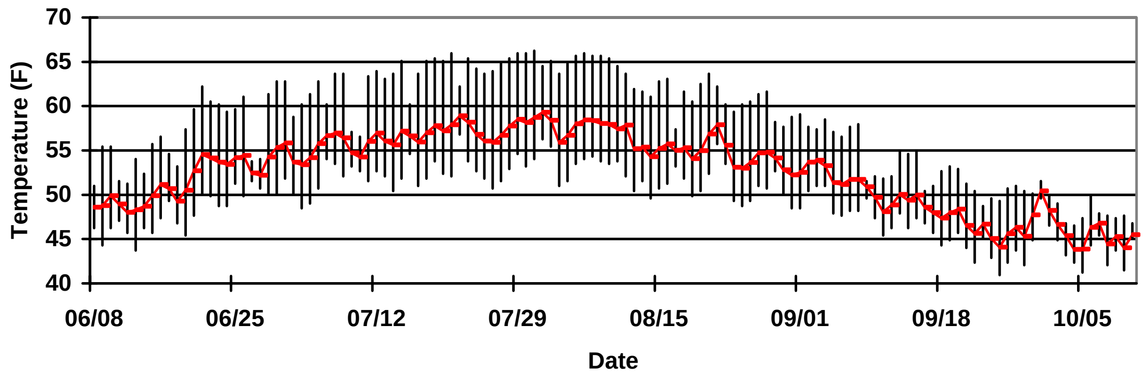
Green Fk--just above mouth (GF-1)



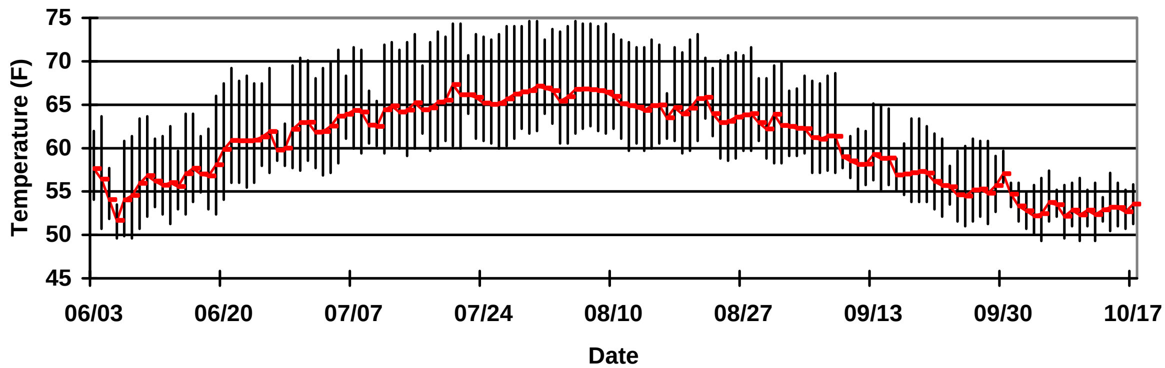
Burnt Fk--just above mouth (BF-5)



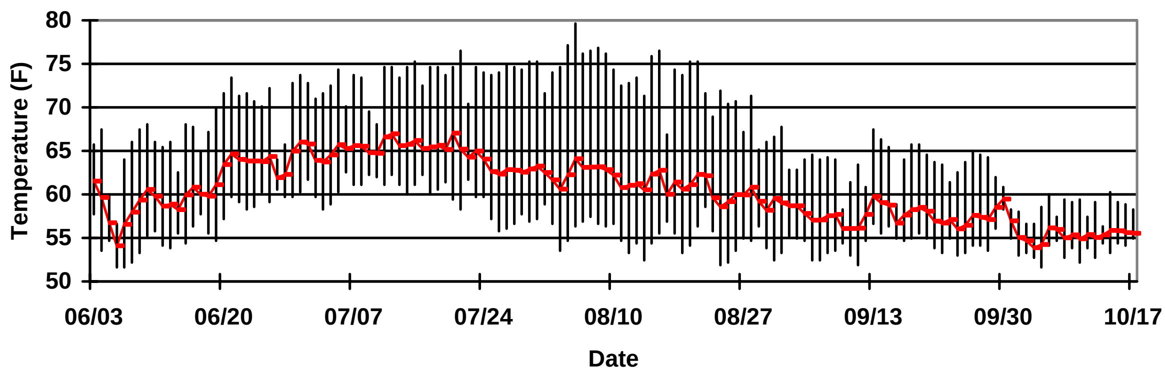
SF Touchet--below Burnt Fk (SFT-2)



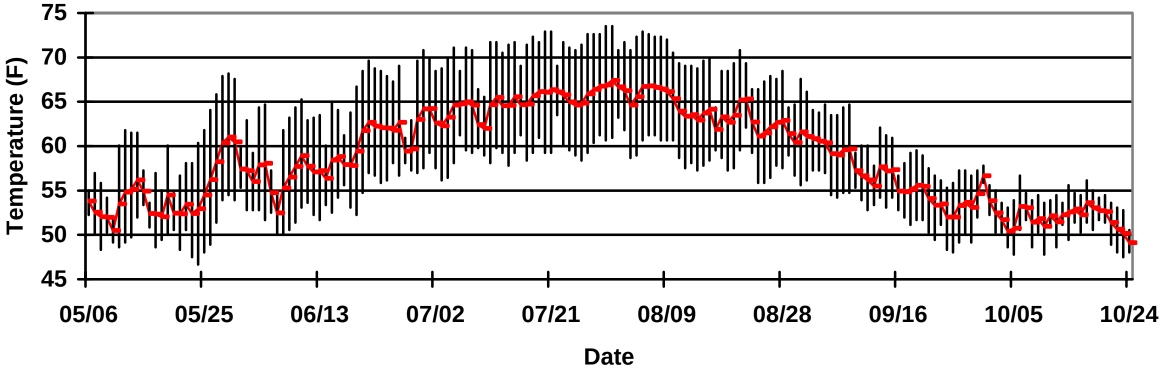
SF Touchet--Camp Nancy Lee brg (SFT-3)



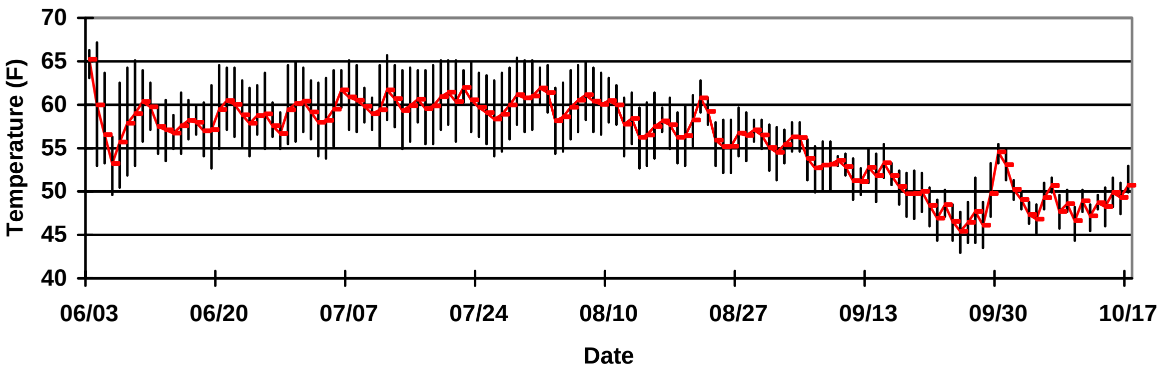
SF Touchet--Gephart Rd. (SFT-4)



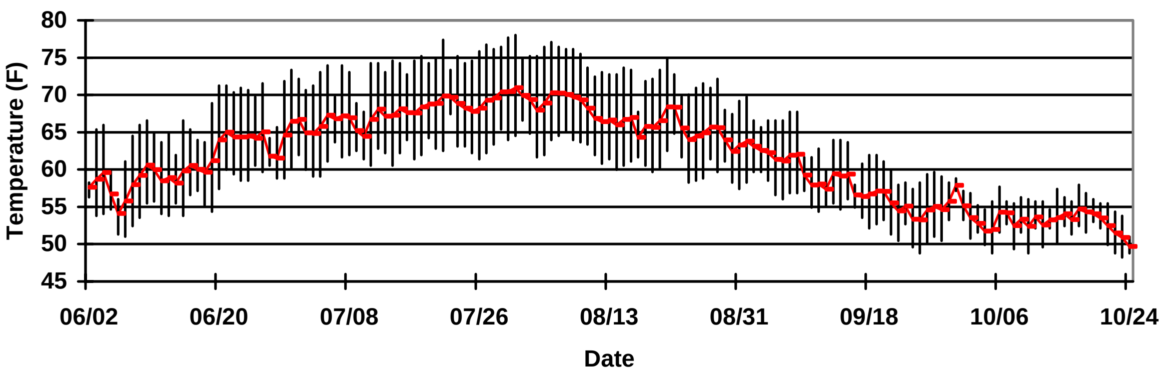
Touchet River--below SRL trap (TR-1)



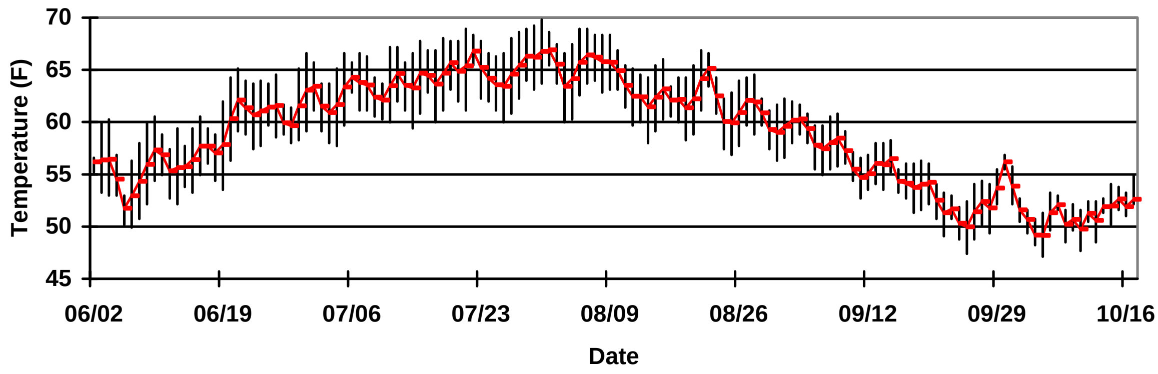
Patit Ck--1st brg on Patit Rd. (P-1)



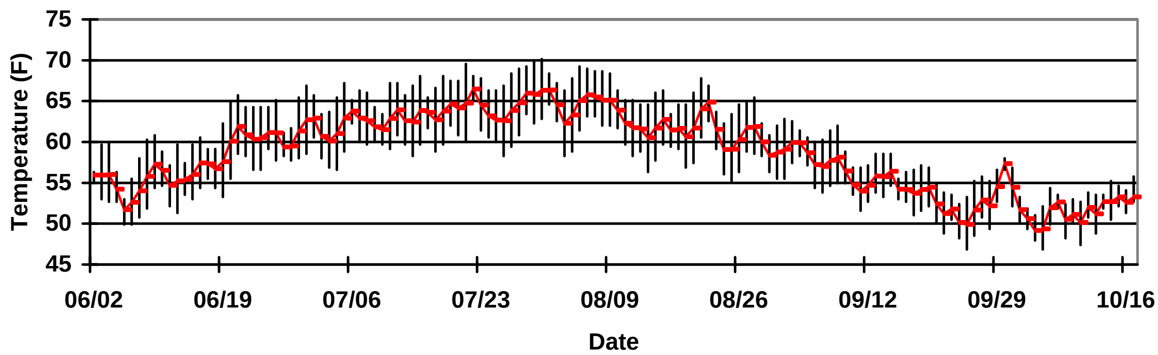
Touchet River--Lewis and Clark State Park (TR-3)



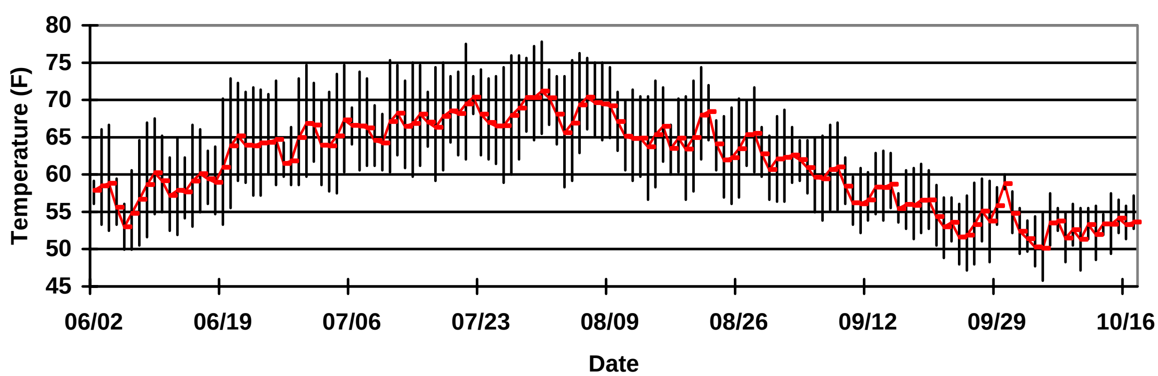
SF Coppei--2nd brg on SF Coppei Rd. (SFC-1)



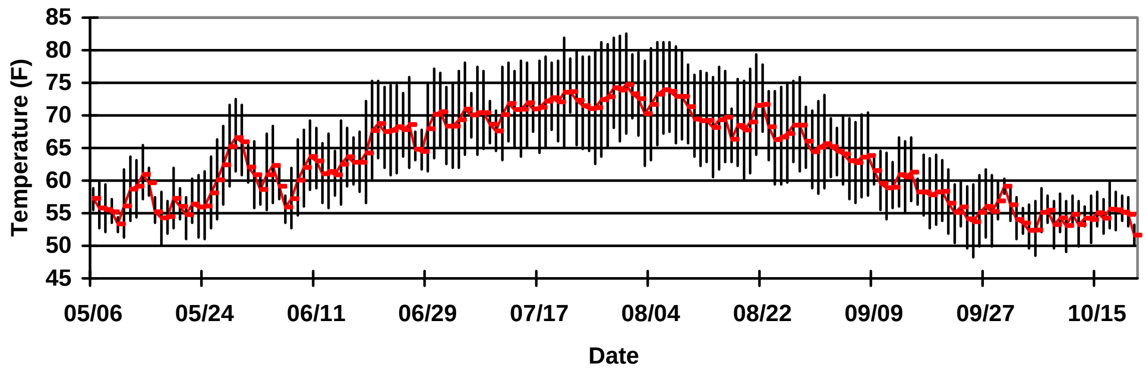
NF Coppei--0.1 mi above mouth (NFC-1)



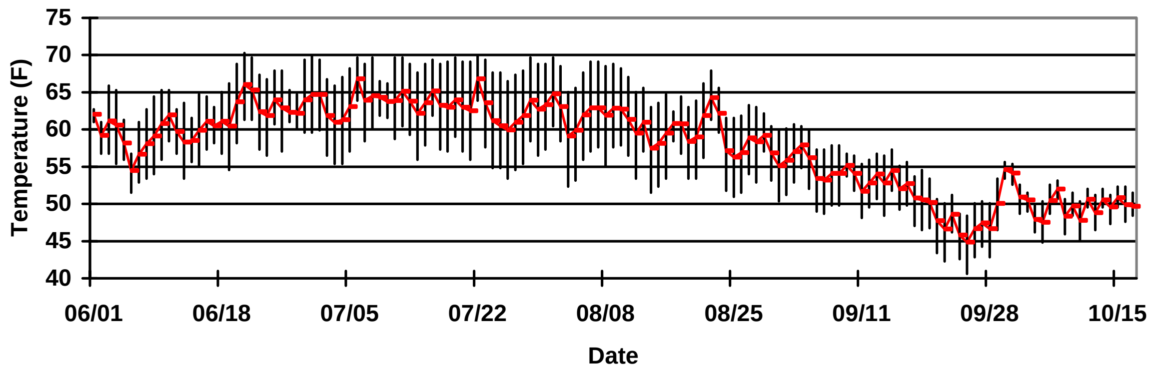
Coppei Ck--McCowan Rd. (CO-1)



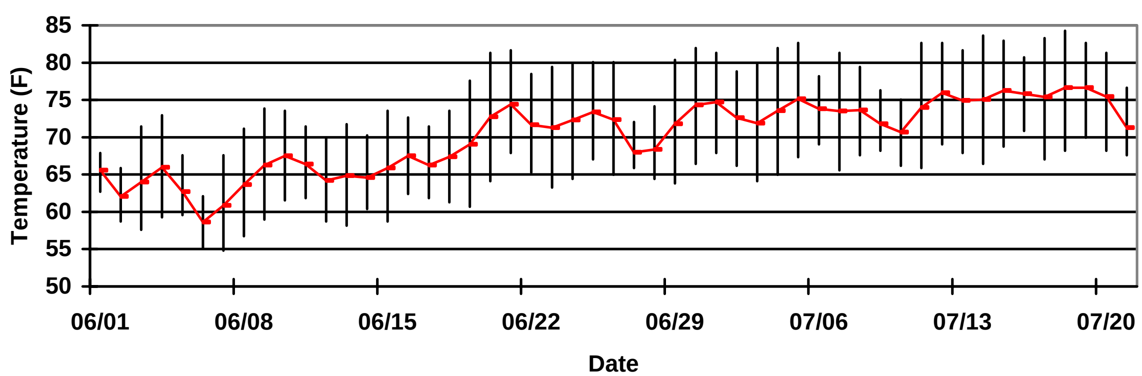
Touchet River--above Bolles brg (TR-5)



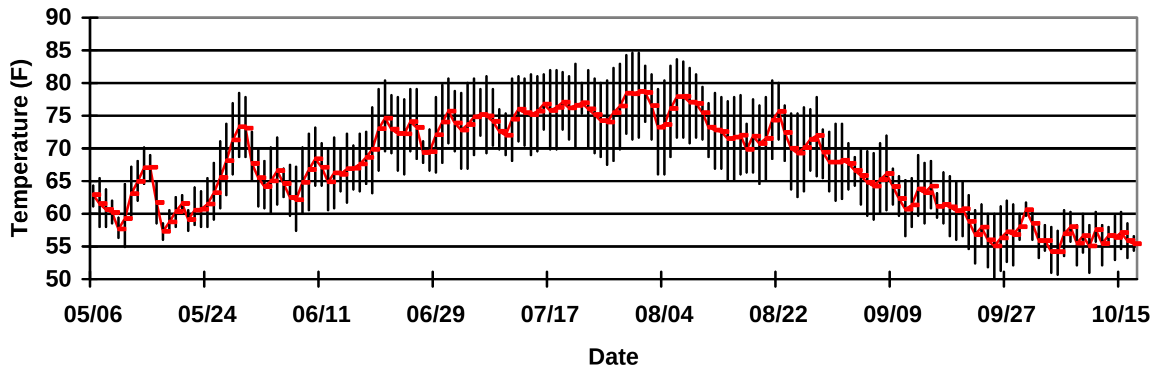
Whetstone--Highway 124 brg (WS-1)



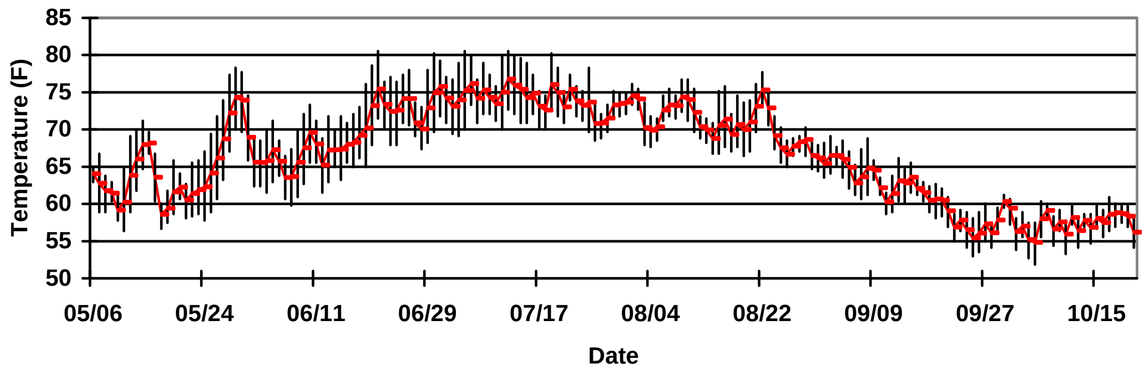
Touchet River--below Harvey Shaw Rd. (TR-6)



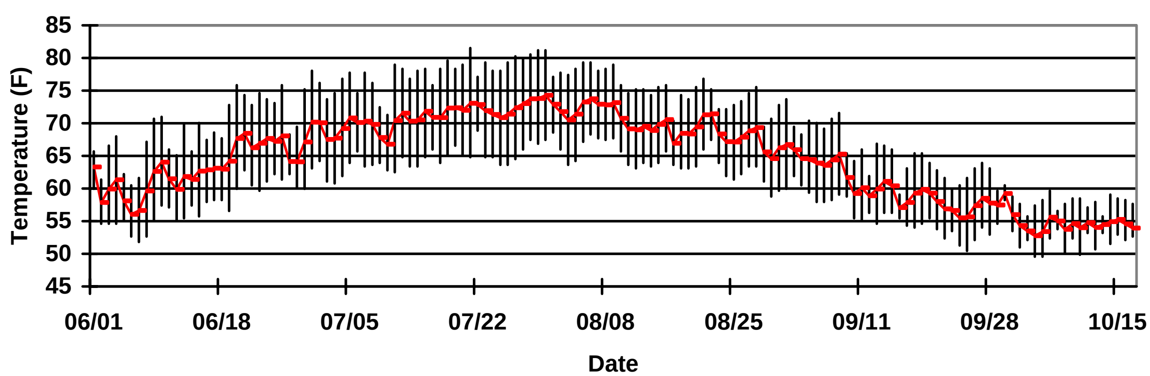
Touchet River--WDFW Public Access (TR-7)



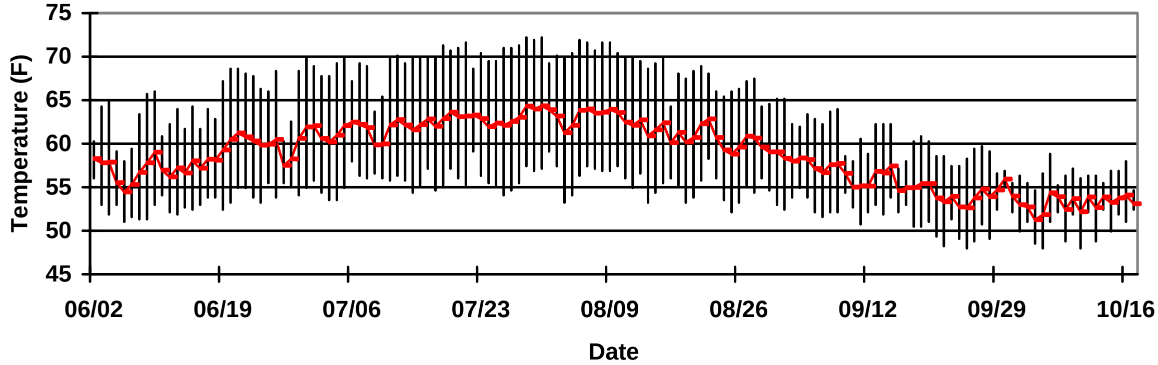
Touchet River--Cummins Rd. brg (TR-8)



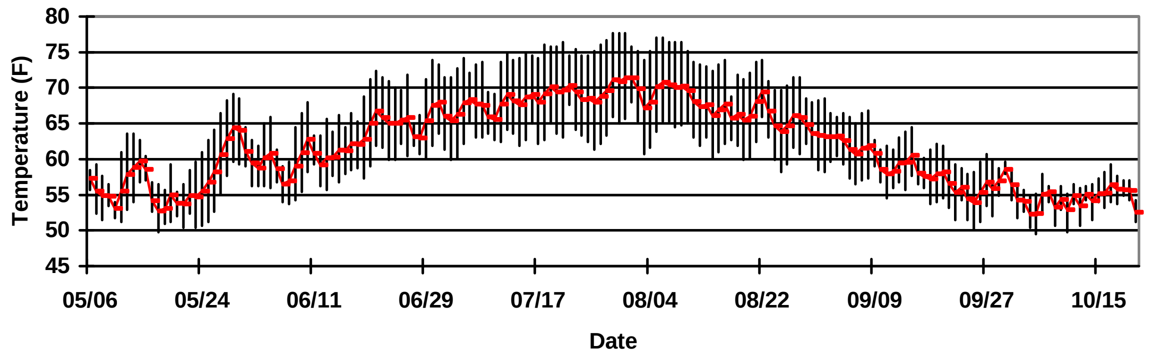
Yellowhawk Ck--below diversion (YC-1)



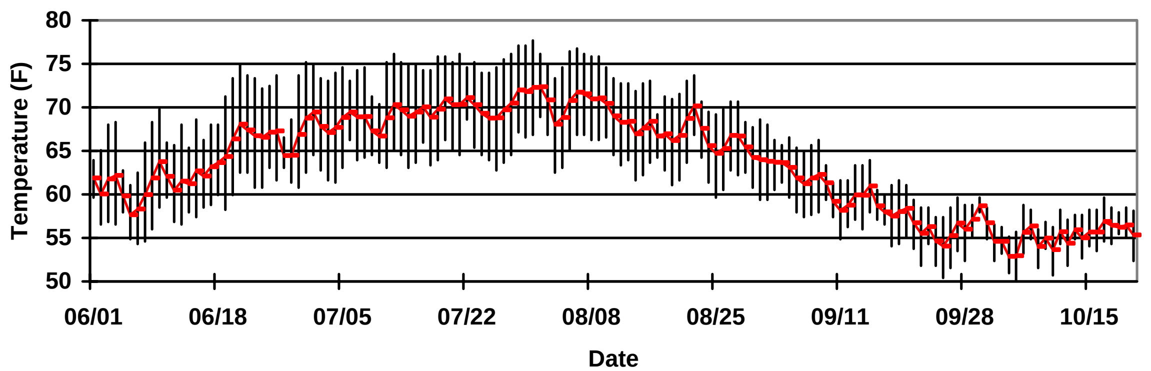
East Little WW--above mouth (ELW-3)

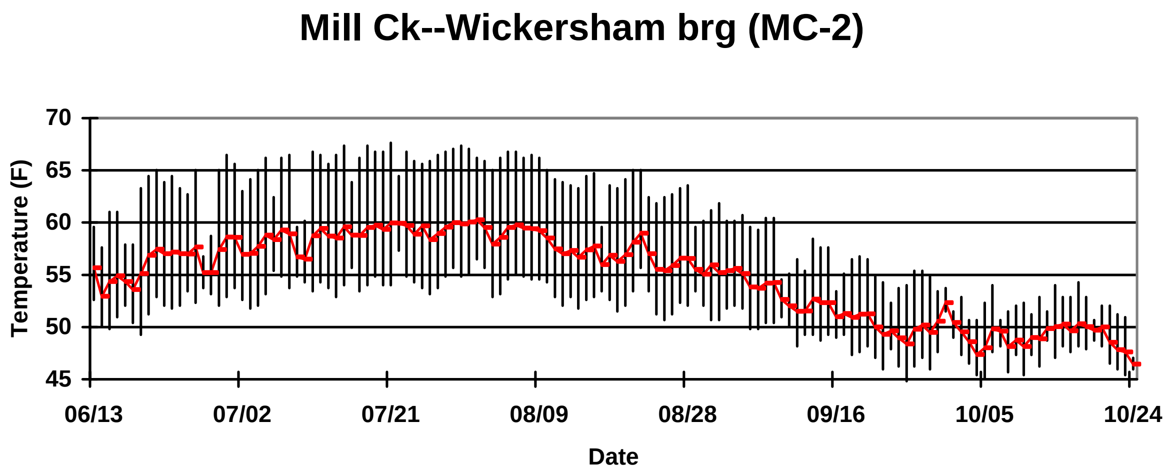


Walla Walla River--below Burlingame (WW-3)

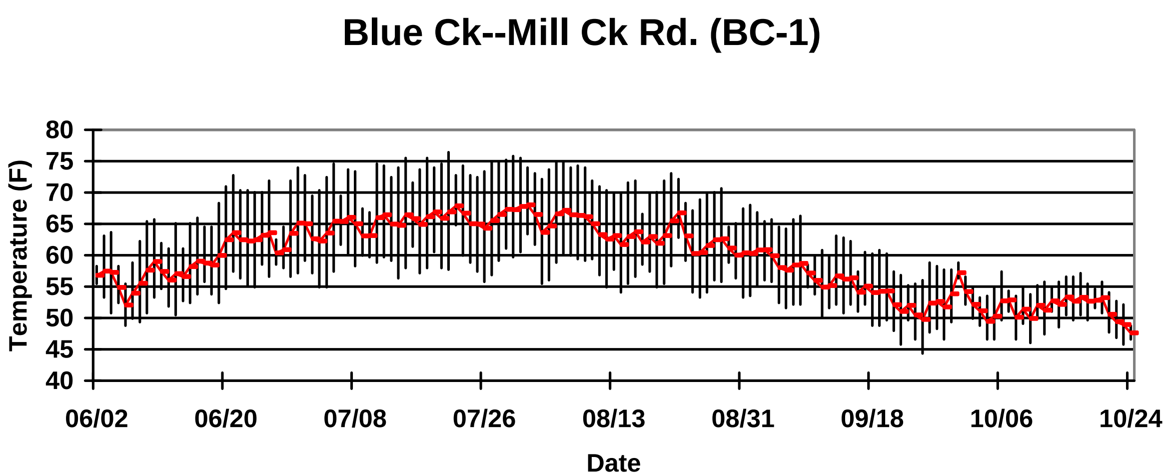


Walla Walla River--Swegle Rd. (WW-6)

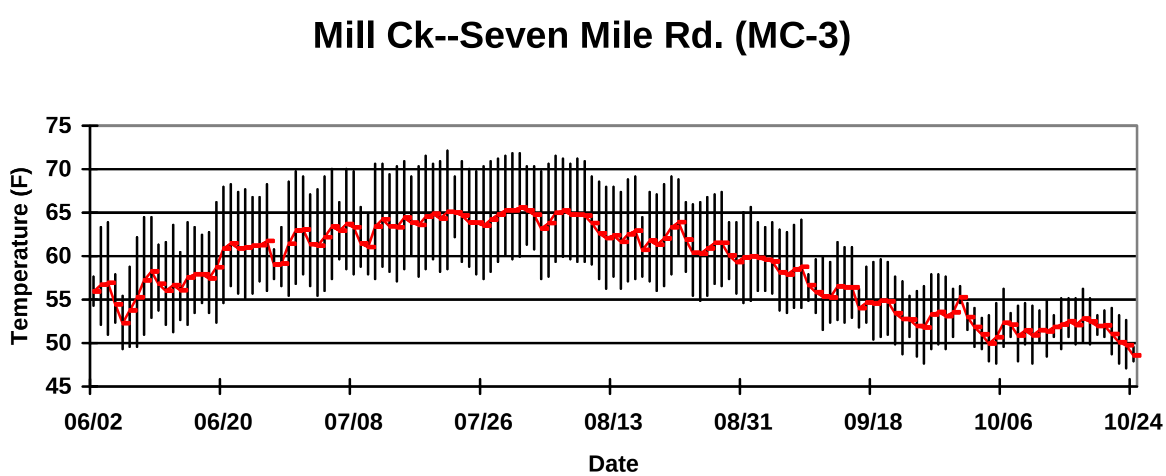




Mill Ck--Wickersham brg (MC-2)
70
65
60
55
50
45
Temperature (F)
06/13
07/02
07/21
08/09
08/28
09/16
10/05
10/24
Date

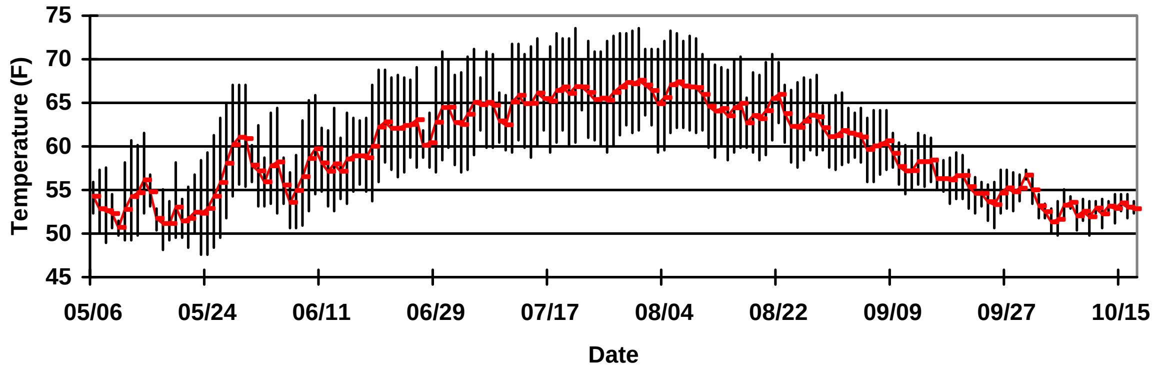


Blue Ck--Mill Ck Rd. (BC-1)
80
75
70
65
60
55
50
45
40
Temperature (F)
06/02
06/20
07/08
07/26
08/13
08/31
09/18
10/06
10/24
Date

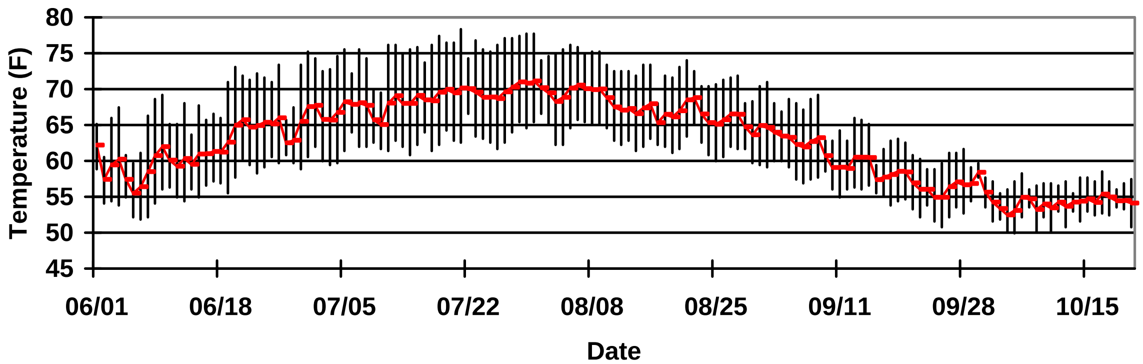


Mill Ck--Seven Mile Rd. (MC-3)
75
70
65
60
55
50
45
Temperature (F)
06/02
06/20
07/08
07/26
08/13
08/31
09/18
10/06
10/24
Date

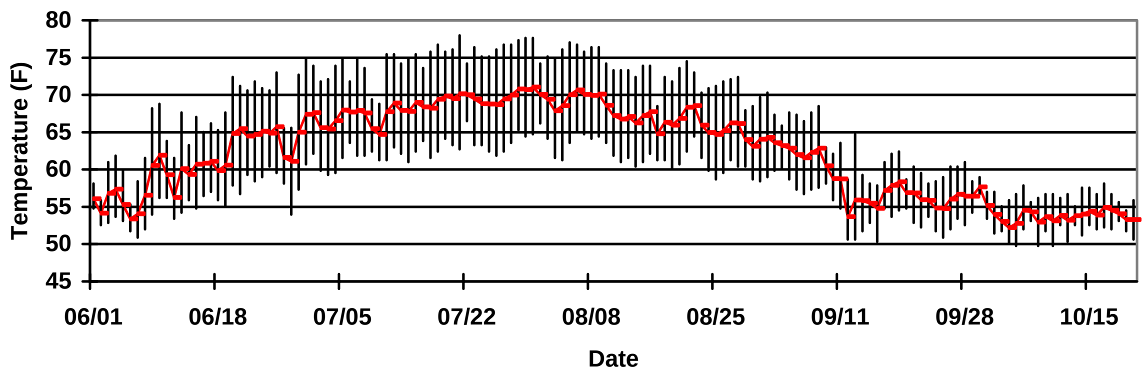
Mill Ck--Five Mile Rd. (MC-4)



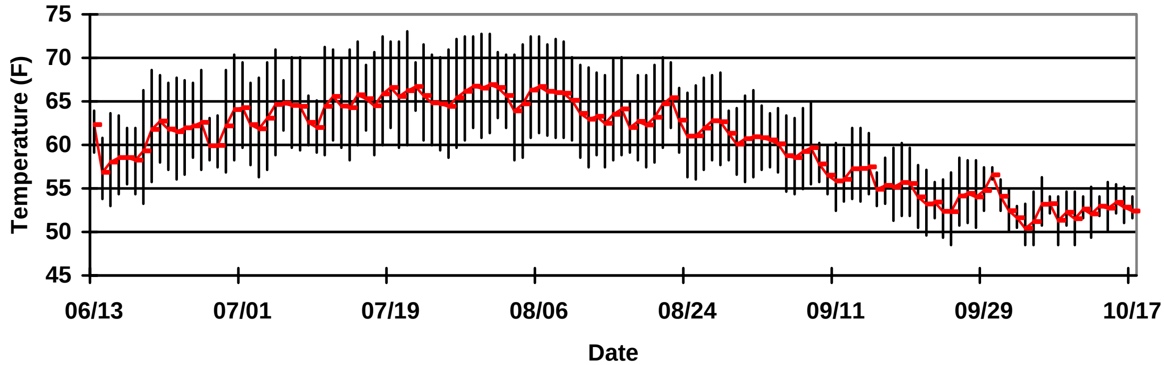
Mill Ck--above cold return (MC-5)



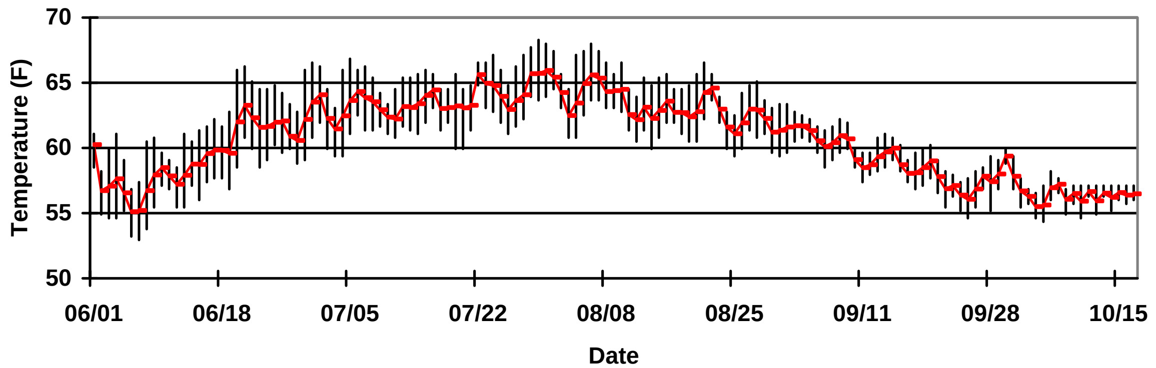
Mill Ck--below cold return (MC-7)



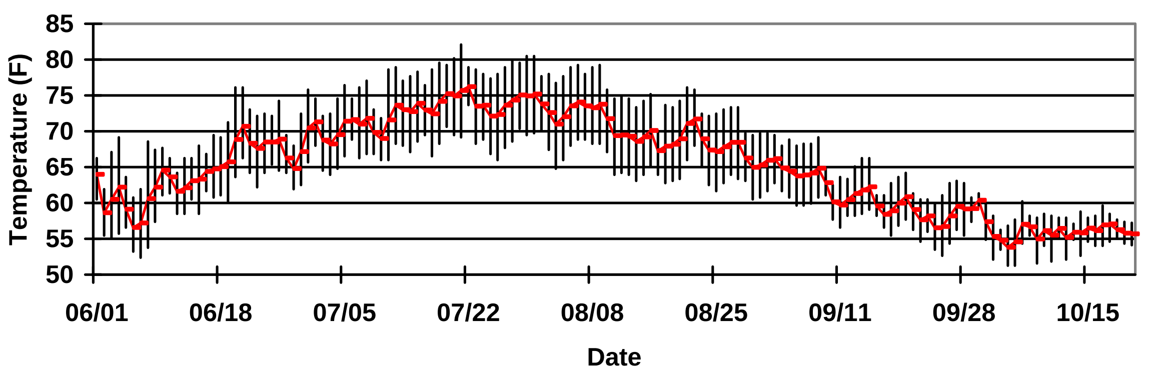
Titus Ck--Five Mile Rd. (TC-3)

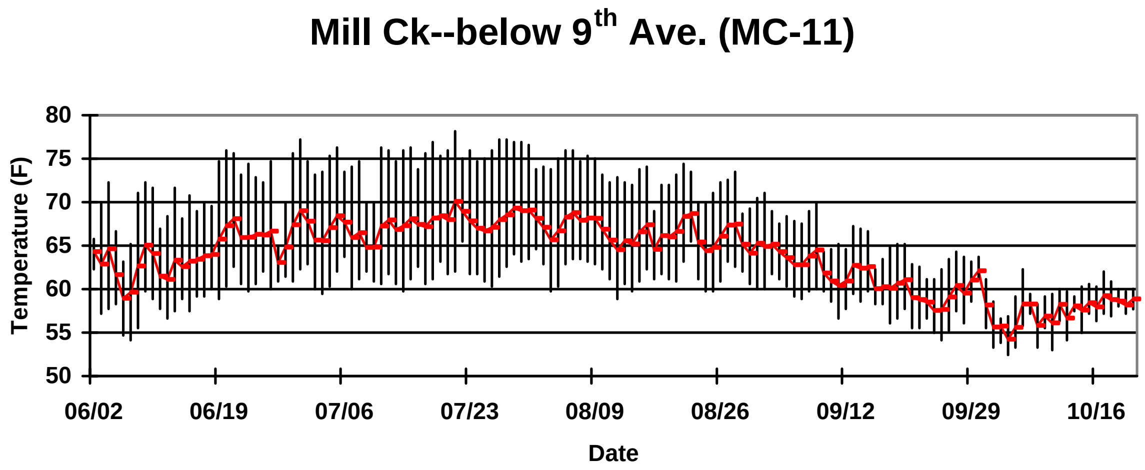


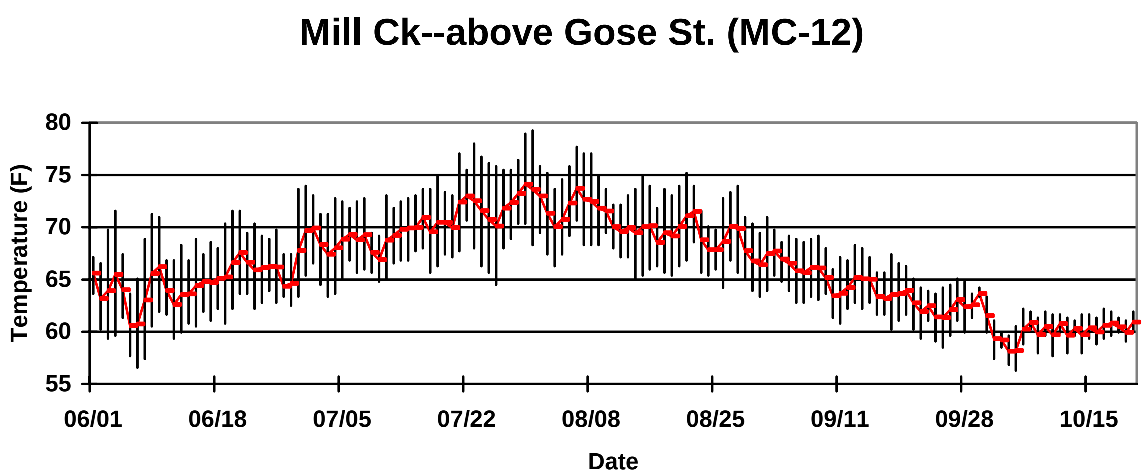
Titus Ck--WWCC campus (TC-4)

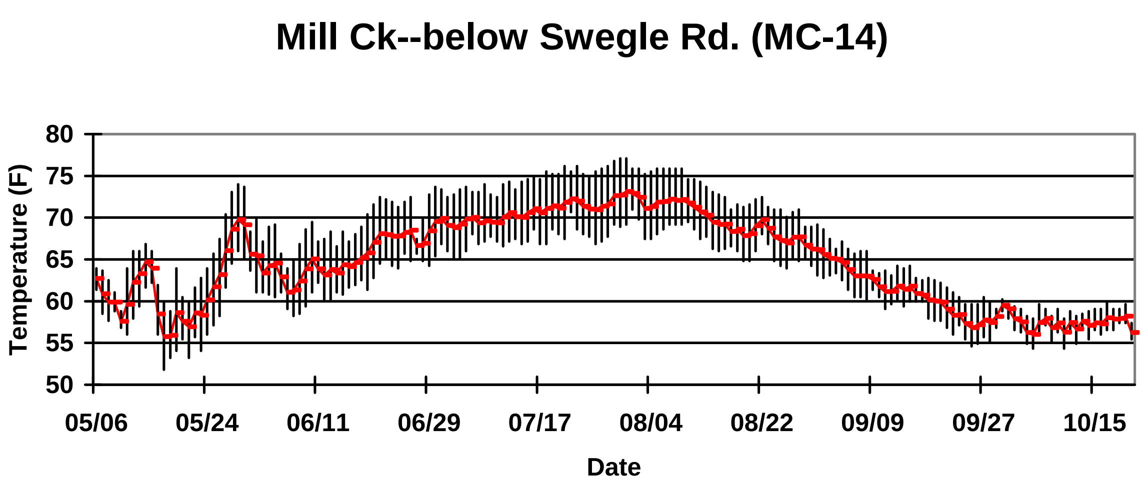


Mill Ck--above Tausick Way brg (MC-8)

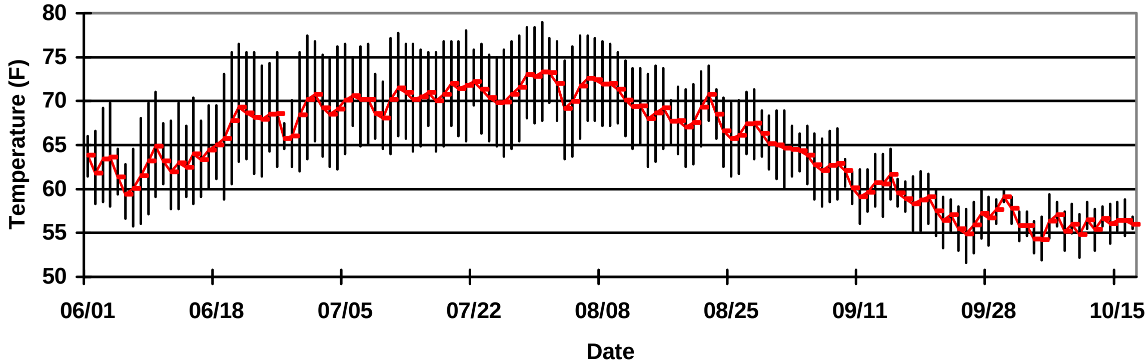



Mill Ck--below 9th Ave. (MC-11)
Temperature (F)
80
75
70
65
60
55
50
06/02
06/19
07/06
07/23
08/09
08/26
09/12
09/29
10/16
Date

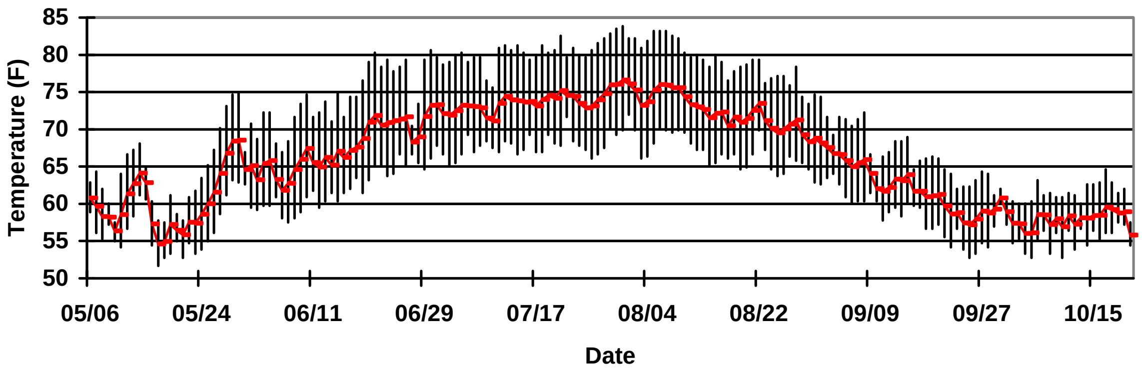

Mill Ck--above Gose St. (MC-12)
Temperature (F)
80
75
70
65
60
55
06/01
06/18
07/05
07/22
08/08
08/25
09/11
09/28
10/15
Date


Mill Ck--below Swegle Rd. (MC-14)
Temperature (F)
80
75
70
65
60
55
50
05/06
05/24
06/11
06/29
07/17
08/04
08/22
09/09
09/27
10/15
Date

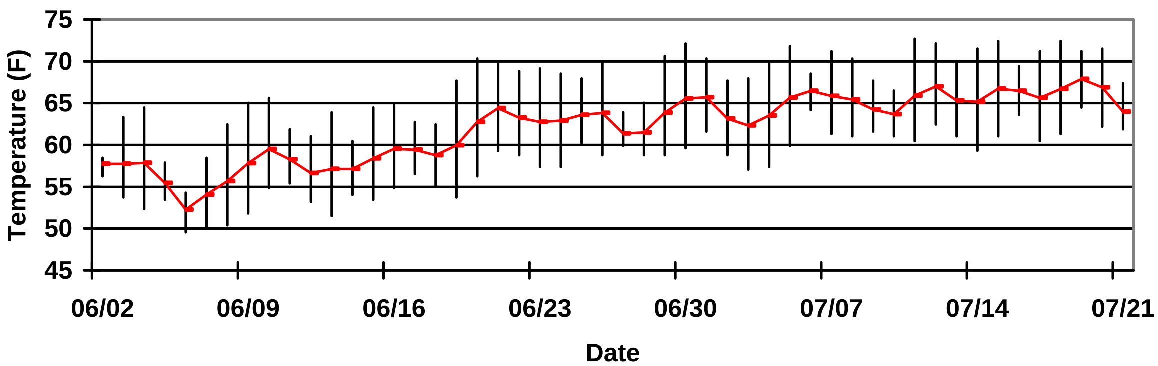
Walla Walla River--Detour Rd. (WW-8)



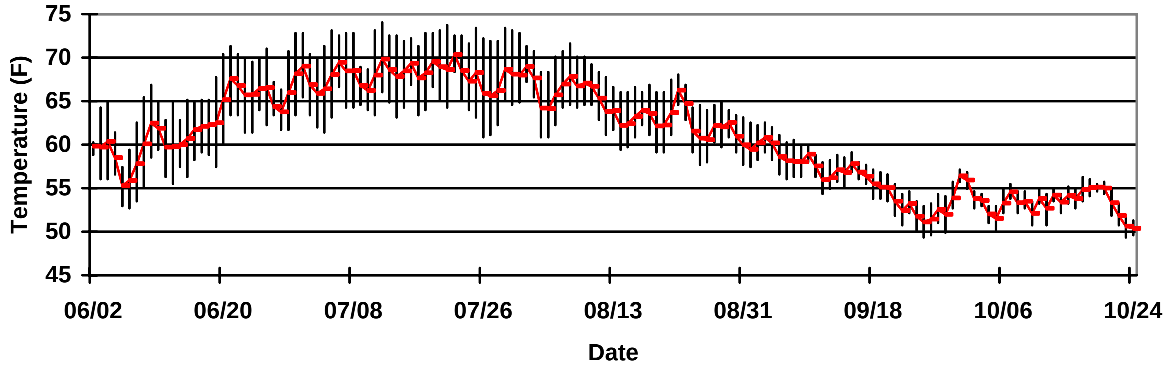
Walla Walla River--McDonald Rd. (WW-9)



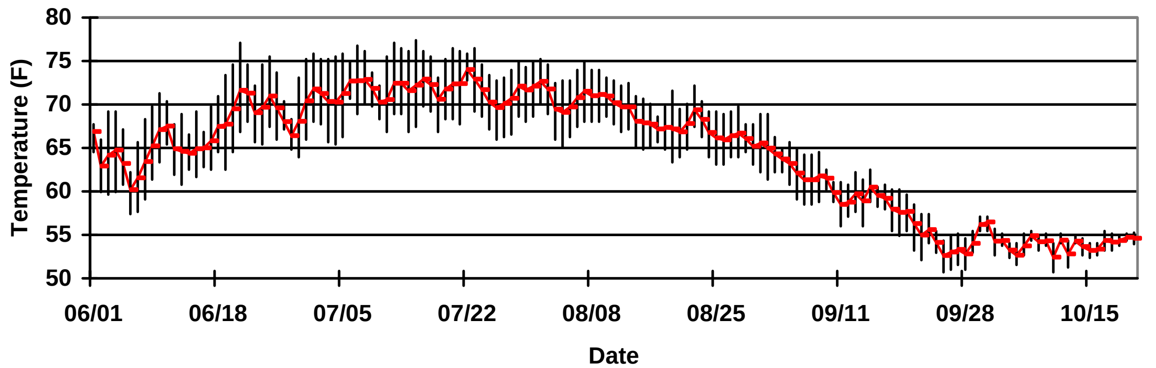
Dry Ck--Highway 12 brg in Dixie (DRC-1)



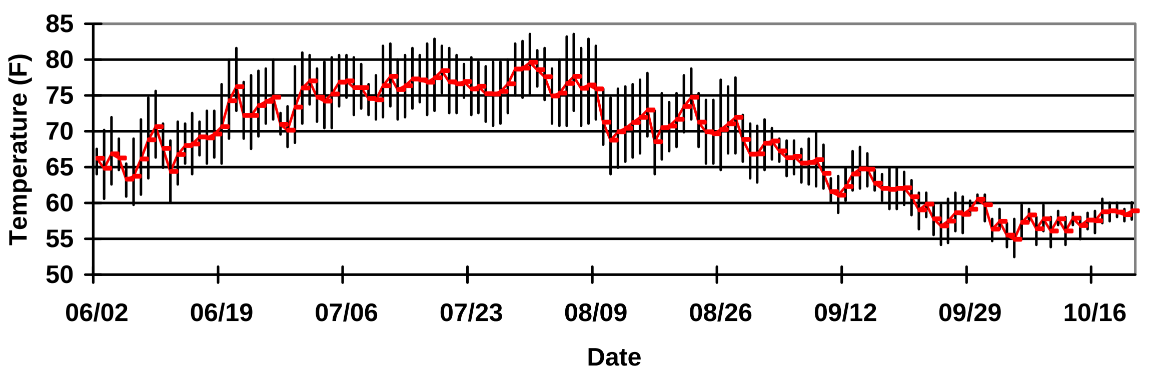
Dry Ck--above Lower Waitsburg Rd. (DRC-2)

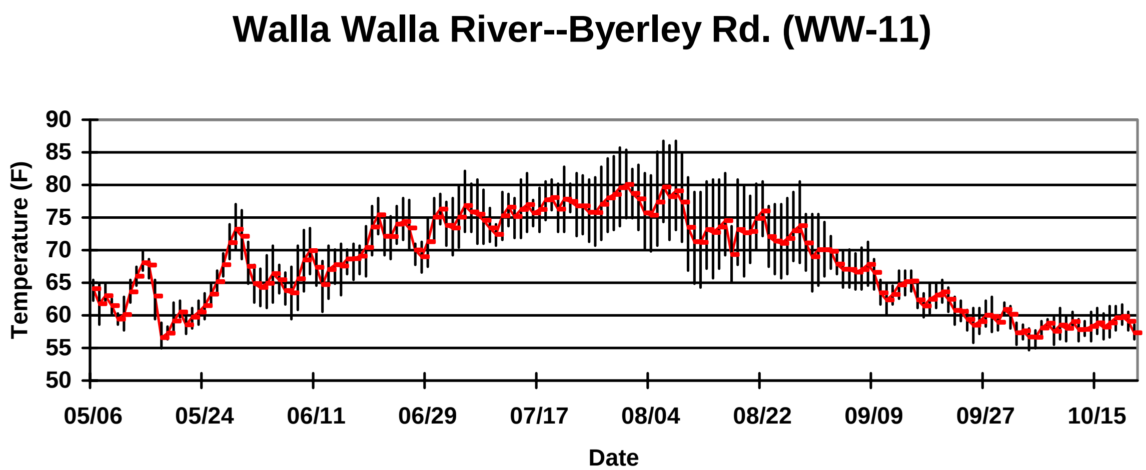


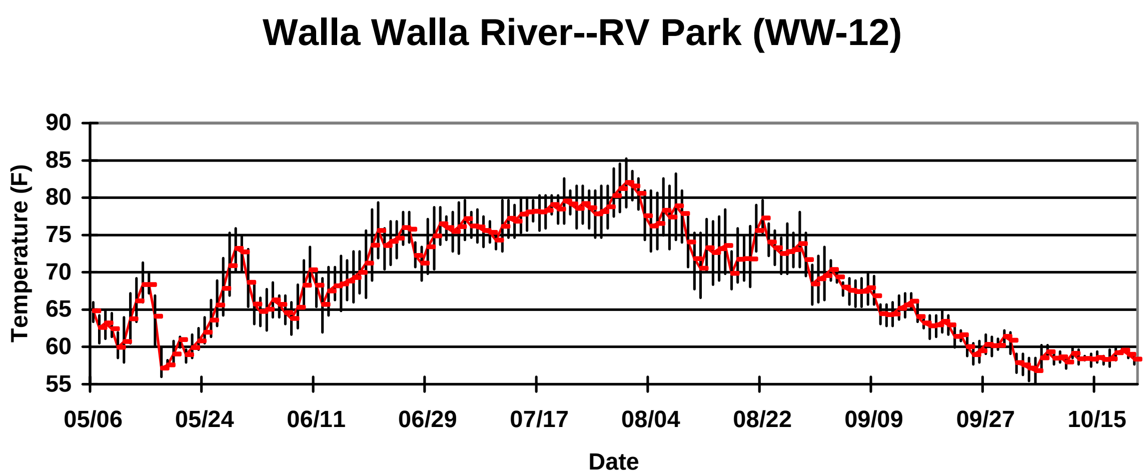
Dry Ck--Talbott Rd. (DRC-3)



Walla Walla River--Touchet Gardena Rd. (WW-10)







List of lost or stolen loggers, and loggers with only partially collected data or data that has inconsistencies, 2005.

NF Touchet—above Jim Ck (NFT-9)

- Logger was deployed on 06/07
- Downloaded on 07/20 and 08/31
- Logger was pulled and downloaded on 10/17, but appears to have failed after the download on 08/31
- No data after 08/31

Wolf Fk—below Green Fly (WF-6)

- Logger was deployed on 06/03
- Logger was pulled early because it was dead and would not download
- No data collected

Wolf Fk—3rd brg on Wolf Fk Rd. (WF-8)

- Logger was deployed on 06/03
- Went to download logger on 07/20, but logger was dead and would not download so was pulled for the season
- No data collected

Green Fk—just above mouth (GF-1)

- Logger was deployed on 06/08
- Logger was downloaded on 08/11
- Removed logger for season on 10/11, but logger was dead and would not download
- No data after 08/11

Touchet River—below Harvey Shaw Rd. (TR-6)

- Logger was deployed on 06/01
- Downloaded logger on 07/21
- Went to download logger on 08/31, but logger could not be found because of a bridge replacement project that had disturbed the area where the logger had been
- No data after 07/21

Mill Ck—in cold return (MC-6)

- Logger was deployed on 06/01
- Went to download on 07/25, but logger was missing
- No data collected

Titus Ck—covered brg (TC-2)

- Logger was deployed on 06/02
- Went to download on 07/25, but rope was chewed through and logger was not found
- No data collected

Dry Ck—Highway 12 brg in Dixie (DRC-1)

- Logger was deployed on 06/02
- Logger was downloaded on 07/21
- Went to download logger on 09/06, but logger was dead and would not download so was pulled for the season
- No data after 07/21

Appendix D. Relative Abundance of Non-Salmonids, 2005

Appendix D. Relative abundance[a] of non-salmonids in the Walla Walla Subbasin, 2005.

	Touchet River and Tributaries						Walla Walla River and Tributaries			
	NF Touchet	Corral Creek	Lewis Creek	Wolf Fork	Burnt Fork	Coppei Creek	East Little Walla Walla	Big Spring Branch	Mill Creek	West Little Walla Walla
Petromyzontidae lamprey larvae	0	0	0	0	0	0	0	1	3	0
Cyprinidae speckled dace *Rhinichthys osculus*	0	0	0	0	0	4	3	3	0	4
longnose dace *Rhinichthys alutaceus*	0	0	0	0	0	0	0	0	3	0
redside shiner *Richardsonius balteatus*	0	0	0	0	0	2	2	2	0	0
northern pikeminnow *Ptychocheilus oregonesis*	0	0	0	0	0	3	0	3	0	0
Catostomidae Suckers[b] *Catostomus sp.*	0	0	0	0	0	3	1	0	0	0
Cottidae Sculpin[b] *Cottus sp.*	0	0	2	1	2	3	3	3	4	2
Crayfish[b] *Pacifastacus sp.*	0	0	1	0	0	0	0	0	P	0
tailed frogs *Ascaphus truei*	1	1	2	2	3	0	0	0	0	0

[a] Categories of relative abundance are: 1=1 to 3 fish, 2=4 to 10, 3=11 to 100, 4=100+, P=present
[b] Noted by genus only, not identified by species

Appendix E. Manual Flow Summary for the Walla Walla River, 1998-2005

Appendix E. Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegel Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
state line																
June									18	117.8	10	18.7	1	N/M[a]		
									24	35.1	24	11.8	23	35.6		
Avg. Monthly CFS										76.45		15.25		N/A[b]		
(SD)										(41.350)		(3.450)				
July							17	14.59	8	20.2	7	12.0	1	15.1		
							24	8.5	22	18.8	21	9.0	7	14.4		
							31	9.68					19	19.9		
Avg. Monthly CFS								10.92		19.50		10.50		16.47		
(SD)								(2.637)		(0.700)		(1.500)		(2.444)		
August							7	13.91	5	15.8	6	16.7	2	13.7		
							20	13.88	20	12.5	19	14.6	17	11.0		
													30	9.4		
Avg. Monthly CFS								13.90		14.15		15.65		11.37		
(SD)								(0.015)		(1.650)		(1.050)		(1.775)		
September							4	12.79	4	13.2	2	16.2	13	15.7		
							17	12.93	17	26.6	15	12.4	27	13.1		
											29	23.9				
Avg. Monthly CFS								12.86		19.90		17.50		14.40		
(SD)								(0.070)		(6.700)		(4.784)		(1.300)		
October							2	23.35	1	18.6	13	19.0	11	13.3		
							8	18.91	15	15.7	29	27.3	28	14.6		
							16	36.88	31	16.9						
							23	55.16								
							31	73.02								
Avg. Monthly CFS								41.46		17.07		23.15		13.95		
(SD)								(20.205)		(1.190)		(4.150)		(0.650)		

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
Pepper Rd.																
June			14	78.5	20	79.3	12	27.13	24	36.7			23	41.0		
			30	9.9	29	5.5	21	11.98								
							26	17.60								
Avg. Monthly CFS				44.2		42.4		18.9		N/A[b]				N/A[b]		
(SD)				(34.300)		(36.900)		(6.253)								
July	27	3.16	13	5.1	11	3.6	5	13.65	8	21.0						
			28	2.3	20	4.0	11	14.45	22	16.5						
							17	14.16								
							24	9.19								
							31	9.66								
Avg. Monthly CFS		N/A[b]		3.7		3.8		12.22		18.75						
(SD)				(1.400)		(0.200)		(2.303)		(2.250)						
August	03	3.42	10	3.1	7	4.1	7	12.51	5	17.7						
	17	3.09					20	14.79	20	12.4						
Avg. Monthly CFS		3.26		N/A[b]		N/A[b]		13.65		15.05						
(SD)		(0.165)						(1.140)		(2.650)						
September	01	2.79	15	2.7			4	11.13	4	16.1						
	16	3.32	28	2.7			17	12.87	17	27.5						
Avg. Monthly CFS		3.06		2.7				12.00		21.80						
(SD)		(0.265)		(0.000)				(0.870)		(5.700)						
October	16	2.86	5	2.6	4	81.0	2	26.00	1	17.4						
	28	3.22	13	2.7	19	23.7	16	39.08	15	13.6						
							23	65.61	31	17.5						
							31	81.84								
Avg. Monthly CFS		3.04		2.65		52.35		53.13		16.17						
(SD)		(0.180)		(0.050)		(28.650)		(21.872)		(1.815)						

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
0.4 mi above Hwy 125																
June							12	29.58	24	35.4						
							26	16.28								
Avg. Monthly CFS								22.93		N/A[b]						
(SD)								(6.650)								
July							5	13.74	8	21.2						
							11	14.62	22	15.1						
							17	13.35								
							24	7.86								
							31	9.82								
Avg. Monthly CFS								11.88		18.15						
(SD)								(2.590)		(3.050)						
August							7	13.34	5	16.3						
							20	12.92	20	12.5						
Avg. Monthly CFS								13.13		14.40						
(SD)								(0.210)		(1.900)						
September							4	11.29	4	14.2						
							17	13.15	17	27.0						
Avg. Monthly CFS								12.22		20.60						
(SD)								(0.930)		(6.400)						
October							2	22.06	1	19.5						
							8	19.42	15	16.0						
							16	37.47	31	16.3						
							23	60.90								
							31	70.22								
Avg. Monthly CFS								42.01		17.27						
(SD)								(20.404)		(1.584)						

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
0.5 mi above Buringame Div.																
June					26	83.0	12	78.6	24	81.0	10	55.5	1	N/M[a]	22	57.9
							28	68.2			24	41.0	23	92.6		
Avg. Monthly CFS						N/A[b]		73.40		N/A[b]		48.25		N/A[b]		N/A[b]
(SD)								(5.200)				(7.250)				
July					11	45.1	10	41.9	8	61.6	7	55.4	1	60.6	5	49.1
							24	36.0	22	41.0	21	43.0	7	65.8	20	37.1
							31	43.9					19	49.6		
Avg. Monthly CFS						N/A[b]		40.60		51.30		49.20		58.67		43.10
(SD)								(3.354)		(10.300)		(6.200)		(6.753)		(6.000)
August					7	27.6	6	48.6	5	36.3	6	53.7	2	40.6	9	32.4
					8	33.1	20	54.6	20	36.6	19	44.1	17	36.9	22	31.7
													30	48.5		
Avg. Monthly CFS						30.35		51.60		36.45		48.90		42.00		32.05
(SD)						(2.750)		(3.000)		(0.150)		(4.800)		(4.838)		(0.350)
September					5	48.7	4	46.8	4	39.5	2	44.3	13	52.1	6	38.8
					18	48.1	17	41.6	17	52.2	15	52.3	27	50.0	19	43.3
											29	50.0				
Avg. Monthly CFS						48.40		44.20		45.85		48.87		51.05		41.05
(SD)						(0.300)		(2.600)		(6.350)		(3.363)		(1.050)		(2.250)
October					19	81.9	2	62.4	1	50.8	13	64.6	11	59.6	3	54.2
							16	90.2	15	49.1	29	66.6	28	64.3	17	44.4
							31	136.6	31	40.2						
Avg. Monthly CFS						N/A[b]		96.40		46.70		65.60		61.95		49.3
(SD)								(30.608)		(4.648)		(1.000)		(2.350)		(4.900)

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
Mojonnier Rd.																
June			1	296.0	20	104.6	12	32.69	24	30.1	4	23.9	1	N/M[a]	13	20.3
			9	83.7	29	10.5	26	31.22			10	36.4	23	49.7		
			30	5.9							24	31.7				
Avg. Monthly CFS				128.53		57.55		31.96		N/A[b]		30.67		N/A[b]		N/A[b]
(SD)				(122.602		(47.050)		(0.735)				(5.155)				
July	9	29.48	13	15.5	11	16.4	5	24.26	8	41.7	7	45.3	1	64.0		
	20	36.05	28	25.7	20	42.2	10	43.28	22	43.9	21	37.3	7	71.4		
							11	49.88					19	50.9		
							17	45.24								
							24	33.42								
							31	42.65								
Avg. Monthly CFS		32.77		20.60		29.30		39.79		42.80		41.30		62.10		
(SD)		(3.285)		(5.100)		(12.900)		(8.501)		(1.100)		(4.000)		(8.476)		
August	3	25.77	10	22.6	7	29.9	7	46.42	5	42.5	6	57.1	2	42.6		
	17	25.14	23	25.0	21	32.2	20	51.26	20	38.1	19	38.7	17	37.2		
													30	51.8		
Avg. Monthly CFS		25.46		23.80		31.05		48.84		40.30		47.90		43.87		
(SD)		(0.315)		(1.200)		(1.150)		(2.420)		(2.200)		(9.200)		(6.027)		
September	1	28.30	15	21.7	5	49.0	4	45.48	4	40.7	2	42.5	13	53.4		
	16	35.01	28	26.1	18	47.7	17	37.08	17	61.8	15	45.8	27	51.4		
											29	46.9				
Avg. Monthly CFS		31.66		23.90		48.35		41.28		51.30		45.07		52.4		
(SD)		(3.355)		(2.200)		(0.650)		(4.200)		(10.550)		(1.870)		(1.000)		
October	16	1.83	5	31.4	4	93.4	2	40.86	1	57.9	13	38.9	11	26.9		
	28	13.72	13	15.1	19	16.5	8	25.97	15	22.7	29	34.5	28	13.4		
			18	8.4			16	18.58	31	17.9						
							23	55.64								
							31	68.74								
Avg. Monthly CFS		7.78		18.30		54.95		41.96		32.83		36.70		20.15		
(SD)		(5.945)		(9.659)		(38.450)		(18.481)		(17.833)		(2.200)		(6.750)		

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
Swegle Rd.																
June			1	287.6	26	42.9	11	27.95	24	34.3	10	48.4	1	N/M[a]		
			9	85.6			27	26.64			24	36.2	23	56.1		
			30	7.0												
Avg. Monthly CFS				126.73		N/A[b]		27.30		N/A[b]		42.30		N/A[b]		
(SD)				(118.189				(0.655)				(6.100)				
July	2	3.43	13	17.5	11	22.2	10	43.74	8	41.1	7	41.0	1	63.9	20	37.1
	9	31.65	28	23.7			24	33.21	22	46.4	21	42.3	7	75.0		
	20	35.52					31	45.93					19	77.7		
Avg. Monthly CFS		23.53		20.60		N/A[b]		40.96		43.75		41.65		72.20		N/A[b]
(SD)		(14.303		(3.100)				(5.553)		(2.650)		(0.650)		(5.972)		
August	3	27.22	10	23.6	7	29.1	6	40.58	5	45.4	6	54.3	2	45.8	22	30.5
	17	21.66	23	24.9	21	36.7	20	42.52	20	32.4	19	40.4	17	60.7		
													30	47.1		
Avg. Monthly CFS		24.44		24.25		32.90		41.55		38.90		47.35		51.20		N/A[b]
(SD)		(2.780)		(0.650)		(3.800)		(0.970)		(6.500)		(6.950)		(6.738)		
September	1	25.55	15	26.6	5	54.8	4	42.95	4	35.1	2	38.7	13	58.7		
	16	37.28	28	31.3	18	56.3	17	45.80	17	50.6	15	54.8	27	56.3		
											29	56.2				
Avg. Monthly CFS		31.42		28.95		55.55		44.38		42.85		49.90		57.50		
(SD)		(5.865)		(2.350)		(0.750)		(1.425)		(7.750)		(7.940)		(1.200)		
October	16	8.32	13	20.4	4	97.1	1	49.81	1	54.8	13	40.8	11	28.3		
	26	20.43			19	23.7	16	28.41	15	26.5	29	33.0	28	22.7		
							31	47.96	31	21.7						
Avg. Monthly CFS		14.38		N/A[b]		60.40		42.06		34.33		36.90		25.50		
(SD)		(6.055)				(36.700)		(9.682)		(14.604)		(3.900)		(2.800)		

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
Detour Rd.																
June			1	403.4	20	171.7	11	34.10	18	148.4	4	43.6	1	N/M[a]	13	28.8
			9	121.9	29	22.7	27	46.95	24	50.8	10	47.7	23	91.4	22	27.8
			30	15.9							24	47.5				
Avg. Monthly CFS				180.40		97.20		40.53		99.60		46.27		N/A[b]		28.3
(SD)				(163.515		(74.500)		(6.425)		(48.800)		(1.887)				(0.500)
July			13	19.2	10	25.6	10	57.32	8	45.9	7	54.4	1	74.0	5	37.6
			28	26.8	20	38.5	24	38.75	22	41.8	21	38.2	7	87.7	20	41.2
							31	52.82					19	64.7		
Avg. Monthly CFS				23.00		32.05		49.63		43.85		46.30		75.47		39.4
(SD)				(3.800)		(6.450)		(7.910)		(2.050)		(8.100)		(9.447)		(1.800)
August			10	30.6	7	29.3	6	43.55	5	45.9	6	53.6	2	61.0	9	28.7
			24	32.6	21	38.1	20	41.11	20	32.4	19	41.7	17	37.0	22	32.2
													30	55.4		
Avg. Monthly CFS				31.6		33.70		42.33		39.15		47.65		51.13		30.45
(SD)				(1.000)		(4.400)		(1.220)		(6.750)		(5.950)		(10.252		(1.750)
September			15	29.0	5	55.0	4	44.29	4	35.9	2	46.3	13	60.0	6	39.2
			28	35.4	18	59.9	17	44.25	17	50.6	15	63.6	27	59.8	19	48.9
											29	59.4				
Avg. Monthly CFS				32.20		57.45		44.27		43.25		56.43		59.9		44.05
(SD)				(3.200)		(2.450)		(0.020)		(7.350)		(7.368)		(0.100)		(4.850)
October			13	31.8	4	128.2	1	54.34	1	56.3	13	45.7	11	38.8	3	50.4
					19	41.7	8	35.71	15	30.5	29	41.7	28	37.3	17	30.9
							16	35.43	31	37.7						
							23	69.66								
							31	69.10								
Avg. Monthly CFS				N/A[b]		84.95		52.85		41.50		43.70		38.05		40.65
(SD)						(43.250)		(15.140)		(10.870)		(2.000)		(0.750)		(9.750)

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
McDonald Rd.																
June					26	36.6	11	18.62	24	20.4	10	21.1	1	N/M[a]		
							27	27.61			24	23.3	23	58.5		
Avg. Monthly CFS						N/A[b]		23.12		N/A[b]		22.20		N/A[b]		
(SD)								(4.495)				(1.100)				
July	9	4.09	13	6.73	10	5.9	10	17.50	8	19.5	7	9.8	1	38.7		
	20	4.92					23	21.83	22	17.3	21	12.0	7	39.1		
													19	31.2		
Avg. Monthly CFS		4.51		N/A[b]		N/A[b]		19.67		18.40		10.90		36.33		
(SD)		(0.415)						(2.165)		(1.100)		(1.100)		(3.633)		
August	3	0.00	10	9.1	7	11.0	6	23.71	5	18.9	6	24.7	2	23.8		
	17	7.96	23	11.4	21	17.8	20	16.23	20	9.9	19	12.5	17	19.7		
													30	41.6		
Avg. Monthly CFS		3.98		10.25		14.40		19.97		14.40		18.60		28.37		
(SD)		(3.98)		(1.150)		(3.400)		(3.740)		(4.500)		(6.100)		(9.506)		
September	1	9.97	15	12.1	5	34.3	4	17.73	4	16.2	2	16.7	13	45.8		
	17	17.31	28	14.5	18	41.0	17	21.26	17	30.9	15	32.6	27	43.6		
											29	44.4				
Avg. Monthly CFS		13.64		13.30		37.65		19.50		23.55		31.23		44.70		
(SD)		(3.670)		(1.200)		(3.350)		(1.765)		(7.350)		(11.350)		(1.100)		
October			13	15.8	4	112.2	1	38.2	1	33.3	13	34.5	11	21.7		
					19	27.3	16	26.68	15	20.3	29	26.9	28	20.8		
							31	54.9	31	18.5						
Avg. Monthly CFS				N/A[b]		69.75		39.93		24.03		30.70		21.25		
(SD)						(42.450)		(11.585)		(6.594)		(3.800)		(0.450)		

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix E. (Cont.) Manual flow summary (average monthly cfs and standard deviation) from June through September, 1998-2005, on the Walla Walla River at state line, Pepper Rd., 0.4 mi above Hwy 125, 0.5 mi above Burlingame Diversion, Mojonnier Rd., Swegle Rd., Detour Rd., McDonald Rd., and McKay Rd.

	1998		1999		2000		2001		2002		2003		2004		2005	
	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs	Day	cfs
McKay Rd.[c]																
July	27	3.80														
Avg. Monthly CFS (SD)		N/A[b]														
August	17	0.00														
Avg. Monthly CFS (SD)		N/A[b]														
September	1	2.42														
	28	15.21														
Avg. Monthly CFS (SD)		8.82 (6.395)														
October	16	0.76														
	28	7.63														
Avg. Monthly CFS (SD)		4.20 (3.435)														

[a] Flow was unmeasurable (water was high, not enough water, etc.).
[b] N/A- only one measurement was taken during the month so no average or standard deviation was calculated.
[c] No data was collected in June at these sites.

Appendix F. Mean Monthly Stream Flow (cfs) and Standard Deviation from Continuous Flow Monitors in the Walla Walla Subbasin, 1998-2005

Appendix F. Mean Monthly stream flow (cfs) and standard deviation (SD) from continuous flow monitors in the Walla Walla Subbasin, 1998-2005.

	1998		1999		2000		2001		2002		2003		2004		2005	
	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD
Walla Walla River																
state line																
June (20th-30th)							N/A	N/A	29.15	19.302						
July							11.95[a]	2.152[a]	12.71	1.369						
August							11.40	1.354	13.39	1.478						
September							14.48	5.415	16.80	2.028						
October							31.37	16.736	17.68	1.868						
Nov. (1st-14th)							11.37	6.413	21.86[b]	3.817[b]						
Pepper Rd.																
June (20th-30th)					35.42	28.261	15.22[d]	3.853[d]	See DOE Data		See DOE Data		See DOE Data		See DOE Data	
July					5.75[c]	1.227[c]	10.71[d]	3.404[d]								
August					N/A	N/A	12.05[d]	2.946[d]								
September					N/A	N/A	15.55[d]	6.198[d]								
October					N/A	N/A	30.85[d]	10.331[d]								
Nov. (1st-14th)					N/A	N/A	27.13[d]	7.235[d]								
Mojonnier Rd.																
June (20th-30th)	N/A	N/A	14.55	6.979	46.33	33.203	26.45	7.094	28.58[f,g]	7.408[f,g]	33.90	5.150	See DOE Data		See DOE Data	
July	N/A	N/A	16.52	5.156	20.63	4.270	36.91	9.335	32.52[g]	5.582[g]	33.37	2.559				
August	N/A	N/A	18.97	4.608	26.40	1.925	40.88	5.206	34.62[g]	3.725[g]	37.35	2.415				
September	N/A	N/A	24.14	3.131	51.73	9.259	43.50	8.350	45.91[g]	5.324[g]	48.95	7.722				
October	N/A	N/A	20.06	13.970	24.71[e]	14.075[e]	29.37	13.222	29.59[g]	11.364[g]	35.94	6.162				
Nov. (1st-14th)	N/A	N/A	11.23	5.038	58.44	42.236	18.93	4.513	28.43[g]	9.012[g]	31.64	7.039				
Swegle Rd.																
June (20th-30th)	N/A	N/A	19.92	8.530												
July	25.73[h]	3.968[h]	20.90	5.121												
August	21.24	3.318	22.40	5.036												
September	37.54	10.234	24.48	2.684												
October	13.49	7.902	21.99	12.220												
Nov. (1st-14th)	18.79	11.444	14.34	5.090												

[a] Monitor in the Walla Walla River (state line) in 2001 was put in place on July 17th.
[b] Monitor in the Walla Walla River (state line) in 2002 was removed on November 13th.
[c] Monitor in the Walla Walla River (Pepper Rd.) in 2000 quit working on July 27th, so no data was available after that point.
[d] Monitor in the Walla Walla River (Pepper Rd.) in 2001 was actually 0.6 miles below Pepper Rd. bridge.
[e] At least one measurement for the month was removed as an outlier.
[f] Monitor in the Walla Walla River (Mojonnier Rd.) in 2002 was put in place on June 26th.
[g] Data collected by the Department of Ecology as part of TMDL monitoring.
[h] Monitor in the Walla Walla River (Swegle Rd.) in 1998 was put in place on July 9th.

Appendix F (cont.). Mean Monthly stream flow (cfs) and standard deviation (SD) from continuous flow monitors in the Walla Walla Subbasin, 1998-2005.																
	1998		1999		2000		2001		2002		2003		2004		2005	
	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD
Walla Walla River																
Detour Rd.																
June (20th-30th)			35.49	13.353	69.05	41.052	45.70	10.362	51.57	22.947	50.80	1.437	N/A	N/A	26.82	2.865
July			24.73	3.447	30.77	3.028	41.72	4.159	31.00	6.433	51.17[i]	1.045[i]	N/A	N/A	31.99	3.450
August			26.18	5.855	31.12	1.575	38.12	3.601	26.09	6.729	N/A[i]	N/A[i]	N/A	N/A	31.82	2.338
September			29.15	2.762	53.57[e]	9.922[e]	43.16	8.530	44.37	8.041	52.29[i]	2.814[i]	N/A	N/A	43.64	3.604
October			32.29	11.496	52.48[e]	21.484[e]	43.33	12.052	27.35	13.092	36.79	7.162	N/A	N/A	36.98	7.765
Nov. (1st-14th)			26.93	6.417	96.89	57.287	46.82	9.649	55.62	8.792	43.21	9.788	N/A	N/A	52.88[j]	9.299[j]
Touchet River																
Simms Rd.																
June (20th-30th)			86.63	11.482	101.25	18.396	80.65	10.636								
July			50.20	7.812	45.86	16.762	28.22	11.905								
August			41.15	3.861	19.27	3.906	9.54	6.246								
September			39.75	2.358	43.92	9.700	14.56	12.565								
October			48.73	8.624	69.08	20.896	53.05	11.915								
Nov. (1st-14th)			55.58	2.544	75.36	9.877	67.17	12.911								
Cummins Bridge																
June (20th-30th)	N/A[k]	N/A[k]	108.68[m]	22.531[m]	89.42	23.612	67.09	41.993								
July	9.21[k,l]	5.504[k,l]	30.27[m]	14.450[m]	23.61	15.674	10.51	7.525								
August	7.48[k]	6.107[k]	12.97[m]	5.017[m]	3.85	1.219	5.24	4.287	See DOE Data		See DOE Data		See DOE Data		See DOE Data	
September	12.15[k]	9.280[k]	13.75[m]	2.165[m]	24.12	9.815	3.62[n]	3.746[n]								
October	35.71[k]	5.827[k]	30.06[m]	16.732[m]	99.26	145.013	N/A	N/A								
Nov. (1st-14th)	75.44[k]	11.912[k]	47.70[m]	3.988[m]	104.51	36.490	N/A	N/A								
Above Hofer Dam																
June (20th-30th)							N/A	N/A	104.50	27.347						
July							N/A	N/A	51.75[o]	16.333[o]						
August							N/A	N/A	26.35[o]	2.376[o]						
September							N/A	N/A	27.93	2.611						
October							N/A	N/A	39.66	3.257						
Nov. (1st-14th)							N/A	N/A	61.30[o]	10.344[o]						

[e] At least one measurement for the month was removed as an outlier.
[i] Monitor in the Walla Walla River (Detour Rd.) malfunctioned from July 12th through September 25th, so no data was collected during this period.
[j] Monitor in the Walla Walla River (Detour Rd.) was removed on November 9th.
[k] Monitor in the Touchet River (Cummins Bridge) was at the Touchet River Gun Club ~1.7 miles above Cummins Bridge.
[l] Monitor in the Touchet River (Cummins Bridge) in 1998 was put in place on July 9th.
[m] Monitor in the Touchet River (Cummins Bridge) was 0.9 miles above Cummins Bridge.
[n] Monitor in the Touchet River (Cummins Bridge) in 2001 quit working on September 25th, so no data was available after that point.
[o] Monitor above Hofer Dam in 2002 quit working from July 21st to August 23rd, and then was pulled on November 13th.

Appendix F (cont.). Mean Monthly stream flow (cfs) and standard deviation (SD) from continuous flow monitors in the Walla Walla Subbasin, 1998-2005.																
	1998		1999		2000		2001		2002		2003		2004		2005	
	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD
Yellowhawk Creek																
Below Diversion																
June (20th-30th)							N/A	N/A	30.14	3.100	36.23	7.735			22.33	1.841
July							21.11[p]	1.540[p]	16.47	3.620	23.06	3.016			17.53	3.050
August							19.95	7.037	12.95	1.700	21.76[q]	1.745[q]			12.10	1.468
September							16.53	2.628	16.07	2.647	N/A	N/A			13.36	2.614
October							27.91	5.995	19.09	2.086	N/A	N/A			19.98[r]	2.397[r]
Nov. (1st-14th)							36.72	2.210	26.45	3.639	N/A	N/A			N/A	N/A
Just above mouth																
June (20th-30th)					44.20	3.274	26.53	0.893	31.47[g]	3.423[g]	28.83	3.152	27.53[s]	2.043[s]		
July					28.05	5.754	23.87	1.905	14.02[g]	6.324[g]	22.01	3.076	20.49	3.035		
August					17.66	1.962	18.58	4.687	12.93[g]	3.722[g]	19.84	2.421	19.06	5.107		
September					28.56[e]	4.589[e]	13.75	1.606	14.95[g]	2.889[g]	24.65	4.850	22.73	3.055		
October					50.51	9.115	19.97	3.484	9.88[g]	4.397[g]	32.12	5.046	27.37	3.108		
Nov. (1st-14th)					56.07	9.347	21.80	3.213	22.14[g]	6.042[g]	38.47	4.070	31.75	2.703		
East Little Walla Walla																
0.3 miles above mouth																
June (20th-30th)									10.67	0.934	12.52	0.378	15.88	1.587	10.47	0.739
July									9.40	2.093	11.68	0.824	9.98[v]	0.275[v]	8.36	1.210
August									9.34	0.903	10.10	0.296	12.22	1.449	7.10	0.890
September									11.33[t]	1.495[t]	10.79[u]	0.197[u]	13.67	0.429	11.24	1.255
October									N/A	N/A	N/A	N/A	15.51	1.036	16.23	1.023
Nov. (1st-14th)									N/A	N/A	N/A	N/A	14.31	0.784	15.69[w]	0.561[w]

[e] At least one measurement for the month was removed as an outlier.
[g] Data collected be the Department of Ecology as part of TMDL monitoring.
[p] Monitor in Yellowhawk Creek (Below Diversion) in 2001 was put in place on July 17th.
[q] Monitor in Yellowhawk Creek (Below Diversion) in 2003 was removed on August 28th.
[r] Monitor in Yellowhawk Creek (Below Diversion) in 2005 was removed on October 24th.
[s] Monitor in Yellowhawk Creek (Just above mouth) in 2004 was put in place on June 24th.
[t] Monitor in East Little Walla Walla (0.3 miles above mouth) in 2002 quit working on September 10th, so no data is available after that point.
[u] Monitor in East Little Walla Walla (0.3 miles above mouth) in 2003 quit working on September 5th, so no data is available after that point.
[v] Monitor in East Little Walla Walla (0.3 miles above mouth) in 2004 had a rating curve shift, so data for July is from the 10th to the 31st.
[w] Monitor in East Little Walla Walla (0.3 miles above mouth) in 2005 was removed on November 9th.

Appendix F (cont.). Mean Monthly stream flow (cfs) and standard deviation (SD) from continuous flow monitors in the Walla Walla Subbasin, 1998-2005.																
	1998		1999		2000		2001		2002		2003		2004		2005	
	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD	cfs	SD
Mill Creek																
Wallula Rd.																
June (20th-30th)							N/A	N/A	12.61	6.871	5.05	0.192				
July							5.28[x]	0.387[x]	5.05	1.535	4.68	0.281				
August							3.09	1.017	3.99	0.328	6.65	0.343				
September							4.13	0.910	5.07	0.373	10.29	19.491				
October							9.13	3.107	11.17	10.342	8.70	1.264				
Nov. (1st-14th)							13.92	3.527	43.38[y]	27.774[y]	12.95	3.164				
Titus Creek																
~1.4 miles above Five Mile Rd.																
June (20th-30th)													8.43[z]	0.641[z]	7.35[aa]	0.301[aa]
July													7.22	0.447	6.78	0.609
August													7.89	0.934	7.56	0.220
September													7.77	0.650	9.07	0.437
October													8.02	0.751	10.56	0.487
Nov. (1st-14th)													9.49	0.744	12.65[aa]	0.246[aa]
Covered bridge above Five Mile Rd.																
June (20th-30th)													N/A	N/A	N/A	N/A
July													N/A	N/A	N/A	N/A
August													N/A	N/A	2.91[ab]	0.264[ab]
September													N/A	N/A	2.89	0.816
October													N/A	N/A	8.48	0.616
Nov. (1st-14th)													N/A	N/A	9.97[ab]	0.416[ab]

[x] Monitor in Mill Creek (Wallula Rd.) in 2001 was put in place on July 17th.
[y] Monitor in Mill Creek (Wallula Rd.) in 2002 was removed on November 13th.
[z] Monitor in Titus Creek (~1.4 miles above Five Mile Rd.) in 2004 was put in place on June 24th.
[aa] Monitor in Titus Creek (~1.4 miles above Five Mile Rd.) in 2005 was put in place on June 22nd and removed on November 9th.
[ab] Monitor in Titus Creek (Covered bridge above Five Mile Rd.) in 2005 had problems due to a beaver dam until August 22nd and was removed on November 9th.