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

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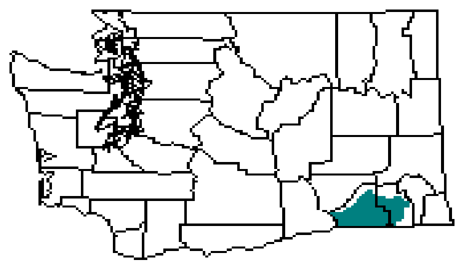
Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin of Washington:

2000 Annual Report



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This project could not have progressed without the approval of landowners in granting access to their lands. We sincerely appreciate their cooperation and consideration.

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Bill Neve and John Covert (DOE) provided valuable assistance both establishing and operating the constant recording stream flow monitors. Jon Germond (ODFW) and his staff collected DNA samples from steelhead and bull trout in the upper Walla Walla River. Thanks to W. S. "Wib" Wagoner for operating the adult steelhead trap on Yellowhawk Creek. Jim Shaklee was in charge of DNA analyses. We thank them all.

Joe Bumgarner, Bill Neve, and Craig Contour reviewed this draft and provided comments for revisions. We appreciate their assistance in preparation of this report.

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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 management plans and actions intended to protect and restore salmonid fishes and their habitats.

In 1998 bull trout were listed under the Endangered Species Act (ESA), as "Threatened", for the Walla Walla River and its tributaries. Steelhead were listed as "Threatened" in 1999 for the mid–Columbia River and its tributaries. These ESA listings emphasize the need for information about the 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) for a study to assess salmonid distribution, relative abundance, genetics, and the condition of their habitats in the Walla Walla River basin.

The primary purposes of this project are to collect baseline biological and habitat data, to identify major data gaps, and to draw conclusions whenever possible. The study reported herein details the findings of the 2000 field season (March to November, 2000).

Background

The Walla Walla River and its major tributaries, including the Touchet River, comprise a watershed of 1,758 square miles (ACOE 1997) and 2,454 major stream miles (Knutson et al. 1992). The majority of the watershed (73%) lies within Washington State, with the remainder in Oregon (Figure 1). The Walla Walla River originates from a fine network of deeply incised streams on the western slopes of the Blue Mountains. The Touchet River originates from similar streams on the northwestern slopes of the Blue Mountains, and also from seasonal streams draining Palouse hillsides to the north. The Walla Walla River drains into the Columbia River near Wallula Gap, about 21 miles above McNary Dam and 6 miles above the Oregon border. The Touchet River drains into the Walla Walla River just west of the town of Touchet, WA.

Historic and contemporary land–use practices have had a profound impact on the salmonid species abundance and distribution in the watershed. Fish habitat in area streams has been severely degraded by urban and agricultural development, grazing, tilling, logging, recreational activities, and flood control structures. Agricultural diversions have severely impacted stream flows in the Walla Walla River since the 1880s (Nielson 1950). Nearly all (99%) of the surface water diversions within Washington are for the purpose of irrigation (Pacific Groundwater Group

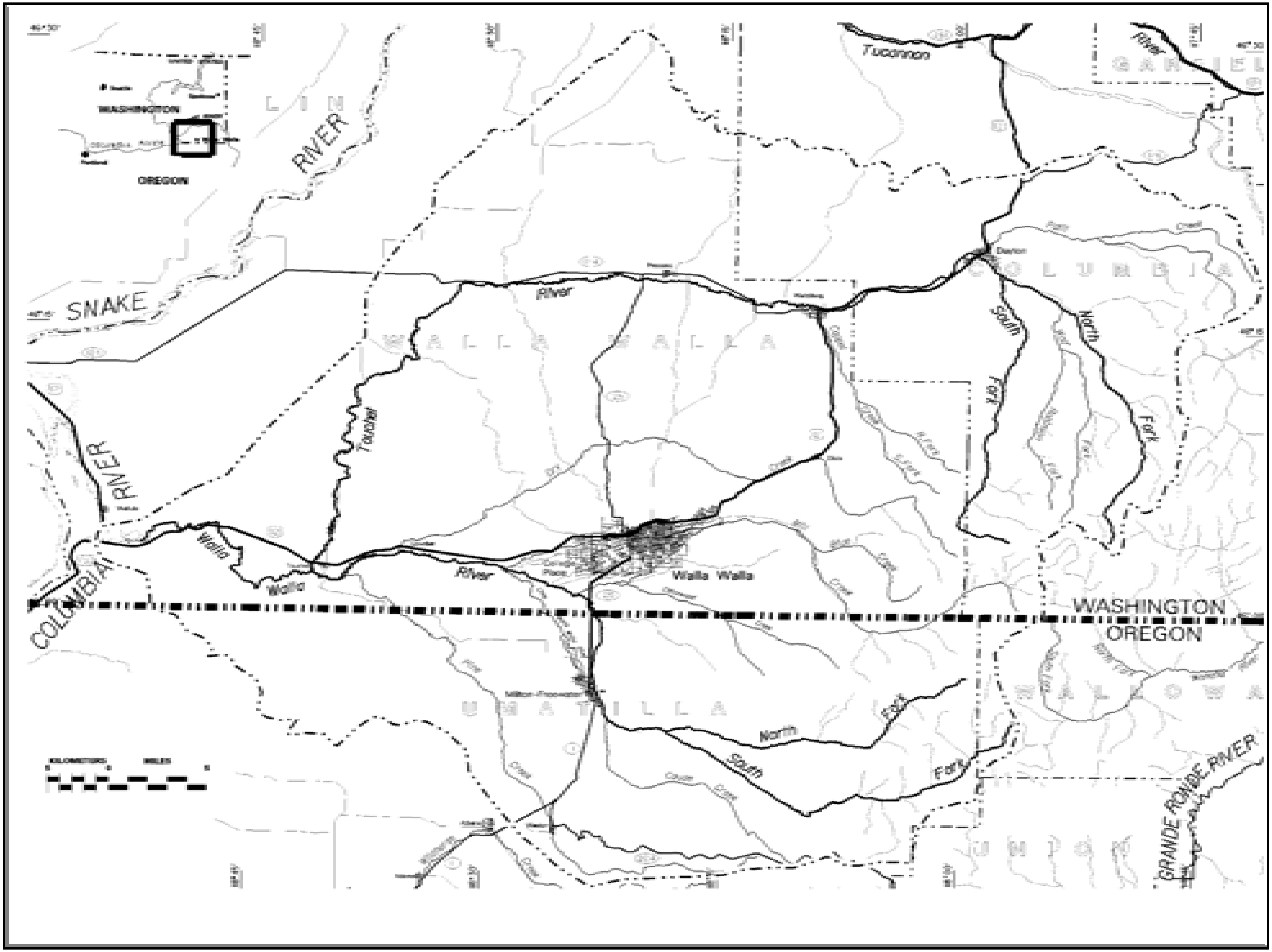


Figure 2. Walla Walla River watershed (modified from map courtesy of USACE, Walla Walla District).

1995). The reduced stream flows created by irrigation withdrawals adversely impact salmonid survival within the basin. Additionally, many unscreened or partly screened diversions and fish passage barriers exist within the basin.

Out-of-basin impacts to local fish populations have been substantial. Salmon migrating to or from the ocean must pass through four dams and reservoirs on the Columbia River before reaching their destination. Juvenile and adult salmonid mortalities occur as they pass through each reservoir or dam. Other impacts include over-harvest, habitat destruction in the lower Columbia River and estuaries, predation, and industrial pollution.

Historically the basin probably produced substantial runs of both spring chinook 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 basin (Nielson 1950, ACOE 1997). Anecdotal accounts and reports of historic fisheries in adjacent basins, indicate that chum and coho could have occurred in substantial numbers in the Walla Walla Basin (Pirtle 1957), but little written documentation exists. Endemic steelhead persist throughout much of the basin, but the population is considered depressed (WDF and WDW 1993). Annually, approximately 200,000 non-endemic hatchery steelhead (Lyons Ferry stock) are released 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.

Not all native salmonids in the basin are anadromous. Whitefish, bull trout and rainbow/redband trout exist within the basin. However, only rainbow/redband trout retain a wide distribution. In the past, bull trout are thought to have been widely distributed in the basin. Currently, bull trout distribution is generally limited to montane upper tributaries of the Touchet River, Walla Walla River, and Mill Creek (Mongillo 1993). However, bull trout are known to migrate into the middle or lower reaches of these rivers during the 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 or brown trout may have increased competition or predation for bull trout.

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

Study Purpose and Objectives

The purpose of this study is to determine fish passage, rearing, and spawning conditions for steelhead and for potential reintroduction of chinook salmon, and to assess steelhead and bull trout distribution, densities, habitat, and genetic composition in the Walla Walla watershed.

Specific objectives and tasks were outlined in WDFW's proposal and statement of work to the Bonneville Power Administration (BPA Project # 199802000). Some tasks had to be scaled back or postponed. Multi–year study objectives include:

1. Assess baseline habitat conditions for salmonids in the Washington portion of the Walla Walla watershed;
2. Determine salmonid distribution and relative abundance in the Washington portion of the Walla Walla watershed; and
3. Identify genetic stocks of steelhead and bull trout in the Walla Walla watershed.

Specific objectives and tasks were outlined in the statement of work. Tasks included:

- Establish constant recording temperature and flow data loggers in the Walla Walla River basin, to identify available water for salmon passage and rearing, as well as temperature limitations for salmonid passage, spawning and rearing;
- Conduct an Instream Flow Incremental Methodology (IFIM) study, in order to quantify available habitat as it relates to stream discharge (flow);
- Conduct biweekly manual stream flow and temperature measurements to calibrate instream monitor data outputs, and to provide data for reaches that did not have instream discharge monitors;
- Monitor water quality by sampling dissolved oxygen, pH, turbidity, and conductivity;
- Conduct electrofishing to determine salmonid distribution, abundance, and habitat use;
- Conduct snorkel surveys during the spring and summer to supplement electrofishing data and for seasonal density comparisons;
- Conduct periodic flights of the lower Walla Walla and Touchet Rivers to determine continuity of stream flows for adequate fish passage and rearing;
- Conduct general habitat surveys in portions of the stream with potential for salmonid use to quantify habitat conditions and identify limiting factors (This task has been deferred).
- Conduct steelhead and bull trout spawning surveys to determine spawning timing and distribution, and to establish an index of relative abundance.
- Collect tissue samples from bull trout and steelhead for genetic analyses.

Methods

Study Area

The study area encompasses the greater Walla Walla River basin in Washington State (Figure 1). The Walla Walla River, the Touchet River, and Mill Creek are the major rivers within the basin. The Walla Walla River in Washington, lower Mill Creek, and the Touchet River and thier tributaries, were the primary study reaches in 2000.

Stream Reaches

Representative stream reaches were identified based on general physical characteristics and readily identifiable landmarks (Appendix A). General physical characteristics included: slope, width, depth, and temperature; as well as, predominant adjacent land uses. 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 potential 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 (Appendix A), and sites are listed and identified in order from upstream to downstream.

River miles were determined by measuring 1:24000 USGS topographic maps with a map wheel. River miles were determined by measuring the distance between the confluence of each stream and the study site. 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, such as deep pools, rapids, multiple channels, and/or for safety concerns.

Snorkeling sites were designed to extend and compliment the area initially surveyed by electrofishing. Sites were located using the same randomization process used for establishing electrofishing sites.

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 Quattro Pro© spreadsheets. The second method involved the use of continuous flow data loggers (Unidata America, Model KB/DSP 128K). The monitors were placed at three sites on the Walla Walla River, and two sites on the lower Touchet River (Appendix A, Figure 2). WDFW contracted with the Washington Department of Ecology (WDOE) 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 which were flows taken just occasionally (Appendix A, Figure 2).

IFIM - We subcontracted with Hal Beecher (WDFW) and Brad Caldwell (WDOE) to conduct an IFIM study on the Walla Walla River and lower Mill Creek in 1999. Preliminary results are provided in Appendix G.

Stream Temperatures

We used three methods to collect water temperatures. Manual water temperature (EF) was measured 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 EF at 30 minute intervals. The monitors were placed at sites throughout the Walla Walla River basin (Appendix A, Figure 3). WDFW maintained the temperature monitors and downloaded the data using an Optic Stowaway Shuttle®. Temperature data were exported from Onset Boxcar 4.0 software into Quattro Pro spreadsheets. Daily minimum, maximum, and mean temperatures were prepared using a Quattro Pro spreadsheet macro.

The third method involved the use of continuous flow and temperature data loggers (Unidata America, Model KB/DSP 128K). The monitors collect both stream discharge (stage value) and temperature data every 15 seconds and stores the data every four hours as averages for discharge and minimum, maximum, and mean temperatures. The monitors were used to collect temperatures as a substitute for the stowaway temperature loggers at their respective sites (Appendix A, Figure 3). The accuracy of field thermometers and data loggers was evaluated using a laboratory calibrated thermometer (Kessler Instruments).

Stream temperatures were also collected by the Army Corp of Engineers using temperature loggers provided by the Walla Walla Conservation District (Appendix C1, Figure 3).

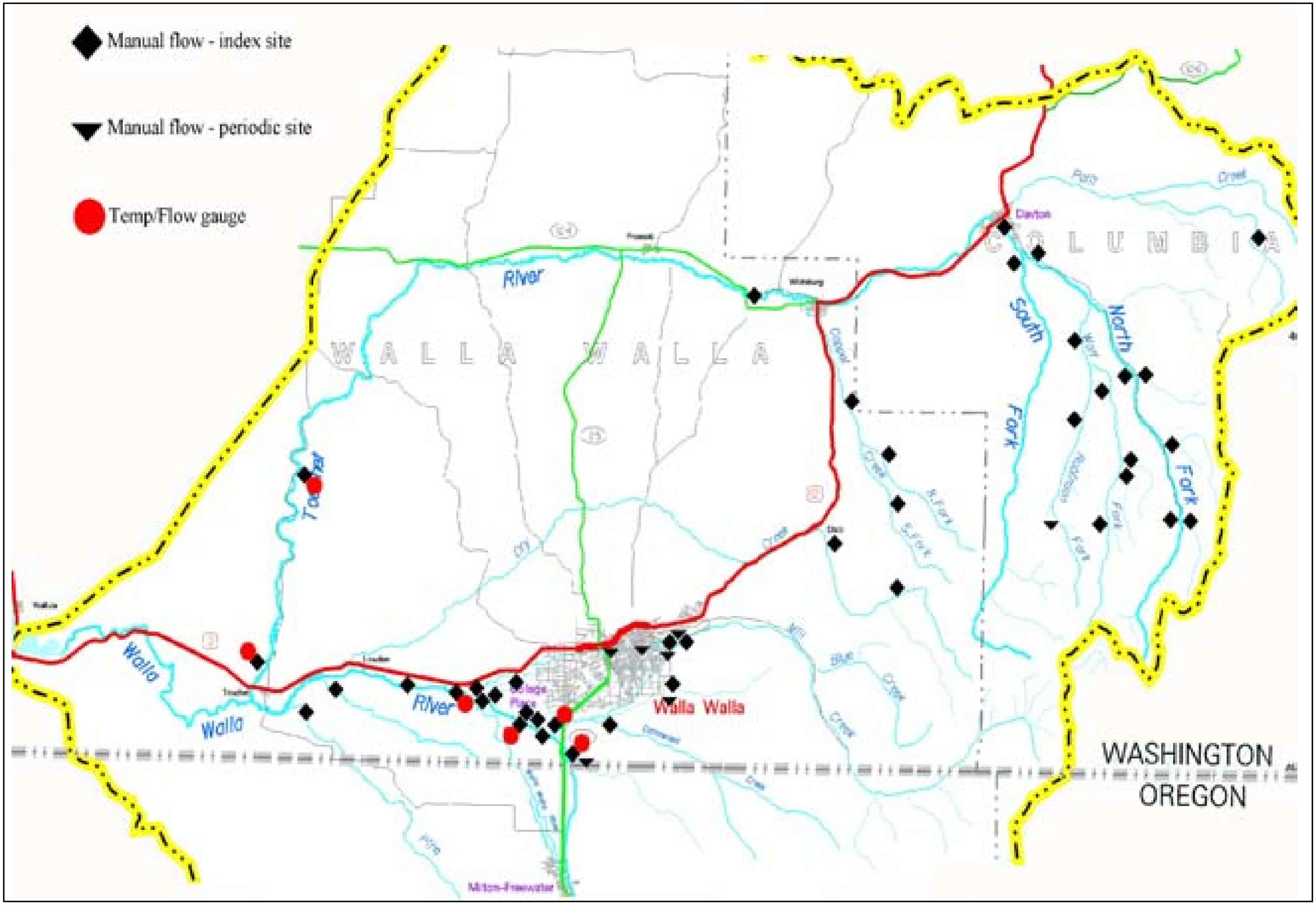


Figure 2. Relative locations of flow monitoring sites in the Walla Walla Basin, 2000.

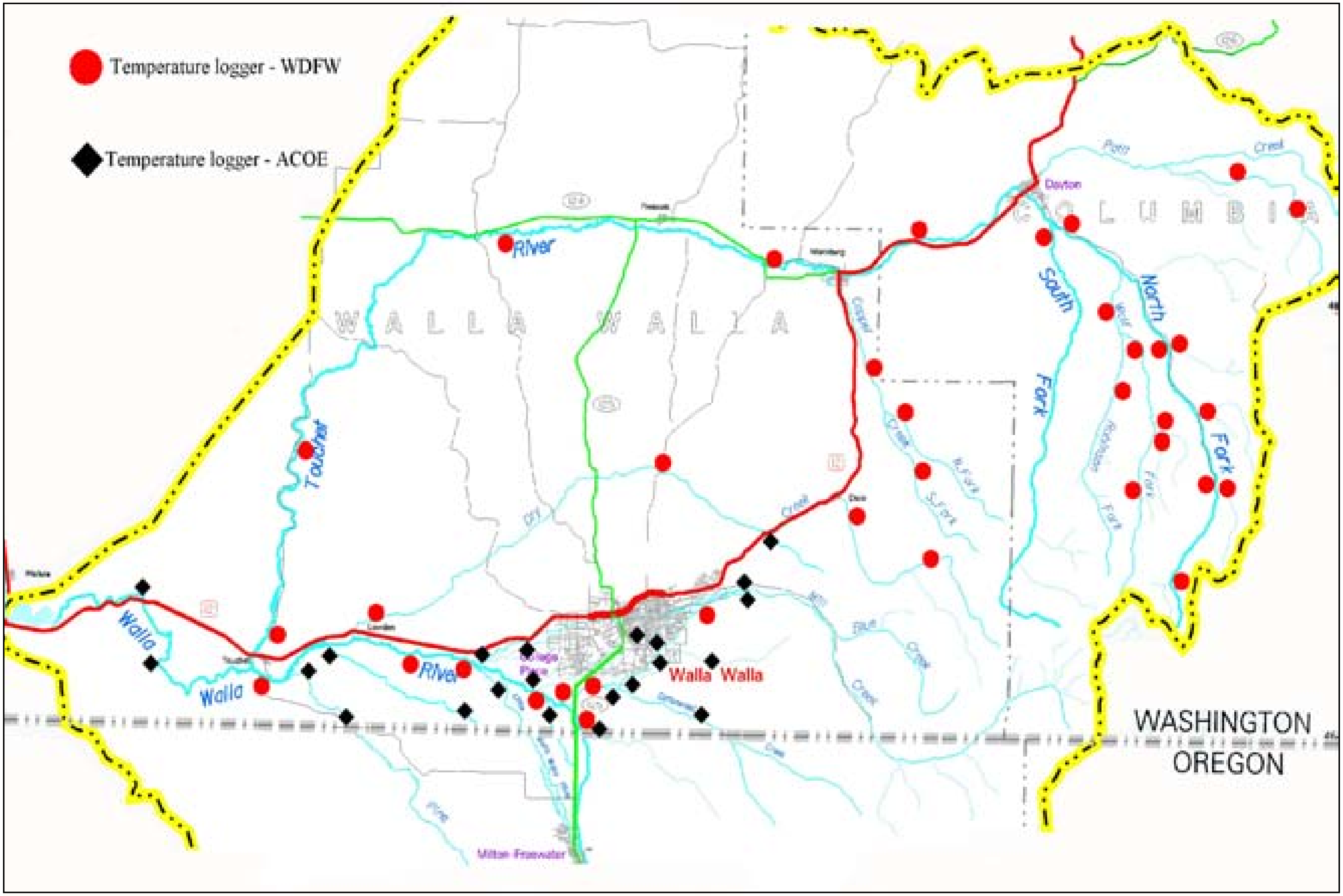


Figure 3. Relative locations of temperature logger sites in the Walla Walla Basin, 2000.

Water Quality

Miscellaneous water quality data were collected by WDFW during the 2000 field season. Sampled water quality variables included conductivity (umhos/cm), and pH (Appendix D). Conductivity data was collected using an Orion Model 115 conductivity meter. We collected pH data using a VWR brand model 2000 pH meter. Meters were calibrated according to manufacturer specifications prior to collection efforts.

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 rehabilitation 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 75EF (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 so we could calculate densities at various study sites in the Walla Walla basin (Figures 3, 4). We used pulsed DC (direct current) between 400 and 600 volts. Sites were delimited by block nets spanning the channel, usually placed approximately 30 meters apart. Block nets prevented fish from entering or leaving the site, so that densities could be calculated (Platts et al. 1983). The operator began at the upstream net and worked downstream, covering the entire wetted width. One "pass" was completed when the downstream net 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 placed in buckets until they could be sampled for lengths and weights. Collected fish were anesthetized with FINQUEL® (MS-222 tricaine methane sulfonate), identified, weighed (g), and measured to fork length (mm).

Fork lengths collected during quantitative electrofishing were used to create length frequency histograms. The histograms were used to determine age classes (Mendel et al. 1999). These age class delineations were checked against ages determined from reading fish scales that were collected from several of the stream reaches. Age class groupings were specific for each stream reach.

A removal–depletion software program developed by the U.S. Forest Service (Van Deventer and Platts, 1983) was used to calculate population densities (#/100 m^2) for each salmonid species, by age class. The average weight (grams) of each age class was multiplied by its density to calculate biomass (g/100 m^2) per age class.

Area sampled was determined by multiplying site length by the average of four or more site width measurements. A brief description of the riparian, bank stability, substrate, pools/riffle ratio, and the presence of large organic debris (LOD) was recorded for each site.

Fish identification included genus and species for all Salmonids, and most Cottids, and *Cyprinidae*; and genus only for *Catostomidae*, and *Petromyzontidae*. Our sampling protocol was to collect 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).

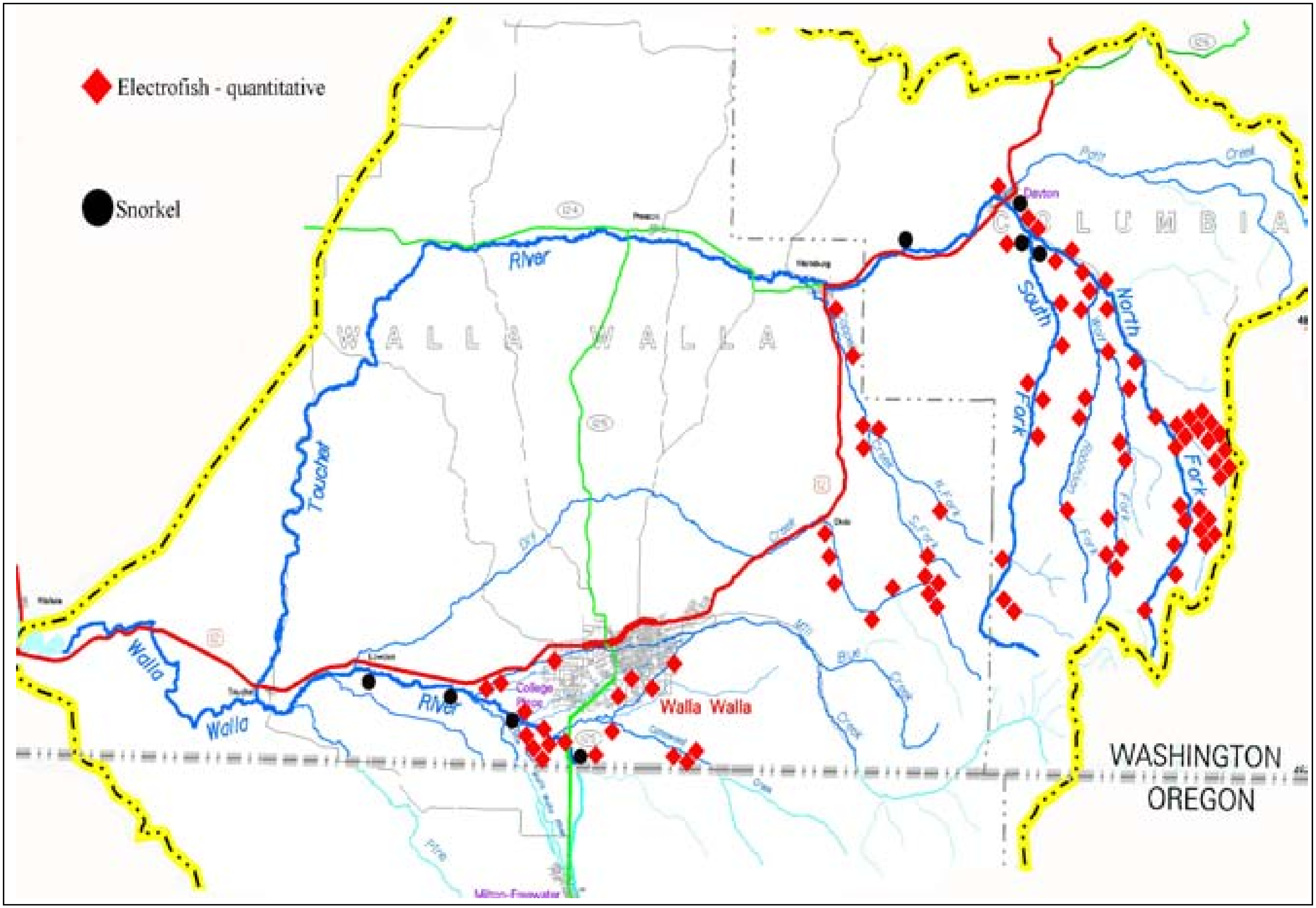


Figure 4. Relative locations of quantitative electrofishing and snorkeling sites in the Walla Walla Basin, 2000.

Relative abundance for non–salmonid species were treated semi–quantitatively. For each species in each site, a relative abundance was determined. The relative abundance was assigned a corresponding ranking value (Table 1). Ranked values were averaged to determine a relative abundance for each species per designated reach. Relative abundance data were tabulated to provide qualitative comparisons between reaches and species.

Table 1. Categories of relative abundance (per site) for non–salmonids.

Category	Count (individuals seen)	Ranking Value
Absent	0	0
Rare	1-3	1
Uncommon	4-10	2
Common	11-100	3
Abundant	100+	4

We also conducted "qualitative" electrofishing surveys in several Walla Walla and Touchet River tributaries (Figure 4). These surveys enabled us to cover large areas relatively quickly as they did not entail the use of block nets or repeat passes with the electrofisher. We electrofished while moving upstream and capturing fish to determine species presence, size of fish (age class), and their relative abundance. We also noted the presence or general abundance of non–salmonids. This method supplemented our intensive "quantitative" electrofishing surveys and our snorkel surveys to provide a more complete view of salmonid distribution and abundance.

Snorkeling

Snorkeling sites were generally 90-120 meters in length. Snorkelers moved upstream, counting and identifying species, and estimating the age class of all salmonid fishes. Counts were recorded on PVC armbands. General abundance of non–salmonids were also noted. Snorkel surveys could be performed in deeper water, braided channels, and at other locations where electrofishing was not feasible or effective. Another advantage of snorkeling was that we were able to cover a large stream area in a short period of time and still provide density estimates. Snorkel surveys were conducted at selected sites both in the spring and summer for comparisons of salmonid distribution and densities temporally and by geographic location (Figure 3).

Salmonids observed during snorkel surveys were classified by age class based on their estimated size. Snorkelers reported genus classifications for all non–salmonid fish. Age class and relative abundance of non–salmonids were estimated and recorded. Site length and width measurements were taken to calculate the area surveyed. Brief habitat descriptions were recorded .

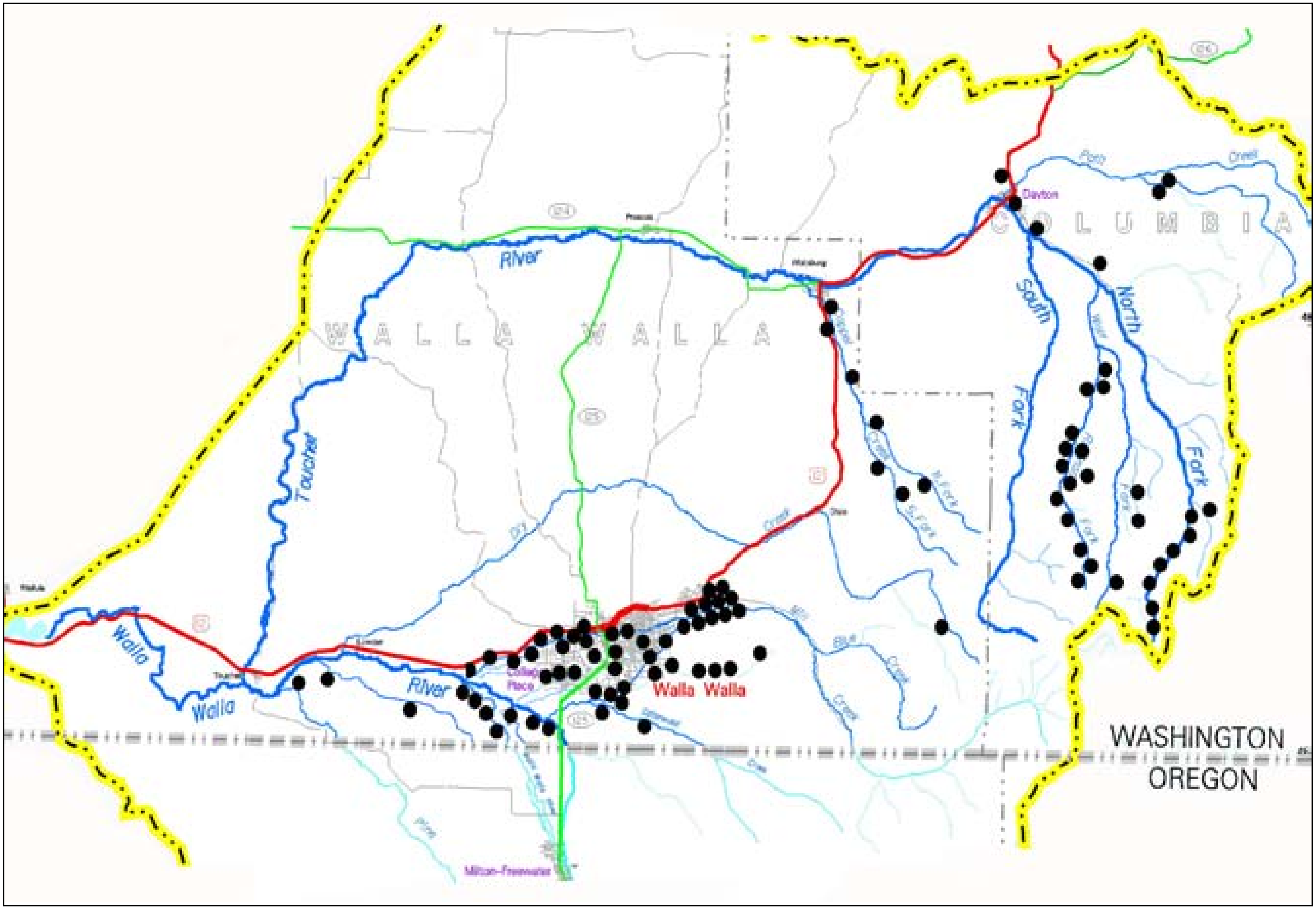


Figure 5. Relative locations of qualitative electrofishing sites in the Walla Walla Basin, 2000.

Spawning Surveys

Spawning surveys were conducted in the same manner for both steelhead and bull trout. Surveyors walked downstream and visually identified spawning fish and/or redds (nests). Redds were easily identified, characterized by an area of clean gravel with a large depression and mound. Each redd observed was assigned a two–part identification code representing the survey number and the redd number. A flag was hung in adjacent vegetation, and marked with the identification (ID) code, the date, and the surveyor's initials, so the same redd would not be counted in subsequent surveys. Each redd was recorded in a notebook with the date, time, ID code, general description of the redd and its location. Counts were tallied for each designated stream reach.

Genetic Sampling

Sampling of salmonid tissues was undertaken by WDFW, cooperating agencies, and volunteer personnel for later genetic analyses. Fin clips or opercle punches were obtained from adult steelhead, rainbow trout/steelhead, bull trout, and whitefish. Tissue was collected at established fish traps on the Walla Walla River, Touchet River, Mill Creek, and Yellowhawk Creek and during electrofishing efforts within the basin. Fin clips were placed in tubes of 95 % ethanol for preservation, labeled and 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 River basin.

Results and Discussion

Habitat Assessment

Stream Flows

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

In 2000, irrigators, under a settlement agreement with the USFWS, maintained a minimum instream flow of 13 cfs at Nursery Bridge in Milton Freewater, OR. Nursery Bridge is approximately four miles upstream from the Washington state line. The additional water made an immediate impact in Oregon by considerably reducing the historic dewatered area. A continuous flow monitor placed at the Washington state line showed a slight increase in flow, conceivably caused by additional groundwater recharge. Unfortunately, we had multiple problems with the flow monitor at the state line, therefore the data is inconclusive. Also, under the auspices of the settlement agreement, Touchet Gardenia Co., in Washington maintained at least a 10 cfs streamflow past Burlingame Dam during their spring, early summer, and fall irrigation season.

Reduced flows downstream of major irrigation diversions were observed during the field season (Appendix B). Specific observations included: (1) dewatering of the Walla Walla River channel for about 0.5 miles around Tum-a-lum Bridge, in Oregon, with some recharge near the Oregon State line; (2) sharp flow reductions below Burlingame Diversion in mid to late June and again in mid–October through mid- November (as recorded by manual and instream flow monitors); and (3) a steep decline in flows on the Touchet River below Hofer Diversion in August (as recorded by manual and instream flow monitors).

The 1999-2000 winter provided an average snowpack in the Blue mountains. Spring/summer discharges for the Touchet River were generally lower for the same sites in 2000 than they were in 1999. In the Blue mountains, the Touchet station recorded a maximum snow water equivalent of 36.1 inches March and April 2000. Comparatively, in 1999 the maximum snow water equivalent recorded for March and April were 55.9 and 56.8 (WA NRCS website ftp://ftp.wcc.nrcs.usda.gov).

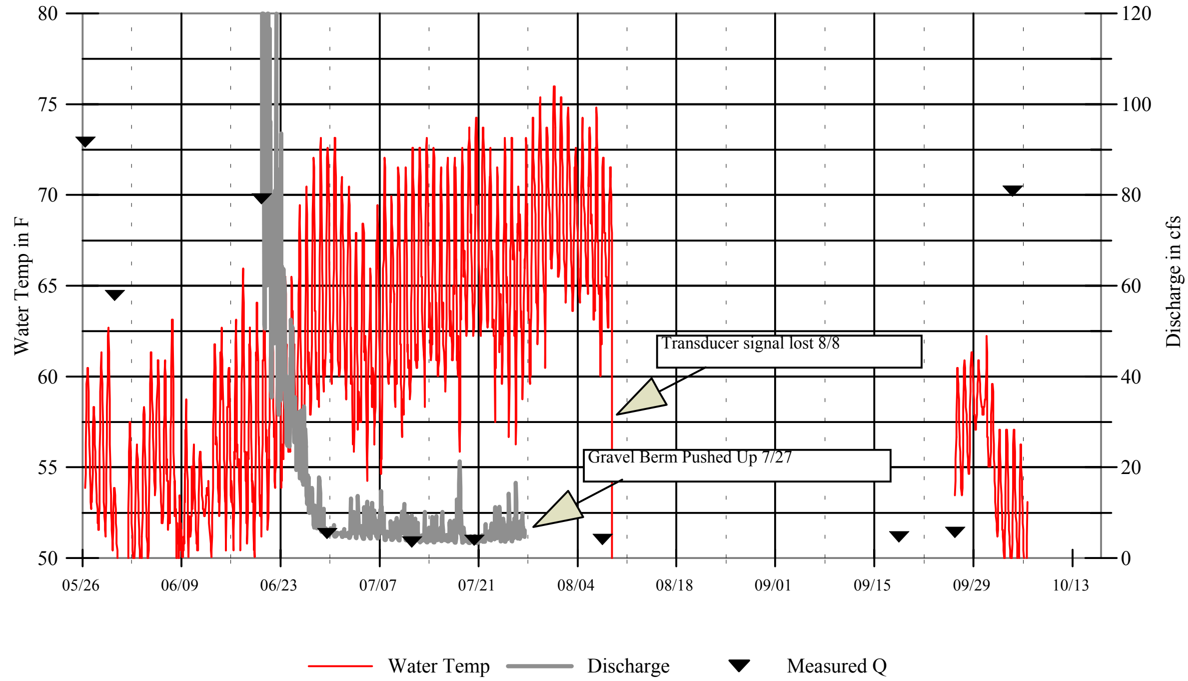


Figure 6. Walla Walla River stream discharge (CFS) and daily maximum water temperatures (EF) every four hours, above Pepper Rd Bridge(WW-2), 2000. (Field Q = manual stream discharge measurement)

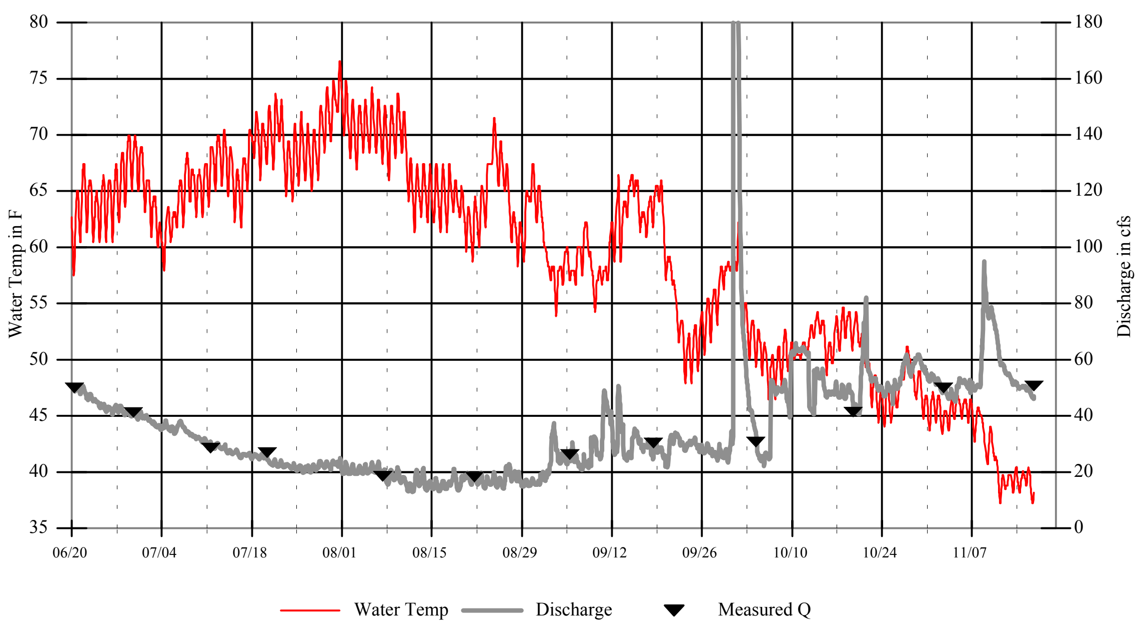


Figure 7. Yellowhawk Creek stream discharge (CFS) and daily maximum water temperatures (EF) every four hours, near confluence with the Walla Walla River (YC-8), 2000. (Field Q = manual stream discharge measurement)

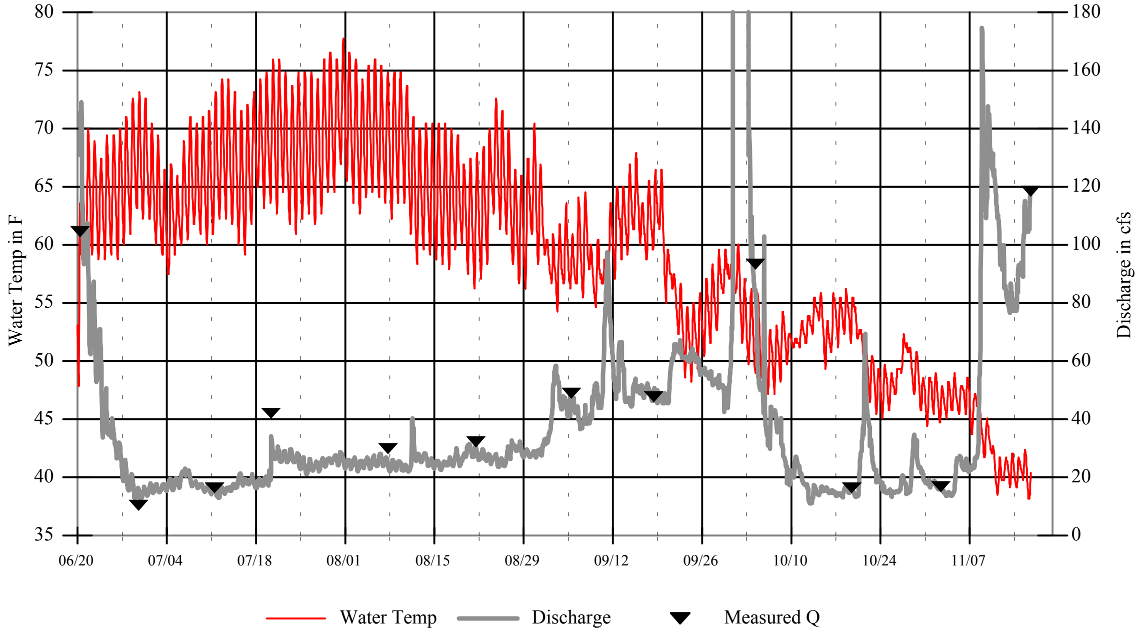


Figure 8. Walla Walla River stream discharge (CFS) and daily maximum water temperatures (EF) every four hours, below Mojonnier Bridge and Burlingame Dam (WW-6), 2000 (Field Q = manual stream discharge measurement).

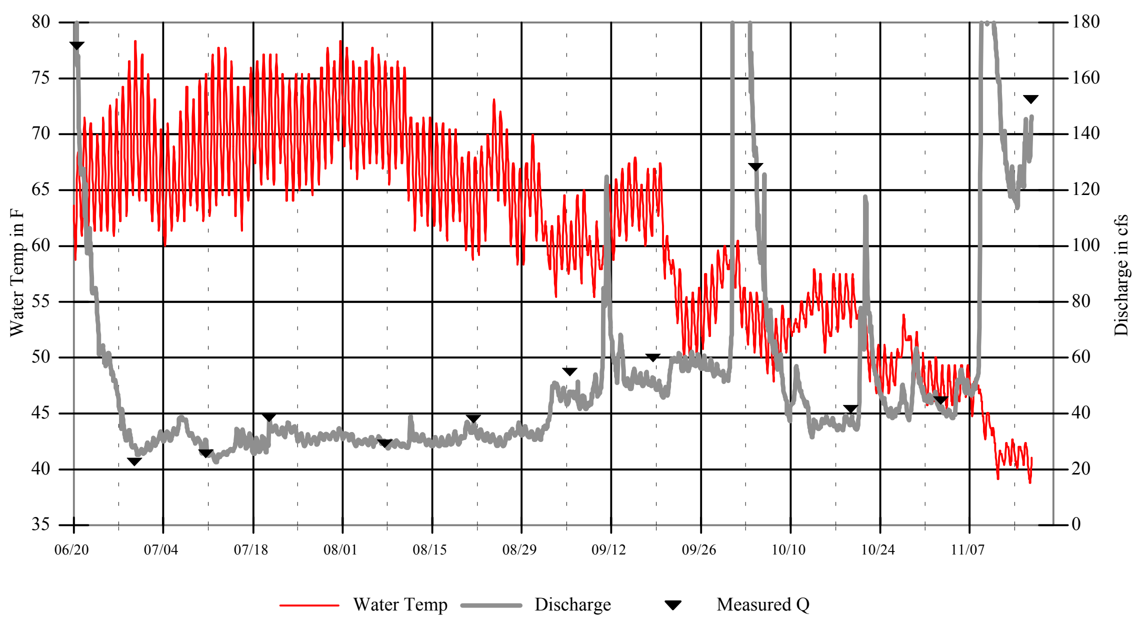


Figure 9. Walla Walla River stream discharge (CFS) and daily maximum water temperatures (EF) every four hours, above Detour Rd Bridge (ww-9), 2000 (Field Q = manual stream discharge measurement).

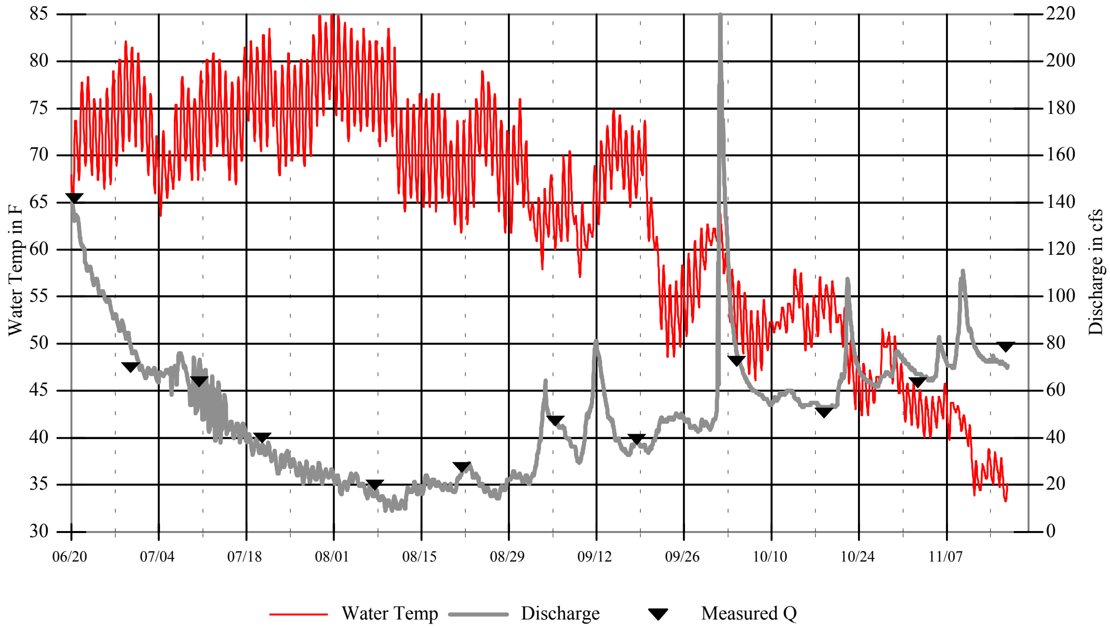


Figure 10. Touchet River stream discharge (CFS) and daily maximum water temperatures (EF) every four hours, below Sims Rd Bridge(TR-9), 2000 (Field Q = manual stream discharge measurement).

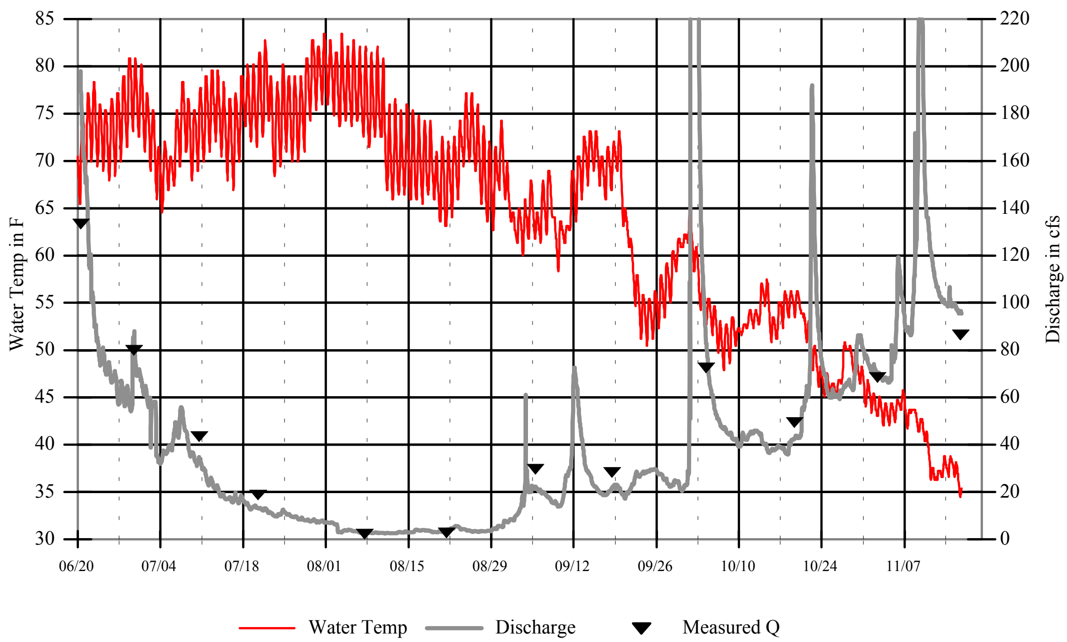


Figure 11. Touchet River stream discharge (CFS) and daily maximum water temperatures (EF) every four hours, above Cummins Rd Bridge (TR-10), 2000 (Field Q = manual stream discharge measurement).

Preliminary results of the IFIM stream discharge modeling for the Walla Walla River and lower Mill Creek in 1999 are provided in Appendix G.

Stream Temperatures

Stream temperature monitoring for the 2000 season was focused primarily in the mainstem Walla Walla River and the Touchet River and its tributaries (Appendix C & C1). Despite low water flows and very little precipitation, water temperatures in 2000 were similar to water temperatures in 1999 throughout the Walla Walla basin. A cold weather pattern and heavy rains during early and mid June caused water temperatures to drop throughout the basin. The low water temperatures in June interrupted the normal summer temperature development and with a declining photo-period, stream temperatures remained relatively moderate throughout the rest of the summer. Sites where maximum water temperatures were less than or equal to 65EF during summer months were generally located in tributaries associated with the Blue mountains; Bluewood Culvert (NFT1), Spangler Ck (SC6), NF Touchet (NFT7), Lewis Ck (LC12), Wolf Fork (WF5,WF9),Whitney Ck (WH2), Coates Creek (C1), and Upper Robinson Fork (RF4). Maximum daily temperatures at some instream monitoring sites routinely exceeded lethal temperatures for salmonids (75-84EF, Bjornn and Reiser 1991) during mid–summer, when the photo–period is long and evening cooling is brief. Sites with maximum water temperatures greater than 75EF included the Washington state portion of the Walla Walla River (WW2, WW6,WW8, WW9, WW10, WW11), Walla Walla River at Byrely Bridge (COE), Walla Walla River at Nine Mile (COE), Yellowhawk Creek(YC1, YC8), Birch Creek (COE), Caldwell Creek (COE), Garrison Creek 1 & 2 (COE), Mill Creek 1 & 2 (COE), Mud Creek (COE), Pine Creek (COE), the Touchet River below Dayton (TR6, TR7, TR8, TR10), Dry Creek (DC4, DC5, DC6), Lower Robinson Fork (RF14), Lower South Fork Touchet (SFT9), South Patit Creek (SFP2), and the mainstem of Coppei Creek (MC3). Sites in the mid and lower Touchet and Walla Walla rivers frequently had daily maximum temperatures that were high enough (above 68EF) to inhibit migration of adults and young, and to sharply reduce survival of embryos and fry (Bjornn and Reiser 1991,Figure 6). However, at night, temperatures would usually decrease to within reasonable physiological limits for steelhead/rainbow trout (<65-70EF).

Water Quality

Miscellaneous water quality measurements were taken by WDFW during the 2000 season (Appendix D). We anticipated having more water quality data, but we had equipment difficulties throughout the season.

Limiting Factor Identification

A number of barriers or impediments to salmonid passage and rearing were identified during the 2000 field season. A portion of those barriers were physical (e.g., structures or dewatered streambeds) that physically blocked salmonid movement. Physiological barriers and impediments to salmonid passage and rearing were extensive in terms of stream miles affected. The primary physiological factor was temperature, although high pH and low dissolved oxygen levels were also documented in some mid– or lower mainstem river reaches. Temperature possibly represents the most critical physiological barrier to salmonids, particularly for passage or rearing. Temperature related barriers for salmonids generally occur in lower areas of the Touchet and Walla Walla Rivers and their tributaries. Stream reaches with mean water temperatures exceeding 75 EF 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.

One barrier found on Russell Creek was a Civilian Conservation Corp diversion structure that was built in the 1930's or 40's. The stream bed had eroded and incised the stream channel over the years forming an impassible barrier about 15-20 ft tall. During qualitative electrofishing efforts one 190mm rainbow/steelhead trout was found just below the barrier, and at least three different age classes of rainbow/steelhead trout were found downstream of the barrier. No fish of any kind were found at several sites above the barrier.

Turbidity, sedimentation, lack of pools and cover, and other habitat factors, may also present challenges to migrating, breeding and rearing salmonids. Extensive and intensive surveys of habitat conditions to identify limiting factors were deferred because of lack of adequate staff time .

Fish Stock Assessment

Distribution and Abundance

Densities and biomass of four salmonid species were calculated from electrofishing and snorkel surveys (Tables 2-6). Adult rainbow densities represent wild or unknown origin trout unless noted. Identified salmonid species included: mountain whitefish (*Prosopium williamsoni*), brown trout (*Salmo trutta*), bull trout (*Salvelinus confluentus*), and rainbow/steelhead trout (*Oncorhynchus mykiss*).

Rainbow/steelhead trout represent the most common salmonid found in the Walla Walla Basin. Age 0+ rainbow/steelhead densities are typically higher than older age classes for most sites. Age 1+ rainbow/steelhead trout predominated in Lewis Creek, Spangler Creek, Burnt Fork, Coppei Creek, North Fork Coppei Creek, South Fork Coppei Creek, Dry Creek, Yellowhawk Creek, and Caldwell Creek. Large or "legal sized"($8 in.) rainbow trout were found in very low densities throughout the basin. The numbers of age 0+ steelhead found in the mainstem Walla Walla River suggests that spawning is commonly occurring within the Washington portion of the river.

Other salmonid species had a limited distribution (Tables 2-6, Appendix E). Bull trout distribution was greatest in the North Fork and the Wolf Fork of the Touchet River. In 2000, a new population of bull trout was identified in the Burnt Fork Touchet, also a few fish from two age classes were found in the South Fork Touchet. Age 1+ age class/ sub adult bull trout were observed in the South Fork around the mouth of Griffin Fork. Bull trout in the Burnt Fork ranged between 102mm-273mm, potentially representing 4 age classes (Appendix E). Low densities of bull trout were observed in

North Fork Touchet tributaries; Lewis Creek, Spangler Creek, and Corral Creek. Mountain whitefish were rare, and they were found in low densities at only a few sites in the Walla Walla River (WW4, WW6), North Fork Touchet (NFT12, 14,15, 16), Wolf Fork (WF12) and the Touchet River (TR4). Brown trout were found in low densities (but included some very large individuals) in the mainstem in the North Fork Touchet, Wolf Fork, and the Touchet River around Dayton. Juvenile brown trout production appeared to be limited in 2000, but greater than observed in 1999. No juvenile chinook salmon were observed during the 2000 field season, although 4 adult Spring Chinook were observed in the Touchet River at the Dayton intake trap in late spring. One of the adult chinook had a radio transmitter and was tracked for a short time by the WDFW Snake River Lab.

Table 2. Densities of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Densities (#/100 m²)							
					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[b]	0+	1+	$8 in
N. Fork Touchet												
NFT1	07/31	45.0	2.7	123.0	0	0	0	0	BT	4.9	38.2	0
NFT3	09/20	37.6	4.3	160.2	0	1.2	0	1.2	BT	5.6	3.7	0
NFT6	08/03	30.0	4.1	123.0	1.6	16.3	1.6	19.5	BT	0.8	0	0
NFT8	08/03	30.0	6.3	187.8	19.2	20.2	0	39.4	BT	0	0.5	0
NFT9	08/08	30.0	6.5	194.0	14.4 [a]	13.4[a]	0	27.8	BT	0	0	0.5
NFT10	08/08	40.0	6.1	244.0	26.6	11.1	0.4	38.1				
NFT11	08/02	30.0	6.1	184.2	21.7	5.4 [a]	0.5	27.6				
NFT12	08/09	35.0	5.9	207.2	19.8	9.7 [a]	1.0	30.5	BRT	0	0	0.5
									MTW	0	0	0.5
NFT13	08/09	30.0	6.5	196.2	20.4	7.1	0.5	28.0	BRT	0.5	0	0
NFT14	08/09	38.8	8.8	341.4	7.6 [a]	7.3 [a]	0.6	15.5	MTW	0	0	1.2 [a]
NFT15	08/15	40.0	9.1	365.3	16.1 [a]	20.0 [a]	0.9	37.0	BRT	0	1.1	0.8
									MTW	0	0	1.6[a]
NFT16	08/14	37.0	11.6	427.4	29.3 [a]	11.2	0.7	41.2	BRT	0.2	0.2	0
									MTW	0	0.2	0.5
NFT17	08/14	37.0	10.2	376.2	16.5	5.1	0	21.6	BRT	0.5	0	0
Spangler Creek												
SC1	07/18	24.2	2.5	61.0	1.6	11.5	0	13.1	BT	0	14.8	0
SC2	07/18	17.3	2.8	48.4	4.1	18.6	0	22.7	BT	0	10.3	0
SC3	07/18	22.3	3.0	67.3	0	10.4	0	10.4	BT	0	4.5	0
SC4	08/02	30.6	2.7	83.8	6.0	17.9	0	23.9	BT	0	6.0	0
SC5	08/01	62.0	3.3	205.1	0.5	9.8	0.5	10.8				
SC6	08/01	37.5	3.1	114.8	5.2 [a]	14.8	0	20.0				
Lewis Creek												
LC1	07/17	48.0	2.8	133.6	0.7	0.7	0.7	2.1				
LC2	07/17	25.0	2.5	62.5	0	0	0	0				
LC3	07/17	30.0	2.6	80.0	0	0	0	0				
LC4	07/17	30.0	2.0	59.4	0	15.2	1.7	16.9				
LC5	07/17	30.0	1.9	56.0	1.8	12.5	0	14.3				
LC6	07/17	30.0	2.8	82.8	3.6	19.3	0	22.9	BT	0	1.2	0
LC7	07/13	30.0	1.9	57.8	0	13.9	0	13.9	BT	0	3.5	0
LC8	07/13	30.0	3.3	100.2	0	10.0	0	10.0	BT	0	5.0	0
LC9	07/13	30.0	2.6	76.8	0	15.6	0	15.6	BT	0	1.3	0
LC10	07/12	30.0	2.8	83.0	0	9.6	1.2	10.8				
LC11	07/10	30.0	3.1	94.3	0	10.6	1.1	11.7				
LC12	07/12	46.6	3.6	168.5	0	19.0	0	19.0				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 2. (Continued) Densities of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

Stream Reach	Date	Site Length	Mean Width	Area	Densities (#/100 m²) Rainbow/steelhead Age/size					Age/size		
Site Name	(mm/dd)	(m)	(m)	(m²)	0+	1+	$8 in	Total	Other Species[b]	0+	1+	$8 in
Wolf Fork of the Touchet												
WF2	08/10	71.0	3.4	241.4	0	1.7	0	1.7	BT	0	11.2	0
WF3	08/02	50.0	3.5	175.0	0.6	4.0	1.1	5.7	BT	8.6	6.3	0.6
WF4	08/02	50.0	3.0	149.0	0	15.4	0	15.4	BT	4.0	8.1	0
WF5	08/02	50.0	5.4	269.0	0.7	8.9	1.1	10.7	BT	7.1	13	0.7
WF6	08/02	50.0	7.7	384.0	6.8	9.9	0	16.7	BT	0.3	0	0.3
WF7	08/03	50.0	7.0	348.0	17.0	8.9	0.3	26.2				
WF8	08/01	40.0	9.2	366.4	17.7	9.6	0	27.3	BT	0	0	0.3
WF10	08/01	50.0	7.5	374.0	17.9	8.0	0	25.9	BRT	1.4	0	0
WF11	07/25	50.0	10.5	532.0	22.0	4.3	0.2	26.5	BRT	0.5	0	0
									BT	0.5	0.3	0
WF12	07/26	50.0	6.5	451.8	19.9	7.5	0	27.4	MTW	0	0	1.2
									BRT	4.0	0	0.2
									BT	0	0.2	0
Robinson Fork of the Touchet												
RF3	07/19	30.0	3.2	95.4	6.3	22.0	0	28.3				
RF8	07/19	30.0	3.7	111.0	55.0	13.5	0	68.5				
RF11	08/02	30.0	5.6	166.8	30.0	7.8 [a]	0	37.8				
RF13	08/02	30.0	4.6	138.6	10.8	14.4	0	25.2				
Burnt Fork of the S. Touchet												
BF3	08/07	25.0	2.7	67.9	4.4	22.1	0	26.5				
South Fork of the Touchet												
SF1	08/10	50.0	5.6	278	11.9	41.0	1.4	54.3	BT	0	2.2	0.7
SF2	08/10	50.0	5.5	277	12.6	14.4	0	27.0				
SF3	07/27	50.0	4.9	245	2.0	9.0	0.8	11.8				
SF4	08/24	30.0	4.4	132.0	47.0	19.7	0.7	67.4				
SF5	07/20	30.0	6.5	196.2	14.3	1.0	0	15.3				
SF6	07/27	50.0	5.9	297.0	17.9	10.4	0	28.3				
SF7	07/19	35.0	4.7	165.2	10.3	14.5	0.6	25.4				
SF8	07/20	30.0	5.0	151.2	4.0	0	0	4.0				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 2. (Continued) Densities of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Densities (#/100 m²)							
					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[b]	0+	1+	$8 in
Touchet River												
TR1	08/30	45.0	11.4	513.0	2.3	8.2	3.1	13.6	BRT	0.2	0	0
TR4	08/31	50.0	12.5	625.0	31.7	6.1	2.2	40.0	BRT	0.3	0	0.2
									MTW	0.2	0	0
TR5	08/31	40.0	14.4	576.8	5.4	1.4	1.0	7.8				
North Coppei Creek												
NFC1	08/17	30.0	3.1	93.0	0	3.2	1.1	4.3				
NFC3	08/17	30.0	1.6	48.6	24.7	41.2	0	65.9				
NFC5	08/17	30.0	2.3	69.6	5.7	54.6	2.9	63.2				
South Coppei Creek												
SFC1	08/17	30.0	4.0	118.8	9.3 [a]	21.9	0	31.2				
SFC5	08/17	30.0	3.1	93.6	4.3	32.1	0	36.4				
Coppei Creek												
MC2	08/17	30	3.0	90.0	1.1	5.6	0	6.7				
MC3	08/17	50	3.0	148.0	0.7	4.1	0	4.8				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 3. Densities of salmonids from electrofishing sites in the Walla Walla River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Densities (#/100 m²)							
					Rainbow/steelhead							
Stream Reach	Date	Site Length	Mean Width	Area	Age/size					Age/size		
Site Name	(mm/dd)	(m)	(m)	(m^2)	0+	1+	$8 in	Total	Other Species[b]	0+	1+	$8 in
Walla Walla River												
WW1	08/01	30.6	5.0	152.4	12.5	4.6	0	17.1				
WW3	08/01	30.0	8.4	252.6	1.6	0.8	0	2.4				
WW4	08/01	31.0	5.7	177.3	3.4	0	1.1	4.5	MTW	0	0.6	0
WW6	08/10	30.0	10.8	323.4	13.9	0.6	0	14.5	MTW	0.3	2.5	0
WW8	08/10	30.0	5.5	166.2	2.4	0.6	0	3.0				
WW9	08/10	30.0	9.8	294.0	0	0	0	0				
North Dry Creek												
NFD2	08/24	34.0	2.4	82.3	40.1	7.3	0	47.4				
NFD3	08/29	30.6	1.4	41.0	31.7	39.0	0	70.7				
NFD4	08/29	30.0	1.9	58.3	0	3.4	0	3.4				
NFD6	08/29	30.0	1.8	55.0	9.1	16.4	0	25.5				
Dry Creek												
DC1	08/29	30.0	3.8	113.4	0	20.3	0	20.3				
DC2	08/29	30.0	3.7	111.6	2.7	5.4	0	8.1				
DC3	08/30	30.0	3.0	88.8	3.4	19.1	1.1	23.6				
DC4	08/30	40.0	4.7	189.6	4.2	11.6	0	15.8				
Yellowhawk Creek												
YC1	07/18	35.0	6.2	217.7	0	0.5	0.5	1.0				
YC2	08/28	33.0	4.2	137.3	4.4	5.1	0	9.5				
YC3	08/23	105.0	4.2	437.5	2.7	8.7	0.5	11.9				
YC5	08/28	30.0	5.0	150.0	0	0	0	0				
YC6	08/16	30.0	4.7	140.0	0	0.7	0	0.7				
YC7	08/28	30.0	3.9	116.4	0.9	0.9	0	1.8				
Cottonwood Creek												
CWC1	07/10	31.0	7.1	218.6	12.8	4.6	0	17.4				
CWC2	07/12	33.0	2.8	93.7	60.8	3.2	0	64.0				
CWC3	07/06	30.0	4.3	127.8	36.0	4.7	0	40.7				
CWC6	07/05	33.0	3.1	99.3	67.6	0	0	67.6				
Caldwell Creek												
CCC2	07/11	30.0	1.6	48.0	0	2.1	0	2.1				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 3. (Continued) Densities of salmonids from electrofishing sites in the Walla Walla River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Densities (#/100 m²)							
					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[b]	0+	1+	$8 in
Mill Creek												
MC16	08/22	56.2	3.4	191.1	0	0	0	0				
MC20	08/22	30.0	3.3	99.0	2.0	0	0	0				
MC21	07/10	30.0	6.1	183.0	1.6	0	0	0				
East Little Walla Walla												
ELW1	07/17	30.0	3.9	117.0	0.9	0	0	0.9				
ELW2	07/17	30.0	3.4	102.0	0	1.0	0	1.0				
ELW3	07/17	30.0	3.7	111.0	0	0	0	0				
Doan Creek												
DC2	08/15	30	1.1	33.0	9.1	0	0	9.1				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 4. Biomass of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Biomass (g/100 m²)							
					Rainbow/steelhead							
Stream Reach	Date	Site Length	Mean Width	Area	Age/size				Other Species[b]	Age/size		
Site Name	(mm/dd)	(m)	(m)	(m²)	0+	1+	≥8 in	Total		0+	1+	≥8 in
N. Fork Touchet												
NFT1	07/31	45.0	2.7	123.0	0	0	0	0	BT	3.0	718.4	0
NFT3	09/20	37.6	4.3	160.2	0	29.2	0	29.2	BT	5.6	109.0	0
NFT6	08/03	30.0	4.1	123.0	3.7	443.1	257.8	704.6	BT	12.	0	0
NFT8	08/03	30.0	6.3	187.8	39.1	501.4	0	540.5	BT	8	51.9	0
NFT9	08/08	30.0	6.5	194.0	14.2 [a]	338.4[a]	0	352.6	BT	0	0	125.3
NFT10	08/08	40.0	6.1	244.0	72.9	286.0	66.4	425.3		0		
NFT11	08/02	30.0	6.1	184.2	74.7	125.5[a]	55.1	255.3				
NFT12	08/09	35.0	5.9	207.2	57.2	288.1[a]	149.6	494.9	BRT	0	0	1204.1
									MTW	0	0	142.6
NFT13	08/09	30.0	6.5	196.2	58.1	232.8	63.0	353.9	BRT	3.6	0	0
NFT14	08/09	38.8	8.8	341.4	29.8 [a]	245.0[a]	93.2	368.0	MTW	1.6	0	277.1
NFT15	08/15	40.0	9.1	365.3	76.6 [a]	730.7[a]	209.1	1016.4	BRT	0	16.0	1355.5
									MTW	0	0	496.3
NFT16	08/14	37.0	11.6	427.4	106.1[a]	421.1	12.8	540.0	BRT	3.9	2.5	0
									MTW	0	17.2	520.5
NFT17	08/14	37.0	10.2	376.2	56.6	178.1	0	234.7	BRT	4.0	0	0
Spangler Creek												
SC1	07/18	24.2	2.5	61.0	3.1	393.5	0	396.6	BT	0	128.1	0
SC2	07/18	17.3	2.8	48.4	11.1	671.1	0	688.2	BT	0	197.7	0
SC3	07/18	22.3	3.0	67.3	0	271.7	0	271.7	BT	0	91.6	0
SC4	08/02	30.6	2.7	83.8	20.5	484.3	0	504.8	BT	0	57.6	0
SC5	08/01	62.0	3.3	205.1	2.1	284.2	45.2	331.5				
SC6	08/01	37.5	3.1	114.8	24.6 [a]	420.1	0	444.7				
Lewis Creek												
LC1	07/17	48.0	2.8	133.6	1.9	5.2	71.8	78.9				
LC2	07/17	25.0	2.5	62.5	0	0	0	0				
LC3	07/17	30.0	2.6	80.0	0	0	0	0				
LC4	07/17	30.0	2.0	59.4	0	508.0	147.1	655.1				
LC5	07/17	30.0	1.9	56.0	7.1	352.6	0	359.7				
LC6	07/17	30.0	2.8	82.8	14.6	661.8	0	676.4	BT	0	25.4	0
LC7	07/13	30.0	1.9	57.8	0	349.4	0	349.4	BT	0	76.4	0
LC8	07/13	30.0	3.3	100.2	0	347.1	0	347.1	BT	0	117.7	0
LC9	07/13	30.0	2.6	76.8	0	550.2	0	550.2	BT	0	25.0	0
LC10	07/12	30.0	2.8	83.0	0	198.3	113.4	311.7				
LC11	07/10	30.0	3.1	94.3	0	238.6	101.8	340.4				
LC12	07/12	46.6	3.6	168.5	0	565.3	0	565.3				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 4. (Continued) Biomass of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

Stream Reach	Date	Site Length	Mean Width	Area	Biomass (g/100 m²)							
					Rainbow/steelhead							
					Age/size				Other Species[b]	Age/size		
Site Name	(mm/dd)	(m)	(m)	(m²)	0+	1+	$8 in	Total		0+	1+	$8 in
Wolf Fork of the Touchet												
WF2	08/10	71.0	3.4	241.4	NA	NA	NA	NA	BT	NA	NA	NA
WF3	08/02	50.0	3.5	175.0	1.2	226.6	146.5	374.3	BT	7.9	204.2	NA
WF4	08/02	50.0	3.0	149.0	0	385.3	0	385.3	BT	3.2	185.7	0
WF5	08/02	50.0	5.4	269.0	0.3	144.7	165.0	310.0	BT	14.1	188.5	NA
WF6	08/02	50.0	7.7	384.0	7.8	233.2	0	241.0	BT	5.1	0	17.8
WF7	08/03	50.0	7.0	348.0	27.2	258.0	45.0	330.2				
WF8	08/01	40.0	9.2	366.4	31.5	167.2	0	198.7	BT	0	0	49.7
WF10	08/01	50.0	7.5	374.0	NA	NA	NA	NA	BRT	NA	NA	NA
WF11	07/25	50.0	10.5	532.0	63.1	96.9	22.2	182.2	BRT	2.3	0	0
									BT	2.7	8.5	0
WF12	07/26	50.0	6.5	451.8	NA	NA	NA	NA	MTW	NA	NA	NA
									BRT	NA	NA	NA
									BT	NA	NA	NA
Robinson Fork of the Touchet												
RF3	07/19	30.0	3.2	95.4	2.1	556.5	0	558.6				
RF8	07/19	30.0	3.7	111.0	55.7	186.5	0	242.2				
RF11	08/02	30.0	5.6	166.8	50.5	184.6 [a]	0	235.1				
RF13	08/02	30.0	4.6	138.6	23.5	261.7	0	285.2				
Burnt Fork of the S. Touchet												
BF3	08/07	25.0	2.7	67.9	15.0	713.5	0	728.5				
South Fork of the Touchet												
SF1	08/10	50.0	5.6	278	23.8	880.4	143.6	1047.8				
SF2	08/10	50.0	5.5	277	23.2	255.5	0	278.7				
SF3	07/27	50.0	4.9	245	4.6	293.6	124.1	422.3				
SF4	08/24	30.0	4.4	132.0	164.5	490.5	72.6	727.6				
SF5	07/20	30.0	6.5	196.2	42.2	22.2	0	64.4				
SF6	07/27	50.0	5.9	297.0	57.2	203.2	0	260.4				
SF7	07/19	35.0	4.7	165.2	25.4	573.6	122.3	721.3				
SF8	07/20	30.0	5.0	151.2	9.2	0	0	9.2				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 4. (Continued) Biomass of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Biomass (g/100 m²)							
					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[b]	0+	1+	$8 in
Touchet River												
TR1	08/30	45.0	11.4	513.0	27.4	435.0	503.2	965.6	BRT	4.0	0	0
TR4	08/31	50.0	12.5	625.0	234.6	308.5	527.5	1070.6	BRT	4.6	0	34.6
									MTW	2.6	0	0
TR5	08/31	40.0	14.4	576.8	40.3	68.5	144.8	253.6				
North Coppei Creek												
NFC1	08/17	30.0	3.1	93.0	0	85.8	108.4	194.2				
NFC3	08/17	30.0	1.6	48.6	75.1	723.0	0	798.1				
NFC5	08/17	30.0	2.3	69.6	28.6	1036	562.8	1627.4				
South Coppei Creek												
SFC1	08/17	30.0	4.0	118.8	36.3 [a]	412.6	0	448.9				
SFC5	08/17	30.0	3.1	93.6	18.3	655.8	0	674.1				
Coppei Creek												
MC2	08/17	30	3.0	90.0	4.4	168.6	0	173.0				
MC3	08/17	50	3.0	148.0	4.1	160.9	0	165.0				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Table 5. Biomass of salmonids from electrofishing sites in the Walla Walla River and some of its tributaries, summer and fall 2000. Sites are listed in order from upstream to downstream.

					Biomass (g/100 m^2)							
					Rainbow/steelhead							
Stream Reach	Date	Site Length	Mean Width	Area	Age/size					Age/size		
Site Name	(mm/dd)	(m)	(m)	(m^2)	0+	1+	$8 in	Total	Other Species[b]	0+	1+	$8 in
Walla Walla River												
WW1	08/01	30.6	5.0	152.4	69.1	164.8	0	233.9				
WW3	08/01	30.0	8.4	252.6	12.2	32.3	0	44.5				
WW4	08/01	31.0	5.7	177.3	22.1	0	159.6	181.7	MTW	0	7.7	0
WW6	08/10	30.0	10.8	323.4	89.3	30.0	0	119.3	MTW	12.1	24.1	0
WW8	08/10	30.0	5.5	166.2	19.7	52.9	0	72.6				
WW9	08/10	30.0	9.8	294.0								
North Dry Creek												
NFD2	08/24	34.0	2.4	82.3	97.5	246.7	0	344.2				
NFD3	08/29	30.6	1.4	41.0	122.9	1180	0	1302.9				
NFD4	08/29	30.0	1.9	58.3	0	68.2	0	68.2				
NFD6	08/29	30.0	1.8	55.0	44.7	451.3	0	496.0				
Dry Creek												
DC1	08/29	30.0	3.8	113.4	0	480.7	0	480.7				
DC2	08/29	30.0	3.7	111.6	13.9	93.0	0	106.9				
DC3	08/30	30.0	3.0	88.8	17.0	504.0	161.5	682.5				
DC4	08/30	40.0	4.7	189.6	15.8	301.4	0	317.2				
Yellowhawk Creek												
YC1	07/18	35.0	6.2	217.7	0	11.2	98.8	110.0				
YC2	08/28	33.0	4.2	137.3	15.1	163.5	0	178.6				
YC3	08/23	105.0	4.2	437.5	6.0	241.8	48.1	295.9				
YC6	08/16	30.0	4.7	140.0	0	14.4	0	14.4				
YC7	08/28	30.0	3.9	116.4	3.9	30.2	0	34.1				
Cootonwood Creek												
CWC1	07/10	31.0	7.1	218.6	56.5	157.5	0	214.0				
CWC2	07/12	33.0	2.8	93.7	372.8	92.0	0	464.8				
CWC3	07/16	30.0	4.3	127.8	165.0	85.2	0	250.2				
CWC6	07/15	30.0	3.1	91.8	358.8	0	0	358.8				
Caldwell Creek												
CCC2	07/11	30.0	1.6	48.0	0	54.0	0	54.0				
East Little Walla Walla												
ELW1	07/17	30.0	3.9	117.0	3.3	0	0	3.3				
ELW2	07/17	30.0	3.4	102.0	0	77.3	0	77.3				
Doan Creek												
DC2	08/15	30	1.1	33.0	115.6	0	0	115.6				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; MTW = White Fish.

Electrofishing

Densities of rainbow/steelhead trout ranged from 0 to 70.7 fish per 100 m^2 at sampled sites (Tables 2 & 3). Sub–yearling (age 0+) were the most abundant age class at sites in the mainstem and lower reaches. Yearling (age 1+) rainbow/steelhead were most abundant in tributaries and upper mainstem reaches (Tables 2-6). Biomass of salmonids ranged from 0 to1,627 grams per 100m^2 (Tables 4 & 5). Rainbow/steelhead parr (age 1+) yielded the greatest biomass at most sites.

Snorkeling

Snorkeling surveys were cut short in 2000 because of high turbid flows in June.

Table 6. Densities of salmonids from snorkel surveys in the Touchet River and Walla Walla River, summer 2000. Sites are listed in order from upstream to downstream.

Stream Reach		Site Length	Mean Width	Area	Densities (#/100 m^2)							
					Rainbow/steelhead Age/size					Age/size		
Site Name	(Mo/ day)	(m)	(m)	(m^2)	0+	1+	≥ 8 in	Total	Other Species [a]	0+	1+	≥ 8 in
Touchet River												
TR2	(6/7)	75.0	17	1275	2.4	0.2	0.9	3.5				
TR6	(6/22)	93.0	20	1860	6.3	0.5	0.6	7.4	BRT	0.8	0	0.1
SF Touchet River												
SFT-8	(6/7)	100.0	7.7	770	3.0	0.8	2.5	6.3				
SFT-9	(6/7)	75.0	10.1	758	1.7	0.4	2.6	4.5	BRT			0.1
Walla Walla River												
WW1	(6/30)	134.6	8.1	1090	18.5	1.6	0.3	20.4	MTW	0.1		
WW5	(6/23)	93	17.2	1599.6	204	0.7	0.3	3.4				
WW9	(5/30)	110	13.7	1507	205	0.2	0.3	3				
WW10	(5/30)	149	13.1	1951.9	1.2	0	0	1.2				

[a] BRT = Brown Trout, MTW = Mountain whitefish.

Non–Salmonid Species Abundance and Distribution

Speckled dace and sculpins were the most common non–salmonids found at most of our sampling sites (Appendix F). Speckled dace generally did not exist at upper sites where water temperatures were relatively cool. A longnose dace was observed during electrofishing in Mill Creek. Torrent sculpin distribution was limited to mid and lower river sites, and these fish were usually found in low densities. Paiute and Margined sculpin are found throughout the basin except in the lower sections of the mainstem Walla Walla and Touchet rivers. Northern Pikeminnow are distributed in lower sections of tributaries and mainstem rivers. Tailed frogs/ tadpoles 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

Steelhead

Steelhead spawning surveys were conducted in Coppei Creek, Dry Creek, and Patit Creek in 2000 between April and late May (Table 7). Five steelhead redds were observed in the lower 2.5 miles of South Patit Creek. Four of five steelhead observed in South Patit Creek were wild and the other was unknown. The North Fork, South Fork and mainstem Coppei Creek produced a total of 31 steelhead redds in the 14.3 stream miles surveyed, averaging 2.2 redds per mile (Table 7). Three wild, two unknown, and one hatchery steelhead were observed in the Coppei system. In addition, a 435 mm hatchery female steelhead that was spawned out was captured in Coppei Creek on January 25, 2000. Five steelhead redds were observed in Dry Creek in 7.2 stream miles surveyed. Two steelhead redds were observed in North Fork Dry Creek. In Cottonwood Creek, one steelhead redd and three steelhead were observed. One steelhead was a dead wild female, one was a wild male, and one was unknown. Surveys in the North Fork, Wolf Fork, Robinson Fork, and South Fork Touchet Rivers were conducted by the Snake River Lab, Dayton.

Table 7. Steelhead spawning survey summary for some of the tributaries of the Walla Walla River in Washington State, 2000.

Reach/ date	Survey	Stream section	Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
Dry Creek							
04/19	1	River mile 32.0 to river mile 32.9	0.9	1	1.1	0	0
03/27	1	River mile 29.6 to river mile 31.6	2.0	0	0	0	0
03/29	1	River mile 27.6 to river mile 29.6	2.0	0	0	0	0
03/30	1	River mile 25.5 to river mile 26.7	1.2	0	0	0	0
03/30	1	River mile 24.4 to river mile 25.5	1.1	0	0	0	0
05/15	2	River mile 32.0 to river mile 32.9	0.9	1	1.1	0	0
04/24	2	River mile 29.6 to river mile 31.6	2.0	0	0	0	0
04/24	2	River mile 27.6 to river mile 29.6	2.0	1	0.5	0	0
04/25	2	River mile 25.5 to river mile 26.7	1.2	0	0	0	0
04/25	2	River mile 24.4 to river mile 25.5	1.1	0	0	0	0
05/23	3	River mile 29.6 to river mile 31.6	2.0	2	1.0	0	0
05/23	3	River mile 27.6 to river mile 29.6	2.0	0	0	0	0
		Total	**7.2**	**5**	**0.7**	**0**	**0**
North Dry Creek							
04/19	1	River mile 0.9 to river mile 1.4	0.5	1	2.0	0	0
05/15	1	River mile 0.0 to river mile 0.9	0.9	1	1.1	0	0
05/15	2	River mile 0.0 to river mile 0.9	0.9	0	0	0	0
		Total	**1.4**	**2**	**1.4**	**0**	**0**
Mill Creek							
05/23	1	River mile 0.0 to river mile 0.5	0.5	0	0	0	0
		Total	**0.5**	**0**	**0**	**0**	**0**

Table 7. (Continued) Steelhead spawning survey summary for some of the tributaries of the Walla Walla River in Washington State, 2000.

Reach/ date	Survey	Stream section	Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
East Little Walla Walla							
03/14	1	River mile 0.6 to river mile 1.7	1.1	0	0	2	0
04/03	2	River mile 0.6 to river mile 1.7	1.1	0	0	0	0
04/25	3	River mile 0.6 to river mile 1.7	1.1	0	0	0	0
		Total	**1.1**	**0**	**0**	**2**	**0**
West Little Walla Walla							
03/14	1	River mile 3.0 to river mile 4.1	1.1	0	0	0	0
04/03	2	River mile 3.0 to river mile 4.1	1.1	1	0.9	0	0
04/25	3	River mile 3.0 to river mile 4.1	1.1	0	0	0	0
		Total	**1.1**	**1**	**0.9**	**0**	**0**
Cottonwood Creek							
04/06	1	River mile 4.2 to river mile 5.3	1.1	0	0	0	0
04/06	1	River mile 2.5 to river mile 4.2	1.7	0	0	0	0
04/06	1	River mile 0.8 to river mile 2.5	1.7	0	0	0	0
04/25	2	River mile 4.2 to river mile 5.3	1.1	0	0	0	0
04/25	2	River mile 2.5 to river mile 4.2	1.7	1	0.6	0	0
04/25	2	River mile 0.8 to river mile 2.5	1.7	0	0	2	1
05/15	3	River mile 4.2 to river mile 5.3	1.1	0	0	0	0
05/15	3	River mile 2.5 to river mile 4.2	1.7	0	0	0	0
05/15	3	River mile 0.8 to river mile 2.5	1.7	0	0	0	0
		Total	**4.5**	**1**	**0.2**	**2**	**1**
Russell Creek							
04/06	1	River mile 6.7 to river mile 7.8	1.1	0	0	0	0
04/06	1	River mile 3.0 to river mile 5.8	2.8	0	0	0	0
		Total	**3.9**	**0**	**0**	**0**	**0**
Yellowhawk Creek							
04/25	1	River mile 0.8 to river mile 2.7	1.9	0	0	1	0
05/22	1	River mile 7.1 to river mile 8.3	1.2	0	0	0	0
05/16	2	River mile 0.8 to river mile 2.7	1.5	1	0.7	0	0
		Total	**3.1**	**1**	**0.4**	**1**	**0**

Table 7. Steelhead spawning survey summary for the Touchet River and some of its tributaries, 2000.

Reach/ date	Survey	Stream section	Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
North Fork Touchet						**Live**	**Dead**
05/11	1	River mile 7.0 to river mile 13.7	6.7	11	1.6	NA	NA
03/28	1	River mile 5.7 to river mile 6.8 (Index)	1.1	4	3.6	NA	NA
05/11	1	River mile 4.0 to river mile 5.7	1.7	3	1.8	NA	NA
03/28	1	River mile 0.4 to river mile 2.0 (Index)	1.6	1	0.6	NA	NA
05/11	1	River mile 0.0 to river mile 0.4	0.4	2	5.0	NA	NA
04/12	2	River mile 5.7 to river mile 6.8 (Index)	1.1	3	2.7	NA	NA
05/01	2	River mile 0.4 to river mile 2.0 (Index)	1.6	1	0.6	NA	NA
05/01	3	River mile 5.7 to river mile 6.8 (Index)	1.1	3	2.7	NA	NA
05/11	3	River mile 0.4 to river mile 2.0 (Index)	1.6	2	1.3	NA	NA
05/11	4	River mile 5.7 to river mile 6.8 (Index)	1.1	6	5.5	NA	NA
		Total	**11.5**	**36**	**3.1**	**0**	**0**
Touchet River							
05/11	1	River mile 53.3 to river mile 55.3	2.0	4	2.0	NA	NA
03/28	1	River mile 51.5 to river mile 53.3 (Index)	1.8	1	0.6	NA	NA
05/01	1	River mile 48.5 to river mile 51.5	3.0	5	1.7	1	0
05/11	2	River mile 51.5 to river mile 53.3 (Index)	1.8	5	2.8	NA	NA
		Total	**6.8**	**15**	**2.2**	**1**	**0**
Wolf Fork Touchet							
04/20	1	River mile 0.0 to river mile 10.0	10	19	1.9	NA	NA
03/28	1	River mile 2.8 to river mile 5.1 (Index)	2.3	4	1.7	NA	NA
05/04	2	River mile 0.0 to river mile 10.0	10	11	1.1	NA	NA
04/06	2	River mile 2.8 to river mile 5.1 (Index)	2.3	0	0	NA	NA
04/20	3	River mile 2.8 to river mile 5.1 (Index)	2.3	6	2.6	NA	NA
05/02	4	River mile 2.8 to river mile 5.1 (Index)	2.3	2	0.9	NA	NA
		Total	**10**	**42**	**4.2**	**0**	**0**
Robinson Fork Touchet							
05/15	1	River mile 3.5 to river mile 5.5	2.0	4	2.0	NA	NA
04/21	1	River mile 1.5 to river mile 3.5 (Index)	2.0	5	2.5	NA	NA
04/06	1	River mile 0.0 to river mile 1.5 (Index)	1.5	0	0	NA	NA
05/04	2	River mile 1.5 to river mile 3.5 (Index)	2.0	2	1.0	NA	NA
04/13	2	River mile 0.0 to river mile 1.5 (Index)	1.5	2	1.3	NA	NA
04/21	3	River mile 0.0 to river mile 1.5 (Index)	1.5	2	1.3	NA	NA
05/04	4	River mile 0.0 to river mile 1.5 (Index)	1.5	1	0.7	NA	NA
		Total	**5.5**	**16**	**2.9**	**0**	**0**

Table 7. (Continued) Steelhead spawning survey summary for the Touchet River and some of its tributaries, 2000.

Reach/ date	Survey	Stream section	Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
South Fork Touchet							
05/02	1	River mile 12.7 to river mile 14.7	2.0	6	3.0	NA	NA
05/02	1	River mile 9.7 to river mile 11.7	2.0	7	3.5	NA	NA
05/02	1	River mile 7.7 to river mile 8.7	1.0	2	2	NA	NA
03/27	1	River mile 5.0 to river mile 7.0 (Index)	2.0	3	1.5	NA	NA
03/27	1	River mile 2.0 to river mile 4.0 (Index)	2.0	2	1	NA	NA
04/10	2	River mile 5.0 to river mile 7.0 (Index)	2.0	3	1.5	NA	NA
04/10	2	River mile 2.0 to river mile 4.0 (Index)	2.0	6	3.0	NA	NA
05/01	3	River mile 5.0 to river mile 7.0 (Index)	2.0	2	1.0	NA	NA
05/01	3	River mile 2.0 to river mile 4.0 (Index)	2.0	1	0.5	NA	NA
		Total	**11.0**	**32**	**2.9**	**0**	**0**
Lewis Creek							
04/25	1	River mile 1.2 to river mile 2.1	0.9	0	0	0	0
04/25	1	River mile 0.0 to river mile 1.2	1.2	0	0	0	0
		Total	**2.1**	**0**	**0**	**0**	**0**
Jim Creek							
05/01	1	River mile 0.0 to river mile 0.3	0.3	0	0	0	0
		Total	**0.3**	**0**	**0**	**0**	**0**
South Patit Creek							
05/01	1	River mile 2.1 to river mile 3.6	1.5	3	2.0	5	0
05/01	1	River mile 1.1 to river mile 2.1	1.0	1	1.0	0	0
05/19	1	River mile 2.1 to river mile 3.6	1.5	1	0.7	0	0
05/19	1	River mile 1.1 to river mile 2.1	1.0	0	0	0	0
		Total	**2.5**	**5**	**2**	**5**	**0**
North Coppei Creek							
03/29	1	River mile 3.6 to river mile 5.1	1.5	0	0	0	0
03/29	1	River mile 2.5 to river mile 3.6	1.1	0	0	0	0
03/22	1	River mile 0.8 to river mile 1.4	0.6	2	3.3	0	0
03/22	1	River mile 0.0 to river mile 0.8	0.8	1	1.3	1	0
04/18	2	River mile 3.6 to river mile 5.1	1.5	0	0	0	0
04/18	2	River mile 2.5 to river mile 3.6	1.1	0	0	0	0
04/18	2	River mile 0.8 to river mile 1.4	0.6	0	0	0	0
04/18	2	River mile 0.0 to river mile 0.8	0.8	0	0	0	0
05/10	2	River mile 3.6 to river mile 5.1	1.5	0	0	0	0
05/10	2	River mile 2.5 to river mile 3.6	1.1	0	0	0	0
05/10	2	River mile 0.8 to river mile 1.4	0.6	0	0	0	0
05/10	2	River mile 0.0 to river mile 0.8	0.8	1	1.3	0	0
		Total	**4.0**	**4**	**1.0**	**1**	**0**

Table 7. (Continued) Steelhead spawning survey summary for the Touchet River and some of its tributaries, 2000.

Reach/ date	Survey	Stream section	Miles	Redds	Redds per mile	Fish Observed Live	Fish Observed Dead
South Coppei Creek							
03/30	1	River mile 4.3 to river mile 4.9	0.6	1	1.7	0	0
03/21	1	River mile 3.2 to river mile 4.3	1.1	1	0.9	0	0
03/21	1	River mile 2.1 to river mile 3.2	1.1	1	0.9	0	0
03/21	1	River mile 0.0 to river mile 2.1	2.1	0	0	0	0
04/18	2	River mile 4.3 to river mile 4.9	0.6	0	0	0	0
04/18	2	River mile 3.2 to river mile 4.3	1.1	3	2.7	0	0
04/18	2	River mile 2.1 to river mile 3.2	1.1	3	2.7	0	0
04/18	2	River mile 0.0 to river mile 2.1	2.1	2	1.0	0	0
05/10	3	River mile 3.2 to river mile 4.3	1.1	0	0	0	0
05/10	3	River mile 2.1 to river mile 3.2	1.1	0	0	0	0
05/10	3	River mile 0.0 to river mile 2.1	2.1	5	2.4	0	0
		Total	**4.9**	**16**	**3.3**	**0**	**0**
Coppei Creek							
03/22	1	River mile 6.1 to river mile 7.2	1.1	0	0	0	0
03/27	1	River mile 4.6 to river mile 6.1	1.5	2	1.3	0	0
03/27	1	River mile 3.1 to river mile 4.6	1.5	0	0	4	0
03/30	1	River mile 1.8 to river mile 3.1	1.3	0	0	0	0
04/07	2	River mile 6.1 to river mile 7.2	1.1	5	4.5	1	0
04/19	2	River mile 4.6 to river mile 6.1	1.5	0	0	0	0
04/04	2	River mile 3.1 to river mile 4.6	1.5	0	0	0	0
04/19	2	River mile 1.8 to river mile 3.1	1.3	0	0	0	0
04/19	3	River mile 6.1 to river mile 7.2	1.1	2	1.8	0	0
05/15	3	River mile 4.6 to river mile 6.1	1.5	1	0.7	0	0
05/16	3	River mile 3.1 to river mile 4.6	1.5	0	0	0	0
05/15	3	River mile 1.8 to river mile 3.1	1.3	0	0	0	0
05/16	4	River mile 6.1 to river mile 7.2	1.1	1	0.9	0	0
		Total	**5.4**	**11**	**2.0**	**5**	**0**

Bull Trout

Bull trout spawning surveys were conducted in the upper Wolf Fork Touchet in 2000 (Table 8). Water temperatures in the Wolf Fork during bull trout spawning season were generally in the low to mid 40's (EF). A total of 48 bull trout and 64 redds were observed between river mile 7.3 and river mile 12.8. Redd counts in the Wolf Fork from 1990-2000 are presented in Figure 12.

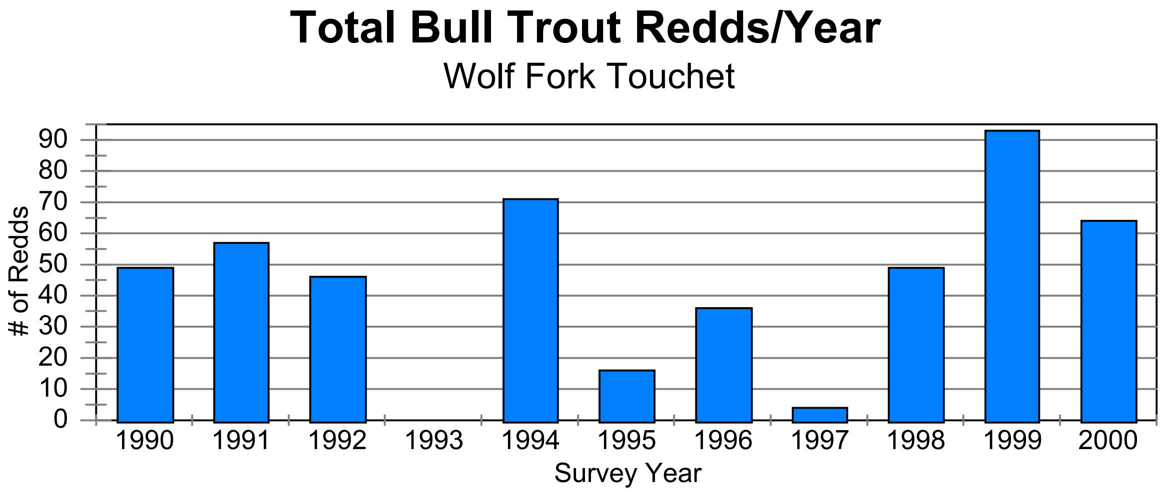
In 2000, we also surveyed the Burnt Fork Touchet from its headwaters downstream to determine bull trout spawning distribution (Table 9.). Spawning distribution was limited to the lower 2.5 miles of the stream. A total of 4 redds and 6 bull trout were observed .

Table 8. Bull trout spawning survey summary for the Wolf Fork of the Touchet River, 2000.

Reach/date	Survey	Stream section	Miles	Redds	Redds per mile
9/8	1	(A) River mile 11.3 to river mile 12.8	1.5	1	0.7
9/8	1	(B) River mile 10.3 to river mile 11.3	1.0	7	7
9/8	1	(C) River mile 9.6 to river mile 10.3	0.7	15	21.4
9/8	1	(D) River mile 8.7 to river mile 9.6	0.9	3	3.3
9/21	2	(A) River mile 11.3 to river mile 12.8	1.5	1	0.7
9/21	2	(B) River mile 10.3 to river mile 11.3	1.0	7	7
9/21	2	(C) River mile 9.6 to river mile 10.3	0.7	11	15.7
9/21	2	(D) River mile 8.7 to river mile 9.6	0.9	3	3.3
9/21	2	(E) River mile 7.3 to river mile 8.7	1.4	1	0.7
10/10	3	(A) River mile 11.3 to river mile 12.8	1.5	1	0.7
10/10	3	(B) River mile 10.3 to river mile 11.3	1.0	3	3
10/10	3	(C) River mile 9.6 to river mile 10.3	0.7	4	5.7
10/10	3	(D) River mile 8.7 to river mile 9.6	0.9	1	1.1
10/10	3	(E) River mile 7.3 to river mile 8.7	1.4	1	0.7
10/23	4	(B) River mile 10.3 to river mile 11.3	1.0	0	0
10/23	4	(C) River mile 9.6 to river mile 10.3	0.7	3	4.3
10/23	4	(D) River mile 8.7 to river mile 9.6	0.9	0	0
10/23	4	(E) River mile 7.3 to river mile 8.7	1.4	2	1.4
			5.5	**64**	**11.6**

Table 9. Bull trout spawning survey summary for the Burnt Fork of the Touchet River, 2000.

Reach/date	Survey	Stream section	Miles	Redds	Redds per mile
9/12	1	River mile 3.0 to river mile 1.5	1.5	1	0.67
9/27	2	River mile 3.0 to river mile 2.0	1.0	0	0
10/16	3	River mile 3.0 to river mile 2.0	1.0	0	0
10/16	3	River mile 2.0 to river mile 0.0	2.0	3	1.5
			3.0	**4**	**1.3**



	Reach Surveyed [a]						
	A	B	C	D	E	F	
Year	River Mile 12.8 - 11.3	River Mile 11.3 - 10.3	River Mile 10.3 - 9.6	River Mile 9.6 - 8.7	River Mile 8.7 - 7.3	River Mile 7.3 - 6.8	Total Redds
1990		18	31				49
1991		20	37				57
1992			46				46
1993[b]							0
1994			71				71
1995			16				16
1996			36				36
1997[c]					4		4
1998	11	7	18	12	0		48
1999	32	14	34	11	2		93
2000	3	17	33	7	4		64

a. A: RM 11.3 = USFS boundary, B: RM 10.3 = Tate Cr., C: RM 9.6 = Newby's ford, D: RM 8.7 = second bridge down, E: RM 7.3 = Whitney Cr., F: RM 6.8 = County bridge.
b. No survey.
c. One survey done late in October and too far down stream.

Figure 12. Bull trout spawning survey summary for the Wolf Fork of the Touchet River, 1990-2000.

In 2000, WDFW participated with the USFS in a bull trout spawning survey of the North Fork Touchet River. Thirty-six bull trout and 43 redds were observed between Bluewood Creek and Spangler Creek. The Forest Service has been conducting bull trout spawning surveys since 1994 on the North Fork Touchet, during which time redd numbers have steadily increased (Figure 13).

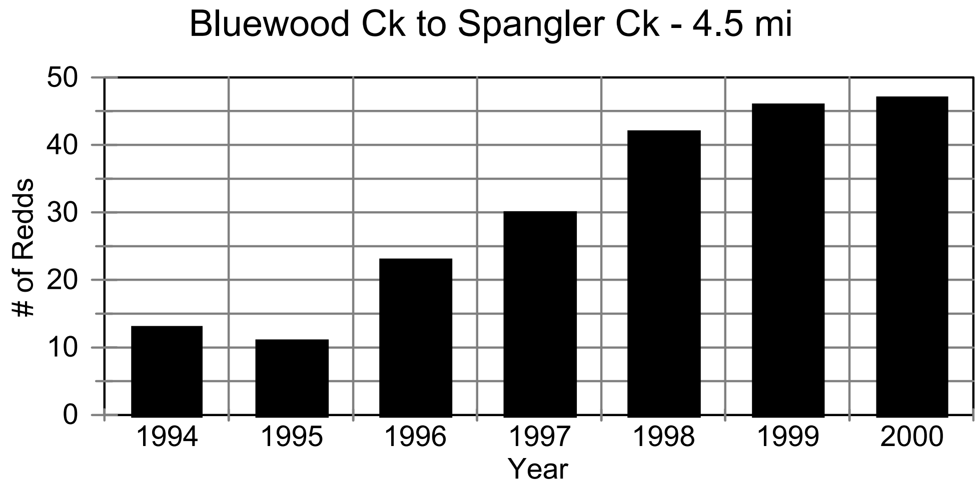


Figure 13. Bull trout redd counts for the North Fork Touchet, 1994-2000

Genetic Sampling

Fin clips were collected from a total of 103 bull trout during the 2000 season; 14 adult bull trout were collected from the trap at Nursery Bridge in Oregon, 21 adult bull trout from the trap on the Touchet River in Dayton, Washington, and 50 adult bull trout were collected at the Mill Creek watershed intake dam in Oregon. Eighteen other bull trout samples were collected from adults and juveniles during electrofishing surveys.

Fin clip or opercle punch tissue samples were collected from 45 adult steelhead in the Walla Walla basin during the 2000 season; 30 from the trap at Dayton Touchet River, 11 from WDFW trap on Yellowhawk Creek, 2 from Coppei Creek and 2 from Cottonwood Creek..

Tissue samples were collected for 180 juvenile rainbow/steelhead trout using electrofishing equipment; 60 fish from the North Fork Touchet, 60 fish from the Robinson Fork Touchet, and 60 fish from Coppei Creek. Fish were collected only if they were approximately age 1+ or older ($\geq$ 80 mm). We collected no more than 6 fish each from several sites to minimize the chances of collecting siblings.

Tissue samples were collected from a total of 38 mountain whitefish in the Walla Walla basin in 2000; 20 from Mill Creek at the watershed intake dam, 15 from the Touchet River at the Dayton trap, and 3 from the Walla Walla River below Burlingame dam during electrofishing sampling.

Some of the genetic samples were sent to the WDFW Genetics Stock Identification Lab for DNA analysis; others are being held at the fish management office in Dayton.

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). Am. Fish. Soc. Special Pub. 19.

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. 94 pages.

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. Washington Department of Wildlife, Olympia. 25 pages plus extensive appendices.

Mendel, G., V. Naef, and D. Karl. 1999. Assessment of Salmonid Fishes and their Habitat Condiditons in the Walla Walla River Basin - 1998 Annual Report. Report to BPA. Project 98-20. Report # FPA 99-01. 94 pages.

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

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

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, 47 pages, plus appendices.

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, Idaho Fish and Game, Boise. 49pp 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. GTR.INT-138. 70 pages.

US Army Corps of Engineers (ACOE) 1992. Walla Walla River Basin, Oregon and Washington: reconnaissance report. Walla Walla. 43 pages, plus extensive appendices.

US Army Corps of Engineers (ACOE) 1997. Walla Walla River Watershed, Oregon and Washington: reconnaissance report. Walla Walla. 78 pages, plus extensive appendices.

Van Deventer, 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 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.

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

Appendix A. Study Sites, 2000

Appendix A. Table 1. Touchet River and tributary study sites, 2000.

Reach	Site #	RM[a]	Location	Sample Type[b]	Comments
NF Touchet River	NFT-1	18.4	T7N,R40E,Sect 5,SE¼,SE¼	EQ,T	Bluewood culvert
	NFT-2	17.0	T7N,R40E,Sect 5,SW¼,NE¼	EL	3.3 mi above Spangler
	NFT-3	16.6	T7N,R40E,Sect 5,NE¼,SW¼	EL,EQ	3.0 mi above Spangler turn
	NFT-4	16.0	T8N,R40E,Sect 33,SW¼,SE¼	EL	2.3 mi above Spangler turn
	NFT-5	15.6	T8N,R40E,Sect 33,SW¼,NE¼	EL	1.8 mi above Spangler turn
	NFT-6	15.3	T8N,R40E,Sect 33,NE¼,SW¼	EQ	1.5 mi above Spangler turn
	NFT-7	13.7	T8N,R40E,Sect 21,SE¼,SE¼	T,F[c]	Spangler mouth
	NFT-8	12.7	T8N,R40E,Sect 16,SE¼,SW¼	EQ	Hompegg Falls
	NFT-9	10.7	T8N,R40E,Sect 5,SE¼,SE¼	EQ	Just below Lewis Ck mouth
	NFT-10	9.3	T8N,R40E,Sect 6,NE¼,NE¼	EQ	blue mailbox
	NFT-11	7.5	T9N,R40E,Sect 30,NE¼,SW¼	EQ,T,F[c]	Jim Ck mouth
	NFT-12	5.7	T9N,R39E,Sect 24,NE¼,NW¼	EQ	1.6 mi above Wolf Fk turn
	NFT-13	4.4	T9N,R39E,Sect 12,SW¼,SW¼	EQ	0.3 mi above Wolf Fk turn
	NFT-14	3.1	T9N,R39E,Sect 3,SE¼,SE¼	EQ	Orchard
	NFT-15	2.1	T9N,R39E,Sect 3,SW¼,NE¼	EQ	Vernon Rd
	NFT-16	1.6	T9N,R39E,Sect 3,NW¼,NW¼	EQ,T,F[c]	Above Baileysburg
	NFT-17	0	T10N,R39E,Sect 32,SE¼,NW¼	EQ	Just above confluence
Corral Ck	CC-1	0.6	T7N,R40E,Sect 17,NW¼,SW¼	EL	2nd stream crossing
	CC-2	0.2	T7N,R40E,Sect 18,NE¼,NE¼	EL	5 min above 1st site
	CC-3	0.1	T7N,R40E,Sect 7,SE¼,SE¼	EL,F	1st stream crossing
Spangler Ck	SC-1	1.5	T8N,R40E,Sect 34,NE¼,NW¼	EQ	Top site
	SC-2	1.2	T8N,R40E,Sect 34,NE¼,NW¼	EQ	Site 3
	SC-3	1.2	T8N,R40E,Sect 34,NE¼,NW¼	EQ	Site 2
	SC-4	1.0	T8N,R40E,Sect 27,SE¼,SW¼	EQ	1 mi above Spangler mouth
	SC-5	0.3	T8N,R40E,Sect 27,NW¼,NW¼	EQ	0.3 mi above Spangler mouth
	SC-6	0.2	T8N,R40E,Sect 28,NE¼,NE¼	EQ,T,F[c]	0.2 mi above Spangler mouth
Patrick Sp Ck	PSC-1	0.1	T8N,R40E,Sect 27,NW¼,SE¼	EL	~100 yards above mouth
Lewis Ck	LC-1	3.8	T8N,R40E,Sect 14,SW¼,NW¼	EQ	Top/Headwaters
	LC-2	3.5	T8N,R40E,Sect 14,NW¼,NW¼	EQ	0.3 mi down from top
	LC-3	3.1	T8N,R40E,Sect 11,SW¼,SW¼	EQ	0.7 mi down from top
	LC-4	2.8	T8N,R40E,Sect 11,SW¼,NW¼	EQ	1.7 mi above FS line
	LC-5	2.4	T8N,R40E,Sect 10,NE¼,SE¼	EQ	1.3 mi above FS line
	LC-6	1.9	T8N,R40E,Sect 11,SW¼,NW¼	EQ	0.8 mi above FS line
	LC-7	1.7	T8N,R40E,Sect 3,SE¼,SW¼	EQ	0.7 mi above FS line
	LC-8	1.6	T8N,R40E,Sect 3,SE¼,SW¼	EQ	0.5 mi above FS line
	LC-9	1.4	T8N,R40E,Sect 3,SW¼,NW¼	EQ	0.2 mi above FS line
	LC-10	0.4	T8N,R40E,Sect 9,NW¼,NE¼	EQ	1st bridge
	LC-11	0.2	T8N,R40E,Sect 9,NW¼,NW¼	EQ	0.1 mi above NF Touchet Rd
	LC-12	0.1	T8N,R40E,Sect 9,NW¼,NW¼	EQ,T,F[c]	At NF Touchet R bridge
Jim Creek	JC-1	0.1	T9N,R40E,Sect30,NE¼,NE¼	T,F	Below culvert
Hatley Gulch	HG-1	0.7	T9N,R39E,Sect 2,SE¼,SE¼	EL	Hatley Gulch Rd
Johnson	JH-1	1.0	T10N,R39E,Sect 18,SE¼,NW¼	EL	Eager Rd

[a] River mile.
[b] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[c] Index discharge sites.
[d] Sites electrofished by Snake River Lab personnel.

Appendix A. Table 1. Touchet River and tributary study sites, 2000 (continued).

Reach	Site #	RM[a]	Location	Sample Type[b]	Comments
Davis Hollow	DH-1	0.3	T10N,R39E,Sect 32,SE¼,NE¼	EL	Baileysburg
Cougar Canyon	CC-1	0.1	T10N,R40E,Sect 20,SW¼,SE¼	EL	Up Cougar Canyon Rd
Mustard Hollow	MH-1	0.5	T10N,R39E,Sect29,NW¼,SE¼	EL	By cemetary
Wolf Fork	WF-1	13.2	T7N,R39E,Sect 12,SW¼,NW¼	EL [d]	1.5 mi above FS line
	WF-2	12.7	T7N,R39E,Sect 12,NW¼,SE¼	EQ [d]	0.3 mi below meadow
	WF-3	11.8	T7N,R39E,Sect 1,NW¼,SW¼	EQ [d]	0.5 mi below FS line
	WF-4	11.1	T8N,R39E,Sect 36,SE¼,NW¼	EQ [d]	1.0 mi above Green Fly
	WF-5	10.0	T8N,R39E,Sect 25,NE¼,SW¼	T,F,W,EQ [d]	Below Green Fly Canyon
	WF-6	7.6	T8N,R40E,Sect 18,NW¼,NW¼	EQ [d]	Upstream of Whitney Ck
	WF-7	6.6	T8N,R39E,Sect 12,NE¼,NE¼	EQ [d]	Below Coates Ck
	WF-8	5.2	T9N,R39E,Sect 36,SE¼,NW¼	EQ [d]	3rd brg above Robinson Fk
	WF-9	4.0	T9N,R39E,Sect 25,SE¼,NW¼	T,F [c]	2nd bridge
	WF-10	3.2	T9N,R39E,Sect 25,NW¼,NW¼	EQ [d]	0.2 mi above Robinson Fk
	WF-11	1.7	T9N,R39E,Sect 23,NW¼,NW¼	F[c],T,EQ [d]	Holmberg Rd Bridge
	WF-12	0	T9N,R39E,Sect 11,NE¼,SW¼	EQ [d]	Just above mouth
Coates Creek	C-1	0.1	T8N,R40E,Sect 7,SW¼,NE¼	T,F [c]	Above Rd
Whitney Creek	WH-1	3.5	T8N,R40E,Sect 30,NW¼,NE¼	EL	Headwaters to FS line
	WH-2	0.3	T8N,R40E,Sect 18,NW¼,NE¼	T,W,F [c]	0.2 mi above Wolf Fk Rd.
Robinson Fork	RF-1	7.1	T8N,R39E,Sect 27,NW¼,SE¼	EL	Robinson Fk tributaries
	RF-2	6.6	T8N,R39E,Sect 22,SW¼,SW¼	EL	5.5 mi above Broughton
	RF-3	6.3	T8N,R39E,Sect 22,NW¼,NW¼	EQ,T,W,F [c]	6.3 mi up Robinson Fk Rd
	RF-4	6.1	T8N,R39E,Sect 22,NW¼,SW¼	EL	5.0 mi above Broughton
	RF-5	5.6	T8N,R39E,Sect 22,NW¼,NE¼	EL	4.5 mi above Broughton
	RF-6	5.1	T8N,R39E,Sect 15,SW¼,NE¼	EL	4.0 mi above Broughton
	RF-7	4.6	T8N,R39E,Sect 15,NE¼,NW¼	EL	3.5 mi above Broughton
	RF-8	4.5	T8N,R39E,Sect 15,NE¼,NE¼	EL	Up Robinson tributary
	RF-9	4.4	T8N,R39E,Sect 22,NW¼,NE¼	EL	3.0 mi above Broughton
	RF-10	4.2	T8N,R39E,Sect 15,SW¼,SE¼	EL	2.5 mi above Broughton
	RF-11	3.8	T8N,R39E,Sect 10,NE¼,SE¼	EQ	1.9 mi above Broughton
	RF-12	3.2	T8N,R39E,Sect 2,SW¼,SW¼	EL	2.0 mi above Broughton
	RF-13	2.3	T8N,R39E,Sect 2,NW¼,NE¼	EL,EQ	1st bridge above gate
	RF-14	1.5	T9N,R39E,Sect 35,NE¼,SW¼	T,W,F [c]	Below Robinson Fk bridge
SF Touchet River	SFT-1	16.6	T7N,R39E,Sect 8,SW¼,SW¼	EQ [d]	FS line
	SFT-2	13.4	T8N,R39E,Sect 31,SE¼,SE¼	EQ [d]	Below Griffin Fk
	SFT-3	9.2	T8N,R39E,Sect 8,SE¼,NW¼	EQ [d]	Mile post 9
	SFT-4	7.2	T9N,R39E,Sect 32,SE¼,SE¼	EQ [d]	Mile post 7
	SFT-5	6.9	T9N,R39E,Sect 32,SE¼,NE¼	EQ	6.5 mi up SF Touchet Rd
	SFT-6	5.0	T9N,R39E,Sect 28,NW¼,NE¼	EQ [d]	Below powerlines
	SFT-7	3.0	T9N,R39E,Sect 16,NE¼,NW¼	EQ [d]	1st bridge up SFT Rd
	SFT-8	0.4	T10N,R39E,Sect 32,SE¼,SW¼	S,EQ [d]	0.1 mi above Gephart Rd
	SFT-9	0.3	T10N,R39E,Sect 32,SE¼,SW¼	T,F [c],W,S	Gephart Rd

[a] River mile.
[b] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[c] Index discharge sites.
[d] Sites electrofished by Snake River Lab personnel.

Appendix A. Table 1. Touchet River and tributary study sites, 2000 (continued).

Reach	Site #	RM[a]	Location	Sample Type[b]	Comments
SF Patit Creek	SFP-1	6.7	T10N,R40E,Sect 25,SE¼,SE¼	T,W,F [c]	End of Road
	SFP-2	3.5	T10N,R40E,Sect 22,SE¼,SW¼	T	Blue Gate
	SFP-3	1.1	T10N,R40E,Sect 22,SE¼,SW¼	EL	1.2 mi up SF Patit Rd
Touchet River	TR-1	54.5	T10N,R39E,Sect 32,NW¼,SW¼	EQ,S	N & S fork confluence
	TR-2	54.0	T10N,R39E,Sect 30,SE¼,SE¼	S	Above intake
	TR-3	53.8	T10N,R39E,Sect 30,SE¼,SE¼	T,S	Snake River Lab
	TR-4	53.5	T10N,R39E,Sect 30,SE¼,NW¼	EQ,F [c]	Flag pole
	TR-5	52.3	T10N,R38E,Sect 25,SE¼,NW¼	EQ	Sewer plant
	TR-6	48.4	T9N,R38E,Sect 4,NW¼,SW¼	S,T	L & C State Park
	TR-7	40.5	T9N,R37E,Sect 8,NW¼,SW¼	T,F [c]	Bolles Br.
	TR-8	27.4	T9N,R35E,Sect 5,NW¼,SW¼	T	Lamar Rd
	TR-9	11.3	T8N,R33E,Sect 23,SW¼,NE¼	T,F[c],G,W	Below Simms Rd. Br.
	TR-10	1.5	T8N,R33E,Sect 27,SE¼,NW¼	T,F[c],G	Cummins Bridge
South Fork Coppei	SFC-1	4.8	T8N,R38E,Sect 33,NW¼,NE¼	EQ	Below Barnes Rd./Ck
	SFC-2	3.5	T8N,R38E,Sect 22,NE¼,NE¼	EL	Geir Road
	SFC-3	3.2	T8N,R38E,Sect 20,SE¼,SE¼	T,F[c]	Canyon Culvert
	SFC-4	1.1	T8N,R38E,Sect 18,NW¼,NE¼	EL	1 mi above Walker Rd Brg
	SFC-5	0.8	T8N,R38E,Sect 18,NW¼,NE¼	EQ	Walker Rd Bridge
North Fork Coppei	NFC-1	5.2	T8N,R38E,Sect 27,SE¼,NE¼	EQ	DNR gate
	NFC-2	3.3	T8N,R38E,Sect 21,NE¼,NW¼	EL	2.1 mi below DNR gate
	NFC-3	1.1	T8N,R38E,Sect 8,SW¼,SE¼	EQ	Power lines
	NFC-4	0.8	T8N,R38E,Sect 8,SW¼,NW¼	EL,T,F [c]	Grain Elevators
	NFC-5	0.1	T8N,R38E,Sect 7,NW¼,NW¼	EQ	Forks Bridge
Mainstem Coppei	MC-1	4.0	T9N,R37E,Sect 24,NW¼,SW¼	EL	0.5 mi below McCowen Brg
	MC-2	5.8	T9N,R37E,Sect 36,SE¼,SW¼	EL	Below power lines
	MC-3	4.6	T9N,R37E,Sect 25,SW¼,SE¼	EQ,T,F [c]	Above McCowen Rd. Br
	MC-4	1.8	T9N,R37E,Sect 14,NW¼,SE¼	EQ,EL	Below Meinberg Rd. Br.
Dry Creek	DC-1	31.2	T7N,R38E,Sect 18,NW¼,NW¼	EQ	Biscuit Ridge bridge
	DC-2	29.4	T7N,R37E,Sect 1,SW¼,SW¼	EQ	1.5 mi below Biscuit Rd Br
	DC-3	28.8	T7N,R37E,Sect 1,SW¼,NW¼	EQ	2.1 mi up Biscuit Ridge Rd
	DC-4	27.3	T8N,R37E,Sect 35,NE¼,NW¼	EQ,T,F[c],W	0.5 mi up Biscuit Ridge Rd
	DC-5	17.4	T7N,R36E,Sect 21,SW¼,NE¼	T	Low Waitsburg Rd. Bridge
	DC-6	3.4	T7N,R34E,Sect 22,SE¼,NE¼	T	Talbott Rd Bridge
Burnt Fork	BF-1	2.8	T7N,R39E,Sect 16,NE¼,SW¼	EL	Just below trib fork
	BF-2	2.4	T7N,R39E,Sect 16,NW¼,NE¼	EL	0.4 mi below trib fork
	BF-3	2.3	T7N,R39E,Sect 16,NW¼,NW¼	EQ	Just above FS line
N Fork Dry Crk	NFD-1	4.8	T7N,R38E,Sect 23,SE¼,NW¼	EL	End of road
	NFD-2	1.7	T7N,R38E,Sect 10,NW¼,NE¼	EQ	4th stream crossing
	NFD-3	1.1	T7N,R38E,Sect 9,NE¼,NW¼	EQ	3rd stream crossing
	NFD-4	0.8	T7N,R38E,Sect 9,NW¼,SE¼	EQ	0.8 mi up Scott Rd
	NFD-5	0.4	T7N,R38E,Sect 8,NE¼,SE¼	T,F[c]	0.4 mi up Scott Rd
	NFD-6	0.0	T7N,R38E,Sect 8,SE¼,NW¼	EQ	NFD & SFD confluence

[a] River mile.
[b] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[c] Index discharge sites.
[d] Sites electrofished by Snake River Lab personnel.

Appendix A. Table 2. Walla Walla River and tributary study sites, 2000 (continued).

Reach	Site #	RM[a]	Location	Sample Type[b]	Comments
Mill Ck	MC-1	11.5	T7N,R36E,Sect 13,SW¼,SE¼	EL	Rooks Park
	MC-2	11.4	T7N,R36E,Sect 13,SW¼,SW¼	EL	Below Rooks Park
	MC-3	10.6	T7N,R36E,Sect 23,NE¼,NW¼	EL	two weirs above diversion
	MC-4	10.5	T7N,R36E,Sect 23,NE¼,NW¼	EL	Above diversion
	MC-5	10.4	T7N,R36E,Sect 23,NE¼,NW¼	EL	At diversion
	MC-6	10.4	T7N,R36E,Sect 23,NW¼,NW¼	EL	Below diversion
	MC-7	10.3	T7N,R36E,Sect 23,NW¼,NW¼	EL	Across from WWCC
	MC-8	10.1	T7N,R36E,Sect 23,NW¼,NW¼	EL	Below Titus Ck mouth
	MC-9	8.9	T7N,R36E,Sect 22,SW¼,NW¼	EL	Above Wilbur Rd bridge
	MC-10	8.1	T7N,R36E,Sect 21,SW¼,NW¼	F	Wildwood Park
	MC-11	6.7	T7N,R36E,Sect 19,SE¼,SE¼	EL	9th street bridge
	MC-12	6.7	T7N,R36E,Sect 19,SE¼,SE¼	EL	9th street to Roosevelt
	MC-13	6.6	T7N,R36E,Sect 19,SE¼,SE¼	F	Below 9th street bridge
	MC-14	4.8	T7N,R35E,Sect 24,SW¼,SW¼	EL	Above Gose St bridge
	MC-15	4.7	T7N,R35E,Sect 24,SW¼,SW¼	EL	Below Gose St bridge
	MC-16	4.1	T7N,R35E,Sect 26,NW¼,NW¼	EL,EQ	2.2 mi above Wallula Br
	MC-17	3.7	T7N,R35E,Sect 26,NE¼,SW¼	EL	1.4 mi above Wallula Br
	MC-18	3.3	T7N,R35E,Sect 27,NW¼,SE¼	EL	0.9 mi above Wallula Br
	MC-19	2.7	T7N,R35E,Sect 28,SE¼,NE¼	EL	Wallula Rd bridge
	MC-20	1.2	T7N,R35E,Sect 32,NE¼,NW¼	EQ	0.2 mi below Last Chance Rd
	MC-21	0.4	T7N,R35E,Sect 32,SW¼,NW¼	EQ,F[c]	Swegle Rd
Titus Ck	TC-1	0.3	T7N,R36E,Sect 14,SE ¼,SW¼	EL,F	Above WWCC boundary
	TC-2	0.2	T7N,R36E,Sect 23,NW¼,NE¼	EL	WWCC nursing building
	TC-3	0.1	T7N,R36E,Sect 23,NW¼,NE¼	EL	Footbridge at WWCC
Walla Walla R	WW-1	39.7	T6N,R35E,Sect 13,NW¼,NW¼	EQ,S	Below Birch Ck mouth
	WW-2	39.6	T6N,R35E,Sect 13,NW¼,NW¼	W,T,F[c],G	Pepper Bridge Rd Br
	WW-3	38.1	T6N,R35E,Sect 11,NW¼,NE¼	EQ,EL	Above Yellowhawk mouth
	WW-4	37.2	T6N,R35E,Sect 3,SE¼,SW¼	EQ,F[c]	0.5 mi above Burlingame
	WW-5	36.7	T6N,R35E,Sect 3,SW¼,SW¼	S	Burlingame Diversion
	WW-6	36.5	T6N,R35E,Sect 3,SW¼,NW¼	EQ,F[c],W,G,T	Below Mojonnier Rd.
	WW-7	35.4	T6N,R35E,Sect 4,NW¼,SW¼	W	Above Last Chance Rd Br
	WW-8	34.0	T7N,R35E,Sect 32,SW¼,SW¼	EQ,T,F[c]	Below Swegle Rd Br
	WW-9	32.9	T7N,R35E,Sect 31,SW¼,NW¼	S,T,F[c],W,G	Above Detour Rd Br
	WW-10	29.3	T7N,R34E,Sect 34,NW¼,NW¼	S,T,F[c]	Above McDonald Rd Br
	WW-11	22.7	T7N,R33E,Sect 3,NW¼,SE¼	T	Touchet-Gardena Rd
Birch Ck	BC-1	0.1	T6N,R35E,Sect13,NW¼,NW¼	F	At mouth Walla Walla R.
W. Little Walla	WLW-1	4.1	T6N,R35E,Sect 9,SE¼,NW¼	EL,F[c]	0.6 mi up Valley Chapel Rd
	WLW-2	3	T6N,R35E,Sect 5,SE¼,SE¼	EL,F	Frog Hollow Rd
	WLW-3	0.7	T6N,R35E,Sect 5,NW¼,NW¼	EL	East of Swegle Rd
	WLW-4	0.6	T7N,R35E,Sect 31,SE¼,SE¼	EL	West of Swegle Rd
E. Little Walla	ELW-1	1.5	T6N,R35E,Sect 14,SE¼,SE¼	EQ,F[c]	At river fork
	ELW-2	1.0	T6N,R35E,Sect 11,NW¼,NW¼	EQ	0.5 mi below river fork
	ELW-3	0.6	T6N,R35E,Sect 10,SE¼,SE¼	EQ	Springdale Rd Bridge
	ELW-4	0.2	T6N,R35E,Sect 10,NW¼,NW¼	EL	Upstream of mouth

[a] River mile.
[b] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[c] Index discharge sites.

Appendix A. Table 2. Walla Walla River and tributary study sites, 2000 (continued).

Reach	Site #	RM[a]	Location	Sample Type[b]	Comments
Garrison Ck	GC-1	9.1	T7N,R36E,Sect 23,NW¼,NE¼	T,F[c]	Below Mill Ck diversion
	GC-2	7.2	T7N,R36E,Sect 28,NE¼,NW¼	EL	Pioneer High School
	GC-3	5.4	T7N,R36E,Sect 29,SW¼,NW¼	EL	Garrison School
	GC-4	4.4	T7N,R36E,Sect 31,NW¼,NW¼	EL	Fort Walla Walla
	GC-5	3.5	T7N,R35E,Sect 36,SW¼,NE¼	EL	Lyon's Park
	GC-6	0.3	T6N,R35E,Sect 3,NW¼,SW¼	F[c]	Mojonnier Rd culvert
	GC-7	0.1	T6N,R35E,Sect 4,SE¼,NE¼	EL	Culvert to mouth
Doan Ck	DN-1	0.8	T7N,R35E,Sect 32,NE¼,SW¼	EQ	Below irrigation diversion
	DN-2	0.8	T7N,R35E,Sect 32,NE¼,SW¼	EL,F[c]	~100 yards above diversion
Cold Ck	CC-1	2.2	T7N,R35E,Sect 27,SW¼,SW¼	EL	Wallula Rd
	CC-2	0.6	T7N,R35E,Sect 32,NE¼,NE¼	EL,F[c]	Last Chance Rd
Caldwell Ck	CD-1	0.3	T6N,R36E,Sect 5,NE¼,NW¼	EQ	Below goat pen
	CD-2	0.3	T6N,R36E,Sect 5,NE¼,NW¼	EL	Above goat pen
Bryant Ck	BC-1	0.8	T7N,R36E,Sect 29,SW¼,NW¼	EL	Jefferson Park
Stone Ck	SC-1	7.2	T7N,R36E,Sect 28,NE¼,SW¼	EL	Home Ave
	SC-2	5.5	T7N,R36E,Sect 32,NW¼,NE¼	EL	Tietan St
	SC-3	2.6	T6N,R35E,Sect 1,NW¼,NW¼	EL	Behind Walmart
	SC-4	1.6	T6N,R35E,Sect 2,NW¼,NE¼	EL	Mojonnier & College Ave
	SC-5	0.5	T6N,R35E,Sect 3,SE¼,NW¼	F[c]	Above Bussell Rd
Mud Ck	MC-1	7.6	T6N,R34E,Sect 12,NE¼,NE¼	EL	Below Forest Rd
	MC-2	0.5	T7N,R33E,Sect 31,NW¼,SW¼	EL,F[c]	Barney Rd
Pine Ck	PC-1	1.3	T6N,R33E,Sect 1,SW¼,NW¼	EL,F[c]	Sand Pit Rd
Cottonwood Ck	CWC-1	5.3	T6N,R36E,Sect 11,SE¼,SE¼	EQ	1.0 mi above Hood Rd
	CWC-2	5.0	T6N,R36E,Sect 11,SE¼,SW¼	EQ	0.7 mi above Hood Rd
	CWC-3	4.2	T6N,R36E,Sect 10,SE¼,NE¼	EQ	Hood Rd Bridge
	CWC-4	2.6	T6N,R36E,Sect 9,NW¼,NW¼	EL	Powerline Rd Bridge
	CWC-5	0.9	T6N,R36E,Sect 6,NW¼,NW¼	EL,F[c]	Braden Rd Bridge
	CWC-6	0.8	T6N,R36E,Sect 6,NW¼,NW¼	EQ	~100 yrd below Braden Rd
Russell Ck	RC-1	6.7	T7N,R37E,Sect 32,NW¼,SW¼	EL	Above Foster Rd bridge
	RC-2	6.3	T7N,R37E,Sect 31,NE¼,SW¼	EL	0.3 mi below Foster Rd
	RC-3	5.0	T7N,R36E,Sect 36,NW¼,SE¼	EL	CCC dam
	RC-4	3.0	T7N,R36E,Sect 34,NW¼,NE¼	EL,F[c]	Above Depping Rd
	RC-5	3.0	T7N,R36E,Sect 34,NW¼,NE¼	EL	Below Depping Rd
	RC-6	1.5	T7N,R36E,Sect 33,SW¼,NW¼	EL	3rd St above dam
	RC-7	1.5	T7N,R36E,Sect 33,SW¼,NW¼	EL	3rd St below dam
SF Russell Ck	SRC-1	0.1	T7N,R37E,Sect 32,NW¼,NW¼	EL	Above Foster Rd bridge
Yellowhawk Ck	YC-1	8.0	T7N,R36E,Sect 23,NE¼,NE¼	EQ,T,F[c]	Diversion
	YC-2	7.0	T7N,R36E,Sect 27,SE¼,NW¼	EQ	Carl St
	YC-3	5.4	T7N,R36E,Sect 33,NW¼,NE¼	EQ	Fern Rd
	YC-4	4.1	T7N,R36E,Sect 32,SE¼,SW¼	EL	3rd and Yellowhawk Rd
	YC-5	3.4	T6N,R36E,Sect 6,NE¼,SE¼	EL	South 9th Street
	YC-6	1.7	T6N,R35E,Sect 1,SE¼,NW¼	EQ	Above Pepper Bridge
	YC-7	1.0	T6N,R35E,Sect 1,SW¼,SW¼	F	Below Hwy 125
	YC-8	0.1	T6N,R35E,Sect 11,NW¼,NE¼	EQ,T,F[c],G	Above mouth

[a] River mile.
[b] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[c] Index discharge sites.

Appendix B. Discharge Data 2000

Appendix B. Table 1. Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
NF Touchet R	NFT-7	5/4	**60.9**	40	10:27	below mouth of Spangler Creek
		5/17	**44.2**	40	11:29	
		6/1	**33.1**	42	9:48	
		6/12	**47.5**	44	11:46	
		6/27	**19.0**	50	11:15	
		7/10	**11.3**	54	14:10	
		7/20	**10.0**	51	08:48	
		8/3	**7.7**	56	12:29	
		8/21	**6.5**	50	10:55	
		9/11	**8.4**	48	10:15	
		9/19	**6.4**	57	11:47	
		10/5	**6.0**	40	09:13	
		10/18	**6.1**	45	10:47	
		11/1	**6.6**	38	09:31	
		11/15	**5.6**	33	10:42	
NF Touchet R	NFT-11	5/4	**89.4**	47	11:50	Below Jim Ck Mouth
		5/17	**72.0**	47	12:05	
		6/1	**58.1**	51	10:56	
		6/13	**59.2**	51	13:21	
		6/27	**38.2**	60	12:23	
		7/11	**33.7**	53	08:25	
		7/20	**29.5**	58	09:42	
		8/3	**21.9**	65	13:20	
		8/21	**23.2**	58	12:00	
		9/11	**31.0**	54.5	11:45	
		9/19	**21.6**	59	13:02	
		10/5	**24.8**	45.5	09:58	
		10/18	**23.7**	49	11:28	
		11/1	**26.2**	44	10:21	
		11/15	**26.9**	35	11:28	
NF Touchet R	NFT-16	5/25	**114.5**	61	15:00	Above Baileysburg
		6/6	**182.9**	62	13:44	
		6/15	**131.6**	55	10:35	
		6/29	**69.2**	58	09:23	
		7/11	**63.9**	61	10:40	
		7/20	**52.3**	65	11:38	
		8/9	**47.3**	61	09:45	
		8/21	**45.2**	67	14:40	
		9/8	**43.2**	58	15:00	
		9/19	**43.3**	65	15:06	
		10/5	**52.6**	52	12:53	
		10/18	**48.1**	53	13:21	
		11/1	**53.6**	47	12:24	
		11/17	**52.2**	39	14:44	
Corral Ck	CC-3	7/31	**0.5**	52	13:35	Snow park

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Spangler Creek	SC-6	5/4	**18.1**	41	09:45	0.2 mi up Spangler Creek
		5/17	**13.3**	40	11:09	
		6/1	**9.8**	40	9:13	
		6/12	**13.2**	45	12:03	
		6/27	**4.9**	49	10:40	
		7/10	**4.3**	52	13:55	
		7/20	**3.7**	50	08:30	
		8/3	**3.1**	55	12:16	
		8/21	**2.7**	48	10:35	
		9/11	**3.1**	47	09:45	
		9/19	**2.2**	52	11:33	
		10/5	**2.1**	39	08:58	
		10/18	**2.2**	44	10:36	
		11/1	**2.3**	37.5	09:16	
		11/15	**1.9**	32	10:30	
Lewis Creek	LC-12	5/4	**12.5**	44	10:55	Above N. Fork Touchet Rd
		5/17	**8.7**	48	14:14	
		6/1	**9.0**	46	10:12	
		6/12	**8.7**	48	12:37	
		6/27	**6.6**	53	11:34	
		7/10	**7.0**	56	14:27	
		7/20	**6.4**	52	09:03	
		8/3	**6.0**	53	12:48	
		8/21	**4.8**	49	11:15	
		9/11	**5.6**	49.5	10:50	
		9/19	**4.8**	53.5	12:50	
		10/5	**4.8**	43	09:31	
		10/18	**4.8**	46	11:01	
		11/1	**4.8**	42	09:45	
		11/15	**5.3**	37	11:06	
Jim Creek	JC-1	5/4	**2.8**	49	11:21	Culvert at Jim Ck Rd
		5/17	**2.7**	55	14:38	
		6/1	**2.8**	51	10:33	
		6/13	**2.9**	53	13:00	
		6/27	**1.7**	60	12:00	
		7/11	**1.1**	61	14:50	
		7/20	**1.0**	58	09:27	
		8/3	**1.0**	66	13:04	
		8/21	**1.2**	55	11:35	
		9/11	**1.2**	54.5	11:25	
		9/19	**1.0**	59	12:50	
		10/5	**1.1**	43	09:45	
		10/18	**1.1**	49	11:13	
		11/1	**1.3**	40	10:03	
		11/15	**1.3**	35	11:28	
Wolf Fork	WF-5	5/17	**41.6**	41	13:45	Below Green Fly Canyon
		6/19	**25.1**	48	12:59	
		9/8	**16.9**	45	12:25	
		10/11	**16.5**	44	12:24	
		11/15	**14.4**	37	12:37	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Wolf Fork	WF-9	6/1	**65.3**	54	12:54	Nelson's
		6/12	**77.0**	48	14:51	
		6/27	**35.3**	58.5	13:42	
		7/11	**33.2**	50	09:40	
		7/20	**32.1**	54	10:44	
		8/3	**28.2**	52	14:20	
		8/21	**26.5**	56	13:20	
		9/8	**27.8**	51	15:13	
		9/19	**24.7**	56	14:14	
		10/5	**26.9**	45	11:42	
		10/18	**27.6**	48	12:28	
		11/1	**28.8**	44	11:19	
		11/15	**28.0**	37	13:55	
Wolf Fork	WF-11	5/4	**122.5**	50	14:13	Holmberg Rd Bridge
		5/17	**76.2**	50	10:48	
		6/1	**89.9**	57	13:55	
		6/12	**93.4**	51	15:45	
		6/27	**32.4**	65	14:51	
		7/11	**28.1**	55	10:20	
		7/20	**27.0**	59	11:17	
		8/9	**26.1**	55	10:16	
		8/21	**20.5**	60	14:13	
		9/8	**20.7**	55	14:49	
		9/19	**21.1**	59	14:47	
		10/5	**21.5**	48	12:27	
		10/18	**24.1**	49	13:00	
		11/1	**23.5**	44	12:06	
		11/15	**25.0**	37	14:25	
Coates Creek	C-1	5/4	**7.5**	45	13:13	Wolf Fork Rd
		5/17	**5.9**	46	14:45	
		6/1	**6.0**	49	12:30	
		6/14	**8.9**	55	14:31	
		6/27	**3.1**	54.5	13:26	
		7/11	**2.5**	51	09:27	
		7/20	**2.4**	55	10:26	
		8/3	**3.2**	58	13:55	
		8/21	**1.9**	53	12:51	
		9/8	**2.0**	50	14:50	
		9/19	**2.0**	55.5	13:55	
		10/5	**2.3**	43	11:18	
		10/18	**1.9**	49	12:11	
		11/1	**2.4**	41	11:00	
		11/15	**2.2**	37	13:33	
Whitney Creek	WC-2	5/4	**13.4**	45	12:46	0.2 mi up Whitney Creek
		5/17	**10.0**	45	14:21	
		6/1	**8.7**	48	12:09	
		6/12	**14.9**	47	14:11	
		6/27	**6.7**	54.5	13:00	
		7/11	**5.2**	51	09:03	
		7/20	**4.3**	54	10:13	
		8/3	**3.2**	57	13:50	
		8/21	**4.1**	57	12:35	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Whitney Creek	WC-2	9/8	**4.3**	50	14:30	0.2 mi up Whitney Creek
(cond't)		9/19	**3.3**	53.5	13:30	
		10/5	**3.5**	43.5	10:39	
		10/18	**3.4**	48	12:00	
		11/1	**3.0**	41	10:49	
		11/15	**3.6**	39	13:08	
Robinson Fork	RF-14	5/4	**16.9**	51	13:44	Broughton Land Co. gate
		5/17	**14.3**	50	15:10	
		6/1	**30.9**	56	13:24	
		6/12	**31.3**	53	15:11	
		6/27	**5.4**	69	14:05	
		7/11	**3.0**	57	10:02	
		7/20	**2.0**	65	11:00	
		8/3	**1.1**	69	15:26	
		8/21	**0.9**	68	13:40	
		9/8	**0.9**	58	14:26	
		9/19	**0.9**	67	14:30	
		10/5	**1.7**	48.5	12:05	
		10/18	**0.8**	51	12:42	
		11/1	**1.9**	42	11:27	
		11/15	**1.6**	37	14:15	
Robinson Fk	RF-3	6/19	**7.2**	50	11:45	6 miles above BLC gate
SF Patit Creek	SFP-9	4/17	**17.8**	43	12:09	200 ft above end of road
		5/1	**3.5**	47	17:00	
		5/18	**2.7**	45	11:32	
		6/6	**5.2**	53	12:46	
		6/15	**3.4**	51	11:21	
		6/27	**1.2**	50	09:23	
		7/20	**0.6**	64	12:46	
		8/21	**0.3**	59	15:53	
		9/19	**0.3**	55.5	10:26	
		10/18	**0.4**	42	09:25	
		11/13	**0.6**	34	13:24	
SF Touchet R	SFT-9	5/4	**53.7**	58	14:55	Gephart Rd off S.Fork Touchet Rd
		5/16	**47.0**	58	15:10	
		6/6	**61.4**	63	14:07	
		6/15	**68.3**	55	10:13	
		6/29	**14.7**	64	09:45	
		7/11	**8.7**	66	11:06	
		7/20	**5.8**	70	11:54	
		8/9	**2.9**	64	09:23	
		8/21	**3.6**	72	15:00	
		9/11	**11.9**	64	13:00	
		9/18	**3.8**	71	15:21	
		10/5	**7.6**	56.5	13:53	
		10/18	**4.6**	56	13:36	
		11/1	**9.2**	48	12:40	
		11/17	**9.5**	39	15:02	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.						
Stream	**Site**	**Date**	**CFS**	**Temp(F)**	**Time**	**Comments**
Touchet River	TR-4	4/17	**377.2**	52	13:25	Football field in Dayton
		5/12	**204.9**	47	09:08	
		5/18	**192.4**	54	12:30	
		6/6	**187.7**	63	14:50	
		6/14	**211.5**	66	15:15	
		6/29	**78.5**	62	10:20	
		7/12	**62.5**	63	11:25	
		7/20	**57.4**	71	13:40	
		8/8	**39.4**	72	17:00	
		8/21	**43.0**	67	16:45	
		9/7	**45.0**	68	15:20	
		9/18	**48.7**	65.5	02:56	
		10/5	**62.6**	53	14:24	
		10/23	**67.6**	44	09:44	
		11/6	**65.5**	45	12:35	
		11/20	**61.6**	34	09:15	
Touchet River	TR-7	4/11	**297.3**	57.5	15:30	above Bolles Br.
		5/1	**220.7**	58	15:59	
		5/16	**211.8**	60	13:10	
		6/6	**265.2**	57	08:40	
		6/29	**82.1**	69	10:55	
		7/12	**64.5**	66	10:47	
		8/8	**36.9**	77	16:07	
		8/22	**32.8**	59	8:43	
		9/5	**49.2**	57	09:00	
		9/18	**47.9**	62.5	09:08	
		10/4	**68.4**	49	08:46	
		10/23	**72.8**	45	09:11	
		11/1	**72.1**	50	14:33	
		11/17	**76.7**	38	13:35	
Touchet River	TR-9	4/11	**303.2**	60	14:38	Below Simms Road Br.
		5/1	**203.3**	63	14:53	
		5/15	**199.0**	69	15:28	
		5/25	**177.4**	64	13:10	
		6/6	**243.5**	64	09:50	
		6/20	**141.7**	68	12:35	
		6/29	**69.9**	75	11:50	
		7/10	**63.9**	75	13:25	
		7/20	**40.0**	78	13:20	
		8/7	**20.0**	70	13:05	
		8/21	**27.5**	62	10:30	
		9/5	**47.2**	60	10:14	
		9/18	**39.4**	66.5	10:12	
		10/4	**72.6**	50	09:53	
		10/19	**50.6**	51	07:50	
		11/2	**63.5**	41	09:05	
		11/16	**78.6**	33.8	09:45	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Touchet River	TR-10	5/25	**149.8**	63.5	12:25	Cummins Bridge
		6/20	**133.5**	68	11:53	
		6/29	**80.0**	76	12:20	
		7/10	**43.5**	76	14:00	
		7/20	**18.9**	75	12:40	
		8/7	**2.3**	77	13:45	
		8/21	**2.8**	63	11:00	
		9/5	**29.7**	62	10:57	
		9/18	**28.4**	68	10:54	
		10/4	**72.6**	52	10:30	
		10/19	**49.4**	52	08:10	
		11/2	**68.6**	42	09:25	
		11/16	**86.6**	34.3	11:17	
SF Coppei Ck	SFC-3	4/11	**5.0**	55	12:20	Below Geir Rd
		5/1	**3.2**	54	11:24	
		5/16	**8.0**	54	11:55	
		5/30	**2.3**	54	10:25	
		6/13	**29.4**	52	10:18	
		6/26	**2.5**	55	09:04	
		7/12	**1.6**	58	09:37	
		8/8	**1.0**	67	14:50	
		8/22	**1.1**	56	10:27	
		9/5	**1.5**	53	09:35	
		9/19	**1.3**	59	08:52	
		10/4	**2.0**	50	13:45	
		10/20	**1.8**	51	10:39	
		11/1	**2.2**	45.5	13:45	
		11/17	**2.6**	37	10:50	
NF Coppei Ck	NFC-4	4/11	**3.6**	54	11:49	0.7 mi above N. Fork Coppei Rd.
		5/1	**2.1**	55	10:47	
		5/16	**4.7**	57	12:30	
		5/30	**1.3**	55	09:58	
		6/13	**20.6**	53	09:43	
		6/26	**2.4**	56	08:46	
		7/12	**1.9**	59	10:01	
		8/8	**1.2**	68	15:15	
		8/22	**1.5**	56	09:23	
		9/5	**1.7**	54.5	09:16	
		9/19	**1.5**	61	09:14	
		10/4	**2.0**	51	14:15	
		10/20	**2.3**	52	11:00	
		11/1	**1.8**	46	13:23	
		11/17	**2.3**	37	09:17	
Coppei Ck	MC-3	5/17	**7.2**	66	14:50	Below Meinberg Rd Br
		5/30	**4.3**	55.5	09:36	
		6/14	**32.1**	56	09:38	
		6/26	**4.7**	56	08:30	
		7/12	**3.0**	63	10:21	
		8/8	**1.2**	73	15:40	
		8/22	**1.6**	56	09:07	
		9/5	**2.5**	54	09:00	
		9/19	**2.2**	63	09:30	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.						
Stream	**Site**	**Date**	**CFS**	**Temp(F)**	**Time**	**Comments**
Coppei Ck (Cont'd)	MC-3	10/4	**4.3**	54.5	14:36	Below Meinberg Road Br.
		10/20	**3.7**	53	11:30	
		11/1	**4.6**	49	14:05	
		11/17	**5.9**	36	08:45	
Dry Creek	DC-4	4/11	**16.5**	53	12:41	0.5 miles up Biscuit Ridge Rd
		4/24	**14.3**	53	14:50	
		5/1	**9.1**	57	12:30	
		5/16	**14.0**	64	14:26	
		5/30	**4.4**	55	11:24	
		6/13	**52.6**	53	11:37	
		6/26	**5.5**	57	09:57	
		7/12	**2.7**	60	09:12	
		8/8	**1.0**	72	14:20	
		8/22	**1.2**	57.5	11:20	
		9/5	**1.9**	55	10:22	
		9/18	**1.3**	64	15:45	
		10/4	**4.1**	51	13:15	
		10/19	**2.4**	53	14:25	
		11/6	**3.7**	43	11:45	
		11/17	**4.6**	36.5	11:10	
NF Dry Ck	NFD-5	5/16	**7.9**	60	14:00	0.4 mi up Scott Rd
		5/30	**1.8**	52	11:00	
		6/13	**19.2**	50.5	11:03	
		6/26	**2.2**	53	09:34	
		7/12	**1.4**	55	08:49	
		8/8	**1.1**	64	14:00	
		8/22	**0.7**	54	10:56	
		9/5	**0.9**	53.5	10:04	
		9/18	**1.1**	59	15:23	
		10/4	**1.4**	48	12:53	
		10/19	**1.0**	50	14:10	
		11/6	**2.1**	42	11:05	
		11/17	**2.1**	39	10:40	
Walla Walla R.	WW-2	5/16	**226.7**	58	12:40	Above Pepper Bridge
		5/26	**91.7**	51.5	9:50	
		5/30	**57.9**	56	13:14	
		6/20	**79.3**	56	9:20	
		6/29	**5.5**	71	14:30	
		7/11	**3.6**	72	15:06	
		7/20	**4.0**	65	09:30	
		8/7	**4.1**	66	10:15	
		8/21	***0.2**	69	16:15	*equipment failure
		9/5	***0.3**	61	11:50	*equipment failure
		9/18	**4.3**	63.5	12:30	
		9/26	**5.3**	52	09:50	
		9/18	**4.7**	63.5	12:00	
		9/26	**5.7**	52	09:02	
		10/4	**81.0**	50.5	11:10	
		10/19	**23.7**	53.5	12:35	
		11/2	**48.6**	47	13:20	
		11/19	**107.6**	38	13:52	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Walla Walla R.	WW-4	5/30	**113.6**	56.5	13:59	Above Burlingame Diversion
		6/26	**83.0**	63	11:50	
		7/11	**45.1**	71	14:15	
		8/7	**27.6**	65	11:20	
		8/8	**33.1**	66	14:23	
		9/5	**48.7**	57	13:17	
		9/18	**48.1**	61.5	10:50	
		10/19	**81.9**	52	11:20	
		11/2	**119.3**	46	12:15	
		11/16	**193.2**	38	15:24	
Walla Walla R.	WW-6	5/1	**187.2**	56	14:00	Below Mojonnier Rd
		5/15	**260.1**	61	14:10	
		5/25	**64.9**	57	15:28	
		5/30	**30.0**	57	14:23	
		6/20	**104.6**	59	10:21	
		6/29	**10.5**	71	13:40	
		7/11	**16.4**	71	13:54	
		7/20	**42.2**	69	10:45	
		8/7	**29.9**	N/A	16:45	
		8/21	**32.2**	65	14:05	
		9/5	**49.0**	59.5	13:40	
		9/18	**47.7**	61.5	10:30	
		10/4	**93.4**	49	09:28	
		10/19	**16.5**	52	11:00	
		11/2	**16.9**	46	12:00	
		11/16	**118.5**	41	14:53	
Walla Walla R.	WW-8	5/16	**220.0**	58	12:15	Below Swegle Rd Bridge
		6/26	**42.9**	68	14:16	
		7/11	**22.2**	73	12:43	
		8/7	**29.1**	74	16:15	
		8/21	**36.7**	64	12:35	
		9/5	**54.8**	59	13:05	
		9/18	**56.3**	65.5	13:14	
		10/4	**97.1**	52.5	12:03	
		10/19	**23.7**	52	09:35	
		11/2	**24.4**	47	11:20	
		11/16	**122.6**	40.5	14:06	
		11/17	**122.0**	38.3	11:54	
Walla Walla R.	WW-9	4/11	**428.1**	52	13:40	Below Detour Rd Bridge
		5/1	**258.4**	57	13:25	
		5/15	**360.1**	62	14:41	
		5/25	**124.2**	59	14:30	
		6/20	**171.7**	62	10:58	
		6/29	**22.7**	76	13:05	
		7/10	**25.6**	75	16:00	
		7/20	**38.5**	74	12:00	
		8/7	**29.3**	75	15:30	
		8/21	**38.1**	65	12:17	
		9/5	**55.0**	60	12:28	
		9/18	**59.9**	65.5	12:40	
		10/4	**128.2**	53	12:32	

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Walla Walla R.	WW-9	10/19	**41.7**	52	09:17	Below Detour Rd Bridge
(Cont'd)		11/2	**44.7**	47	10:30	
		11/16	**152.5**	41	13:20	
Walla Walla R.	WW-10	6/26	**36.6**	76	14:45	Above McDonald Rd Bridge
		7/10	**5.9**	81	14:45	
		8/7	**11.0**	81	15:05	
		8/21	**17.8**	69	11:55	
		9/5	**34.3**	61	11:54	
		9/18	**41.0**	67.5	12:04	
		10/4	**112.2**	54	12:00	
		10/19	**27.3**	52	08:55	
		11/2	**35.2**	46.5	10:00	
		11/16	**136.3**	38	10:39	
Birch Ck		9/5	**0.2**	63	12:01	State line
		9/18	**0.3**	63	12:40	
Yellowhawk Ck	YC-1	5/25	**38.5**	59	12:01	Above diversion
		5/30	**40.9**	55	11:58	
Yellowhawk Ck	YC-1	6/13	**46.3**	54	12:30	Below diversion
		6/26	**35.0**	61	10:31	
		7/11	**24.1**	75	16:31	
		8/8	**15.8**	73	13:15	
		8/22	**14.5**	65	11:54	
		9/5	**28.9**	55	10:58	
		9/18	**26.3**	66	14:22	
		10/4	**20.7**	NA	NA	
		10/19	**34.1**	54	13:38	
		11/2	**48.4**	45	14:47	
		11/17	**42.3**	39	12:04	
Yellowhawk Ck	YC-7	5/17	**50.6**	58	12:20	Highway 125
		5/30	**43.3**	56	13:32	
		6/13	**94.1**	56	13:52	
Yellowhawk Ck	YC-8	5/26	**42.8**	56	10:50	Above mouth
		6/20	**50.0**	58	09:48	
		6/29	**41.3**	68	14:02	
		7/11	**28.6**	68	14:32	
		7/20	**27.0**	75	10:00	
		8/7	**18.5**	68	10:40	
		8/21	**18.3**	63	15:18	
		9/5	**26.3**	57	12:31	
		9/18	**30.4**	62	11:07	
		10/4	**30.8**	49	10:00	
		10/19	**41.5**	54	11:32	
		11/2	**50.0**	44	12:30	
		11/16	**50.7**	38.8	15:50	
Yellowhawk Ck	YC-2	5/17	**24.6**	54	10:27	Carl St.
Mill Creek	MC-13	8/10	**3.0**	71.5	15:47	9th Street
Mill Creek	MC-10	8/10	**0.4**	57	17:15	Wildwood Park
Titus Creek	TC-1	9/18	**2.7**	64	14:40	Community College

Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Mill Creek	MC-20	5/17	**71.8**	65	14:05	Below Swegle Rd
		6/6	**130.6**	57	10:34	
		6/26	**10.3**	70	13:39	
		7/10	**2.8**	76	16:15	
		8/7	**1.1**	76	16:00	
		8/21	**2.2**	68	13:14	
		9/5	**3.7**	64	13:25	
		9/18	**6.1**	67.5	13:43	
		10/4	**37.6**	56	13:50	
		10/19	**11.3**	54	10:10	
		11/2	**13.1**	49	10:45	
		11/18	**21.9**	41.5	11:07	
Garrison Ck	GC-1	6/13	**5.6**	55	12:08	Below Diversion
		6/26	**4.1**	61	10:20	
		7/11	**4.0**	75	16:20	
		8/8	**3.4**	73	13:03	
		8/22	**4.8**	64	11:45	
		9/5	**6.0**	54	10:46	
		9/18	**3.8**	66	14:10	
		10/4	**2.4**	NA	NA	
		10/19	**5.0**	NA	NA	
		11/2	**4.2**	45	14:40	
		11/17	**4.3**	39	11:45	
Garrison Ck	GC-6	5/17	**4.9**	64	13:38	Mission Rd
		5/30	**5.3**	60	14:40	
		6/14	**8.8**	62	11:23	
		6/26	**3.5**	65	12:20	
		7/11	**2.6**	69	13:36	
		8/8	**- -**	NA	00:00	No flow
		8/21	**1.9**	65	13:48	
		9/5	**2.2**	61	14:04	
		9/18	**3.1**	61	10:25	
		10/4	**5.2**	53	09:08	
		10/19	**3.6**	54	10:37	
		11/2	**4.2**	47	11:45	
		11/18	**5.4**	40.5	12:35	
E. Little Walla Walla	ELW-1	4/25	**9.1**	50	13:38	Above river fork
		5/15	**9.3**	58	11:12	
		6/2	**10.0**	54	9:31	
		6/13	**11.3**	61	14:15	
		6/26	**9.4**	57	11:30	
		7/11	**6.0**	66	14:50	
		8/7	**6.2**	58	11:05	
		8/21	**5.5**	61	15:00	
		9/5	**9.6**	55	12:46	
		9/18	**11.9**	56.5	11:25	
		10/4	**12.4**	48	10:18	
		10/19	**10.7**	50.5	11:50	
		11/2	**10.7**	48.5	12:50	
		11/18	**8.9**	44.5	13:03	

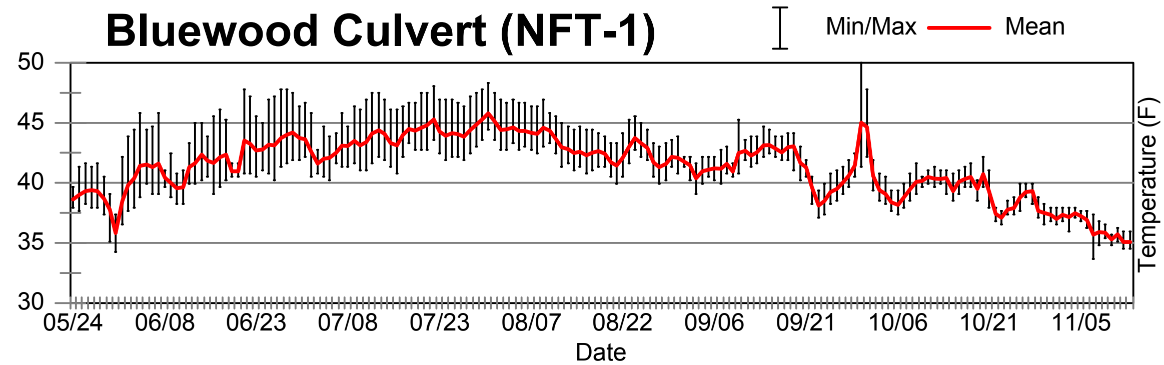
Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Stone Creek	SC-5	5/26	**0.2**	67	11:51	Above Bussell Rd
		6/2	**1.8**	63.5	9:48	
		6/13	**1.6**	64	14:38	
		6/26	**0.3**	70	12:06	
		7/11	**- -**			No water
		11/18	**0.5**	43.5	12:47	
Russell Ck	RC-4	5/17	**2.8**	58	11:32	Above Depping Rd
		5/30	**1.2**	56	12:22	
		6/13	**13.7**	55	12:57	
		6/26	**1.9**	59	10:53	
		7/11	**0.4**	67	15:49	
		7/20	**- -**			No measurable flow
Reser Ck		5/17	**0.3**	63	11:07	Reser Creek Rd
Cottonwood Ck	CWC-5	4/25	**9.7**	50	11:25	Braden Rd
		5/15	**13.1**	70	13:21	
		5/30	**1.3**	55.5	12:49	
		6/13	**30.8**	64	13:23	
		6/26	**1.6**	55	11:10	
		7/11	**1.2**	60	15:32	
		8/8	**0.4**	58	12:20	
		8/22	**0.2**	57	12:21	
		9/5	**0.1**	54	11:26	
		10/4	**2.2**	49	11:25	
		11/2	**0.5**	51	13:35	
		11/17	**2.4**	42	12:41	
Doan Creek	DN-2	5/25	**1.4**	59	11:24	Whitman Mission
		6/2	**2.1**	59	10:58	
		6/14	**2.6**	61	12:50	
		6/26	**1.9**	60	13:57	
		7/11	**1.7**	63	12:15	
		8/8	**0.6**	61	10:30	
		8/21	**0.5**	62	12:52	
		9/5	**0.7**	58.5	14:09	
		9/18	**0.8**	60	09:43	
		10/4	**0.5**	54	13:28	
		10/19	**1.2**	53	09:55	
		11/2	**1.5**	47	11:06	
		11/17	**1.3**	43.2	11:28	
Cold Creek	CC-2	5/26	**1.2**	61	12:20	Swegle Rd
		6/2	**2.6**	61	10:35	
		6/14	**1.0**	63.5	12:25	
		6/26	**0.7**	62	13:20	
		7/11	**0.7**	62	13:03	
		8/21	**0.2**	57	13:33	
		9/5	**0.6**	56	14:23	
		9/18	**1.2**	61.5	10:00	
		10/4	**2.2**	52	14:15	
		10/19	**1.9**	53	10:25	
		11/2	**1.8**	44.5	11:35	
		11/18	**1.7**	38.3	12:17	

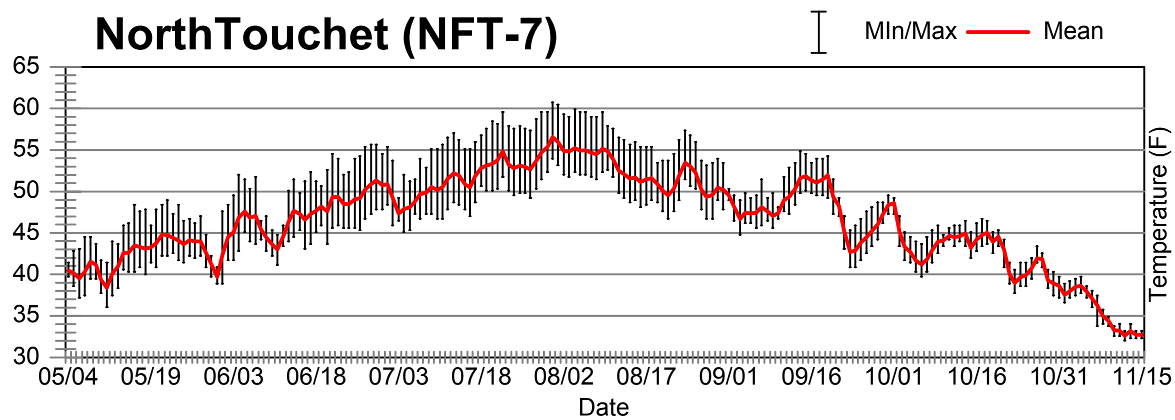
Appendix B. Table 1. (Continued) Manual discharge (cfs) measurements 2000.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
West Little Walla Walla	WLW-1	6/14	**8.1**	61	12:08	Valley Chapel Rd
		6/26	**3.2**	63	13:08	
		7/11	**1.5**	66	13:20	
		8/7	**1.0**	66	11:30	
		8/21	**2.1**	63	14:45	
		9/5	**4.1**	58	14:39	
		9/18	**5.5**	61	14:40	
		10/4	**8.3**	50	10:35	
		10/19	**8.3**	55	12:07	
		11/2	**8.3**	49	13:05	
		11/18	**4.0**	45.5	13:21	
West Little Walla Walla	WLW-2	5/15	**2.7**	61	12:13	Frog Hollow Rd
		6/2	**3.0**	60	10:14	
Mud Creek	MC-2	5/26	**1.6**	65	12:56	Barney Rd
		6/2	**3.7**	64	11:35	
		6/14	**6.2**	68	13:24	
		6/26	**2.2**	76	15:15	
		7/10	**1.5**	77	15:00	
		8/7	**2.2**	78	14:40	
		8/21	**7.1**	64	11:36	
		9/5	**1.6**	59	11:30	
		9/18	**3.1**	63.5	11:38	
		10/4	**0.8**	52	11:21	
		10/19	**0.1**	51	08:40	
		11/2	**0.4**	43	09:45	
		11/16	**4.8**	36.1	12:32	
Pine Creek	PC-1	5/26	**7.5**	67	13:45	Sandpit Rd
		6/14	**36.1**	68	13:49	
		6/26	**2.5**	76	15:30	
		7/10	**1.9**	78	14:30	
		8/7	**0.1**	80	14:25	
		8/21	**0.0**	65	11:23	
		9/5	**- -**			No measurable flow
		10/4	**29.3**	52	10:58	
		10/19	**1.2**	51	08:30	
		11/2	**5.6**	43	09:45	
		11/16	**15.2**	37.3	12:09	

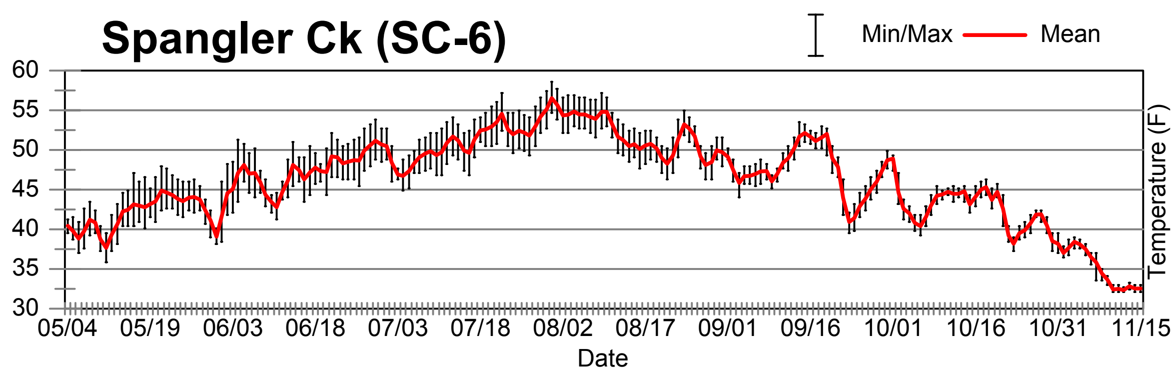
Appendix C - Stream Temperature Graphs (EF) 2000.



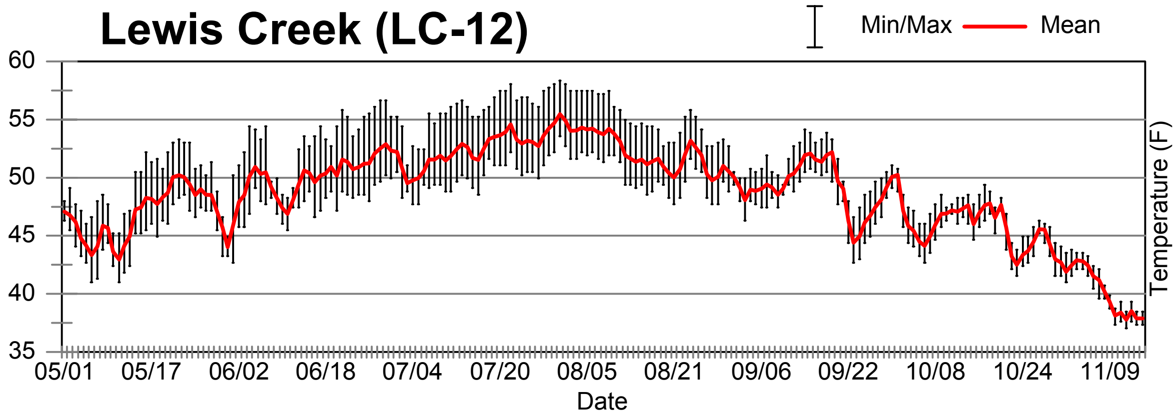
Bluewood Culvert (NFT-1)
Min/Max
Mean
50
45
40
35
30
05/24
06/08
06/23
07/08
07/23
08/07
08/22
09/06
09/21
10/06
10/21
11/05
Date
Temperature (F)

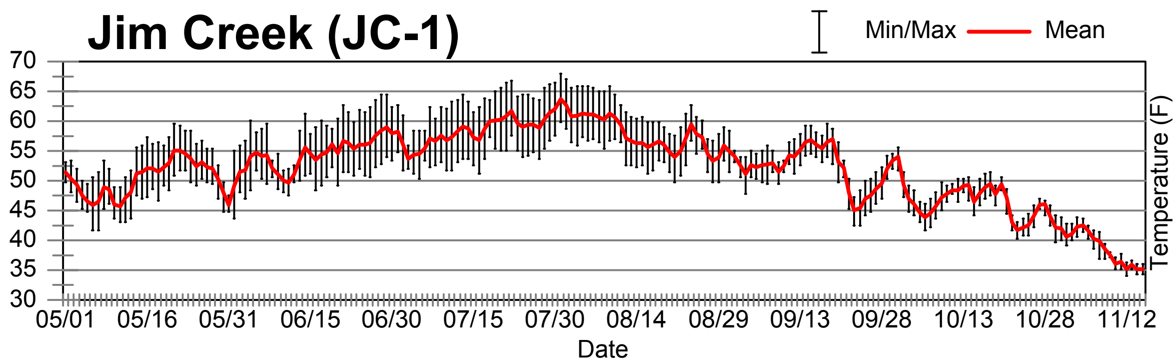


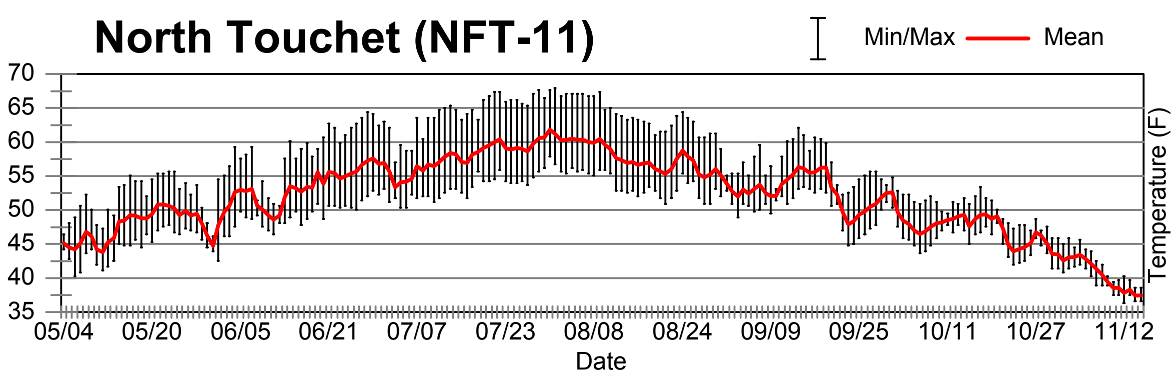
NorthTouchet (NFT-7)
MIn/Max
Mean
65
60
55
50
45
40
35
30
05/04
05/19
06/03
06/18
07/03
07/18
08/02
08/17
09/01
09/16
10/01
10/16
10/31
11/15
Date
Temperature (F)

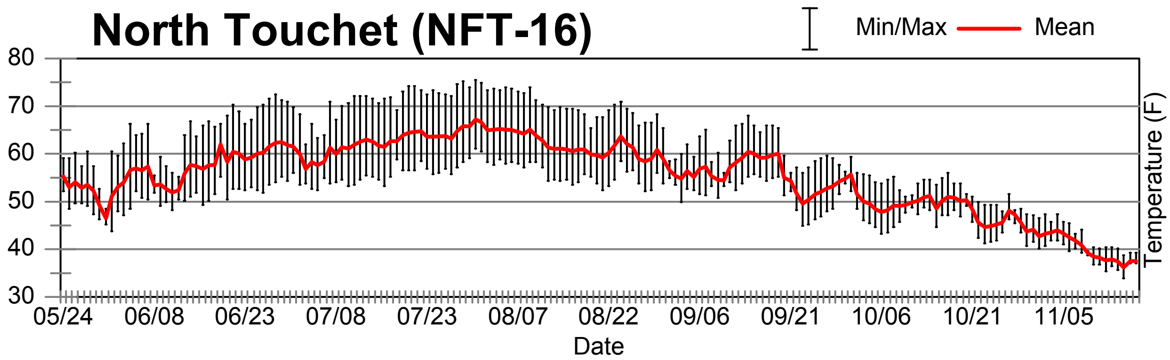


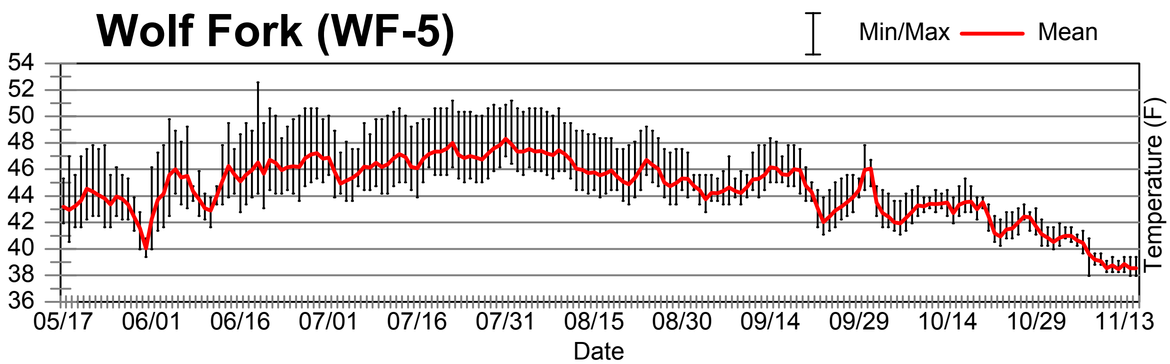
Spangler Ck (SC-6)
Min/Max
Mean
60
55
50
45
40
35
30
05/04
05/19
06/03
06/18
07/03
07/18
08/02
08/17
09/01
09/16
10/01
10/16
10/31
11/15
Date
Temperature (F)

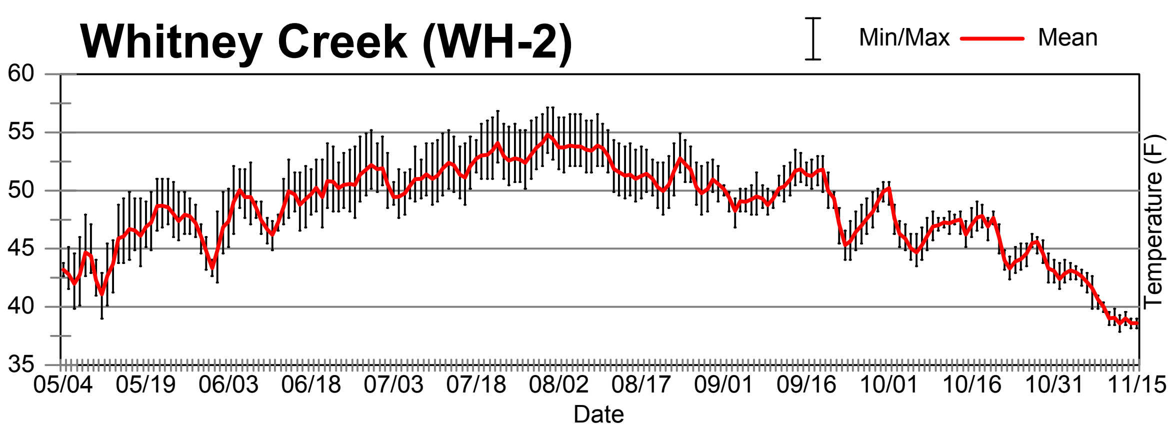

Lewis Creek (LC-12)
Min/Max
Mean
60
55
50
45
40
35
05/01
05/17
06/02
06/18
07/04
07/20
08/05
08/21
09/06
09/22
10/08
10/24
11/09
Date
Temperature (F)

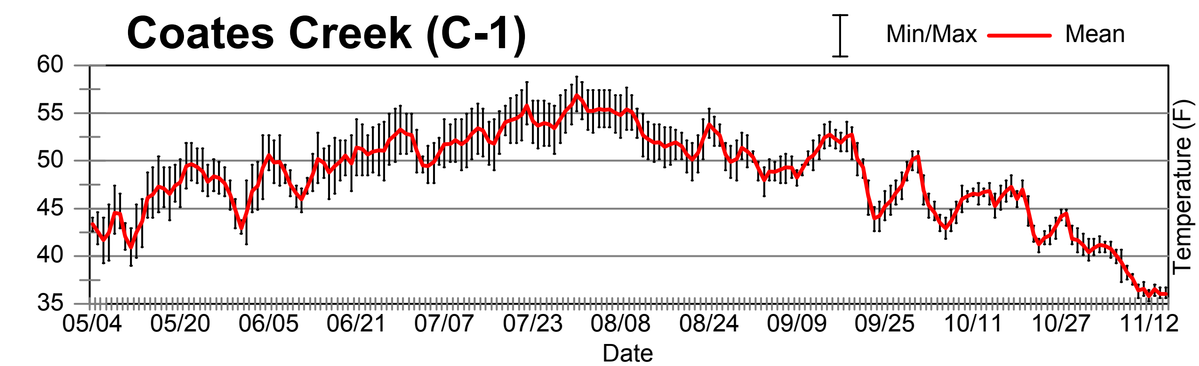

Jim Creek (JC-1)
Min/Max
Mean
70
65
60
55
50
45
40
35
30
05/01
05/16
05/31
06/15
06/30
07/15
07/30
08/14
08/29
09/13
09/28
10/13
10/28
11/12
Date
Temperature (F)


North Touchet (NFT-11)
Min/Max
Mean
70
65
60
55
50
45
40
35
05/04
05/20
06/05
06/21
07/07
07/23
08/08
08/24
09/09
09/25
10/11
10/27
11/12
Date
Temperature (F)

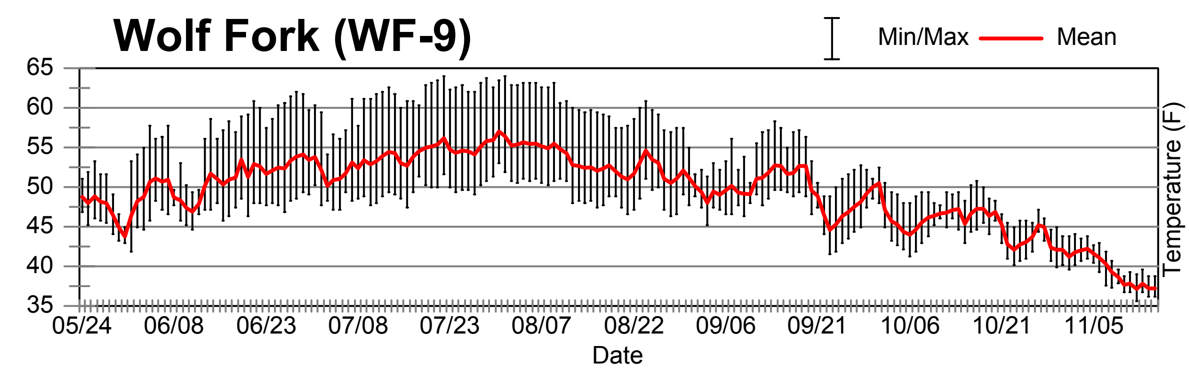

North Touchet (NFT-16)
Min/Max
Mean
80
70
60
50
40
30
05/24
06/08
06/23
07/08
07/23
08/07
08/22
09/06
09/21
10/06
10/21
11/05
Date
Temperature (F)


Wolf Fork (WF-5)
Min/Max
Mean
54
52
50
48
46
44
42
40
38
36
05/17
06/01
06/16
07/01
07/16
07/31
08/15
08/30
09/14
09/29
10/14
10/29
11/13
Date
Temperature (F)

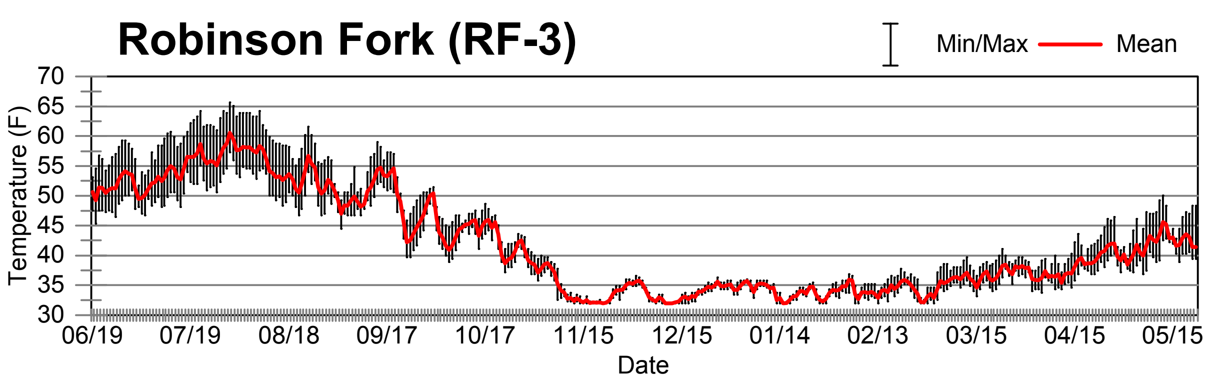

Whitney Creek (WH-2)
Min/Max
Mean
60
55
50
45
40
35
05/04
05/19
06/03
06/18
07/03
07/18
08/02
08/17
09/01
09/16
10/01
10/16
10/31
11/15
Date
Temperature (F)



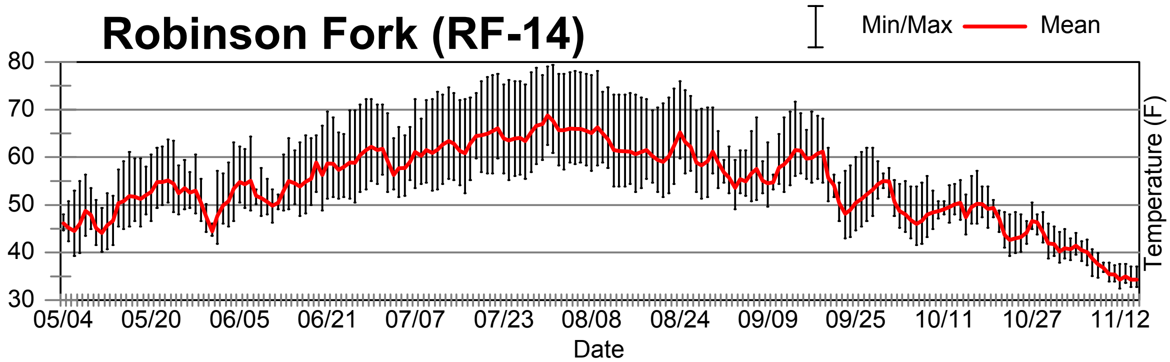
Coates Creek (C-1)
Min/Max
Mean
60
55
50
45
40
35
05/04
05/20
06/05
06/21
07/07
07/23
08/08
08/24
09/09
09/25
10/11
10/27
11/12
Date
Temperature (F)

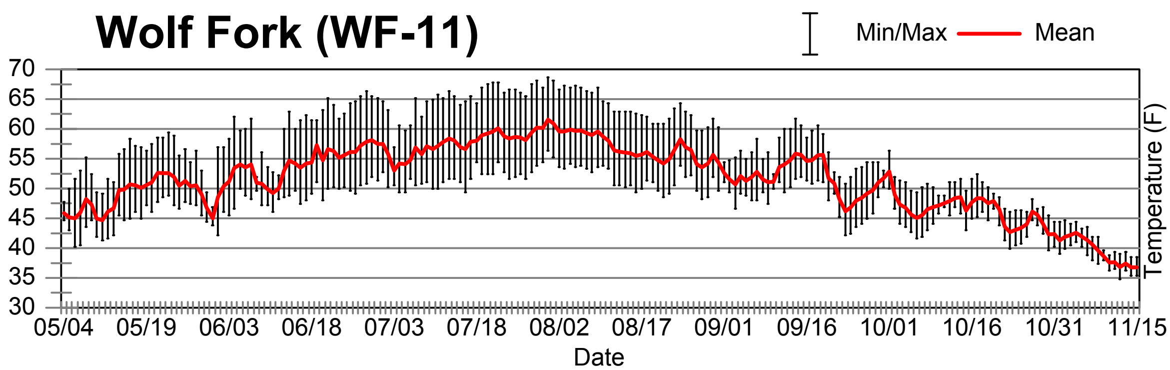


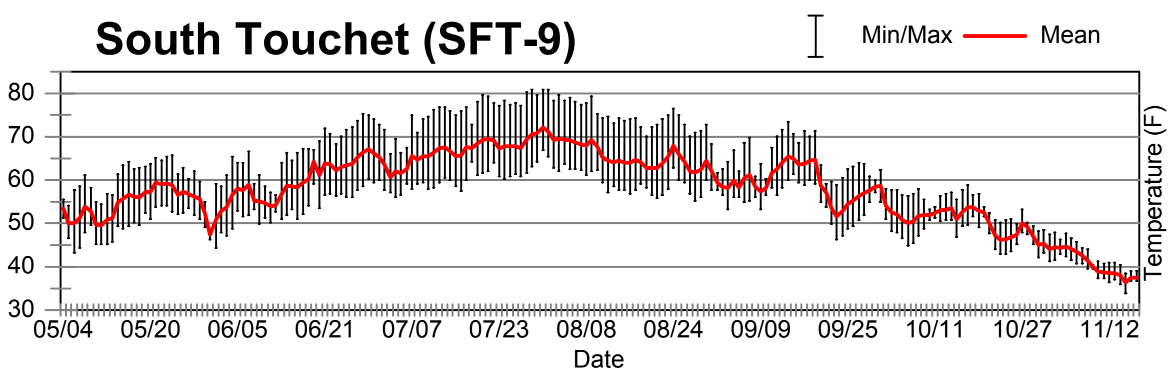
Wolf Fork (WF-9)
Min/Max
Mean
65
60
55
50
45
40
35
05/24
06/08
06/23
07/08
07/23
08/07
08/22
09/06
09/21
10/06
10/21
11/05
Date
Temperature (F)

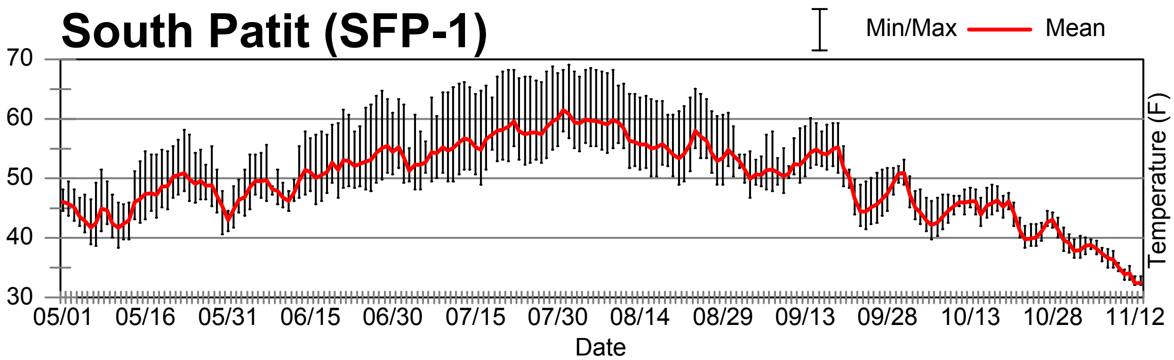


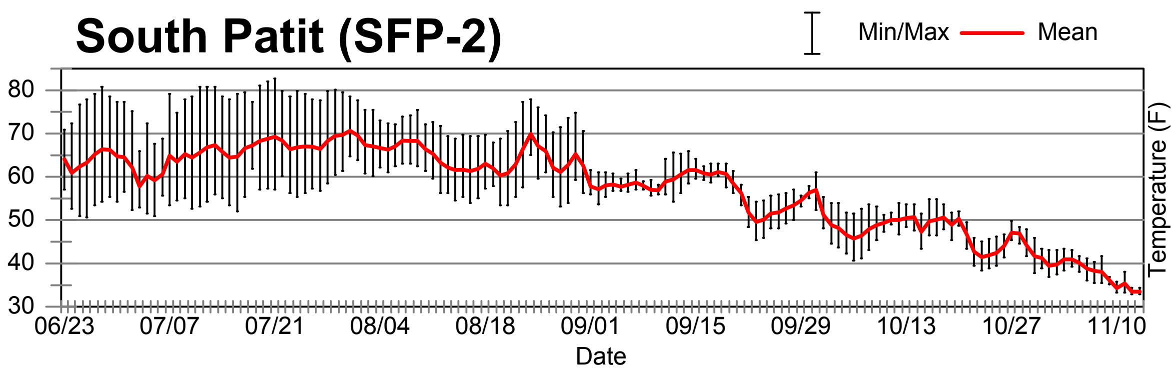
Robinson Fork (RF-3)
Min/Max
Mean
70
65
60
55
50
45
40
35
30
Temperature (F)
06/19
07/19
08/18
09/17
10/17
11/15
12/15
01/14
02/13
03/15
04/15
05/15
Date

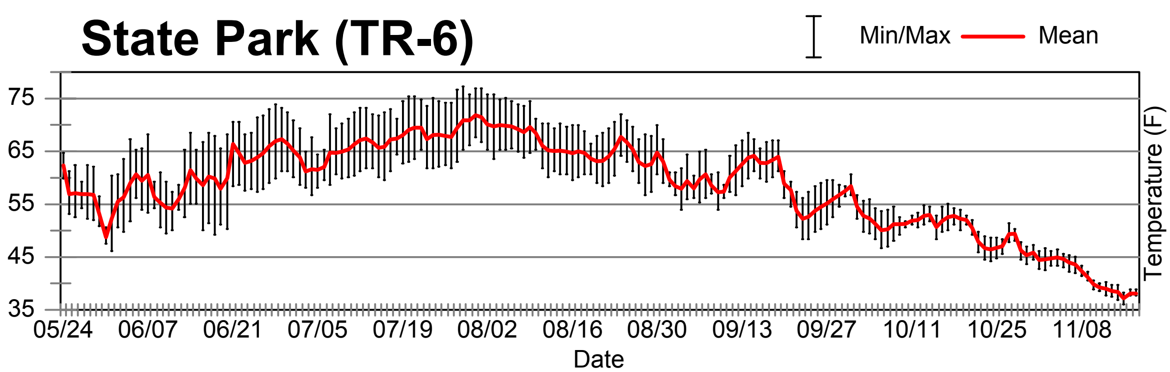

Robinson Fork (RF-14)
Min/Max
Mean
80
70
60
50
40
30
05/04
05/20
06/05
06/21
07/07
07/23
08/08
08/24
09/09
09/25
10/11
10/27
11/12
Date
Temperature (F)

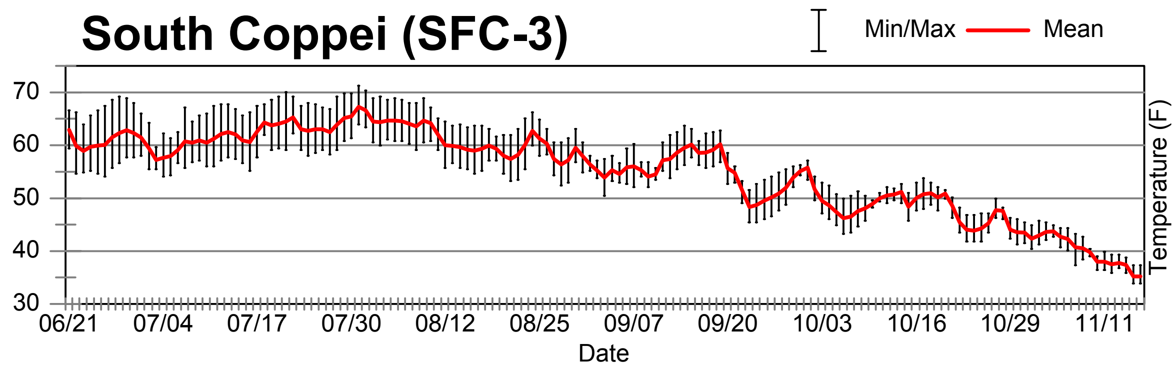

Wolf Fork (WF-11)
Min/Max
Mean
70
65
60
55
50
45
40
35
30
05/04
05/19
06/03
06/18
07/03
07/18
08/02
08/17
09/01
09/16
10/01
10/16
10/31
11/15
Date
Temperature (F)

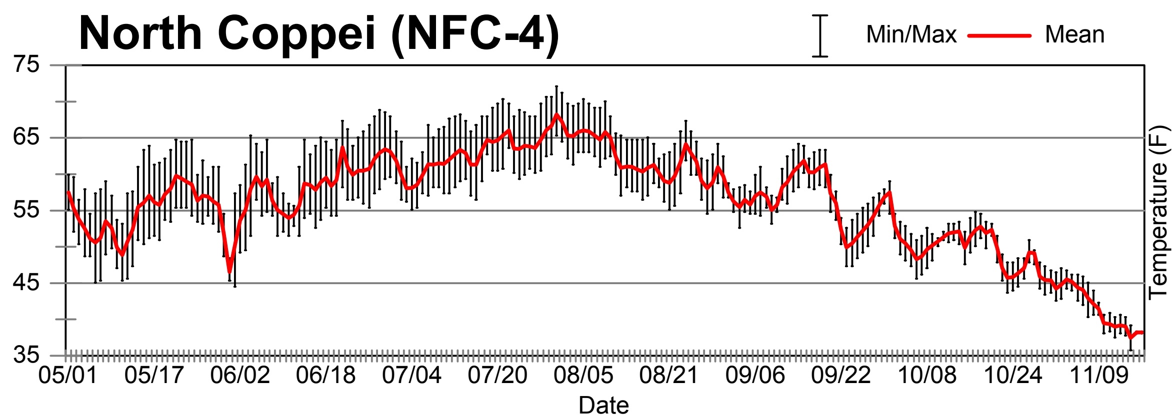

South Touchet (SFT-9)
Min/Max
Mean
80
70
60
50
40
30
05/04
05/20
06/05
06/21
07/07
07/23
08/08
08/24
09/09
09/25
10/11
10/27
11/12
Date
Temperature (F)

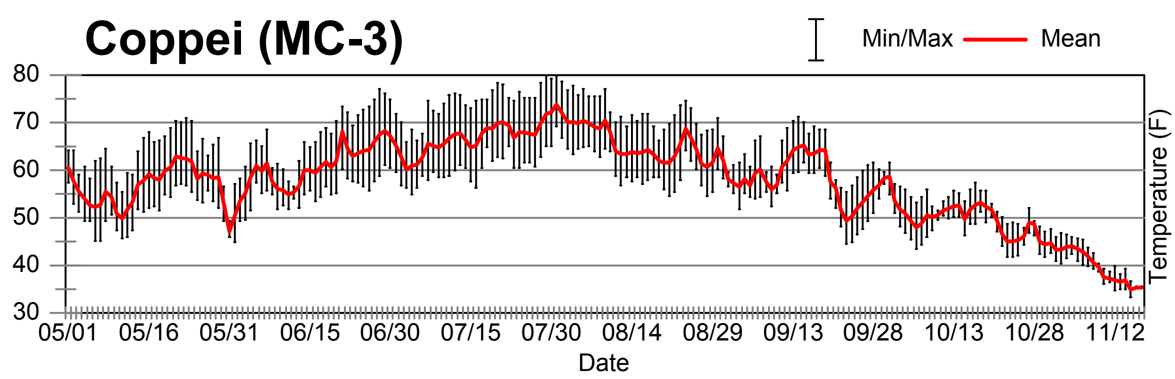

South Patit (SFP-1)
Min/Max
Mean
70
60
50
40
30
05/01 05/16 05/31 06/15 06/30 07/15 07/30 08/14 08/29 09/13 09/28 10/13 10/28 11/12
Date
Temperature (F)

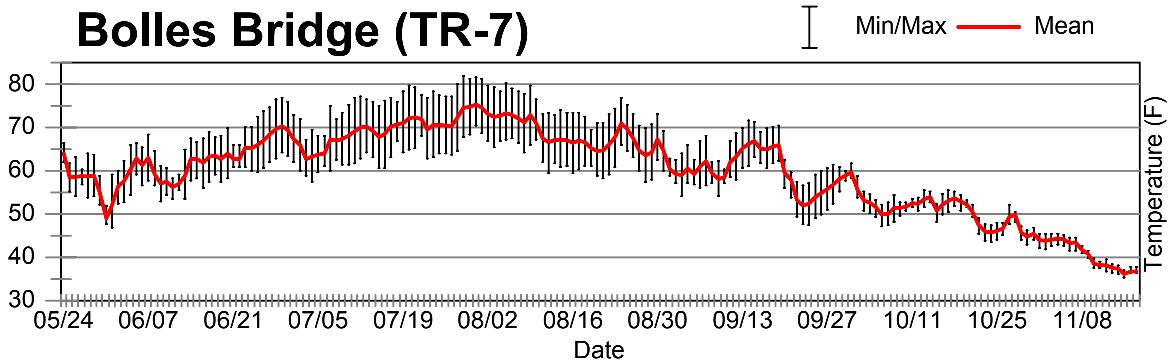

South Patit (SFP-2)
Min/Max
Mean
80
70
60
50
40
30
06/23 07/07 07/21 08/04 08/18 09/01 09/15 09/29 10/13 10/27 11/10
Date
Temperature (F)

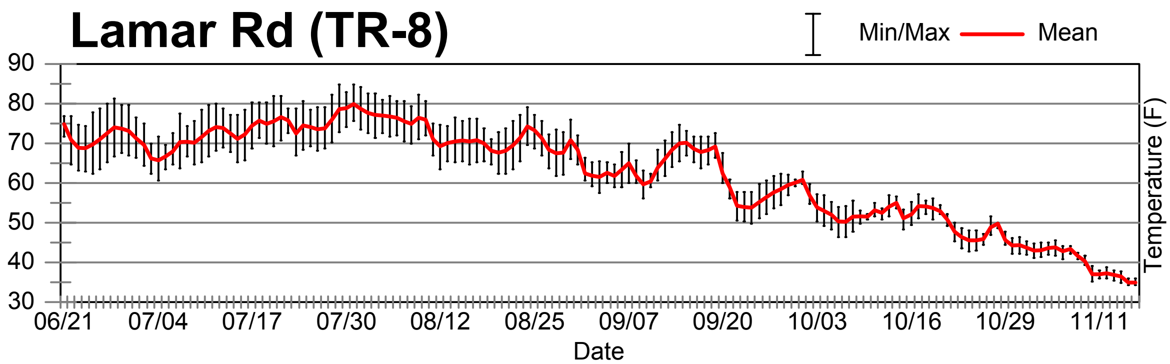

State Park (TR-6)
Min/Max
Mean
75
65
55
45
35
05/24 06/07 06/21 07/05 07/19 08/02 08/16 08/30 09/13 09/27 10/11 10/25 11/08
Date
Temperature (F)

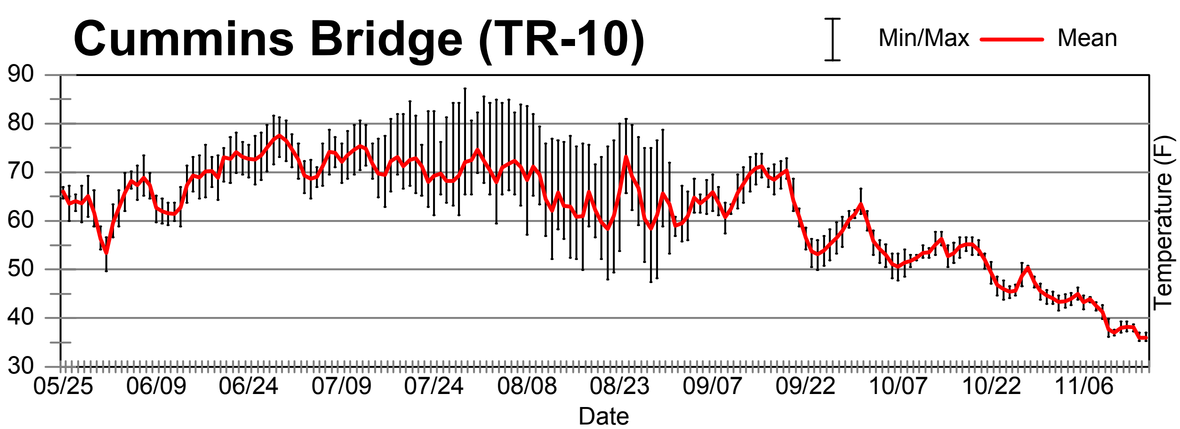

South Coppei (SFC-3)
Min/Max
Mean
70
60
50
40
30
06/21
07/04
07/17
07/30
08/12
08/25
09/07
09/20
10/03
10/16
10/29
11/11
Date
Temperature (F)

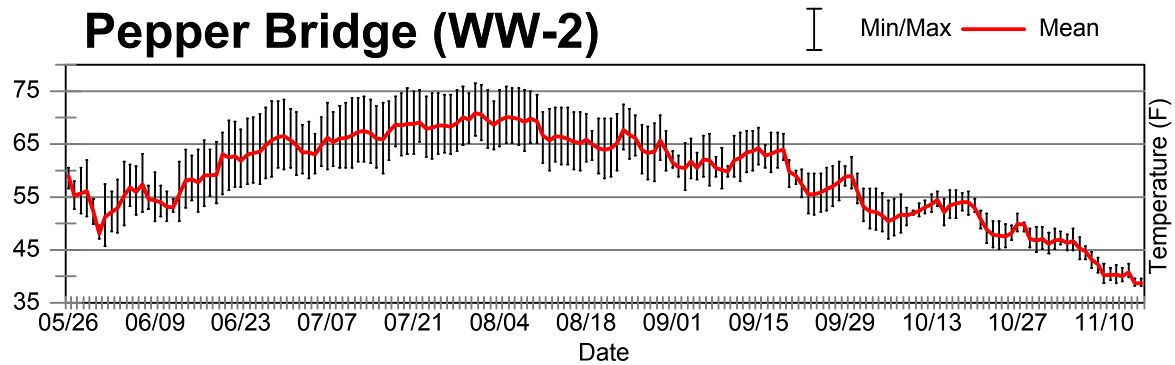

North Coppei (NFC-4)
Min/Max
Mean
75
65
55
45
35
05/01
05/17
06/02
06/18
07/04
07/20
08/05
08/21
09/06
09/22
10/08
10/24
11/09
Date
Temperature (F)

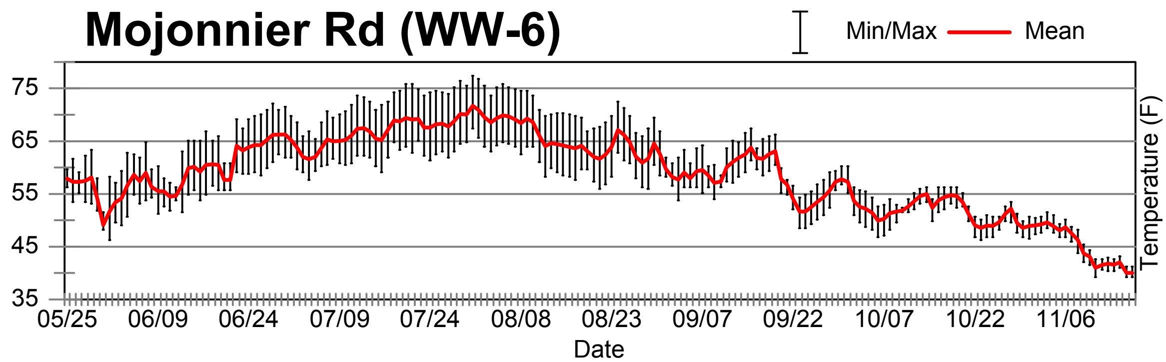

Coppei (MC-3)
Min/Max
Mean
80
70
60
50
40
30
05/01
05/16
05/31
06/15
06/30
07/15
07/30
08/14
08/29
09/13
09/28
10/13
10/28
11/12
Date
Temperature (F)

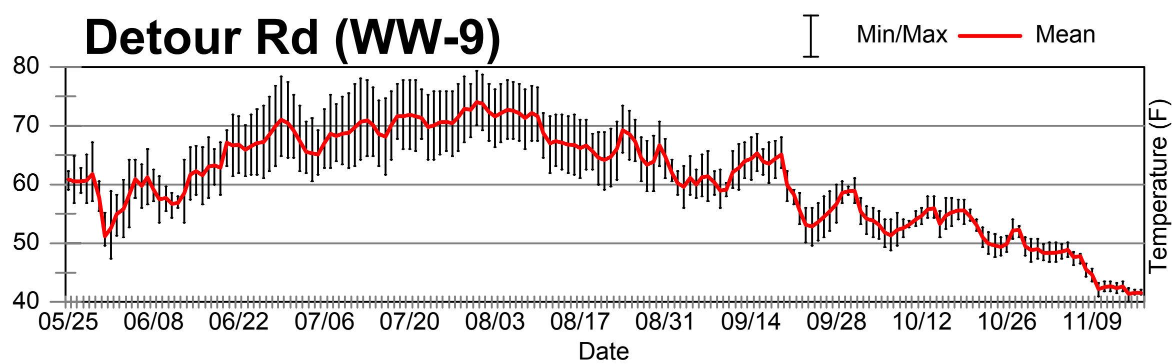

Bolles Bridge (TR-7)
Min/Max
Mean
80
70
60
50
40
30
05/24
06/07
06/21
07/05
07/19
08/02
08/16
08/30
09/13
09/27
10/11
10/25
11/08
Date
Temperature (F)

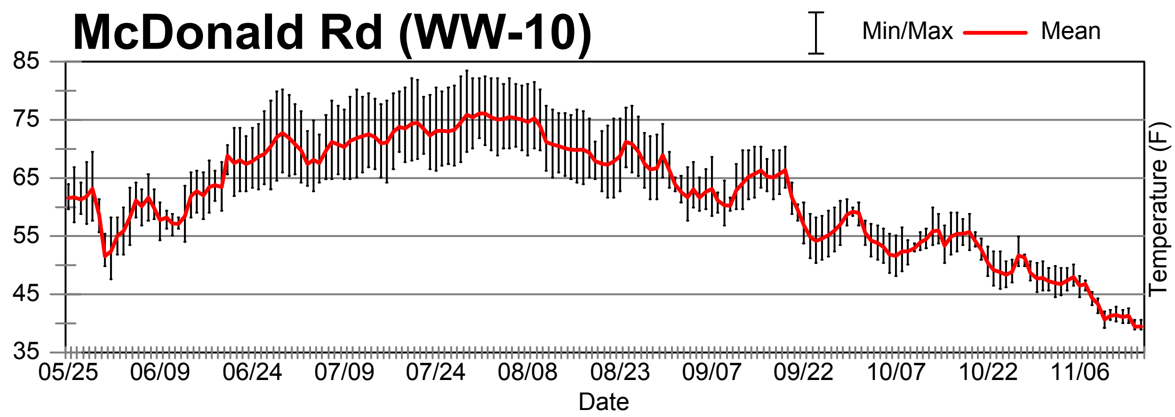

Lamar Rd (TR-8)
Min/Max
Mean
90
80
70
60
50
40
30
06/21
07/04
07/17
07/30
08/12
08/25
09/07
09/20
10/03
10/16
10/29
11/11
Date
Temperature (F)

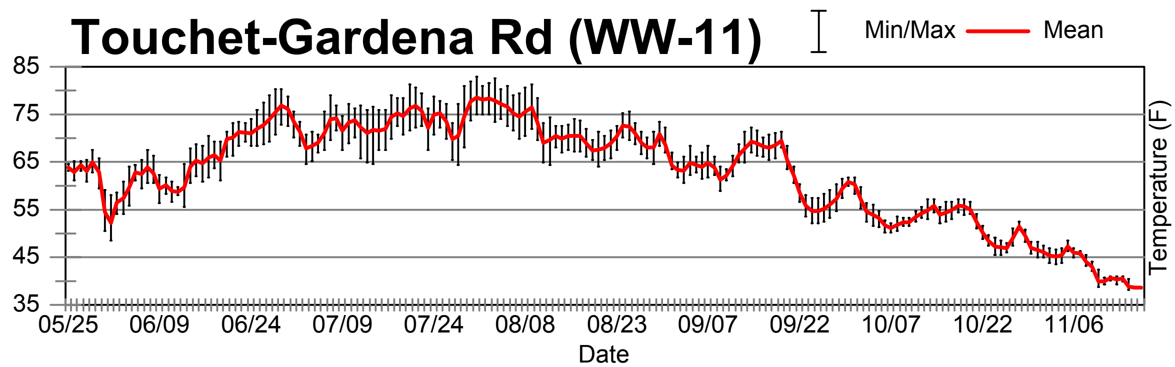

Cummins Bridge (TR-10)
Min/Max
Mean
90
80
70
60
50
40
30
05/25
06/09
06/24
07/09
07/24
08/08
08/23
09/07
09/22
10/07
10/22
11/06
Date
Temperature (F)

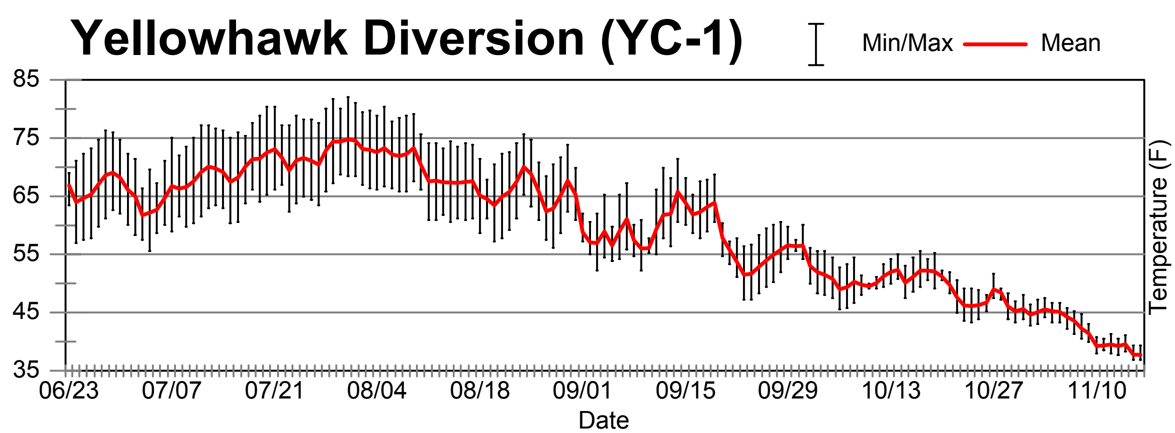

Pepper Bridge (WW-2)
Min/Max
Mean
75
65
55
45
35
05/26
06/09
06/23
07/07
07/21
08/04
08/18
09/01
09/15
09/29
10/13
10/27
11/10
Date
Temperature (F)

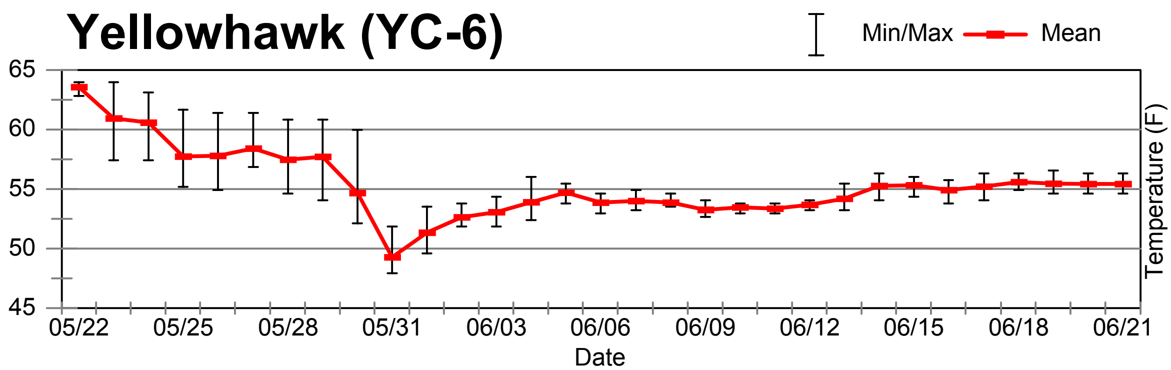

Mojonnier Rd (WW-6)
Min/Max
Mean
75
65
55
45
35
05/25
06/09
06/24
07/09
07/24
08/08
08/23
09/07
09/22
10/07
10/22
11/06
Date
Temperature (F)


Detour Rd (WW-9)
Min/Max
Mean
80
70
60
50
40
05/25
06/08
06/22
07/06
07/20
08/03
08/17
08/31
09/14
09/28
10/12
10/26
11/09
Date
Temperature (F)

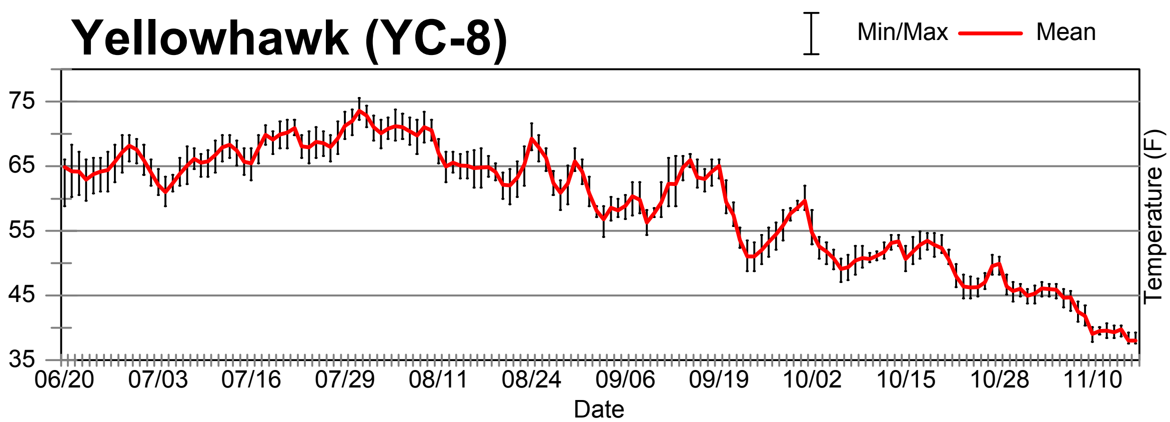

McDonald Rd (WW-10)
Min/Max
Mean
85
75
65
55
45
35
05/25
06/09
06/24
07/09
07/24
08/08
08/23
09/07
09/22
10/07
10/22
11/06
Date
Temperature (F)


Touchet-Gardena Rd (WW-11)
Min/Max
Mean
85
75
65
55
45
35
05/25
06/09
06/24
07/09
07/24
08/08
08/23
09/07
09/22
10/07
10/22
11/06
Date
Temperature (F)

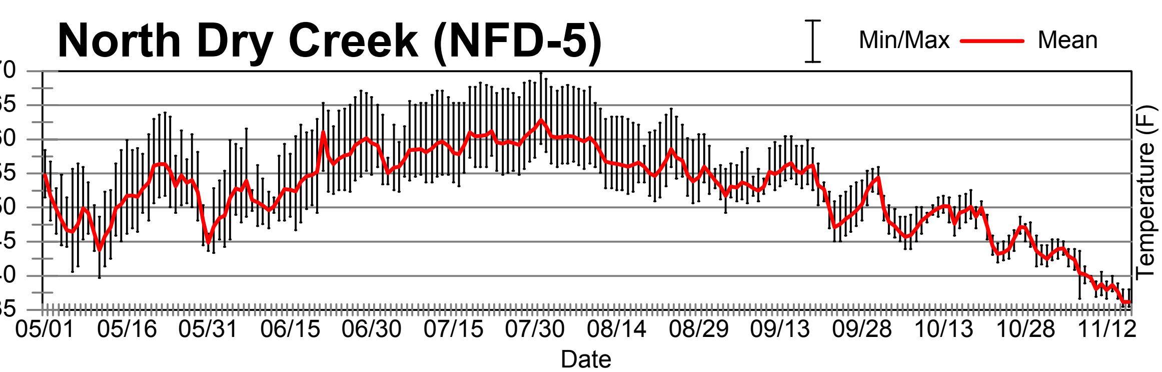

Yellowhawk Diversion (YC-1)
Min/Max
Mean
85
75
65
55
45
35
06/23
07/07
07/21
08/04
08/18
09/01
09/15
09/29
10/13
10/27
11/10
Date
Temperature (F)



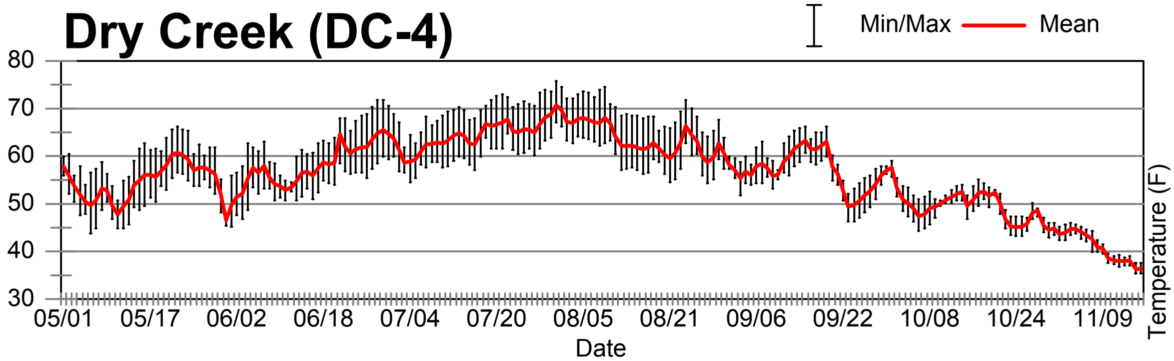
Yellowhawk (YC-6)
Min/Max
Mean
65
60
55
50
45
05/22
05/25
05/28
05/31
06/03
06/06
06/09
06/12
06/15
06/18
06/21
Date
Temperature (F)

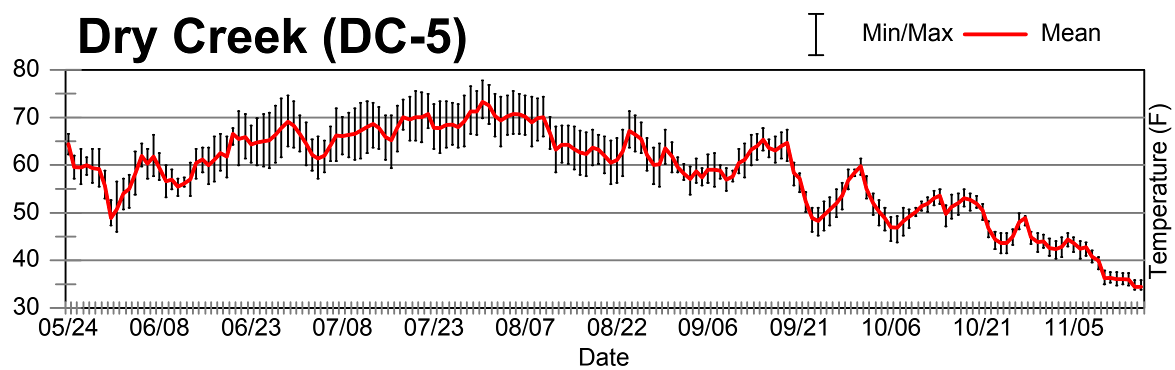


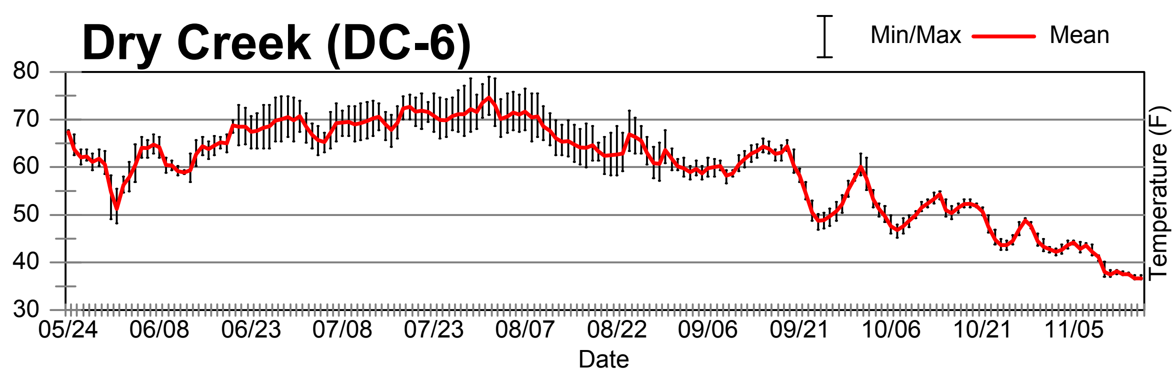
Yellowhawk (YC-8)
Min/Max
Mean
75
65
55
45
35
06/20
07/03
07/16
07/29
08/11
08/24
09/06
09/19
10/02
10/15
10/28
11/10
Date
Temperature (F)



North Dry Creek (NFD-5)
Min/Max
Mean
70
65
60
55
50
45
40
35
05/01
05/16
05/31
06/15
06/30
07/15
07/30
08/14
08/29
09/13
09/28
10/13
10/28
11/12
Date
Temperature (F)


Dry Creek (DC-4)
Min/Max
Mean
80
70
60
50
40
30
05/01
05/17
06/02
06/18
07/04
07/20
08/05
08/21
09/06
09/22
10/08
10/24
11/09
Date
Temperature (F)

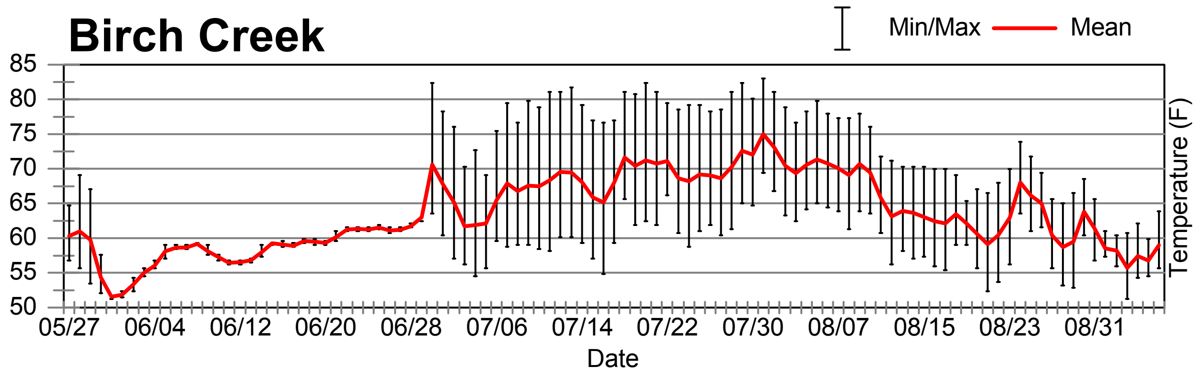

Dry Creek (DC-5)
Min/Max
Mean
80
70
60
50
40
30
05/24
06/08
06/23
07/08
07/23
08/07
08/22
09/06
09/21
10/06
10/21
11/05
Date
Temperature (F)

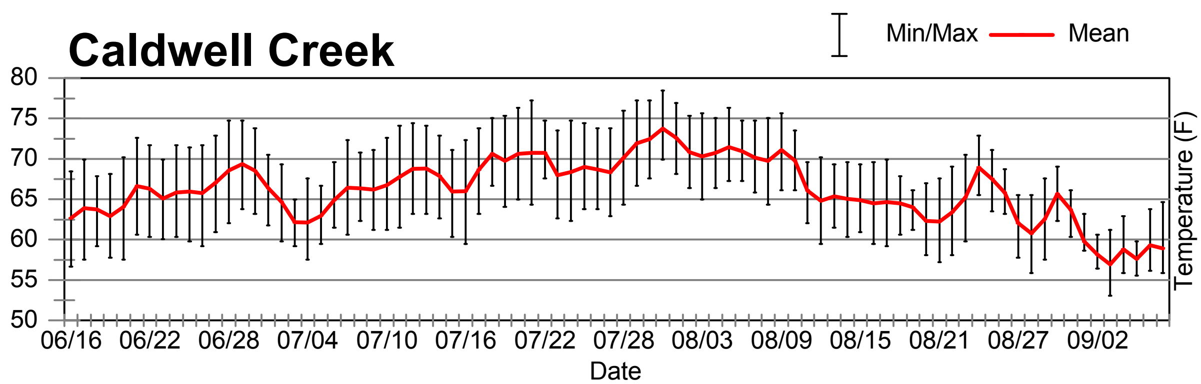

Dry Creek (DC-6)
Min/Max
Mean
80
70
60
50
40
30
05/24
06/08
06/23
07/08
07/23
08/07
08/22
09/06
09/21
10/06
10/21
11/05
Date
Temperature (F)

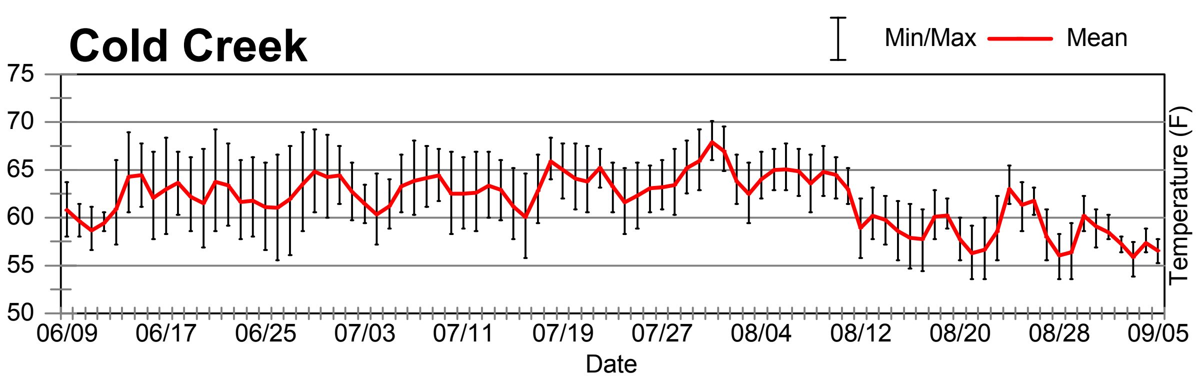
Appendix C1. Additional Stream Temperature Graphs 2000

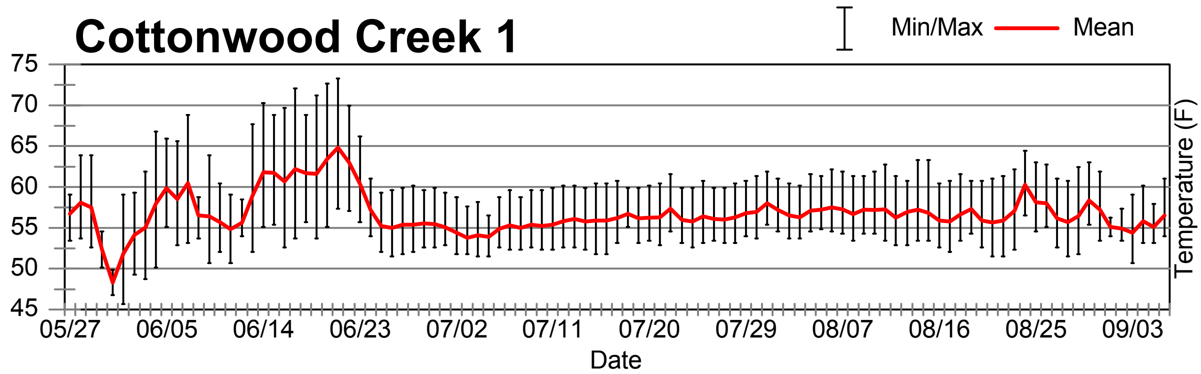
Temperature data provided by Army Corp of Engineers (Ben Tice)
and The Walla Walla Conservation District

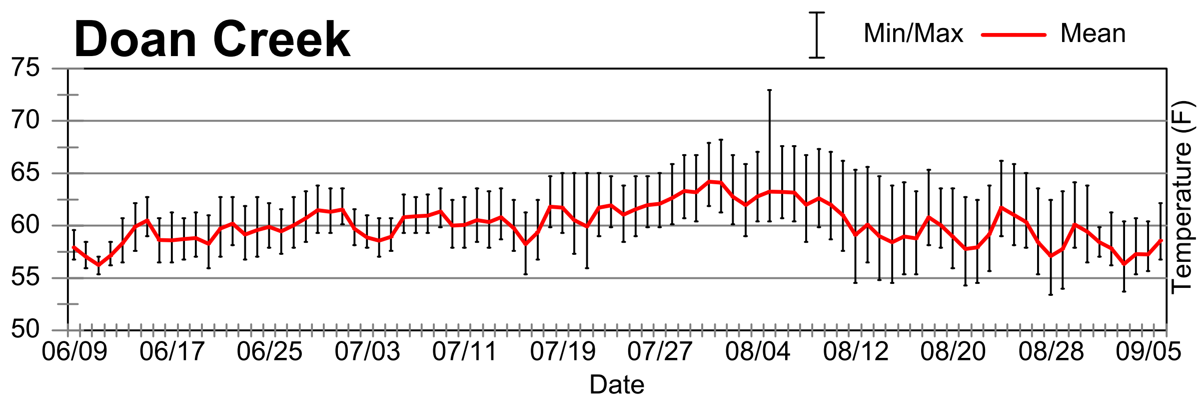
COE/WWCD Temperature Monitors, 1999.				
Stream Name	**Site Name**	**Type**	**Location**	**Comments**
Birch Creek	Pepper Rd	Temp	T6N, R35E, S13, NW¼	In-7/13/1999
Caldwell Creek	S. Second	Temp	T7N, R36E, S33, SW¼	In-7/13/1999
Cold Creek	Last Chance Rd	Temp	T7N, R35E, S32, NE¼	In-7/13/1999
Cottonwood Creek 1	Plaza Way	Temp	T6N, R36E, S6, SE¼	In-7/13/1999
Cottonwood Creek 2	Hood Rd	Temp	T6N, R36E, S11, SW¼	In-7/13/1999
Doan Creek	Whitman Mission	Temp	T7N, R35E, S38, NE¼	In-7/13/1999
East Little Walla Walla	Springdale Rd	Temp	T6N, R35E, S38, SW¼	In-7/13/1999
Garrison Creek 1	Majonnier	Temp	T6N, R35E, S3, SW¼	In-7/13/1999
Garrison Creek 2	Pi-Hi	Temp	T7N, R35E, S38, NE¼	In-8/5/1999
Mill Creek 1	Whitman Mission	Temp	T7N, R36E, S21, SE¼	In-8/5/1999
Mill Creek 2	5-mile Rd	Temp	T7N, R37E, S18, NE¼	In-8/5/1999
Mud Creek 1	Barney Rd	Temp	T7N, R34E, S31, SW¼	In-7/20/1999
Mud Creek 2	Private drive off Locher	Temp	T6N, R35E, S7, NE¼	In-7/13/1999
Pine Creek 1	Sand Pit Rd	Temp	T6N, R33E, S1, NW¼	In-7/20/1999
Pine Creek 2	Stateline Rd	Temp	T6N, R34E, S17, NW¼	In-7/20/1999
Reser Creek			T7N, R36E, S34, SW¼	7/13/99 Dry
Russell Creek 1	Plaza Way	Temp	T6N, R36E, S5, NW¼	In-7/13/1999
Russell Creek 2	Russell Creek Rd	Temp	T7N, R37E, S29, SW¼	In-7/13/1999
Spring Creek	Rt 12 bridge	Temp	T7N, R37E, S5, NW¼	In-7/13/1999
Stone Creek	Tiatan, @ 3rd	Temp	T7N, R36E, S29, SW¼	In-7/13/1999
Titus Creek	5-mile Rd	Temp	T7N, R37E, S18, NE¼	In-7/13/1999
West Little Walla Walla	Stoval Rd	Temp	T7N, R35E, S38, SW¼	In-7/13/1999
Temperature times may be rounded to the nearest 30 minutes.				

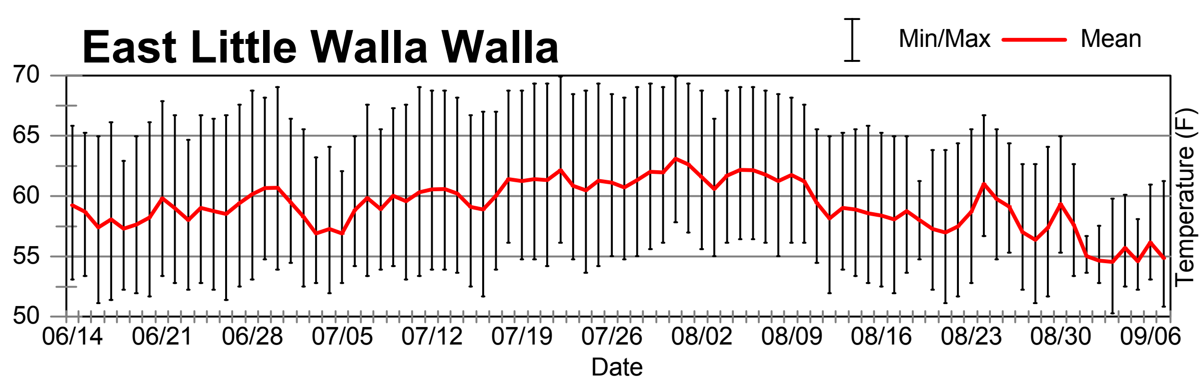

Birch Creek
Min/Max
Mean
85
80
75
70
65
60
55
50
05/27
06/04
06/12
06/20
06/28
07/06
07/14
07/22
07/30
08/07
08/15
08/23
08/31
Date
Temperature (F)

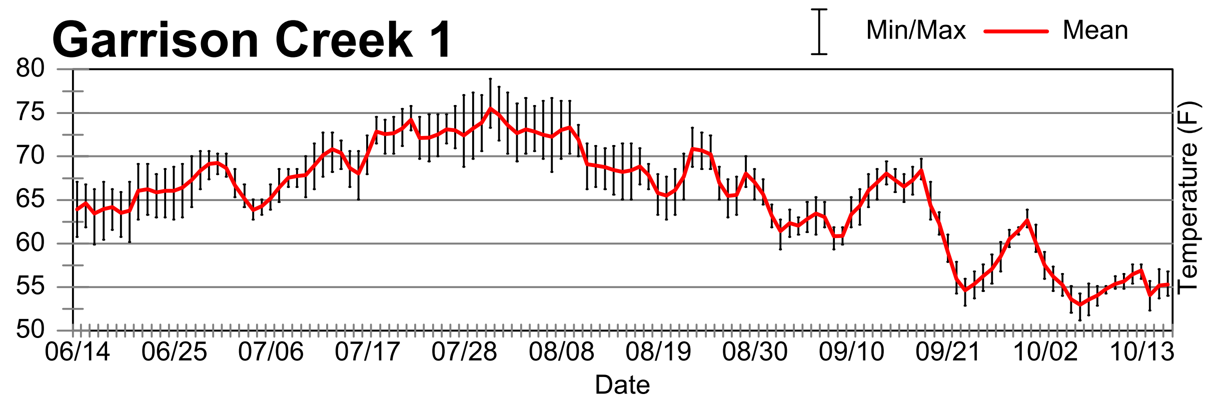

Caldwell Creek
Min/Max
Mean
80
75
70
65
60
55
50
06/16
06/22
06/28
07/04
07/10
07/16
07/22
07/28
08/03
08/09
08/15
08/21
08/27
09/02
Date
Temperature (F)

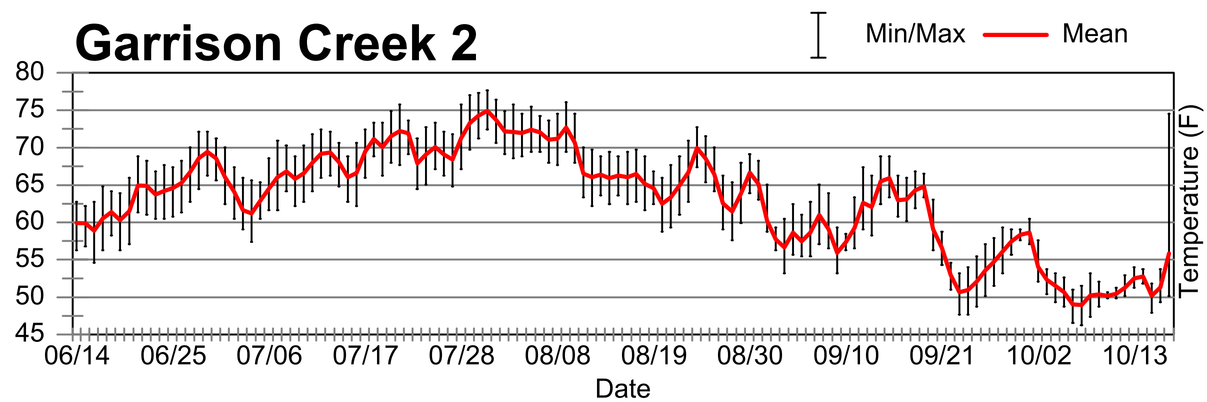

Cold Creek
Min/Max
Mean
75
70
65
60
55
50
06/09
06/17
06/25
07/03
07/11
07/19
07/27
08/04
08/12
08/20
08/28
09/05
Date
Temperature (F)

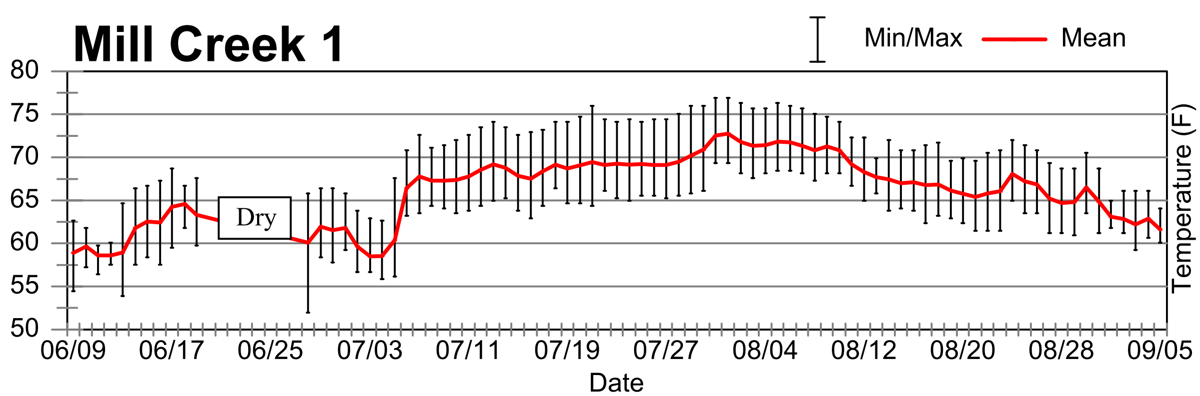

Cottonwood Creek 1
Min/Max
Mean
75
70
65
60
55
50
45
05/27
06/05
06/14
06/23
07/02
07/11
07/20
07/29
08/07
08/16
08/25
09/03
Date
Temperature (F)


Doan Creek
Min/Max
Mean
75
70
65
60
55
50
06/09
06/17
06/25
07/03
07/11
07/19
07/27
08/04
08/12
08/20
08/28
09/05
Date
Temperature (F)


East Little Walla Walla
Min/Max
Mean
70
65
60
55
50
06/14
06/21
06/28
07/05
07/12
07/19
07/26
08/02
08/09
08/16
08/23
08/30
09/06
Date
Temperature (F)


Garrison Creek 1
Min/Max
Mean
80
75
70
65
60
55
50
06/14
06/25
07/06
07/17
07/28
08/08
08/19
08/30
09/10
09/21
10/02
10/13
Date
Temperature (F)


Garrison Creek 2
Min/Max
Mean
80
75
70
65
60
55
50
45
06/14
06/25
07/06
07/17
07/28
08/08
08/19
08/30
09/10
09/21
10/02
10/13
Date
Temperature (F)


Mill Creek 1
Min/Max
Mean
Dry
80
75
70
65
60
55
50
06/09
06/17
06/25
07/03
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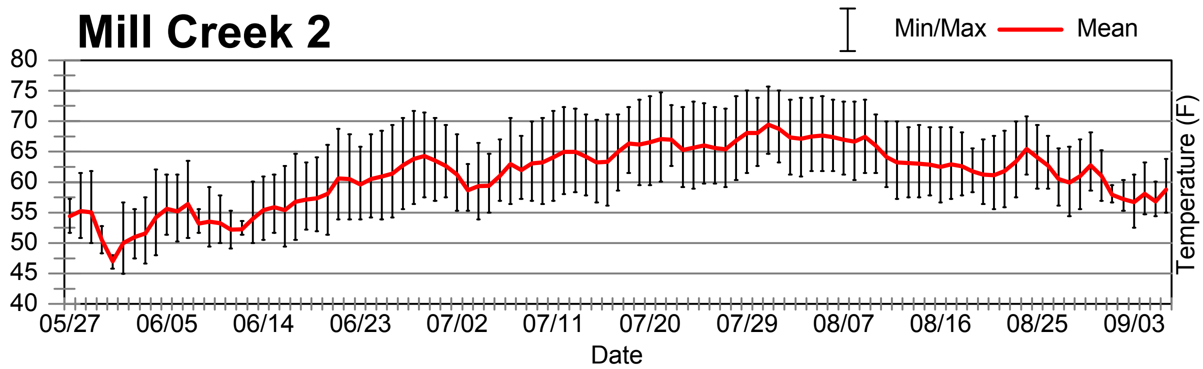
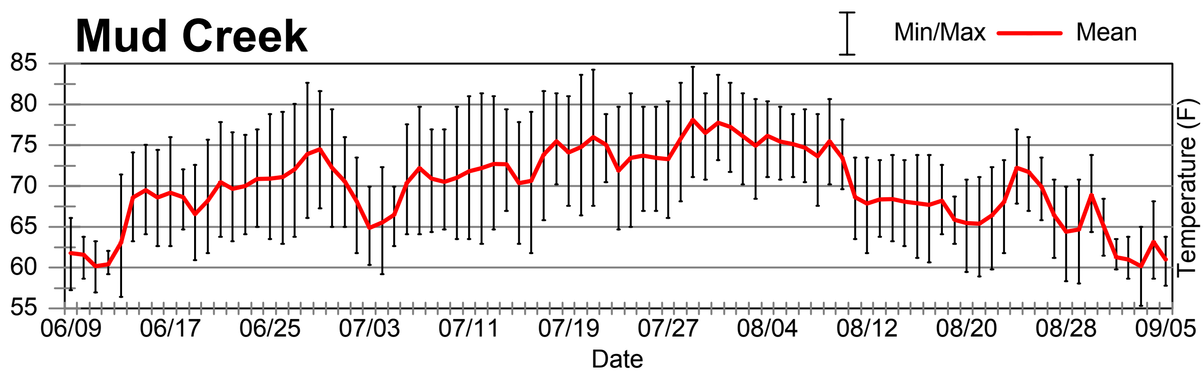
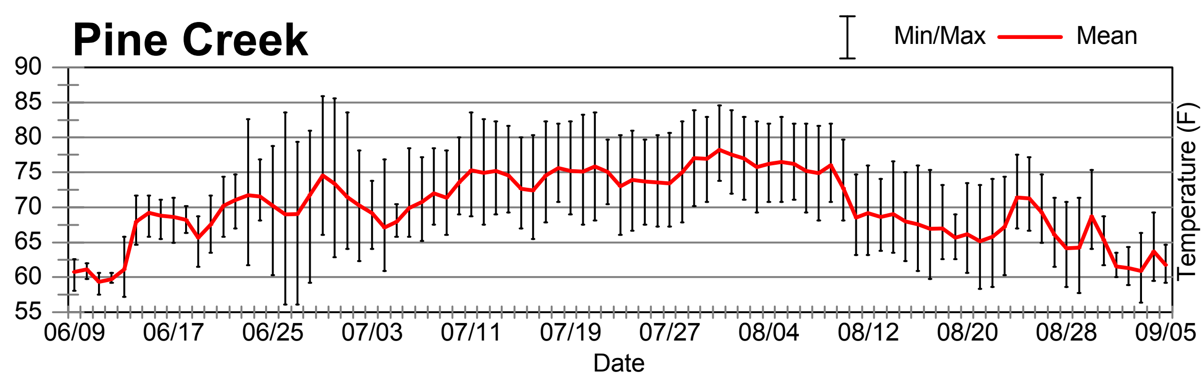
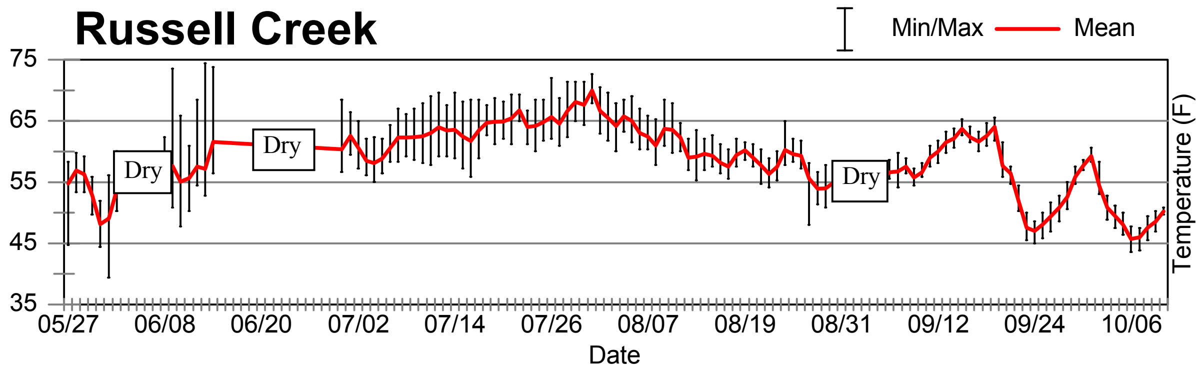
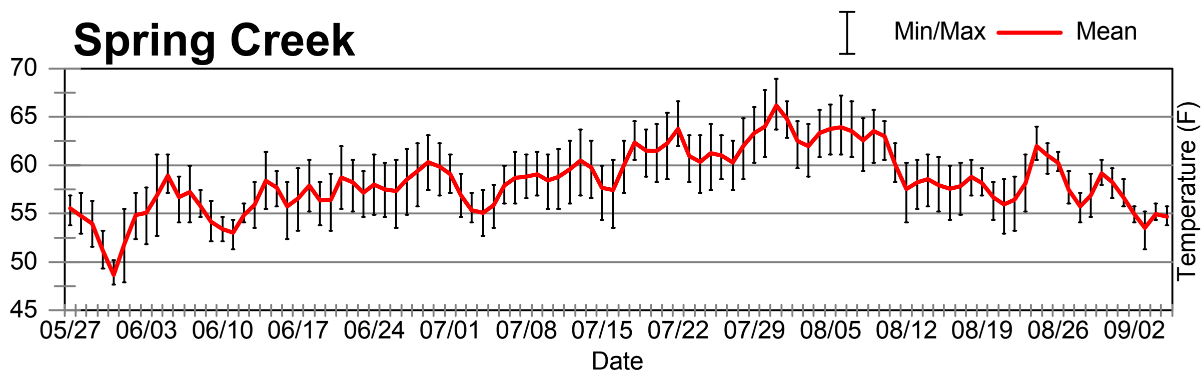
07/19
07/27
08/04
08/12
08/20
08/28
09/05
Date
Temperature (F)

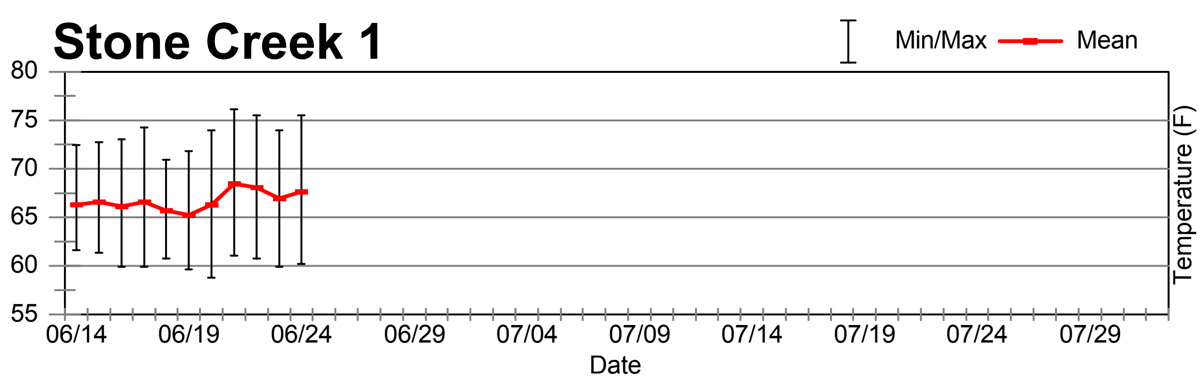

Mill Creek 2
Min/Max
Mean
80
75
70
65
60
55
50
45
40
05/27
06/05
06/14
06/23
07/02
07/11
07/20
07/29
08/07
08/16
08/25
09/03
Date
Temperature (F)

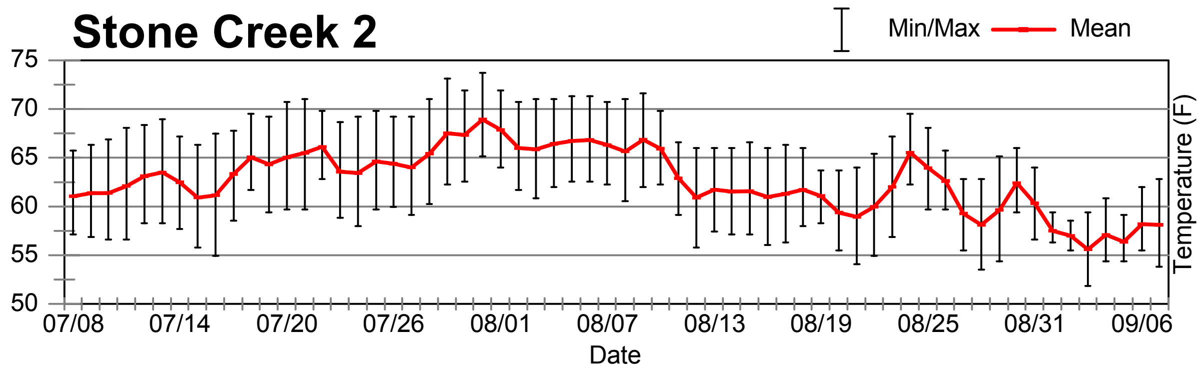

Mud Creek
Min/Max
Mean
85
80
75
70
65
60
55
06/09
06/17
06/25
07/03
07/11
07/19
07/27
08/04
08/12
08/20
08/28
09/05
Date
Temperature (F)

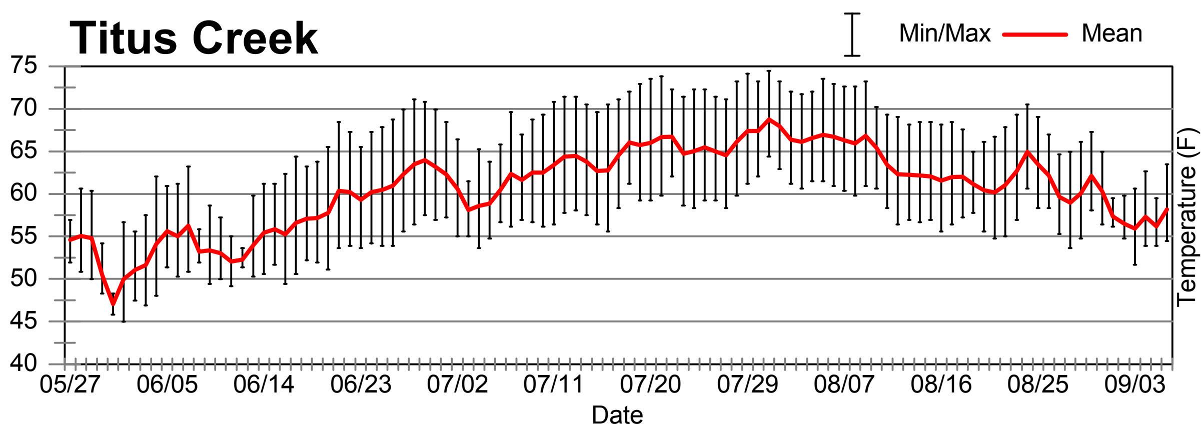

Pine Creek
Min/Max
Mean
90
85
80
75
70
65
60
55
06/09
06/17
06/25
07/03
07/11
07/19
07/27
08/04
08/12
08/20
08/28
09/05
Date
Temperature (F)

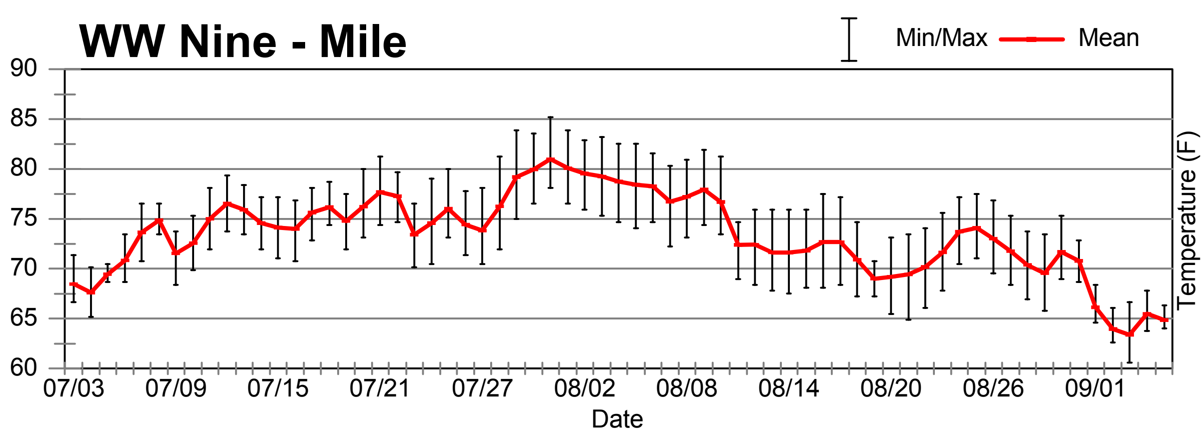

Russell Creek
Min/Max
Mean
75
65
55
45
35
Dry
Dry
Dry
05/27
06/08
06/20
07/02
07/14
07/26
08/07
08/19
08/31
09/12
09/24
10/06
Date
Temperature (F)

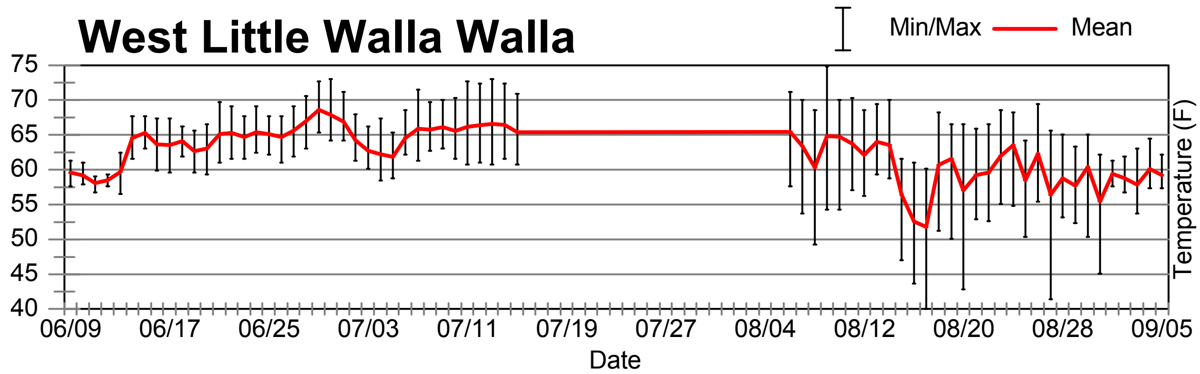

Spring Creek
Min/Max
Mean
70
65
60
55
50
45
05/27
06/03
06/10
06/17
06/24
07/01
07/08
07/15
07/22
07/29
08/05
08/12
08/19
08/26
09/02
Date
Temperature (F)

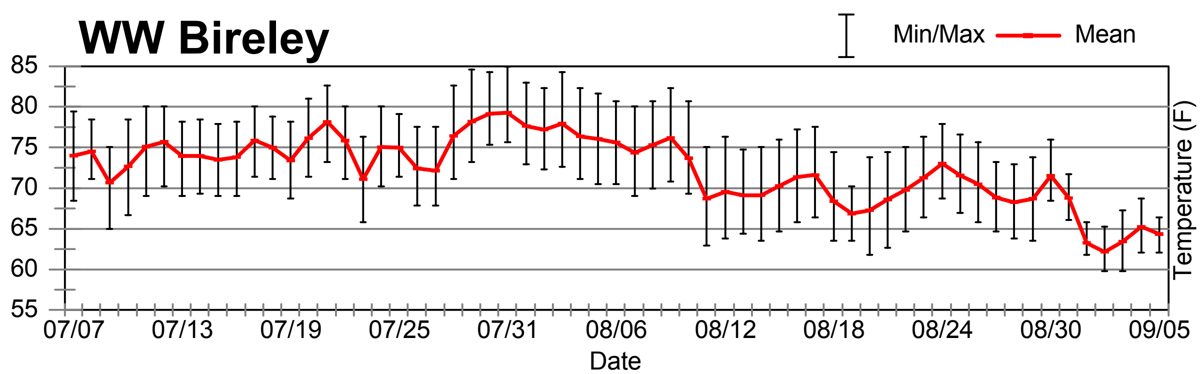

Stone Creek 1
Min/Max
Mean
80
75
70
65
60
55
06/14
06/19
06/24
06/29
07/04
07/09
07/14
07/19
07/24
07/29
Date
Temperature (F)


Stone Creek 2
Min/Max
Mean
75
70
65
60
55
50
07/08
07/14
07/20
07/26
08/01
08/07
08/13
08/19
08/25
08/31
09/06
Date
Temperature (F)


Titus Creek
Min/Max
Mean
75
70
65
60
55
50
45
40
05/27
06/05
06/14
06/23
07/02
07/11
07/20
07/29
08/07
08/16
08/25
09/03
Date
Temperature (F)


WW Nine - Mile
Min/Max
Mean
90
85
80
75
70
65
60
07/03
07/09
07/15
07/21
07/27
08/02
08/08
08/14
08/20
08/26
09/01
Date
Temperature (F)


West Little Walla Walla
Min/Max
Mean
75
70
65
60
55
50
45
40
06/09
06/17
06/25
07/03
07/11
07/19
07/27
08/04
08/12
08/20
08/28
09/05
Date
Temperature (F)


WW Bireley
Min/Max
Mean
85
80
75
70
65
60
55
07/07
07/13
07/19
07/25
07/31
08/06
08/12
08/18
08/24
08/30
09/05
Date
Temperature (F)

Appendix D. Water Quality Data 2000

Appendix D. Miscellaneous Water Quality Field Data 2000.

Data	Stream	Site #	pH	Conductivity (umhos/cm)
6-27-00	SF Patit	SFP-1	7.07 Temp (C) 10.9 Time 9:30	74.0 Temp 11.4 (C) Time 9:30
6-27-00	Spangler Ck	SC-6	7.05 Temp (C) 11.5 Time 10:52	52.7 Temp (C) 12.1 Time 10:52
6-27-00	NF Touchet	NFT-7	7.10 Temp (C) 11.5 Time 11:17	53.3 Temp (C) 11.9 Time 11:17
6-27-00	NF Touchet	NFT-11	7.48 Temp (C) 16.8 Time 12:26	63.6 Temp (C) 17.3 Time 12:26
6-29-00	NF Touchet	NFT-16	7.11 Temp (C) 15.5 Time 9:25	83.1 Temp (C) 15.7 Time 9:25
6-27-00	Lewis Ck	LC-12	7.35 Temp (C) 13.1 Time - -	72.6 Temp (C) 14.1 Time - -
6-27-00	Jim Ck	JC-1	7.55 Temp (C) 17.0 Time - -	92.4 Temp (C) 17.7 Time - -
6-27-00	Whitney Ck	WH-2	7.23 Temp (C) 13.8 Time 13:00	64.3 Temp (C) 14.1 Time 13:00
6-27-00	Coates Ck	C-1	7.46 Temp (C) 13.8 Time 13:26	62.5 Temp (C) 14.1 Time 13:26
6-27-00	Wolf Fork	WF-9	7.69 Temp (C) 16.3 Time 13:53	61.5 Temp (C) 17.0 Time 13:53
6-27-00	Wolf Fork	WF-11	7.84 Temp (C) 19.5 Time 14:50	62.0 Temp (C) 19.8 Time 14:50
6-27-00	Robinson Fork	RF-14	7.63 Temp (C) 21.2 Time 14:15	58.7 Time (C) 21.7 Time 14:15
6-29-00	SF Touchet	SFT-9	7.28 Temp (C) 17.9 Time 9:45	108.7 Time (C) 17.9 Time 9:45

Appendix D. Miscellaneous Water Quality Field Data 2000.

Data	Stream	Site #	pH	Conductivity (umhos/cm)
6-29-00	Touchet R	TR-4	7.7 Temp (C) 17.6 Time 10:20	113.5 Temp (C) 17.8 Time 10:20
6-29-00	Touchet R	TR-7	9.15 Temp (C) 21.2 Time 10:55	111.5 Temp (C) 21.2 Time 10:55
6-29-00	Touchet R	TR-9	8.43 Temp (C) 24.2 Time 11:50	103.7 Temp (C) 24.4 Time 11:50
7-10-00	Touchet R	TR-9	9.09 Temp (C) 24.6 Time 13:25	80.4 Temp (C) 24.7 Time 13:25
6-29-00	Touchet R	TR-10	7.98 Temp (C) 25.5 Time 12:20	137.1 Temp (C) 25.6 Time 12:20
7-10-00	Touchet R	TR-10	8.54 Temp (C) 23.8 Time 14:00	89.0 Temp (C) 24.4 Time 14:00
6-29-00	Walla Walla	WW-9	8.78 Temp (C) 25.2 Time 13:10	229.0 Temp (C) 25.3 Time 13:10
7-10-00	Walla Walla	WW-9	9.31 Temp (C) 24.6 Time 16:00	155.1 Temp (C) 24.9 Time 16:00
6-29-00	Walla Walla	WW-6	8.26 Temp (C) 22.5 Time 13:40	125.5 Temp (C) 22.7 Time 13:40
6-29-00	Walla Walla	WW-2	8.05 Temp (C) 23.6 Time 14:30	117.4 Temp (C) 23.7 Time 14:30
7-10-00	Walla Walla	WW-10	9.46 Temp (C) 28.7 Time 15:20	170.2 Temp (C) 29.0 Time 15:20
7-10-00	Walla Walla	WW-8	8.6 Temp (C) 23.4 Time 16:15	290 Temp (C) 23.6 Time 16:15

Appendix D. Miscellaneous Water Quality Field Data 2000.

Data	Stream	Site #	pH	Conductivity (umhos/cm)
7-10-00	Pine Ck	PC-1	8.76 Temp (C) 24.4 Time 14:30	354 Temp (C) 25.6 Time 14:30
7-10-00	Mud Ck	MC-2	7.89 Temp (C) 24.8 Time 15:00	239 Temp (C) 25.1 Time 15:00

Appendix E. Qualitative Electrofishing 2000

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
NF Touchet	NFT-2	9/20	100	Three 1+ RBT's (170-175mm) & three BT (50-163mm) found Tailed-frogs - common	Moderate intensity survey, sampling mostly pools.
	NFT-3	8/29	25	One 55mm BT & one 28mm RBT found; RBT & BT - rare	Moderate intensity survey. Very few fish found
	NFT-4	9/20	100	Three BT (55-63mm) found; no other fish found	Light survey effort, sampled mainly pools
	NFT-5	9/20	100	Five 0+ (35-73mm), one 152 mm & one 215mm RBT found; four BT (55-70mm) found	Light survey effort, sampled mostly pools
Coppei Ck	MC-1*	8/17	45	Five 1+ RBT's for DNA, RBT, SCP, dace - common	Light effort, mainly pools electrofished
	MC-3*	8/17	100	Five 1+ RBT's for DNA; two age classes present. RSS, SCP, BLS, dace - common	Light effort with mainly pools electrofished. Few RBT's present for large area
	MC-4*	8/17	100	Two RBT's (133, 135 mm), RSS & crayfish - common, dace - abundant.	Light effort - mainly pools electrofished. Very few RBT's present for large area
NF Coppei	NFC-1*	8/17	30	Three 1+ & one 206 mm RBT; RBT's - uncommon, crayfish - rare; SCP - common	Light effort with mainly pools electrofished
	NFC-2*	8/17	.1mi	Five 1+ RBT's; two age classes observed; RBT's - uncommon, dace, SCP - common	Moderate effort
	NFC-4*	8/17	5	Five 1+ RBT's, dace-common, SCP - abundant, crayfish - uncommon	Only one pool electrofished to collect DNA samples
NF Dry Ck	NFD-1	8/24	58	Thirteen 1+ & one 237 mm RBT, RBT's, dace - uncommon; SCP - common.	Moderately intensive survey Sampled mainly pools. Little water in stream
Walla Walla	WW-3	8/1	38	Six 1+ & one 273mm hatchery RBT; dace, RSS - abundant; RSS - abundant; sucker, NPM, SCP - common	Light survey - area deep and wide - difficult to survey

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
E ast Little Walla Walla	ELW-4	8/1	72	One 290mm RBT(H) & one 127mm MTW found; NPM, 3-spine stickleback, SCP - common; dace - uncommon; crayfish; RBT - rare	Moderate survey intensity
West Little Walla Walla	WLW-1	7/18	90	No RBT's found; two age classes of RSS, dace, SCP - common; suckers - uncommon	Intense electrofishing effort. Good habitat, no RBT's
	WLW-2	7/12	45	Two 0+ RBT's found; RBT's - rare; dace, crayfish - common; RSS - uncommon	Moderate survey intensity. Very little water with dense grass
	WLW-3	7/18	100	No fish found	Light survey targeting mostly pools. Difficult to survey due to dense grass and shrubs
	WLW-4	7/12	200	One 1+ RBT found; shiner - common; dace - uncommon; crayfish - rare	Light effort targeting mostly pools due to dense grass and shrubs. Little water
Mill Ck	MC-1	8/23	19	Twenty-nine 1+ (68-196mm) & Twenty-one >8 in (200-345mm) RBT's found; dace, RSS, RBT - common; SCP, ameocete - uncommon	Moderate intensity electrofish
	MC-2	8/23	38	Nine 1+ (66-196mm) & three >8in (220-395mm) RBT's; RSS, RBT,dace, sucker - common; SCP - uncommon	Moderate electrofishing effort targeting mostly below weirs
	MC-3	8/23	38	Three 1+ (74, 86 & 184mm) & five >8in (201-370mm) RBT's; dace, SCP, crayfish, RSS, sucker - common; ameocete, RBT - uncommon	Moderate effort. Surveyed mostly pools
	MC-4	7/5	37	No RBT's found; SCP, dace, RSS - common	Light effort - sampled mainly below weirs
	MC-6	8/23	145	No RBT's found; two age classes sucker, dace - abundant; two age classes RSS & SCP - common	Moderate electrofishing effort

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
Mill Ck	MC-7	7/5	148	Two 0+ (60 & 64mm), two 1+ (163 & 176mm) & four >8 in (203 - 291mm) RBT's; dace, SCP, RSS - abundant	Moderate effort - pools below weirs sampled. Few RBT's found for large area
	MC-8	8/23	152	Nine 1+ (70-197mm) & nine >8in (226 - 396mm) RBT's; dace, sucker - abundant; shiners, SCP - common	Intense electrofish survey
	MC-8	7/5	161	Three 1+ (175-187mm) & two >8 in (236 & 299mm) RBT; three age classes of dace, sucker, RSS, SCP - abundant	Moderate survey effort with mostly pools below weirs sampled
	MC-9	7/5	55.5	Two 0+ & two 1+ RBT's; dace, SCP, RSS - abundant	Intense survey. Area is more like wetlands
	MC-11	8/10	30	Nine RBT's (80-115mm); RBT, sucker, dace, SCP - common; crayfish - uncommon	Light effort. Mainly electrofished to collect weights
	MC-12	8/10	2 mi.	168 RBT's 64-119mm found; RBT, dace, RSS, BLS, crayfish, SCP - common; MTW, long-nose dace - rare	Intensive electrofishing effort
	MC-14	7/6	93.8	One 63mm RBT found; RBT, SCP - rare; two age classes of RSS, sucker, NPM - common; dace - abundant;	Moderate effort. Rt bank void of life due to Chlorine leak. Most fish had bumps and lesions.
	MC-15	7/6	89.8	Two RBT's (58 & 255mm); RSS, dace, NPM - abundant	Moderate effort. Strong chlorine smell in river
	MC-16	8/22	50	No fish found	Moderate effort. Very strong chlorine smell in river
	MC-17	8/22	189	Ten 1+ and two >8 in RBT's (223 & 363 (hatchery) mm); RBT's - rare; dace - abundant; BLS, RSS - common, SCP - uncommon	Intense effort. Good habitat, but chlorine smell smell in river
	MC-18	7/6	76.5	Ten 0+, one 1+, & one 310mm hatchery RBT found; dace, SCP RSS - abundant; NPM, sucker - common	Moderate survey intensity

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
S Russell	SRC-1	7/11	33	No fish found.	Intensive survey
Russell	RC-1	7/11	50	No fish found.	Intensive survey
	RC-2	7/12	23	No fish found.	Intensive survey
	RC-3	7/11	125	One 190mm RBT found. No other fish found.	Intensive survey
	RC-4	7/11	80	3-4 age classes of RBT. Seventeen RBT's ranging from 63-252 mm. Dace - common, SCP & RSSuncommon.	Intensive survey
	RC-5	7/11	64	Seven RBT representing 2 age classes found. Dace - common, SCP- uncommon Lamprey - rare	Intensive survey
	RC-6	7/12	71	Two RBT found 166mm & 182mm. SCP - common	Intensive survey
	RC-7	7/12	58	Two 0+ RBT found. Dace & RSS abundant. SCP - common Suckers - uncommon	Moderate
Garrison	GC-2	7/20	38	No RBT's found; RSS, dace, ameocete - common; NPM - rare; SCP - abundant	Light survey. Poor habitat
	GC-3	7/20	37.7	No RBT's found; crayfish & SCP - common	Moderate survey intensity with mostly pools electrofished
	GC-4	7/20	37	No RBT's found; SCP - abundant; RSS - rare	Moderate survewy intensity with mostly pools electrofished
	GC-5	7/20	85.5	No RBT's found; NPM, SCP, sucker, dace - common; RSS - Abundant	Intense survey
	GC-7	7/18	.2 mi	No RBT's found; two age classes dace - common	Moderate survey intensity. Difficult to survey due to dense vegetation growth

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
Caldwell	CD-2	7/11	56	No RBT's found; one age class of dace - common	Moderate survey effort. Poor habitat - very muddy
Mud Ck	MC-1	8/16	20	No RBT's found; dace, 3-spine stickleback - abundant; SCP - common; crayfish - rare	Moderate intensity survey. Poor habitat with heavy cattle use, mud botton and no riparian
	MC-2	8/16	100	No RBT's found; 3-spine stickleback - common; dace - uncommon	Light effort. Deep, slow pools with no riparian. Heavy cattle use
Pine Ck	PC-1	8/28	140	No RBT's found; dace - rare; small mouth bass - uncommon; madtom - rare	Light survey intensity. Poor habitat with deep pools and no flow. Thick scum layer on surface.
Stone Ck	SC-1	8/22	30	No RBT's found; dace, SCP, crayfish - common; ameocetes - rare	Moderate survey intensity. Good riparian, but little flow and mud substrate
	SC-2	7/20	44.1	No RBT's found; crayfish, SCP - uncommon; dace - rare	Light survey intensity. Very dense grass and cattails. Very little water. Difficult to electrofish.
	SC-3	7/21	200	No RBT's found; two age classes of dace, SCP - abundant; ameocete, crayfish - common; sucker, NPM - rare	Intense survey. Wetland like habitat with little open water, dense grass and mud bottom
	SC-4	7/20	24	No RBT's found; dace - abundant	Light survey intensity. Very poor habitat with little flow and mud bottom. Poor ripairian
Doan Ck	DN-2	8/15	30	No RBT's found; SCP, dace - common	Light survey intensity. Dense grass growth
Cold Ck	CC-1	8/22	30	No RBT's found; three age classes of dace - common; two age classes of SCP - common.	Light survey intensity. Good riparian, but no bank stability and mud bottom
	CC-2	8/16	30	No RBT's found; two age classes of dace and SCP; dace - abundant SCP - common	Moderate survey intensity. Very poor habitat with heavy cattle use, no riparian & mud substrate

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
Cottonwood	CCC-4	7/6	117	No fish found	Light survey. Little water with many dry spots. No riparian and very little flow
	CCC-5	7/5	30.5	Fifteen 0+ (56-78mm), seven 1+ (133-153mm), one 221mm RBT's found; dace - uncommon; SCP - rare	Moderate intensity survey. Mainly pools sampled
Whitney	WH-1	8/2	3.5 mi	RBT's - common; T-frog - common	Moderate intense survey. Some larger RBT's to 12in found.
Corral Ck	CC-1	7/31	200	Four BT (146-168mm) found; Tailed frog - rare	Light electrofish survey with mostly pools sampled
	CC-2	7/31	200	No fish found; Tailed frog - rare	Light electrofish survey with mostly pools sampled
	CC-3	7/31	40	Five BT (121-157mm) found; No RBT's found	Intense electrofish survey.
Mustard Hollow	MH-1	8/21	10	No RBT's found; one red-eared sunfish captured	Light electrofish survey. Very poor habitat with dense grass and mud substrate.
Cougar Hollow	CH-1	8/21	100	No water	
Johnson Hollow	JH-1	8/21	100	No fish found	Almost no water
South Fk Patit	SCP-3	8/21	100	Three age classes of RBT's found; RBT's abundant; SCP - rare	Moderate electrofish effort sampling mostly pools
Patrick Sp Creek	PSC-1	7/18	30	One 126mm RBT & two BT (93 & 84mm); BT, RBT & tailed frog - rare	Light electrofish effort. Likely barrier in stream with fish found below falls, No fish found above
. Hatley Gulch	HG-1	8/21	15	No fish found Very little water.	Moderate electrofish effort.

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
Davis Hollow	DH-1	8/21		No water	
Titus Ck	TC-1	9/11	25	One 281mm RBT found; RSS, SCP, dace - common; BLS - uncommon	Light survey intensity due to dense and shrub growth. Difficult access
	TC-3	9/11	30	Three 1+ (120-143mm) & two >8in (234 & 243mm) RBT's; SCP, BLS - uncommon; dace - common; RSS - abundant	Moderate intensity survey. Very deep and muddy pools with little flow. Difficult to sample
Bryant Ck	BC-1	8/22	30	One 97mm RBT found; dace, SCP - common grass and mud substrate	Intense electrofish survey. Poor habitat with dense
Burnt Fk	BF-1*	8/7	60	Six 0+ (58-64mm) & twenty-three 1+ (73-175mm) RBT's found; twelve BT (102-273mm); Tailed frog - uncommon	Intense electrofish survey. Excellent habitat
	BF-2	8/7	30	Two 0+ (62 & 70), fourteen 1+ (99-192mm) & one 204mm RBT found; RBT's - common; tailed frog - rare; SCP - uncommon	Intense electrofish survey. Excellent habitat
Robinson Fk	RF-1*	8/15	30	Five RBT's (81-110mm) sampled for DNA; RBT, SCP - common	Light effort. Little water with small pools. Lots of algae on rocks
	RF-2*	8/15	30	Five RBT's (94-128mm) sampled for DNA; RBT, SCP - common	Light effort. Good habitat with some large pools
	RF-3*	8/15	5	Five RBT's (56-119mm) sampled for DNA; RBT, SCP - common	Light effort. Electrofished two pools
	RF-4	8/15	16	Five RBT's (85-138mm) sampled for DNA; RBT, SCP - common; crayfish - uncommon	Light survey. Surveyed mostly pools. Good habitat
	RF-5*	8/15	12	Five RBT's (92-116mm) sampled for DNA; RBT, SCP,	Light survey. Sampled mostly pools. Site exposed

Relative abundance for qualitative electrofishing sites in the Walla Walla River basin, 2000.

Stream	Site #	Date	Approx Site Length (m)	Relative Abundance*	Comments
Robinson Fk				crayfish - common	with no shade and no LOD
	RF-6*	8/15	17	Five RBT's (83-143mm) sampled for DNA; RBT, SCP, crayfish - common	Light survey. Sampled mostly pools. Little shade and poor riparian.
	RF-7*	8/15	18	Five RBT's (84-121mm) sampled for DNA; RBT, SCP, crayfish - common	Light survey. Sampled mostly pools
	RF-8*	8/15	3	Five RBT's (103-127mm) sampled for DNA	Very light survey. Sampled only one pool.
	RF-8*	8/15	150	Nine RBT's (76-162mm) found; RBT's - uncommon	Moderate intensity survey.
	RF-9*	8/15	9	Five RBT's (94-127mm) sampled for DNA	Very light survey. Only sampled one pool.
	RF-10*	8/15	26	Five RBT's (88-118mm) sampled for DNA; RBT, SCP, crayfish - common	Light survey. Sampled mostly pools.
	RF-13*	8/15	13	Five RBT's (105-141mm) sampled for DNA; RBT, SCP, dace & crayfish - common	Very light survey. Sampled two pools. Poor riparian.
	RF-14*	8/15	65	Five RBT's (91-117mm) sampled for DNA; RBT, SCP, crayfish - common	Light survey. Sampled mostly pools. Mostly larger 1+ RBT's found
	Pond trib	7/19	600	Nine RBT's (30-225mm) found; no other fish found; RBT's - rare	Intense electrofish survey. Little water and heavy cattle use, but good riparian
	Headwaters down	7/19	~3mi	No RBT's found 1st two miles; tailed frogs - common; RBT's - uncommon last mile; tailed frogs- uncommon	Moderate intensity survey. Steep gradient and multiple barriers on upper reach. Lower reach has good habitat with good riparian.

Appendix F. Relative Abundance of Non–Salmonids 2000

Appendix F. Table 1. **Relative Abundance - Non- Salmonids 2000** Touchet River

Species	NF Touchet 8 Lewis Ck	NF Touchet 9 Lewis Ck	Corral Creek	Patrick Spring Creek	Spangler Creek	Lewis Creek	Wolf Fork	Whitney Creek	Robinson Fork	Burnt Fork	South Fork Touchet	Touchet River	North Fork Coppei	South Fork Coppei	Coppei Creek
Petromyzontide Lamprey	1	1	0	0	0	0	P	0	P	0	1	1	1	1	P
Cyprinidae Speckled dace *Rhinichtys osculus*	4	3	0	0	0	0	1	0	2	0	4	4	3	3	4
Chiselmouth *Acroheilus alutaceus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Redside shiner *Richardsonius balteatus*	0	1	0	0	0	0	0	0	0	0	2	2	0	0	2
Northern pikeminnow *Ptychocheilus oregonesis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Catostomidae Suckers[a] *Catostomus sp.*	0	0	0	0	0	0	0	0	0	0	P	P	P	P	P
Gasterosteidae Threespine stickleback Gasterosteus aculeatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cottidae Piute sculpin *Cottus beldingi*	3	3	0	0	P	1	3	P	3	1	3	3	2	3	0
Margin sculpin *Cottus marginatus*	2	3	0	0	P	1	2	0	2	1	3	3	2	3	3
Torrent sculpin *Cottus rhotheus*	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Tailed Frogs *Ascaphus truei*	3[c]	0	1[b]	1[b]	3	1	P	3[b]	1	1	0	0	0	0	0
Crayfish *Pacifastacus Spp.*	2	3	0	0	0	P	P	0	3	0	2	3	1	1	3

[a]. Noted by genus only, not identified by species.
[b]. Relative abundance derive from qualitative electrofishing.

Appendix F. Table 1.	Walla Walla River Basin																	
Species	Walla Walla River	North Fork Dry Creek	Dry Creek	Yellowhawk Creek	Russell Creek	Cottonwood Creek	Caldwell Creek	Mill Creek	Titus Creek	East Little Walla Walla	West Little Walla Walla	Cold Creek	Doan Creek	Garrison Creek	Bryant Creek	Mud Creek	Pine Creek	Stone Creek
Petromyzontide Lamprey larvae	1	0	1	1	P	0	1	1	0	1	P	0	0	1	0	P	P	1[b]
Cyprinidae Speckled dace *Rhinichtys osculus*	4	1	3	3	4	3	3	4	3	3	3	4	3	3	3b	3[b]	1[b]	3[b]
Longnose dace Rhinichtys cataractae	0	0	0	0	0	0	0	P	0	0	0	0	0	0	0	0	0	0
Chiselmouth *Acroheilus alutaceus*	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Redside shiner *Richardsonius balteatus*	4	0	1	3	3	0	0	3	3	2	3	0	0	3	0	0	0	0
Northern pikeminnow *Ptychocheilus oregonesis*	3	0	0	1	0	0	0	2	0	2	0	0	0	0	0	0	0	1[b]
Ictaluridae Tadpole Madtom *Notorus gyrinus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1[b]	0
Catostomidae Suckers[a] *Catostomus sp.*	3	0	P	2	1	P	0	3	2	2	2	0	0	1	0	0	0	1[b]
Gasterosteidae Threespine stickleback *Gasterosteus aculeatus*	P	0	0	0	0	0	0	0	0	P	0	0	0	0	0	4[b]	0	0
Centrarchidae Smallmouth Bass *Micropterus dolomieu*	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2[b]	0
Cottidae Piute sculpin *Cottus beldingi*	2	0	0	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0
Margin sculpin *Cottus marginatus*	3	2	3	3	0	2	0	3	1	2	2	3	3	3	3[b]	2[b]	0	3[b]
Torrent sculpin *Cottus rhotheus*	3	0	0	1	0	0	0	P	1	0	0	0	0	0	0	0	0	0
Crayfish *Pacifastacus Spp.*	3	2	2	2	0	P	0	1	0	2	1	0	P	P	0	P	0	3[b]

Table 2. Categories of relative abundance.

Category	Count	Ranking Value
Absent	0	0
Rare	1-3	1
Uncommon	4-10	2
Common	11-100	3
Abundant	100+	4

P = present,

[a]. Nnoted by genus only, not identified by species.

[b]. Relative abundance derive from qualitative electrofishing.

Appendix G. Preliminary Results of Instream Flow Incremental Methodology for the Walla Walla River and Mill Creek 1999

Preliminary Results

April 2, 2001

TO: Glen Mendel

FROM: Hal Beecher

SUBJECT: Instream flow study of the Walla Walla River and lower Mill Creek

The purpose of the study was to determine how summer flows in the Walla Walla River immediately downstream from the mouth of Mill Creek and in lower Mill Creek affect habitat conditions for juvenile steelhead. We used Physical Habitat Simulation (PHABSIM) models of the two study reaches to determine the distribution of water depths and velocities in relation to substrate and cover and to evaluate these distributions in relation to habitat selection preferences of juvenile steelhead.

The PHABSIM model does not address water temperature nor other aspects of water quality. It assumes a constant channel or at least one that is in dynamic equilibrium so that the frequency of mesohabitat types and microhabitat types will be represented by the model even if there are channel changes. The PHABSIM model does not address the following, which are important factors in maintaining or restoring watershed health:
-channel maintenance flows, including flushing flows
-flows to maintain riparian vegetation
-flows for outmigration of smolts.

Site Selection
We relied heavily on the judgement and experience of WDFW fish biologists (Glen Mendel and staff) who have worked in the Walla Walla River basin and know fish distribution and stream habitat characteristics throughout the basin. In October 1998, Glen Mendel and I flew the Walla Walla River from the Oregon border to the confluence with the Columbia River. We delineated reaches on a topographic map. Reaches were similar throughout in gradient, flow, and sinuosity. Based on the judgement of Glen Mendel, his staff, and my impressions, the reach selected was "typical" of a portion of the Walla Walla River considered important for steelhead because a few juveniles currently rear in this reach.

Hydraulic Model Calibration
We measured depths, velocities, and recorded substrate and cover at points along transects at our two sites in June and July, 1999 (Table 1). All measurements are in English units: flow is in cubic feet per second (cfs), depth in feet, and velocity in feet per second (fps).

Table 1. Transects and measured flows in Walla Walla River and Mill Creek	Walla Walla River immediately downstream from mouth of Mill Creek	Mill Creek immediately upstream of Wallula Road bridge
number of transects	9	8
date & measured flow (cfs)	6/4/99 - 182	6/3/99 - 61
date & measured flow (cfs)	6/11/99 - 70	6/10/99 - 25
date & measured flow (cfs)	7/7/99 - 21	7/6/99 - 5

Surveying and measurement data were entered into the IFG4 hydraulic simulation model using velocity regression ("3-flow model"). We chose this hydraulic model because it has fewer assumptions than the alternative models and allows comparison of measured and simulated data.

The initial run was reviewed to compare measured and simulated water surface elevations and velocities at each of the three calibration flows. Velocity adjustment factors (VAFs) were also reviewed; VAFs were considered acceptable if they were between 0.80 and 1.20. The initial run was also used to simulate 2.5 times the high calibration flow and 0.4 times the low calibration flow. These upper and lower extrapolations were reviewed for extremely high and unlikely velocities or velocity distributions, as well as patterns of water surface elevation from transect to transect and VAFs.

In comparisons of measured and simulated velocities, I tallied “good” matches and “poor” matches. A match between measured and simulated velocity was considered “good” if the simulated velocity was within 0.20 fps or between 80% and 120% of the measured velocity at a point. Otherwise it was considered a “poor” match. This standard is based on the assumption that at velocities less than 1.0 fps some error is acceptable without biological consequences: water is still relatively slow if it is 0.4 instead of 0.2 fps, but a 20% tolerance would allow almost no error at low velocity. At high velocities, a 20% error can be substantial, e.g., 6 fps instead of 5 fps, but both velocities are high for most fish.

Each “poor” velocity was reviewed along with the pattern for the other two measurements at that measurement point or vertical. Input velocities were modified from measured velocities where such changes were expected to improve the match at all three flows between measured and simulated velocities. Subsequent calibration runs were compared for the numbers of “good” and “poor” matches. A new calibration run was only accepted if the number of “good” matches at each transect was no less than the number in the previous calibration run. The upper and lower extrapolations were also reviewed at each calibration to determine if extrapolated velocities were reasonable; any simulated velocity over 10.0 fps was considered unreasonable.

Calibration criteria are compared between initial and final calibration runs in Tables 2 and 3.

Walla Walla River

Water surface elevations (stage) are modeled reasonably well at the Walla Walla River below Mill Creek (Table 2). At the 3 calibration flows the simulated water surface elevations are within 0.05 ft except for transect 9. At transect 9, water surface was underestimated by 0.06 feet at the high calibration flow (182 cfs), overestimated by 0.13 ft at 70 cfs, and underestimated by 0.07 ft at the low calibration flow (21 cfs). All simulated water surface elevations increase in an upstream direction except at the low simulated flow (10 cfs), where transect 2 is 0.07 ft lower than the transect downstream (#1) and transect 8 is 0.01 lower than transect 7. Transect 9 was the head of a pool at higher flows, but at low flow it included elevated riffle and pool.

Table 2. Walla Walla River water surface elevations: measured/simulated - run 5

Transect	450 cfs		182 cfs		70 cfs		21 cfs		10 cfs	
	meas	simulated	meas	simulated	meas	simulated	meas	simulated	meas	simulated
1		98.5	97.93	97.9	97.39	97.43	97.01	97		96.9
2		98.74	98.1	98.07	97.48	97.53	97.07	97.05		96.83
3		99.71	99.13	99.11	98.64	98.66	98.29	98.28		98.12
4		100.18	99.56	99.53	98.99	99.03	98.6	98.59		98.39
5		100.27	99.64	99.62	99.07	99.1	98.66	98.65		98.44
6		100.66	99.92	99.88	99.25	99.3	98.84	98.82		98.62
7		101.96	101.21	101.18	100.52	100.57	100.04	100.02		99.78
8		102.16	101.31	101.29	100.58	100.61	100.04	100.03		99.77
9		101.82	101.31	101.25	100.66	100.79	10.43	100.36		100.16

Simulated velocities more closely matched measured velocities at the three calibration flows at the final simulation compared to the initial simulation (Table 3).

Table 3. Number of velocities within 20% and/or 0.20 fps of measured velocity - Walla Walla

Transect	182 cfs		70 cfs		21 cfs	
	initial	final	initial	final	initial	final
1	30/32	30/32	28/31	30/31	23/25	27/27
2	25/30	30/30	19/26	21/26	7/13	19/21
3	31/39	30/39	11/32	14/32	21/27	21/25
4	35/38	38/38	29/30	31/32	22/24	22/24
5	44/55	48/48	36/37	45/45	30/32	30/32
6	30/37	38/42	24/37	33/41	33/35	36/36
7	35/59	35/55	39/43	43/48	18/20	28/32
8	30/40	25/33	9/15	17/26	11/13	21/21

	954/59	48/48	53/58	39/44	40/43	42/46
Total	3 1 4 / 3 8 9	3 2 2 / 3 6 5	2 4 8 / 3 0 9	2 7 3 / 3 2 4	2 0 5 / 2 3 0	2 3 7 / 2 6 4
	(81%)	(88%)	(80%)	(84%)	(89%)	(90%)

Velocity adjustment factors (VAFs) improved from the initial calibration run to the final calibration run (Table 4). However, based on the acceptable limits for VAFs, extrapolation of the model should be limited to 10-300 cfs.

Table 4. Walla Walla River velocity adjustment factors (VAFs) are quality indicators. VAFs should be between 0.80 and 1.20.

flow:	10		21		70		182		450	
transect	initial	final	initial	final	initial	final	initial	final	initial	final
T1	1.04	1.04	1.00	1.01	1.01	1.00	.99	.99	.76	.83
T2	.87	.88	.98	.96	1.08	1.06	.97	.97	.40	.60
T3	1.15	1.09	1.09	1.03	1.01	.97	.81	.96	.00	.96
T4	.97	.97	.97	.97	.99	.99	1.00	.99	.67	.91
T5	.95	.95	.99	.99	1.01	1.01	.98	.99	.90	.94
T6	1.06	1.07	1.01	1.02	.96	.99	.93	.99	.87	.95
T7	.95	.95	.99	.98	1.02	1.01	.97	.98	.86	.92
T8	1.21	1.19	1.09	1.00	1.03	1.02	1.02	1.03	.93	.93
T9	1.00	.99	1.03	1.02	1.02	.99	.91	.97	.60	.88

Mill Creek

Water surface elevations (stage) are modeled reasonably well at Mill Creek (Table 5). At the 3 calibration flows the simulated water surface elevations are within 0.07 ft. All simulated water surface elevations increase in an upstream direction except transect 1, which is 0.10 ft higher than the next transect upstream (#2) at the high simulated flow (135 cfs); 0.02 and 0.05 ft at the high simulated and measured calibration flow (56 cfs), respectively; 0.015 and 0.02 ft at the medium simulated and measured calibration flow ((22 cfs), respectively. These deviations from the expected pattern include surveyed water surface elevations at higher flows, and the differences are not considered a problem at the range of extrapolations.

Table 5. Mill Creek water surface elevations: measured/simulated - run 5

Transect	135 cfs		56 cfs		22 cfs		6 cfs		3 cfs			
	meas	sim	meas	sim	meas	sim	meas	sim	meas	simulated		
1		98.87	98.55	98.55	98.31	98.31	98.10	98.10		98.03		
2		98.77	98.53	98.50	98.295		98.29	98.11	98.11		98.04	
3		99.13	98.88	98.86	98.605		98.63	98.41	98.40		98.30	
4		99.55	99.415		99.39	99.195		99.26	99.03	99.10		99.04
5		99.84	99.635		99.60	99.37	99.40	99.21	99.19		99.10	
6		100.72		100.50		100.47		100.20		100.26		100.07
	100.04			99.15								
7		101.79		101.695	101.68		101.52		101.56		101.43	
	101.41			101.33								
8		103.71		103.36		103.36		103.07		103.07		102.76
	102.76			102.63								

Simulated velocities more closely matched measured velocities at the three calibration flows at the final simulation compared to the initial simulation (Table 6).

Table 6. Number of velocities within 20% and/or 0.20 fps of measured velocity - Mill Creek

Transect	56 cfs		22 cfs		6 cfs	
	initial	final	initial	final	initial	final
1	22/26	23/26	21/26	25/26	24/26	24/26
2	18/22	19/22	19/21	18/21	16/20	18/20
3	22/27	23/27	15/25	20/25	20/21	19/21
4	29/29	28/29	24/29	23/29	25/27	25/27
5	25/28	26/28	18/25	22/25	19/21	20/21
6	25/28	24/28	20/27	21/27	22/23	23/23
7	29/32	28/32	21/25	21/25	13/14	14/14
8	34/35	35/35	33/34	32/34	30/30	30/30
Total	169/182 (90%)	173/182 (95%)	176/202 (85%)	182/202 (90%)	204/227 (93%)	206/227 (91%)

Velocity adjustment factors improved from the initial calibration run to the final calibration run (Table 7). However, the range of extrapolation for the Mill Creek model should be limited to 5-110 cfs, based on an acceptable range of 0.8 to 1.2.

Table 7. Mill Creek velocity adjustment factors (VAFs) are quality indicators. VAFs should be between 0.80 and 1.20.

flow:		135 cfs	56 cfs		22 cfs		6 cfs		3 cfs		
transect	initial	final	initial	final	initial	final	initial	final	initial	final	
T1		0.53	0.74	0.91	0.97	1.10	1.02	1.01	0.89	0.86	0.78
T2		0.85	0.86	0.99	0.98	1.07	1.06	1.19	1.00	1.29	0.87
T3		0.54	0.83	0.96	0.98	1.07	1.03	0.97	0.95	0.88	0.85
T4		0.79	0.80	0.92	0.91	1.00	1.01	1.09	1.08	1.13	1.13
T5		0.80	0.92	0.96	0.99	1.01	1.01	0.98	0.98	0.94	0.95
T6		0.67	0.90	0.94	0.95	0.99	0.99	1.02	1.02	1.04	1.04
T7		0.86	0.86	0.98	0.97	0.97	0.96	0.82	0.83	0.72	0.72
T8		0.63	0.67	0.99	0.98	1.01	1.01	0.98	0.99	0.97	0.97

Results

Walla Walla River below mouth of Mill Creek

Habitat (WUA) for juvenile steelhead, the primary species and life-stage of interest at this site, increased consistently from the lowest simulated flow of 10 cfs through the lowest measured flow (21 cfs) through the highest measured (182 cfs) and extrapolated (300 cfs) flows (Tables 8 and 9). It should not be assumed that 300 cfs maximizes juvenile steelhead WUA. Juvenile steelhead WUA increases most rapidly up to 100 cfs (Table 10). WUA for juvenile steelhead at 100 cfs is about 80% of the WUA at 300 cfs (Table 9).

Although this reach of the Walla Walla River is not prime steelhead spawning habitat, we modeled steelhead spawning habitat in case future water and land management makes it a more suitable reach for steelhead spawning. Steelhead spawning WUA at this site peaks at 182 cfs, our high calibration flow (Tables 8 and 9).

Chinook salmon were extirpated from the Walla Walla River drainage about 1950, but some efforts are aimed at restoration of chinook runs in the Walla Walla. We modeled juvenile chinook salmon rearing habitat to provide information for use in chinook restoration. We do not anticipate any spring chinook spawning in this reach because of high temperatures and poor holding conditions, so we have not modeled chinook spawning habitat. Habitat (WUA) for juvenile chinook increased consistently from the lowest simulated flow of 10 cfs through the lowest measured flow (21 cfs) to the middle measured flow (70 cfs), declined slightly to 125 cfs, then increased through the highest measured (182 cfs) and extrapolated (300 cfs) flows (Tables 8 and 9). It should not be assumed that 300 cfs maximizes juvenile chinook WUA. Juvenile chinook WUA increases most rapidly up to 30-50 cfs (Table 10). WUA for juvenile chinook at 30 cfs is about 71% and at 50 cfs about 84% of the WUA at 300 cfs (Table 9).

Table 8. Square feet of Weighted Usable Area (WUA) per thousand feet of stream in the Walla Walla River below the mouth of Mill Creek, as measured and modeled in June-July, 1999.

Flow (cfs)	Steelhead WUA		Chinook salmon WUA	Wetted channel
	juvenile	spawning	juvenile	gross area
10	224.27	26.65	667.21	27752
21	495.2	496.34	1266.27	35020
30	736.1	1360.15	1529.16	37303

40	979.6	2861.47	1684.58	38651
50	1207.22	4779.38	1808.22	39684
60	1405.79	6468.45	1938.27	41360
70	1595.52	8142.4	1991.77	43792
80	1754.83	9674.53	1949.66	44771
100	1976.7	12362.91	1745.9	47282
125	2092.39	15086.33	1712.9	49378
150	2141.59	16780.77	1748.99	52528
182	2199.93	17197.71	1921.72	55959
200	2258.34	16748.66	1982.25	57952
250	2369.95	15007.43	1986.77	62839
300	2480.15	13341.04	2152.59	65424
350	X2612.76	X11940.86	X2224.25	68749
400	X2760.96	X10617.89	X2333.52	71629
450	X2943.85	X9879.21	X2606.73	74024

X - indicates habitat model is unreliable.

Table 9. Fraction of maximum modeled Weighted Usable Area at each flow of interest in the Walla Walla River below the mouth of Mill Creek.

Flow (cfs)	Steelhead WUA		Chinook salmon WUA
	juvenile	spawning	juvenile
10	0.090	0.002	0.310
21	0.200	0.029	0.588
30	0.297	0.079	0.710
40	0.395	0.166	0.783
50	0.487	0.278	0.840
60	0.567	0.376	0.900
70	0.643	0.473	0.925
80	0.708	0.563	0.906
100	0.797	0.719	0.811
125	0.844	0.877	0.796
150	0.863	0.976	0.813
182	0.887	1	0.893
200	0.911	0.974	0.921
250	0.956	0.873	0.923
300	1	0.776	1

Table 10. Incremental rate of change of juvenile steelhead and chinook salmon WUA at each flow of interest at the Walla Walla River below Mill Creek.

Flow (cfs)	juvenile steelhead	juvenile chinook salmon
10		
21	0.0099	0.0253
30	0.0108	0.0136
40	0.0098	0.0072
50	0.0092	0.0057
60	0.0080	0.0060

70	0.0076	0.0025
80	0.0064	-0.0020
100	0.0045	-0.0047
125	0.0019	-0.0006
150	0.0008	0.0007
182	0.0007	0.0025
200	0.0013	0.0016
250	0.0009	0.0000
300	0.0009	0.0015

Mill Creek

Habitat (WUA) for juvenile steelhead, the primary species and life-stage of interest at this site, increased consistently from the lowest simulated flow of 3 cfs through the lowest measured flow (6 cfs) through the highest measured (56 cfs) and simulated (135 cfs) flows (Tables 11 and 12). Juvenile steelhead WUA increases most rapidly up to 20 cfs (Table 13). WUA for juvenile steelhead at 20 cfs is about half of the WUA at 135 cfs (Table 12).

Steelhead spawning WUA at this site peaks at 65 cfs (Tables 11 and 12).

Table 11. Square feet of Weighted Usable Area (WUA) per thousand feet of stream in Mill Creek, as measured and modeled in June-July, 1999. X - indicates model results are unreliable.

Flow (cfs)	Steelhead WUA		Chinook salmon WUA	
	juvenile	spawning	juvenile	gross area
3	X 264.69	X 0	X 220.09	30631
4	X 288.9	X 0	X 262.83	31539
5	311.48	0	316.35	32286
6	334.21	0	412.36	32753
8	386.93	0	710.77	33769
10	446.36	7.84	952.95	34927
12	506.42	22.6	1184.51	35509
15	598.62	51.15	1415.67	36270
18	692.59	110.94	1620	36810
20	756.91	234.01	1712.37	37213
22	816.41	412.68	1777.61	37517
25	895.58	770.87	1848.03	38002
30	1007.16	1548.34	1887.77	38784
35	1100.4	2389.66	1913.86	39348
40	1175.47	3297.82	1944.14	40045
45	1232.58	4208.92	1879.43	40458
50	1277.91	5115.74	1853.52	40820
56	1318.2	6038.11	1868.46	41168
60	1341.52	6494.74	1865.01	41355
65	1361.18	6841.59	1792.83	41631
70	1369.89	6819.24	1734.12	41817
75	1383.15	6791.88	1690.99	42686
80	1394.16	6747.55	1651.91	42920
90	1412.81	6573.66	1599.22	43323
100	1444.97	6331.55	1564.31	43653
110	1465.55	6039.21	1554.41	43920

120	X1487.08	X 5801	X1503.08	44169
125	X1497.36	X5694.96	X1500.93	44287
130	X1504.46	X5569.78	X1492.33	44394
135	X1511.34	X5444.14	X1484.42	44669

Chinook salmon were extirpated from the Walla Walla River drainage about 1950, but some efforts are aimed at restoration of chinook runs in the Walla Walla. We modeled juvenile chinook salmon rearing habitat to provide information for use in chinook restoration. We do not anticipate any spring chinook spawning in this reach because of high temperatures and poor holding conditions, so we have not modeled chinook spawning habitat. Habitat (WUA) for juvenile chinook at this site peaks at 65 cfs (Tables 11 and 12). Juvenile chinook WUA increases most rapidly up to 8 cfs (Table 13). WUA for juvenile chinook at 8 cfs is about 37% of the WUA at 65 cfs.

Table 12. Fraction of maximum modeled Weighted Usable Area at each flow of interest in Mill Creek.

Flow (cfs)	Steelhead WUA		Chinook salmon WUA
	juvenile	spawning	juvenile
5	0.213	0	0.163
6	0.228	0	0.212
8	0.264	0	0.366
10	0.305	0.001	0.490
12	0.346	0.003	0.609
15	0.408	0.007	0.728
18	0.473	0.016	0.833
20	0.516	0.034	0.881
22	0.557	0.060	0.914
25	0.611	0.113	0.951
30	0.687	0.226	0.971
35	0.751	0.349	0.984
40	0.802	0.482	1
45	0.841	0.615	0.967
50	0.872	0.748	0.953
56	0.899	0.883	0.961
60	0.915	0.949	0.959
65	0.929	1	0.922
70	0.935	0.997	0.892
75	0.944	0.998	0.870
80	0.951	0.986	0.850
90	0.964	0.961	0.823
100	0.986	0.925	0.805
110	1	0.883	0.800

Table 13. Incremental rate of change of juvenile steelhead and chinook salmon WUA at each flow of interest in Mill Creek.

Flow (cfs)	steelhead	chinook
5	0.0154	0.0275
6	0.0155	0.0494
8	0.0180	0.0767
10	0.0203	0.0623
12	0.0205	0.0596
15	0.0210	0.0396
18	0.0214	0.0350
20	0.0219	0.0238
22	0.0203	0.0168
25	0.0180	0.0121
30	0.0152	0.0041
35	0.0127	0.0027
40	0.0102	0.0031
45	0.0078	-0.0067
50	0.0062	-0.0027
56	0.0046	0.0013
60	0.0040	-0.0004
65	0.0027	-0.0074
70	0.0012	-0.0060
75	0.0018	-0.0044
80	0.0015	-0.0040
90	0.0013	-0.0027
100	0.0022	-0.0018
110	0.0014	-0.0005

Discussion
In 1999, flow at our study sites dropped to 21 cfs in the Walla Walla River and 6 cfs in Mill Creek by early July. The Walla Walla River flow included the Mill Creek inflow. These were not the lowest flows of 1999, according to Mendel, et al. (2000, Appendix B). At these low flows juvenile steelhead habitat was severely reduced (20-23% of WUA at highest simulated flows). Juvenile steelhead WUA increases most rapidly up to 100 cfs in the Walla Walla River and up to 20 cfs in Mill Creek.

Two additional PHABSIM study sites upstream from our Walla Walla River study site are being modeled by Brad Caldwell and Jim Shedd of Washington Department of Ecology. We will combine analysis of all four sites in one report.

The Walla Walla River site below the mouth of Mill Creek is in T7N R35E S31, which corresponds to station WW-9 in the WDFW report #FPA 00-18, Assessment of Salmonid Fishes and their Habitat Conditions in the Walla Walla River Basin of Washington: 1999 Annual Report, by Glen Mendel, David Karl, and Terrence Coyle. This site is at RM 32.9. Water temperatures at WW9 for June-November, 1999, (Appendix C, p. 65) were at or above 70 F during most of the summer, which are unfavorable for salmonid fishes. Flows at the site ranged from 4 cfs in early July, 1998, to no flow in early August, to 17 cfs in mid September, and 86 cfs in mid-November 1998, and in 1999 ranged from 15 cfs in late June to 403 cfs in early June (Appendix B, pp. 50). Age 0+and 1+ juvenile steelhead were observed at RM 32.9 and both upstream and downstream (Table 6, p. 28; Fig. 10, p. 30).

The report by Mendel et al. (2000) does not include sites on Mill Creek near our PHABSIM site. However, because it is upstream of WW9, it is certain to be inhabited by steelhead.

Flows modeled in this report do not ensure properly functioning habitat; they are part of what is needed for providing habitat. We report WUA, which is an index of physical microhabitat, but only if water quality is satisfactory. If temperature or dissolved oxygen or pollutants are unsatisfactory, providing abundant WUA will not ensure usable habitat for fish. Sufficient flows can contribute to favorable water quality. The flows modeled depend on channel condition and shape, including sediment distribution (gravels, sand, etc.), which in turn depend on high flows. Those high flows serve other ecological functions, including stimulation of upstream migration of adult salmonids, transport of juvenile anadromous salmonids (steelhead and salmon) to sea, and recharge of the water table. Water table recharge can contribute to riparian vegetation growth, which can shade the east-west flowing river and moderate temperature, where land use allows riparian trees to grow.

Literature Cited

Mendel, G., D. Karl, and T. Coyle. 2000. Assessment of Salmonid Fishes and their Habitat Conditions in the Walla Walla River Basin of Washington: 1999 Annual Report. Washington Department of Fish and Wildlife, Fish Program, Fish Management Division. Report #FPA 00-18.

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