CHAPTER 3 – EXISTING CONDITIONS

INTRODUCTION

Chapter 3 provides information about the existing conditions of the physical, biological, and social resources of the area associated with the proposed action and alternatives. Within each resource section, the conditions that currently exist are described, in some cases supplemented by historical data or analyses. The inclusion of historical information is generally presented to provide a basis of context for the origin of the current conditions. The existing resource conditions (not historical or natural conditions) provide the baseline for evaluating the effects of the proposed action and alternatives. This chapter is organized by resource, and area of potential effects. The existing conditions of the immediate areas associated with each Special Use Permit are generally described separately from the greater watershed area. For a complete description of the existing resource conditions of the permitted areas, it is important to read all resource sections.

AVAILABLE INFORMATION

Much of the information used for the description of existing resource conditions came from resource studies completed on the Big Quilcene and Little Quilcene River watersheds and geographic information systems mapping data. Additional information was collected for analysis as necessary to address specific issues, fill gaps in existing data, or to provide a complete description of the existing resource conditions. Source material is identified within the text and documented in the literature-cited section.

AREA OF EVALUATION

The description of existing resource conditions for this project is divided into the immediate permit area, and the watershed or regional area (Figure 3-1). The immediate permit area is most likely to be impacted by direct effects of the proposed action, while the larger watershed or regional area is more likely to be impacted by indirect or cumulative effects of the proposed action.

Immediate Permit Area

The immediate permit area for this project includes the area defined within each of the existing Special Use Permits. These areas are described below and are shown in Figure 3-2.

Permit 1 includes 7.3 acres and 6 miles of 10-foot-wide right-of-way adjacent to the Big Quilcene River. The diversion site portion of the permit area includes the water diversion dam, intake structure, caretaker's residence, and security fencing at the Big Quilcene River diversion site. The linear right-of-way portion of the permit area includes the location of the transmission pipeline from the Big Quilcene River diversion site downstream (east) along the Big Quilcene River then northward along Penny Creek until exiting Federal lands. The right-of-way portion of the permit area is generally within, or immediately adjacent to, the existing developed road right-of-way.

Permit 2 includes one acre and 0.4 miles of 50-foot-wide right-of-way adjacent to the Little Quilcene River. The diversion site portion of the permit area includes the water diversion dam and intake

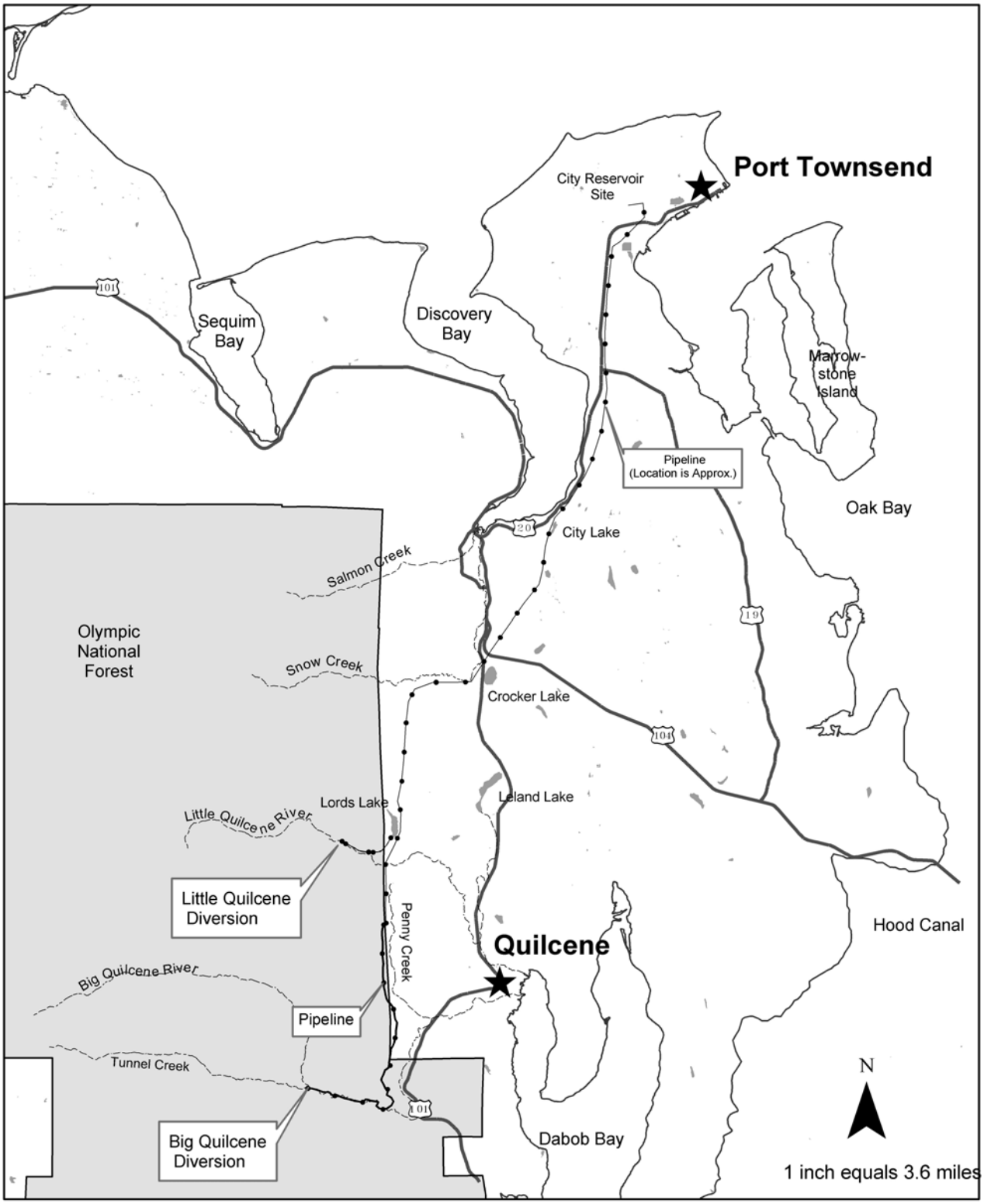


Figure 3-1. Vicinity Map of Port Townsend Water Supply System.

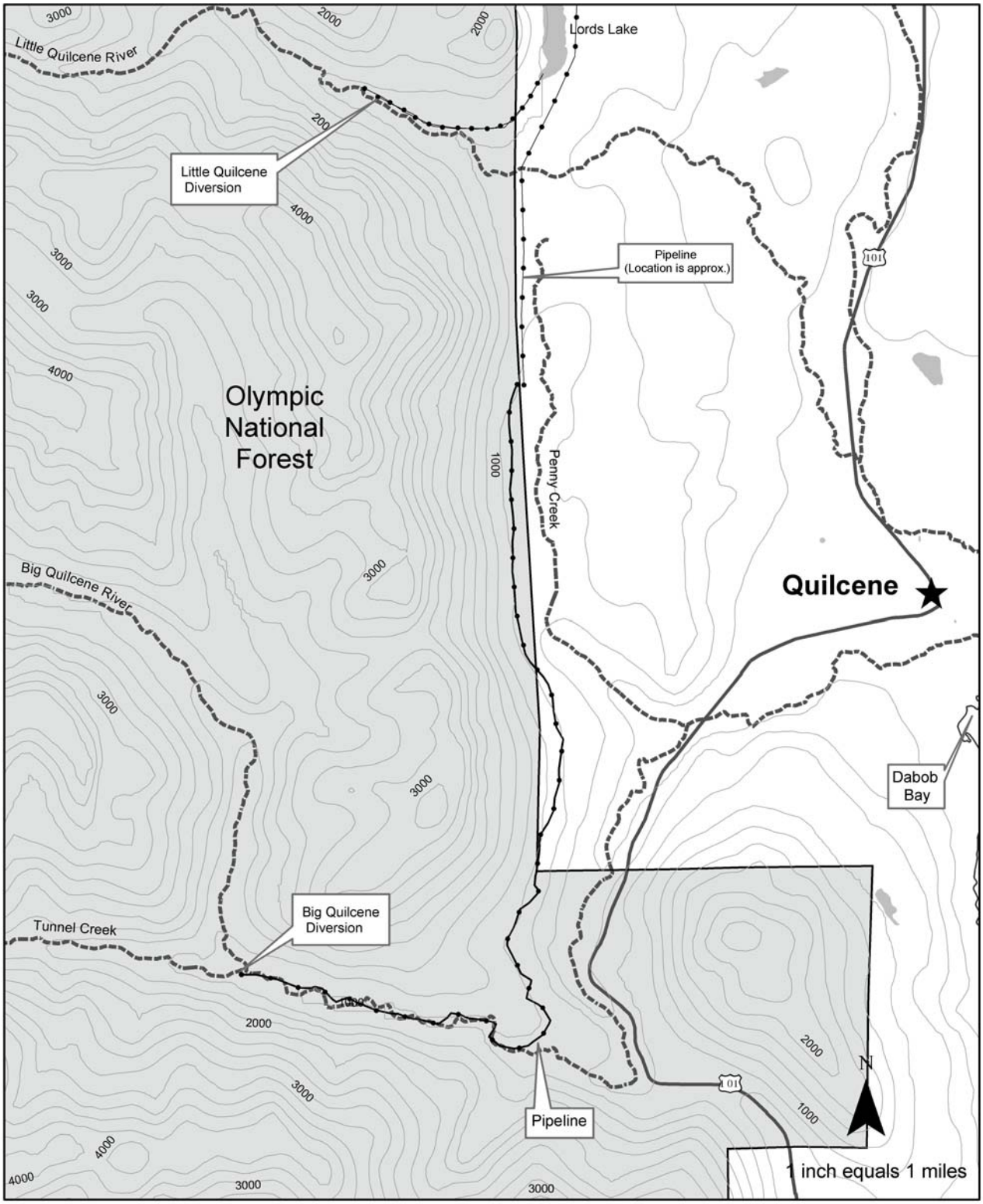


Figure 3-2. Special Use Permit Area

structure at the Little Quilcene diversion site. The linear right-of-way portion of the permit area includes the location of the transmission pipeline from the Little Quilcene diversion site downstream (east) along the Little Quilcene River until exiting Federal lands. The right-of-way portion of the permit area is generally within, or immediately adjacent to, the existing developed road right-of-way.

Permit 3 includes two acres within the 7.3 acres identified in Permit 1 immediately adjacent to the Big Quilcene diversion site. This permit authorizes the use of this area for a caretaker's residence and other buildings and improvements needed for the supervision and security of the water supply system.

Watershed or Regional Area

The evaluation of indirect or cumulative effects requires evaluating resource impacts in an area larger than, or outside of, the immediate permit area. The area of potential effects that may be considered for each resource is described within the existing conditions and effects analysis sections of the EA. The area of potential effects may be defined differently for each resource area depending on the relationship of the resource to the proposed action. For example, the area of potential indirect effects on fisheries resources is the Big Quilcene and Little Quilcene Rivers downstream of the diversion facilities. In contrast, the area of potential indirect effects on socioeconomics includes the City of Port Townsend and the water system customer base outside of the City.

EXISTING CONDITIONS

Facilities and Operations

Project Facilities

The City of Port Townsend maintains water diversion facilities at River Mile (RM) 9.4 of the Big Quilcene River and RM 7.2 of the Little Quilcene River for the purpose of providing residential, commercial, and industrial customers with a reliable, cost effective, and uninterrupted supply of water. Figure 3-1 shows the Port Townsend water supply facilities (diversions, transmission pipeline, and reservoirs) in relation to the City of Port Townsend, the community of Quilcene, and the Olympic National Forest boundary.

The Big Quilcene River diversion facilities consist of a timber crib dam approximately 10 feet high and 51 feet wide, and a concrete intake structure with a gate and screening system. The diversion facility is located immediately below the confluence of the Big Quilcene River and Tunnel Creek. The elevation of the Big Quilcene diversion facility is approximately 1,023 feet. Water is diverted from the river through gate intake structure and rotating screen into a steel pipeline for transmission to the City's water supply distribution facilities. The City has a water right for an amount not to exceed 30 cubic feet per second (cfs) from the Big Quilcene River.

The Little Quilcene River diversion facilities consist of a stream bypass and concrete diversion and intake structure on an outside bend of the river. The elevation of the Little Quilcene diversion facility is approximately 1,048 feet. A small concrete weir spans the river and directs a portion of the flow to the intake structure. The concrete weir is notched to allow fish passage upstream and downstream. River water is diverted through a screen and gate intake structure into a steel pipeline for transmission to the City's Lords Lake reservoir. The City has a water right for an amount not to exceed 9.56 cfs, with a minimum instream flow requirement of 6 cfs.

The water transmission pipeline is engineered as a gravity operated system and does not require pumping to deliver water to storage reservoirs and system users. Water diverted from the Little Quilcene River enters a 20-inch diameter pipeline for transmission to Lords Lake. Water diverted from the Big Quilcene River enters a 36-inch diameter steel pipeline that turns into a 30-inch diameter pipe after approximately 0.5 miles, for transmission to City Lake. Water from the Big Quilcene diversion can also be transmitted to Lords Lake to speed refilling of the reservoir during the fall and winter months.

Lords Lake is located approximately 1.5 miles from the Little Quilcene diversion and is the primary storage facility for the City water supply system. The elevation of Lords Lake is approximately 920 feet. The storage capacity of Lords Lake is 500 million gallons, and provides approximately a 30-day storage supply for the City. Lords Lake is filled directly by the Little Quilcene River diversion.

City Lake reservoir is located along the pipeline approximately 20 miles from the Big Quilcene diversion. City Lake has a capacity of 120 million gallons, and functions as an equalizing storage reservoir to meet the short-term fluctuations in water demand. The elevation of City Lake is approximately 610 feet.

Figure 3-1 shows the Port Townsend water supply system and the Olympic National Forest boundary. Lords Lake and City Lake storage reservoirs are located on City owned lands. The facilities that are located on federal land and under the jurisdiction of the Forest Service Special Use Permits include:

1. The Big Quilcene River diversion facilities and approximately six miles of 10-foot-wide right-of-way for the water transmission pipeline.
2. The Little Quilcene River diversion facilities and approximately 0.4 miles of 50-foot-wide right-of-way for the water transmission pipeline.
3. Caretaker residence and maintenance buildings adjacent to the Big Quilcene River diversion facilities.

Project Operations

The water supply diversion facilities and water transmission system is cooperatively managed by the City of Port Townsend and the Port Townsend Paper Company. Through a contractual relationship with the City of Port Townsend, the Port Townsend Paper Company operates and maintains the water diversion facilities and transmission system. The City of Port Townsend Department of Public Works operates and maintains the water treatment facilities and the distribution system within the City.

Big Quilcene River Diversion

The Big Quilcene River diversion is the primary water source for the City. During periods of high stream turbidity, or when flows within the river are limited, water is supplied to the City from storage in Lords Lake. The City's water right on the Big Quilcene River is for an amount not to exceed 30 cfs. There is no minimum instream flow requirement as a condition of this water right, although since 1994, the City has maintained a policy of providing a minimum instream flow below their diversion (when available) for instream fish habitat and water supply to the Quilcene National Fish

Hatchery (QNFH). Before 1994 the City and Mill worked cooperatively with the QNFH, a junior water rights holder, to ensure they had sufficient water for operations. This is estimated to have been between 20-25 cfs. In 1994 the City and Mill, as part of the Dungeness-Quilcene Water Resources Management Planning process, agreed to leave 24 cfs instream. In 1997 the voluntary instream flow was increased to 27 cfs. A U.S. Geological Survey (USGS) staff gage is located approximately 100 feet below the diversion and is used to verify the instream flow amount.

Little Quilcene River Diversion

The Little Quilcene River diversion is used to supply water to the Lords Lake reservoir, except during turbid river conditions or low flows. The City's water right on the Little Quilcene River is for an amount not to exceed 9.56 cfs, provided that a minimum of 6 cfs is maintained instream. Stream flows and Lords Lake reservoir levels determine the operation of the Little Quilcene diversion. A USGS staff gage is located approximately 100 feet below the diversion gatehouse. The river stage at this gage is recorded once a day by maintenance personnel. Using the current USGS rating table, the gage height can be translated to cfs to determine whether the instream flow requirement below the diversion is being met. A flow meter is monitored in the pipeline immediately below the diversion to ensure that the maximum diversion amount is not exceeded.

Lords Lake Reservoir

Lords Lake reservoir is located approximately 1.5 miles from the Little Quilcene diversion and is adjacent to National Forest System Land. Lords Lake is generally filled from the Little Quilcene diversion. The reservoir has a storage capacity of 500 million gallons, approximately a 30-day supply.

Under normal operations Lords Lake reservoir is maintained at full pool throughout most of the year and drawn down during the late summer and early fall. Draw down usually occurs during periods of low water availability, or as a result of high turbidity events.

Project Maintenance

The project facilities are maintained by the Port Townsend Paper Company through a contractual agreement with the City of Port Townsend. The paper company employees perform all operation and maintenance on the transmission pipeline, diversion facilities, and reservoirs. Three full-time employees of the paper company maintain and monitor the operation and condition of the system. The City of Port Townsend Department of Public Works operates and maintains the water treatment facilities and distribution system within the City. Responsibilities for maintenance and operation of the project facilities are detailed in the Operations and Maintenance Manual for the Olympic Gravity Water Supply System (Port Townsend Paper Company, undated).

Key Resource Issues

Hydrology

The objectives of the Aquatic Conservation Strategy for the Northwest Forest Plan are based on the protection or maintenance of aquatic functions within the natural range of variation. Stream hydrology is an important component of the aquatic ecosystem and is described by the parameters of magnitude, frequency, duration, timing, and rate of change. The existing conditions of each of these parameters will be discussed in following sections. The natural range of variability of these parameters for the Big Quilcene and Little Quilcene Rivers is difficult to quantify due to the limited

amount of historical and current stream gaging information, and the establishment of stream diversions. Hydrological modeling has been conducted to estimate the natural flows (without diversion) of the Big Quilcene and Little Quilcene Rivers (Orsborn 2003). This information is provided to present a broader picture of the hydrological resources of the watershed. Although information describing the estimated natural flows is provided, NEPA regulations require that existing stream flow conditions (with diversion) be used as the baseline for the evaluation of environmental effects.

Hydrological Data

There are limited long-term direct hydrological records for the Big Quilcene and Little Quilcene Rivers. U.S. Geological Survey (USGS) flow data for the Big Quilcene River is available for 1926-27, 1951-52, 1971-72 in the lower river and 1994-present at the diversion site. Flow data for the Little Quilcene River is available for 1926-27 and 1951-57 near Highway 101, and below the diversion site since 1998.

Methods used by the USGS for measuring stream flow provide data at an estimated level of accuracy. The accuracy of these records depends primarily on: (1) the stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements, and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records (USGS 2000). In addition, the hydrological analysis for the Big Quilcene and Little Quilcene Rivers is also subject to statistical error associated with the modeling of flows between other watersheds and the Big Quilcene and Little Quilcene Rivers.

The accuracy of stream flow records for the Big Quilcene River gage located immediately downstream of the City of Port Townsend diversion (USGS Gage 12052210) is described by USGS as “fair” for discharges below 600 cfs, and “poor” for discharges above 600 cfs. An accuracy rating of fair means that about 95 percent of the (average) daily discharge values are within 15 percent of the true value. An accuracy rating of poor means that the accuracy of the records does not meet the minimum criteria for a fair rating. The staff gage below the diversion on the Little Quilcene River is read only once a day; therefore, this data is only representative of the average daily flow during periods of stable flow.

Due to the limited direct stream flow gaging information for the Big Quilcene and Little Quilcene Rivers, the estimated average annual and maximum, mean, and minimum monthly flows for these streams were modeled using data from seven USGS gaging stations in the Olympic Peninsula region (Orsborn 2003).

Hydrological Influence of Project Operations

The City of Port Townsend has maintained a water diversion facility on the Big Quilcene River at RM 9.4 since 1928. The City of Port Townsend water supply diversion facility on the Little Quilcene River at RM 7.2 has been in place since 1956. The original diversion dam on the Little Quilcene River was destroyed in a storm in December 1993, and was reconstructed in 1995. During this period, concrete blocks were used to maintain a continuous water supply to the City. The USFWS Hatchery at RM 2.8 on the Big Quilcene River also diverts flow from the Big Quilcene River at RM 3.2 for the fish production facilities. Water used for fish production by USFWS is returned to the river below the hatchery site.

The City of Port Townsend diverts an average annual flow of 17.3 – 18.4 cfs from the Big Quilcene River, although the average daily diversion during normal operations is approximately 23 cfs. Average annual diversions from the Little Quilcene River are 2.2 – 3.5 cfs (City of Port Townsend, unpublished data). Daily diversions from the Little Quilcene River vary with the Lords Lake reservoir level. The natural average annual flow for the Big Quilcene River at Highway 101 is 200 cfs, and the Little Quilcene River is 48 cfs (Orsborn and Orsborn, 2002). The City of Port Townsend holds water rights for an amount not to exceed 30 cfs from the Big Quilcene River, and 9.56 cfs from the Little Quilcene River. The City voluntarily limits the diversion of water from the Big Quilcene River during low flow periods to maintain a minimum of 27 cfs instream for the benefit of fish habitat and to provide water to the USFWS fish hatchery production facilities. The City's water right on the Little Quilcene River requires a minimum 6 cfs be maintained instream below the point of diversion.

Water diverted from the Big Quilcene River enters the Olympic Gravity Water Pipeline and is normally conveyed to City Lake, which functions as a short-term storage reservoir. Water diverted from the Little Quilcene River is conveyed to Lords Lake, which functions as a long-term storage reservoir, and moderates the seasonal differences between flow that is available in the rivers for diversion, and the level of water consumption. If needed, water diverted from the Big Quilcene River can be conveyed to Lords Lake to speed the reservoir refilling.

The second half of 2002 represented an unusual dry period for rainfall and stream flow in the Northwest. The management of water resources by the City of Port Townsend and Port Townsend Paper Company during this period represents the balancing of decisions that are made regarding the consumptive use versus the conservation of water resources. Figure 3-3 displays the stream flow in the Big Quilcene River, the diverted flow, and the supply of stored water in Lords Lake. During this dry period when stream flows dropped below 57 cfs in the Big Quilcene River, the City and Mill carried out their policy of reducing the amount of water diverted in order to maintain 27 cfs instream below the diversion. Implementation of this policy during the long dry period of 2002 required the City and Mill to use stored water in Lords Lake and to implement conservation measures designed to extend the number of days the supply of stored water would cover the average daily use. The extent of the dry period in 2002 resulted in the total use of the designed storage reservoir capacity, and the installation of a pump to draw water from below the reservoir elevation that could be accessed from the engineered intake structure. Throughout the entire dry period the City and Mill maintained the policy of providing 27 cfs below the diversion when it was naturally available. In late October the natural flow in the Big Quilcene River dropped below 27 cfs, reaching a yearly minimum of approximately 23 cfs in early November 2002; compared to modeled September and October minimum flows of 23 cfs and 20 cfs (City of Port Townsend, unpublished data; Orsborn, unpublished data).

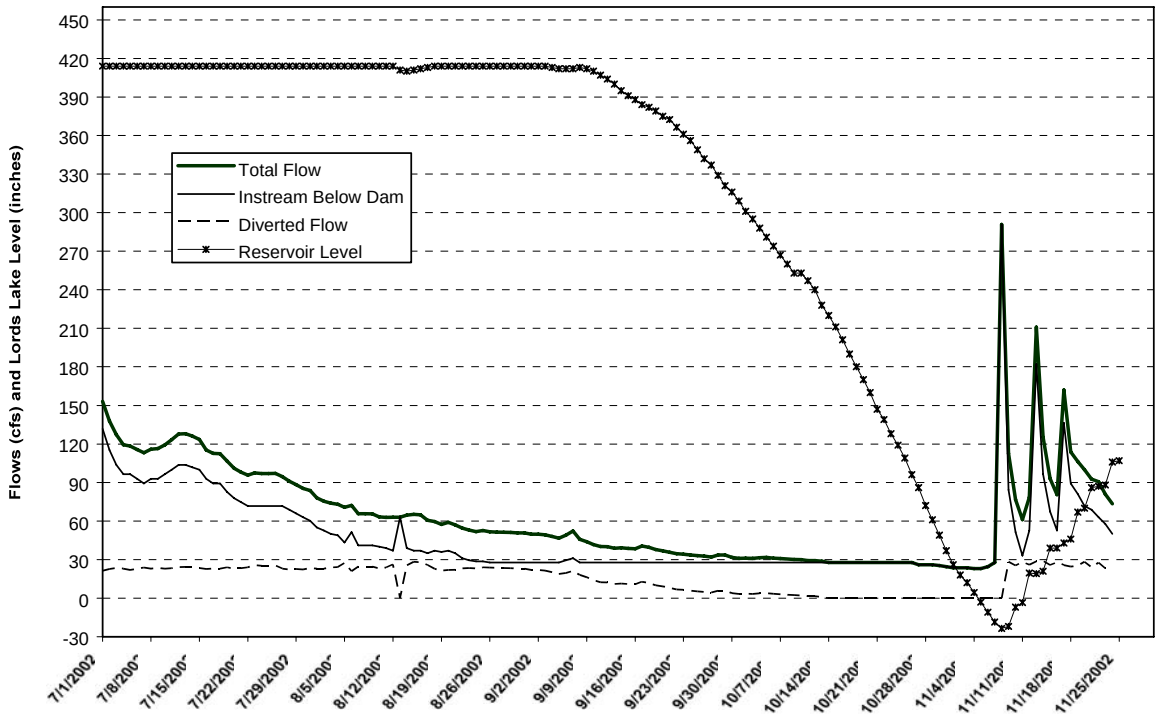


Figure 3-3. Big Quilcene Flows, and Lords Lake Reservoir Level, July to November 2002.

Timing and Frequency of Flows

There is no storage of water at the diversion sites on the Big Quilcene and Little Quilcene Rivers. Therefore, the management of the water supply diversion facilities by the City has no influence on the timing or frequency of the natural flow events in the Big Quilcene and Little Quilcene Rivers below the City diversion sites.

Rate of Change of Flows

The rate of change in flows is defined as the change in stage (river surface water elevation) over a period of time at a single point on the river. Quick reductions in the stage of a river have the potential to strand fish or other aquatic organisms along the margins of the river. The potential for stranding fish along the margins of the river depends on how quickly the flow is reduced, the cross section profile of the river (flat cross section profiles have a greater potential for stranding fish), and the presence or seasonal use of the river margins by fish species.

The City water supply diversion facilities are operated as a continuous diversion. The diversion of water on the Big Quilcene and Little Quilcene Rivers is stopped only when there is either high turbidity, low instream flows, or during required maintenance. During these periods, water is supplied from stored water held in Lords Lake. Decreases in river stage as a result of project operations could only occur upon re-initiation of diversion up to the maximum allowable amount

following a period of no diversion, since there is no instream storage capability. Operating guidelines for the Big Quilcene River diversion require that the intake gate be opened in three stages with 15-20 minute pauses between stages to permit the pipeline to fill gradually, reducing the risk of rapid pressure increases that could weaken or damage the pipeline (Port Townsend, undated [Operations and Maintenance Manual]).

Magnitude

The magnitude of stream flow at any particular time is the quantity of water moving past a fixed location. Stream flow magnitude is generally described in units of cubic feet per second, or the mean daily or mean monthly discharge.

The hydrological cycle for the Big Quilcene and Little Quilcene Rivers is influenced by the seasonal rainfall and snowmelt conditions. Peak stream flows can occur at anytime during the late fall to early spring period (November – April). Minimum stream flows generally occur during the late summer to early fall (August – October) when the snow pack in the upper watershed is reduced.

The average natural monthly flows (without diversion) modeled for the Big Quilcene and Little Quilcene Rivers at the diversion sites and at Highway 101 are presented in Tables 3-1 and 3-2 below. The largest tributary that provides inflow to the Big Quilcene River between the diversion site and Highway 101 is Penny Creek. On the Little Quilcene River measurable inflow is added between the diversion and Highway 101 by Howe and Ripley Creeks.

Table 3-1. Average Monthly Natural Flows (cfs) (modeled flows without diversion) for the Big Quilcene River below the Diversion and at Highway 101.

	Big Quilcene River Below Diversion			Big Quilcene River at Highway 101		
	Average Annual Flow: 165 cfs			Average Annual Flow: 200 cfs		
Month	Maximum	Mean	Minimum	Maximum	Mean	Minimum
Oct	267	94	24	332	117	29
Nov	416	180	38	521	222	44
Dec	581	245	77	700	296	94
Jan	588	251	53	689	296	63
Feb	492	224	54	583	266	64
Mar	375	178	66	443	210	79
Apr	310	177	94	365	210	112
May	370	204	101	452	250	126
Jun	334	175	78	417	220	98
Jul	228	101	41	284	128	51
Aug	115	56	25	144	70	31
Sep	128	46	21	159	57	26

Source: Orsborn, unpublished data, 3/12/2003.

Table 3-2. Average Monthly Natural Flows (cfs) (modeled flows without diversion) for the Little Quilcene River below the Diversion and at Highway 101.

	Little Quilcene River Below Diversion			Little Quilcene River at Highway 101		
	Average Annual Flow: 24 cfs			Average Annual Flow: 48 cfs		
Month	Maximum	Mean	Minimum	Maximum	Mean	Minimum
Oct	31	11	4	67	23	7
Nov	43	21	7	98	46	13

Dec	90	38	11	176	74	22
Jan	120	47	9	212	86	17
Feb	91	40	10	167	75	18
Mar	70	34	11	127	61	21
Apr	60	31	16	108	58	31
May	50	27	12	102	56	26
Jun	37	18	8	81	41	18
Jul	25	10	5	55	23	10
Aug	11	6	3	26	13	6
Sep	15	5	3	32	11	6

Source: Orsborn, unpublished data, 3/12/2003.

High and Low Flows

High and low stream flow events are important for maintaining channel form, distributing gravels and sediments throughout the stream, and providing cues to biological organisms to initiate important life history events. High and low flow events are described as the statistical probability of recurring over a specified time period. Natural (undiverted) flows for the Big Quilcene and Little Quilcene River have been modeled to present additional descriptive information regarding the flow characteristics of each stream. Estimated low flows and flood flows for the Big Quilcene River are shown in Table 3-3, and Table 3-4 for the Little Quilcene River.

The timing of flood flow events on the Big Quilcene River at Highway 101 is estimated to occur on January 1, with a 95 percent confidence limit range of 90 days. The timing of low flow events on the Big Quilcene River is estimated to occur on October 1, with a 95 percent confidence limit range of 30 days.

The timing of flood flow events on the Little Quilcene River at Highway 101 is estimated to occur on January 15, with a 95 percent confidence limit range of 60 days. The timing of low flow events on the Little Quilcene River is estimated to occur on September 10, with a 95 percent confidence limit range of 40 days.

Table 3-3. Estimated Average Natural Low and High Flows (cfs) (modeled flows without diversion) for the Big Quilcene River.

	Big Quilcene below Diversion	Big Quilcene at Highway 101
Low Flows		
7-Day Average with 2-Year Return Interval	26	40
7-Day Average with 10-Year Return Interval	20	31
7-Day Average with 20-Year Return Interval	17	26
30-Day Average with 2-Year Return Interval	31	48
60-Day Average with 2-Year Return Interval	38	60
Average Daily Floods		
2-Year Return Interval	1,200	1,660
50-Year Return Interval	2,775	3,700
100-Year Return Interval	3,100	4,100
Peak Floods		
2-Year Return Interval	1,780	2,490
50-Year Return Interval	4,590	6,150
100-Year Return Interval	5,200	6,950

Source: Orsborn, unpublished data, 3/12/2003

Table 3-4. Estimated Average Natural Low and High Flows (cfs) (modeled flows without diversion) for the Little Quilcene River.

	Little Quilcene below Diversion	Little Quilcene at Highway 101
Low Flows		
7-Day Average with 2-Year Return Interval	3	9
7-Day Average with 10-Year Return Interval	2.5	7
7-Day Average with 20-Year Return Interval	2	6
30-Day Average with 2-Year Return Interval	3.6	11
60-Day Average with 2-Year Return Interval	4.2	13
Average Daily Floods		
2-Year Return Interval	230	430
50-Year Return Interval	640	1,120
100-Year Return Interval	745	1,280
Peak Floods		
2-Year Return Interval	320	612
50-Year Return Interval	1,035	1,820
100-Year Return Interval	1,210	2,100

Source: Orsborn, unpublished data, 3/12/2003

Change in Magnitude

The diversion of water by the City of Port Townsend on the Big Quilcene and Little Quilcene Rivers changes the magnitude of flow in the rivers below the point of diversion. The percent reduction of flow attributed to the City diversions on the Big Quilcene and Little Quilcene Rivers is shown in Tables 3-5 and 3-6 below.

Table 3-5. Percent Reduction in Flows on the Big Quilcene River as a Result of Diversions by the City of Port Townsend.

	Percent at Diversion	Percent at Highway 101
Peak Flows		
2-Year Return Interval	1.7	1.2
100-Year Return Interval	0.5	0.4
Average Annual Flow	18.2	15.0
Annual Duration Curves (2001)	26	- - - - -
Monthly Flows		
August	20	- - - - -
September	27	- - - - -
October	27	- - - - -

Table 3-6. Percent Reduction in Flows on the Little Quilcene River as a Result of Diversions by the City of Port Townsend.

	Percent at Diversion	Percent at Highway 101
Peak Flows		
2-Year Return Interval	3.0	1.5
100-Year Return Interval	0.7	0.4
Average Annual Flow	39.6	19.8
Annual Duration Curves (2001)	18	- - - - -
Monthly Flows		
August	28	- - - - -
September	18	- - - - -
October	7	- - - - -

The analysis for the Big Quilcene River assumed the scenario that the City diverts the maximum amount allowed by water right of 30 cfs when available, while also following the City policy of

leaving 27 cfs instream below the diversion. The actual percent reduction of flows on the Big Quilcene River will be less than shown in Table 3-5, as the annual average flow actually diverted by the City ranges from 20 to 24 cfs. The analysis for the Little Quilcene River assumed that the City diverts the maximum allowed by water right of 9.56 cfs when available, while also leaving 6 cfs instream below the diversion. Therefore anytime the average monthly flow is below 57 cfs in the Big Quilcene River and 15.56 cfs in the Little Quilcene River, conditions under which withdrawals may be reduced (on the average) to maintain instream flow requirements and policies are anticipated to occur. The actual amount of stream flow diverted from each river is managed on a daily basis with on-site personnel.

The estimated (modeled) average annual flow of the Big Quilcene River immediately below the diversion is 165 cfs. Analysis of the annual duration curve for the Big Quilcene River for the year 2001 indicates that the City diversion accounts for a 26 percent reduction in flow immediately below the diversion site. Data for 2001 annual duration curves represent real data (not modeled) for the only common period of record with complete records for every day. Water year 2001 is representative of a dry year for streams on the Olympic Peninsula. The average annual flow of the Big Quilcene River for water year 2001 was 53 cfs, approximately 34 percent of the average annual flow between 1995 and 2001 of 154 cfs. Therefore the 26 percent reduction in annual flow represents an amount that is higher than would be expected during an average water year.

The percent reduction of low flows as a result of the City's diversion in the Big Quilcene River is derived using data from October 1998 to December 2002 to develop duration curves. Analysis of these data shows that the percent reduction of low flows during the late summer low flow period ranges from 20 percent in August, to 27 percent in October. Estimated mean monthly (modeled) flows immediately below the City diversion during August, September, and October are 56 cfs, 46 cfs, and 94 cfs respectively.

The estimated (modeled) average annual flow of the Little Quilcene River immediately below the diversion is 24 cfs. Analysis of the annual duration curve for the Little Quilcene River for the year 2001 indicates that the City diversion accounts for an 18 percent reduction in flow immediately below the diversion site. Data for 2001 annual duration curves represent real data (not modeled) for the only common period of record with complete records for every day. Water year 2001 is representative of a dry year for streams on the Olympic Peninsula. Therefore the 18 percent reduction in annual flow represents an amount that is higher than would be expected during an average water year.

The percent reduction of low flows as a result of the City's diversion in the Little Quilcene River is derived using data from October 1998 to December 2002 to develop duration curves. Analysis of these data shows that the percent reduction of low flows during the late summer low flow period ranges from 28 percent in August, to 7 percent in October. Estimated mean monthly (modeled) flows immediately below the City diversion during August, September, and October are 6 cfs, 5 cfs, and 11 cfs respectively.

Duration

The duration of a stream flow event describes the period of time over which the event occurs. Duration can be relative to a specific event, such as a flood flow occurring for a 10-day period, or with a statistical composite value, such as the percent of time when a flow exceeds a certain level.

Figures 3-4 and 3-5 below represent the annual duration curves for the Big Quilcene and Little Quilcene Rivers for water year 2001. These duration curves represent real data (not modeled) for the only common period of record with complete records for every day. Water year 2001 is representative of a dry year for streams on the Olympic Peninsula. The average annual flow of 53 cfs for the Big Quilcene River below the diversion represents approximately 32 percent of the long-term average annual flow of 165 cfs. Prior to 2001, the minimum recorded annual flow was 132 cfs in 2000 at the Big Quilcene diversion.

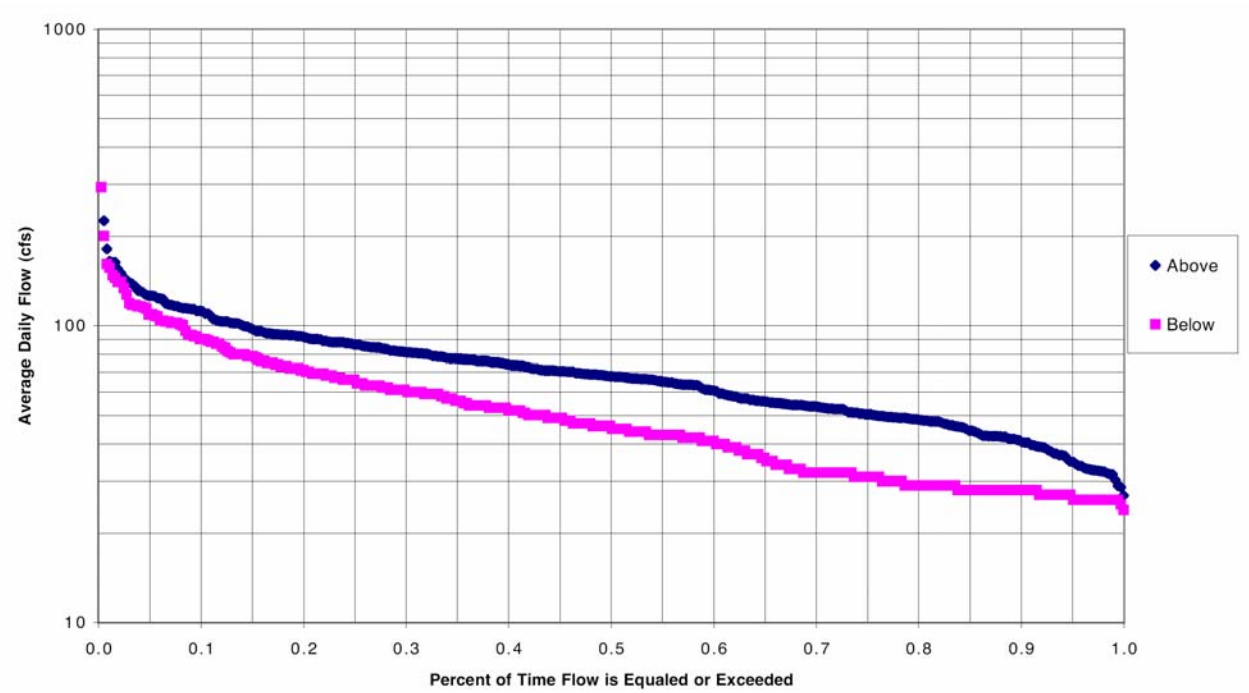


Figure 3-4. Big Quilcene River Duration Curve for Water Year 2001, Above and Below Diversion. Gage # 12052210. Area between the curves is 26 percent of the area under the "Above" curve.

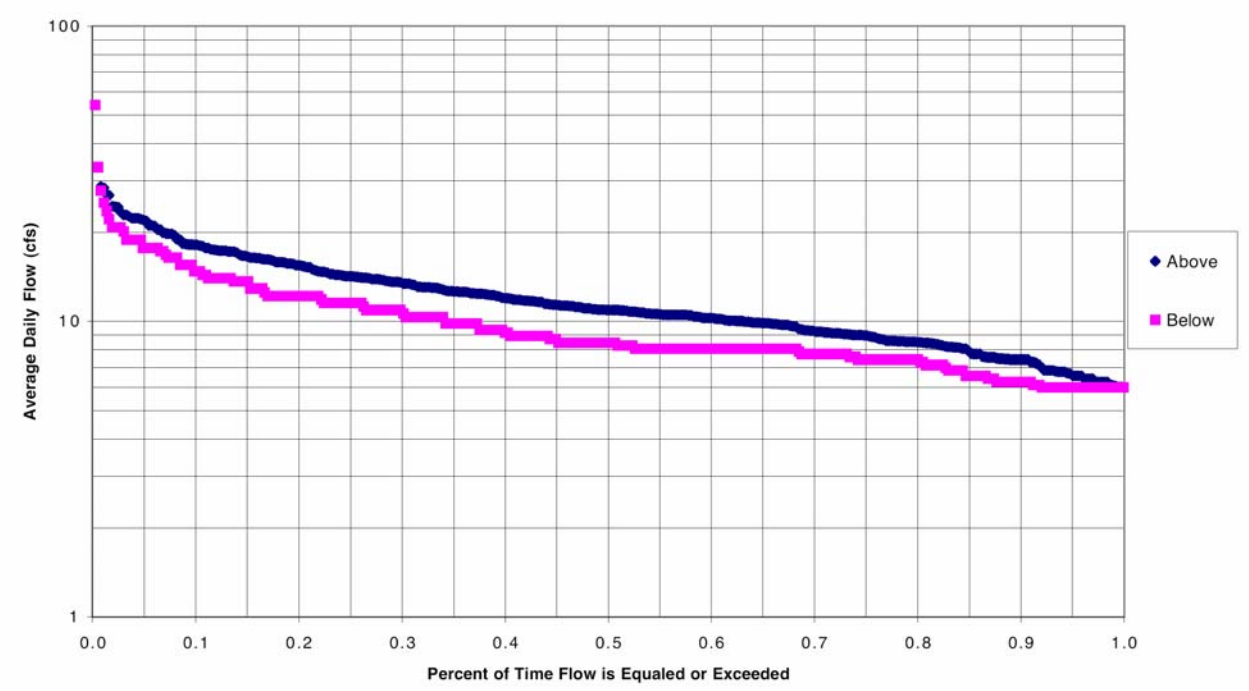


Figure 3-5. Little Quilcene River Duration Curve for Water Year 2001, Above and Below Diversion. Gage # 12051900. Area between the curves is 18 percent of the area under the "Above" curve.

Figures 3-6, 3-7, and 3-8 below represent the duration curves for the Big Quilcene River above and below the diversion for the months of August, September, and October. These months represent the period when low flows occur in the river, and correspond to the period when adult summer chum salmon are migrating and spawning in the lower portion of the Big Quilcene River.

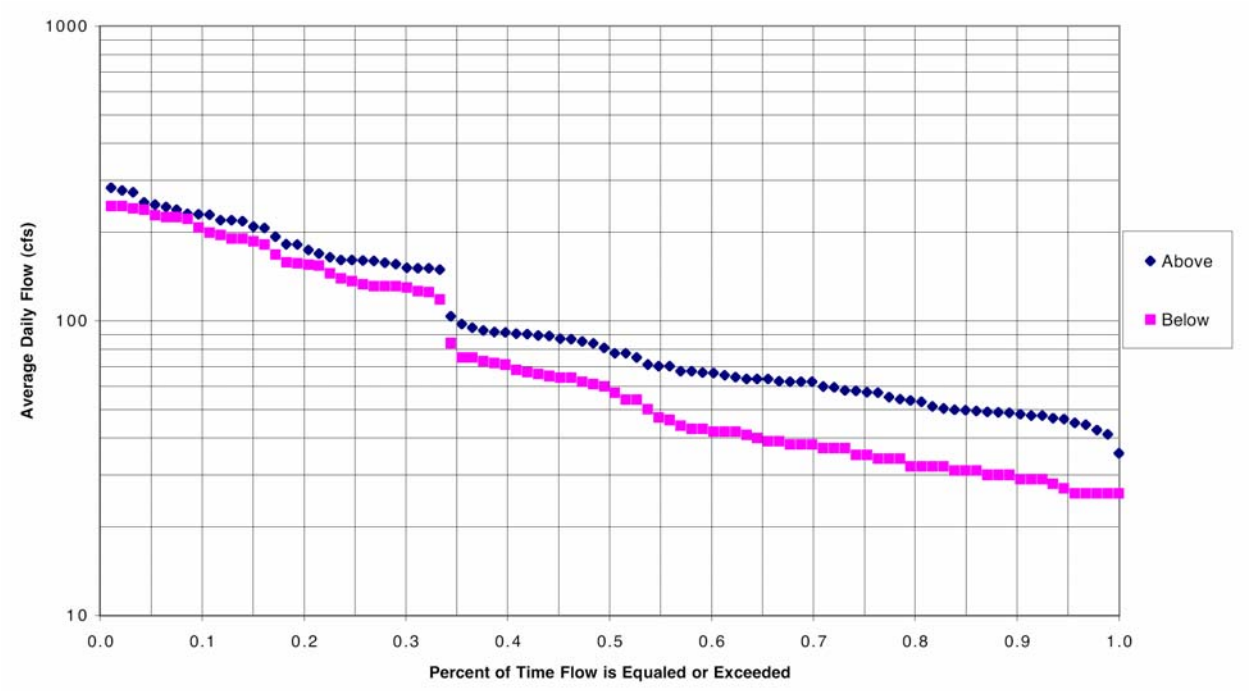


Figure 3-6. Duration Curves for the Big Quilcene River Above and Below the Diversion in August. Period of Record for October 1998 to September 2001. Gage # 12052210. Data from the City of Port Townsend. Area between the curves is 20 percent of the area under the "Above" duration curve.

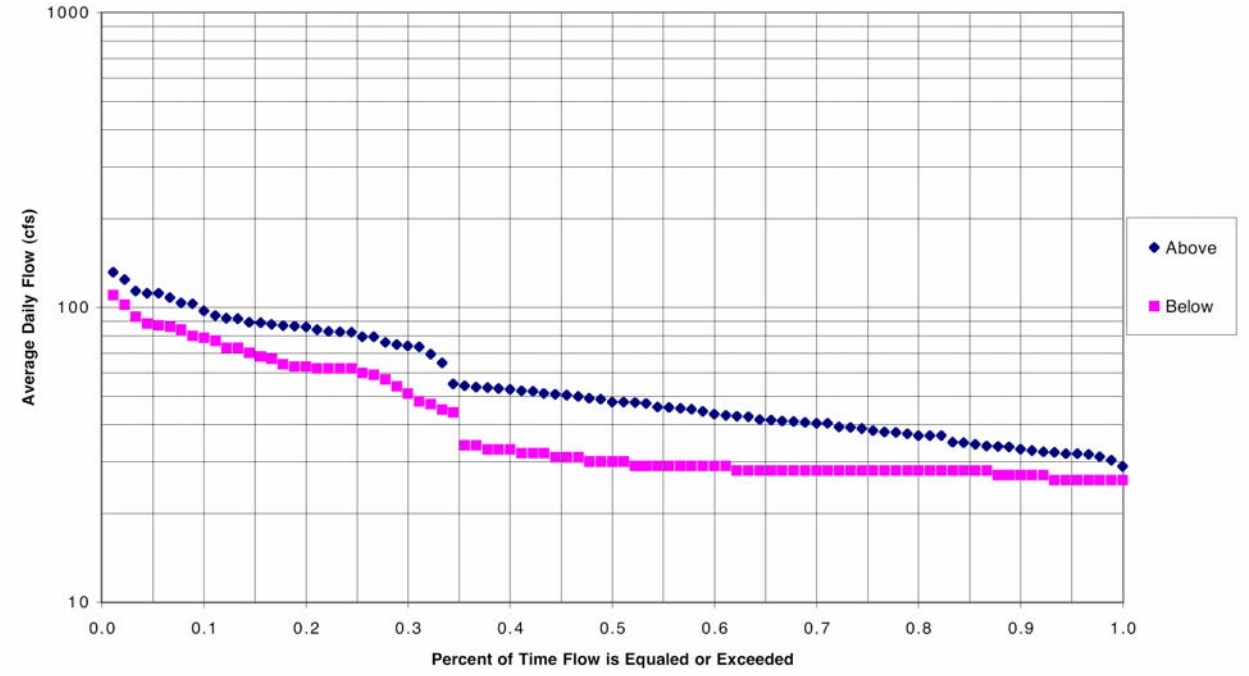


Figure 3-7. Duration Curves for the Big Quilcene River Above and Below the Diversion in September. Period of Record for October 1998 to September 2001. Gage # 12052210. Data from the City of Port Townsend. Area between the curves is 27 percent of the area under the "Above" duration curve.

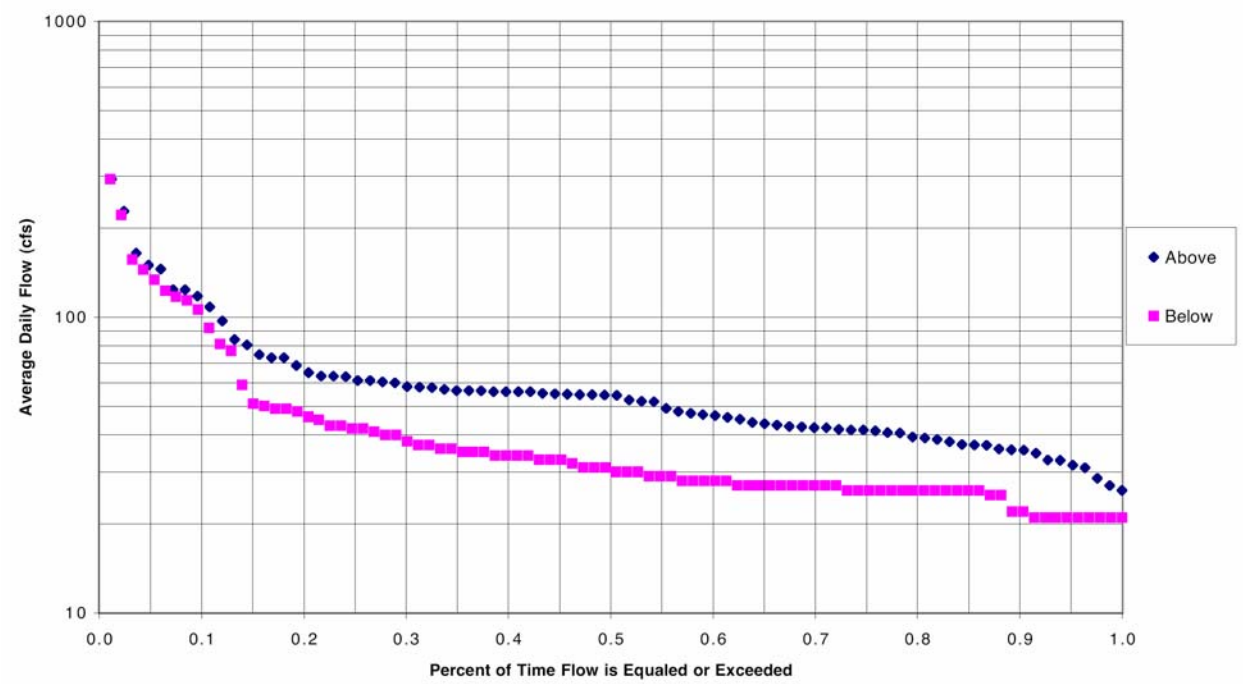


Figure 3-8. Duration Curves for the Big Quilcene River Above and Below the Diversion in October. Period of Record for October 1998 to September 2001. Gage # 12052210. Data from the City of Port Townsend. Area between the curves is 27 percent of the area under the "Above" duration curve.

Figures 3-9, 3-10, and 3-11 below represent the duration curves for the Little Quilcene River above and below the diversion for the months of August, September, and October. These months represent the period when low flows occur in the river, and correspond to the period when adult summer chum salmon are migrating and spawning in the lower portion of the Little Quilcene River.

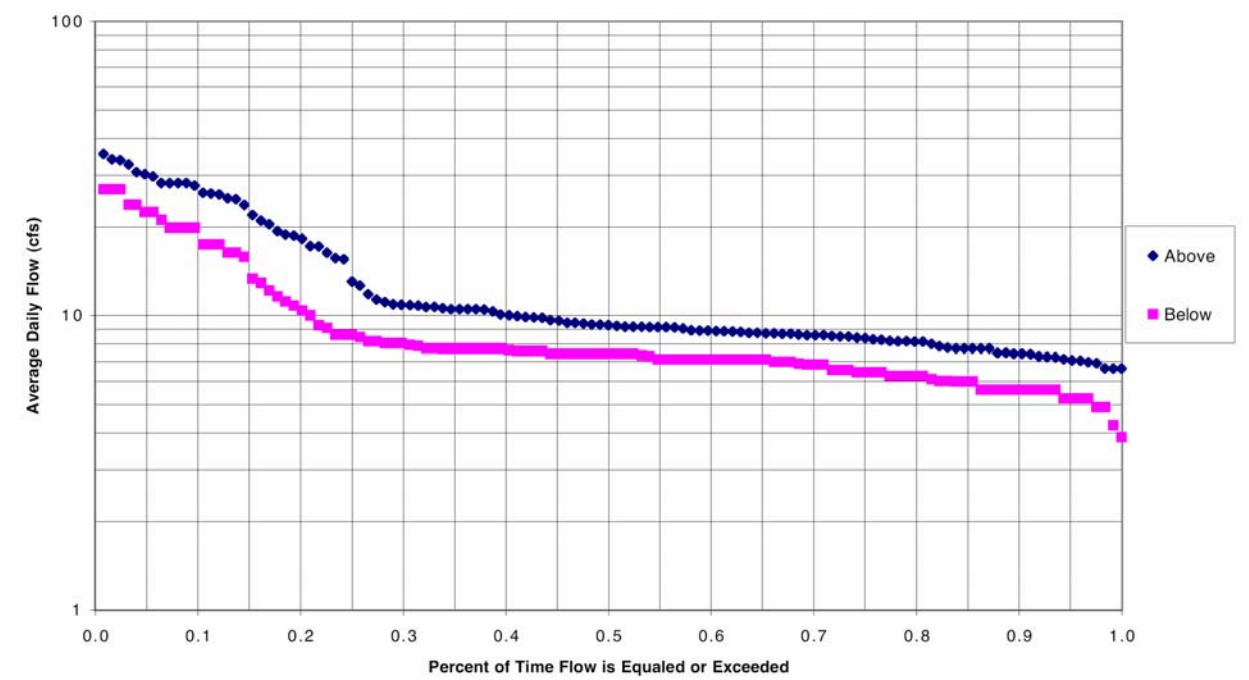


Figure 3-9. Duration Curves for the Little Quilcene River Above and Below the Diversion in August. Period of Record for October 1998 to September 2002. Gage # 12051900. Data from the City of Port Townsend. Area between the curves is 28 percent of the area under the "Above" duration curve.

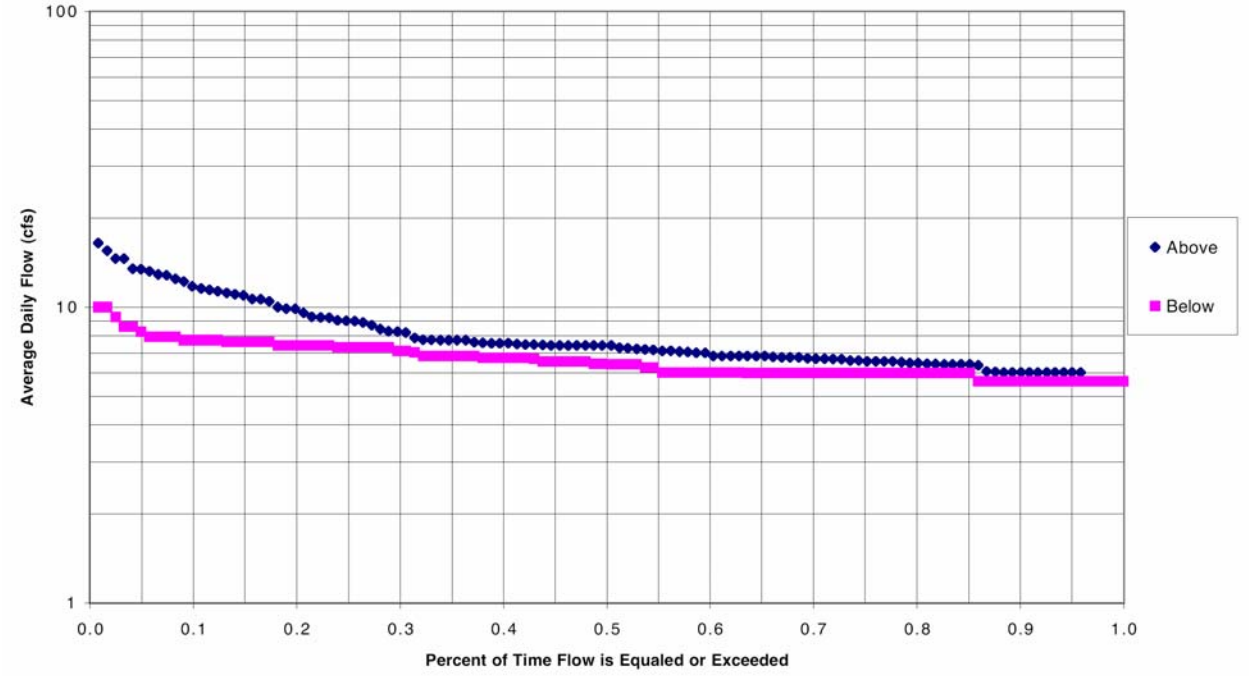


Figure 3-10. Duration Curves for the Little Quilcene River Above and Below the Diversion in September. Period of Record for October 1998 to September 2002. Gage # 12051900. Data from the City of Port Townsend. Area between the curves is 18 percent of the area under the "Above" duration curve.

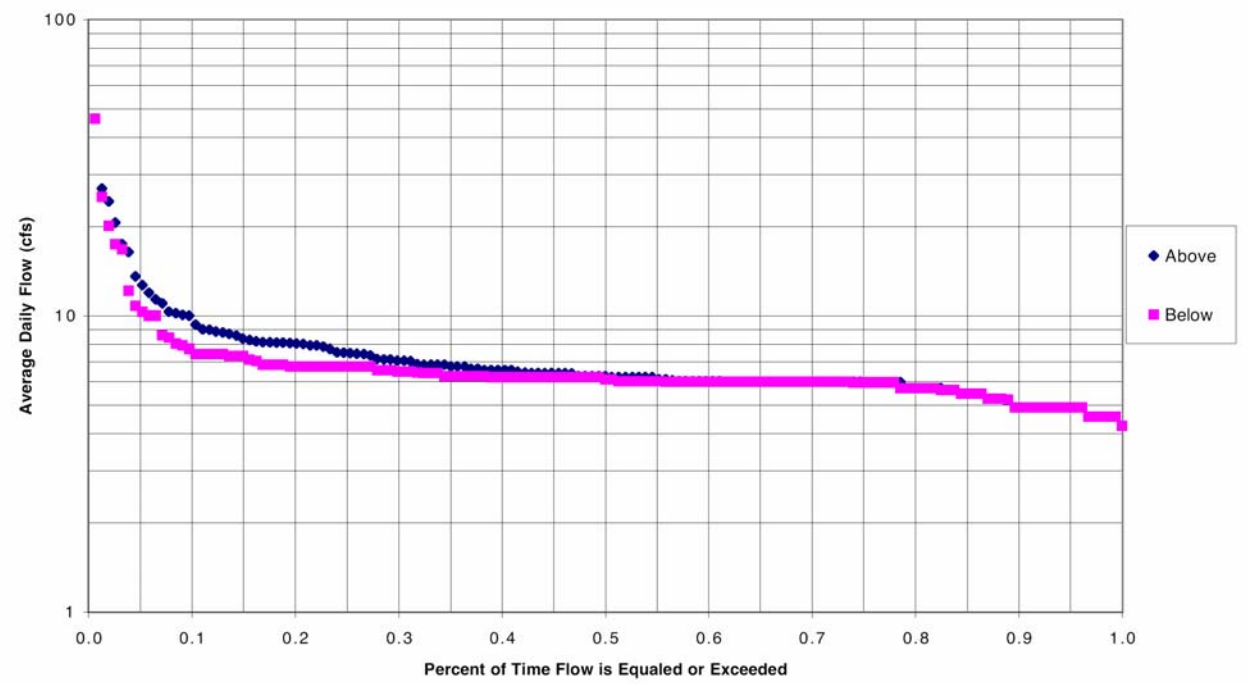


Figure 3-11. Duration Curves for the Little Quilcene River Above and Below the Diversion in October. Period of Record for October 1998 to September 2002. Gage # 12051900. Data from the City of Port Townsend. Area between the curves is 7 percent of the area under the "Above" duration curve.

Water Quality

Immediate Permit Area

Water temperatures were recorded during 2002 at the project diversion facilities located at RM 9.4 of the Big Quilcene River and RM 7.2 of the Little Quilcene River. These data are presented with the water temperature data for the Big Quilcene and Little Quilcene River watersheds in the following section.

Watershed

Limited water temperature data were available to describe the existing condition in the project area. The Port Gamble S'Klallam Tribe collected water temperature data from the Big Quilcene and the Little Quilcene Rivers and major tributaries during the summer of 2001, and summer through fall of 2002. The USFWS has collected water temperature data for the Big Quilcene River and Penny Creek, a tributary to the Big Quilcene River, since the 1970's. In 2002, the City of Port Townsend initiated the collection of water temperature data from the Big Quilcene and Little Quilcene Rivers.

Water temperature data collected from the Big Quilcene and Little Quilcene Rivers and tributaries included 10 sites in 2001, and 13 sites in 2002 (Figure 3-12). The Tribe's instream data loggers recorded data every half hour in 2001, while USFWS's loggers were set to record data every four hours. In 2002, the Tribe recorded data hourly, and the City recorded data every half hour. The USFWS recorded data every four hours in the first half of 2002, and hourly after July 2002. The maximum water temperature values recorded from these sites are presented in Figures 3-13 and 3-14.

Under Washington Administrative Code *(WAC) 173-201A*, the Big Quilcene River, the Little Quilcene River, and their major tributaries are designated as Class AA surface water of the state. The following temperature criteria shall apply to Class AA surface waters in the state of Washington per *WAC 173-201A-030*.

> *(iv) Temperature shall not exceed 16.0 C (freshwater) or 13.0 C (marine water) due to human activities. When natural conditions exceed 16.0 C (freshwater) and 13.0 C (marine water), no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3 C. Incremental temperature increases resulting from point source activities shall not, at any time, exceed t=23/(T+5) (freshwater) or t=8/(T-4) (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8 C. For purposes thereof, "t" represents the maximum permissible temperature increase measured at a mixing zone boundary; and "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge.*

This temperature criteria was determined by assessing requirements for bull trout. Bull trout are thought to be an “indicator species” because they require the coolest water temperatures to complete their life cycle compared with other native salmonids. Therefore, it was assumed by the State when setting temperature standards that if water temperatures could support bull trout, they also could support all other native salmonids. It has been widely reported in the literature that 15 to 16ºC is the upper temperature at which bull trout can be found, that bull trout avoid temperatures above approximately 16ºC, and that bull trout are temperature limited (Brown 1994, Goetz 2002, and Kraemer 1994). However, new data has shown that some local populations or individual bull trout can experience and survive temperatures as high as 18ºC for a short period of time (Pers. comm. J. Dunham, ScCS 2002 Annual Meeting). Tables 3-7 and 3-8 summarize the number of days (during the period of record) that the daily maximum temperature exceeded 16ºC for the Big Quilcene and Little Quilcene Rivers. Table 3-9 summarizes the exceedance for the major tributaries.

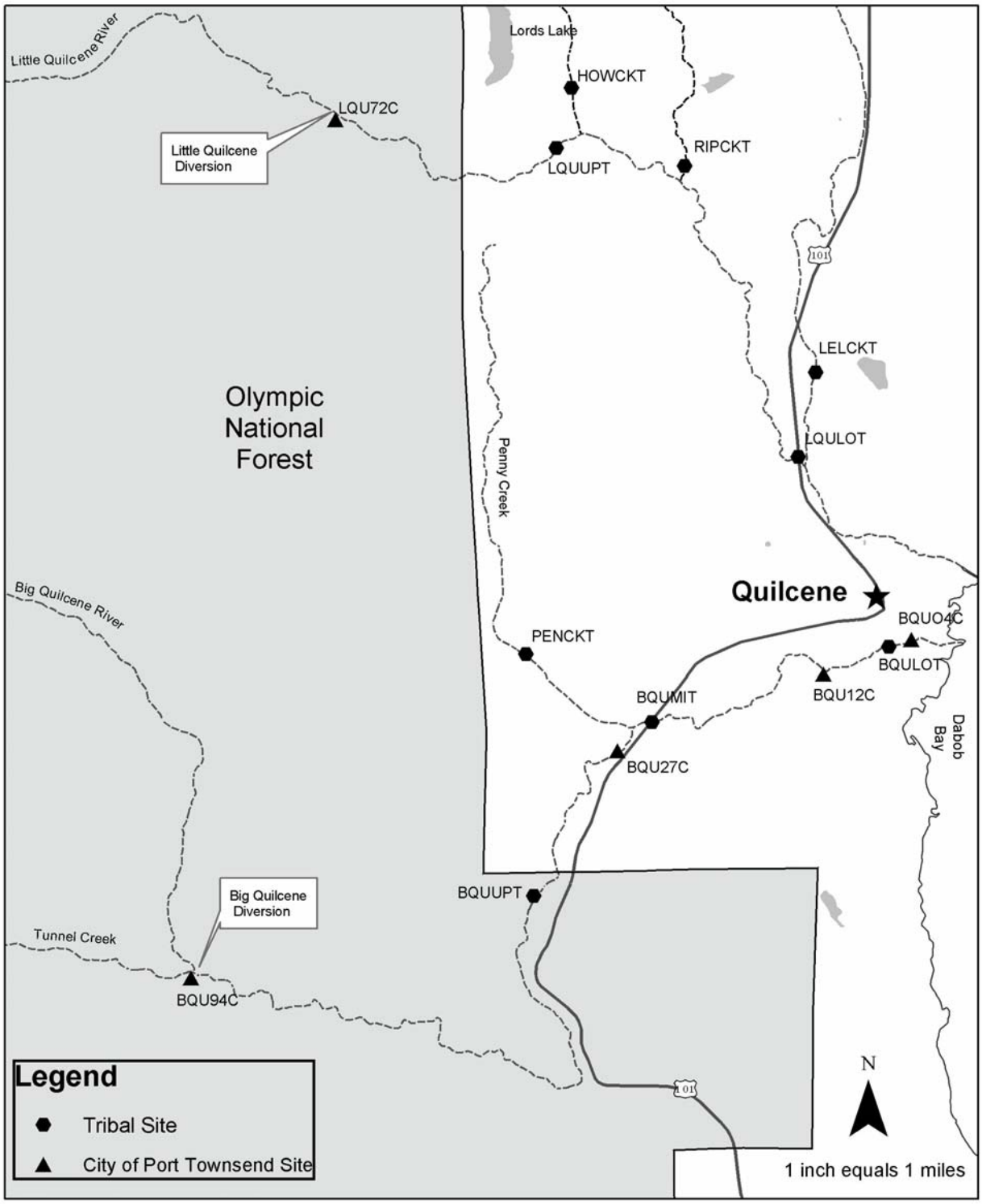


Figure 3-12. Water temperature sites monitored by the City of Port Townsend (code with suffix C) and the Port Gamble S'Klallam Tribe (code with suffix T).

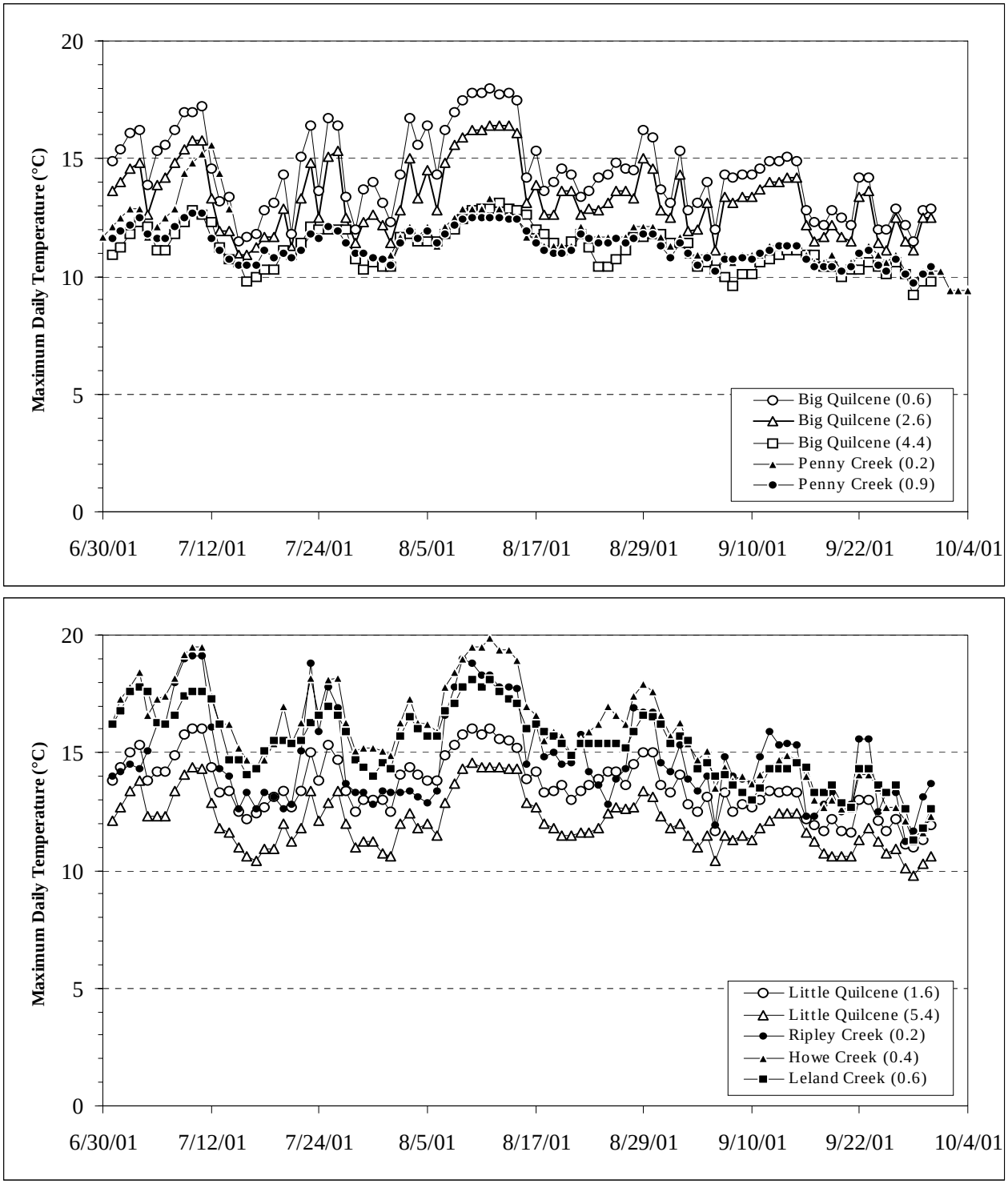


Figure 3-13. Maximum water temperature recorded at monitoring sites at Big Quilcene and its tributaries (top), and at Little Quilcene and its tributaries (bottom) in 2001.

Notes: tributaries denoted in solid dark symbols. The number in parentheses in the legend refers to the location of data logger in river miles.

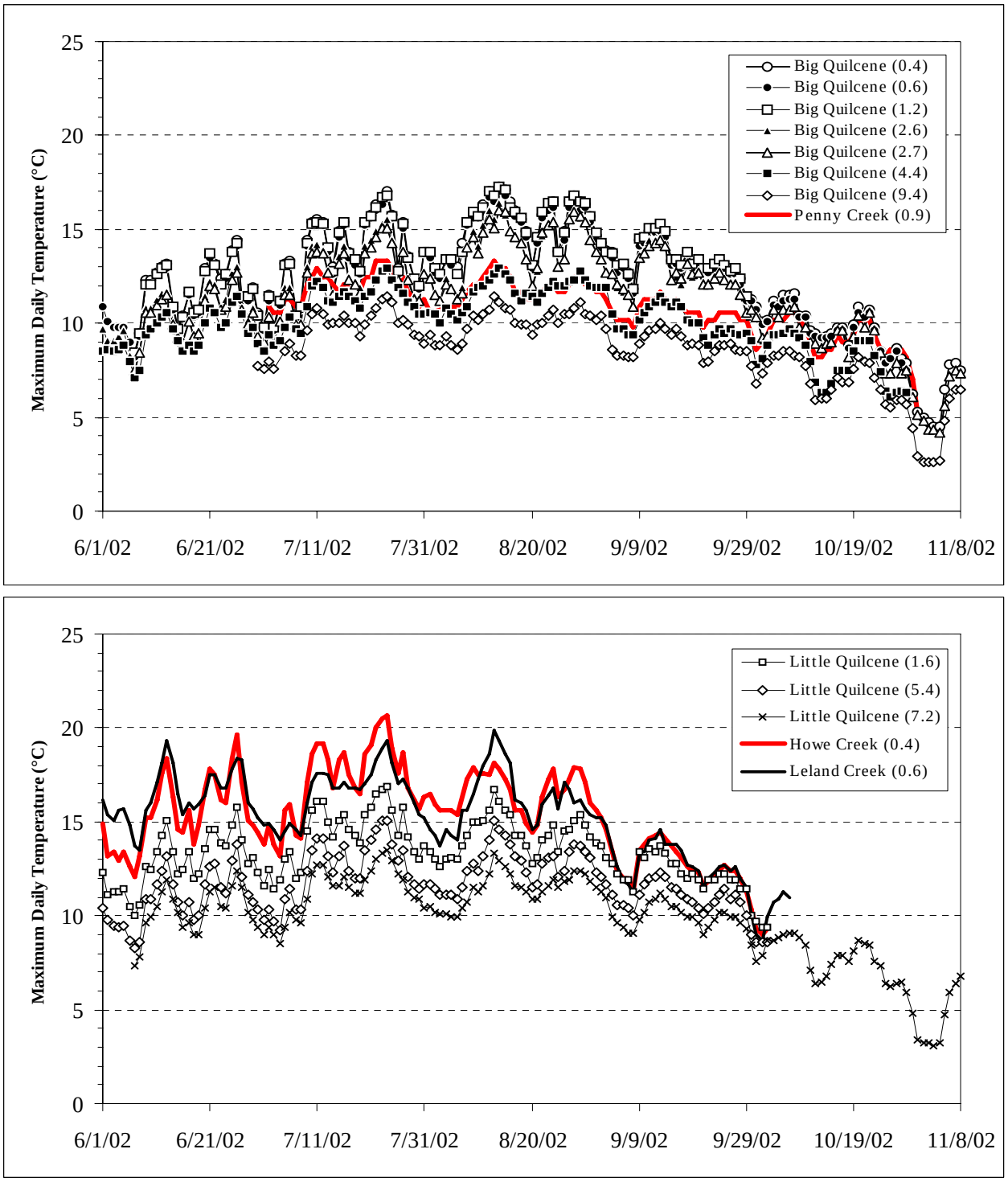


Figure 3-14. Maximum water temperature recorded at monitoring sites at Big Quilcene and its tributary (top), and at Little Quilcene and its tributaries (bottom) in 2002.

Notes: Tributaries denoted in solid line. The number in parentheses in the legend refers to the location of data logger in river miles.

Table 3-7. Number of total and consecutive days temperature exceeded 16ºC at various locations in the Big Quilcene River in 2001 and 2002.

River Mile (data source)	Period of Record	Month / Year	Daily Max. Temp. Exceeded 16ºC		Maximum Temp. Recorded (ºC)
			Total Days	Maximum Consecutive Days	
0.4 (Port Townsend)	June 7 - Nov 8	July, 2002	3	3	17.0
		August, 2002	12	6	17.3
0.6 (Port Gamble S'Klallam)	July 1 - Sep 30	July, 2001	9	4	17.2
		August, 2001	12	9	18.0
	June 1 - Oct 29	July, 2002	2	2	16.7
		August, 2002	9	5	17.0
1.2 (Port Townsend)	June 7 - Sep 30	July, 2002	3	3	16.8
		August, 2002	12	6	17.3
2.6 (Port Gamble S'Klallam)	July 1 - Sep 30	August, 2001	6	6	16.4
	June 1 - Oct 3	August, 2002	1	1	16.4
2.7 (Port Townsend)	June 7 - Nov 8	2002	None	None	16.0
4.4 (Port Gamble S'Klallam)	July 1 - Sep 30	2001	None	None	13.1
	June 1 - Oct 29	2002	None	None	12.9
9.4 (Port Townsend)	June 30 - Nov 8	2002	None	None	11.4

Note: Gray highlight indicates year 2002 and white indicates 2001.

Table 3-8. Number of total and consecutive days temperature exceeded 16ºC at various locations in the Little Quilcene River in 2001 and 2002.

River Mile (data source)	Period of Record	Month / Year	Daily Max. Temp. Exceeded 16ºC		Maximum Temp. Recorded (ºC)
			Total Days	Maximum Consecutive Days	
1.6 (Port Gamble S'Klallam)	July 1 - Sep 30	2001	None	None	16.0
	June 1 - Oct 3	July, 2002	5	3	16.9
		August, 2002	2	2	16.7
5.4 (Port Gamble S'Klallam)	July 1 - Sep 30	2001	None	None	14.6
	June 1 - Oct 3	2002	None	None	15.1
7.2 (Port Townsend)	June 7 - Nov 8	2002	None	None	13.5

Note: Gray highlight indicates year 2002 and white indicates 2001.

Table 3-9. Number of total and consecutive days temperature exceeded 16ºC in major tributaries to Big Quilcene and Little Quilcene River in 2001 and 2002.

Creek	Tributary to	River Mile to the Confluence (data source)	Period of Record	Month / Year	Daily Max. Temp. Exceeded 16ºC		Max. Temp. Recorded (ºC)
					Total Days	Maximum Consecutive Days	
Penny	Big Quilcene River	0.9 (Port Gamble S'Klallam)	Jul. 1 - Sep. 30	None	None	None	12.7
		0.2 (USFWS)	May 1 - Jan. 3	None	None	None	15.6
			Jul. 2 - Nov. 1	None	None	None	13.3
Leland	Little Quilcene River	0.6 (Port Gamble S'Klallam)	Jul. 1 - Sep. 30	July, 2001	17	14	17.8
				August, 2001	14	9	18.1
			Jun. 1 - Oct. 7	June, 2002	14	8	19.3
				July, 2002	19	19	19.3
				August, 2002	14	9	19.9
Howe	Little Quilcene River	0.4 (Port Gamble S'Klallam)	Jul. 1 - Sep. 30	July, 2001	21	14	19.5
				August, 2001	24	15	19.9
			Jun. 1 - Oct. 3	June, 2002	11	4	19.6
				July, 2002	22	21	20.7
				August, 2002	20	10	18.1
Ripley	Little Quilcene River	0.2 (Port Gamble S'Klallam)	Jul. 1 - Sep. 30	July, 2001	10	7	19.1
				August, 2001	13	9	19.0

Note: Gray highlight indicates year 2002 and white indicates 2001.

Tables 3-7 through 3-9 above summarize the occurrence of temperatures that exceeded the state temperature standard. The days that temperatures exceeded 16°C occurred as isolated days, and on consecutive days. Across consecutive days of exceedance, diurnal patterns in solar radiation resulted in stream temperatures dropping below 16°C during the evening and early morning hours, limiting the total time of exceedance to less than 24 hours in each day. The analysis file contains a table that displays the maximum hourly temperatures recorded for each water temperature-monitoring site. Time periods in 2001 and 2002 when stream temperatures exceeded 16°C are shaded within the table to provide a visual representation of the periods when state temperature standards were exceeded.

Data presented in Tables 3-7 and 3-8 indicate that water temperature in the mainstem Big Quilcene River falls within the state temperature standards except during July and August. State standards were exceeded during July and August in the lower Big Quilcene River for both record years. During the summer of 2002, which was a very low water year, temperature standards were exceeded 3 days during July and 12 days during August at RM 0.4 (Port Townsend Data). However, the consecutive days of the exceedances do not indicate that the hourly exceedances occurred continuously during the day. The consecutive hours temperature standards were exceeded at RM 0.4 during July and August ranged from 3 to 7 hours.

The highest daily maximum water temperature in the Big Quilcene River was 18.0ºC in 2001 and 17.3ºC in 2002. For the Little Quilcene River, temperature standards were not exceeded at RM 1.6 (2001) or at any of the upstream monitoring sites (2001 and 2002). However, water temperatures exceeded the state standard at the RM 1.6 on 5 days in July and 2 days in August of 2002. The consecutive hours temperature exceedances occurred at the site during July and August ranged from

1 to 7 hours and 3 to 7 hours, respectively. The highest water temperature recorded in the Little Quilcene River was 16.0 in 2001 and 16.9 in 2002.

Water temperatures measured in the tributaries were generally higher than the mainstem Little Quilcene River (Figure 3-13 and 3-14). In 2001 and 2002, the maximum daily water temperatures recorded in Leland, Howe, and Ripley Creeks exceeded the state temperature standards in July and August (Table 3-9). The exceeded values ranged from about 2 to 5°C over the state standards of 16°C. The maximum daily water temperature observed in Leland Creek also exceeded the state standards by about 3°C in June 2002 (Table 3-9). The highest tributary water temperatures were recorded in Howe Creek at 19.9°C and 20.7°C in 2001 and 2002, respectively. The consecutive hours temperature standards were exceeded at Howe Creek in July and August 2001 ranged from 4 to 17 hours and 5 to 19 hours, respectively (see Daily Maximum Water Temperature Records in project record). While during a very low water year in 2002, the consecutive hours of exceedances ranged from 5 to 114 hours (4.75 days) in July and 4 to 18 hours in August.

Based on the temperature records available, water temperatures entering the Big Quilcene River from Penny Creek appear to be cooler than mainstem temperatures (Figure 3-13 and 3-14). The maximum daily water temperatures recorded in Penny Creek were within the state temperature standards (Table 3-9). The highest water temperature recorded in Penny Creek in 2001 and 2002 were 15.6°C and 13.3°C, respectively.

The water temperature exceedances occurred for more consecutive hours at the major tributaries of the Little Quilcene River than at the mainstems of the Little Quilcene and Big Quilcene Rivers. The temperature exceedances in Big Quilcene and Little Quilcene Rivers typically occurred between 1300 and 2000 hours. In the major tributaries, the hours when the exceedances occurred were generally longer than the duration of exceedance in the mainstem (typically occurring between 1200 and 0600 hours), and in one extreme event continued for more than four continuous days (Howe Creek in July 2002).

Fisheries Resources

Immediate Permit Area

Big Quilcene River Water Diversion

This section describes the current instream and riparian habitat conditions, and fish species presence and use of habitat, in the vicinity of the water diversion structure located at river mile (RM) 9.4 of the Big Quilcene River. Riparian habitat conditions along the diversion pipeline located adjacent to the river for approximately two miles downstream of the diversion structure is also described. Existing condition descriptions are limited to the reach actually encompassing the diversion structure and the water pipeline adjacent to the river (located from RM 9.4 to RM 7.5).

Fish Use

All fish populations found in the reach near the diversion facility are resident life history forms, as there is a natural upstream migration barrier located at RM 7.6, approximately 1.8 miles downstream of the diversion facility (Williams et. al. 1975, Dilley 1982, Zajac 2000). In addition, the diversion facility is an upstream migration barrier, as there is no fishway at the diversion dam. Therefore, there are two distinct reaches that are spatially separated within the non-anadromous zone; the reach upstream of the diversion dam and the reach between the diversion dam downstream to the steep

cascade at RM 7.6 (subsequently referred to as the upper reach and middle reach, respectively). However, there is potential one-way interaction between the upper reach and the middle reach fish populations through downstream migration of individual fish past the diversion dam.

Rainbow trout and brook trout are known to be present upstream of the diversion facility, and cutthroat trout may be present based on limited anecdotal information. In addition, rainbow trout are known to be present in the reach immediately downstream of the diversion facility. Although existing data does not indicate the presence of brook trout or cutthroat trout downstream of the diversion facility, there are no downstream migration barriers that would preclude their use.

Presumably, all life stages and supporting habitat types for rainbow and brook trout are present upstream of the diversion dam in order for these populations to be self-sustaining (no stocking for either of these species has occurred in the Big Quilcene River for several years) (WDFW 1999, 2000, 2001, 2002a). Portions of the upper reach are likely suitable for spawning, rearing, and foraging. However, all life stages and supporting habitats may not be present within the middle reach, as fish presence could be driven by emigration from the upper reach to the middle reach. Spawning need not occur in the middle reach to support fish presence, only foraging and rearing habitat need be available.

Rainbow trout was the only species collected by Dames and Moore (1984) using electrofishing within the 1.75-mile reach upstream of the diversion facility, with density estimates reported of 0.04 fish/square yard or 784 fish/mile. All fish were less than 6 inches in total length. Hosey (1985) reported anecdotal information from Washington Department of Game (WDG) personnel that brook trout and cutthroat trout occurred within the 1.75-mile reach upstream of the diversion facility. Donald (1991) captured 17 brook trout in the upper reach (approximately 5 miles upstream of the diversion facility), of which all were approximately 6 inches or greater in length. These data support the WDG anecdotal information of brook trout occurrence near the diversion facility since there are no physical barriers limiting downstream migration of brook trout to the diversion area.

A few investigators have sampled fish species presence and abundance within the middle reach. Stober and Steward (1983) and Dames and Moore (1984) only collected rainbow trout (less than 7 inches in length) at RM 9.1 and 9.0, respectively. However, the sample size was low; only three fish were captured at RM 9.1 using electrofishing techniques. Hosey (1983) also recorded only rainbow trout in the middle reach during snorkel surveys. Dames and Moore (1984) estimated rainbow trout densities of 0.03-fish/square yard or 470 fish/mile for the middle reach. Hosey (1985) reported that for several years WDG stocked approximately 1,500 rainbow trout annually in the middle reach to provide for a recreational put-and-take trout fishery.

Instream Habitat

Hosey and Associates (1985) reported that the reach upstream of the diversion facility was composed of a mixture of pool and riffle/cascade habitat. Sampling results show that water quality at the diversion facility is generally excellent, with low or non-detectable levels recorded for volatile and synthetic organic compounds, inorganic chemicals, and turbidity (Parametrix et. al. 2000).

A stream survey of the Big Quilcene River near the diversion dam was conducted by the Forest Service in 1992 using the Hankin and Reeves methodology. A summary of the habitat conditions from this survey is provided below. Although the stream gradient and valley floor parameters are the

same today, high flow events in the mid-1990's may have changed the composition of the substrate, riffle/pool ratio, and quantity of large wood since the survey was conducted.

Downstream of Diversion

The reach surveyed by the Forest Service immediately downstream of the diversion extends from the diversion dam at RM 9.4 to RM 7.0. The valley form in this area is moderately V-shaped (slopes ranging from 30-60%) with a narrow floor (less than 100-ft). Average stream gradient is 2 percent. Stream substrate is dominated by cobble and small boulders, with limited gravel. Long riffles dominate this reach. Pools account for 15 percent of the wetted area, with 12 pools/mile. Large wood is scarce and provides little fish cover. Riprap is common in locations where the road borders the stream.

Upstream of Diversion

The reach surveyed by the Forest Service immediately upstream of the diversion extends from the diversion dam at RM 9.4 to RM 11. The valley form in this area is steeply V-shaped (long slopes approximately 60 percent) with a narrow floor (less than 100-ft). Average stream gradient is 5 percent. Stream substrate is dominated by cobble and small boulders, with limited gravel. Pools account for 10 percent of the wetted area, with 21 pools/mile. Large wood is present mostly as debris jams averaging 4.5/mile and providing good fish cover.

Riparian Habitat

Forest Service Road 040 runs parallel to the river for greater than one mile downstream of the diversion. Undeveloped campsites are located within the riparian zone along the road. The Forest Service (1992) reported that tree saplings were the dominant size class in this area, and alder was the most common species. Western red cedar, western hemlock and big-leaf maple were also found throughout this area (USDA Forest Service 1992).

Upstream of the diversion the riparian zone is heavily vegetated. The Forest Service (1992) reported that large trees were the dominant size class in this area, consisting mostly of Douglas-fir and western red cedar, providing heavy stream shading.

Little Quilcene River Water Diversion

This section describes the current instream and riparian habitat conditions, and fish species presence and use of habitat in the vicinity of the water diversion structure located at RM 7.2 of the Little Quilcene River. Existing condition descriptions are limited to the reach immediately adjacent to the diversion facility.

Fish Use

It is assumed that all fish species found in the reach near the diversion facility are resident life history forms as there is a natural upstream migration barrier to anadromous fish (steep cascade) located at RM 6.6, approximately 0.6 miles downstream of the diversion facility (Parametrix et. al. 2000). A natural fishway constructed from large boulders and trees provides upstream passage over the notched weir at the diversion facility.

Donald (1991) caught four brook trout (3 greater than 6 inches, 1 less than 6 inches in length) and nine rainbow trout (3 greater than 6 inches, 6 less than 6 inches in length) approximately 1.5 miles upstream of the diversion facility, and 134 rainbow trout (1 to 8 inches in length) approximately one

mile downstream of the diversion facility using electrofishing techniques. Stocking has occurred in this reach in the past; however, no stocking of brook trout or rainbow trout has occurred for several years (WDFW 1999, 2000, 2001, 2002a). Stocked trout are generally of catchable size (6 inches or greater). Since Donald (1991) found rainbow and brook trout less than 6 inches in length, this indicates that natural production of rainbow and brook trout occurs in the upper watershed. It is likely that spawning, foraging and rearing habitat for rainbow and brook trout is present in the upper watershed. However, quantity and quality of spawning, rearing, and foraging habitats are not known.

Instream Habitat

A natural fishway (constructed in 1995) is located at the immediate downstream side of the diversion weir within the river channel to provide upstream fish passage over the diversion weir. The fishway begins at the sluiceway exit below the gatehouse and terminates at the low flow notch in the diversion weir. The fishway is constructed primarily from large boulders and a few large root-wads and logs, and was designed to emulate a natural step/pool series of microhabitat units.

Riparian Habitat

Riparian vegetation for the area immediately above and below the diversion is dominated by an alder overstory ranging from 6 to 12 inches diameter, and an understory of salmonberry. Other species commonly found adjacent to the riparian zone include western red cedar, western hemlock, Douglas-fir, and sword fern. The access road to the diversion facility parallels the Little Quilcene River for approximately one-quarter mile below the diversion site.

Watershed

Existing watershed conditions are primarily focused on the portion of the watershed downstream of the immediate permit area.

Big Quilcene River Watershed

This section describes the current instream and riparian habitat conditions, and fish presence and use of habitat downstream of the project diversion facilities located at RM 9.4 of the Big Quilcene River.

Fish Use

Current salmonid populations within the Big Quilcene watershed include coho salmon, summer and fall chum salmon, steelhead/rainbow trout, coastal cutthroat trout, and brook trout. Summer/fall Chinook salmon and pink salmon are known to sporadically stray into the system, but are not considered self-sustaining populations (Parametrix et. al. 2000). Anadromous fish production in the Big Quilcene River is dominated by coho and chum salmon production from the QNFH (USDA Forest Service 1994). Anadromous salmonid use is generally restricted to the lower river due to an electric weir located at RM 2.8 that is used to divert fish into the QNFH. The electric weir is operated from October through December of each year. The QNFH has occasionally out-planted juvenile coho salmon in previous years above the hatchery barrier, and has sporadically passed a limited number of coho salmon adults above the barrier.

A natural anadromous fish barrier consisting of a steep cascade is located at RM 7.4. Little information is available on natural production of anadromous fish in the reach between the natural barrier at RM 7.4 and the hatchery weir at RM 2.8; although, the hatchery weir is passable by winter steelhead, coho, and cutthroat during high flows or through a bypass ladder. The bypass ladder is currently impassable due to gravel accumulation. Figure 3-15 summarizes salmonid species' life

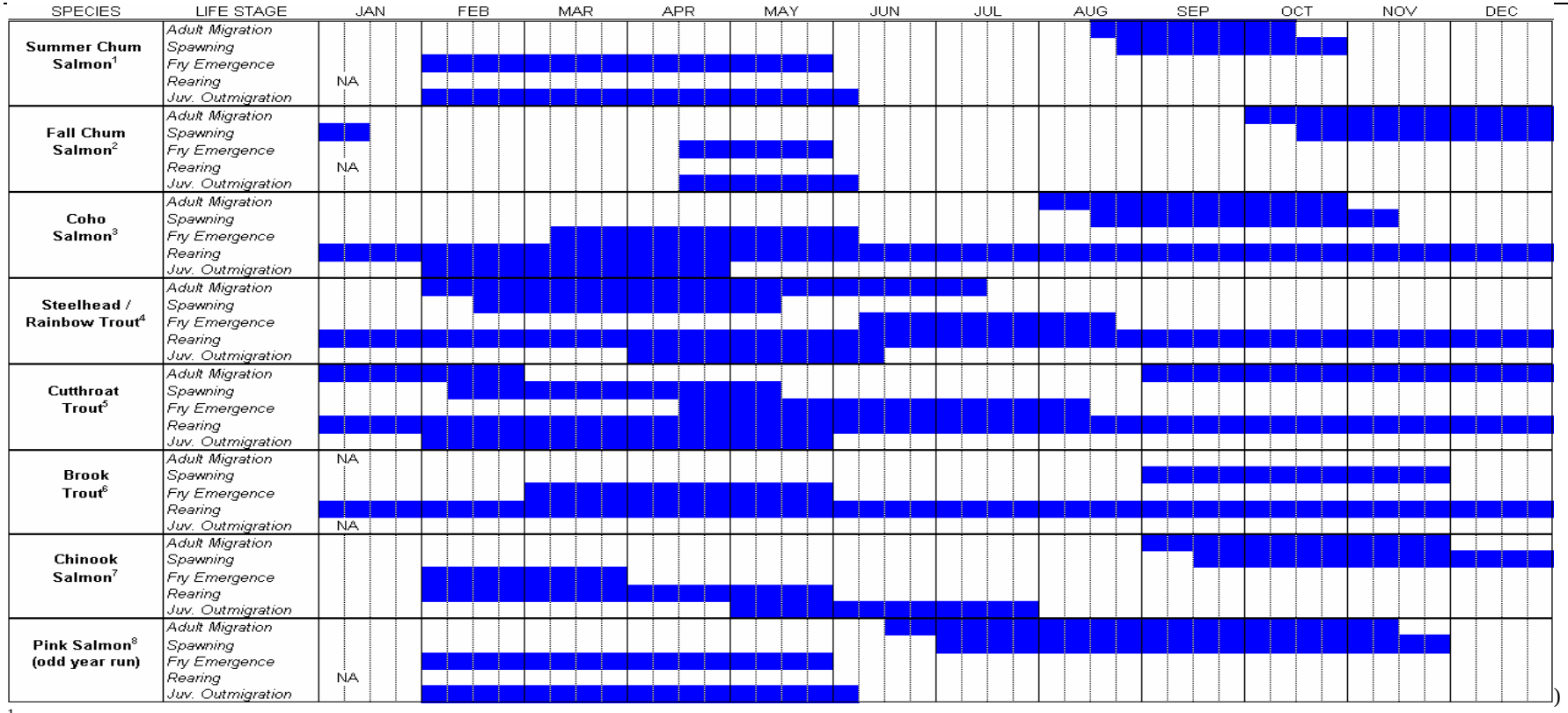
history periodicity within the Big Quilcene watershed. The following sections provide individual descriptions of the current occurrence, habitat use, and abundance for each species.

Summer Chum Salmon

The summer chum salmon population from the Big Quilcene River is a composite of natural and hatchery production and is managed within the aggregate Quilcene and Dabob Bay stock. The QNFH recorded 433 summer chum salmon during the year 2000. Based on this number, the total run size was estimated to be approximately 5,126 fish (Pers. comm. L. Telles, in Harza 2000). Historical spawning escapement of summer chum salmon to the Big Quilcene River has been highly variable, but has generally declined from 1978 (2,978 fish) to 1989 when only one fish was recorded. In 1992 the QNFH supplementation program began, using broodstock collected from the tribal coho salmon fishery in Quilcene Bay, in-river collection, and from fish captured at the hatchery. Average spawning escapement to the Big Quilcene River from 1992 to 1998 was 3,652 fish, with a high of 9,361 fish in 1996, and a low of 147 fish in 1993 (WDFW and PNPTC 2000). These numbers include returns of fish derived from both natural production and hatchery supplementation. The current production goals for the QNFH include rearing 400,000 chum salmon juveniles, of which the majority is released directly to the Big Quilcene River.

Fall Chum Salmon

Fall chum salmon are genetically distinct from summer chum salmon stocks. In addition, Big Quilcene hatchery fall chum salmon are genetically distinct from other Hood Canal fall chum salmon stocks (Parametrix et. al. 2000). Fall chum salmon in the Big Quilcene watershed are from a mixed origin, composed of stock indigenous to the watershed and from stock brought in from other watersheds through hatchery introductions (WDF et. al. 1993). In addition, this mixed origin stock is currently a composite of hatchery and natural production (WDF et. al. 1993). In 2000, the QNFH production goals for fall chum salmon included releasing 2.2 million juvenile fish to the Big Quilcene River. Recent fall chum salmon spawning escapement has been highly variable with approximate counts for the years 1993, 1995, and 1998 of 2,500, 14,500, and 600 fish respectively.



[1] Summer chum migrate directly to marine environments after fry emergence; freshwater rearing does not apply.
[2] Fall chum migrate directly to marine environments after fry emergence; freshwater rearing does not apply.
[3] This adult migration and spawn timing is for the early-run hatchery stock; the native stock was thought to spawn from November to January.
[4] This periodicity applies to the anadromous form (steelhead); the adult migration and juvenile out migration do not apply to the resident rainbow trout life history form. Adult migration includes upstream (pre-spawn) and downstream (post-spawn) timing.
[5] This periodicity applies to the anadromous form; the adult migration and juvenile out migration do not apply to the resident life history form.
[6] Brook trout are assumed to be resident; therefore, the adult migration and juvenile out migration life stages do not apply.
[7] Chinook salmon are of infrequent occurrence and very low abundance, and are thought to be strays form other watersheds.
[8] Pink salmon are of infrequent occurrence and very low abundance, and are thought to be strays from other watersheds. Pink salmon migrate directly to marine environments after fry emergence; freshwater rearing does not apply.

Figure 3-15. Periodicity Chart for Salmonid Species Known to Occur in the Big Quilcene River Watershed.

(Periodicity is based on established ranges published in research and local observation**)**

Coho Salmon

Naturally reproducing coho salmon in the Big Quilcene River are lumped by fishery managers into a single management unit containing all populations within Quilcene and Dabob Bays (Parametrix et. al. 2000). Hatchery coho salmon predominate within the Big Quilcene watershed. The QNFH raises coho salmon primarily for release into the Big Quilcene River. Current hatchery production objectives include rearing 750,000 coho salmon juveniles, with 450,000 released directly into the Big Quilcene River; the remainders are sent to net pen facilities (Parametrix et. al. 2000). In addition, coho salmon are known to use the Quilcene River below the QNFH for spawning and rearing; however, upstream migration is limited by the hatchery weir at RM 2.8. Hosey and Associates (1985) reported several thousand coho salmon spawn, and/or are caught, downstream of the hatchery. The QNFH has occasionally released adult and juvenile coho salmon upstream of the hatchery weir in previous years.

Steelhead/Rainbow Trout

Little data are present regarding steelhead in the Big Quilcene River. Winter steelhead have been caught recreationally in the Big Quilcene River with up to 200 fish harvested in the 1970's (Parametrix et. al. 2000). More recently, very few summer steelhead have been harvested and it is not known if a self-sustaining population exists (Parametrix et. al. 2000). Winter steelhead can pass the hatchery barrier during high flows, when the electric weir is not in operation, or if the bypass ladder is open. Access past the hatchery barrier would allow winter steelhead to spawn from the mouth of the river to the natural barrier at RM 7.4. Hatchery rainbow trout have been historically planted within the reach immediately downstream of the diversion dam, but have not been stocked for several years.

Cutthroat Trout

Anadromous cutthroat trout are present in the lower Big Quilcene River below the QNFH barrier (Caldwell 1999) and could potentially spawn and rear in the habitat available upstream of this barrier. The current population status and distribution of anadromous cutthroat trout in the watershed is not known. Resident life history forms are also present throughout the watershed and are isolated by manmade and natural barriers (Parametrix et. al. 2000). Penny Creek supports a healthy population of resident cutthroat, but are isolated by the hatchery intake and road culvert at the mouth (Parametrix et. al. 2000).

Brook Trout

Brook trout are present in the upper watershed and were likely initially stocked by resource agencies in the early 1900's. Brook trout are not indigenous to the western United States. Brook trout appear to be abundant in the upper watershed and are the most abundant salmonid in the headwater reaches. Brook trout populations are maintained by natural production.

Chinook Salmon

Currently, there is no self-sustaining Chinook salmon population that exists in the Big Quilcene and Little Quilcene watersheds (Parametrix et. al. 2000, WDF et. al. 1993). Any Chinook salmon returns would be considered strays likely derived from watersheds in Hood Canal that still support local Chinook salmon populations. Therefore, stock information presented in this section refers to populations of Chinook salmon located in watersheds near Quilcene Bay that may contribute strays to the Big Quilcene and Little Quilcene Rivers.

In Hood Canal, summer/fall-run Chinook salmon spawn in the Skokomish, Union, Tahuya, Duckabush, Dosewallips and Hamma Hamma Rivers. Because of transfers of hatchery fish, these

spawning populations are considered a single stock (WDF et. al. 1993). Chinook salmon populations in Hood Canal are summer/fall-runs. Spring-run populations were thought to be historically present in the Skokomish and Dosewallips rivers, but no longer exist (Nehlsen et. al. 1991). Chinook salmon in Hood Canal are mainly of hatchery origin. Most watersheds within the region are lowland tributaries of low to moderate flow. These watersheds lack characteristics necessary to support self-sustaining Chinook salmon populations, with habitats more suited for coho and chum salmon production. Native populations in the Skokomish, Hamma Hamma, and Duckabush river watersheds may no longer be present, and have potentially been replaced with naturally spawning hatchery origin fish of Green River lineage (out of basin hatchery stock).

The QNFH produced fall Chinook salmon in the 1960's and 1970's from broodstock imported from other Puget Sound hatchery programs, but the program was discontinued due to poor survival and insignificant contributions to local fisheries (Parametrix et. al. 2000). Spring Chinook salmon were also raised by the QNFH from 1978 to 1993 using imported broodstock, but this program was also discontinued (Parametrix et. al. 2000). No spring Chinook salmon have been counted at the QNFH rack since 1998, when only eight adults were observed (QNFH unpublished data). Fall Chinook salmon have been observed in the Big Quilcene River on an infrequent basis. Fall Chinook salmon in the Big Quilcene and Little Quilcene Rivers are thought to be strays from other watersheds. Fall Chinook salmon adults have been observed very rarely at the QNFH salmon rack since 1990; one fall Chinook salmon was observed at the rack in 1996 and one was observed in 1989 (QNFH unpublished data). Four Chinook salmon of an unknown race were counted in 1999 (QNFH unpublished data).

Fisheries in the area are managed primarily for hatchery production and secondarily for natural escapement (WDF et. al. 1993). High harvest rates directed at hatchery stocks have resulted in a failure to meet natural escapement goals in most years (USFWS 1997). For Hood Canal Chinook salmon, the 5-year geometric mean for natural spawning escapement has been 1,100 fish. A decreasing short-term and long-term trend is noted for all Hood Canal rivers except the Dosewallips. The 2002/2003 summer/fall Chinook salmon run forecast for the Hood Canal region is 21,098 returning hatchery fish and 2,938 wild fish, with an estimated total spawning escapement of 2,400 fish (WDFW 2002b).

Pink Salmon

Self-sustaining pink salmon populations are not recognized in the Big Quilcene River (WDFW et. al. 1993); however, pink salmon adults may stray into the system during odd years. Pink salmon have been observed infrequently at the QNFH fish rack. One adult pink salmon was observed at the QNFH fish rack in 1989 and 1995 (QNFH unpublished data). Pink salmon normally spawn within a few miles of the coast, often within the intertidal zone. The adult pink salmon found in the Big Quilcene River are likely strays from the Duckabush and Hamma Hamma rivers, which are the nearest watersheds with relatively robust self-sustaining populations (WDFW et. al. 1993). Since no self-sustaining population of pink salmon is present in the Big Quilcene River, the following stock information refers to populations of pink salmon located in watersheds near Quilcene Bay that may contribute strays to the Big Quilcene River.

Escapement in the Hamma Hamma River from 1967 to 1991 ranged from 2,000 to 38,000 fish; the Duckabush River escapement ranged from 2,300 to 72,000 fish between 1959 and 1967 (WDFW et. al. 1993). WDFW et. al. (1993) rated both the Hamma Hamma and Duckabush populations as healthy. Three hatcheries have dominated pink salmon production in Washington, including the Hood Canal Hatchery on Finch Creek, located in southern Hood Canal. In recent years, only the Hood Canal Hatchery has maintained an active pink salmon production program. A population of

odd-year pink salmon was established in 1953 at Hood Canal Hatchery from the gametes of adults returning to the upper Dungeness River (approximately 90 percent) and the Dosewallips River (approximately 10 percent). Since then, production of odd-year fish has ranged from less than 15,000 fry in 1955, to over 4 million fry in 1988. The average hatchery release of pink salmon fry was approximately one million annually during the late 1980's to early 1990's (NMFS 1995).

Bull Trout

All available information indicates that no resident bull trout population exists in the Big Quilcene and Little Quilcene Rivers. Surveys to address the presence of native char (i.e. Dolly Varden and bull trout) were conducted in the Big Quilcene River with results showing that bull trout were not present in reaches located within the Olympic National Forest (Olympic National Forest et. al. 1996). Recent surveys by WDFW have also failed to find bull trout present in the Big Quilcene and Little Quilcene Rivers. According to the 1998 Washington Salmonid Stock Inventory, there is believed to be no distinct bull trout/Dolly Varden stock inhabiting the Big Quilcene River (WDFW 1998). The closest known population is located in the upper North Fork Skokomish River and Lake Cushman, which drains into southern Hood Canal (Parametrix et. al. 2000). One observation of a bull trout in the Big Quilcene River is reported in the WDFW PHS database (2002). A National Park Service employee made the observation. The observed fish was likely a brook trout, as brook trout are found in the watershed and are commonly confused with bull trout (Pers. comm. S. Spalding, USFWS, 2002).

Anadromous char have been documented in the Puget Sound region, although the distribution within the marine environment, migration timing, and proportion of populations that exhibit anadromy is not known. It is possible that anadromous bull trout could use the lower portion of the Big Quilcene River during some portion of the year, although, abundance appears to be extremely low or zero. Angling pressure is very high on the lower Big Quilcene River during the summer and fall for coho and chum salmon. Both bull trout and Dolly Varden have a reputation for easy catchability and can be easily over-fished. If char were common in the lower Big Quilcene River and at the river mouth, one would expect to hear local angling reports of catching char during the salmon season; however, this does not happen in the Quilcene area. This anecdotal evidence further supports that very few if any char migrate into the Big Quilcene River in the summer or fall. However, they may be present in the late winter and spring, but no known data exists to confirm this possibility.

Instream Habit

Aquatic habitat within this watershed includes 18.9 miles of mainstem channel and 81.9 miles of tributary streams (Parametrix et. al. 2000). Potential anadromous fish habitat (i.e. excluding human made barriers) in the lower Big Quilcene River valley (downstream of the natural barrier at RM 7.4) is estimated to include 7.4 miles of mainstem channel, 5.1 miles of tributary channel, 15.1 acres of perennial wetland, and 41.8 acres of seasonal wetland (Parametrix et. al. 2000). However, anadromous fish use is limited by the QNFH barrier at RM 2.8. Water quality in the majority of the Big Quilcene watershed is good (Parametrix et. al. 2000). Temperatures in the Big Quilcene River and Penny Creek are generally within state water quality standards (Parametrix et. al. 2000). However, habitat in the lower river has been affected by channelization, increased sediment transport from the upper watershed, and the loss of large wood recruitment and retention. The result has been an increase in riffle area, and a reduction in pool frequency and volume. Consequently, the adult salmon holding areas and juvenile rearing habitats have been reduced (USDA Forest Service 1994b). Current conditions indicate that mass-wasting from roads and timber harvest are the major sources of increased sediment transport in the basin (USDA Forest Service 1994).

The mainstem reach below the QNFH barrier (RM 2.8 to the mouth) is dominated by riffle units, contains few pieces of large wood, has few pools, and contains abundant gravel (Parametrix et. al. 2000). The majority of this reach is braided and unstable, with moderately confined side channels of 1-2 percent gradient (Parametrix et. al. 2000).

Below RM 4.8, the watershed changes from a steep, high-gradient stream to a braided channel with moderate gradient flowing through a wide floodplain. Within the relatively recent past (1989 to 1995) approximately 24 projects have been conducted that have impacted instream habitat in the lower 4 miles of the Big Quilcene River (Parametrix et. al. 2000). These include 11 dredging projects, three large wood removal projects, and 10 bank protection projects. Portions of the channel have been dredged several times between RM 4.8 and RM 0. Several areas have been diked or armored including 1.1 miles of mainstem channel in the lower 2 miles of the Big Quilcene River, and 0.6 miles between RM 2 and RM 4 (Parametrix et. al. 2000). Approximately 41 percent of the lower 4 miles of mainstem channel have been diked or armored (Parametrix et. al. 2000).

Between RM 4.8 and RM 6.1 the floodplain is less than 100 feet wide and side slopes steeper than 60 percent (USDA Forest Service 1992). Long riffles greater than 500 feet are common in this reach, and large wood is scarce (USDA Forest Service 1992). Between RM 6.1 and RM 7.0 side slopes are steep, terminating in rocky cliffs near the stream channel. The stream gradient is approximately 6 percent, and many deep pools and high gradient cascades are present (USDA Forest Service 1992).

Riparian Habitat

From the river mouth to RM 4.8, 38 percent of the riparian zone is disturbed by various land uses. Roads and dikes make up the largest percent (21 percent), with agricultural use around 10 percent (Parametrix et al 2000). Overall, the lower reach riparian zone (below RM 2.8) is in poor condition (Parametrix et. al. 2000). The riparian zone is less than 66 feet wide for 45 percent of the lower reach (Parametrix et. al. 2000). The existing forested component of this reach is composed of young deciduous tree species, 44 percent less than 12 inches diameter (Parametrix et. al. 2000). Upstream of RM 4.8 riparian vegetation is dense, but dominated by young deciduous trees and shrubs (USDA Forest Service 1992). From RM 6.1 to RM 7.0 the riparian zone contains large evergreen trees, but is dominated by bedrock and cliffs (USDA Forest Service 1992).

Little Quilcene River Watershed

This section describes the current instream and riparian habitat conditions, and fish presence and use of habitat downstream of the project diversion facilities located at RM 7.2 of the Little Quilcene River.

Fish Use

Salmonid fish species currently known to occur within the Little Quilcene watershed include coho salmon, summer and fall chum salmon, steelhead/rainbow trout, coastal cutthroat trout, and brook trout. Chinook and pink salmon may stray into the system, but are not considered self-sustaining populations (Parametrix et. al. 2000; Lichatowich 1993). Anadromous fish production in the Little Quilcene River is dominated by natural production of coho and chum salmon. Anadromous salmonid use is restricted to the lower river by a natural upstream migration barrier at RM 6.6. Periodicity of fish in the Little Quilcene River is the same as presented in Figure 3-15 for the Big Quilcene River.

Summer Chum Salmon

Summer chum salmon are native to the Little Quilcene River and are part of the Hood Canal summer chum salmon ESU, but have been heavily influenced by hatchery production from the QNFH located

on the Big Quilcene River (Parametrix et. al. 2000). Spawning occurs in the Little Quilcene River up to RM 3.0, but primarily below RM 1.8 (Parametrix et. al. 2000). Spawning escapement was less than 300 fish annually from 1979 to 2000 for the Little Quilcene River (Parametrix et. al. 2000). Summer chum salmon within the Little Quilcene River is managed within a local aggregate of watersheds including the Big Quilcene watershed.

Fall Chum Salmon

Fall chum salmon are native to the Little Quilcene River, but have been heavily influenced by hatchery production from the QNFH located on the Big Quilcene River (Parametrix et. al. 2000). Fall chum salmon spawning distribution is similar to the summer chum spawning distribution. Spawning escapement has been highly variable ranging from near zero to over 24,000 fish from 1968 to 2000 (Parametrix et. al. 2000). However, escapement has been low for at least two decades with less than 400 fish spawning annual from 1979 to 2000 (Parametrix et. al. 2000). Escapement was below 100 fish for ten of the years within this same time period (Parametrix et. al. 2000).

Coho Salmon

The coho salmon stock in the Little Quilcene River is thought to be of native origin, but significantly influenced by hatchery production from the QNFH located on the Big Quilcene River (Parametrix et. al. 2000). The run starts in August and peaks between the 2nd week and last week of September (Pers. comm. L. Telles, 2002) in the Little Quilcene River. However, the native origin stock was believed to spawn from October through January (Pers. comm. L. Telles, 2002). The current dominant early run time in the Little Quilcene River is the same as the hatchery stock from the QNFH, providing evidence that Big Quilcene River hatchery strays have influenced natural production in the Little Quilcene River. Past hatchery practices of spawning the first returning coho adults (until their quota was reached) may be responsible for shifting the run timing. In addition, studies have shown that net pen reared coho salmon from Quilcene Bay may comprise 10 to 20 percent of the spawning escapement in adjacent streams, including the Little Quilcene River (Parametrix et. al. 2000). Coho salmon use available habitat up from the mouth to the natural barrier at RM 6.6 (Parametrix et. al. 2000). Adult escapement to the Little Quilcene River ranged from 200 to 1,200 fish between 1986 and 1998 (Parametrix et. al. 2000).

Steelhead/Rainbow Trout

Steelhead escapement is not regularly monitored in the Little Quilcene River; therefore, their status is unknown (Parametrix et. al. 2000). Anecdotal and supplemental data from other monitoring efforts suggest there is a very low escapement of steelhead to the Little Quilcene River (Parametrix et. al. 2000). Resident rainbow trout are present above the natural barrier at RM 6.6, but distribution and abundance are not known.

Cutthroat Trout

Anadromous cutthroat are present in the Little Quilcene River; however abundance is not known (Parametrix et. al. 2000). Surveys confirming distribution and abundance are lacking. When the City rebuilt the diversion on the Little Quilcene River, approximately 100 cutthroat trout were captured using electrofishing within 300-ft of the diversion (Pers. comm. I. Jablonski, 2002).

Brook Trout

Brook trout are present in the upper watershed, however their distribution and abundance are not known. This species is not indigenous to the western United States and were likely initially stocked by resources agencies in the early 1900's. The brook trout population is maintained by natural production, as no stocking has occurred for several years.

Chinook Salmon

There is no Chinook salmon stock native to the Little Quilcene River. A few adult Chinook salmon were observed through the 1970's and are thought to be strays from the QNFH Chinook salmon program (Parametrix et. al. 2000). No Chinook salmon have been observed in the Little Quilcene since the mid-1970's (Parametrix et. al. 2000). However, straying from other watersheds may continue to occur.

Pink Salmon

Pink salmon use of the Little Quilcene River was reported by Williams et. al. (1975); however, pink salmon were not mentioned in three separate pacific salmon stock evaluations covering the Little Quilcene River (Lichatowich 1993). WDF et. al. (1993) recognized healthy, wild stocks of pink salmon in the Hamma Hamma and Duckabush rivers. These streams are near enough to the Little Quilcene River, and may be potential sources for pink salmon strays to the system.

Bull Trout

Resident bull trout are not known to occur in the Little Quilcene River; however, anadromous bull trout may use the lower portion of the river during some part of the year. As with the Big Quilcene River, no known data exist to confirm this possibility.

Instream Habitat

Aquatic habitat within the Little Quilcene watershed includes 12.2 miles of mainstem channel and 81.2 miles of tributary streams (Parametrix et. al. 2000). The upper watershed (upstream of RM 6.6) consists of high gradient, confined stream channels, and the lower watershed consists of moderate to low gradient channels within a broad valley. Water quality in the majority of the Little Quilcene watershed is good; water temperature, dissolved oxygen, and fecal coliform bacteria levels have generally not exceeded state standards (Parametrix et. al. 2000).

The lower 0.8 miles of the Little Quilcene River has been diked and the banks armored (Parametrix et. al. 2000). The reach from RM 0.0 to 1.3 is reported to be less than 1 percent in gradient; confined by dikes; lacking large wood; with a substrate dominated by sand and gravel (Parametrix et. al. 2000). The reach from RM 1.3 to 3.3 is reported as moderately confined with a gradient between 1-2 percent; containing more large wood than the lower reach, but less frequent pools with a substrate dominated by gravel (Parametrix et. al. 2000).

Major tributaries, such as Howe Creek and Ripley Creek, are in better condition than the mainstem of the Little Quilcene River. Large wood, pool frequencies, canopy closure, and wetland areas are reported to be substantially higher for the lower 2.8 miles of Howe Creek and 1.5 miles of Ripley Creek than the mainstem Little Quilcene River (Parametrix et. al. 2000). However the Leland Creek tributary is reported to be degraded with culverts that block fish passage, low levels of large wood, and riparian cover dominated by reed-canary grass (Parametrix et. al. 2000).

Riparian Habitat

Approximately 60 percent of the riparian zone downstream of RM 3.0 is developed and consists of approximately 33 percent agricultural use, 11 percent roads and dikes, 6 percent commercial forestry, and 10 percent commercial property and residential development (Parametrix et. al. 2000). Undeveloped areas of the riparian zone are dominated by young deciduous or mixed deciduous and conifer forest (Parametrix et. al. 2000).

Threatened, Endangered, and Sensitive Species

Fish

Immediate Permit Area

No threatened, endangered, or sensitive fish species are known or suspected to occur in the immediate permit area in the Big Quilcene and Little Quilcene Rivers.

Watershed

Requests for documentation of the potential presence of federally proposed, or listed threatened or endangered species, candidate species, and designated critical habitat in the action area were made to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). The Washington Department of Natural Resources Natural Heritage Program and Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) Program were also contacted for information on listed and sensitive species occurrence in the action area. Threatened (ESA) fish species in the Big Quilcene and Little Quilcene Rivers include Hood Canal summer-run chum salmon, Puget Sound Chinook salmon, and Puget Sound steelhead. However, Chinook salmon occurrence is infrequent and is thought to be derived from strays from other watersheds. Anadromous Coastal/Puget Sound bull trout may occur in the lower reaches of both river systems on an infrequent basis although no data confirms this possibility. Puget Sound/Strait of Georgia coho salmon (ESA candidate) are present in both the Big Quilcene and Little Quilcene Rivers. A detailed analysis of the use of the Big Quilcene and Little Quilcene watersheds by Hood Canal Summer Chum Salmon and Puget Sound Chinook Salmon is given in the Biological Assessment for this action.

Wildlife

Immediate Permit Area

Marbled murrelet (ESA threatened) observations have been recorded within one mile of the Big Quilcene River diversion. Both the Big Quilcene and Little Quilcene River diversions are located within the management circles of established northern spotted owl (ESA threatened) territories.

Watershed

Bald eagles forage for spawning salmon in the areas accessible to salmon in the Big Quilcene and Little Quilcene Rivers. They are most common during the late fall and winter, when many eagles perch alongside the river during the chum and coho salmon runs. According to the WDFW Priority Habitats and Species (PHS) database information (2002), two regular small concentrations of bald eagles are found along the lower 2 miles of the Big Quilcene River and one regular small concentration is located near the QNFH (WDFW 2002c). Another regular small concentration is located along Penny Creek approximately one mile upstream from the QNFH (WDFW 2002c). These concentrations consist of up to 11 birds roosting or perching within close proximity. At least three nests are located along the Quilcene Bay shoreline and one nest is located just below Penny Creek on the Big Quilcene River (WDFW 2002c). Bald eagle nests and concentrations are not mapped as occurring in the Little Quilcene watershed (WDFW 2002c).

More than 60 observations of marbled murrelets have been recorded in the Big Quilcene River watershed (WDFW 2002c). However, most observations are located upstream of the City's diversion in the Tunnel Creek drainage approximately three miles from the diversion site, and scattered in the upper mainstem of the Big Quilcene River. Approximately seven murrelet observations have been recorded downstream of the Big Quilcene diversion, distributed between the

diversion site and Penny Creek. No marbled murrelet observations are mapped in the Little Quilcene River watershed (WDFW 2002c).

The entire action area from the Big Quilcene River diversion to RM 0.0 is located within three management circles for established spotted owl territories. The nearest site center to the Big Quilcene River is located approximately four miles downstream of the Big Quilcene River diversion. The upper half of the action area in the Little Quilcene River Watershed is located within the management circle of one established spotted owl territory. The site center for this territory is located approximately one mile from the Little Quilcene River diversion.

Potential habitat exists for one sensitive mollusk species, *Hemphillia glandulosa* (warty jumping slug), in the project area. This species may be found in down woody debris, under moss, in hardwood leaf litter or on the forest floor.

Plants

There are no plant species that are listed as threatened or endangered, proposed for listing, or candidates for listing in Jefferson County (USFWS 2002). The USFWS has documented two species of concern in Jefferson County; *Abronia umbellata* ssp. *acutalata* (rose-purple sand-verbena) and *Astragalus australis* var. *olympicus* (Cotton's milk-vetch). There is potential habitat for some of the Forest Service sensitive fungi, lichens, mosses, and vascular plants in the project area. Since the alternatives propose no substantial changes to the occupancy and use of National Forest System land or facilities, and no additional ground disturbance activities are planned, field surveys were not conducted for the sensitive botanical species.

Other Rare or Uncommon Species

Other rare or uncommon species were assessed for this project. The project area does not have potential habitat for any of these species, due to the disturbed nature of the area. A review of the most recent database (GeoBob Database, February 2004) indicated there were no known sites of other rare or uncommon species in the project area.

Geology / Geomorphology

Immediate Permit Area

Bedrock underlying the permit areas of both the Big Quilcene and Little Quilcene diversion sites consists of rocks belonging to the Crescent Formation, which includes erosion-resistant volcanic basalt. These rocks are mantled by a thin veneer of glacially derived soils composed of dense sandy silt with gravel, cobbles, and boulders. Slopes in the vicinity of the diversion sites generally exceed 50 percent, and the river valleys are V-shaped within structurally controlled inner gorges. Hill and channel sideslopes in the immediate vicinities are relatively stable.

The headwaters of the Big Quilcene River downstream to about Threemile Creek (RM 7.8) have landforms and surficial deposits from several stages of alpine glaciation. Landforms are characterized by broad basin-like glacial cirques at the very headwaters with steep downcut U-shaped valley sidewalls. Landforms on the north-facing slopes draining to the Big Quilcene mainstem between Tunnel Creek (RM 9.0) and Elbo Creek (RM 5.7) exhibit features indicative of debris flows and shallow rapid debris slides regimes. Downstream of Threemile Creek, landforms are generally smoother on mountain sideslopes and ridges, and are mantled with relatively thick deposits of till and glacial outwash. Where the Big Quilcene River emerges from the canyons of the foothills near the Highway 101 crossing, it enters a relatively broad valley of generally shallow relief.

Roughly one-half of the Little Quilcene River drainage area down to about RM 6.6 lies within mountainous terrain that is steeply dissected with high gradient, confined stream channels. Most hill slopes in this area exceed 50 percent. Terrain in the lower seven miles of the watershed becomes less rugged, being more influenced by deposition of glacial sediment. The lower three miles of the river form a broad valley of generally shallow relief.

Geomorphology

The channel form and functional characteristics of the Big Quilcene and Little Quilcene Rivers in the lower 2-3 miles have been influenced substantially by human activities. Most of this activity has been oriented around the protection of economic interests that have developed within the floodplain of the river since European settlement of the area.

Levees

Historical aerial photos indicate that the construction and modification of levees along the Big Quilcene River below Rodgers Street (approximately RM 1.0) has occurred numerous times since the 1940's (Collins 1995). Levee development in this area may also precede the period identified in photo records. The purpose of these levees is to protect approximately 170 acres of floodplain that includes rural residential housing. Further upriver, dikes have been constructed and maintained to protect the Hiddendale residential community, which is entirely within the 100-year floodplain. Levees are also present along the Little Quilcene River from approximately the Highway 101 crossing downstream to near the mouth.

Bank Stabilization

Bank reinforcement and stabilization projects have mostly been conducted along the Big Quilcene River upstream and downstream of the Highway 101 crossing. Immediately downstream of the highway, large logs have been cabled into the right bank to protect the river from encroaching towards a home site. Immediately upstream of the highway, the QNFH recently completed a bank stabilization project to protect infrastructure associated with the hatchery (Harza Engineering 2000). Further upstream of the hatchery, additional bank stabilization was completed in 1996 to protect the river from encroaching upon the Hiddendale residential community. This effort by the community performed well during high flows in the winter of 1996/1997 (GeoEngineers 1998).

Stream Aggradation

The elevation of the streambed in the lower Big Quilcene River has aggraded (raised) since European settlement in the lower watershed, and the management of natural resources in the upper watershed. Streambed aggradation is a result of an increased input of coarse and fine sediment to the river greater than the energy potential of the river to carry the sediment from the system. Sediment is deposited in the lower gradient reaches that are present in the lower two miles of the Big Quilcene and Little Quilcene Rivers. The aggradation of the Big Quilcene and Little Quilcene Rivers results in a reduction in the carrying capacity of the channels and therefore increases the likelihood of overbank flooding at a given amount of stream discharge.

Increases in sediment are primarily attributed to road construction and maintenance, and timber harvest practices in the upper watershed (USFS 1994). The average decadal acres of timber harvest from the Big Quilcene watershed was approximately 2,300 acres (average of 230 acres per year) between 1960 and 1990 (Amato 1996). Currently the rate of timber harvest in the Big Quilcene watershed is at a much lower level within the watershed than in past decades (1991 to 1993 period averaged 62 acres per year), and using practices that provide greater protection to riparian and stream

resources (USFS 1994). Therefore, sediment input to the stream system should be decreasing back towards natural background levels.

The fish weir at the QNFH and the removal of riparian vegetation are also considered contributing factors in the change in the river morphology above the hatchery. The deposition of sediment immediately upstream of the weir has raised the channel bed and decreased the gradient of the stream. The effect of the hatchery weir is cumulative with the increased sedimentation from timber harvest activities. This has resulted in the increased bedload deposition and braiding of the channel upstream of the hatchery observed in aerial photos after 1973 (GeoEngineers 1998).

Dredging

Dredging projects have been implemented on the lower portion of the Big Quilcene River as a method to address flooding concerns by the local residents. The purpose of these projects is to reduce the total quantity of streambed material in the river and thereby decrease the potential of overbank flooding. Gravel trap projects have been used to capture quantities of sediment that are transported downstream. Gravel traps were installed in the Big Quilcene River below Rodgers Street on six occasions between 1993 and 1999. The traps are excavated gravel bars above the low water line that result in low impacts to fisheries resources, and remove sediment from upstream sources. The gravel traps have been periodically re-excavated after they become filled with sediment and stream flows have reduced to make them accessible to heavy equipment. An average of 1,900 cubic yards of gravel were removed from several sites during excavation (Cook 2000).

Water Use

Immediate Permit Area

The demand for water in the City of Port Townsend and surrounding area is the primary factor responsible for water use in the immediate permit area. The purpose of two of the Special Use Permits is to facilitate the diversion of water from the Big Quilcene and Little Quilcene Rivers. The City of Port Townsend maintains water rights for the beneficial use of water diverted from these rivers.

The Big Quilcene River diversion is authorized by the Washington Department of Ecology for the withdrawal of an amount not to exceed 30 cfs. Since 1997 the city has had a policy of maintaining a minimum of 27 cfs instream below its diversion site for the benefit of fish habitat and to meet critical water supply needs at the Quilcene National Fish Hatchery.

The Little Quilcene River diversion is authorized by the Washington Department of Ecology for the withdrawal of an amount not to exceed 9.56 cfs, provided that a minimum of 6 cfs is maintained in stream at all times during the year. Water diverted from the Little Quilcene River is transmitted to Lords Lake for seasonal water storage and use.

The City of Port Townsend diverts an average annual flow of 20-22 cfs from the Big Quilcene and Little Quilcene Rivers. During 2002, the average annual diversion from the Big Quilcene River was 17.6 cfs, and the Little Quilcene River was 3.5 cfs (City of Port Townsend, unpublished data).

Community / Region

Water withdraws from the Big Quilcene and Little Quilcene Rivers provide 100 percent of the water supply for the residential and commercial customers in the city of Port Townsend. The population of the city of Port Townsend in 2000 was 8,334 and is estimated to grow at an average annual rate of 2 percent through 2046 (City of Port Townsend unpublished data, and CH2M Hill 1998).

The Quilcene National Fish Hatchery (QNFH) withdraws water from the Big Quilcene for use in the fish production facilities. The QNFH has two water rights on Penny Creek, and two water rights on the Big Quilcene River. The Penny Creek water rights are for an amount not to exceed 25 cfs, with no minimum instream flow. The first Big Quilcene River permit has a priority date of 1946 and is for an amount not to exceed 15 cfs, with no minimum instream flow. The second Big Quilcene River permit has a priority date of 1991 and is for an amount not to exceed 25 cfs. The rate of diversion under the second permit must maintain an instream flow in the bypass reach of 50 cfs from July 1 through January 31, and 165 cfs from February 1 through June 30.

There is no community water system within Quilcene. There are numerous small wells located in the lower watershed of the Big Quilcene and Little Quilcene Rivers that provide a supply of water for individual homes and businesses.

Other Resource Issues

Wildlife Resources

Immediate Permit Area

The vegetation and wildlife habitat resources of the immediate permit areas are a mixture of native forest vegetation and residential landscaping. Wildlife surveys to identify the presence, distribution, or frequency of use specifically for the permit areas have not been conducted. Wildlife species associated with forested riparian and upland vegetation sites immediately adjacent to the diversion facilities are expected to be present and use the permit areas when not disturbed by operations or maintenance activities.

Watershed

The Olympic National Forest is host to approximately 63 species of mammals, 183 species of birds, and 23 species of amphibians and reptiles (USDA Forest Service 1989, Guenther and Kucera 1978). In addition, 32 saltwater bird species are known to occupy the areas immediately adjacent to the Forest. Wildlife species use a variety of habitats within the Olympic National Forest ranging from old-growth Douglas-fir and western hemlock forests to non-forested subalpine and alpine zones. Riparian environments are common throughout all the vegetation zones and provide important habitats features for many of the wildlife species on the Olympic National Forest.

Vegetation Resources

Immediate Permit Area

Vegetation resources at the Big Quilcene diversion permit site are a mixture of native forest vegetation and residential landscaping. The caretaker residence, maintenance, and operations buildings comprise approximately 1/2 acre within the permit site, and the immediate area around the buildings have been converted from native vegetation to grass and ornamental shrubs and flowers. The remaining portion of the permit site consists of native forest upland and riparian vegetation. Overstory trees include Douglas-fir, western hemlock, western red cedar, and red alder. Understory vegetation includes sword fern, Oregon grape, Alaska huckleberry, and salmon berry.

Vegetation resources at the Little Quilcene diversion permit site are dominated by native forest upland and riparian vegetation comparable to the Big Quilcene diversion permit site. A small portion of the permit site has been cleared for the diversion facility and a narrow road to access the site.

Vegetation resources along the right-of-way for the water transmission line are a mixture of native forest vegetation and early successional grasses, herbs, and shrubs within the managed road corridor.

Watershed

The watersheds of the Big Quilcene and Little Quilcene Rivers are predominantly within the western hemlock zone as defined by the Forest Service ecosystem classification system (USDA Forest Service 1989). Plant communities within the western hemlock zone generally consist of Douglas-fir and western hemlock overstory with understories dominated by rhododendron, Alaska huckleberry, sword fern, salal, or Oregon grape. Higher elevations within the watershed transition to pacific silver fir, mountain hemlock, and subalpine fir up to the timberline limit. Above the timberline, alpine vegetation, rock, scree, and permanent snowfields are present.

The forested portion of the watershed has been actively managed by the Forest Service, Washington State Department of Natural Resources, and private landowners for the production of timber. Logging roads traverse the watershed to provide access for timber harvesting and other forest management activities. Timber harvesting has occurred in the watershed since the early 1900's, although the annual harvest increased after approximately 1950, peaked during the 1970's and began declining after the mid 1980's.

Portions of the lower watershed are comprised of open agriculture grassland and rural residential development.

Invasive Species

Invasive plants have been found in the permit areas, by the Little Quilcene River diversion, the Penny Creek pipeline, and the Big Quilcene diversion. Current inventory includes herb Robert, common St. Johnswort, tansy ragwort, Canada thistle, and Scot's broom. There are also other invasive plants in the vicinity of the project area, and these may spread into the permit area.

Socioeconomics

Immediate Permit Area

The water supply diversion facilities on the Big Quilcene and the Little Quilcene Rivers, and the Olympic Gravity Water Supply transmission pipeline provide employment for three full-time maintenance personnel. A caretaker's residence is maintained at the Big Quilcene diversion site and maintenance of the facilities provides a nominal amount of income to the local Quilcene economy.

Community / Region

Jefferson County is a rural county stretching across the Olympic Peninsula in western Washington. The City of Port Townsend is the county seat and is located in the northeast corner of the county. Port Townsend is the largest and only incorporated community in Jefferson County, and its residents account for one-third of the county's population. In 1990, 52 percent of the county population was rural and 17 percent of workers commuted outside the county to work, primarily Kitsap, Clallam, and King Counties (USDA Forest Service 1997). The employment structure of the County is dominated by the services sector (31 percent), followed by manufacturing and construction (23 percent), and government (17 percent) (USDA Forest Service 1997). Port Townsend and the surrounding area are known for their historic buildings and parks, which provide a basis for a seasonal tourism industry. The mild climate, due to the rain shadow of the Olympic Mountains, results in the attraction of retirees to the Port Townsend area. The median age of the county is 41 years, and a larger proportion of the county is over 50 years of age than the state average.

Water withdrawals from the Big Quilcene and Little Quilcene Rivers provide 100 percent of the water supply for the residential and commercial customers in the City of Port Townsend. The future population in the City of Port Townsend is estimated to grow at an average annual rate of 2 percent

through 2046 (CH2M Hill 1998). The population in the City of Port Townsend in 2002 was 8,334, with a total number of water service connections of 3,775, resulting in an average water usage of 0.974 million gallons per day (City of Port Townsend, unpublished data).

Port Townsend Paper Company operations are directly related to the water supply from the Big and Little Quilcene Rivers. At this time, the Mill has 313 employees who receive $24,000,000 per year in wages and benefits. Purchases of wood chips and cardboard contribute $22,000,000 to the Olympic Peninsula economy, including providing a 300-ton per day market for recycling cardboard. An additional $3,000,000 per year is spent on local services and products, Mill property taxes add $412,000 to Jefferson County collections and the company and employees donate an average of $100,000 per year to local community programs.

Soils

Immediate Permit Area

Soils within the immediate permit areas are generally thin, glacially derived silt, gravel, and cobble.

Watershed

Generally, soils in both the Big Quilcene and Little Quilcene River watersheds are glacially derived. They tend to be gravelly textured in the upper horizons. Higher elevations typically have a thin soil mantle, while the valley bottom soils tend to be finer material of alluvial origin. Both soils can become unstable under certain conditions. Ridges and sideslopes tend to have shallow, well-drained, gravelly textured soils. Some of these soils overlay thick, well compacted, gravelly till that is of low permeability. The sideslope soils are generally colluvial in nature, and relatively stable if not disturbed. Midslope and toeslope soils are primarily deep, moderately structured, well- or moderately well-drained, and gravelly to extremely gravelly textured. Unstable soils are usually associated with oversteepened slopes that have been carved by adjacent streams along slope breaks where perched water tables are formed by compacted till.

Recreation / Scenic Resources

Immediate Permit Area

There is no recreational use of the immediate permit areas at the Big Quilcene and Little Quilcene River diversion sites. Both diversion sites are located at the end of single-lane dirt roads that provide no additional access to any other recreational site or facilities, and access is restricted by State regulation. The Big Quilcene River diversion site, caretaker's residence, and maintenance facilities are located behind a gated fence to protect the water diversion facilities. The Little Quilcene diversion facility is located approximately a half mile beyond a locked gate that blocks vehicle access.

Recreational vehicles may traverse the single lane roads that are immediately adjacent to portions of the buried transmission line right-of-way. The roads also provide access to hiking, fishing, hunting, and other recreational opportunities within the watershed.

Watershed

Recreational activity in the municipal watershed consists of undeveloped motorized and undeveloped non-motorized classifications. There are no developed recreational facilities located within the municipal watershed, and none are planned. Some developed recreational facilities are available in the lower watershed (below the municipal diversion sites) near the town of Quilcene.

Undeveloped motorized recreational activity in the watershed includes dispersed and unmaintained camping areas. These sites are used by hunters and fisherman on an impromptu basis. Undeveloped nonmotorized recreational activity includes hiking and camping in the backcountry portion of the watershed. The municipal watershed includes approximately 14,000 acres of the Buckhorn wilderness area and contains approximately 23 miles of hiking trails. Backcountry recreation is a popular activity in certain areas of the municipal watershed, and hiking trails in the watershed attracted over 11,500 visitors in 2002.

Heritage / Cultural Resources

Immediate Permit Area

There are no cultural sites documented by the Olympic National Forest within the Special Use Permit areas. The Big Quilcene diversion dam and some of the associated facilities may be eligible for nomination to the National Register of Historic Places.

Watershed

Special consideration is provided to non-renewable cultural and historical resources in accordance with the National Historic Preservation Act. Regulations and policies outlined in the Forest Plan and Forest Service Manuals and Handbooks describe a program to identify, evaluate, preserve, protect and enhance cultural resources present within the area administered by the Olympic National Forest.

Historic / Cultural Properties

In 1978 the Olympic National Forest completed an overview study for a comprehensive assessment of the cultural resources present. Since then, additional studies have been conducted to further identify and locate historic and cultural resources. Efforts are routinely made to locate cultural properties and evaluate their significance for nomination to the National Register of Historic Places (NRHP). The evaluation, nomination, management, and maintenance of historic properties are done in consultation with the State of Washington Office of Archaeology and Historic Preservation (SHPO). One of the criteria for eligibility of a site for the NRHP is 50 years of age for buildings and structures. The Big Quilcene diversion dam was constructed in 1927 and therefore may meet the criteria for eligibility in the NRHP. An assessment of the project site and facilities would need to be conducted to determine National Register eligibility. Where sites are selected for preservation, management should be positive, involving adequate measures for protection and monitoring the effects of natural degradation and public use.

Cultural sites on the Olympic National Forest are protected in several ways. If a site is discovered during project planning, its significance is evaluated during the environmental assessment process. If a site is determined to be significant, it is either avoided, or adequate mitigation is provided before the project is allowed to proceed. The development of alternative management strategies and mitigation measures is coordinated through consultation with SHPO or the Advisory Council on Historic Preservation.

Native American Treaty Rights and Traditional Uses

National Forest lands within the project area were ceded to the United States by the Point-No-Point Treaty of 1855. While the treaty generally resulted in the resettlement of Native Americans to reservations, important rights and privileges were retained on the ceded lands by the Native Americans. These rights in general terms include the right of taking fish at all usual and accustomed grounds, the privilege of hunting, and gathering roots and berries on all open and unclaimed lands. Areas within the ceded lands, which have become the Olympic National Forest, are considered “open and unclaimed lands” with respect to treaty rights. A fundamental aspect of the treaties is the

understanding of a trust or fiduciary duty of Federal agencies regarding caring for the welfare, land, and interests of the Native Americans.

A concern in the management of the Olympic National Forest is the protection of the habitat of treaty fish, since the existence of an environmentally acceptable habitat is essential to fish survival. The rights reserved by Native Americans under treaty affect management activities on the Olympic National Forest, specifically those activities that could impair or degrade water quality or anadromous fish habitat.

Concentrated prehistoric and historic use of the Olympic Peninsula was generally in areas of moderate topography and lower elevations along the coastal region. Fish were the primary attraction and the dominant resource used along the lower reaches of all the major streams within the Peninsula. Gathering sites, hunting locations, and camps have been readily associated with the heavily used areas along the lower reaches of streams. The Olympic National Forest areas on the east slope of the Olympics are generally very steep and there is limited documentation of use of these areas, although seasonal encampments and trails for hunting, gathering, and commerce are speculated to have occurred in the area.

Transportation and Access Management

The US Forest Service manages the transportation network within the municipal watershed with the goal of minimizing the input of physical, biological, and chemical materials to the public water supply system.

Immediate Permit Area

Vehicle access to the Big Quilcene and Little Quilcene diversion sites is restricted at gated access points downstream of the diversion facilities. Access to the diversion sites is controlled by representatives of the Port Townsend Paper Company as part of their responsibility for the maintenance and operation of the Olympic Gravity Water Supply system.

Watershed

The watershed area below the Big Quilcene and Little Quilcene diversion facilities is a mixture of private and publicly owned land. Vehicular access throughout the lower watersheds occurs on logging roads and the established public road system.

The watershed area above the Big Quilcene and Little Quilcene diversion facilities is managed by the US Forest Service and the National Park Service. Access to the upper watershed is available to motorized vehicles, bikes, horses, and hikers. Vehicular access to the upper watershed is limited to a road system developed on the US Forest Service managed lands. The arterial roads in each watershed are maintained for passenger car travel to provide access to the public lands for recreational activities. Secondary roads in the watershed are maintained for high clearance vehicles and are used primarily to provide access for forest management activities.

The Olympic National Forest has completed an access and travel management plan as part of a nation-wide effort to reduce road maintenance costs and the environmental impacts associated with the forest road system. A Road Management Strategy analysis has been completed to develop a systematic approach for prioritizing road management activities on the basis of risk to resources, as well as social and management needs. The revised access and travel management plan is used to set priorities and provide a basis for making site-specific road management decisions.

Lands and Land Use

Immediate Permit Area

Lands within the permit areas for the Big Quilcene and Little Quilcene diversion sites, and the water transmission line right-of-way, are publicly owned (or National Forest Land) and administered by the U.S. Forest Service. Land use within the permit areas is designated for the establishment and maintenance of the water diversion and transmission pipeline facilities.

Watershed

Lands within the Big Quilcene watershed above approximately RM 4, and the Little Quilcene watershed above approximately RM 6, are publicly owned (or National Forest Land) and administered by the U.S. Forest Service. Land ownership in the lower portion of both watersheds is a mixture of state and private ownership.

The dominant land use within the Big Quilcene and Little Quilcene watersheds by all landowners is forest management. Agricultural and rural residential land uses are also common in the lower watershed.

Floodplains and Wetlands

Immediate Permit Area

Floodplains are virtually non-existent at the diversion sites of both the Big Quilcene and Little Quilcene Rivers, due to the steepness of the valley sidewalls.

Watershed

Floodplains on the Big Quilcene River are mapped from its delta upstream to a short distance above the Quilcene Fish Hatchery above the Highway 101 Bridge. The floodplain is variable between about 100 feet and 1,500 feet, but generally narrows in the upstream direction where the river is confined by steep valley sideslopes. Floodplain soils are formed in alluvium, generally composed of well-drained silt loam with gravel.

Floodplains on the Little Quilcene River are mapped from its delta upstream to its confluence with Ripley Creek (approximate RM 4). Floodplain width is variable between about 2,000 feet near the delta to about a hundred feet in the upper reaches where the river is progressively confined by steep valley sideslopes. Floodplain soils are formed in alluvium, generally composed of well-drained silt loam with gravel.