Issaquah Creek Section 206 Restoration Project

Draft Environmental Assessment

King County, Washington

November 2003

US Army Corps of Engineers®
Seattle District

Environmental Resources Section
Planning Branch

Draft Environmental Assessment

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prepared by

Seattle District
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1.0 BACKGROUND

1.1 PROJECT AUTHORITY

This Ecosystem Environmental Assessment (EA) is submitted under Section 206 authority of the Water Resources Development Act of 1996, P.L. 104-303 (WRDA). This authority authorizes the Secretary of the Army to carry out aquatic ecosystem restoration and protection projects if the Secretary determines that the project will improve the quality of the environment, is in the public interest, and is cost-effective. This EA is in accordance with EC 1105-2-214, Project Modifications for Improvement of the Environment and Aquatic Ecosystem Restoration. The Washington Department of Fish and Wildlife (WDFW), by letter dated April 18, 2001, requested federal assistance in planning, designing and conducting a stream restoration project along Issaquah Creek.

1.2 STUDY PURPOSE, SCOPE & PARTNERSHIP

1.2.1 Purpose

This report addresses the need and justification for implementing a restoration project along Issaquah Creek. The project would consist of replacing an existing dam structure, which is a hindrance to both upstream and downstream fish passage, while maintaining an existing auxiliary water supply to the Issaquah Hatchery. If implemented, the project would allow dwindling salmonid populations to return to one of the last largely unspoiled watersheds in the Lake Washington Basin.

1.2.2 Scope

The scope of the current study and project area is focused on the dam and adjacent areas, including 10 feet upstream of the dam and roughly 100 feet downstream. Beyond the direct project area, connectivity to the upstream and downstream areas has also been addressed. Flow conveyance considerations have been considered downstream through the City of Issaquah to Lake Sammamish. The production potential of the watershed upstream of the existing dam has also been considered to assess project benefits.

1.2.3 Corps Involvement & Partnership with Other Entities

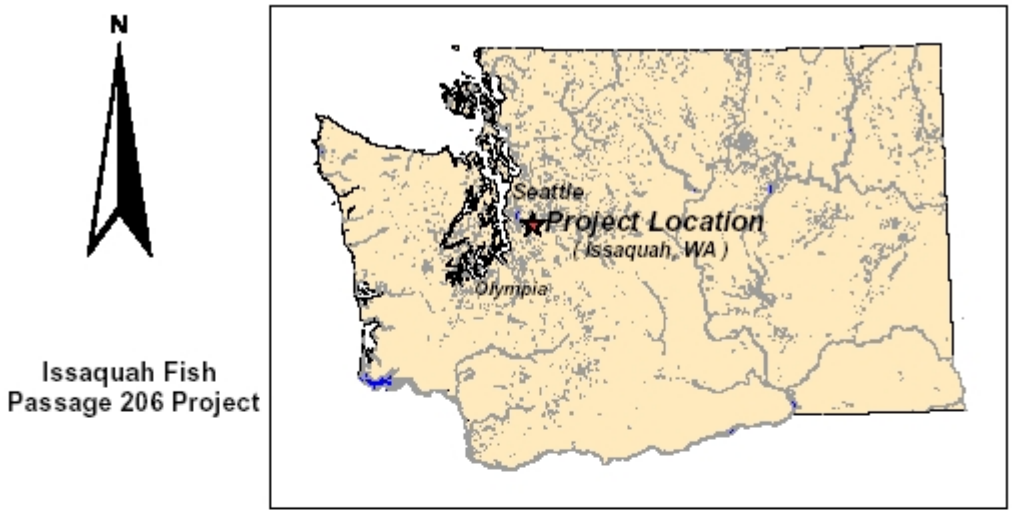
The Issaquah Creek Restoration Project was born of a motivated team of private, governmental and tribal interests, and continues to benefit from this broad base of support. The project stakeholders and partners include WDFW, The Muckleshoot Tribe, US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Friends of Issaquah Hatchery (FISH). The Seattle District Corps of Engineers (Corps), at the request of the WDFW, requested funding under Section 206 of WRDA 1996 to conduct a reconnaissance evaluation for the proposed project. The Corps received funding in Spring 2001 to prepare the Preliminary Restoration Plan, which is the vehicle used to determine whether there is federal interest to continue to investigate the potential project. The Preliminary Restoration Plan was submitted to Corps Headquarters in August 2001. The District received approval and funding to begin the Project Planning and Design (PDA) phase in October 2001 with a scheduled completion of PDA in April 2004.

1.3 PROJECT LOCATION AND HISTORY

The existing dam is located at river mile (RM) 3.5 on Issaquah Creek in Section 33, T24 N, R6E, City of Issaquah, King County, Washington. Downstream of the project area, the creek runs through the City of Issaquah into Lake Sammamish State Park and empties into Lake Sammamish. Upstream of the project the creek flows primarily through forested areas, draining approximately 55 square miles of quality habitat.

In 1936, in response to growing demands of fish resources and diminishing returns, the Washington State Department of Fish and Wildlife (WDFW) began supplementing salmon production through operation of the Issaquah creek Fish Hatchery as a salmon production facility in the City of Issaquah. Two dams were constructed to support the hatchery, the lower dam or "barrier dam" located at the hatchery site and an upper dam, "diversion dam". This project focuses on the upper dam – and its associated fish passage problems.

The intake structure or diversion dam located ½ mile upstream of the hatchery has supplied water to the hatchery since 1960 through diverting creek flow and creating the elevation head necessary to deliver a gravity flow water supply. In 1972 the gravity intake was reconstructed, the walls at the intake were raised one foot, two additional pools were added to the fish ladder, and a new screen structure incorporated. Since then, the hatchery has become a historical and cultural feature as well as a fish production facility.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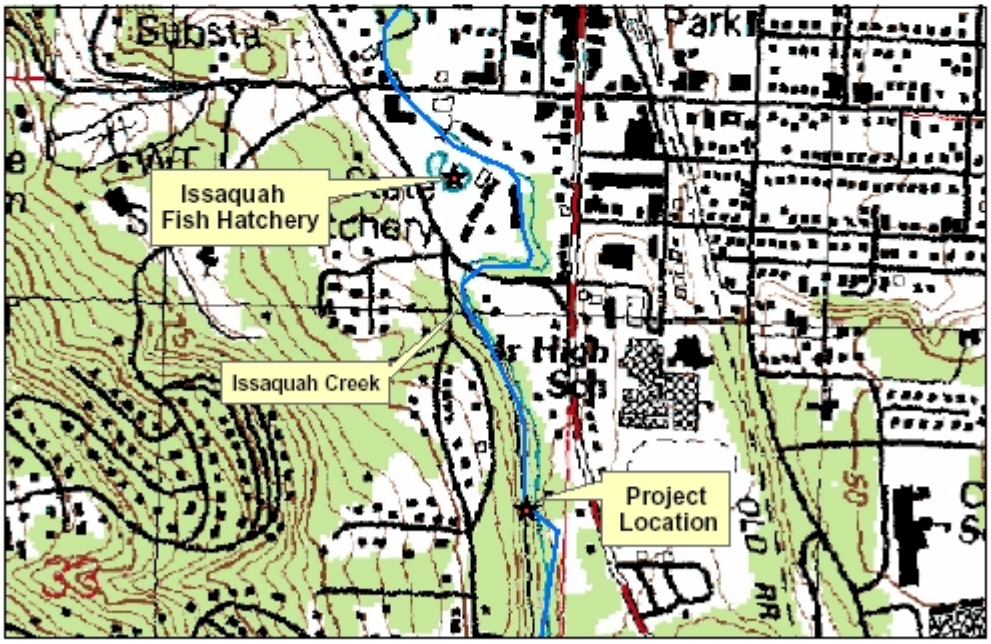
Issaquah
Fish Hatchery
Issaquah Creek
Project
Location
0
100
200
400
600
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Meters

1.4 RESOURCE PROBLEMS

The degraded project area is really only a small part of an otherwise healthy watershed. But under the existing without project condition the dam is a bottleneck that restricts use of the watershed by some of the Northwest's most important species. Four species of anadromous salmonids (coho, chinook, sockeye salmon, and steelhead) inhabit the creek. In addition, numerous cutthroat trout inhabit the entire watershed, kokanee historically inhabited the creek, and some anecdotal information suggests that native char have inhabited the creek.

The intake dam and its associated fish ladder currently present a challenge to migrating juvenile and adult salmonids marginalizing access to at least 10 miles of spawning and rearing habitat. The numerous passage problems associated with the project vary in degree of magnitude depending on the stream flow that is passing the project.

The fish ladder has many problems such as inadequate flow, velocity, slope, attraction velocities, and perhaps entrance pool depth. The existing gravity intake screen structure is detrimental to downstream juvenile fish passage as it was originally designed primarily for flushing the screen box of sediment and debris. For example, during low flow when little water is bypassed, the intake chamber can trap juvenile fish. The intake structure poses other problems for migrating juveniles such as screening not meeting current standards and routing fish through hardware and then discharging fish from a height of 6-8 ft onto rocks during higher flows.

The spillway and the accompanying concrete apron produce problems for both adult and juvenile salmonids at this facility also. During high flow events, the elevated size and quantity of bedload being moved can plug the pools of the fish ladder, significantly marginalizing the ability to pass fish upstream. In addition, high flow attracts the adult fish to the apron below the spillway where they are unable to pass the structure. The concrete apron below the spillway attracts adult fish during times of low flow also causing stranding. The spillway on this dam consists of timbers angled at about 60^{o} from the crest of the dam to the concrete apron. Most of these timbers are missing and the majority of fish passing the project fall from the crest of the dam about 4 ft to the concrete apron. Even the fish that happen to pass the project in an area with the timbers still present, encounter a rapid descent and abrupt impact with the concrete apron.

No detailed survival studies of juvenile salmon and trout passing the project have been completed to date, but based on current passage criteria, and the previously listed observations, the project is clearly resulting in unnecessary mortality to juvenile salmonids and substantially restricting adult passage. In October through December of 2002, the Corps conducted an adult passage rate study at the site. The results indicated that 115 chinook passed the fishway and diversion dam and although coho salmon were observed in the pool below the diversion dam and attempting to migrate upstream through the fishway, no coho salmon were observed successfully passing upstream of the diversion dam.

Downstream of the dam, the City of Issaquah surrounds this portion of the creek, which has been extensively altered by both natural processes and human activity. Hardened banks dominate this reach and riparian habitat is often sparse varying from native vegetation to bare riprap. However, all salmonid species that inhabit the Issaquah Creek basin have been observed spawning in this reach. Upstream of the dam over ten miles of quality habitat features exist which have high value for biological use. Special habitat features including snags, down logs, and open water contribute to high habitat values. The side channels associated with many of the tributaries provide winter rearing habitat for juvenile fish and refuge from seasonal high flows following large storm events. The limited amount of instream large woody debris recruited from riparian areas also provides excellent habitat. Without the proposed restoration the high value habitat areas would continue to be under-utilized by key anadromous fish species.

1.5 RESOURCE SIGNIFICANCE

Northwest salmonid stocks have been declining for decades, and many are now reaching critically low levels. Puget Sound Chinook salmon have been listed as threatened under the Endangered Species Act and coho and coastal cutthroat trout are candidate species for listing.

Issaquah Creek, with its many tributaries having excellent substrate and excellent pool to riffle ratios, is especially suitable spawning and rearing habitat for Chinook salmon. It is one of the few streams in the Lake Washington Watershed that provides excellent fish habitat.

Providing upstream passage of spawning anadromous fish also provides a critical link in aquatic food webs in the Pacific Northwest. Pacific salmon are considered a “keystone” species upon which producers and consumers from the bottom to the top of the food chain depend on (Wilson and Halupka 1995). Rearing in the rich-ocean environment, adult salmon return to nutrient poor streams with a wealth of ocean nutrients, enriching the food web from primary producers to top carnivores. At the top, at least 22 species of wildlife, including black bear, mink, river otter, and bald eagle, feed on salmon carcasses (Cederholm *et al*. 1989). At the base of the food web, salmon carcasses provide a significant, if not major amount of nitrogen to streamside vegetation as well as large amounts of carbon and nitrogen to aquatic insects and other macroinvertebrates (Bilby *et al.* 1996). Juvenile salmon also utilize spawned-out salmon carcasses directly as a food source. Bilby *et al.* (1998) witnessed increased densities, increased body weight, and improved condition factor of juvenile coho and steelhead in stream reaches supplemented by the addition of salmon carcasses from a nearby hatchery. Sixty to 96 percent of the food material in the stomachs of juvenile steelhead and coho consisted of carcass flesh and eggs.

1.6 PRIOR STUDIES AND REPORTS

Prior to Corps involvement, a number of engineering and biological studies and reports had been completed in the area related to fish passage improvements for the diversion dam. These studies are summarized below.

- Sverdrup Civil, Inc. (June 1996), *Issaquah Hatchery Facilities Master Plan.* Prepared for Washington Department of Fish and Wildlife. The report recommends improvements to the hatchery facility including the diversion dam.

- WIRA 8 Steering Committee (2002), *Near Term Action Agenda for Salmon Habitat Conservation.* The report lists factors for the decline for salmonids in the WIRA 8 and provides recommendations for action to rehabilitate various areas. The top project listed for the Issaquah Creek Watershed is to improve fish passage at the Issaquah Hatchery Intake Dam.

1.7 EXPECTED SUCCESS OF RESTORATION

Guided by a committed team of professionals from numerous stakeholders, this project enjoys high levels of support because of the potential for successful restoration. Restoration issues on Issaquah Creek are not terribly complex: the present fish blockage is a major limiting factor for migratory fish use of this stream. Because the available upstream habitat is largely pristine, additional factors limiting restoration success are minimal. Specifically, the project as proposed has great potential for successful restoration for the following two main reasons: migrating salmon and resident fish will have a significantly higher probability of ascending and descending through the project reach.

2.0 DESCRIPTION OF PROPOSED PROJECT

The proposed project will correct the current problems of upstream adult and juvenile salmon migration and downstream juvenile passage at the upper water intake of the Issaquah Salmon Hatchery on Issaquah Creek. The design guidelines include a 50-year project life, 100-year flood levels, and fish passage for flows ranging from 5-95% of the daily averaged values, 16 cfs – 320 cfs.

The project will replace the existing dam and fish ladder with new configurations, modify the existing intake structure and replace the intake screens, provide a juvenile fish bypass return and alarm system, and install seven downstream grade control weirs. Specifics include:

- The spillway will be moved downstream coincident with the entrance of the fishway to prevent fish from being attracted beyond the fishway entrance by spill flows. The right abutment will also be extended at least 17 feet downstream to the crest of the new spillway.

- The spillway will be founded on the existing apron, removing it as a potential location for stranding of adults at lower tailwater levels.

- A new ten-foot apron will be placed below the new spillway to prevent scour, and two feet below the minimum water elevation.

- A new fish ladder consisting of five pool and chute weirs will provide upstream and downstream fish passage past the dam. The four pools will each be twenty feet wide, ten feet long, and three feet deep from crest to floor. The weirs will each have a low flow notch and sloping sides. A sluice opening will be provided on each side of each fishway weir to allow flushing of accumulated sediment and debris.

- Seven grade control weirs spaced at 25 foot intervals with .8 foot drops will be constructed downstream of the dam. The weir spans range from 70 to 120 feet in length.

- Streambed and bank protection will be placed for each weir to prevent scour and weir failure. Riprap will be placed at the depth of expected scour and covered with gravel having a range of sizes that replicate exiting substrate.

- The inlet and trashrack of the screen will be extended upstream, approximately 10 feet, so that debris will sweep past the trashrack and continue down the fishway rather than accumulate in front of the intake. The extension of the structure will require fill along the left bank and excavation along the right bank.

- The intake structure will be modified into a V-shaped configuration to meet the screen sweeping and approaching velocity criterion
- A collection trough and outfall conduit will transport juvenile fish from the intake structure to below the fishway
- The existing sluiceway and walls will remain but be extended upstream parallel to the intake and fishway
- The bank will be planted with native plant species following construction
- An alarm system, using water level sensors, will be installed to alert the hatchery when the intake system needs to be cleaned

For additional details, please see the attached design drawings in Appendix A.

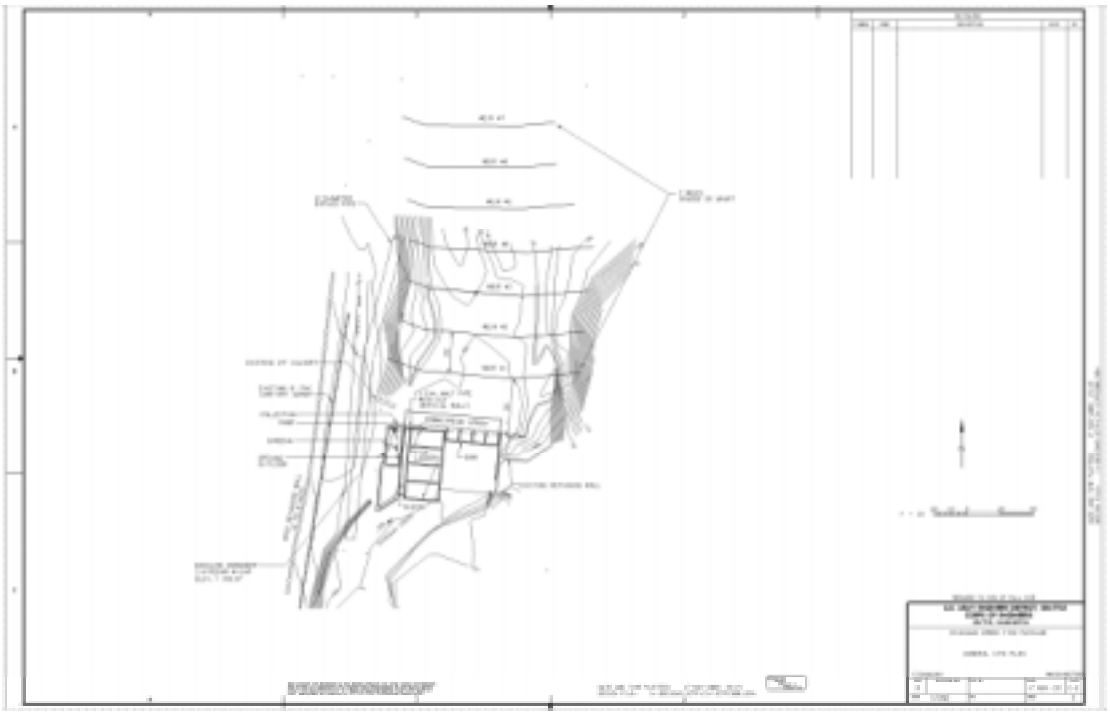

Figure 1. Proposed Project

3.0 NON-SELECTED ALTERNATIVES

3.1 NO ACTION

This alternative contains no directed restoration activities at the project site. The fish ladder will continue to present a challenge to migrating adults due to many factors including but not limited to insufficient attraction flows, insufficient pool size, plugging with sediment and debris, and entrance pool design. The gravity intake screen structure will continue to impact juvenile salmonids by stranding fish at low flows, or discharging them onto rocks at higher flows. The apron will continue to strand adult salmon and injure juvenile salmon.

3.2 ALTERNATIVES NOT CONSIDERED IN DETAIL

During the planning process, various alternatives were initially considered. As an initial screen for these planning alternatives, the Corps performed an analysis of environmental benefits to fish and wildlife habitat in relation to project cost performed. Following more detailed design work, technical review of alternative feasibility was performed on the remaining alternatives. The alternatives described below were considered at various stages during the planning process, but, for the reasons stated below, will not be carried forward for further evaluation because the environmental benefits were not sufficient to justify the costs, or they entailed unacceptable environmental impacts.

3.3 POOL AND WEIR FISHWAY

Under this alternative, the fish ladder design flow range will be 5 to 40 cfs. At 320 cfs Creek flow there would be 280 cfs spillway flow. Ladder step increases will be 0.8 ft. The dam crest will be moved downstream eliminating the adult stranding issue, reducing/eliminating false attraction, and reduce injury to fish moving downstream. The intake screen will be modified to improve sweeping and bypass flows, reducing the stranding and injury of juvenile salmonids at all flows. This alternative was determined to have lower environmental benefits associated with adult passage (primarily attraction flow) so it was eliminated from further analysis.

3.4 POOL AND WEIR/CHUTE COMBINATION ON LEFT BANK WITH TURNING POOL

Under this alternative, the fish ladder will operate at a wide range of creek flows (5–320 cfs). The fishway would be an "L" shaped configuration. The upper segment would be a pool and weir. This would empty into a turn pool where a pool and chute would then be used for the lower segment. Auxiliary water from the intake would be introduced at the turn pool to increase the attraction flow resulting from the pool and chute discharge jet. Ladder step increases will be 0.8 ft. The dam crest will be moved downstream eliminating the adult stranding issue, reducing/eliminating false attraction, and reduce injury to fish moving downstream. The intake screen will be modified reducing the stranding of juvenile salmonids at low flow, and the addition of a chute or other modification will reduce injury caused by the intake at high flows. This alternative was determined to have lower environmental benefits associated with adult passage (primarily attraction flow) so it was eliminated from further analysis. In addition, it was determined that this alternative was more likely to require more maintenance than other alternatives.

3.5 POOL AND WEIR WRAP AROUND BACK TO DAM CREST.

Under this alternative, the fish ladder design flow range will be 5 to 40 cfs. At 320 cfs Creek flow there would be 280 cfs spillway flow. Ladder step increases will be 0.8 ft. The dam crest will not be moved downstream but a plunge pool along with one weir downstream of the structure will be created eliminating the adult stranding issue, reducing/eliminating false attraction, and reducing injury to fish moving downstream. The intake screen will be modified reducing the stranding of juvenile salmonids at low flow, and the addition of a chute or other modification will reduce injury caused by the intake at high flows. This alternative was determined to have lower environmental benefits associated with adult passage (primarily attraction flow) so it was eliminated from further analysis. In addition, it was determined that this alternative was more likely to require more maintenance than other alternatives.

3.6 CUT AND FILL-RELOCATE INTAKE

Under this alternative, the existing dam will be demolished, and a new intake structure will be constructed upstream of the existing dam. The configuration of this intake has not been determined, nor has the routing of the supply pipeline. Eight grade control weirs with 1.0 ft elevation drops will be installed spaced 50 ft apart. The gradient through the reach would be 2%. Each of the weirs would have a low flow notch, roughly a 45 ft bottom width, and 3:1 side slopes. The weirs will extend to the existing bank with a slope of approximately 15:1. This design is essentially a fish way, which uses the entire width of the stream as steps for the ascent and decent

of fish. In addition, these weirs will provide a grade control to eliminate head cutting. This alternative will allow the placement of large woody debris and bank vegetation. This alternative will include the excavation of 4500 cu yds of sediment upstream of the existing structure and the placement of 2500 cu yds of sediment downstream of the existing structure along with the installation of a 450 ft long 12-18 inch sediment bypass pipe. The addition of approximately 2000 yds of 9-inch riprap/bank protection will be necessary. This alternative was discarded because the costs were deemed to high.

3.7 LARGE SPACING, CONCRETE OR BOULDER WEIRS 50 FT SPACING

Under this alternative, the existing dam will be demolished but the hatchery intake structure location will remain. A series of weirs with 1.0 ft elevation drops will be constructed beginning at the intake structure and moving downstream of the dam spaced fifty feet apart. This 50 ft spacing of weirs results in a total of 13 weirs. The gradient through the reach would be 2%. Each of the weirs would have a low flow notch, roughly a 45 ft bottom width, and 3:1 side slopes. The weirs will extend to the existing bank with a slope of approximately 15:1. This design is essentially a fish way, which uses the entire width of the stream as steps for the ascent and decent of fish. In addition, these weirs will provide a grade control to eliminate head cutting. This alternative will allow the placement of large woody debris and bank vegetation. This alternative will also include the placement/grading of 8000 cu yds of imported gravels/cobbles. The addition of approximately 3300 cu yds of 9-inch riprap/bank protection will be necessary, along with installing a 650 ft long 12-18 inch sediment bypass pipe. This alternative was quickly discarded because the costs were deemed to high.

3.8 CONCENTRATED DROPS, CONCRETE OR BOULDER WEIRS 15 FT SPACING

Under this alternative, the existing dam will be demolished but the hatchery intake structure location will remain. A series of weirs with 0.8 ft elevation drops will be constructed beginning at the intake structure and moving downstream of the dam spaced 15 feet apart. This 15 ft spacing of weirs results in a total of 12 weirs. The gradient through the reach would be 10%. Each of the weirs would have a low flow notch, roughly a 45 ft bottom width, and 3:1 side slopes. The weirs will extent to the existing bank with a slope of approximately 15:1. This design is essentially a fish way, which uses the entire width of the stream as steps for the ascent and decent of fish. In addition, these weirs will provide a grade control to eliminate head cutting. This alternative will also include the grading of 1000 cu yds of channel sediments. The addition of approximately 1700 cu yds of 2.5-inch riprap/bank protection will be necessary, along with installing a 100 ft long 12-18 inch sediment bypass pipe. The 15 ft spacing of the weirs will reduce the project length, however it may reduce the ability to successfully pass fish through the

steepened reach. This alternative was quickly discarded because the costs were deemed to high. In addition, the 15 ft spacing would not meet fish passage criteria.

3.9 ENLARGED CHANNEL POOL AND CHUTE FISHWAY

Under this alternative, the fish ladder will span the majority of the width of the channel, and it will operate at a wide range of flows. Pool and chute fishways have been shown to be more self-cleaning compared to more traditional style fishways. The dam crest will be moved downstream eliminating the adult stranding issue, reducing /eliminating false attraction, and reducing injury to fish moving downstream. Several weirs with 0.8 ft elevation drops will be installed downstream of the dam functioning essentially as ladder steps and grade control. This allows the ladder to be constructed in a linear fashion while still meeting current specifications for ladder pool area and volume with 0.8 step increases. The intake screen will be modified reducing the stranding of juvenile salmonids at low flow, and the addition of a chute or other modification will reduce injury caused by the intake at high flows. This alternative was eliminated as project cost was higher than the preferred alternative however it had almost identical environmental benefits.

4.0 AFFECTED ENVIRONMENT

4.1 GENERAL

The Issaquah Creek basin drains about 61 square miles of King County and includes both Issaquah Creek and Tibbetts Creek. Tibbetts Creek basin drains approximately 6 square miles and does not connect to Issaquah creek. Both creeks flow from steep headwaters in the southern basin into Lake Sammamish at the northern edge of the basin. The basin elevations range from approximately 3,000 feet at the peak of Tiger Mountain to near sea level at the mouth of Issaquah Creek. More than 80 percent of the basin is forested, with the remainder in wetlands, pastures, urban, and low-density single-family residences.

4.2 GEOLOGY/SOILS

The soils and land types of the King County Area were formed largely in deposits of glacial drift laid down during the Vashon period of the Fraser glaciation late in the Pleistocene. The major kinds of material left by the glacier are till, recessional outwash, and pro-glacial lacustrine and outwash sediments (Washington Agricultural Experiment Station 1973). The action area and project are founded upon the landtype known as "Vashon till" commonly found throughout King County. Vashon till consists of very dense, consolidated lodgment till that ranges in thickness from about 5 feet to nearly 100 feet and has a mantle of ablation till about 3 feet thick. The ablation till is loose, and it is in this material that soils of the Alderwood series formed (Washington Agricultural Experiment Station 1973). The till plain is undulating and slopes are mostly between 6 and 15 percent.

4.2.1 Sediments

The forebay immediately upstream of the dam has trapped sediment over the years. Total weight of the sediment has been estimated to be between approximately 63 to 94 tons.

Sediment in the Issaquah Creek basin is produced by soil surface erosion and stream erosion. Finer-grained sediment is carried downstream most of the year, while coarser sediment is moved only during higher flows in most of the subbasins. The coarser sediment accumulates in the bed of the stream and in point and side-channel bars at times of lower flow. Sediment

transport and deposition varies throughout the Issaquah Creek Basin as the numerous subbasins have many different characteristics. For example, Fifteenmile Creek has a slope averaging 10 percent resulting in high levels of sediment transport. Carey Creek maintains a balance between water and sediment discharge and the Middle Issaquah Creek Subbasin consists of both flat and steep tributaries resulting in a relatively consistent sediment movement throughout the subbasin. Detailed erosion and deposition information is available in the Current/Future Conditions & Source Identification Report produced by King County Surface Water Management in October 1991.

4.3 WATER/WATER QUALITY

4.3.1 General

Issaquah Creek is one of the larger creeks in the Lake Washington Watershed, with stream flows ranging from a winter high of about 276 cfs to summer lows of about 32 cfs. Mean flow is 134 cfs. Unit area discharges have been calculated for the basin and range from 0.06 to 0.12 cfs/acre, with a mean flow of 0.099 cfs/acre (King County 1991). This number is relatively large compared to other highly urbanized Lower Puget Sound basins that are typically in the 0.078 cfs/acre range (King County, 1990b). The large unit area discharge in the Issaquah Creek basin is the result of greater local precipitation, generally steeper topography, and a local geology dominated by significant amounts of bedrock and till. The 30-35 year flood discharge is approximately 3,200 cfs.

The lower Issaquah Creek overflows it's banks on a frequent basis, resulting in the flooding of hundreds of homes and businesses. Flooding problems are largely the result of extensive development in floodplains in the lower basin, rather than increases in flood flows due to upstream development (King county, 1996).

Water quality in the basin is generally good. Despite localized pollution from urban sources, roads, and agricultural and forestry activities, the water quality in Issaquah Creek and its tributaries is good, particularly during baseflow conditions (King county, 1996).

4.3.2 Land Use and Potential Pollution Sources

More than 80 percent of the basin is forested, with the remainder in wetlands, pastures, urban, and low-density single-family residences. The current land use surrounding Upper Issaquah creek and its tributaries is mostly forestry uses. The forest surrounding Holder Creek is under management of the Washington State Department of Natural Resources and the forest surrounding Carey Creek is primarily in private ownership. This sub-basin is largely undeveloped

it represents the most abundant and relatively undamaged salmonid habitat in the Issaquah Creek basin (King County 1996).

The Middle Issaquah Creek Sub-basin is much like the upper basin but also contains farms with pastures, homes, and highway passing through it.

The Lower Issaquah Creek Sub-basin will be defined here as RM 3.5 just downstream of the diversion dam to the confluence with Lake Sammamish. The City of Issaquah surrounds this portion of the creek, which has been extensively altered by both natural processes and human activity. The lowest reach from the mouth to about RM 0.6 winds through Lake Sammamish Park where the stream is large, deep, and slow moving.

Potential sources of nonpoint pollution in Issaquah basin include agriculture, stormwater runoff, failing onsite septic systems, improper pesticide and fertilizer application, hazardous wastes, underground storage tanks, landfills, resource extraction, forestry operations, and gravel mining.

Point source pollution sources in the basin include Lakeside Sand and Gravel, Consolidated Dairy Products, Washington State Department of Fisheries, and Sunset Quarry.

4.4 HYDRAULICS AND HYDROLOGY

Issaquah Creek is one of the larger creeks in the Lake Washington watershed, with stream flows ranging from several hundred cubic feet per second (cfs) in the winter to summer lows of about 30 cfs. Mean flow is 134 cfs. Drainage area for Issaquah Creek is about 61 square miles. Unit area discharges have been calculated for the basin and range from 0.06 to 0.12 cfs/acre, with a mean flow of 0.099 cfs/acre. This number is relatively large compared to other highly urbanized Lower Puget Sound basins that are typically in the 0.078 cfs/acre range (King County, 1991). The large unit area discharge in the Issaquah Creek basin is the result of greater local precipitation, generally steeper topography, and a local geology dominated by significant amounts of bedrock and till. The 100-year flood discharge is estimated to be 3,160 cfs and the 10-year flood discharge to be 1,960 cfs.

4.5 VEGETATION

Generally the vegetation in the project area is generally comprised of a mixed coniferous forest on the valley slopes and mixed deciduous forest in the valley floor. Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), bigleaf maple (*Acer macrophyllum*) and alder (*Alnus rubra*) dominate the overstory, while Indian plum (*Oemleria cerasiformis*), salal (*Gaultheria shallon*), and oregon grape (*Berberis aquifolium*) are common

understory species. The riparian area of the Upper Issaquah Creek Sub-basin is in excellent condition, primarily vegetated with deciduous species along with conifers. This sub-basin is largely undeveloped it represents the most abundant and relatively undamaged salmonid habitat in the Issaquah Creek basin (King County 1996). The riparian area through the middle Issaquah reach is in very good condition and is dominated by deciduous species. The riparian zone varies from a width of 30-50 feet per bank to over 200 feet per bank, interrupted by pastures, highways, and homes. The canopy vegetation consists primarily of alder (*Alnus rubra*), cottonwood (*Populus trichocarpa*), and Oregon ash (*Fraxinus latifolia*), and the understory consists of salmonberry (*Rubus spectabilis*), snowberry (Symphoricarpos albus), elderberry (*Sambucus racemosa*), Indian plum (*Oemleria cerasiformis*), swordfern (*Polystichum munitum*), and Oregon grape (*Berberis aquifolium*). The City of Issaquah surrounds the lower portion of the creek, which has been extensively altered by both natural processes and human activity.

4.6 WETLANDS

King County conducted a wetland inventory where they inventoried 38 wetlands totaling 324.8 acres. These 324.8 acres of wetlands is less than 1 percent of the total land in the basin of about 40,000 acres. However, riparian wetlands (those that are developed on floodplains along streams) were largely omitted in the original inventory process (King County 1981) and have not been evaluated at this time. It has been estimated that 200 to 400 acres of riparian wetlands remain to be mapped with large portions of this along the Issaquah Creek main stem and along Carey Creek. By including the unmapped riparian wetlands, a more accurate estimate of the total wetland acreage in the basin is approximately 600-700 acres, or about 1.5 percent of the basin area.

4.7 FISH AND WILDLIFE

Anadromous fish found in Issaquah Creek include chinook, coho, sockeye, and Steelhead. In recent years large numbers of chinook, coho, and sockeye have returned to Issaquah Creek but only a small percentage of these salmonids have been documented upstream of the intake dam. Resident fish in the creek include sculpin, and large numbers of cutthroat trout. There has been an observation of a native char in the creek years ago and a population of kokanee apparently inhabited the creek at one time but one year of sampling has not captured a single char or kokanee. Further information is described below.

4.7.1 Stream Habitat

The proposed project would reopen approximately 10 to 11 miles of quality fish spawning and rearing habitat to anadromous and resident fish. The Issaquah Creek Basin includes

Issaquah Creek and many of its tributaries such as Holder, Carey, Fifteenmile, and McDonald Creeks. The basin also includes the North and East Forks of Issaquah Creek and Tibbetts Creek. The North and East Forks of Issaquah Creek are located below the diversion dam and Tibbetts Creek is not a tributary of Issaquah Creek but they would all benefit indirectly by the increased production that would result from the proposed project. The middle and upper Issaquah Creek Basin has exceptional fisheries habitat primarily provided from Carey and Holder Creeks (WIRA 8 2002).

The Middle Issaquah Creek Sub-basin is defined here as RM 3.5 to RM 11.4 with Fifteenmile Creek entering the mainstem at RM 6.9 and McDonald Creek entering at RM 7.45 both of which are utilized by anadromous and resident fish. The gradient throughout this long reach is less that 1 percent, and many channel braids are present providing excellent summer rearing habitat and refuge during high flow events. The gravels are free of fines, providing excellent spawning conditions and the pool to riffle ratio is slightly uneven with riffles being more frequent.

The riparian area through this reach is in very good condition and is dominated by deciduous species. The riparian zone varies from a width of 30-50 feet per bank to over 200 feet per bank, interrupted by pastures, highways, and homes. The canopy vegetation consists primarily of alder, cottonwood, and Oregon ash, and the understory consists of salmonberry, snowberry, elderberry, Indian plum, swordfern, and Oregon grape.

The Upper Issaquah Creek Sub-basin is formed by the drainages of Holder and Carey creeks. Holder Creek headwaters on the southeastern slopes of Tiger Mountain and flows approximately 6-7 miles to its confluence with Carey Creek. Holder Creek is dominated by large cobble and boulders, and the gradient is typically greater than three percent. In addition, the habitat is generally low in complexity, lacking large woody debris thus this creek provides little salmonid habitat. Carey Creek headwaters on the southeastern slopes of South Taylor Mountain and flows 7 miles to the confluence with Holder, which forms the upstream end of the mainstem Issaquah Creek. Unlike Holder Creek, Carey Creek is an ideal salmon stream. It has a very low gradient, extensive pool and riffle complexes, and abundant large woody debris. Gravel beds are numerous, and the gravels are typically free of fines. Coho salmon, steelhead, and both sea run and resident cutthroat trout utilize the river for both spawning and rearing. Unfortunately, the stream appears to be underutilized by anadromous salmonids given the quality and abundance of habitat (King County 1991). At RM 5.2 a series of cascades provides an anadromous barrier and resident cutthroat inhabit this section to the headwaters.

The riparian area of the Upper Issaquah Creek Sub-basin is in excellent condition, primarily vegetated with deciduous species along with conifers. The current land use surrounding both tributaries is mostly forestry uses. The forest surrounding Holder Creek is under management of the Washington State Department of Natural Resources and the forest surrounding Carey Creek is primarily in private ownership. This sub-basin is largely undeveloped

it represents the most abundant and relatively undamaged salmonid habitat in the Issaquah Creek basin (King County 1996).

The Lower Issaquah Creek Sub-basin will be defined here as RM 3.5 just downstream of the diversion dam to the confluence with Lake Sammamish. The City of Issaquah surrounds this portion of the creek, which has been extensively altered by both natural processes and human activity. The lowest reach from the mouth to about RM 0.6 winds through Lake Sammamish Park where the stream is large, deep, and slow moving. The mean stream width is over 30 feet, and pools can exceed six feet in depth, with the substrate consisting of fine sand and silt. This section of the stream is utilized for spawning by bass, perch, and suckers, and provides rearing habitat for salmonids. From RM 0.6 to about RM 1.2 the gradient increases, and gravels become present along with some pools and riffles. In addition some very old large woody debris is present along with some smaller woody debris. This area provides excellent spawning substrate as evidenced by the large number of redds observed in the area but survival of these redds is unknown. From about RM 1.2 to the hatchery diversion dam at RM 3.5 Issaquah Creek flows through the City of Issaquah. Hardened banks dominate this reach and riparian habitat is often sparse varying from native vegetation to bare rip-rap. However, all salmonid species that inhabit the Issaquah Creek basin have been observed spawning in this reach.

4.7.1.2 Biota

The City of Issaquah (2001) performed a Benthic Index of Biotic Integrity (B-IBI) in 1999. This index evaluates general stream health in comparison to similar lowland streams in Puget Sound. Three sites were sampled, two sites were located below the diversion dam, and one site was above the diversion dam. All of the sites are located within 2 miles of the proposed project. The downstream site closest to the proposed project was rated as “poor’ and the site farther downstream was rated as “fair”. The benthic macroinvertebrate sample site above the proposed project was rated as “fair”. The fair score is similar to other streams in newly urbanizing areas such as Bear Creek, which was sampled in 1999 (Morley 2000).

4.7.2 Anadromous Fish

4.7.2.1 Chinook Salmon

The Puget Sound chinook salmon Evolutionary Significant Unit (ESU), including the populations in the Lake Washington Basin, were proposed for listing as threatened under the federal Endangered Species Act on 9 March 1998 (63 FR 11482). Cedar River chinook salmon, along with 28 other stocks, have been placed into the Puget Sound ESU by NMFS (Myers *et al.* 1998). The Puget Sound ESU encompasses all chinook populations from the Elwha River on the Olympic Peninsula to the Nooksack River in North Puget Sound and south to the Nisqually River. The five-year mean natural escapement (1992-1996) for the Puget Sound ESU is

approximately 27,000 spawners; recent total escapement (natural and hatchery fish) has averaged 71,000 spawners (Myers *et al.* 1998).

Three stocks of chinook are present in Lake Washington: (1) the Issaquah Creek stock, a composite population (utilizing Green River stock) that is at least partially sustained by production from the Issaquah hatchery; (2) the Cedar River stock, classified as native/wild; and (3) the north Lake Washington tributary stock also classified as native/wild. Lake Washington chinook represent approximately 12% of the natural escapement occurring in the Puget Sound ESU. The WDFW listed the status of chinook in the Cedar River as unknown due to unreliable abundance data (WDFW *et al.* 1994 Summer/fall chinook of the Cedar River basin are distinguished from other Puget Sound stocks by geographic isolation. The stock is native and all production comes from naturally spawning fish. Genetic analysis has not been conducted to date (WDFW *et al.* 1994). Recent trends in abundance of Lake Washington chinook have declined since 1991. The Lake Washington chinook stock is now considered to be depressed (City of Seattle 1998).

Issaquah Creek is one of the three major chinook spawning streams in the Lake Washington basin. It has been estimated that Issaquah Creek produced approximately 33% of all wild chinook smolts entering the Lake Washington basin in 2000. The Issaquah Creek Hatchery and the accompanying weir are located about .5 miles downstream of the diversion dam and the collection of broodstock precludes any chinook and coho escapement above the hatchery. The chinook return to Issaquah Creek from July through October, with the peak in late August through September. The collection of adult coho and chinook for egg propagation takes place during the months of September, October, and at least part of November. Approximately 2,400 coho and 1,200 chinook are required to meet the egg take goals of 3.3 million coho and 2.425 million chinook. During the collection period, essentially all salmonids other than chinook and coho are sorted out manually and released back into Issaquah Creek upstream of the weir. During the rest of the year, approximately December through August, upstream-bound fish are allowed to pass over the hatchery weir on their own volition. Therefore, if any Chinook were to return before or after the collection period they would be able to move upstream of the hatchery and spawn naturally.

As stated previously, the hatchery's production goals require approximately 1,200 adult chinook for egg production and the escapement goal is 500 chinook. However, the escapement goal had not been met from 1990 to 1996. In fact, some years the 1,200 spawners needed for egg-take was not achieved. As a result there has been some discussion regarding the priority of allowing some chinook to spawn naturally upstream of the hatchery regardless if the 1,200 fish needed for production is achieved. Presently this has not been an issue due to the recent increase in adult returns. From 1997 to present, the escapement (upstream of the hatchery) has ranged from approximately 1,100 fish in 1999, to 7000 adult chinook in 2001 (Table 1).

TABLE 1. ISSAQUAH HATCHERY ADULT CHINOOK RETURNS 1994-2001 BROOD YEARS

	Fish Trapped		Fish Released Upstream	
Brood Year	**Adults**	**Jacks**	**Adults**	**Jacks**
2001	10,451	287	7,014	146
2000	3,776	458	1,321	49
1999	3,529	434	1,113	59
1998	4,867	24	3,820	20
1997	3,815	125	1,700	116
1996	1,246	2	150	0
1995	1,910	270	0	0
1994	3,703	43	0	0

As stated previously, Issaquah Creek is one of the three major Chinook spawning streams in the Lake Washington basin, but it differs from the Cedar River and Bear Creek, in that the majority of the "wild" production is believed to be progeny of hatchery fish. The majority of spawning occurs in the East Fork Issaquah Creek and in the mainstem below the hatchery. The WDFW installed and operated a screw trap on the lower mainstem in the spring of 2000 primarily to measure the production of naturally produced chinook along with obtaining other biological data. The preliminary results of this study estimated that from 14 March through 3 July, 29,196 chinook migrants passed the screw trap. It is likely that many juvenile chinook may have migrated out of Issaquah Creek prior to or after the period of trap operation due to the typical migrational characteristics of the Lake Washington chinook. The chinook in Issaquah creek and other local streams and rivers, migrate downstream as fry from January through March and later in the year from May through early July as smolts. Based on migration timing curves generated in 2000 for the Cedar River, Soos Creek, and Bear Creek it is believed that the sample period may have missed 30% to 50% of total chinook migrants leaving the system (Dave Sieler personal comm). The vast majority of chinook that the sampling missed would have been the fry that migrate out of the creek prior to the sampling that began 14 March. By incorporating the estimate of the early migrants along with the estimate of chinook passing the trap during the sample period, the estimated production from Issaquah Creek in 2000 ranges from about 39,000 to 45,000 chinook.

4.7.2.2 Coho Salmon

Coho salmon, like chinook, are raised at the Issaquah hatchery so there is a hatchery component and a wild component to the Issaquah Creek coho. As stated previously in the chinook salmon section, coho returning to Issaquah Creek are collected during the months of September, October and part of November. Generally the procedure has been to collect approximately 2,400

coho for egg propagation and allow 1,300 to 2,400 coho above the rack to spawn naturally. The coho escapement goals for Issaquah Creek and other Puget Sound streams have been determined by various methods through the years resulting in varying escapement goals depending on the methods used. King County Surface Water Management has suggested that enough usable habitat is available in Issaquah Creek and its tributaries upstream of the hatchery to justify allowing 6,000 to 10,000 adult coho to pass upstream of the hatchery every year. In addition, if nutrients are limiting production, allowing larger numbers of fish upstream of the hatchery may increase the capacity of the stream as the decaying carcasses provide needed nutrients.

Adult coho return and migrate upstream from early September through late December and juvenile coho migrate downstream in mid March through May in Issaquah Creek. Trapping was conducted in the spring of 2000 from March 14 through July 3 to estimate the wild coho production of Issaquah Creek. The entire coho migration was sampled in 2000, estimating a production of 18,232 wild coho (Seiler 2002).

4.7.2.3 Sockeye

It has been estimated that 80% of the Lake Washington sockeye spawn in the lower Cedar River, with the remaining 20% spawning primarily in Bear Creek and Issaquah Creek. The 1992 Washington State Salmon and Steelhead Inventory (SASSI 1994) identified three distinct sockeye stocks in Lake Washington, with the Issaquah Creek sockeye as a part of the Sammamish Tributary Stock. Historic run sizes (1972-1990) for Issaquah Creek in particular are not available but the entire Lake population had a median of 246,913 adults, ranging from 122,964 in 1990 to 531,062 in 1988. From 1988 to 1995 the population continually declined with the lowest run on record in 1995, with 23,997 adults returning. However, in 1996 and 2000, large numbers of sockeye returned allowing sport and Tribal fisheries suggesting that the long-term negative escapement trend is reversing.

Adult sockeye return to Issaquah Creek from August to November with peak returns in September and October. Juvenile sockeye migrate downstream from January through April.

4.7.2.4 Kokanee

Native kokanee were historically widespread throughout Lake Washington and its tributaries (Bean 1891). From 1978 to 1998, the native early run timing kokanee stock was found largely in Issaquah Creek and is believed to be the only remaining native stock of kokanee present in the Lake Washington Basin (Pfeifer 1995). Historically, this stock was present in at least Swamp and Bear Creeks. During the 1930's and 1040's, WDG took up to 10 million eggs from kokanee that were trapped in Bear Creek. This suggests that an egg take of this size would have required the trapping of in excess of 10,000 adults and as high as 25,000. However, the annual escapement rates into Issaquah Creek were reported to vary between one and three thousand individual spawners during the early 1970's (Berggren 1974). From 1980 through 1982, estimated kokanee escapement into Issaquah Creek ranged from approximately 400 and 1,000

fish (Pfeifer 1992). In 1983, only 10 early run kokanee were observed in Issaquah Creek. Kokanee escapement counts conducted from 1992 through 1998 showed a continual low escapement. In 2000, the WDFW conducted trapping on Issaquah Creek from March 14 through July 3, and 0 kokanee were caught. The decline of the Issaquah Creek kokanee is most likely due to their spawning timing. These fish spawn in July and August subjecting there redds to the typical low flow period that is accompanied by warm water temperatures. In addition, sockeye, chinook, and coho would potentially construct their redds in the same locations as the kokanee redds that were constructed just a few weeks earlier.

4.7.2.4 Steelhead

Steelhead, displaying perhaps the most diverse life history pattern of all Pacific salmonids, reside in most Puget Sound streams. Their historic native distribution extended from northern Mexico to the Alaska Peninsula. Presently, spawning steelhead are found as far south as Malibu Creek, California (Busby *et al.* 1996). Two different genetic groups (coastal and inland) of steelhead are recognized in North America (Busby *et al.* 1996). British Columbia, Washington, and Oregon, have both coastal and inland steelhead, while Idaho has only the inland form and California steelhead stocks are all of the coastal variety (Busby *et al.* 1996). Within these groups, steelhead trout are further divided based on the state of sexual maturity when they enter freshwater. Stream-maturing steelhead (also called summer steelhead) enter freshwater in an immature life stage, while ocean-maturing (or winter steelhead) enter freshwater with well developed sexual organs (Busby *et al.* 1996). Lake Washington Basin steelhead have been placed into the Puget Sound ESU, along with 53 other steelhead stocks, by the National Marine Fisheries Service (Busby *et al.* 1996). Total run size for the major stocks of this ESU was estimated at 45,000, and natural escapement of approximately 22,000 steelhead (Busby *et al.* 1996).

The Lake Washington Basin does not have a summer steelhead stock and winter steelhead adults spawn from February through May. Juvenile Steelhead migrate in April and May. Much like chinook and coho, the steelhead population is composed of hatchery and wild fish. In 1998 fry were planted in the upper river and the Issaquah hatchery also raises steelhead that are released as fingerlings. In recent years only a couple of adult steelhead return to Issaquah Creek each spring. In 2000, the juvenile sampling estimated that a total of 1,146 wild steelhead smolts migrated past the trap. However, no attempts were made to adjust this number to represent the total basin production.

4.7.2.5 Coastal Cutthroat Trout

Coastal, or anadromous cutthroat trout, are distributed on the Pacific Coast from Prince William Sound in southern Alaska to the Eel River in northern California, rarely penetrating more than 100 miles inland (Johnston 1982; Behnke 1992). Considerable information exists for Puget Sound cutthroat trout, though little of that has been collected in a standardized manner and over a long enough time period to establish trends in populations (Leider 1997). Coastal cutthroat trout exhibit early life history characteristics similar to coho and steelhead whereby juveniles spend

time rearing in freshwater before outmigrating as smolts (Leider 1997). While little information exists on Issaquah Creek cutthroat, Puget Sound cutthroat emigrate to estuaries at a younger age (age II) and smaller size (6 inches TL) than cutthroat that are exposed to rough coastal waters (age III to V, 8-10 inches TL) (Johnston 1982). Puget Sound cutthroat trout will feed and migrate along beaches, often in waters less than 10 feet deep (Johnston 1982). Many stocks are thought to stay within estuarine habitats for their entire marine life (Leider 1997). Most cutthroat return to freshwater the same year they migrate to sea. Little information is available on the status of coastal cutthroat trout in Issaquah Creek. It is known that the adult coho return to Issaquah creek in February through April, and the juvenile migrate downstream in February through June. The Lake Washington cutthroat spawn in tributaries and appear to spend their entire life in Lake Washington rather than migrating into the Puget Sound. This theory is based on 4 years of purse-seining in Lake Union and the Large Lock where thousands of sockeye, coho, and chinook have been sampled and only a few cutthroat have ever been captured. As mentioned previously several times, trapping was conducted in the spring of 2000 from March 14 through July 3 to estimate the wild coho production of Issaquah Creek. In addition to obtaining coho production, information on cutthroat trout was obtained. It was estimated that 14,803 cutthroat migrated past the trap during the sample period. However, no attempts were made to adjust this number to represent the total basin production.

4.7.3 Resident Fish

4.7.3.1 General

Little information about resident fish is available for Issaquah Creek other than the cutthroat discussed previously. The lowest half mile of the stream provides spawning areas for bass, perch, and suckers from Lake Sammamish. It can be reasonably assumed that various sculpins (*Cottus* species), and threespine stickleback (*Gasterosteus aculeatus*) would be present upstream of mouth.

4.7.3.2 Bull Trout

Endangered Species Act of 1973, as amended (64 FR 16397). A 1998 WDFW study reported 80 bull trout/Dolly Varden populations in Washington: 14 (18%) were healthy; two (3%) were in poor condition; six (8%) were critical; and the status of 58 (72%) was unknown. Bull trout are estimated to have occupied approximately 60% of the Columbia River Basin and presently occur in only 45% of the estimated historical range (Quigley and Arbelbide 1997).

In the past 10 years, only two "native char" have been reported in Issaquah Creek and none have been reported in the Sammamish River (64 FR 16397; 1999; WDFW 1998). The USFWS is not certain that the latter subpopulation is "viable." There is no known spawning subpopulation resident in Lake Washington or Lake Sammamish, however, bull trout have been observed in the fish ladder viewing pool at the Locks as recently as 1997 (F. Goetz, USACE,

pers. comm.) and isolated reports of bull trout captures in or around Lake Washington occur every few years. A larger juvenile bull trout (~250 mm, 3 year old) was caught in the lower Cedar River in July of 1998 (M. Martz, USACE, *pers. comm*.).

The only likely viable bull trout subpopulation in the Lake Washington watershed is the Chester Morse Reservoir subpopulation. However, the Chester Morse Reservoir subpopulation is above an anadromous barrier and is a glacial relic population (WDFW 1998). The population exhibits an adfluvial life history strategy, although residents could exist in the upper watershed (WDFW 1998). Because all life history strategies can arise from the same population, it is possible that some fish emigrate from the Chester Morse Reservoir to exhibit anadromy or to reside in Lake Washington. Water temperatures in the lower Cedar River may be too high to support a fluvial population (WDFW 1998).

The Washington Resources Inventory Area (WRIA) 8 has recommended an investigation for char (bull trout and/or Dolly Varden) to be completed throughout the watershed, especially in the upper watershed above 1,000 feet and in cool water. Preliminary surveys were scheduled for summer 2000. The findings of this recommended three to five year investigation will determine the likelihood of needing future studies to determine char strategies in the basin. The preliminary results of the WDFW sampling conducted in the spring of 2000 from 14 March through 3 July indicated that 0 char were caught out of more than 6,500 fish sampled. The sample collected at the trap consisted of chinook, coho, steelhead, and cutthroat trout.

4.7.4 Fish Passage

The intake dam and its associated fish ladder currently present a challenge to migrating juvenile and adult salmonids restricting access to at least 10 miles of spawning and rearing habitat. The existing dam has passage problems with the ladder, the water supply intake, the spillway, and the accompanying apron. The numerous passage problems associated with the project vary in degree of magnitude depending on the stream flow that is passing the project.

The fish ladder has many problems such as inadequate flow, velocity, slope, attraction velocities, and perhaps entrance pool depth. Another problem occurs during high flow events, when the sediment that has built up around the intake erodes plugging the ladder with sediment and rendered it unusable. The existing gravity intake screen structure is detrimental to juvenile fish passage as it was originally designed for flushing the screen box of sediment and debris. For example, during low flow when little water is bypassed, the intake chamber can trap juvenile fish. The intake structure poses other problems for migrating juveniles such as screening not meeting current standards and routing fish through hardware and then discharging fish from a height of 6-8 ft onto rocks during higher flows. The spillway and the accompanying concrete apron produce problems for both adult and juvenile salmonids at this facility also. During high flows, the apron below the spillway attracts the adult fish to an area where they are unable to pass the project (false attraction). During these high flows the fish attempt to ascend the spillway until they

become exhausted and they then locate the ladder entrance only because they are looking for a refuge from the high velocity flows below the spillway. The concrete apron below the spillway attracts adult fish during times of low flow also. The problem with this is that once fish jump on to the apron they can become stranded. Another passage issue for the spillway is that the spillway consists of timbers angled at about 60^{o} from the crest of the dam to the concrete apron. Most of these timbers are missing and the majority of fish passing the project fall from the crest of the dam about 4 ft to the concrete apron. Even the fish that happen to pass the project in an area with the timbers still present, encounter a rapid descent and abrupt impact with the concrete apron.

No detailed survival studies of juvenile salmon and trout passing the project have been completed to date, but based on current passage criteria, and the previously listed observations, the project is clearly resulting in unnecessary mortality to juvenile salmonids and substantially restricting adult passage. Although no detailed passage or survival studies have been conducted at the intake dam, spawning surveys have been conducted upstream and downstream of the project. The results of the 2001 surveys identified 14 chinook, 197 coho, 88 sockeye, and 28 unidentified fish at RM 3.3 below the diversion dam. The results of the RM 5.8 surveys identified 9 chinook, 42 coho, 43 sockeye and 8 unidentified fish above the diversion dam. This data shows that out of the total numbers of fish identified at the 2 sites, 39% of the chinook, 21% of the coho, 33% of the sockeye, and 22% of the unidentified fish were identified above the diversion dam at RM 5.8. Combined with the knowledge that salmonids have been identified spawning up to 11 miles upstream of the diversion dam and that there is approximately 11 miles of quality spawning and rearing habitat upstream of the dam, this data provides further evidence of a passage problem at the project site.

4.7.5 Wildlife

Wildlife in the basin include over 100 species of birds, including bald eagles (Haliaeetus leucocephalus), barred owls (Strix varia), northern saw-whet owls (Aegolius acaducus), red-tailed hawks (Buteo jamaicensus), pileated woodpeckers (Dryocopus pileatus), and blue grouse (Dendragapus obscurus). Round lake provides excellent nesting habitat for a variety of waterfowl including eared grebes (Podiceps nigricollis) and bufflehead (Bucephala albeola). In addition, dippers (Cinclus mexicanus) and belted kingfishers (Ceryle alcyon) have been observed throughout the basin. Several species of amphibians and reptiles are found in the area including the rubber boa (Charina bottae) and the pacific giant salamander (Dicamptodon ensatus). Large mammals in the basin include elk (Cervus elephus), black-tailed deer (Odocoileus hemionus columbianus), black bear (Ursus americanus), bobcat (Felis rufus), and beaver (Castor Canadensis). Historically cougar (Felis concolor) were common in the area but presently they are known only to inhabit the upper Carey Creek basin and area of Tiger Mountain (King County 1991).

4.8 THREATENED AND ENDANGERED SPECIES

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed and proposed threatened or endangered species. Several species listed as either threatened or endangered are potentially found in the Issaquah Creek Basin, and are listed in Table 2.

TABLE 2. ENDANGERED SPECIES IN THE PROJECT VICINITY

Scientific Name	Common Name	Status
Haliaeetus leucocephalus	Bald Eagle	Threatened
Salvelinus confluentus	Coastal/Puget Sound Population Segment Bull Trout	Threatened
Oncorhynchus tshawytscha	Puget Sound ESU Chinook Salmon	Threatened
Oncorhynchus kisutch	Puget Sound/Straight of Georgia ESU Coho Salmon	Candidate

Information on known occurrences of endangered and threatened species in the project vicinity, and the impacts of the completed and proposed projects on these species will be addressed in a separate BE.

4.9 NATIVE AMERICAN AND CULTURAL RESOURCES SITES

Section 106 compliance studies completed to date include an examination of the electronic database containing the archaeological and historic site records of the Washington State Office of Archaeology and Historic Preservation (OAHP) and other background research. The records search indicated that no properties listed on the National Register of Historic Places (NRHP) and no sites or structures listed on the state inventory are located within the proposed project area.. Native Americans do harvest salmonids from the Lake Washington-Sammamish system, including those that originate from the Issaquah Creek basin.

4.10 AIR QUALITY

Air quality in the Puget Sound Basin is generally good. However, urban areas experience moderately degraded air quality during certain times of the year. Motor vehicles are the largest

source of air pollutants in King County, although wood-burning stoves also contribute. Particulates, sulfur dioxide, ozone, and carbon monoxide are the pollutants of concern. High concentrations of these pollutants generally occur during the dry, late summer months when minimal wind conditions persist for long periods of time or during mid-winter thermal inversions.

Carbon monoxide, a product of incomplete combustion, is generated by automobiles and other fuel burning activities (e.g. residential heating with wood). The highest ambient concentrations of carbon monoxide tend to occur in localized areas such as major roadways and intersections during periods of low temperatures, light winds, and stable atmospheric conditions. Ozone is a highly reactive form of oxygen created by sunlight-activated chemical reactions of nitrogen oxides and volatile organic compounds. Unlike high carbon monoxide concentrations, which tend to occur close to emission sources, ozone problems tend to be regional since ozone precursors can be transported far from their sources. Ozone precursors are primarily generated by motor vehicle engines.

5.0 EFFECTS OF THE PROPOSED ACTION

5.1 GEOLOGY/SOILS

Construction activities associated with the proposed project will result in soil being disturbed and compacted from heavy machinery throughout the construction area. The installation of grade control structures will include the placement of large rock immediately below the weirs to reduce the potential of scour. This area between the weirs including the large rock immediately below the weirs will be covered with pool mix (gravel coble mix). The installation of seven weirs will require a total of approximately 1000 cubic yds of substrate places between the weirs. Rock armoring may be necessary on the banks immediately above and below each weir also. In addition, some rock armoring will need to be placed on the right bank immediately below the dam.

5.1.1 Sediments

The proposed projects dam face will be built approximately 10 ft downstream of the existing dam face. Following the river diversion removal, and consequential rerouting of the river through the creek channel, the sediment that has accumulated in the forebay will be mobilized a short distance to the new dam face. After a few high flow events the sediment will accumulate in the new forebay and continue to pass the project as it has been doing for decades.

5.2 WATER/WATER QUALITY

5.2.1 General

Water quality and flow in Issaquah Creek are expected to change little. Because the project area is in a relatively small area in comparison to the remainder of the watershed, flow stability will not be altered. The stream will continue to transport fine sediment throughout its length, through Issaquah into Lake Sammamish.

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Potential point and non-point sources of water pollution will not be affected by this project. Some canopy cover in the project area will be lost during project construction. Though replanting will occur, it may take several years for the canopy to return to pre-project conditions. This loss is not expected to result in any temperature increases even during warm temperature and low flow conditions within the project reach.

There will be some construction impacts on water quality at several stages during the construction process. Large pulses of sedimentation following diversion of the stream back into the restored stream bed will result in short term turbidity until the water slows sufficiently to allow settlement, potentially lowering dissolved oxygen concentrations for short durations. Localized shifting of sediments will continue sporadically as the new stream heals and adjusts. Floods during the winter and spring following construction will continue to mobilize sediments in the project area, potentially contributing to small increases in turbidity over that normally seen during flood events. Sedimentation impacts will be controlled through best management and conservation practices during construction. They should be temporary and of short duration. Water quality will be monitored in the project area and downstream during construction to detect any unacceptably high water quality impacts.

5.2.2 Land Use and Potential Pollution Sources

The proposed project will not alter land use or pollution sources except for the temporary water quality issues discussed in the previous paragraph.

5.3 HYDRAULICS AND HYDROLOGY

The hydraulic impacts of any of the proposed alternatives were viewed from the perspective of changes from the existing condition. The intent of the hydraulic evaluation was to ascertain any changed conditions in water surface profiles.

There are three potential areas of concern related to the performance of the recommended plan; sedimentation, flood conveyance, and erosion. Substantial efforts have been made to reduce any possibility of impacts outside of the project area. The flood conveyance through the project reach is equal to the existing condition. By maintaining existing channel cross-section widths, with appropriate side-slopes and tying into high ground ensures flood flows will be contained. Finally, the potential for any increased erosion, through changes in channel depth or velocity, have been minimized in the project design. Increased velocities are expected through the project reach, however the hydraulic model indicates that the water surface profile of the preferred plan matches the existing condition profile downstream of the last weir groups, indicating that the weir groups are able to dissipate sufficient energy so that the existing channel controls flow conditions. In other words, implementing the preferred plan should not alter hydraulic conditions below the

last element of the project. As such it is not expected that the project as designed will exacerbate existing instabilities downstream of the project reach. Also, due in part to the increases in velocity in the project reach, bank protection is required intermittently through the project footprint to reduce erosion potential. Bank protection is also required to ensure the integrity of the grade control features.

5.4 VEGETATION

Riparian impacts are not expected upstream of the project reach. However, between the downstream end of the project reach and the dam site, which requires the installation of grade control weirs, riparian areas will be impacted due to construction activities. Riparian impacts downstream of the project area will be non-existent in some areas and moderate in others, depending on construction access needs, siting, and practices. New vegetation will be planted along the disturbed riparian zone following construction. This new vegetation will take several years to replace the shading and detrital functions provided by existing vegetation within the construction area. Riparian and upland vegetation will not need to be removed for access roads and staging areas during construction as an access road presently exists.

5.5 WETLANDS

The proposed project is not expected to have any direct impacts to wetlands in the basin. Hydraulic analysis has determined that the project will not effect water elevations upstream or downstream of the project therefore, it will not have any impacts to wetlands in the basin. One potential effect is that the proposed project will provide upstream migration for juvenile salmonids such a coho. Therefore, it is theorized that juvenile coho may chose to pass upstream of the project to find refuge during high flow events and the refuge they chose may be a wetland that is accessible during this high flow event.

5.6 FISH AND WILDLIFE

5.6.1 Habitat

The weir construction will provide alternating pool and riffle sections mimicking a natural stream gradient. The potential incorporation of habitat enhancement features such as, riparian plantings, deflector logs, and gravel bars, together with large woody debris included in the stream bands, will provide improvements in the rearing and refuge habitat for young salmonids and resident fish in the downstream (weir) section of the project.

5.6.2 Anadromous Fish

Populations of salmon in the Pacific Northwest have declined precipitously over the past several decades (Nehlsen *et al.* 1991). Small streams like Issaquah Creek have the capacity to buffer the declines in larger systems and support the efforts of the federal and state agencies to preserve and recover wild salmonid stocks.

The Issaquah Creek Dam is the primary bottleneck to salmonid upstream rearing and spawning habitats. Without a project to either remove the dam or significantly modify the fishway, the bottleneck would remain and continue to restrict most salmonids from accessing the upper watershed. This habitat is particularly limited in northern Puget Sound and the condition of Issaquah Creek is better than most other streams in the area. Downstream passage for juvenile and resident fish will also improve through the proposed project. Specifically the intake structure and ladder currently present a challenge to migrating juvenile and adult salmonids. At least 10 miles of prime spawning and rearing habitat experience limited use due to the difficulty of adult upstream migration past the dam. During low flows downstream migrating juvenile fish also experience difficulty as they can be trapped in the intake area or are passed onto a concrete apron. Specific concerns are as follows:

Dam:

1) Low flows over the spillway attract adult fish, where they are stranded on the exposed concrete apron below the spillway,

2) There is not a plunge pool in the tailrace so juvenile fish passing downstream interact with concrete,

3) There is erosion downstream of the right abutment, and

4) The spillway has deteriorated and is clogged with sediment and debris.

Fish Ladder:

1) Ladder step heights exceed the current guidelines,

2) Ladder step volumes do not meet volume guidelines for energy dissipation,

3) Sediment often accumulates in the pools after high flow events, and

4) Attraction flow is inadequate.

Intake Structure:

1) Screen openings are larger than current guidelines,

2) Juvenile fish can be trapped in front of the screens, since a bypass is not provided,

3) The sweeping components of velocities decrease along screens, and

4) The velocity gradient at the screen entrance exceeds guidelines due to sudden contraction of the flow cross section.

All of these issues detailed above will addressed and will result in more efficient fish passage and higher survival for adult and juvenile salmonids during both upstream and downstream migrations.

5.6.3 Resident Fish

Considering the small size of the project reach, there will be little impact to the resident fish population during construction. After diversion of the stream flow into the bypass pipe, as many fish as possible will be collected in the dewatered section. Fish could be trapped in the few pools in this section. Resident fish will be placed upstream a minimum of one mile to avoid the project area and downstream sedimentation.

A significant increase in anadromous fish above the dam could affect the current population of resident trout. The upper watershed has always had some level of salmonid use, including natural spawning and some hatchery supplementation using steelhead fry. The proposed project would result in an incremental increase of primarily chinook, coho, and sockeye fry above the dam.

An increase in cutthroat trout smolt numbers in western Washington streams coincided with declines in coho salmon abundance (Dave Sieler, personal communication). There has also been some evidence that cutthroat trout are relegated to riffles by the more dominant coho salmon (Glova 1986), although other authors have found that cutthroat trout select the shallower and faster waters in riffles even though coho salmon are not present (Sabo and Pauley 1999). When coho salmon fry are present they can dominate cutthroat trout fry because juvenile coho salmon emerge from redds earlier and are larger in size (Laufle *et al.* 1986). Yet, adult cutthroat trout will readily prey on coho salmon fry or other small fish.

Anadromous salmonids currently and historically occurred in the upper watershed. Additional nutrients and elevated primary productivity levels resulting from increased adult

carcass densities will partially offset the detrimental effects to resident fisheries associated with the increased abundance of juvenile anadromous salmonids.

5.6.4 Fish Passage

This project will improve fish passage for all species that inhabit the creek or have inhabited the creek historically. The existing dam has passage problems associated with the dam face, fish ladder, and the intake structure that were listed in section 5.6.2. The stranding issue associated with the apron below the dam face will be resolved as this apron will always be at least 2 ft below the water surface, this will also address the problems encountered by juvenile fish passing over the dam crest. The passage problems associated with the fish ladder will be addressed as the proposed project will meet or exceed current guidelines for ladder step heights, and pool volumes. The sediment and attraction problems will be alleviated by the pool and chute design that utilizes the majority of stream flow through the fish passage structure, increasing attraction flows and passing sediment more efficiently than the present structure. The intake issues will be resolved by meeting current passage criteria for screen opening size, screen configuration, and screen velocities. In addition, a juvenile bypass will be installed to return fish to the river.

5.6.4.1 Short Term Impacts (Construction)

Project construction will require approximately two to four months, depending upon the construction schedule, to complete. During this period, the creek will be diverted into a pipe for the length of the project area, and will provide little or no fish habitat along the length of the diversion.

The construction period will follow the spring high-flow period, so it will avoid impacts to the juvenile salmon migrating downstream during the spring. Most of the construction (all in-water work) will occur prior to the adults arriving in the fall. There is the potential that upstream migrants, particularly early chinook and sockeye, will arrive in Issaquah Creek prior to completion of the stream restoration. However, in recent years water temperatures in Issaquah Creek have been extremely high creating a barrier for passage until mid to late September when water temperatures recede.

5.6.4.2 Construction Contingency Plan (Stream Bypass)

5.6.4.2.1. Adult salmon Collection and Trucking Upstream

To avoid the most direct adverse construction impacts to salmonids, ideally the temporary stream bypass by pipe should only occur between June 15 and July 31, for a construction window of approximately 6 weeks. The downstream migration of smolts is completed by June 15 and the adult return of chinook and sockeye salmon for spawning can begin

in early August. However, the chinook often do not show up in large numbers until mid September. The Corps and WDFW are determining if a more appropriate in water work window of June 15- September 15 would be more accurate, and will continue to coordinate with NMFS. Preliminary consultation with NMFS indicates that the in water work window extending into September may be acceptable. However, if weather conditions in August and early September were cold and wet, the adult migration would likely begin earlier than in recent years. If this occurred a trap and haul operation would likely be necessary. All reasonable effort will be made to require the contractor(s) to include a concentrated and intensive work schedule to complete instream work that requires flow bypass within this time frame.

After diversion of the stream flow into the bypass pipe, a concerted effort will be made to collect as many fish as possible in the dewatered section. Salmonid smolts will be placed downstream to allow them to continue their outmigration and resident fish will be placed at least a mile upstream to remove them from any effects of construction and sedimentation.

If the project in-water work and temporary bypass by pipe cannot be completed in the preferred time frame, even with a concentrated and intensive work schedule, then it would preferable to initiate the work prior to June 15 rather than extend the work into September. However, based on the project schedule, it is extremely unlikely that in-water work could be initiated prior to 15 June 2003. During plans and specifications the project construction schedule will be revisited. If it appears likely that the in-water construction period required exceeds approximately 10 weeks, coordination will occur among all the project stakeholders to determine the best course of action. The options may include delaying construction one year so that the work could begin earlier the following spring, or continuing construction into September, in which case a trap and haul facility would be necessary.

If construction (in water work) is initiated prior to 15 June, the diversion structure would need to accommodate passage of outmigrating fish. No detailed evaluations have been completed as part of the feasibility phase to determine the design requirements that would need to be incorporated into the diversion structure to allow for safe passage of outmigrating fish.

It must be understood that even if the stream diversion is anticipated to be completed by August 31, unplanned delays may make this impossible. A contingency plan must be developed to mitigate this potential problem. Work progress will be carefully monitored throughout the construction period to determine if the schedule is being met. The decision to initiate collection and trucking procedures will be made by July 15 to allow sufficient time for implementation. WDFW has the capability to accomplish this contingency plan very rapidly as the Hatchery collection weir and holding facilities are located about ½ mile downstream of the project. Regardless of when construction occurs, a contingency plan will need to be in place prior to initiating construction.

5.6.4.2.2. Fish Collection after Channel Dewatering

After diversion of the stream flow into the bypass pipe, a concentrated effort will be made to collect as may fish as possible in the dewatered stream. Salmonid smolts will be placed downstream to allow them to continue their out-migration.

5.6.4.3 Long Term Impacts

This project is proposed as a means to remove the existing adverse impact the dam has on anadromous fish passage in Issaquah Creek. The proposed project goal is to improve the spawning success of salmonids and reduce the mortality of juvenile and adult fish in Issaquah Creek. Providing more efficient and effective fish passage at the Issaquah Creek barrier dam is the primary objective of the proposed project.

The proposed project will eliminate the existing problems associated with the dam, fish ladder, and intake structure, that has been an impediment to upstream and downstream passage of salmonids. The dam has apparently impeded the movement of chinook salmon, coho salmon, sockeye salmon, steelhead, cutthroat, and possibly kokanee and native char to productive areas of Issaquah Creek upstream from the dam. Since most of the potential spawning and rearing habitat (about 10 miles) of Issaquah Creek exists upstream of the dam, eliminating this passage impediment has the potential to substantially increase the salmonid production from Issaquah Creek.

5.6.5 Wildlife

Effects to wildlife, if any, will be temporary and occur primarily during construction. The riparian plantings and potential addition of woody material will be added to the site increasing some habitat values. In addition, the increase in fish passage success will provide more adult fish upstream benefiting numerous species. Overall effects, both adverse and favorable, will be insignificant.

5.7 THREATENED AND ENDANGERED SPECIES

Potential impacts of the proposed project on sensitive, threatened and endangered species are summarized below and will be addressed in detail in a separate BE. The effects discussed below will be further considered through consultation with the USFWS and NOAA Fisheries in accordance with Section 7(a)(2) of the Endangered Species Act (see Section 0).

No bald eagle nests occur within one mile of the project or disposal site (Washington Priority Habitat and Species List Database, July 2003). Bald eagles likely use or occur near the project area only sporadically. Bald eagles are more active and abundant in areas closer to Lake Sammamish, more than three miles from the project site. Bald eagle use of the site is most likely

during the winter in association with the salmon spawning period. Construction at the site will occur during the spring and summer months, minimizing the chance of impacts to bald eagles. After construction, the habitat will provide similar eagle habitat to that which currently exists. Accordingly, the proposed project is not likely to adversely affect bald eagles.

Effects on fish, including salmonids, are discussed in detail in Section 5.6.4. Construction will be planned and manage to minimize potential impacts to salmonids and other aquatic species. It will be attempted to conduct all in-water work from June 15 to July 31, the standard WDFW work window for Issaquah Creek that is designed primarily for protection of salmonids. However, this 6 week window may not be practical and an extension of the in water work window until August 30 may be necessary. If this extension is necessary, impact reduction measures will be coordinated with the Services. Bull trout are unlikely to occur in Issaquah Creek during the summer as the water temperature increases. Seasonal abundance of chinook and coho salmon adults and juveniles is the lowest of the year during the standard construction window. Considering the magnitude, timing, and management of construction of the project, the likelihood of impacts to bull trout and chinook salmon during construction are insignificant and discountable. After construction, habitat for salmonids, including chinook salmon, coho salmon, and bull trout, will be enhanced by the creation of the backwater channel habitat. Accordingly, the project is not likely to adversely affect Puget Sound/Coastal bull trout or Puget Sound chinook salmon. Under ESA, effect determinations are not appropriate for candidate species such as Puget Sound/Strait of Georgia coho salmon.

5.8 NATIVE AMERICAN AND CULTURAL RESOURCES SITES

Section 106 of the National Historic Preservation Act of 1966, as amended, requires that Federal agencies identify and assess the effects of Federally assisted undertakings on historic properties and to consult with others to find acceptable ways to resolve adverse effects. Properties protected under Section 106 are those that are listed on or eligible for listing on the National Register of Historic Places (NRHP). Eligible properties must generally be at least 50 years old, possess integrity of physical characteristics, and meet at least one of four criteria for significance. Regulations implementing Section 106 (36 CFR Part 800) encourage maximum coordination with the environmental review process required by the National Environmental Policy Act (NEPA) and with other statutes. The Washington State Archaeological Sites and Resources Act (RCW 27.53) and the Indian Graves and Records Act (RCW 27.44) may also apply.

Section 106 compliance studies completed to date include an examination of the electronic database containing the archaeological and historic site records of the Washington State Office of Archaeology and Historic Preservation (OAHP) and other background research. The records search indicated that no properties listed on the National Register of Historic Places (NRHP) and no sites or structures listed on the state inventory are located within the proposed

project area. During the next phase of studies a professional cultural resources reconnaissance survey will be being conducted for the proposed project by a Corps archaeologist.

5.9 AIR QUALITY

The proposed project has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. The proposed activities would not exceed *de minimis* levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons, a conformity determination is not required for this project.

6.0 CUMULATIVE EFFECTS

The NEPA defines cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in the project vicinity, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR §1508.7). According to Washington State Environmental Policy Act Register (http://www.ecy.wa.gov/apps/sepa/) and Corps records, a number of projects are ongoing or planned to occur along Issaquah Creek.

Three projects (Issaquah Creek Bank Stabilization/Habitat Enhancement Project, Gilman Area Channel Improvement Project, and the Squak Valley Restoration Project) are located within a few miles of the Issaquah Creek Diversion Dam Project. The Issaquah Creek Bank Stabilization/Habitat Enhancement Project, and the Gilman Area Channel Improvement Project are planned to plant willows and place large woody debris along the shoreline. The Squak Valley projects primary purpose is to create off-channel rearing and refuge habitat for salmon and trout. In addition, this project will include riparian plantings that will benefit local wildlife by improving habitat value along the riparian corridor of Issaquah Creek. Another streambank restoration project (the Lasley Streambank Restoration Project) is planned to occur approximately 3 stream miles upstream of the Squak Valley parcel. These projects will enhance the riparian zone of Issaquah Creek and will complement the proposed diversion dam project.

Construction work by the Washington Department of Transportation (WDOT) is ongoing on a new Sunset Way interchange on I-90 adjacent to the East Fork of Issaquah Creek on the east side of the city. This work included authorization to fill wetlands and restore and enhance the creek corridor. In the summer of 2002, routine inspections by Corps Regulatory staff determined that additional unauthorized work had occurred. The unauthorized work included placement of riprap bank protection along the creek and additional wetland fill. To resolve the permit violation, the Corps is working with WDOT to restore the creek and perform additional compensatory mitigation. Together with the above mentioned Squak Valley project, restoration and mitigation work that will likely be performed in conjunction with the Sunset Way interchange will help restore lost ecosystem functions and values.

In summary, the cumulative impact of the Issaquah Creek Diversion Dam project will be to incrementally enhance ecological functions and values, particularly with regard to salmonid passage and habitat utilization.

7.0 TREATY RIGHTS

In the mid-1850's, the United States entered into treaties with a number of Native American tribes in Washington. These treaties guaranteed the signatory tribes the right to "take fish at usual and accustomed grounds and stations . . . in common with all citizens of the territory" [*U.S. v. Washington*, 384 F.Supp. 312 at 332 (WDWA 1974)]. In *U.S. v. Washington*, 384 F.Supp. 312 at 343 - 344, the court also found that the Treaty tribes had the right to take up to 50 percent of the harvestable anadromous fish runs passing through those grounds, as needed to provide them with a moderate standard of living (Fair Share). Over the years, the courts have held that this right comprehends certain subsidiary rights, such as access to their "usual and accustomed" fishing grounds. More than *de minimis* impacts to access to usual and accustomed fishing area violates this treaty right [*Northwest Sea Farms v. Wynn*, F.Supp. 931 F.Supp. 1515 at 1522 (WDWA 1996)]. In *U.S. v. Washington*, 759 F.2d 1353 (9th Cir 1985) the court indicated that the obligation to prevent degradation of the fish habitat would be determined on a case-by-case basis. The Ninth Circuit has held that this right also encompasses the right to take shellfish [*U.S. v. Washington*, 135 F.3d 618 (9th Cir 1998)].

The proposed project has been analyzed with respect to its effects on the treaty rights described above. We anticipate that:

(1) The work will not interfere with access to usual and accustomed fishing grounds or with fishing activities or shellfish harvesting;

(2) The work will not cause the degradation of fish runs and habitat; and

(3) The work will not impair the Treaty tribes' ability to meet moderate living needs.

8.0 ENVIRONMENTAL COMPLIANCE

8.1 NATIONAL ENVIRONMENTAL POLICY ACT

Section 1500.1(c) and 1508.9(1) of the National Environmental Policy Act of 1969 (as amended) requires federal agencies to "provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact" on actions authorized, funded, or carried out by the federal government to insure such actions adequately address "environmental consequences, and take actions that protect, restore, and enhance the environment". This assessment evaluates environmental consequences from the proposed habitat restoration project at the Issaquah Creek diversion dam in Issaquah, Washington.

8.2 ENDANGERED SPECIES ACT

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed or proposed threatened or endangered species. The potential effects of the project and conservation measures taken to reduce those effects are summarized in Paragraph 5.6.4 and will be addressed in more detail in the BE for the project. The Corps will fulfill its responsibilities under the ESA prior to the start of project construction.

8.3 CLEAN WATER ACT COMPLIANCE

Requires federal agencies to protect waters of the United States. Disallows the placement of dredged or fill material into waters (and excavation) unless it can be demonstrated there are no reasonable alternatives. Requires federal agencies to comply with state water quality standards. The Corps will fulfill its responsibilities under the Clean Water Act prior to the start of project construction.

8.4 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA, 16 USC 470) requires that wildlife conservation receive equal consideration and be coordinated with other features of water resource development projects. This goal is accomplished through Corps funding of USFWS habitat surveys evaluating the likely impacts of proposed actions, which provide the basis for recommendations for avoiding or minimizing such impacts. The Corps has attempted to have discussions with USFWS on the Issaquah Creek project and, prior to the start of project construction, the Corps will complete the appropriate FWCA coordination.

8.5 ESSENTIAL FISH HABITAT

In accordance with the Essential Fish Habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act, the Corps has determined that the proposed work would impact approximately 180 linear feet of Issaquah Creek streambank, areas which are classified as EFH utilized by Pacific salmon. We have determined that the proposed action would not adversely affect EFH for federally managed fisheries in Washington waters. The project's BE will provide supporting documentation for our determination.

8.6 NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act (16 USC 470) requires that the effects of proposed actions on sites, buildings, structures, or objects included or eligible for the National Register of Historic Places must be identified and evaluated. The project area does not include any sites listed in or eligible for the National Register of Historic Places.

8.7 CLEAN AIR ACT

The proposed project has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. The proposed activities would not exceed *de minimis* levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons, a conformity determination is not required for this project.

8.8 ENVIRONMENTAL JUSTICE

Executive Order 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of agency programs and activities on minority and low-income populations. No tribal resources would be harmed. No adverse effects to minority or low-income populations would result from the implementation of the proposed project.

8.9 COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act of 1972, as amended, requires Federal agencies to carry out their activities in a manner, which is consistent to the maximum extent practicable with the enforceable policies of the approved Washington Coastal Zone Management Program.

The Corps conducted a review of the City of Issaquah Shoreline Master Program. Based on that review, the Corps has determined that the proposed project is consistent to the maximum extent practicable with enforceable policies of the City of Issaquah shoreline management program. The following sections of the Shoreline Master Program (SMP) are relevant to our project:

II. Master Program Elements: Goals & Policies, Conservation Element, A. Goals: 1. Preserve, protect and restore unique, fragile and scenic elements and non-renewable natural resources, and assure the continued sustained yield management of renewable resources for the benefit of existing and future generations. The goal of the proposed project is to restore/improve fish passage on Issaquah Creek, which is consistent with the SMP.

II. Master Program Elements: Goals & Policies, Conservation Element, A. Goals: 2. Identify and inventory wetlands for inclusion in the Shorelines plan. All wetlands in the basin have been identified and the majority of them have been inventoried by King County in 1991. The proposed project will not have any adverse impact to wetlands, thus the project is consistent with the SMP.

II. Master Program Elements: Goals & Policies, Conservation Element, B. General Policies: 5. The diversity of aquatic life, and wildlife, and habitat within the shoreline should be enhanced. The proposed project will enhance the diversity of aquatic life by improving fish passage to over 10 miles of underutilized salmonid habitat, therefore the project is consistent with the SMP.

II. Master Program Elements: Goals & Policies, Conservation Element, D. Clearing and Grading Policies: 2. Cleared and disturbed sites remaining after completion of construction should be promptly replanted with native vegetation or in certain circumstances with other

species contained in the City's approved plant list. If any clearing is required to allow access for equipment it will be promptly replanted with native vegetation.

II. Master Program Elements: Goals & Policies, Shoreline Use Element, General Policies: 3. Where appropriate, land and water uses should restore or enhance the land and water environments. The proposed project will not change the amount of water used by the hatchery, but by removing the impediments to fish migration, the increased numbers of salmonids utilizing Issaquah Creek will improve the environment in several ways.

9.0 CONCLUSIONS

Based on the above analysis, this project is not a major Federal action significantly affecting the quality of the human or natural environment, and therefore does not require preparation of an environmental impact statement.

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APPENDIX A

Project Drawings

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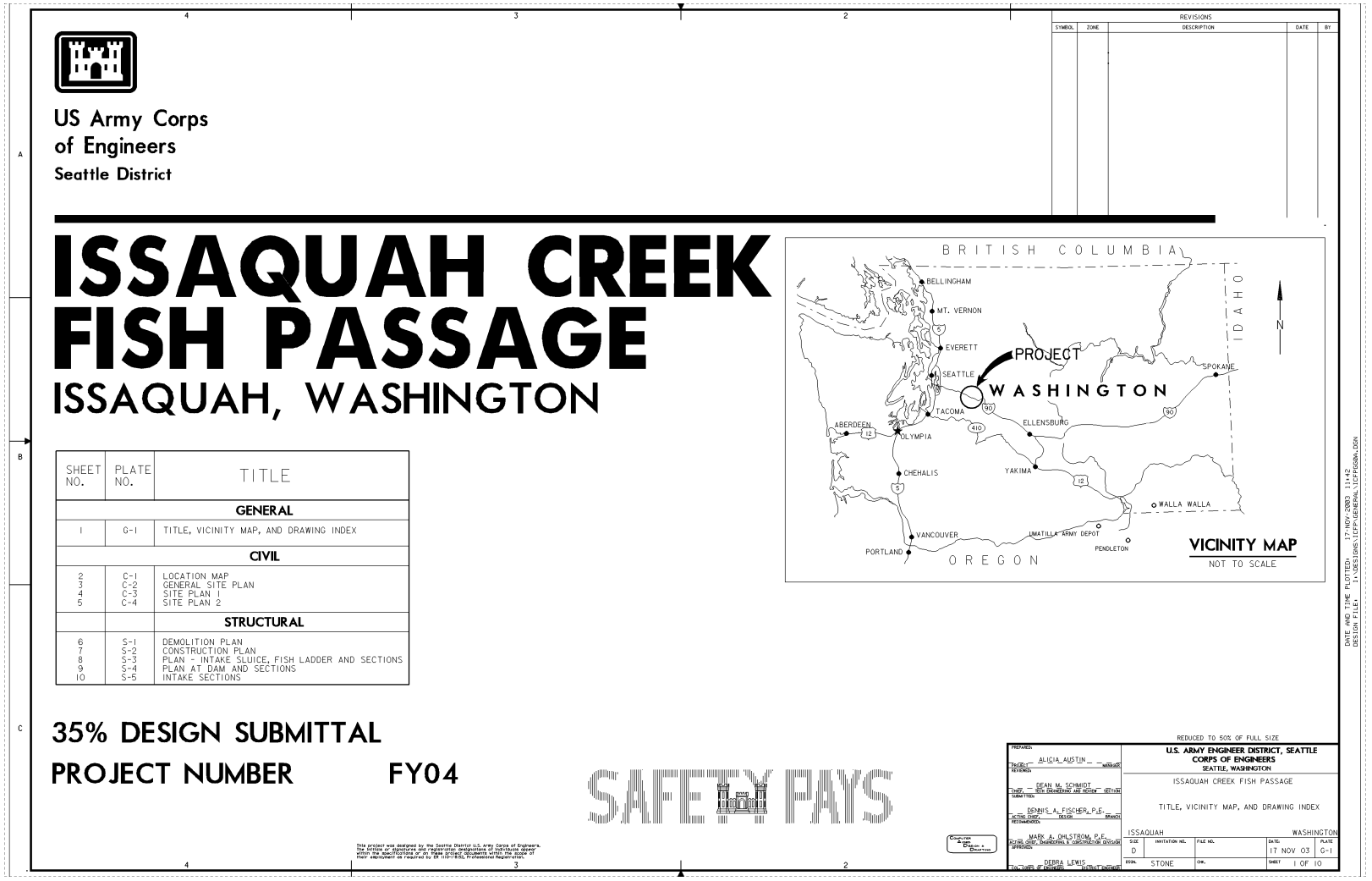

Figure A-1. Vicinity Map

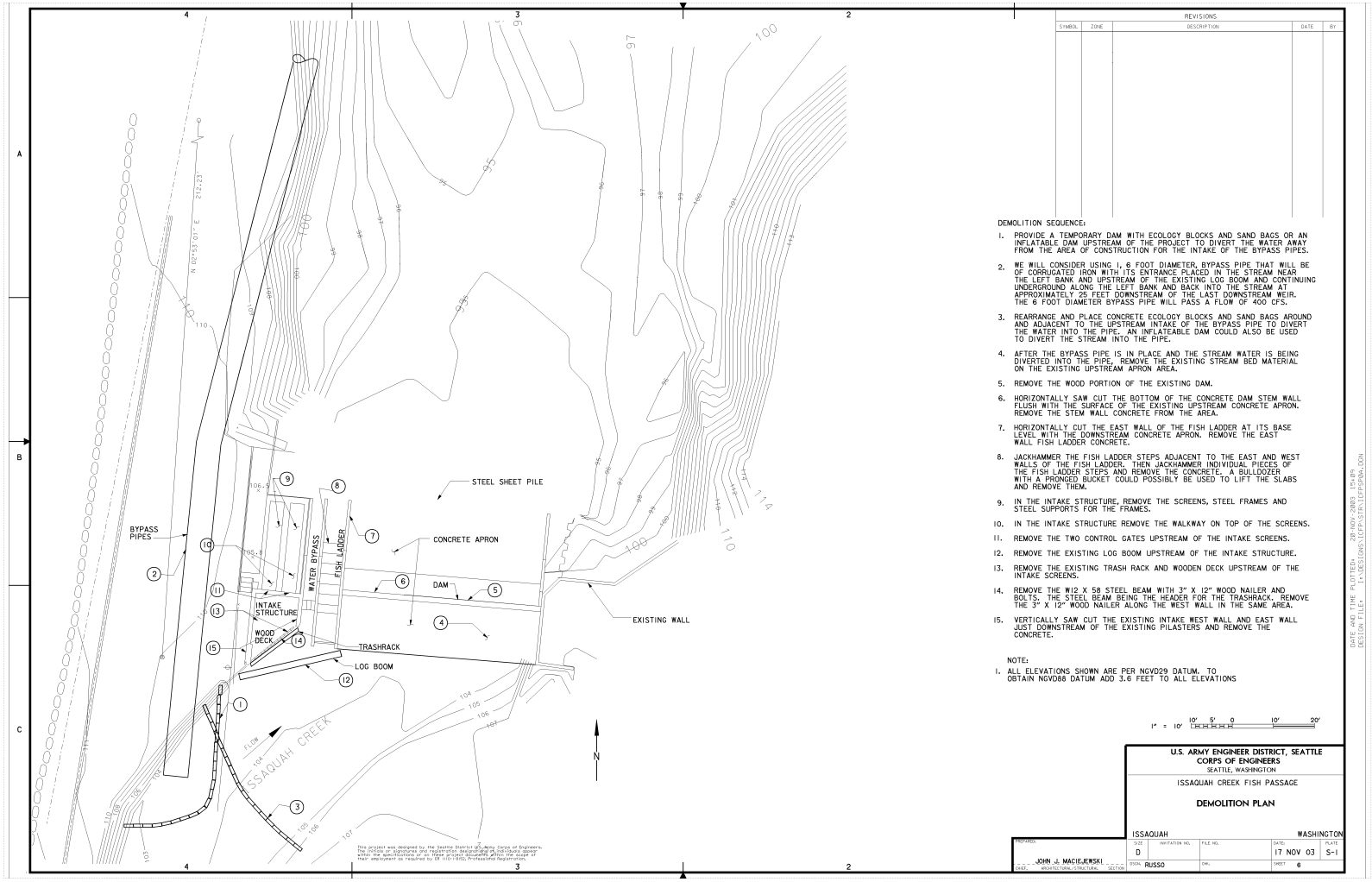

Figure A-2. Proposed Demolition Plan

Figure A-3. Proposed Construction Plan

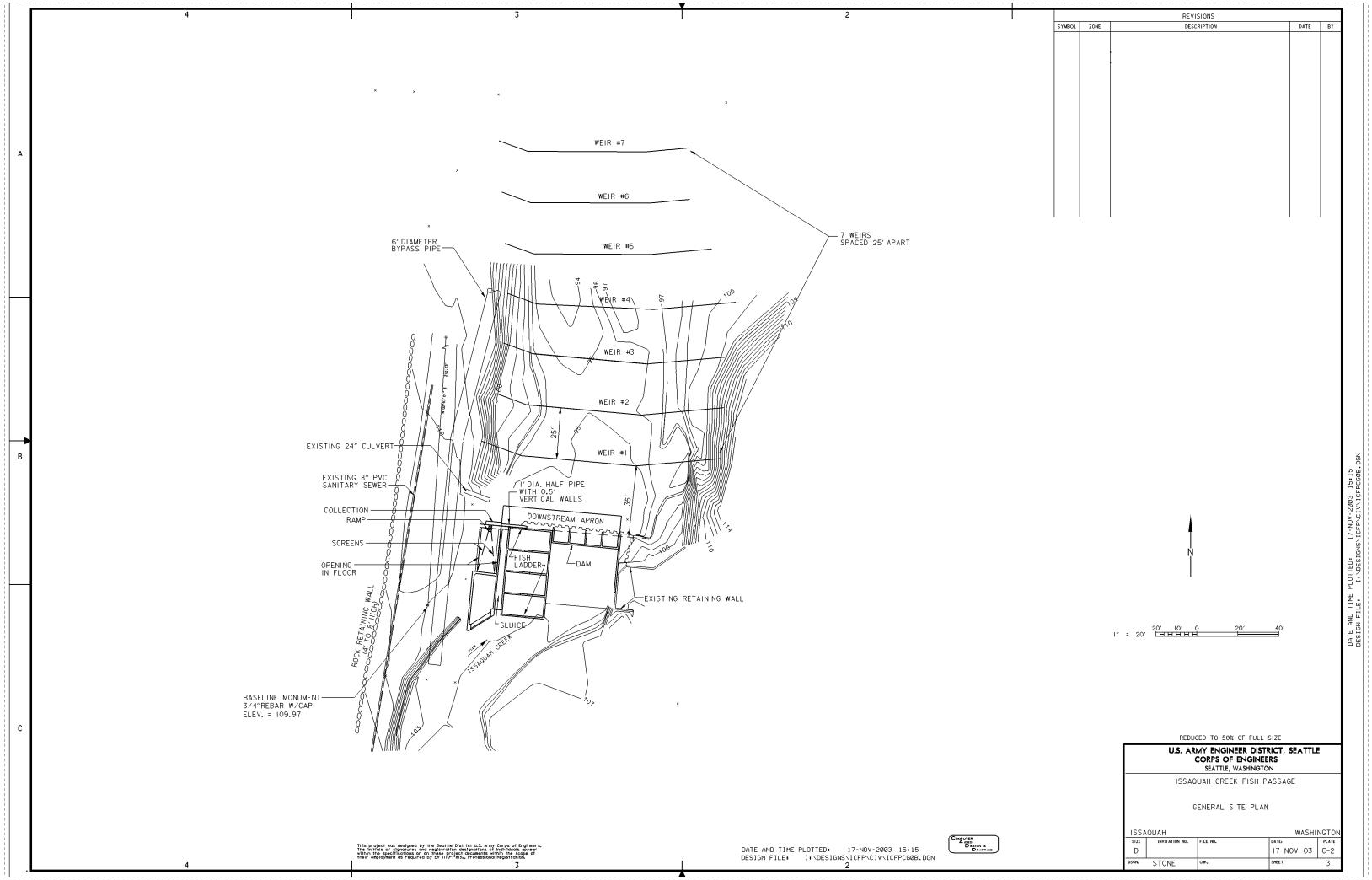

Figure A-4. Entire Site Plan

Figure A-5. Site Plan Downstream

Figure A-6. Site Plan Upstream

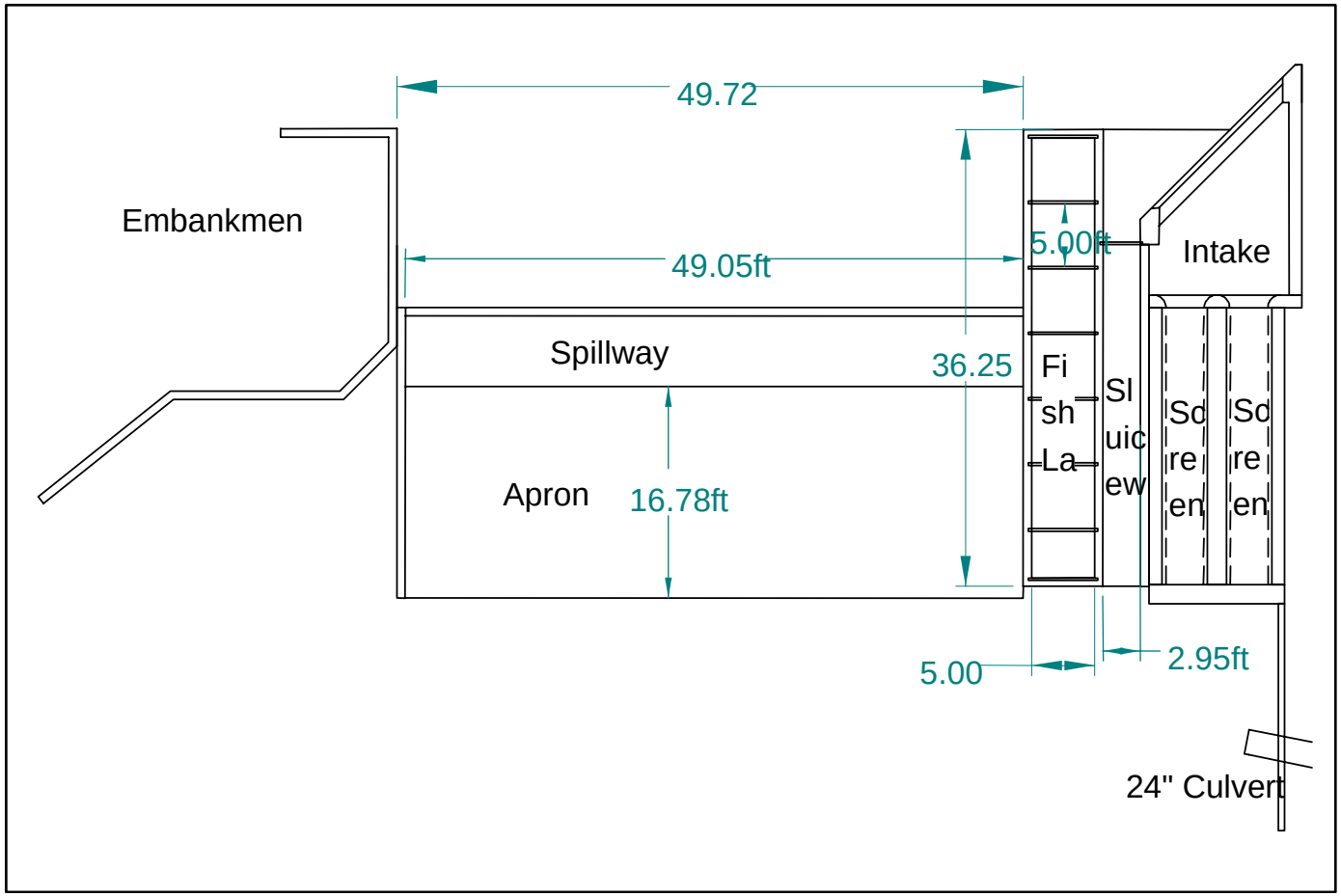

Figure A-7. Existing Structure

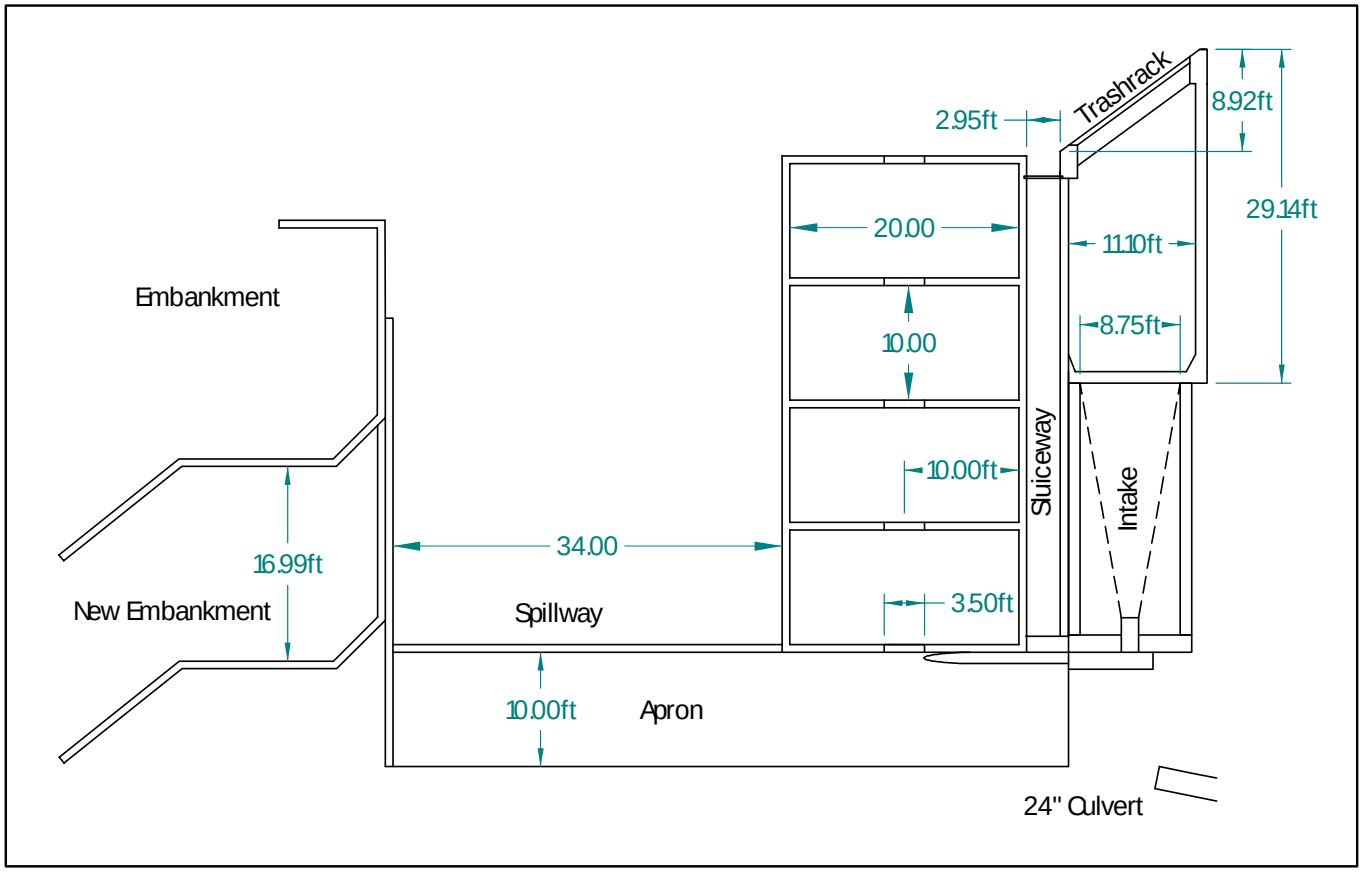

Figure A-8. Proposed Project

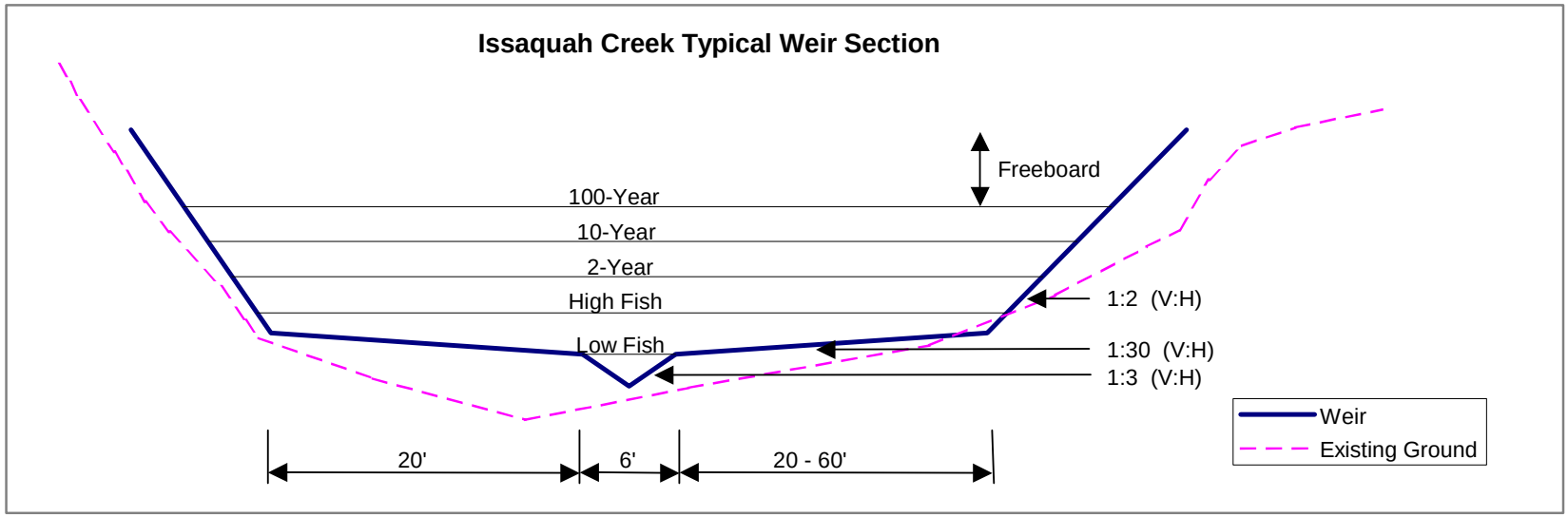

Figure A-9. Cross-section view of a typical pool and chute weir.

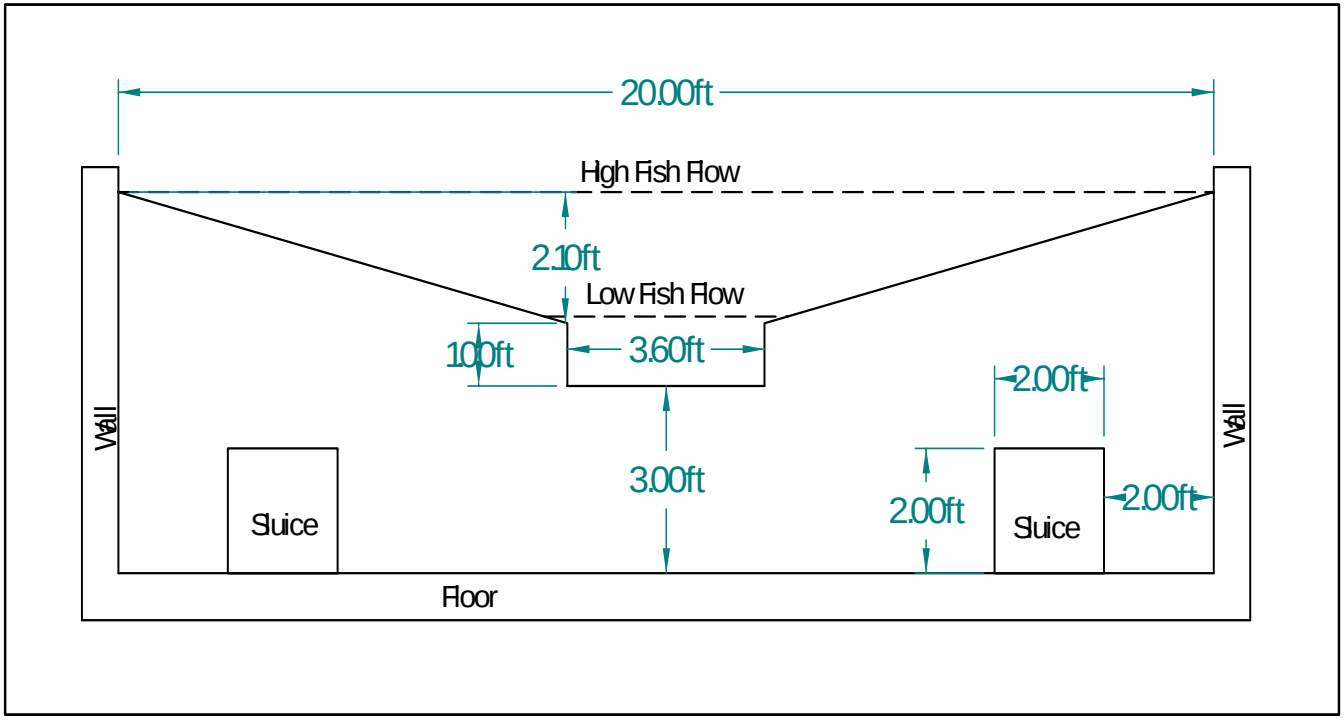

Figure A-10. Typical cross-section view of one of seven grade control weirs.

APPENDIX B

Public Notice

US Army Corps of Engineers
Seattle District

Public Notice

Planning Branch
P.O. Box 3755
Seattle, WA 98124-3755
ATTN: Alicia Austin (PM-PL)

Public Notice Date: December 1, 2003
Expiration Date: December 30, 2003
Reference: CENWS-PL-04-03
Name: Issaquah Creek Section 206 Restoration

30-DAY PUBLIC NOTICE

Interested parties are hereby notified that the U.S. Army Corps of Engineers, Seattle District (Corps) plans to replace a diversion dam that severely restricts fish passage with a structure that meets or exceeds current fish passage criteria in Issaquah, Washington. The Washington Department of Fish and Wildlife (WDFW) is the non-Federal sponsor for the Corps project. The proposed project is described below and shown on the enclosed drawings. The purpose of this Public Notice is to solicit comments from interested persons, groups, and agencies.

LOCATION

The project area is located at river mile (RM) 3.5 on Issaquah Creek about ½ mile upstream of the Issaquah Fish Hatchery in Section 33, T24 N, R6E, City of Issaquah, King County, Washington.

PROJECT BACKGROUND

In 1936, in response to growing demands of fish resources and diminishing returns, the Washington State Department of Fish and Wildlife (WDFW) began supplementing salmon production through operation of the Issaquah creek Fish Hatchery as a salmon production facility in the City of Issaquah. Two dams were constructed to support the hatchery, the lower dam or

“barrier dam” located at the hatchery site and an upper dam, “diversion dam”. This project focuses on the upper dam and its associated fish passage problems.

The intake structure or diversion dam located ½ mile upstream of the hatchery has supplied water to the hatchery since 1960 through diverting creek flow and creating the elevation head necessary to deliver a gravity flow water supply. In 1972 the gravity intake was reconstructed, the walls at the intake were raised one foot, two additional pools were added to the fish ladder, and a new screen structure incorporated. Since then, the hatchery has become a historical and cultural feature as well as a fish production facility.

The existing dam has passage problems with the ladder, the water supply intake, the spillway, and the accompanying apron. At present, adult fish passage is only possible at a narrow range of flows and the projects causes unacceptable mortality to both adult and juvenile salmonids.

PURPOSE AND PROJECT OBJECTIVE

The proposed project will provide low mortality passage at least 90% of the time for both upstream and downsteam passage including juvenile upstream passage, while maintaining an existing water supply to the Issaquah Hatchery.

AUTHORITY

The proposed project is submitted under Section 206 authority of the Water Resources Development Act of 1996, P.L. 104-303. This authority authorizes the Secretary of the Army to carry out aquatic ecosystem restoration and protection projects if the Secretary determines that the project will improve the quality of the environment, is in the public interest, and is cost-effective.

PROPOSED PROJECT

The proposed project will correct the current problems of upstream adult and juvenile salmon migration and downstream juvenile passage at the upper water intake of the Issaquah Salmon Hatchery on Issaquah Creek. The design guidelines include a 50-year project life, 100-year flood levels, and fish passage for flows ranging from 5-95% of the daily averaged values, 16cfs-320cfs.

The project will replace the existing dam and fish ladder with new configurations, modify the existing intake structure and replace the intake screens, provide a juvenile fish bypass return and alarm system, and install 7 downstream grade control weirs. Specifics include:

- The spillway will be moved downstream coincident with the entrance of the fishway to prevent fish from being attracted beyond the fishway entrance by spill flows. The right abutment will also be extended at least 17 feet downstream to the crest of the new spillway.
- The spillway will be founded on the existing apron, removing it as a potential location for stranding of adults at lower tailwater levels
- A new ten-foot apron will be placed below the new spillway to prevent scour, and two feet below the minimum water elevation.
- A new fish ladder consisting of five pool and chute weirs will provide upstream and downstream fish passage past the dam. The four pools will each be twenty feet wide, ten feet long, and three feet deep from crest to floor. The weirs will each have a low flow notch and sloping sides. A sluice opening will be provided on each side of each fishway weir to allow flushing of accumulated sediment and debris.
- Seven grade control weirs spaced at 25 foot intervals with .8 foot drops will be constructed downstream of the dam. The weir spans range from 70 to 120 feet in length
- Streambed and bank protection will be placed for each weir to prevent scour and weir failure. Riprap will be placed at the depth of expected scour and covered with gravel having a range of sizes that replicate exiting substrate

- The inlet and trashrack of the screen will be extended upstream, approximately 10 feet, so that debris will sweep past the trashrack and continue down the fishway rather than accumulate in front of the intake. The extension of the structure will require fill along the left bank and excavation along the right bank.

- The intake structure will be modified into a V-shaped configuration to meet the screen sweeping and approaching velocity criterion

- A collection trough and outfall conduit will transport juvenile fish from the intake structure to below the fishway

- The existing sluiceway and walls will remain but be extended upstream parallel to the intake and fishway

- The bank will be planted with native plant species following construction

- An alarm system, using water level sensors, will be installed to alert the hatchery when the intake system needs to be cleaned.

MITIGATION

The project is considered self-mitigating.

ENDANGERED SPECIES

The Endangered Species Act of 1973, as amended, requires assessment of potential impacts to listed and proposed species. Listed and proposed species that may occur in the project vicinity include:

Bald Eagle (*Haliaeetus leucocephalus*)—threatened;

Coastal/Puget Sound Bull Trout (*Salvelinus confluentus*)—threatened;

Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)—threatened;

The Corps will prepare a biological evaluation to discuss potential impacts to listed and proposed species and initiate consultation with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, according to Section 7 of the ESA, for species under jurisdiction of each respective agency.

CULTURAL AND HISTORIC RESOURCES

The District Engineer has reviewed the latest published version of the National Register of Historic Places, lists of properties determined eligible, and other sources of information. The following is current knowledge of the presence or absence of historic properties and the effects of the undertaking upon these properties:

Section 106 compliance studies completed to date include an examination of the electronic database containing the archaeological and historic site records of the Washington State Office of Archaeology and Historic Preservation (OAHP) and other background research. The records search indicated that no properties listed on the National Register of Historic Places (NRHP) and no sites or structures listed on the state inventory are located within the proposed project area. During the next phase of studies a professional cultural resources reconnaissance survey will be being conducted for the proposed project by a Corps archaeologist.

The District Engineer invites responses to this Public Notice from Federal, State and local agencies, historical and archeological societies, Indian tribes and other parties likely to have knowledge of or concerns with historic properties in the area.

PUBLIC HEARING

Any person may request, in writing and within the comment period specified in this notice, that a public hearing be held to consider this proposal. Requests for public hearings shall state, with particularity, the reason for holding a public hearing.

EVALUATION

The decision whether to perform the proposed work will be based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits that reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people.

The U.S. Army Corps of Engineers, Seattle District is soliciting comments from the public; Federal, State, and local agencies and officials; Indian tribes; and other interested parties in order to consider and evaluate the impacts of this activity. Any comments received will be considered by the Corps of Engineers to determine whether to modify, condition, or not proceed with the proposed work. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the activity.

The evaluation of the activity on the public interest will include application of the guidelines promulgated by the Administrator, Environmental Protection Agency, under authority of Section 404(b) of the Clean Water Act. This evaluation will include an alternatives analysis.

ADDITIONAL EVALUATION

The State of Washington will review this work for consistency with the approved Washington Coastal Zone Management Program. A coastal zone consistency statement will be prepared and submitted to the Department of Ecology. A preliminary determination has been made that the proposed maintenance work is consistent to the maximum extent practicable with the enforceable policies of the City of Issaquah Shorline Management Program.

A Section 401 water quality certification is requested from the State of Washington.

Pursuant to the National Environmental Policy Act, a final Environmental Assessment will be prepared based on responses to this Public Notice. Once complete, the Environment Assessment (EA) will be posted and available on the Seattle District web site at: <http://www.nws.usace.army.mil/ers/envirdocs.html>. A preliminary determination has been made that the proposed maintenance work will not significantly affect the quality of the human environment and, therefore, an Environmental Impact Statement is not required.

COMMENT AND REVIEW PERIOD

Comments on these factors will be accepted, made part of the record, and will be considered in determining whether it would be in the best public interest to proceed with the proposed project. Comments should reach this office, Attn: Planning Branch, not later than the expiration date of this public notice to ensure consideration.

Requests for additional information should be directed to Alicia Austin, Project Manager, at (206) 764-5522 or Chuck Ebel, Environmental Coordinator, at (206) 764-3626.

Encl

Drawings (4)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Notice of Application for
Water Quality Certification
and for
Certification of Consistency with the
Washington Coastal Zone Management Program

Date: December 1, 2003

Notice is herby given that a request has been filed with the Department of Ecology, pursuant to the requirements of Section 401 of the federal Clean Water Act of 1977 (PL 95-217), to certify that the project described in the U.S. Army Corps of Engineers Public Notice No.04-03 will comply with the Sections 301, 302, 303, 306, and 307 of the Act, and with applicable provisions of State and Federal water pollution control laws.

Notice is herby given that a request has been filed with the Department of Ecology, pursuant to the requirements of Section 307© of the Federal Coastal Zone Management Act of 1972 (16 U.S.C. 1451), to certify that the above referenced project will comply with the Washington State Coastal Zone Management Program and that the project will be conducted in a manner consistent with that program.

Any person desiring to present views on the project pertaining to the project on either or both (1) compliance with water pollution control laws or (2) the project's compliance or consistency with the Washington State Coastal Zone Management Program may do so by providing written comments within 30 days of the above publication date to:

Federal Permit Coordinator
Department of Ecology
SEA Program
Post Office Box 47600
Olympia, Washington 98504-7600

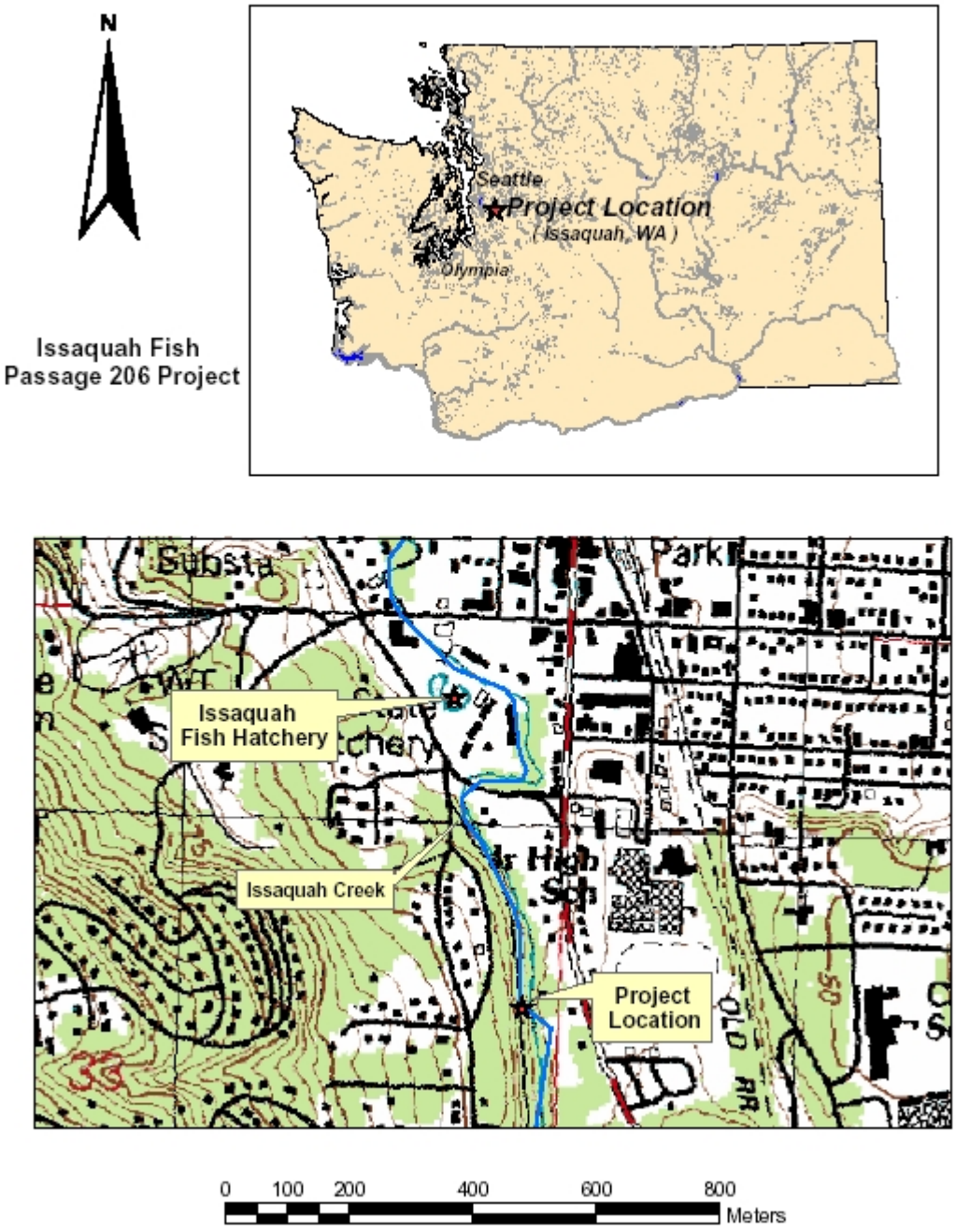

Figure 1. Project Location

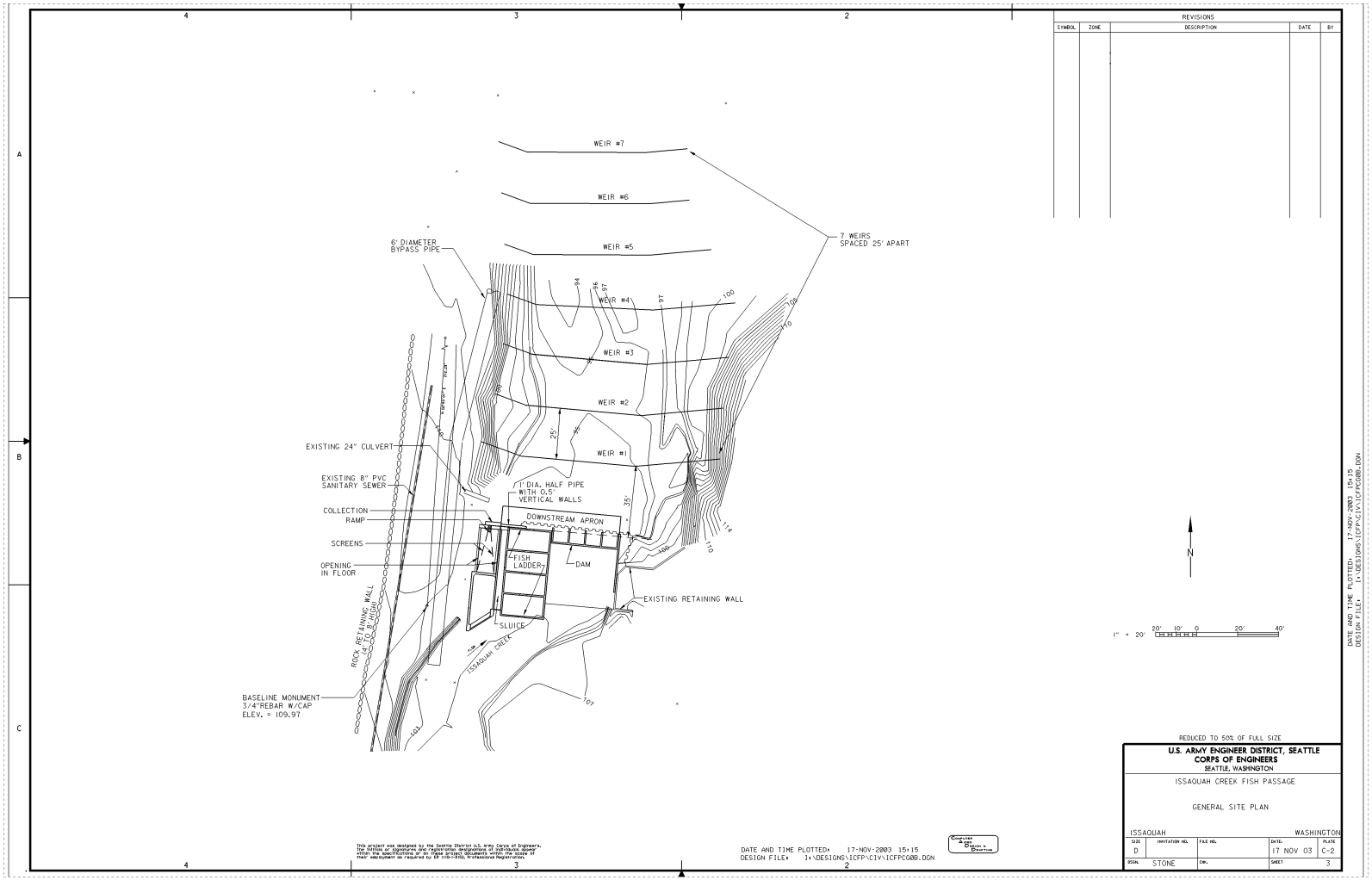

Figure 2. Site Plan

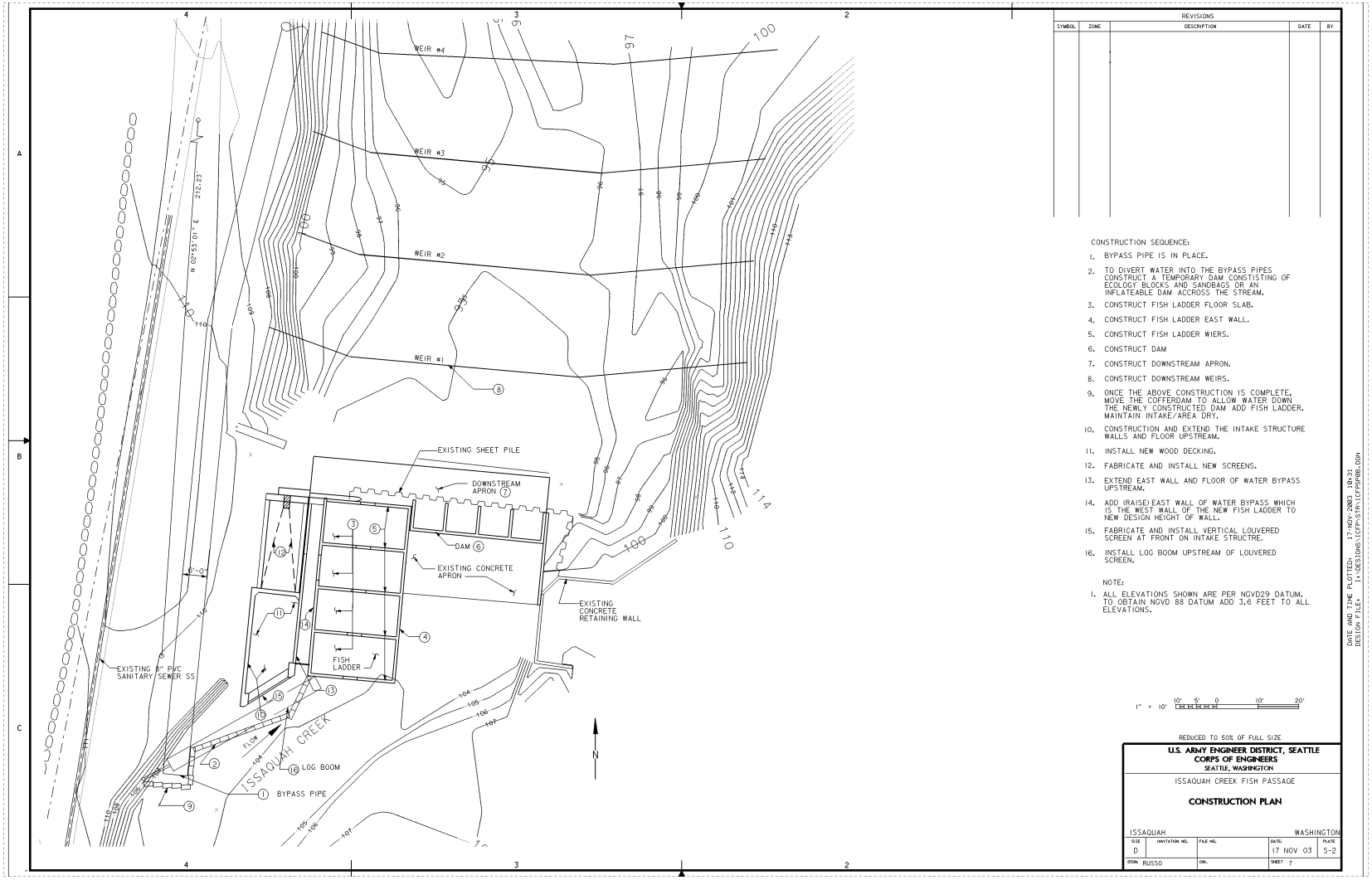

Figure 3. Construction Plan

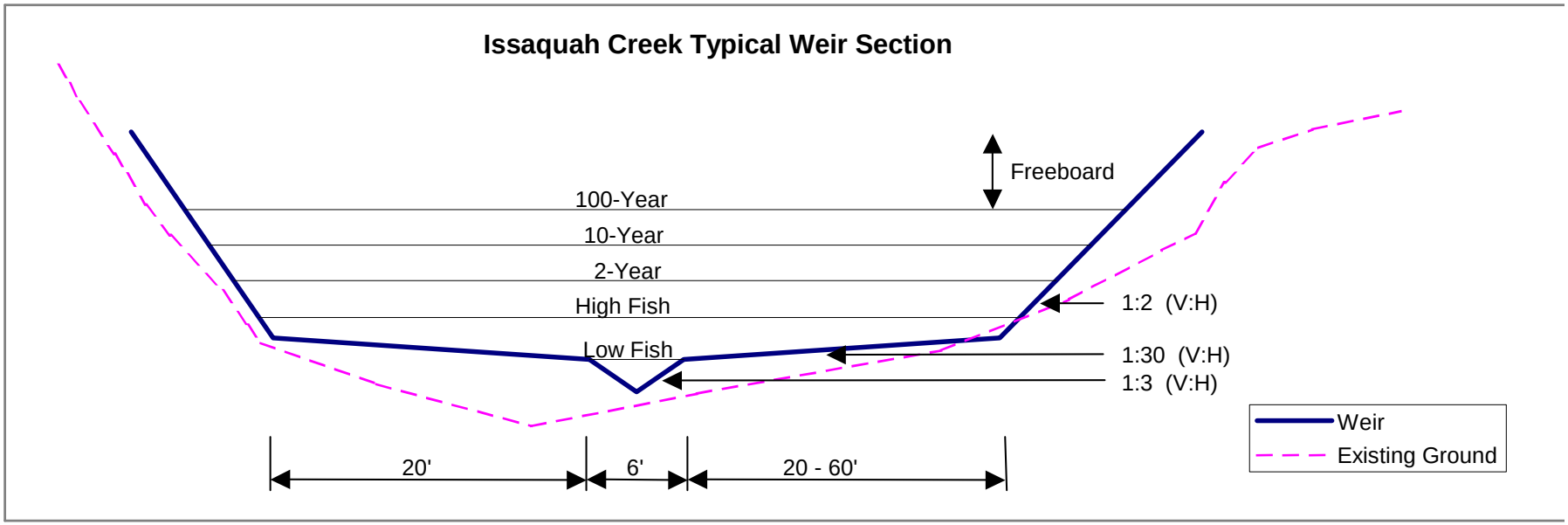

Figure 4. Example Weir Section

DRAFT FINDING OF NO SIGNIFICANT IMPACT

ISSAQUAH CREEK SECTION 206 RESTORATION PROJECT
KING COUNTY, WASHINGTON

The Seattle District, U.S. Army Corps of Engineers proposes to improve fish passage in Issaquah Creek by replacing a deteriorated and outdated diversion dam that supplies water to the Issaquah Creek Salmon Hatchery. The proposed project will include a spillway, fish ladder, and water supply intake that all meet or exceed current fish passage criteria.

The existing intake dam and its associated fish ladder currently present a challenge to migrating juvenile and adult salmonids restricting access to at least 10 miles of spawning and rearing habitat. The existing dam has passage problems with the ladder, the water supply intake, the spillway, and the accompanying apron. At present, adult fish passage is only possible at a narrow range of flows and the projects causes unacceptable mortality to both adult and juvenile salmonids. The proposed project will provide low mortality passage at least 90% of the time for both upstream and downsteam passage including juvenile upstream passage, while maintaining an existing water supply to the Issaquah Hatchery.

The attached environmental assessment and biological evaluation provides an evaluation of the proposed restoration project and its effects on the existing environment. The primary impacts of this action will be to remove a hindrance to both upstream and downstream fish passage.

No significant adverse impacts to fish and wildlife habitat, air quality, noise, esthetics, historical resources, cultural resources, or the social or economic environment are anticipated as a result of the proposed action.

For the reasons described above, I have determined that the restoration project will not result in significant adverse environmental impacts. The proposed project is not a major Federal action with significant impacts on the environment and, therefore, does not require an environmental impact statement.

_____ _____

Date

Debra M. Lewis
Colonel, Corps of Engineers
District Engineer