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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

June 19, 2000

John Matthew Harrington
NEPA Compliance Coordinator
United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Re: Biological Opinion for the Proposed Denny Way/Lake Union CSO Control Project (WSB-00-039)

Dear Mr. Harrington:

This document transmits the National Marine Fisheries Service's (NMFS) Biological Opinion (BO) based on our review of the proposed Denny Way/Lake Union CSO Control Project, King County, Washington and its effects on Puget Sound chinook salmon in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Formal consultation for this project was initiated on November 15, 1999.

This BO is based on information provided in a Biological Assessment dated June 8, 1999, other documents, and communications with the project proponent (King County). A complete administrative record of this consultation is on file at the Washington Habitat Branch Office.

The Biological Assessment determination of effect for the proposed project was "not likely to adversely affect" Puget Sound chinook salmon; however, NMFS determined that the proposed project was "likely to adversely affect" Puget Sound chinook salmon. The enclosed document represents NMFS' BO related to the effects of the actions on federally listed chinook salmon.

The NMFS concludes that implementation of the proposed project is not likely to jeopardize the continued existence of Puget Sound chinook or result in destruction or adverse modification of critical habitat. In your review, please note the incidental take statement, which includes reasonable and prudent measures and terms and conditions designed to minimize take and avoid jeopardy.

If you have any questions, please contact Bob Donnelly of the Washington State Habitat Branch Office at (360) 753-9533.

Sincerely,

Russell M. Strach

for William W. Stelle, Jr.
Regional Administrator

KCR
1683

cc: Roger Maurer, P.E.
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ENDANGERED SPECIES ACT - SECTION 7

BIOLOGICAL OPINION

Denny Way/Lake Union CSO Control Project
WSB-00-039

Agency: U.S. Environmental Protection Agency

Consultation Conducted By: National Marine Fisheries Service
Northwest Region,
Washington State Habitat Branch

Approved Russell M Strach Date 6/20/00

for William W. Stelle, Jr.
Regional Administrator

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I. BACKGROUND AND DESCRIPTION OF THE PROPOSED ACTION

A. Background and Consultation History

In many cities the sewage system is designed to carry both sewage and stormwater (street runoff). Conceptually, this simplifies the underground plumbing and thus saves money. The difficulty is that most of these systems do not have the capacity to transport all of the water that enters the system during a storm event. To take care of these storm events, cities with combined systems usually install Combined Sewage Overflow (CSO) outlets at various (and numerous) locations in local water bodies. These CSO outlets are generally designed to let combined sewage and stormwater overflow into local aquatic environments without benefit of sewage treatment.

In Seattle, the combined sewage/stormwater system is located in the older portions of the city and discharges combined sewage and stormwater into Lake Washington, the Ship Canal, Lake Union, the Duwamish River, Longfellow Creek, east central Puget Sound, and Elliott Bay. The number of times per year these CSOs release material is dependent on the number of storm events and the severity of each such event. In Washington, state law requires all municipalities with CSOs develop plans for "the greatest reasonable reduction at the earliest possible date" of untreated CSO discharge (RCW 90.48.480). State regulations define "reasonable reduction" to be one untreated discharge per year (WAC 173-245-020(22)). King County is on a schedule to be in compliance with this law by the year 2030. The Denny Way CSO project is a joint undertaking between the City of Seattle and King County comprised of two major components: 1) remove one existing CSO outfall in Lake Union, and 2) control other City of Seattle and King County CSOs to Lake Union and Elliott Bay. Controlled CSOs will meet the state regulations which limit untreated overflow events to a frequency of once per year from existing outfalls. These CSOs will be controlled by a strategy that combines 1) storage and transfer to a wastewater treatment plant, and 2) CSO treatment at-site with discharge through a new outfall into Elliott Bay. Discharges through this outfall are expected to occur eight to 20 times per year. In addition, a new outfall will be constructed in Elliott Bay to discharge untreated CSO event from the Denny Way CSO, on average once per year.

The lead federal action agency is the Environmental Protection Agency (EPA), through which King County is receiving funding for the proposed action. NMFS, EPA, and King County have continually communicated during this consultation. NMFS and King County have communicated closely during the development of the Biological Assessment that initiated and informed this consultation. Meetings began on March 5, 1999 with subsequent meetings on April 8, and May 3, 1999 culminating in completion by King County of the Biological Assessment (BA) on June 8, 1999. On that date, EPA and King County requested informal consultation and conferencing on King County's effect determinations of "may affect, not likely to adversely affect" chinook salmon (*Oncorhynchus tshawytscha*). Over the next several months, NMFS and King County staffs informally addressed the effects determination (see Appendix A). Subsequently, NMFS determined that the Denny Way CSO project would likely adversely affect

chinook salmon. This determination was made on November 15, 1999. Originally, the information necessary to complete the Biological Opinion was thought to be compiled by November 15, 1999. However, the monitoring plan for post project effects was not completed until May of 2000.

B. Description of the Proposed Action

This action is proposed by King County Wastewater Treatment Division, King County, Washington. King County would receive funding for this action through the United States Environmental Agency (EPA). Such funding creates a federal nexus triggering the need for consultation under Section 7 of the Endangered Species Act of 1972 (The Act), as amended. The aquatic phase of the construction for the proposed project will occur in Lake Union and Elliott Bay. The operation of the completed project will impact Elliott Bay and eastern central Puget Sound.

The elements of the proposed action that are relevant to an analysis of effects include the construction of the two outfalls in Elliott Bay, removal of one outfall in Lake Union, and the subsequent operation of the completed system.

The action area for the proposed Denny Way CSO project includes Lake Union, the Ship Canal from Lake Union to eastern central Puget Sound, Elliott Bay, and east central Puget Sound. Lake Union is located immediately north of downtown Seattle. The Ship Canal connects Lake Washington with eastern central Puget Sound and bisects Seattle from east to west. Elliott Bay is an embayment of Puget Sound located adjacent to the western edge of the central portion of Seattle (see appendix B of the BA for detailed maps). The area of central Puget Sound of interest to this document is that portion located from Duwamish Head north to Admiralty Inlet.

Lake Union is a fully urbanized freshwater lake, surrounded by the City of Seattle. It is connected upstream via the Ship Canal to Lake Washington and downstream via the Ship Canal to east central Puget Sound (see maps, Appendix B). Lake Union and the Ship Canal are part of the Lake Washington Drainage Basin. The Basin contains threatened Puget Sound chinook salmon.

Elliott Bay is a partially enclosed embayment of Puget Sound. It is surrounded on the south, east, and north by the City of Seattle and opens to eastern central Puget Sound on the west. Elliott Bay is the receiving waters for the Duwamish River which is the lower portion of the Green River and contains threatened Puget Sound chinook salmon. East central Puget Sound is part of the designated critical habitat for threatened chinook salmon (65 Fed. Reg. 7764).

Activities underlying the proposed action fall under two major categories. The first is the diversion of combined sewage and stormwater flows from the Lake Union and Denny Regrade areas to outfalls in Elliott Bay and east central Puget Sound. The second major outcome will be a reduction in storm caused combined sewer overflow (untreated) events from about 50 to 75 per year (current status) to one per year (on average) at the Denny Way CSO and CSO 175. To

accomplish these objectives, King County (with EPA funding) is proposing to build a large tunnel under Mercer Street in Seattle to act as both a transfer facility and storage container. The tunnel would be 6200 feet long by about 14 to 15 feet in diameter, which will allow for the storage of up to 7 million gallons of combined sewage and stormwater. City of Seattle CSO number 125 (that empties into Lake Union) will be eliminated and the effluent diverted into the Mercer Street tunnel. A 250-million-gallon-per-day (mgd) pump station and CSO treatment facility at the west portal of the Mercer Street tunnel, and two outfalls in Elliott Bay will be constructed. One outfall is for the once-per-year (on average) untreated CSO event and will be a 100 foot long extension of the existing CSO outfall, thereby moving the outfall to -20 feet mean-lower-low-water (MLLW). The other outfall will be about 490 feet long with the outlet at -50 to -60 feet MLLW, this outfall will be for effluent that has been processed by the treatment plant mentioned above. Construction of the outfall pipes will involve trenching the substrate from above mean-higher-high-water (MHHW) to near the end of the CSO outfall. The two pipes will be installed in the trench and covered with about 5 feet of uncontaminated backfill. The longer outfall pipe will continue on to its outfall site on the surface of the existing sediment and will be covered with a "concrete mattress" for protection. This pipe will be supported on concrete cradles which are supported by steel piling driven into the substrate. In addition, up to 40% of the combined sewage and stormwater stored in the Mercer Street tunnel will be diverted to Metro's West Point Treatment Facility for processing. The West Point facility is a secondary treatment plant that discharges into east central Puget Sound.

Thus, there are two different phases that will take place. The first is the construction of the facilities and the second is the operation and subsequent discharge of effluent into Elliott Bay and eastern central Puget Sound.

An additional action will be the introduction of intertidal and subtidal "structure" onto the substrate to enhance salmonid habitat. Specifically, large woody debris (logs) and boulders will be placed in and about the Elliott Bay construction site near the completion time of the project.

Conservation measures integrated into the proposed action include:

1. The construction period for the new outfalls and in-water work for removal of CSO number 125 would be scheduled from mid summer to mid winter. Operating during this time of the year will result in the lowest probability of doing any damage to chinook salmon habitat. Also, juvenile chinook salmon will not be present and the small amount of disturbed substrate will then have the rest of the winter and early spring to recover prior to outmigration of the juveniles.

2. King County would obtain a Hydraulic Permit (HPA) from the Washington Department of Fish and Wildlife (WDFW) and follow the restrictions listed in the permit.

3. The underwater dredge (digging) techniques used should be those that create the least amount of mobilization of the existing sediment.

4. Divers should be on site and check for juvenile chinook salmon during construction.

II. STATUS OF THE SPECIES AND CRITICAL HABITAT

The Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) may be adversely affected by the proposed action. For the purposes of conservation under the Act, an ESU is a distinct population segment that is substantially reproductively isolated from other conspecific population units and represents an important component in the evolutionary legacy of the species (Waples 1991). The geographic area of Puget Sound ESU encompasses the entire Puget Sound drainage basin west to the Elwah River basin and north to the Canadian Border. The Puget Sound chinook salmon ESU was listed as Threatened on March 24, 1999 (64 Fed. Reg. 14307). Details regarding the general status of the species at the ESU level are incorporated from the notice of final rule, by reference.

Critical habitat for the Puget Sound chinook salmon includes all marine, estuarine and river reaches accessible to chinook salmon in Puget Sound (65 Fed. Reg. 7764). Further details regarding the designation of critical habitat for the Puget Sound chinook salmon are incorporated from the notice of final rule, by reference. For this consultation, relevant critical habitat includes the Lake Washington/Cedar River basin to the Landsburg diversion dam and the Green/Duwamish River, Elliott Bay and east central Puget Sound. The subareas that may be effected by the proposed action include the freshwater habitat from Lake Union to Puget Sound, Elliott Bay, and east central Puget Sound from Duwamish Head to Admiralty Inlet.

III. EVALUATING THE PROPOSED ACTION

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). NMFS must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of (1) defining the biological requirements of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NMFS evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NMFS must consider the estimated level of mortality attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects. This evaluation must take into account measures for survival and

recovery specific to the listed salmon's life stages that occur beyond the action area. If NMFS finds that the action is likely to jeopardize, NMFS must identify reasonable and prudent alternatives for the action.

Furthermore, NMFS evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. The NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. The NMFS identifies those effects of the action that impair the function of any essential element of critical habitat. The NMFS then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NMFS concludes that the action will adversely modify critical habitat it must identify any reasonable and prudent measures available.

For the proposed action, NMFS' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NMFS' critical habitat analysis considers the extent to which the proposed action impairs the function of essential habitat elements spawning, rearing, feeding, sheltering, or migration of Puget Sound ESU chinook salmon, when compared to the existing environmental baseline.

Typically, this information should include a description of the species status, specific to the action area. This would include mention of the extent of the range of the species comprised in the action area, whether any effects are qualitative, quantitative, or both, and description of the particular constituent elements of critical habitat effected within the action area. Finally, this section should cover the factors affecting species (critical) habitat within the action area, that is, what other actions inform the habitat condition in the action area (*e.g.*, historic timber harvest, road construction, other land uses).

A. Biological Requirements

Life History and Factors Affecting the Species in the Action Area. Chinook salmon have evolved two distinct life history strategies (Scott and Crossman 1973, Wydowski and Whitney 1979, Healey 1991, Myers et al. 1998). One strategy, described as "stream type," is where the juveniles spend one year or longer in freshwater residence after emergence from the egg stage. The other strategy is called "ocean type" because the juveniles migrate to marine waters soon after emergence from the egg stage. In addition, a small fraction of the "ocean type" juveniles may residualize for one year, thus they would appear to be "stream type" juveniles when they outmigrate. Besides the difference between the two life history strategies in freshwater there is a difference in how each uses the estuary. The "ocean type" juveniles generally inhabit the nearshore areas of estuaries and move off and into deeper waters as they grow and age (Healey 1991). The "stream type" juveniles, compared to "ocean type" juveniles, generally move out and into deeper water upon entry into estuarine waters. The separation between these life history strategies are both genetic and morphological and are also commonly manifested in adult migration return timing into freshwater. The "stream type" adults generally return earlier in the year than the "ocean type" and can be found holding in pools prior to spawning. After spending

from a few weeks to a few months in estuarine areas, the juveniles move into the North Pacific Ocean where they reside for one to 6 or more years. At the end of the ocean residence period, they return as mature adults to their natal rivers and spawning grounds. At spawning, the eggs are deposited in nests, called redds, where they remain for varying periods of time depending on stock and location. Hatching and emergence generally occur in late winter or early spring. This completes the overall life "cycle" from the juvenile stage, as either "stream" or "ocean" type juveniles to spawning adults.

Rivers in this ESU are all contained within the Puget Sound Basin, specifically, they drain the west slope of the Cascade Mountains, the east and northeast slopes of the Olympic Mountains, and the north side of the lowlands that separate southern Puget Sound from the Chehalis River drainage. The Puget Sound river systems are generally short compared to systems like the Columbia River and are subject to multiple floods in any given year. Some of these rivers have glaciers at their headwaters, others do not.

The life history stage relevant to this consultation is the freshwater residence, juvenile out-migratory routes in the Lake Union and Ship Canal area, and nearshore areas used by juveniles that have entered Elliott Bay and/or eastern central Puget Sound. Juvenile chinook salmon in Lake Union and the Ship Canal are most likely migrating to central Puget Sound. When these juveniles are in freshwater they will need to forage and simultaneously are subject to predation (Healey 1991). The "ocean type" juveniles generally move and feed in the nearshore areas. Once in estuarine waters, "ocean type" juveniles from the Cedar and Green/Duwamish rivers will inhabit the shallow nearshore areas moving in and out with the tide as they grow (Healey 1991). As they grow they move into deeper water. The "stream type" juveniles, which are larger, generally outmigrate rapidly from freshwater during the spring time, do little foraging in freshwater during outmigration, and once they reach estuarine waters move rapidly into offshore areas. The "stream type" juveniles can be found in the offshore areas feeding during the spring and summer. These two life history strategies may be a adaptation for the juveniles to partition the food resources, reducing competition to the benefit of both. In late summer both life history types move out of the estuaries and into the North Pacific Ocean where they reside for one to several years.

Artificial Propagation. Artificial propagation programs have had considerable influence on this ESU. Nearly 2 billion juvenile chinook salmon have been released into Puget Sound rivers since the 1950's (64 Fed. Reg. 14307). The preponderance of hatchery production may mask trends in natural populations and makes it difficult to determine whether local naturally spawning stocks are self sustaining. This is compounded by the dearth of data on the proportion of naturally spawning fish that are of hatchery origin. There has also been widespread use of a small number of hatchery stocks, which results in a greater risk of fitness loss and reduction in diversity among populations.

B. Environmental Baseline

Population trends for this ESU are generally downward. Overall abundance has declined substantially from historical levels (64 Fed. Reg. 14307). Both long and short term trends in abundance are predominately downward. NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction, but they are likely to become endangered in the foreseeable future.

The condition and status of the critical habit in Lake Union and the Ship Canal is degraded. The shoreline of Lake Union and the Ship Canal is almost totally developed with only a few places left that have natural banks and vegetation. The water quality is also degraded by petroleum products from boats, stormwater, sewers, runoff of pesticides and fertilizers from waterfront homes, spills from live-aboards and houseboats, and CSO discharges directly into the Lake Union and the Ship Canal. Most of the shoreline is armored with little overhanging vegetation, whether native or non-native. Lake Washington, only a few miles upstream from Lake Union, is home to as many as 15 to 20 non-native species of fish. Many of these non-native species can be found in Lake Union and the Ship Canal (Wydoski and Whitney 1979). In summary, this environment is not ideally suited for juvenile chinook salmon.

The status and condition of the critical habitat in Elliott Bay and east central Puget Sound is degraded. Most of the Seattle shoreline of Elliott Bay and east central Puget Sound is armored, generally with rock and riprap . The shoreline lacks natural, overhanging vegetation. Historically, overhanging vegetation was probably a major source of nutrients fueling the nearshore food web (Simenstad and Wissmar 1985). Shoreline armoring has stopped most of the erosion from the feeder bluffs along the shoreline. Historically, these bluffs were a source of sediment and large trees, each supporting structural and biological habitat elements for juvenile salmon. Specifically, sediment from this source was probably important as a substrate for eelgrass and small crustaceans, important habitat and food resource (respectively) for juvenile salmon. Ample portions of waterfront land have been created by filling what was once intertidal beach. To accomplish this, bulkheads were built in the intertidal areas using rock and other erosion-resistant materials and then the spaces behind these bulkheads were filled to create dry land. The result is a shoreline that is not only armored, but much steeper compared to natural shorelines; and usually without the trees and natural vegetation that can be found in undeveloped shorelines. This armoring has generally altered the substrate from soft material and a gently sloping incline to hard material with a steep incline. These changes reduced availability of prey items and preferred habitat for juvenile salmon, thus reducing the probability of survival of those stocks of chinook salmon that depend on these areas as habitat.

The water and sediment quality of Elliott Bay and east central Puget Sound is variously degraded to properly functioning, depending on specific location. Typically, water quality suffers from street runoff, CSO discharges, petroleum products from various human activities, treated and untreated effluent discharges, pesticides and fertilizers, and garbage from people working and living on the water. The nearshore sediment ranges from contaminated to clean. Various levels of contamination can be found in sediment and contaminants include heavy metals, Poly

Aromatic Hydrocarbons (PAHs), and a variety of other compounds. The waterfront adjacent to Seattle and the Duwamish Estuary contain contaminants from turn-of-the-century activities, industrial liquid wastes, and the deliberate dumping of material into the nearshore waters of Elliott Bay and the Duwamish River. All of these materials have contributed to the contamination sediments in the Duwamish River and Elliott Bay. These contaminated sediments can become "mobilized" via turbulence from ship propellor wash. Mobilization involves the suspension of bottom sediment into the water column during a turbulence event. Mobilization can result in contaminants moving from one location to others, therefore even without a specific source of contamination a given location, a site that has been cleaned-up can become recontaminated. Some of the nearshore benthic environment has been cleaned up or covered up to "cap" toxic sediments. Thus, there is a patchwork of sediment that ranges from clean to contaminated.

The major sources of contamination in sediments is discussed above. CSOs are an additional source of contamination. The combined sewage and stormwater released from CSOs during storm events contribute to water and sediment quality degradation. Water soluble fractions are most likely removed from Puget Sound through natural processes before they can become a problem for chinook salmon since most of the storm events that cause the majority of CSO discharges occur during the winter months when juvenile chinook are not present in Elliott Bay. However, particulate and floatable fractions within effluent discharges can adversely impact the nearshore sediments. The particulate fraction, especially the portion that is more dense than the overall outfall effluent can be deposited in the vicinity of the outfalls and accumulate. The floatables rise in the water column and enter the microlayer and then become concentrated in windrows that are then moved by currents and wind onshore where the contamination can accumulate, especially in the intertidal substrate.

In summary, the environmental baseline for both the freshwater and estuarine areas of concern to this consultation are degraded. Almost any action that reduces or eliminates sources and amounts of contaminated materials will be beneficial to the Cedar and Green/Duwamish chinook salmon stocks.

IV. EFFECTS OF THE ACTION

The effects of the action will occur in fresh and marine waters, primarily impacting two stocks of chinook salmon. In freshwater, the action will effect the Cedar River/Lake Washington basin stock of chinook salmon. In marine waters, the proposed action will affect the Green/Duwamish River stock. To a much lesser degree, the project will affect the Cedar River/Lake Washington basin stock and other stocks that may use Elliott Bay and east central Puget Sound as a forage and migration area. Effluent from this action will be split between three outfall locations: two in Elliott Bay, one at -20 feet MLLW, the other at -50 to -60 feet MLLW, offshore of the shallower outfall, and the third outfall location is the West Point Sewage treatment facility outfall located in deep water (~233 feet) generally north of West Point.

A. Direct Effects

Direct effects are the direct or immediate effects of the project on the species or its habitat. Direct effects result from the agency action, including the effects of interrelated actions and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this consultation as they will be the subject of separate consultations under Section 7 of the ESA.

Direct effects of the action are centered about the construction of the Denny Way CSO, the Primary Treatment Outfalls, and the removal of the CSO number 125 from Lake Union. The direct effects from the removal of CSO number 125 will be insignificant to listed species. There may be a small plume of sediment during outfall removal, but this work will be done during the time of the year when fish are not present and there will be an extremely low probability of impact to chinook salmon.

The construction work that will accompany the installation of two outfalls in the marine environment will involve trenching, piling driving, pipe installation and backfilling the trench. Once the pipe leaves the trench it will be placed on the bottom and covered with a "concrete mattress" for protection from fishing gear and anchors. The effects of these activities will be very limited and should not cause significant harm to listed species because the work will be done during a time of the year when juvenile salmon are not present and most of the disturbance to the substrate will have recovered prior to the spring forage season. The trench is sufficiently narrow that any benthic and epibenthic community displaced by construction should return quickly, generally within the first year after construction. Since the work is scheduled during late summer to mid-winter, after the fish leave the area, benthic and epibenthic communities should have recovered in the disturbed areas by the following spring.

The added underwater "structure" placed in the nearshore and intertidal areas will add directly to salmonid habitat by increasing the area of attachment places for macro algae. The large woody debris will act as both habitat for small crustaceans and a source of nutrients for the nearshore food webs.

1. Lake Union/Ship Canal

The removal of the one CSO outfall (number 125) from Lake Union will improve conditions over the baseline. This work should be completed while juvenile salmon are not present, and should therefore have an insignificant effect on the Cedar River/Lake Washington basin chinook salmon stock. Once the CSO outfall is removed and controlled, and effluent is routed away from Lake Union, the water and sediment quality should improve, especially in the nearshore areas. Overall, this action is positive for Lake Union and the Ship Canal, since the amount of contaminants entering these water bodies

will be decreased. The remaining CSOs will be controlled to one event per year per outfall and the CSO volume will be reduced from 100 mg/year (current condition) to 1 mg/year after project completion.

2. Elliott Bay

The proposed action includes two distinct phases in Elliott Bay. One is the construction of the two outfalls, the other is the operation of these outfalls. The CSO is to be located in about -20 feet of water (MLLW) and about 120 feet offshore. The other treated CSO outfall will be located about 490 feet offshore in about -50 to -60 feet MLLW. The CSO outfall will serve as an overflow outlet if the storage facility under Mercer Street is overwhelmed by a major storm event, or during a power failure. In these types of events, the CSO will discharge untreated combined sewage and stormwater into Elliott Bay. The design specifications call for this to happen only once per year, on average. The release of untreated effluent will adversely effect the water quality of Elliott Bay, at least during and shortly after the event. Furthermore, such discharges will adversely effect nearshore and intertidal sediment. Sediment effects will most likely remain, and lead to the accumulation of contaminants in these sediments. Some contaminants are bioactive and will find their way into the food chain and may result in reduced probability of survival of salmon that forage in the impacted areas. Importantly, the occurrence of such events will be limited to once per year by design.

The outfall discharging treated CSO combined sewage and stormwater located at -50 to -60 feet MLLW will release material that has undergone CSO treatment. CSO treatment involves the removal of "settleables and floatables," specifically this means that particulates that are more dense than the effluent will settle out before discharge of the treated effluent. Additionally, some floatable materials will be removed by screens. A large amount of the toxic material, especially heavy metals, adhere to particulates and are thus removed with the settleables. It is expected that CSO treatment will achieve about 18% removal of suspended solids. The screening process removes additional contaminated material. Remaining contaminants will find their way into the water where, via wind and currents, they will be moved inshore and thus find their way into the sediment and then into the juvenile salmon food chain.

3. East Central Puget Sound

The proposed action will eventually lead to increased amounts of treated effluent into the deep waters via the West Point Treatment facility outfall. The effluent from the treatment plant has undergone secondary treatment and the majority, but not all, of contaminants have been removed. This effluent is put into the water column at a depth that moves most of the material out of Puget Sound. Most of the material that is released from the outfall will move out of Puget Sound without reaching the surface or coming in contact with the benthos, thus it is not of concern to this consultation. However, as much as ten percent of the effluent may reach the surface microlayer and might cause adverse effects

to aquatic organisms (Hardy et al. 1987(a), Word et al. 1990) and therefore chinook salmon juveniles. The microlayer is discussed in the next section.

Non site-specific effects. Project activities will affect the microlayer, the thin (generally 10 to 100 microns) surface layer of the water column. The microlayer in the action area contains contaminated materials that are known to be toxic to aquatic organisms (Cross, et al. 1987, Hardy 1997, Hardy, et al. 1997, Hardy and Cleary 1992, Hardy, et al. 1990, Hardy, et al. 1987(b). As much as 10% of the mass of the effluent from the Renton Plant outfall finds its way into the microlayer in as short a time as 12 to 24 hours after discharge (Word, et al. 1990). Since the Renton and West Point treatment plants are both secondary treatment plants, the West Point outfall effluent probably also finds its way into the microlayer. The microlayer is a naturally occurring feature on the surface of water bodies. In Puget Sound, the primary source of material in the microlayer is decomposition of plankton where the light materials from decomposition (generally oils) float to the surface where they form into windrows. Another source of material to the microlayer is anthropogenic - from sewage outfalls and other sources. The material from sewage outfalls that makes its way to the surface concentrates in the microlayer and is then moved around by winds and currents. There are three major fates of this material: 1) photo decomposition of the material that can be decomposed this way, 2) material is transported out of Puget Sound, and 3) material deposits on intertidal substrate - this is similar to what happens in the formation of a bathtub ring. Of concern to this consultation is the material that deposits in the intertidal. There are two major ways that this material might effect chinook salmon: 1) direct toxic effects to juveniles migrating and foraging in areas where microlayer concentrated toxic compounds are located, and 2) the contaminants that deposit on the intertidal substrate may be incorporated and concentrated in the benthic food chain and subsequently eaten by juvenile salmon. Depending on tissue concentrations, these contaminants may reduce the probability of survival of juvenile chinook salmon.

4. Nearshore Structure

The installation of the "structure" in the nearshore and intertidal area of the Elliott Bay project site will add value to the salmonid habitat. The boulders and large woody debris will enhance the production of macro algae and small crustaceans that are preyed on by juvenile salmon.

Effects of Interdependent and Interrelated Actions. Regulations implementing the Act of 1973, as amended, require that the NMFS consider the effects of the activities which are interrelated and interdependent to the proposed Federal action (50 CFR Part 402.02). The Act defines interrelated activities as those which are part of a larger action and depend upon the larger action for their justification, and interdependent activities as those projects which have no independent utility apart from the action that is under

consideration. Both interrelated and interdependent activities may be addressed by applying the "but for" test, which evaluates whether any action and its associated impacts would occur "but for" the proposed action.

The construction of the outfalls will lead the operation of the facilities and the subsequent (albeit reduced) contamination of the local environment. The removal of the CSO outfalls in Lake Union will have the interrelated action of reducing the discharge of untreated effluent into the lake and Ship Canal. The effects of these actions have been described above.

In summary, the activities underlying the proposed action will have both adverse and beneficial direct effects on listed salmon. The removal and control of CSO outfalls in Lake Union will have a positive impact to the Lake Union and Ship Canal environment. The addition of "structure" to the Elliott Bay construction area will positively impact salmon habitat. The construction activities of the Denny Way CSO and associated outfalls will not have a significant effect on listed salmon if it is done during the time of the year when juvenile chinook salmon are not present. The operation of the storage and treatment system will have adverse impacts to listed salmon via the release of contaminated materials to the environment and subsequent accumulation in the nearshore and intertidal sediments. However, the amount released to the environment will be substantially reduced over current levels. Therefore, even though contaminated material will continue to be introduced to the environment, it will be at a much lower rate, from over 50 CSO events per year to one CSO event per year. Overall, the risk to the listed species from this project is small. It is certainly less than doing nothing at all. By building the proposed facility, the amount of untreated combined sewage and stormwater that enters Lake Union and Elliott Bay will be reduced, thus reducing the rate of contamination into the nearshore environment and subsequent effects to listed chinook salmon.

B. Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action. Indirect effects may include other Federal actions that have not undergone Section 7 consultation but will result from the action under consideration. These actions must be reasonably certain to occur, or they are a logical extension of the proposed action.

Indirect effects of the proposed action can be described in two ways. Such effects include general environmental effects that flow from the operation of the projects after construction is complete. Indirect effects for the purposes of this consultation specifically relate the species responses to those operations. The effects of the operation of the system include release of contaminated materials into the water column. These materials include contaminated particulate materials, some of which are sufficiently dense that they will settle out near the outfalls; and a light fraction from the effluent (floatables) that can become entrained in the upper water column

and microlayer and subsequently find its way to the nearshore and/or intertidal and then either contaminate (if the substrate is clean) or add contamination (if the substrate is contaminated) to the substrate. Given the current state of the technology, these effects are unavoidable; probably the best that can be done is to minimize the effects by reducing, to the extent possible, the volume of contaminated material released to the environment.

C. Species' Response to the Effects of the Proposed Action

The construction and operation of treated and untreated CSO outfall pipes may cause a reduction in acceptable habitat for juvenile chinook salmon in the nearshore estuarine areas of Elliott Bay and eastern central Puget Sound. There will be short-term and long-term effects on juvenile chinook salmon habitat, specifically the trenching, pile driving and outfall pipe placement. The trench will be confined to an area that is less than 40 feet wide and extend to about 120 feet offshore. Within one or two years after construction most of the impacts to the benthic community will be undetectable and the food web (chain) will have been be reestablished in the trenched area. The area that will be impacted by the construction will be minimal (less than .0003 percent) compared to the total area of similar depth in Elliott Bay. In addition to the trench, an additional 380 feet of outfall pipe will be laid. To accomplish this, piling will be driven into the substrate and capped with a cradle that will hold the outfall pipe. The top of the cradle will be at the substrate surface level and thus the outfall pipe will be located at the level of the substrate. After the outfall pipe is in place it will be covered with a cement blanket to protect it from fishing gear, anchors, etc. The area occupied by the cover will not provide necessary habitat for the food organisms of juvenile chinook salmon, in effect the productivity of the benthos will be reduced, albeit very little, as a fraction of all comparable habitat in Elliott Bay and the estuarine action area.

The construction activities and outfall pipe installation will have short term effects that should recover within one to two years after disturbance. The outfall pipe construction will also have a long-term impact that will result in the loss of benthic invertebrate habitat for a prolonged period of time, at least on the scale of decades. However, the amount of benthic invertebrate habitat that will be lost is very small compared to all of this type of habitat available in the Elliott Bay and eastern central Puget Sound area. Any juvenile chinook salmon that encounter this disturbed area after construction will find a swath of substrate with fewer available forage organisms; however, the juveniles will continue to search for food and given that the swath is less than 40 feet wide, they will readily find food a short distance away. Thus, the effects to the species from construction will be minimal and probably undetectable.

The operation of the entire system, however, is a different matter. The combined sewage and stormwater from the CSO outfalls, and the West Point Treatment Plant outfall may have long-term consequences for juvenile chinook salmon. The fate of the effluent released from the outfalls is detailed above, but in summary will either: 1) leave Puget Sound, 2) enter the substrate near the outfalls, or 3) enter the nearshore and intertidal substrate. The effluent that leaves Puget Sound is not of concern to this consultation. The treated effluent that enters the substrate near the CSO treatment- and West Point Treatment Plant-outfalls is likewise of little concern since

these outfalls and their surrounding substrate are located in over 50 feet of water. Juvenile chinook salmon can be found to depths of about 40 feet (Healey 1991). The effluent from the treated and untreated CSO-, and West Point Treatment Plant-outfalls that reaches the surface and near surface waters and finds its way into the nearshore and intertidal areas of Elliott Bay and east central Puget Sound may have an adverse impact to juvenile chinook salmon. The mechanism is detailed above, but a summary is that contaminants from the outfalls that enter the substrate may find it way into the food chain, subsequently be ingested by juvenile salmon, and this may result in a reduction in the probability of survival (Tracy Collier, personnel communication). Over time, on the scale of years to decades, King County data (see Appendix C) indicate that several contaminants will accumulate in the substrate. This accumulation, if it reaches sufficient concentrations, can cause adverse impacts to juvenile salmon growth rates and result in reduced survival. However, the current state of affairs where there are about 50 to 75 untreated effluent CSO discharges into Elliott Bay and Lake Union is much more detrimental to juvenile chinook salmon when compared to the expected circumstances after the project is up and running. The untreated discharges of combined sewage and stormwater into Lake Union, the subsequent contamination of the nearshore substrate, and the fact that heavy metals are known to be more toxic in freshwater that saltwater, means that the reduction of combined sewage and stormwater into Lake Union will be an overall benefit to the Puget Sound chinook salmon ESU. Once the project is operational, the amount of untreated combined sewage and stormwater that enters the action area will be greatly reduced over current conditions. Some of the settleable particulates, which will have contaminants adhering to them, will be removed. The amount of untreated water will be drastically reduced and the time of the year when the untreated event occurs (generally winter) will be when the Duwamish River is also at higher water flows thus assisting in the flushing of the effluent. The reduction in contaminated material reaching the Puget Sound environment and the reduced rate of accumulation in the sediments will be an improvement over current effluent and contaminate accumulation circumstances, but will not be a sufficient reduction in contamination to result in no adverse impacts.

The "structure" (boulders and large logs) added to the nearshore and intertidal benthos will enhance salmonid habitat in several ways including added food resources. The effects to the species is generally positive and the large woody debris is particularly valuable since so much of this material has been lost in the nearshore areas over the last 100 to 200 years. This is a small step to return some of the function that was, once upon a time, part of the nearshore and intertidal habitat of Puget Sound.

Given the information on the existing environmental baseline, status of the species and effects of construction, subsequent operation of the project and added "structure," it is unlikely that the proposed project will jeopardize the continued existence of the Puget Sound chinook salmon ESU.

D. Cumulative Effects

Cumulative effects include the effects if future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future

Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the act.

There are not any on-going Federal or non-Federal management activities within the action area that this Biological Opinion addresses. There may be future Army Corps of Engineers' actions, but actions would require review under Section 7 of the Endangered Species Act.

The major cumulative effects that occur in Elliott Bay and to some degree in eastern central Puget Sound are oil spills from bilges, fueling, and leaking vessels; antifouling paint sloughing from vessel bottoms; remobilized contaminated sediment caused by vessel propellor wash; and contaminated Duwamish River sediment.

Oil spills have many sources, some of which are given above. The amount of material from any given spill is generally small, but can be many thousands of gallons depending on the event. Although illegal, bilge pumping when no-one is looking or after dark occurs and is a constant source of contamination. Fueling of vessels can result in a source of surface oil films and can frequently be observed near fuel docks. Accidents where oil barges or ship fuel tanks are ruptured can result in large amounts of fuel oils spilled; fortunately, these events are infrequent, but when they occur the amount of oils spilled can be very large.

Vessels are another source of contamination via antifouling or bottom paint. This paint is put on vessel bottoms to discourage aquatic growth on the hull that can result in decreased speed or more fuel consumption to overcome the increase friction due to aquatic growth. This antifouling paint sloughs off over time, generally 1 to 3 years, and deposits in the substrate. One of the common antifouling paints is tri-butylating and has been linked to reduced survival of juvenile salmon (James Meador, personnel communication).

When vessels of sufficient size and power, such as ferry boats, operate near the shoreline, they will stir up the sediment and create a sediment plume. Vessels that do this in areas where there is contaminated sediment can cause the mobilization of this material and result in the contaminated material drifting with the currents for some distance, thus moving contaminated material further "downstream" and perhaps contributing contamination to places such as existing outfall sites.

The Duwamish River has contaminated sediment that can become mobilized into the water column, especially when it floods. This material can be moved "downstream" and add to the contamination of the sediment near CSO outfalls in Elliott Bay.

Overall, these sources of contaminated sediment far outweigh the amount of contamination that will be put into Puget Sound marine waters from the proposed project.

V. CONCLUSION

After reviewing the current status of chinook salmon, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is the NMFS' biological

opinion that the proposed project is not likely to jeopardize the continued existence of Puget Sound chinook salmon. Furthermore, critical habitat for chinook salmon will likely not be destroyed or adversely modified. This determination is based on the following analysis: 1) The total amount of habitat impacted by the construction of the outfalls will be far less than .0003% of the area used by juvenile chinook salmon in Elliott Bay, eastern central Puget Sound and the Ship Canal, 2) the total amount of desirable habitat removed from production of benthic and epibenthic invertebrates is far less than .0001% of the total area of similar depth, 3) the removal of the two CSO outfalls in Lake Union will be an overall benefit to the ESU, 4) the shifting of effluent discharge from freshwater to the marine waters will significantly reduce the toxicity of heavy metals, 5) the timing of the construction will be after the juvenile chinook salmon have migrated out of the project areas, 6) treatment of the majority of the combined sewage and stormwater will significantly reduce the contaminants in the discharged effluent, 7) once the entire system is up and running it will reduce the number of untreated discharges of effluent by a factor of at least 50, 8) the amount of untreated effluent will be significantly reduced over current circumstances, and 9) large woody debris and large boulders will be added to the substrate which should improve juvenile salmon habitat in the area. Therefore, the proposed action will not jeopardize the recovery of chinook salmon; and accordingly, the NMFS believes this project, as proposed, will not compromise either the recovery or survival of the species

VI. REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary Federal agency involvement or control over the action has been maintained and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to chinook salmon or its critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of the incidental take is exceeded, any operations causing such take must cease pending reinitiation.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, prohibits taking (harass, harm, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The reasonable and prudent measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in Section 7(o)(2) to apply. If the EPA (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. Implementation of the proposed action is not expected to result in the direct mortality of any listed species.

A. Amount or Extent of Incidental Take

The NMFS anticipates that an undetermined number of Puget Sound chinook salmon may be taken as a results of full implementation of the proposed action. The actual number of individual fish taken as a result of the underlying project is impossible to determine. Incidental take is difficult to quantify because: 1) dead chinook salmon juveniles that can be attributed to the effects of the project are difficult to find, and 2) the absence of juveniles in the project area is not conclusive proof of modification of the habitat. The NMFS anticipates that the benthic and epibenthic invertebrate abundance many be depressed in the construction area within Elliott Bay for one to two years. The NMFS also believes that sediment in the area of the new outfalls may become contaminated over time, years to decades. The qualitative results of such effects can be described in this opinion, but no techniques presently exist to correlate those effects with the potential numerical extent of take. Therefore, for the purposes of this opinion, the extent of take is correlated to the extent of habitat affected. Accordingly, the reasonable and prudent measures were developed to address the extent of habitat effects, as described below.

The NMFS will be notified within 24 hours upon locating a dead, injured, or sick chinook salmon specimen. Initial notification must be made to the nearest NMFS Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact our regional law enforcement office at (206)526-6133 or (360)676-9268.

In the accompanying Biological Opinion, the NMFS determined that this level of anticipated incidental take is not likely to result in jeopardy to chinook salmon, or critical habitat for chinook salmon because this project, as proposed, will not compromise either the recovery or survival of the species due to the small amount of habitat effected in Elliott Bay and east central Puget Sound.

B. Reasonable and Prudent Measures

The NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. Protect juvenile chinook salmon through the use of an appropriate construction period. In-water construction will not occur during the nearshore estuarine migratory and rearing period.

2. Chinook salmon will be protected from exposure to contaminated sediment.

C. Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the EPA and the applicant, King County, must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. In-water construction will not occur from March 15 through July 15 of any year.

2a. Any contaminated material, removed during the trenching operation, will be disposed of in an approved upland disposal site(s). Criteria for contamination will be defined by Washington State Sediment Standards.

2b. King County will monitor the sediments in the area of the outfalls (treated and untreated) for the entire life of the project based on the sampling plan in Appendix D. If levels of contamination in the sediment from operation of the outfalls reaches, or exceeds, those listed in Appendix D, King County shall remove the contaminated sediment and dispose of it in an approved upland disposal site(s). If this is impractical and a review of the contamination by disinterested party or parties concludes that the sediment can be successfully capped, then this will be the approved method.

The reasonable and prudent measures, with their implementing terms and conditions are designed to minimize incidental take that might otherwise result from the proposed action. If the action is modified, causing an increase in disturbance levels, such elevated disturbance would imply an increase of incidental take and represent new information requiring review of the reasonable and prudent measures provided. The EPA and its client King County must immediately provide an explanation of the causes of the taking and review with the NMFS the need for possible modification of the reasonable and prudent measures.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and

threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information.

The NMFS recommends that the following conservation measures be implemented, after discussing the proposed project with the EPA and King County:

1. The action proponent should manage the project to minimize impacts to the benthic nearshore and intertidal habitat in the project area.

2. NMFS should be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

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APPENDIX A
Letter from EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

Reply To
Attn Of: OW-130

JAN 13 2000

Mr. Gerry A. Jackson, Supervisor
North Pacific Coast Ecoregion
Western Washington Office
U.S. Fish and Wildlife Service
510 Desmond Drive Southeast, Suite 102
Lacey, WA 98503

RE: Request for Concurrence—Denny Way/Lake Union CSO Control Project

Dear Mr. Jackson:

As Lead Federal Agency for the Denny Way/Lake Union CSO Control Project, we submitted the Biological Assessment for the project to Bobbi Barrera in the U.S. Fish and Wildlife Service Western Washington Office on June 18, 1999. The federal action on the project is a $35 million grant from EPA.

At the time of the submittal, we requested concurrence with an effect determination of **Affects, But Does Not Adversely Affect** bull trout, one of the species covered in the Biological Assessment (the others being Puget Sound chinook salmon, coho salmon, and sea-run cutthroat trout). In a letter dated August 16, 1999, you stated that since the bull trout at that time was proposed for listing, the appropriate determination was whether the Denny Way CSO Project was likely to jeopardize the continued existence of the species. You stated that the U.S. Fish and Wildlife Service had concluded that the Denny Way CSO Project was not likely to jeopardize the continued existence of bull trout. You also stated in your letter that the project should be reanalyzed if a new species is listed that may be affected by the project. Because the bull trout was listed as Threatened subsequent to your August 16, 1999, determination, we are requesting a revised concurrence from your department that the proposed action **Affects, But Does Not Adversely Affect** bull trout.

The June 8, 1999, Biological Assessment, previously sent to Ms. Barrera, describes the action to be considered, the specific area that may be affected by the action, the listed species and critical habitat that may be affected by the action, and the manner in which the action may affect the listed species and critical habitat, and provides an analysis of cumulative effects.

King County anticipates awarding the contract for the Mercer Street Tunnel in early February 2000 and award the contract for the Marine Outfalls in April 2000. We therefore look forward to receiving a revised concurrence with **Affects, But Does Not Adversely Effect** within 30 days.

The June 8, 1999, Biological Assessment, previously sent to Mr. Donnelly, describes the action to be considered, the specific area that may be affected by the action, the listed species and critical habitat that may be affected by the action, and the manner in which the action may affect the listed species and critical habitat, and provides an analysis of cumulative effects. The following information and studies have also been provided to Mr. Donnelly to assist with his evaluation:

King County Department of Natural Resources Wastewater Treatment Division and City of Seattle, Seattle Public Utilities. *Denny Way/Lake Union Combined Sewer Overflow Control Project, Phases 2 and 3/4, Final SEPA Supplemental Environmental Impact Statement and NEPA Environmental Assessment*, Seattle, WA, July 1998.

King County Department of Natural Resources Water and Land Resources Division. *The Denny Way Sediment Cap: 1996 Monitoring Report*, Seattle, WA, May 1999.

Striplin Environmental Associates, Inc. *Denny Way/Lake Union CSO Control Project: Sediment Remediation Plan*, Olympia, WA. Prepared for King County and Black & Veatch, May 1999.

King County and City of Seattle. *Denny Way/Lake Union CSO Control Facilities Plan, Phase 2 and 3/4*, Seattle, WA, July 1998.

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Letter from Judy Cochran to Robert Donnelly, 9/23/99, responding to questions raised in 9/7/99 meeting.

Letter from Judy Cochran to Robert Donnelly, 10/1/99, responding to questions raised in 9/7/99 meeting.

E-mail from Judy Cochran to Robert Donnelly, 10/14/99, summarizing and responding to concerns expressed by Robert Donnelly in previous conversation.

E-mail from Judy Cochran to Robert Donnelly, 10/19/99, responding to questions asked in e-mail from Robert Donnelly to Judy Cochran, 10/15/99.

Our understanding is that the formal consultation period will end on Sunday, February 13, 2000, and that we will receive the Biological Opinion within 45 days of that date, i.e., by Wednesday, March 29, 2000. We request that NMFS provide EPA and King County Wastewater Treatment

Division with a draft Biological Opinion so that we may analyze any reasonable and prudent measures recommended by NMFS or statements concerning incidental take prior to NMFS issuing the final Biological Opinion.

As we have discussed with Mr. Donnelly, King County hopes to award the contract for the Mercer Street Tunnel in early February 2000 and award the contract for the Marine Outfalls in April 2000. We therefore look forward to completing the formal consultation process and receiving the Biological Opinion in a timely manner so we can make any needed changes to the project and begin construction in June 2000.

If you have questions or need additional information, please call Judy Cochran, Project Manager, King County Wastewater Treatment Division, at (206) 684-1351.

Sincerely,

John Matthew Harrington
NEPA Compliance Coordinator

cc: Tim Ceis, Director, King County ESA Policy Coordination Office
John Briggs, Attorney, King County Prosecuting Attorney's Office
Judy Cochran, Project Manager, King County Wastewater Treatment Division
Shirley Marroquin, Environmental Planning Supervisor, King County Wastewater Treatment Division

APPENDIX B

The Biological Assessment

Denny Way/Lake Union Combined Sewer Overflow

Biological Assessment

Prepared for

King County Department of Natural Resources,
Wastewater Treatment Division

June 8, 1999

CH2MHILL
CH2M HILL, Inc.
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A Correspondence for National Marine Fisheries Service and U.S. Fish and Wildlife Service

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Denny Way/Lake Union CSO Biological Assessment

Introduction

The purpose of this Biological Assessment (BA) is to review the proposed Denny Way/Lake Union Combined Sewer Overflow (CSO) Control Project in sufficient detail to determine if the proposed action may affect any of the threatened, proposed, or candidate species listed below. This document is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (19 U.S.C. 1536 (c)) for the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

The biological assessment analyzes the following species:

- Threatened
  - Puget Sound chinook salmon (*Oncorhynchus tshawytscha*)
- Proposed
  - Bull trout (*Salvelinus confluentus*)
- Candidate
  - Coho salmon (*Oncorhynchus kisutch*)
  - Sea-run cutthroat trout (*Oncorhynchus clarki clarki*)

Project Description

The proposed project is the construction and operation of the Denny Way/Lake Union Combined Sewer Overflow (CSO) Control Project. This is a joint project of King County and Seattle Public Utilities to control CSOs into Lake Union and from the Denny Way CSO into Elliot Bay, as required by the State of Washington regulations. The project is partially funded by a $35 million grant from the U.S. Environmental Protection Agency (EPA). The project area is located within the City of Seattle (Figure 1). Facilities would be located in south Lake Union along Lakeview Boulevard East; under Interstate 5 and along Galer Street; at 545-601 Elliott Avenue West; and in Elliott Bay Park, Myrtle Edwards Park, and Elliott Bay. A CSO storage tunnel would be constructed under Mercer Street from Elliott Avenue West to the Roy Street/Eighth Avenue intersection (Figure 2). The following description is an overview; the interested reader should refer to the Final SEIS for details.

Construction

The proposed construction of the Denny Way/Lake Union CSO Control Project consists of the following actions:

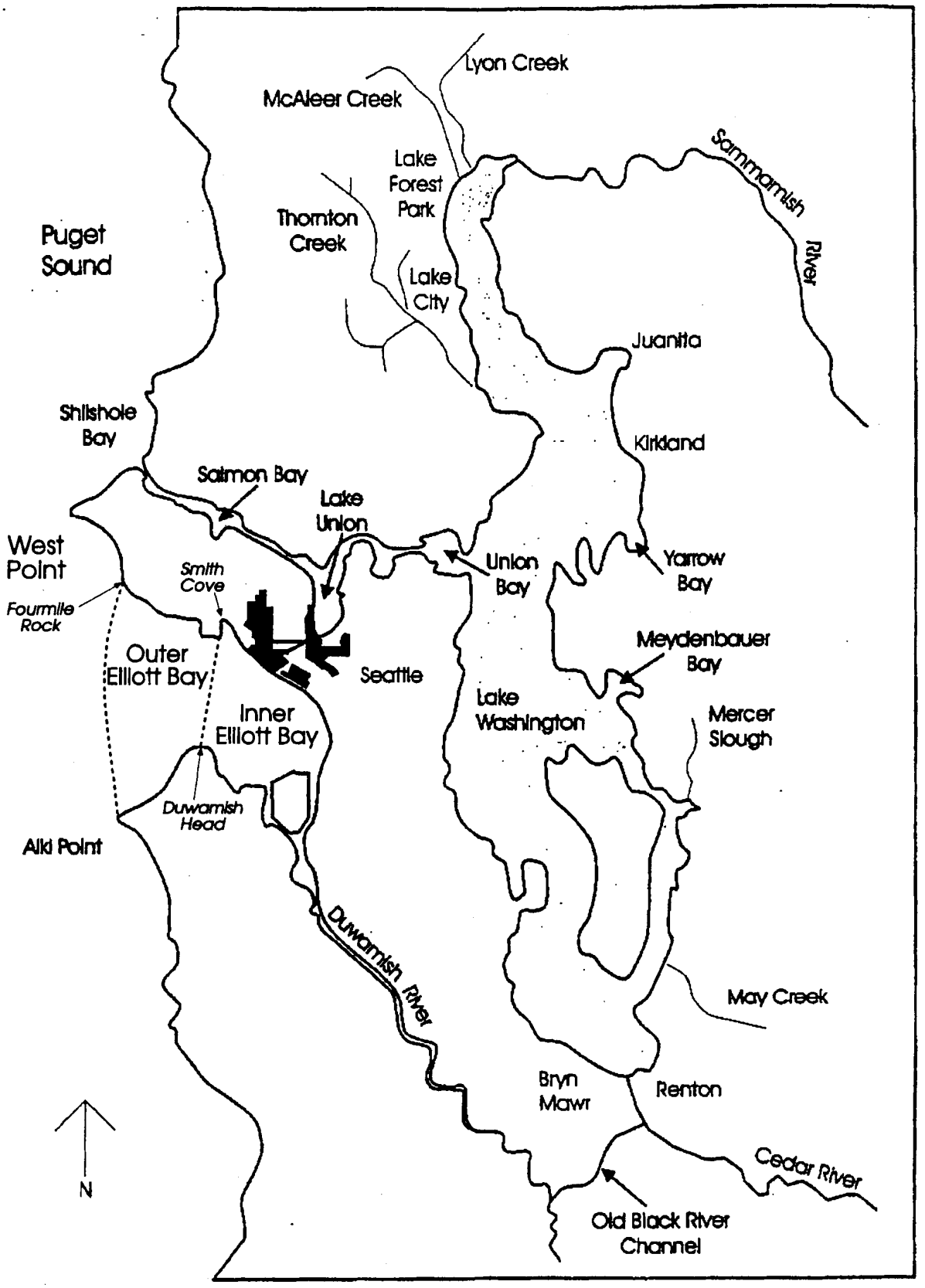

Figure 1. **Project Site Vicinity Map**

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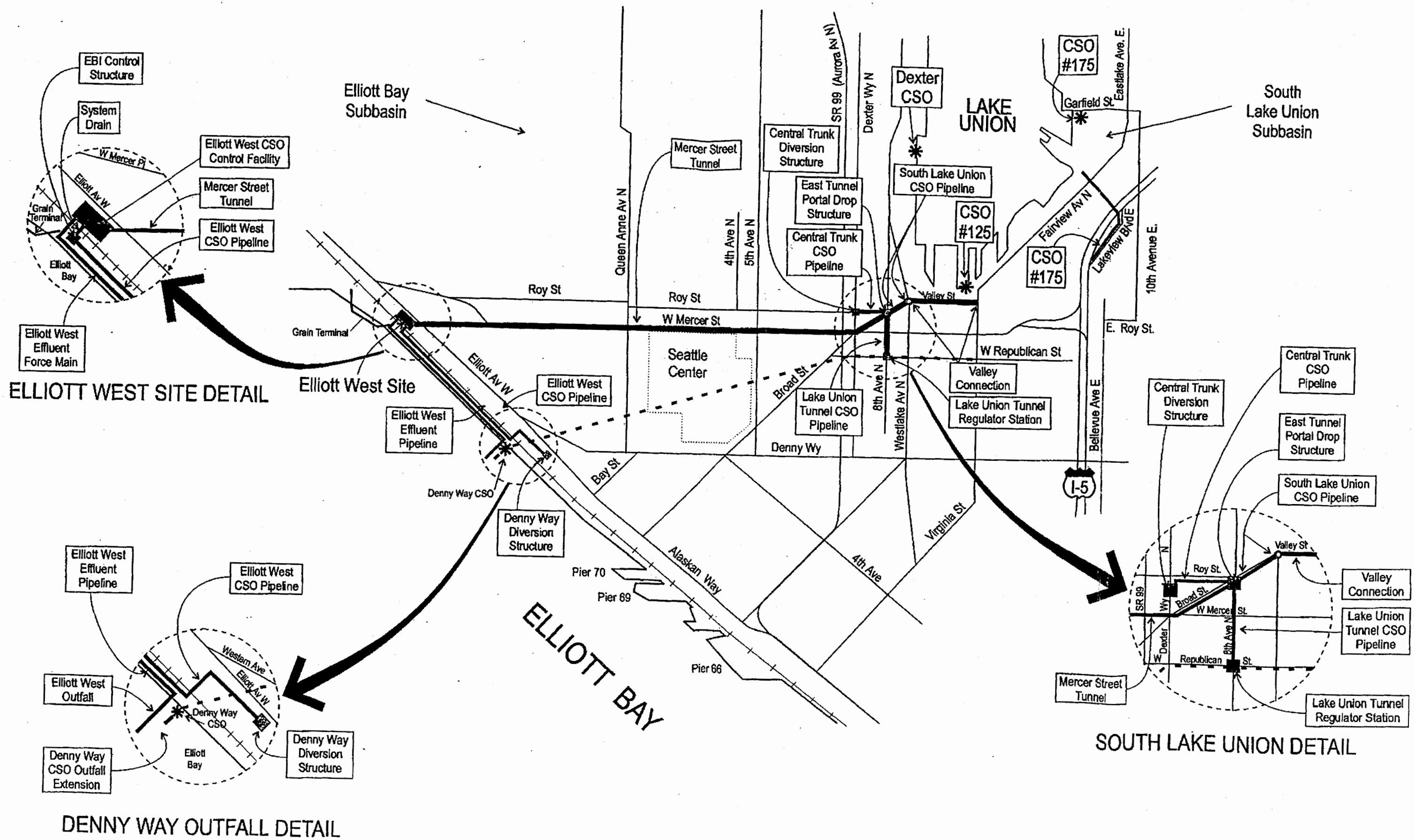

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Figure 2. **CSO Storage and Treatment Facility Locations**

SOURCE: KING CO., 1998

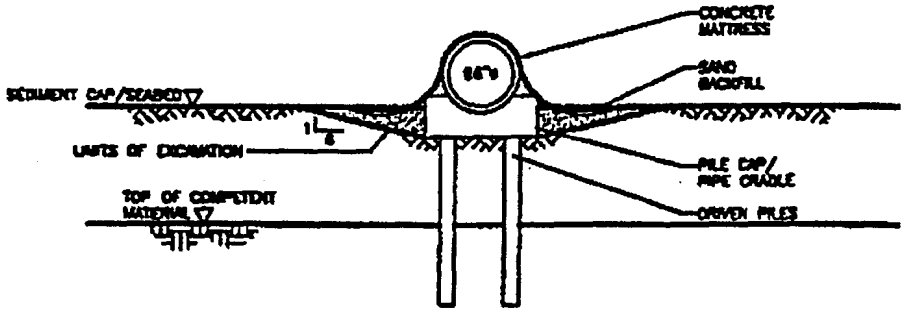
- Connecting the City of Seattle's improved stormwater conveyance facilities on the south and east sides of Lake Union.
- Constructing two diversion/regulator structures and three 54-inch to 84-inch-diameter pipelines to convey flows from the south Lake Union area to a new Mercer Street tunnel. The pipelines would be constructed by open-cut trenching.
- Eliminating the City's CSO 175 and 125.
- Constructing a new 12-inch to 30-inch-diameter pipeline for CSO 175, using open-cut trenching methods. The outfall is essentially at lake level minimizing in-water construction.
- Constructing an approximately 6,200-foot-long, 14-foot to 15-foot-diameter storage tunnel (the Mercer Street tunnel) extending westward beneath Mercer Street from a point near the intersection of Roy Street and Eighth Avenue North to Elliott Avenue West. The storage capacity of the tunnel would be approximately 7 million gallons. A tunnel-boring machine would be used for construction.
- Constructing two diversion/control structures and installing three 72-inch to 108-inch-diameter pipelines to convey flows to and from the new tunnel. The pipelines would be constructed by open-cut trenching.
- Constructing a 250-million-gallon-per-day (mgd) pump station and CSO treatment facility located at the west portal of the Mercer Street tunnel.
- Constructing a new 490-foot-long, 96-inch to 106-inch-diameter outfall into Elliott Bay to a depth of –60 to –70 feet mean lower low water (MLLW).
- Constructing a 100-foot-long, 96-inch to 120-inch-diameter extension of the existing outfall to a depth of approximately –20 feet MLLW to discharge untreated CSOs during the one event per year when flows exceed system capacity (Figure 3).

Construction is expected to begin in 2000 and be completed in 2003.

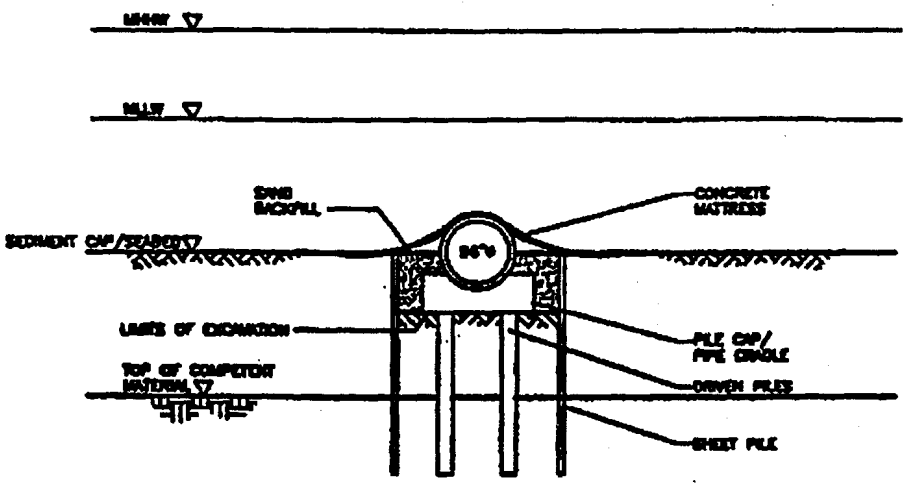
Operation

During operation, combined wastewater would flow through the existing 60-inch to 72-inch diameter, Lake Union tunnel until the capacity of the tunnel is reached. At that point, flows would be directed to the Mercer Street tunnel for storage. Meanwhile, excess flows up to 70 mgd would be pumped from the Elliott Bay Interceptor (EBI) into the CSO control facility at the Elliott West site, and flows from the Dexter Street Station would be diverted from the existing Central Trunk to the Mercer Street Tunnel. When tunnel storage approaches capacity and the EBI has insufficient capacity to accept additional flows, flows would be treated at the CSO control facility and discharged to the Elliott West Outfall.

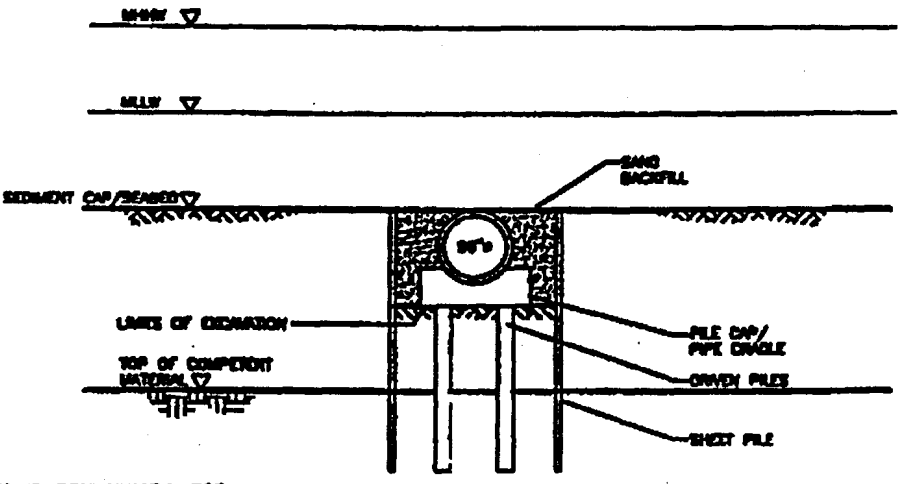
Treated flows would be disinfected with sodium hypochlorite to reduce pathogens, and residual chlorine would be removed from the disinfected effluent prior to discharge to receiving waters. In the event of a storm occurrence that exceeds the capacity of the Elliott West CSO Control facility and outfall beyond the one-year storm, untreated CSO flows would be discharged through the Denny Way CSO



PILE SUPPORTED PIPELINE AT MUDLINE WITH CONCRETE MATRESS



PILE SUPPORTED PIPELINE BURIED TO MID-DEPTH WITH CONCRETE MATRESS



NOTE:
ALL FACILITIES SIZING IS PRELIMINARY, FOR THE PURPOSE OF DEFINING THE PLAN, AND SUBJECT TO CHANGES AS THE PROJECT EVOLVES. FINAL SIZING WILL BE DETERMINED DURING FINAL DESIGN.

PILE SUPPORTED PIPELINE BURRIED TO FULL DEPTH

Figure 3. **Offshore Pipeline Construction Cross Sections**

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SOURCE: KING CO., 1998

outfall extension, and treated flows would be discharged through the Elliott West outfall.

The operation of the CSOs will change as a result of the project. Table 1 summarizes the discharge volumes, frequency of discharges, and treatment level at each CSO for the present and future conditions. Discharge of untreated CSO flows is expected to occur once per year on average.

TABLE 1
Annual Combined Sewer Overflows in the Denny/Lake Union Basin
Comparison of Before and After Project Completion of the Preferred Alternative

Baseline (1981-83)	**Average Total Volume (MG/yr)**	**Avg. Frequency per Outfall (overflows/yr)**
Lake Union CSOs	**101**	**4 to 115**
Seattle's East Lake Union Outfalls	86	
Phase 1 (4 outfalls)	73.2	10 to 115
CSO #125	3.2	30
CSO #175	9.6	115
King County's Lake Union Outfall	15	
Dexter Regulator	15	4
Elliott Bay CSOs	**405**	**51**
Denny Regulator	405	51
Projected (Completion of Project)		
Untreated CSOs		
Lake Union CSOs	**<0.1**	**1 or less**
Seattle's East Lake Union Outfalls	<0.1	1 or less
Phase 1 (4 outfalls)	<0.1	1 or less
CSO #125	0	0
CSO #175	0	1
King County's Lake Union Outfall	1.0	
Dexter Regulator	1.0	1
Elliott Bay CSOs	**7**	**1**
Denny Regulator	7	1
Total Untreated CSOs	**8**	**1 or less**
Treated Flows		
Treated at Elliott West site	281	
Treated at West Point	278	
Total Treated Flows	**567**	**8 to 20**

Source: King County Department of Natural Resources et al., 1998

Operation is expected to begin in 2003.

Purpose and Need of Project

Much of the City of Seattle is served by a combined sewer system rather than separate sanitary and storm sewers. During wet weather, the volume of sanitary sewage and

stormwater entering the combined sewers may exceed collection system capacity, resulting in overflows at designated CSOs.

The Washington State Department of Ecology (Ecology) has adopted a number of regulations pertaining to municipal waste discharges, including CSOs (WAC Chapter 173-245). The regulations require that CSOs be controlled "such that an average of one untreated discharge may occur per year." Currently, CSO discharges from the Denny Way Regulator Station into Elliott Bay occur about 50 times per year, resulting in an annual discharge volume of 450 million gallons. The Denny Way/Lake Union Project has been initiated to meet all current federal and state requirements for control of the City of Seattle's CSO discharges into east and south Lake Union and control of the County's Dexter CSO to Lake Union and Denny Way CSO to Elliott Bay. This project will result in long-term water quality improvements in both water bodies and a reduction in the potential for adverse human health and environmental impacts.

History of Project

In both Metro's and Seattle's 1988 CSO Control Plans, it was recognized that a close hydraulic relationship exists between the facilities owned and managed separately by Seattle and Metro. The Denny and Lake Union basins are one example of that important relationship. Further study indicated the potential for both agencies to optimize CSO control through joint planning; without such planning it was possible for either agency to limit the options of the other and potentially cause increases in CSO discharges to Lake Union or Elliott Bay.

Seattle and Metro began developing the joint Denny Way/Lake Union CSO Control Project in 1991. The intention was to consider King County and Seattle facilities as a single unit in recognition of the close hydraulic connection between facilities and to maximize the ability of both agencies to improve water quality. The City of Seattle and King County entered into a formal agreement on October 23, 1995, specifying how a joint project would be implemented by both jurisdictions. The joint project would allow the parties to pool their resources to design and construct the best system-wide solution.

In 1993, Metro began a planning level analysis for the Denny Way portion of the joint project as part of a system-wide update of Metro's CSO Control Plan and the Regional Wastewater Services Plan (RWSP). The analysis of the Denny Way CSO was again considered as a single unit with Seattle's facilities at Lake Union. The planning for the Denny Way CSO was accelerated both to take advantage of the opportunity to maximize CSO control presented by a joint project, and to be prepared to make an application for a federal Infrastructure Grant of $35 million. The grant was awarded to King County for the joint project in 1995, with Seattle as a subgrantee.

Together, the constructed alternative for Phase 1 and the preferred alternative for Phases 2 and a combined 3/4 of the Denny/Lake Union Project meet the 1991 objectives established by Metro and Seattle for CSO reduction. Since the Facilities Plan for Phase 1 was approved, the Denny/Lake Union Project has been refined from completion of Phases 1, 2, and 3 to achieve a 50 percent reduction in CSOs to completion of Phases 1, 2 and a combined 3/4 to control the affected CSOs to one overflow per outfall per year.

A joint final SEPA Supplemental Environmental Impact Statement (SEIS) and NEPA Environmental Assessment (EA) for the Denny Way/Lake Union Combined Sewer Overflow (CSO) Control Project Phases 2 and 3/4 was prepared by King County and the City of Seattle in July 1998. Three alternatives were compared in the final SEPA SEIS/NEPA EA. The preferred alternative (Alternative 1), now the proposed project, involves CSO storage and treatment, transporting flows from the south Lake Union area through a tunnel to Elliott Avenue West for treatment or transport to the West Point Treatment Plant. Alternative 2 is a partial separation and storage project, and Alternative 3 is the No Action Alternative. Following completion of the final SEPA SEIS/NEPA EA, a Finding of No Significant Impact (FONSI) was issued. The Facilities Plan for Phase 2 and 3/4 was approved by the Department of Ecology in October 1998.

Consultation with NMFS and USFWS

On March 21, 1997, the USFWS issued a letter of concurrence (FWS Reference 1-3-96-I-442) for a Biological Assessment dated July 1, 1996. The Biological Assessment made a determination that the proposed project is "not likely [to] adversely affect " the marbled murrelet (*Brachyramphus marmoratus*). Since that time, chinook salmon and bull trout have been listed or proposed for listing. As a result, a formal request for a list of species potentially found in the project area was again made to USFWS and NMFS (Appendix A), necessitating this Biological Assessment.

Description of Project Area

As stated earlier, facilities would be located in the south Lake Union area along Lakeview Boulevard East; under Interstate 5 and along Galer Street; at 545-601 Elliott Avenue West; and in Elliott Bay Park, Myrtle Edwards Park, and Elliott Bay. A CSO storage tunnel would be constructed under Mercer Street from Elliott Avenue West to the Roy Street/Eighth Avenue intersection. Two water bodies are affected by the proposed project: South Lake Union and Elliott Bay.

South Lake Union

Lake Union is approximately 581 acres (235 hectares) in area, with a mean depth of 32 feet (10 meters). The deepest section in the lake, a canyon 50 to 65 feet (15 to 20 meters) deep, is located parallel to and near the western shore. Water elevation is controlled at the Chittenden Locks and is about 2 feet higher during the summer months.

Water circulation in Lake Union is complex. In general, water flushes from Lake Union to Puget Sound relatively quickly during the winter months with high water inputs from Lake Washington. During certain periods of the year, Lake Union is stratified by two separate processes: 1) intrusion of a saline wedge starting at the locks, and 2) thermal heating of the upper water layer by solar radiation. The degree of stratification is primarily dependent on water temperature and secondarily on the degree of saltwater intrusion from the locks.

Elliott Bay

Elliott Bay is defined as the waterbody east of a line between Fourmile Rock and Alki Point. Inner Elliott Bay is defined as that area east of a line between Duwamish Head and Smith Cove; outer Elliott Bay lies to the west of this line (King County Metro, 1995b). Elliott Bay is

approximately 8 square miles (21 square kilometers) and located on the eastern shore of central Puget Sound. The inner bay receives fresh water from the Duwamish River and most of the stormwater runoff from the highly developed drainage basin of metropolitan Seattle. The most notable bathymetric feature is a north-south oriented submarine canyon (less than 600 feet [200 meters] long), which divides Elliott Bay into the eastern (inner) and western (outer) bay.

Elliott Bay is a very complicated hydraulic system influenced by tidal motions, fresh water from the Duwamish River, wind stress, and boat travel. Three water masses flow in different directions within Elliott Bay. These water masses are separated into layers: an upper layer of the bay flowing to the north, a middle layer flowing south, and a lower layer flowing west, following the bottom contours. This flow pattern is caused by an input of fresh water flowing into Elliott Bay and is described as estuarine circulation.

History of Project Area Relevant to Project

Lake Union and Elliott Bay have been centers for industrial and commercial activities in Seattle for more than one hundred years. Since the late 1880s, major industrial, commercial, and residential developments have expanded in the immediate watershed and surrounding areas. This increased development led to considerable discharges of raw sewage and stormwater, causing releases of nutrients, metals, and organic chemicals.

Approximately 26 square miles (67 square kilometers) of highly developed land in metropolitan Seattle surrounds Lake Union and Elliott Bay. Both waterbodies have historically been and continue to be highly affected by this highly urbanized land use. Currently, the primary sources of pollutant loadings to Lake Union and Elliott Bay are from discharges of industrial wastewater, marina and boat waste, and CSOs.

Inventories and Surveys

A subtidal marine habitat investigation was conducted of the property located offshore of the existing Denny Way CSO in Elliott Bay by Applied Environmental Services for King County Department of Natural Resources. Four dive transects were established to adequately document and cover the survey area. Diver observations were augmented with a videographic survey.

The shoreline was found to be armored with rock riprap down to a maximum depth of about –20 feet MLLW. At the toe of the riprap slope, the substrate transitions into sand, shell, and gravel with mixed cobbles. Larger pieces of rock were sloughed from the shore armor into this zone. This substrate mix forms a zone extending approximately 200 feet offshore. Farther offshore, the substrate was predominantly a sand/silt mix out to the end of the transects (650 feet offshore).

Macroalgae was present within the cobble and rock substrate areas. The most common species observed were: *Fucus gardneri, Laminaria sccharina, Iredea cordata,* and *Ulva fenestrata* (Table 2). These species were present throughout the survey area but were most abundant along the shoreline rock armoring, near a depth of –10 to –20 feet MLLW, with a coverage of about 20 percent. Progressing offshore, the macroalgae became less abundant and appeared to be mostly confined to areas of larger rocks or cobble.

In general, the invertebrate assemblage within the survey area was very sparse. Only two red rock crabs (*Cancer productus*) were observed. The most commonly observed invertebrate was the opalescent nudibranch (*Hermissenda crassicornis*). Several nudibranchs were seen within the survey area to a depth of about –40 feet MLLW. Egg masses from nudibranchs were also observed, along with an occasional anemone.

The only vertebrates observed within the survey area were various species of flatfish, species identification was made difficult by field conditions. Species likely to be found at the site are: Pacific sanddab (*Citharichthys sordidus*), speckled sanddab (*Citharichthys stimaeus*), English sole (*Parophrys vetulus*), and sand sole (*Psettichthys melanostictus*). No salmonids were observed.

Biology of Species Using Affected Habitat

The intertidal and shallow subtidal habitat of the Denny Way Combined Sewer Outfall (CSO) shoreline is inhabited by a sparse assemblage of invertebrates, a few fish species, and some species of algae (AES, 1998). None of these long-term inhabitants are listed or proposed for listing under the Endangered Species Act (ESA). However, some of these species and more specifically many of the small, less conspicuous benthic invertebrates potentially provide food for other species that may be listed under the ESA.

Eight species of salmonids are known to be present in the project area: chinook salmon (*Onorhychus tshawytsaha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), sockeye salmon (*O. nerka*), resident and anadromous (steelhead) rainbow trout (*O. mykiss*), resident and sea-run cutthroat trout (*O. clarki clarki*), Dolly Varden char (*Salvelinus malma*) and bull trout (*S. confluentus*). Of these eight species, four are covered in this document. Relevant aspects of life history, habitat requirements, project area habitat use, and special consideration are presented in the following sections.

Chinook Salmon

In a recent review of the status of chinook salmon in the Pacific Northwest, NMFS identified several naturally spawning runs of spring, summer, and fall chinook salmon within the Puget Sound Evolutionarily Significant Unit (ESU) that are likely to become endangered (Myers et al., 1998) and were listed as threatened on March 16, 1999. The abundance of chinook salmon within Puget Sound has substantially declined from historic levels (NMFS, 1998).

Green-Duwamish River

Two runs of chinook salmon inhabit the Green-Duwamish River basin including a summer/fall run in the Green-Duwamish River, and a fall run in the Newaukum Creek (WDF et al., 1993). Run timing spans the period from June to November with spawning occurring from September through November (Williams et al., 1975).

TABLE 2
Species List for the Denny Way CSO Dive Survey, February 1998

Common Name	Taxa
MARINE ALGAE	
Brown Algae	
Fucus	*Fucus gardneri*
Desmarestia	*Desmarestia sp.*
Sargassum	*Sargussum muticum*
Laminaria	*Laminaria saccharina*
Red Algae	
Turkish Towel	*Girgartina exasperata*
Irridescent Algae	*Iridaea cordata*
Gracilaria	*Gracilariopsis sjoestedtii*
Green Algae	
Porphyra	*Porphyra sp.*
Sea Lettuce	*Ulva fenstrata*
INVERTEBRATES	
Cnidaria	
Anemones	*Metridium senile*
Sea Pen	*Ptilosarcus gumeyi*
Molluscs	
Oplaescent Nudibranch	*Hermissenda crassicornis*
Hardshell Clam	Unidentified
Keyhole Clam	*Diodora aspera*
Finger Limpet	*Lottia digitalis*
Decapods	
Red Rock Crab	*Cancer productus*
Shore Crab	*Hemigrapsus nudus*
Echinoderms	
Blood Starfish	*Henricia leviuscula*
Common Starfish	*Pisaster sp.*
VERTEBRATES	
Flatfish	Unidentified

Chinook salmon of the Green-Duwamish River basin exhibit an ocean-type life history pattern, with smolts migrating to the ocean during their first year, maturing at ages 3 and 4, and having coastal-oriented ocean migration patterns (Myers et al., 1998). Ocean-type chinook rear for 3 to 6 months in freshwater prior to migration into estuarine and marine waters. They also characteristically have an extended estuarine rearing period.

Spawning by the wild runs of chinook salmon in the basin occurs throughout the main stem and larger tributaries of the river system. Supplementation occurs at the Soos Creek Hatchery. The stock is considered a mixed stock with composite production (Table 3). Recent escapements of chinook to the Green-Duwamish River have ranged from 5,000 to 11,500, averaging about 8,700 fish annually. Recent escapements of chinook in the Newaukum Creek have ranged from 300 to 3,000, averaging about 1,600 fish annually. The Newaukum stock is considered genetically mixed with wild production. Stock status is considered to be healthy (WDF et al., 1993).

Chinook salmon potentially use the Seattle waterfront shoreline as juveniles during their outmigration, placing them in close proximity with the CSO. Following entry into Elliott Bay from the Green-Duwamish River basin, the juveniles rear along the bay's shorelines for days to weeks. During this shoreline-rearing period, many or most of the juvenile chinook from the Green-Duwamish River basin presumably pass by the project area prior to moving into deeper offshore waters. Shoreline habitat, such as occurs along the Seattle waterfront including the Denny Way CSO site, is included in the estuarine area that is specified in the NMFS ruling as critical habitat for chinook salmon (NMFS, 1998a).

Juvenile chinook rearing in estuaries feed on a variety of epibenthic, terrestrial, and pelagic food sources as they move along the shorelines. Generally, they tend to prey on the small crustaceans, known as epibenthos, as they first enter the estuaries. As they quickly grow, they tend to shift more to pelagic prey as their food source. Along the Denny Way CSO shoreline, both epibenthic and pelagic prey are likely to be present. Epibenthic prey would be present in the sand and silt habitats, as well as on the algae that attach to cobbles and boulders. Pelagic prey are present in the water column throughout Elliott Bay, including along the Denny Way CSO shoreline.

Adult chinook also pass through Elliott Bay as they return to the Green-Duwamish River basin to spawn. However, adult chinook do not commonly pass directly along the shorelines in shallow water and are not known to use intertidal habitat.

South Lake Union

The Lake Washington basin supports a summer/fall run of chinook salmon, composed of both native and non-native stocks (WDFW et al., 1993). In Issaquah and the East Fork of Issaquah creeks, spawning non-native chinook are found from early September through October. In the north Lake Washington tributaries, including North, Swamp, Bear, Little Bear, and Cottage Lake creeks, spawning native chinook are also found from early September through October. In the Cedar River, spawning native chinook are found from mid-September through mid to late November.

The Issaquah stock escapement ranges from 500 to 5,000 spawners averaging 2,200. Production is a composite of hatchery and natural sources. Stock status is considered

TABLE 3
Summary of Stock Status in Green-Duwamish and Lake Washington Watersheds:
Chinook and Coho Salmon, Sea-Run Cutthroat and Bull Trout

	Stock	Stock Status	Stock Origin / Production Type	Escapement Range	Escapement Average	Notes
Green-Duwamish River Basin						
Summer/Fall Chinook	Green-Duwamish Rivers	Healthy	Mixed/Composite	5,000-11,500	8,700	Composite Production[a]
Summer/Fall Chinook	Newaukum Creek	Healthy	Mixed/Wild	300-3,000	1,600	Wild Production
Coho	Green River-Soos Creek	Healthy	Mixed/Composite	700-12,500	Unknown	Composite Production[b]
Coho	Newaukum Creek	Depressed	Mixed/Composite	Unknown	Unknown	Composite Production
Sea-Run Cutthroat	Green-Duwamish Rivers	Unknown	Native/Wild	Unknown	Unknown	Wild Production
Bull Trout	Green-Duwamish Rivers	Unknown	Native/Wild	Unknown	Unknown	Wild Production
Lake Washington Basin						
Summer/Fall Chinook	Issaquah	Healthy	Non-native/ Composite	500-5,000	2,000	Composite Production[c]
Summer/Fall Chinook	Cedar River	Unknown	Native/Wild	600-4,300	1,900	Wild Production
Summer/Fall Chinook	North Lake Washington tributaries	Unknown	Native/Wild	Unknown	Unknown	Wild Production
Coho	Lake Washington/ Sammamish tributaries	Depressed	Composite	Unknown	Unknown	Composite Production[c]
Coho	Cedar River	Healthy	Mixed/Wild	Unknown	Unknown	Wild Production
Sea-Run Cutthroat	Lake Washington Basin	Unknown	Native/Wild	Unknown	Unknown	Wild Production
Bull Trout	Lake Washington Basin	Unknown	Native/Wild	Unknown	Unknown	Wild Production

[a] Hatchery production at Soos Creek
[b] Soos Creek system almost entirely hatchery production
[c] Hatchery production at Issaquah

healthy (WDFW et al., 1993). Escapement for the north Lake Washington tributaries is uncertain, but is thought to range from about 30 to 500 fish, averaging about 200 (C. Smith, WDFW, personal communication, 1998). This is a native stock with wild production. Stock status is unknown. The Cedar River stock escapement estimates range from 600 to 4,300 fish, averaging 1,900. The stock is native in origin with wild production. Stock status is unknown (WDFW et al., 1993).

Puget Sound chinook primarily use Lake Union and Lake Washington as a migratory corridor to and from habitats upstream. Adult chinook pass through Lake Union relatively quickly on their way to destinations upstream (Whitman et al., 1982). It is unlikely that adults spend any time in the southern portion of the lake as it is out of the migratory pathway. Juvenile chinook also pass through Lake Union on their way out of the system as smolts. Their use of Lake Union as a primary rearing area is unlikely due to its location near the outlet of the system. A short transient rearing function is possible for chinook salmon smolts as they work their way to Puget Sound. Due to extensive alteration of the Lake Union shoreline, however, only a few small areas of littoral or shallow water habitat are available for habitat (Metro, 1993). One area is located at the north end of the lake along the shoreline of Gas Works Park. Two smaller areas are present at the southern end of the lake within the vicinity of the project area, but are out of the migratory path of outmigrant fish.

Coho Salmon

A status review of coho salmon was recently completed by NMFS in response to petitions seeking to list several Pacific Northwest populations of coho salmon as threatened or endangered (Weitkamp et al., 1995). Based on genetic, life history, biogeographic, geologic, and environmental information, six ESUs were defined for coho salmon in Washington, Oregon, and California. Despite recent stable trends in population abundance near historic levels, the status of the Puget Sound/Strait of Georgia ESU was determined to warrant further consideration for listing due to concerns over current genetic, environmental, and habitat conditions. Risk factors identified as potentially deleterious to Puget Sound coho salmon stocks included high harvest rates, extensive habitat degradation, unfavorable ocean conditions, and declines in adult size (Weitkamp et al. , 1995). The genetic fitness of Puget Sound coho stocks has been altered by widespread and intensive artificial propagation that includes interbasin transfers of broodstock, and by natural spawning between wild and hatchery origin fish. Hatchery supplementation in south Puget Sound, including the Green-Duwamish River basin, has been particularly extensive.

Green-Duwamish River

Two coho salmon populations have been identified within the Green-Duwamish River basin based on geographic differences in spawning locations; the Green-Duwamish River stock is considered healthy while the Newaukum Creek stock is considered depressed (WDF et al., 1993).

Coho fry in the Green-Duwamish River basin are dependent on availability of quality river habitat for growth, and typically use side channels, wetlands, and off-channel sloughs for over wintering and rearing (Sandercock, 1991; Grette and Salo, 1986). Juveniles outmigrate during spring freshets, usually in May, after rearing in freshwater for about 18 months. Smolts mature in the marine environment for another 18 months before returning to spawn as three-year-old fish (Weitkamp et al., 1995).

The Green-Duwamish River runs of coho spawn late October through mid-December in the Green River tributaries except in Newaukum Creek where spawning occurs through mid-January. The Soos Creek system is almost entirely dependent upon hatchery origin adults passed above the hatchery weir. Production above Howard Hanson Dam is all derived from off-station hatchery fingerling releases. Recent escapements of coho have ranged from 700 to 12,500 between 1967 and 1991, which includes the Newaukum Creek system (WDF et al., 1993).

Coho smolts migrate into estuarine and marine waters starting in late April and extend into June. Their residence period inshore is limited to a brief period prior to movement offshore. Some of the coho smolts originating from the Green-Duwamish system can be expected to traverse the vicinity of the Denny Way/Lake Union CSO on their way out of Elliott Bay. During this period, coho feed primarily on pelagic and epibenthic invertebrates but may quickly shift to suitable fish prey such as herring, sound lance, or smelt larvae, if available (Sandercock, 1991).

South Lake Union

The Lake Washington basin supports coho salmon composed of mixed stocks (WDFW et al., 1993). Spawning in the Cedar River system occurs in late October through early March. In the Lake Washington and Sammamish tributaries outside of the Cedar River system, spawning coho are found from late October through mid-December.

Lake Washington and Sammamish tributary wild coho escapement is largely unknown but thought to be very low (WDFW et al., 1993). Production is a mixed stock with composite production. The stock status has been characterized as depressed due to a severe short-term decline in escapement (WDFW et al., 1993). There have been large releases of hatchery-origin coho in this area; however, the genetic impact is unknown (WDFW et al., 1993). As with the Lake Washington and Sammamish tributaries, escapement in the Cedar River is unknown. There have been large releases of hatchery-origin coho in this area in the Cedar River. Production is a mixed stock with wild production (WDFW et al., 1993). The stock status is characterized as healthy.

Coho primarily use Lake Union and Lake Washington as a migratory corridor to and from their upstream rearing habitats. Adult coho travel through the lakes in a few days to reach their spawning grounds upstream. Juvenile coho pass through Lake Washington as smolts onto feeding grounds in Puget Sound. It is unlikely juveniles would use the lake for their primary rearing area because of their preference for riverine habitats. Although some juvenile coho smolts use lakes for rearing habitat, they do not use Lake Washington.

Sea-Run Cutthroat Trout

Sea-run cutthroat trout remain close to the coast as adults in marine waters overwintering in freshwater preceding and following spawning (Johnson et al., 1994). Spawning migrations may begin after as few as 8 months in the marine environment (Grette and Salo, 1986) and occur from late summer through mid-winter. Spawning occurs between December and May in small, low-gradient tributary streams (Trotter, 1989). Some cutthroat trout remain in freshwater after spawning, although most return to Puget Sound.

Juvenile cutthroat migrate to Puget Sound in the spring, during their second or third year of life at a size of about 120-170 mm (Behnke, 1979; Hickman and Raleigh, 1982). Although sea-run cutthroat tend to remain in bays and estuaries, they apparently enter shallow water only when feeding on juvenile salmonids and other small fish. Both juvenile and adult cutthroat are predacious on fish, including other salmonids. Predation on juvenile salmonids seems to be quite variable (Trotter, 1994), but can be significant (Clemens and Wilby, 1946). Other diet items of juvenile sea-run cutthroat are known to include gammarid amphipods, isopods, shrimp mysids, crab megalops, sticklebacks, and other small fish (Trotter, 1989).

Green-Duwamish River

The status and life history of cutthroat trout in the Green-Duwamish River basin is not well documented, and available information often does not distinguish between anadromous and resident forms. It is known that adults begin spawning migrations from July to January, and peak in October and November in the Green River (Grette and Salo, 1986). Population assessment studies have not been conducted on this species in the Green-Duwamish River basin so the population and run size is not known. Similarly, the presence of adult or juvenile cutthroat in Elliott Bay is poorly documented but their usage of the project area is assumed.

South Lake Union

The status and life history of cutthroat trout in Lake Washington and south Lake Union is not well documented, and available information often does not distinguish between anadromous and resident forms. Population assessment studies have not been conducted on this species so the population and run size is not known.

Bull Trout

Green-Duwamish River

Information on the presence, abundance, distribution, and life history of bull trout in the Green River basin is unavailable or extremely limited. Although Mongillo (1993) indicated that bull trout/Dolly Varden are present in the Green River below Howard Hanson Dam, it is unclear whether the Green River supports a population of bull trout. Part of the problem is that Dolly Varden are virtually undistinguishable from bull trout except to the trained eye and have been historically confused. Bull trout were only recognized as a separate species 20 years ago (Cavendar, 1978). Thus, older anecdotal accounts naturally included both species. In addition, the anadromous form of bull trout is rare, even in populations where they are known to exist. Native char have been harvested in the Green River as far upstream as River Mile (RM) 40; however, there is insufficient evidence to determine if these fish are fluvial, or anadromous bull trout. The WDFW bull trout assessment team felt these fish were likely Dolly Varden char (WDFW, 1998). No spawning of this char species has ever been documented in the Green-Duwamish River basin. (Watson and Toth, 1994). The Plum Creek Timber Company conducted extensive presence/absence surveys for bull trout in the upper Green River basin, but no bull trout have been found. It is unknown if bull trout/Dolly Varden ever occupied the upper watershed in the past. If they did, they do not appear to be present now (Watson and Toth, 1994).

South Lake Union

Reproducing populations of bull trout/Dolly Varden, have not been confirmed in the lower Cedar River, Lake Washington, Lake Sammamish or their tributaries (WDFW, 1998). However, Dolly Varden does occur in the upper Cedar River basin in Chester Morse Lake (WDFW, 1998). Reports of Dolly Varden from Lake Washington are rare (WDFW, 1998). One Dolly Varden was identified during a 2-year creel survey on Lake Washington (Pfieffer and Bradbury, 1992). Two bull trout/Dolly Varden were reported holding below a culvert in the headwaters of Issaquah Creek in the fall of 1993 (WDFW, 1998). It is most likely that these fish strayed into the Lake Washington system via the Ballard Locks and were not part of local spawning population within the lower two-lake system. Water temperatures in the lower Cedar River and Issaquah Creek are probably too high to support bull trout/Dolly Varden.

Analysis of Effects

General Impacts to Project Area from Construction

Elliott Bay

During the initial construction phase, portions of the shoreline in the immediate vicinity of the outfall will be modified as a result of pipeline installation. About 40 feet of riprap embankment would be removed to construct the transition structure and demolish the existing outfall grating. The riprap shoreline will be rebuilt in a slightly different configuration. There will be no net change in intertidal area due to the reconfiguration.

The 120-inch Denny Way CSO Outfall Extension will extend to about –20 MLLW, about 120 feet offshore. The 96-inch Elliott West Outfall will extend to about –60 feet MLLW, about 360 feet beyond the end structure of the CSO Outfall Extension. The inshore portion of both outfalls will be installed on a series of pile supports in a sheet pile-lined trench. The trench would be excavated to a depth of about 15 feet. After installation of the outfall pipes, the trench would be backfilled with clean material.

The offshore portion of the Elliott West Outfall will be constructed on piles, similar to the inshore portion. However, the pipe will lie approximately at the sea floor, with the bottom of the pipe at the mudline or partially buried. Excavation of bottom sediments will occur at the pile cap locations. These areas will be backfilled with clean material.

Most of the non-motile organisms in the trenched zone (approximately 60 to 80 feet wide) would be expected to be lost as the result of physical injury or subsequent burial. During this time, suspended sediment would be carried a short distance by currents to deposit in a thin veneer perhaps 100 feet on either side of the trench. Pile driving in the trench would be expected to generate temporary localized turbidity. Monitoring of turbidity and other water quality parameters would be conducted during construction. Monitoring for juvenile salmonid presence will occur. The exact provisions for monitoring would be worked out during the HPA permit process.

Clean fill materials would be placed back over the pipeline in the area where the pipeline runs subsurface. This activity would, as with trenching, cause a thin veneer of sediment to

accumulate adjacent to the pipeline. A concrete mattress would cover the exposed section of pipe. Non-motile organism would be covered by sediment and many of the smaller organisms would perish. Most of the epibenthic and infaunal organisms would be expected to be able to burrow up through the thin veneer and survive, although they would be stressed.

Rock surfaces such as new riprap materials would be expected to be recolonized with algaes, barnacles, and other encrusting organisms by the middle of the summer following construction. Similarly, the new fill materials covering the pipeline would be expected to recolonize during the same time period with the various species of worms, clams, echinoderms, anemones, and crustaceans that settle out of the meroplankton onto soft substrates each season. The time span for full recovery of communities would be on the order of 5 years barring further perturbation. Fish and larger invertebrate species would utilize these newly colonized areas to the extent that they provide forage opportunity. The pipeline mattress, outlet structure, and associated apron would recolonize with subtidal encrusting organisms as well.

South Lake Union

Construction activities for the Lake Union CSO outfalls would cause very minor temporary localized turbidity and a very small amount of shoreline disturbance. Sedimentation would be very localized and the disturbance temporary. Some aquatic insects are likely to be buried and lost in an area of perhaps tens of square yards. Photosynthesis may be impaired from turbidity in the immediate vicinity during construction. Habitat quality is very low in the project area and hence degradation would be minimal.

General Impacts to Project Area from Operation

Elliott Bay

Water quality can be expected to improve significantly as a result of the project. The number of untreated CSO discharge events would be reduced to an average of one per year instead of 75. The volume of untreated discharge would be reduced from 405 million gallons per year (mgy) to 8 mgy of combined sanitary sewage/stormwater. The volume of treated discharge into Elliott Bay would be 278 mgy. Discharge of suspended solids would be substantially reduced from existing conditions, and thus, recontamination of clean sediment areas is expected to be minimal.

Water quality impacts would also be minimized due to the closer temporal matching of CSO discharges to hydrologic responses of the Duwamish River to storm events. At the present time, 51 overflow events occur at the Denny Way CSO per year. This means that nearly every winter storm event causes a CSO discharge. By attenuating flows with the Mercer Street tunnel, the one discharge event per year will most likely be associated with a major storm event sufficient to create a high discharge rate in the Duwamish River. Since the trajectory of river flow in Elliott Bay is along the waterfront, the CSO discharge would receive a high degree of dilution and flushing during CSO discharges. Some sediment may continue to settle in the vicinity of the outfall; however, the current input of contaminants has been greatly reduced by King County's pretreatment program and by the reduction in CSOs. It is expected that sediment contamination that occurs after project completion would be remediated through natural recovery.

Recent water current studies in Elliott Bay show that much of the Denny Way CSO effluent is likely to be carried inshore of the outfall (Ebbesmeyer, 1996). To avoid this condition, the outfall would have to be over 1,000 feet long to reach a depth exceeding 150 feet. This would extend into the middle of the designated anchorage area. The proposed configuration of the outfall extends to the edge of the anchorage area. The outfall cannot extend into the anchorage area because of the risk of a ship tearing out the outfall or alternatively becoming snagged on it.

South Lake Union

Existing water quality is generally poor in the vicinity of the two Lake Union CSOs that will be abandoned by this project and the other Lake Union CSOs that will be controlled to one event per year. The proposed project would significantly improve water quality at the CSOs for the same reasons listed for the Denny Way CSO. The result would be a long-term increase in biological productivity and use by fish and other aquatic life.

Unavoidable Impacts on Listed species

The four species of salmonids considered in this Biological Assessment utilize Elliott Bay and South Lake Union as habitat to varying degrees. This has a direct bearing on the extent of the impact that the proposed project has on the four species. For the most part, the potential impacts to the salmonids are generic. Some considerations are more species-specific, such as diet and temporal presence in the project area.

Elliott Bay

Adult chinook and coho salmon as well as sea-run cutthroat and bull trout are transient residents of Elliott Bay. Chinook and coho may not spend more than a week or two in the bay. When they are present, they are not actively feeding and thus not affected by changes in food resources, even if those changes are beneficial. Sea-run cutthroat may spend 3 to 6 months in Puget Sound feeding mostly on pelagic zooplankton, juvenile salmonids, and other small fish. As such, they are unaffected by the project to the extent that their food resources are unaffected. Temporary displacement may occur during construction, but this would be very localized in nature.

Juvenile salmonids are the focus of the impact discussion because they are much more dependent on Elliott Bay habitat conditions than the adults. Of the four species discussed in this document, chinook are the most vulnerable to, or would benefit the greatest from, changes to the estuarine environment. The reason for this is that chinook salmon smolts spend more time in the estuary, have a greater inshore orientation, depend more on benthic food resources, and are smaller in size than the smolts and post-smolts of the other three species. For this reason, the impact discussion focuses on the use of juvenile chinook as a surrogate for the other three species. Where differences exist, the other species are discussed separately.

The following discussion of impacts is organized by ecological pathways and indicators of estuarine habitat function. Discussion and evaluations are made relative to the listed species covered in this biological assessment and thus may not reflect conditions for other animal groups such as marine mammals and marine birds. Since a matrix of pathways and indicators has not yet been developed by NMFS for estuarine and nearshore marine

environments as has been developed for riverine environments, the following list of topics are suggested for discussion:

- Physical habitat
- Sediment input and quality
- Biological productivity and diversity
- Detritus and other nutrient inputs
- Water quality
- Currents
- Biological interactions

The freshwater matrix has well-developed criteria for the determination of habitat function integrity. In the absence of similar structured guidance, judgment of habitat function integrity in this analysis, out of necessity, relies heavily on best professional judgment.

Physical Habitat

Physical habitat for the nearshore-oriented juvenile salmonids in estuarine environments such as chinook, pink, and chum salmon, is largely a function of substrate composition. Substrate composition, in turn, is strongly influenced by proximity to various sediment inputs, exposure to wind (waves), and other physical processes. In general, sand and gravel comes from eroding bluffs in Puget Sound and the finer materials deposited at or near the mouths of rivers. Habitat quality is, to a lesser extent, influenced by the amount of cover for refuge and connectivity between high-quality rearing environments.

Substrate composition in Puget Sound has been shifting from sand and gravel shorelines towards gravel and cobble. The decline of bluff erosion in Puget Sound has reduced the input of these materials. Shoreline erosion processes have been altered as a result of shoreline stabilization measures such as bulkheads, leading to the impoverishment of finer grain materials in intertidal and shallow subtidal zones. Fine grain substrates are habitat for many of the prey organisms that chinook salmon smolts preferentially feed upon during their estuarine rearing period. Eelgrass grows on fine grain substrates and is recognized as an important habitat for juvenile salmonids and other organisms. We have rated this factor on an estuary scale as **At Risk** because about 45 percent of central Puget Sound and 33 percent of all Puget Sound has modified shorelines (PSWQAT, 1998). At the embayment scale (Elliott Bay), this factor is **Not Properly Functioning**. Elliott Bay has virtually no natural shoreline, thus sediment impact is essentially zero. The project will **Improve/Restore** this factor by backfilling the trench area with clean fine sand. Additionally, a veneer of clean fine sand will be placed over a greater area as a mitigation action (see Mitigation section) (Table 4).

Yes

Beach slopes have been made steeper throughout Puget Sound as a result of nearshore filling and stabilization. This tends to shift substrate towards coarser particle sizes and adversely affects salmonids as previously discussed. Steeper shoreline also provides less refuge for function migrating juvenile salmonids, particularly the smaller smolts such as

TABLE 4
Determination of Effects Summary: Elliott Bay

Pathways and Indicators	Environmental Baseline (Estuary Scale)			Effects of the Action (Project Area Scale)		
	Properly Functioning[1]	At Risk[1]	Not Properly Functioning[1]	Improve/ Restore[2]	Maintain[3]	Degrade[4]
Physical Habitat						
Substrate		X		X		
Beach Slope		X			X	
Refugia		X		X		
Connectivity		X			X	
Sediment Inputs						
Riverine		X			X	
Shoreline			X	X		
Quality		X			X	
Biota						
Infauna	X				X	
Epibenthos		X		X		
Forage Fish		X			X	
Plants		X		X		
Exotic Species	X				X	
Biological-Diversity		X		X		
Detritus						
Shoreline			X	X		
LWD			X	X		
Riverine			X		X	
Water Quality						
Riverine		X			X	
Shoreline		X		X		
Estuarine	X				X	
Current Patterns	X				X	

TABLE 4
Determination of Effects Summary: Elliott Bay

Pathways and Indicators	Environmental Baseline (Estuary Scale)			Effects of the Action (Project Area Scale)		
	Properly Functioning[1]	At Risk[1]	Not Properly Functioning[1]	Improve/ Restore[2]	Maintain[3]	Degrade[4]
Predator/Prey Relations						
Piers/bulkheads		X			X	
Predators		?			X	
Fishing		X			X	
Harassment	X				X	

Notes:

1 The categories of function ("properly functioning," "at risk," and "not properly functioning") are defined for each indicator in the "Matrix of Pathways and Indicators" (NMFS, 1998).

2 For the purposes of this summary, "restore" means to change the function of an "at risk" indicator to "properly functioning," or to change the function of a "not properly functioning" indicator to "at risk" or "properly function" (it does not apply to "properly functioning" indicators).

3 For the purposes of this summary, "maintain" means that the function of an indicator does not change (i.e., "maintain" applies to all indicators regardless of functional level).

4 For the purposes of this summary, "degrade" means to change the function of an indicator for the worse (i.e., it applies to all indicators regardless of function level).

such as ocean-type chinook, by increasing their exposure to predation by larger fish. We have rated beach slopes as **At Risk** on an estuary scale. This factor is **Not Properly Functioning** at the Elliott Bay scale due to the high degree of shoreline modification. The project **Maintains** the status of this factor.

Large woody debris (LWD), eelgrass, and macroalgaes provide a refuge function along shorelines in addition to and interactive with substrate and shoreline slope. LWD (driftwood) has diminished in Puget Sound as a result of its removal from streams and rivers, removal from the Sound, reduced input to rivers from logging, and by dams blocking LWD transport from upper watersheds. LWD in intertidal zones has historically helped maintain shallowly sloped shorelines which benefit juvenile salmon. We rated this factor as **At Risk** on the estuary scale. In Elliott Bay organic debris from LWD, eelgrass, and saltmarsh vegetation is **Not Properly Functioning**. At one time the lower Duwamish River had extensive saltmarsh. This habitat was filled in long ago. The proposed project's mitigation package will include the placement of LWD anchored with ecology blocks or boulders. The LWD will serve as a source of organic debris for the benthic community and as refuge habitat for a number of fish and invertebrate species. As such, this factor is **Improved/Restored** within the project area.

along

Connectivity between quality habitats is important because salmon smolts tend to migrate ~~down~~ shorelines, feeding and growing as they go. This is particularly true for ocean-type chinook. The maintenance of a high rate of growth is important during the smolting period. In addition, disconnection of habitats may lead, in some circumstances, to a higher rate of predation. Because of the widespread loss of eelgrass and shallow-sloped habitats, we have rated this factor as **At Risk** on an estuary scale. In Elliott Bay, habitat connectivity is lost for miles and thus **Not Properly Functioning**. The project does not disrupt connectivity of habitats at the river mouth with habitats to the north, and thus **Maintains** this function.

Sediment Input and Quality

Sedimentation and sediment quality are important aspects of this project. The maintenance of clean fine-grain substrates in the nearshore environment is conducive to the production of the preferred food items utilized by chinook salmon smolts and to a lesser extent by coho and sea-run cutthroat smolts. Fine-grain sediments are deposited in the project area by the Duwamish River and moved along the shoreline by currents. Sediment quality is affected by the Denny Way CSO, other CSOs, and other urban sources.

Riverine sediment dynamics have been changed by dams and by altered hydraulic and hydrologic processes in many Puget Sound river systems. Many rivers carry substantially increased sediment loads due to urbanization and past forestry practices. Riverine sediment functions in Puget Sound is **At Risk** because the population in the area is projected to increase substantially in the coming decades. Thus, despite the increasing awareness and protection measures, this will likely continue to be a problem at an estuary scale. Elliott Bay receives sediment at a level that substantially exceeds historical levels. Dredging at the river mouth upsets the normal delta building dynamics as well, leading us to rate this factor as **Not Properly Functioning** in Elliott Bay. The proposed project would not alter the riverine delivery of sediment to the project area, and thus **Maintains** this function as it is.

Shoreline inputs of sediment to Puget Sound were discussed previously with substrate and physical habitat. This factor is **Not Properly Functioning** in Puget Sound. Sediment inputs

to Elliott Bay from shoreline sources is nonexistent and thus **Not Properly Functioning** at the Elliott Bay scale. The project adds high quality sediment (clean fine sand) into the project area and thus **Improves/Restores** this function albeit in a small area.

Sediment quality is a problem in a number of embayments in Puget Sound including Elliott Bay. Sediment quality problems are the result of urban and industrial inputs of various types of contaminants. While some embayments are degraded, others are not. Remedial actions are being taken in a number of locations including the area immediately offshore of the Denny Way CSO. We have rated this function as **At Risk** because of the improving long-term prognosis at the estuary scale. Sediment quality within Elliott Bay is contaminated to varying degrees on a localized scale. There are many cleanup projects either planned or completed but we must still consider this factor as **Not Properly Functioning** at this geographic scale. The improved water quality of the proposed project can be expected to **Maintain** the newly restored sediment quality in the project area or at least minimize recontamination.

Minimizing Biological Productivity and Diversity

Biotic factors that indicate habitat quality and function include species diversity, relative and absolute abundance of various plant and animal groups, food web integrity, exotic species, and species interactions. Ecological integrity is expressed in the community structure found in a given habitat type. Some portions of the community of nearshore environments are more important than others for supporting juvenile salmonids. Perhaps the most important aspect of the biological community with respect to salmonid population health is that of food supply. Salmonid smolts need to grow rapidly during their estuarine residence period for several reasons. Smolts are undergoing a physiological transformation (smoltification) at this time that requires extra energy. The osmoregulatory stress on salmon smolts that accompanies seawater transition during early estuary residence also requires extra energy. This can be one of the most vulnerable periods of their lives in terms of predation, and a larger size makes a difference in survival rate.

Infauna are animals that live in the sediment such as clams, worms, burrowing crustaceans, burrowing echinoderms, nematodes, and other lesser groups. They are an important part of the biological community but not particularly to salmonids. The infaunal resources on an estuarine scale can be considered to be **Functioning Properly**. The nearshore benthic infauna assemblage has been drastically altered in Elliott Bay as a result of shoreline development and persistent contaminant loading; therefore, infaunal function can be considered **Not Properly Functioning** in Elliott Bay. The proposed project would essentially remove infauna over the footprint of the pipeline excavation, at least temporarily. Infauna would recolonize in the new fill materials within a year. The infaunal community in the containment cap are likely to show improved abundance and species diversity over time as a result of contaminant abatement. The project would then **Maintain** this element of the community within the project area.

Epibenthos are preferentially preyed upon by several salmonid species during early marine residence, including ocean-type chinook. In particular, harpacticoid copepods, gammarid amphipods such as *Corophium salmonis*, ostracods, and mysids are important dietary items. These important food organisms require fine grain substrates to prosper. The shift of substrate size in Puget Sound nearshore areas puts this resource **At Risk** at an estuarine scale. This resource is **Not Properly Functioning** in Elliott Bay for a number of reasons

including substrate shift, detritus loss, and contamination. The project would temporarily remove the smaller epibenthic invertebrates from the footprint of the pipeline excavation. The sediment covered area would then recolonize within a year. The concrete mattress covered section of pipe would be lost to benthic production. This would likely be more than offset by improved epibenthos production on the containment cap due to the lower level of contaminant loading. The project would then **Improve/Restore** the epibenthic community in the project area, at least over the long term.

Forage fish are important food items for coho smolts, sea-run cutthroat, possibly bull trout, and to a lesser extent chinook, at least at the larval and young of the year (YOY) stage. Healthy local spawning populations of surf smelt, sand lance, and herring are important as a rich food source. Forage fish are **At Risk** at the estuary scale. South Puget Sound stocks are depressed by about 20 to 30 percent but considered healthy (Bargmann pers. comm., 1999). However, the Cherry Point stock has experienced a greater than 90 percent decline in recent years, presumably due to climatic conditions and associated predation pressure (West, 1997). Forage fish production in Elliott Bay is virtually nonexistent but fed by production in south Puget Sound. Since historical production in Elliott Bay is unclear and the stocks contributing this resource are depressed, the function in Elliott Bay is **At Risk**. The project does nothing to affect these resources and thus **Maintains** their current status.

Plants such as macroalgaes, eelgrass, and salt marsh vegetation are important to salmonids for cover, as a substrate for epifauna production, for a degree of slope stability and most importantly as a source of detrital material for subsequent infaunal and epibenthos production. Salt marshes appear to be particularly important to juvenile chinook. In Puget Sound, there has been a shift from salt marsh and eelgrass habitats to macroalgaes. This has been viewed as negative in terms of salmonid production. For this reason, we have rated this factor as **At Risk** at the estuary level. The total loss of salt marsh in the Duwamish River and eelgrass along the Elliott Bay shoreline leads to a **Not Properly Functioning** condition in this geographic area. The mitigation package will **Improve/Restore** macroalgae production by enhancing habitat for this assemblage. Placements of boulders and cobble as well as the pipeline mattress will provide many more hold-fast attachment surfaces for these species than currently available.

Exotic Species may be an important consideration in some areas of Puget Sound, but less so in Elliott Bay. Although there is some concern over spartina and green crab invasion, they are not a problem as of yet. There is source indication that spartina may be declining in Skagit Bay in north Puget Sound, where a foot-hold was made by this species (Armstrong, pers. comm., 1999). There is concern by some that the exotic mussel (*Mytilus gallaprovincialis*) cultured in some areas of Puget Sound by mussel farmers may invade and displace the indigenous mussel (*Mytilus krosulus=edulis*). However, Kozloff (pers. comm., 1999) maintains that this species is unable to reproduce in Puget Sound except, perhaps, locally and inconsistently, due to their need for warmer temperatures to successfully reproduce.

The abundance of an exotic amphipod in the Duwamish Waterway is a concern due to the critical need for suitable amphipod forage for salmon smolts entering the estuary. Due to this new finding, we place Elliott Bay **At Risk** for this factor. We have rated this factor as **Properly Functioning** at the estuary level for this reason. The project does not promote the introduction or expansion of exotic species and thus **Maintains** the status quo.

Biological diversity is an indicator of overall environmental health. This should be tempered with the understanding that natural areas of environmental extremes or disturbance may have a naturally low species diversity. Areas with widely fluctuating salinity, such as in upper estuary zones, are in this category. Biological diversity in Puget Sound is high although urban areas have suffered as a result of habitat loss and contamination. As a whole, the estuary appears to be **At Risk** in terms of biological diversity because of the marked decline in certain fish species including a number of rockfish species, walleye pollock, Pacific cod, and Pacific hake. However, much of this loss can be explained by factors other than habitat loss such as overfishing (rockfish, lingcod) and climate cycles (pollock, cod). Elliott Bay has experienced a reduction of biological diversity due to contaminant loading, dredging, and filling. However, the greatest loss is probably due to the elimination of several habitat types such as saltmarsh and eelgrass beds. For this reason we rate this factor as **Not Properly Functioning**. The area offshore of the CSO has been characterized as low in species diversity (Thom and Chew, 1980). The proposed project should **Improve/Restore** diversity in the project area by reducing pollution.

Detritus and Nutrients

Detritus is important to salmonids because this energy source has historically been the primary fuel driving nearshore ecosystems in Puget Sound (Simenstad and Wissmar, 1985). This has shifted to pelagic carbon sources over the years as nearshore sources such as salt marshes were lost due to development. The three most important sources of detritus to Puget Sound nearshore ecosystems were from rivers, LWD, and shoreline or nearshore vegetation.

Shoreline vegetation sources include shoreline trees and bushes, eelgrass and macroalgae beds, and salt marshes. Since salt marshes have disappeared from many locations in Puget sound, eelgrass bed acreage has diminished over the years, and because of the importance of the detritus-based food web to chinook salmon smolts, we have rated this as **Not Properly Functioning** at the estuary scale. Likewise, this factor is **Not Properly Functioning** in Elliott Bay. The proposed project will likely result in an increase in macroalgae production as a result of an increase in subtidal hard substrate and improved water quality, thus **Improving/Restoring** this function in the project area.

Large woody debris in the form of driftwood and trees from eroding bluffs provide detritus to the ecosystem as they decay. The amount of intertidal and subtidal LWD along Puget Sound shorelines has diminished over the years because of removal and decreased supply of new materials. We have rated this pathway of ecosystem energy input as **Not Functioning Properly** at the estuarine scale. Shoreline inputs of LWD in Elliott Bay have been eliminated, and thus is **Not Properly Functioning**. The project does not affect this function inherently. However, the proposed mitigation package will enhance this function by adding LWD placements in the intertidal or subtidal zones. As such, the project would **Improve/Restore** this function in the project area.

Riverine inputs of detritus come in the form of driftwood, decayed vegetation, and historically, salmon carcasses. Development of all types have reduced the detritus input to nearshore environments from this source to a largely unknown degree. Because of the significant loss of salmonid carcass input and logging-related losses of organic materials to the marine ecosystem, we have rated this pathway of detritus to be **Not Properly**

Functioning at the estuarine scale. Similarly, this factor is **Not Properly Functioning** in Elliott Bay. The project does not alter this function in any way and thus **Maintains** it.

Water Quality

Water quality has a direct and indirect effect on all aquatic organisms and has been a concern in Puget Sound since the 1960s when fish kills were common around a number of industrial outfalls. Sources of pollution, either point source or non-point source, entering the marine environment typically come from shoreline or riverine sources. Boats, ships and air pollution also contribute to the contaminant loading to Puget Sound. Stormwater is a special type of contaminant source and the focal point of this project.

Riverine water quality is generally good in many Puget Sound rivers. However, some rivers have degraded water quality especially in the lower reaches. We rated this factor as **At Risk** on an estuary scale because of the concentration of development at the mouths of most of the major rivers and the associated difficulty in restoring water quality in these reaches. The lower Duwamish River has historically had water quality problems such as high temperature and low dissolved oxygen. As such, we rate water quality as **Not Properly Functioning** at the embayment scale. The proposed project will not affect riverine water quality in any way and thus **Maintains** this factor in the project area.

Shoreline sources of water quality degradation other than stormwater comes from a variety of industrial and municipal sources. The extent of water quality problems is localized for the most part around urban areas with large outlying areas, with only minor inputs of contaminants. As a whole, we rate shoreline water quality as **At Risk** at the estuary scale. Part of the problem is that Puget Sound has a naturally low dissolved oxygen level due to density stratification and upwelling marine water inputs. This naturally low dissolved oxygen level exacerbates the impact of anthropogenic inputs of oxygen demanding substances. The natural low oxygen stress (hyoxyin) also adds to contaminant stressors. The Elliott Bay shoreline water quality would have to be considered to be either **At Risk** or **Not Properly Functioning** due to contaminant loading. The project **Improves/Restores** water quality in the project area by reducing the number of untreated overflow events, by treating most of the overflow water, and by greatly reducing the volume of discharge. The sedimentation function of the storage tunnel will reduce heavy metal and organic contaminants from stormwater as these compounds have an affinity for particulate matter, which settle out in the treatment system.

Estuarine function-related water quality refers to temperature and salinity parameters. These can be influenced by thermal discharges and by significant freshwater discharges into restricted estuarine systems. Puget Sound is strongly affected by natural freshwater inputs from rivers. The stratification that occurs in spring as a result of high runoff in the absence of strong tides allows plankton blooms to occur in Puget Sound. These factors are **Properly Functioning** at an estuarine scale. The project will decrease the amount of stormwater flowing into Elliot Bay, but this will not have a significant effect on either temperature or salinity in the project area, and will thus **Maintain** this function.

Currents

Currents, whether tidally driven, wind driven, or from other physical processes, are important as they affect sediment transport, detritus and flocculated organic material ("marine snow") deposition, and outfall mixing zone dynamics. A number a anthropogenic factors can change currents on a localized scale such as large-scale tideland filling, jetties, piers, groins, channelization, and the propeller-wash of large ships.

Current patterns in Puget Sound have not been altered by man's activities on a large scale and thus can be considered to be **Properly Functioning.** The project does not alter current patterns in Elliot Bay and thus **Maintains** current patterns. Channelization and propeller-wash are not factors relevant to this project.

Biological Interactions

There are a number of predator/prey relationships modified by urban development. These include man-made structures that either concentrate juvenile salmonids, make them more vulnerable to predation, increase the number of predators, decrease the abundance of alternative prey for opportunistic predators, or cause harassment. Direct losses from fishing is a separate but related factor. Except for fishing, these are difficult topics to address because they are not well understood and subject to an array of complex interactions.

It is generally believed that bulkheads and piers are detrimental to juvenile salmonids by diverting the smaller salmonid smolts away from shallow shorelines into deeper water, thereby increasing the potential for predation. This would apply to chinook but not sea-run cutthroat, bull trout, or coho. In fact, sea-run cutthroat, Dolly Varden char, and bull trout are the predators of small salmonid smolts that would benefit most from this factor. While the pier/predation concept seems logical, there is no proof of a cause and effect relationship in regards to predation. Because of logic and uncertainty as well as the large numbers of bulkheads in Puget Sound, we have rated this factor as **At Risk** on the estuary scale. Since virtually all of the shoreline in Elliott Bay is altered to a uniformly steep bank configuration, it is **Not Properly Functioning** with regard to this factor. The proposed project will remove and replace a small section of seawall in the process of pipeline installation; however, there will not be a net increase in sea wall or bulkhead. The pipeline will be buried in the intertidal zone and will not divert shoreline oriented fish. The project thus **Maintains** this factor.

Change in predator abundance is mostly a factor in freshwater (e.g. bass or squawfish). In estuarine waters two of the most important predators of salmonid smolts are sea-run cutthroat and Dolly Varden char, two species with much reduced population numbers. Other known smolt predators in estuaries include staghorn and other large sculpins, herons, and a variety of diving birds such as cormorants. While conclusions on this subject would be speculative, it is likely that predator abundance has been diminished. The functional status of this factor is unknown on the estuary scale as well as the Elliott Bay scale. Since the project will not increase predators in any way, this factor is **Maintained.**

Fishing, both commercial and sport, have adversely affected the listed, proposed, and candidate species in Puget Sound. Future fishing closures and altered management is imminent. Unless commercial fisheries can effectively segregate wild fish from hatchery fish and sport catch post-release mortality can be reduced, this factor puts these species **At Risk** at an estuary and Elliott Bay scale. The only reason this factor is not rated lower is that

commercial fisheries for chinook are greatly reduced and tightly regulated. The project does not create increased fishing opportunity and thus **Maintains** this factor.

Harassment of salmon in the marine environment might come in the form of displacement due to noise or turbidity, such as occur during pile-driving or from the activity of boats and ships. Adult salmon are thought to be largely unaffected by boats and ships and juvenile salmonids migrating along shorelines in shallow water are generally separated from boats except in marinas. Pile driving is not permitted to occur during the smolt outmigratory period. We rate this factor as **Properly Functioning** for these reasons. The proposed project does not promote harassment and thus **Maintains** the status quo.

South Lake Union

The determination of effects for south Lake Union are abbreviated due to the obvious lack of potential impact of this project at that location on the species of consideration. Table 5 presents a summary matrix for the determination of effects, although many of the pathways and indicators are not relevant to lacustrine environments (lakes).

Mitigation

During preliminary consultation with NMFS, habitat restoration elements were considered beyond the habitat improvement that is inherent in the project itself. Pursuant to the policies of King County regarding recent salmon ESA listings, King County is offering a mitigation package that includes the following elements (Figure 4):

Rip Rap Replacement

- Purpose is to maintain bank stability along the seawall. Protects the park.
- 100 feet on either side of outfall pipeline
- Same slope and configuration as adjacent shoreline
- Rip rap size and type same as adjacent shoreline

Sand Veneer

- Purpose is to cover mildly contaminated substrates with clean materials and to replace gravel/sand/shell materials with finer grain materials (optimum for epibenthos).
- Clean fine sand blanketed over existing sand and shell fragment bottom between +1 and -20 feet MLLW
- Veneer depth = 4 inches
- Placement by barge and sidecast
- Placement in winter

Large Woody Debris

- Purpose is to provide a long-term source of detritus material as a food source for benthic invertebrates and to provide cover for larger organisms.

TABLE 5
Determination of Effects Summary: Lake Union

Pathways and Indicators	Environmental Baseline (Watershed Scale)			Effects of the Action (Project Area Scale)		
	Properly Functioning[1]	At Risk[1]	Not Properly Functioning[1]	Improve/ Restore[2]	Maintain[3]	Degrade[4]
Water Quality						
Temperature		X			X	
Sediment		X			X	
Chemical		X		X		
Habitat Access						
Physical Barriers		X			X	
Habitat Elements						
Substrate		X			X	
LWD			X		NA	
Pool Frequency			X		NA	
Pool Quality			X		NA	
Off-Channel Habitat		X			X	
Refugia		X			NA	
Channel Conditions and Dynamics						
Width/Depth Ratio			X		NA	
Streambank			X		X	
Floodplain			X		NA	
Flow/Hydrology						
Peak/Base Flows			X	X		
Drainage Network			X		X	
Watershed Conditions						
Road Density &			X		X	
Disturbance History			X		X	
Riparian Reserves			X		X	

Notes:
NA = Not Applicable.

1 The categories of function ("properly functioning," "at risk," and "not properly functioning") are defined for each indicator in the "Matrix of Pathways and Indicators" (NMFS, 1998).

2 For the purposes of this summary, "restore" means to change the function of an "at risk" indicator to "properly functioning," or to change the function of a "not properly functioning" indicator to "at risk" or "properly function" (it does not apply to "properly functioning" indicators).

3 For the purposes of this summary, "maintain" means that the function of an indicator does not change (i.e., "maintain" applies to all indicators regardless of functional level).

4 For the purposes of this summary, "degrade" means to change the function of an indicator for the worse (i.e., it applies to all indicators regardless of function level). In some cases, a "not properly functioning" indicator may be further worsened, and this should be noted.

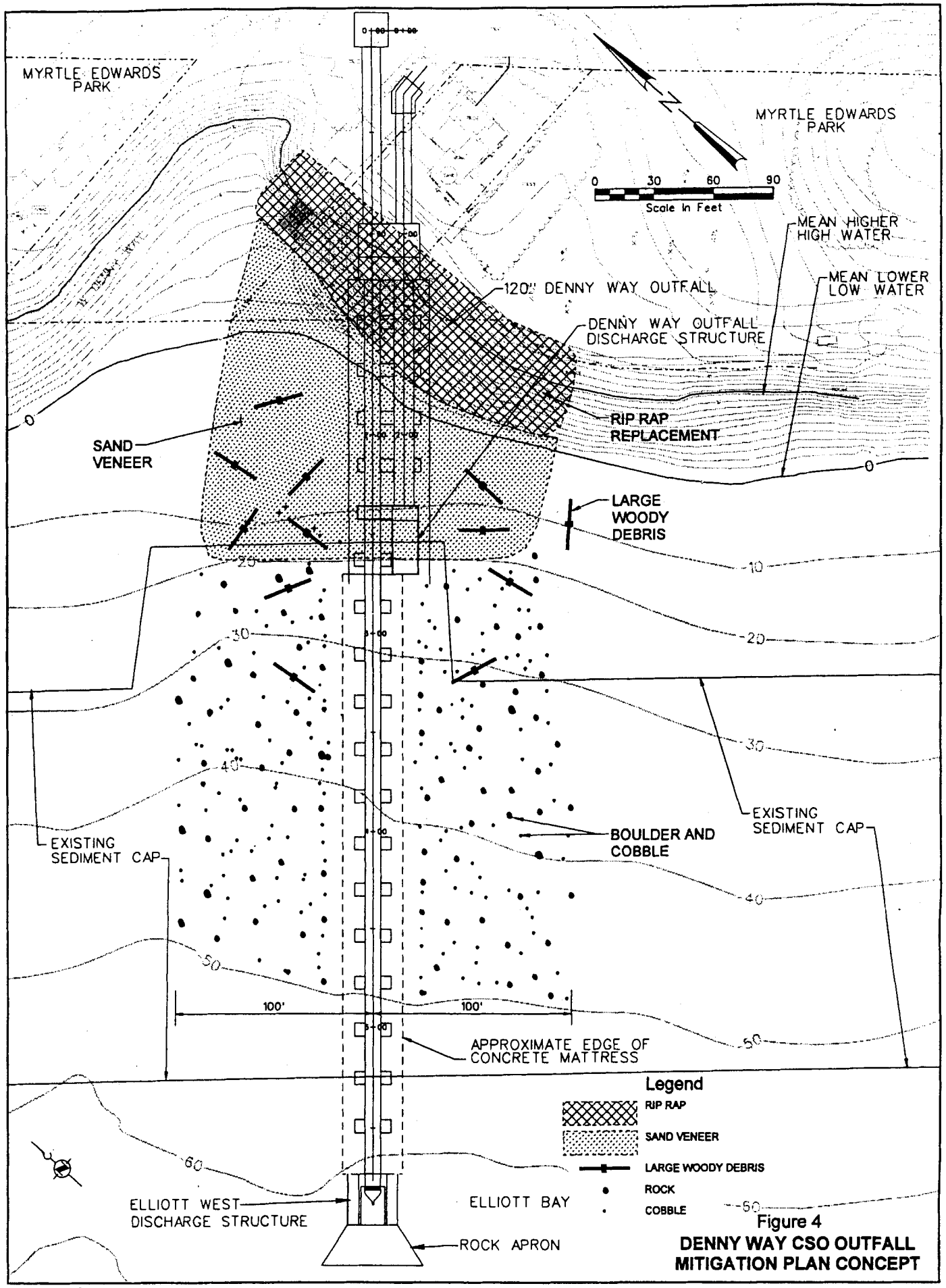

Figure 4
DENNY WAY CSO OUTFALL MITIGATION PLAN CONCEPT

141829.12 DENNYWAY.DGN

- Logs 16 inches in diameter or greater, 12 to 20 feet in length, smooth or with stobs and with root wads if possible.
- Anchored with at least 1,000 pounds of rock or concrete
- 12 units placed between –1 and –22 feet MLLW
- Deployment: sidecasted from barge

Boulder and Cobble

- Purpose is to provide macroalgae with holdfast surfaces
- Boulder size: 12 inches to 20 inches
- Boulder type: basalt or other small riprap material
- Cobble size 4 inches to 12 inches
- Cobble type: rounded river rock
- Even dispersal in 200-foot-wide strip, 100 feet on either side of outfall from –20 to –50 feet MLLW
- Boulder density = 1 per 400 square feet (125 total)
- Cobble density = 1 per 10 square feet (5,000 total)

Monitoring

- SCUBA transects with visual observations
- Once per year in late summer for 3 years

The rationale for the mitigation measures proposed is based on the concept of enhancing biological functions within the physical and socioeconomic constraints of the project area. Shoreline restoration to a natural configuration is usually the preferred type of habitat enhancement measure where seawalls or bulkheads are involved and salmon are the issue in Puget Sound. Unfortunately, this is not a practical solution at the Denny Way CSO outfall vicinity. The problem is that the adjacent land, Myrtle Edwards Park, is narrow, confined by the railroad tracks, and one of the only ocean-front parks in the City. To make matters worse, the toe of the seawall is about 20 feet deep. To reconfigure the shoreline to the preferred shallow slope, would either require the removal of most of the park, large volumes of nearshore fill or both.

The proposed concept is to enhance substrate grain size, sediment quality, and organic detritus inputs. The rationale for applying a sand veneer over the trenched area is to provide the substrate size that is preferred by the epibenthic invertebrate species that juvenile chinook salmon prefer in their diet and to cover mildly contaminated materials with clean materials. The plan is to apply the new clean sand materials in a blanket at least 4 inches deep, but could be 12 inches deep or more. The rationale for organic debris enhancement is to augment this depleted energy source for the nearshore ecosystem. The approach for enhancement has two elements: LWD placements and macroalgae habitat creation. LWD placements would consist of logs exceeding 16 inches in diameter and 12 to

20 feet long, anchored with either concrete blocks or drilled boulders. Either anchor type would be attached to the logs in pairs on both sides with wire cable. Since the preferred detritus sources of salt marsh and eelgrass would be impractical to create at this location, macroalgae habitat enhancement is the only alternative other than the logs. The way this would be done is to scatter small boulders and large cobble over the area designated for mitigation/enhancement. These boulders and large cobble would not be placed on the pipeline mattress because they might crack the mattress upon impact as they would be placed by barge. Boulder and cobble placement would be unnecessary on the mattress anyway because macroalgaes (and other encrusting organisms) will attach directly to the mattress.

The proposed mitigation actions would likely have to be phased to match the sediment cleanup actions in adjacent areas due to spacial overlap. Shoreline remediation area B lies in the cove immediately north of the outfall facilities, extending out to about –12 feet MLLW within the zone of proposed mitigation for this project. The logical solution is to defer the restoration of this small area for 1 year so that it could be completed after the cleanup action rather than being dredged out and redone. The restoration plan for remediation area B could be similar to the mitigation actions proposed for this project.

Conclusions

The proposed project improves habitat function for chinook salmon, coho salmon, sea-run cutthroat trout, and bull trout/Dolly Varden for 9 out of the 24 pathways and indicators discussed. The project does not degrade any of these factors over the long term. The project does affect these species because a benefit is an effect. Therefore, this project **Affects, But Does Not Adversely Affect** the species covered in this Biological Assessment.

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Appendix A

Correspondence from National Marine Fisheries Service and U.S. Fish and Wildlife Service

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
HABITAT PROGRAM/OLYMPIA FIELD OFFICE
510 Desmond Drive SE/Suite 103
LACEY, WASHINGTON 98503

April 5, 1999

Randy Whitman, Senior Fisheries Biologist
CH2M Hill
Post Office Box 91500
Bellevue, Washington 98009-2050

Re: Species List Request for for Denny Way/Lake Union Combined Sewer Overflow Control Project in King County, Washington

Dear Mr. Whitman:

The National Marine Fisheries Service (NMFS) has received your March 31, 1999 letter requesting an updated list of threatened and endangered species for the Denny Way Combined Sewer Overflow Project. The project is located in Section 25, Township 25 North, Range 3 East, W.M. and Section 30, Township 25 North, Range 4 East, W.M. in King County, Washington. Enclosed is a list of those anadromous fish species that are listed as threatened or endangered, those that are proposed for listing, and those that are candidates for listing under the Endangered Species Act (ESA). This inventory only includes those anadromous species under NMFS' jurisdiction. The U.S. Fish and Wildlife Service should be consulted regarding the presence of species falling under their jurisdiction.

Presently, Puget Sound chinook salmon (*Oncorhynchus tshawytscha*) are listed as threatened and may occur in or near the project area. Proposed critical habitat for Puget Sound chinook may be affected by the proposed project. Also, please be aware that coho salmon (*O. kisutch*) and sea-run cutthroat trout (*O. clarki clarki*) also may range in the project area and are candidate species eligible for listing under the ESA. Although candidate species are not afforded protection under the ESA, it would be prudent to incorporate project design features that avoid or minimize impacts to anadromous fish resources should they become listed at a later date.

Also enclosed is a list of threatened and endangered marine mammals and sea turtles under NMFS' jurisdiction that could be present in the project vicinity.

Thank you for your inquiry for information pertaining to federally listed threatened and endangered species. Should you require additional information, please contact DeeAnn Kirkpatrick at (206) 526-4452 or at the letterhead address.

Sincerely,

Dennis Carlson
for Steven W. Landino
Washington State Habitat Branch Chief

Enclosure

ESA STATUS - WASHINGTON STATE ANADROMOUS SALMONIDS - MARCH 1999

Species	(E=endangered, T=threatened, Date is for FR publication)		
	Listed	Proposed	Candidate
Coho (Oncorhynchus kisutch)	None	None	1) Puget Snd/St. of Georgia (7/95) 2) SW WA/L. Col. R. (7/95)
Steelhead (O. mykiss)	1) Upper Col. R. (E - 8/97) 2) Snake R. (T - 8/97) 3) Lower Col. R. (T - 3/98) 4) Middle Col. R. (T - 3/99)	None	None
Chum (O. keta)	1) Hood Canal Summer (T-3/99) 2) Columbia River (T-3/99)	None	None
Chinook (O. tshawytscha)	1) Snake R. fall (T - 4/92) 2) Snake R. spg/smmr (T - 4/92) 3) Upper Col. R. Spring (E - 3/99) 4) Puget Sound (T - 3/99) 5) Lower Col. R. (T-3/99)	None	None
Sockeye (O. nerka)	1) Snake R. (E - 11/91) 2) Ozette Lake (T - 3/99)	None	None
Pink (O. gorbuscha)	None	None	None
Sea-run Cutthroat (O. clarki clarki)	None	None	1) All Populations

NOTE: Listing rules announced on 3/16/99 will become effective 60 days after Federal Register publishing.

ENDANGERED AND THREATENED MARINE MAMMALS
AND SEA TURTLES
UNDER THE JURISDICTION OF
NATIONAL MARINE FISHERIES SERVICE
THAT MAY OCCUR OFF WASHINGTON AND OREGON

MARINE MAMMALS

Humpback Whale	*Megaptera novaeangliae*
Blue Whale	*Balaenoptera musculus*
Fin Whale	*Balaenoptera physalus*
Sei Whale	*Balaenoptera borealis*
Sperm Whale	*Physeter macrocephalus*
Steller Sea Lion	*Eumetopias jubatus*

MARINE TURTLES

Leatherback Sea Turtle	*Dermochelys coriacea*
Loggerhead Sea Turtle	Caretta caretta

****

ENDANGERED AND THREATENED MARINE MAMMALS
AND SEA TURTLES
UNDER THE JURISDICTION OF
NATIONAL MARINE FISHERIES SERVICE
THAT MAY OCCUR IN THE PUGET SOUND

MARINE MAMMALS

Humpback Whales	*Megaptera novaeangliae*
Steller Sea Lion	*Eumetopias jubatus*

MARINE TURTLES

Leatherback Sea Turtle	*Dermochelys coriacea*

United States Department of the Interior

FISH AND WILDLIFE SERVICE
North Pacific Coast Ecoregion
Western Washington Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
(360) 753-9440 FAX: (360) 753-9008

REC'D CH_2M SEA APR 2 3 1999

April 15, 1999

Randy Whitman
Senior Fisheries Biologist
CH2M Hill, Inc.
777 108th Avenue, N.E.
Bellevue, WA 98004-2050

FWS Reference: 1-3-99-SP-0459
Xreference: 1-3-96-SP-0280

Dear Mr. Whitman:

This is in response to your letter dated March 31, 1999 and received in this office on April 1, 1999. You have requested a list of listed and proposed threatened and endangered species, candidate species, and species of concern (Attachment A) that may be present within the area of the proposed Denny Way/Lake Union combined sewer overflow project in King County, Washington. This response fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act of 1973, as amended (Act). We have also enclosed a copy of the requirements for U.S. Army Corps of Engineers (COE) compliance under the Act (Attachment B).

Should the COE determine that a listed species is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. If the COE determines that the proposed action is "not likely to adversely affect" a listed species, you should request Service concurrence with that determination through the informal consultation process. Even if there is a "no effect" situation, we would appreciate receiving a copy for our information.

Both listed and proposed species may occur in the vicinity of the project. Therefore, pursuant to the regulations implementing the Act, impacts to both listed and proposed species must be considered by the COE in a biological assessment (see Attachment B for more information on preparing biological assessments). Formal conference with the Service is required if the COE determines that the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat. The results of the biological assessment will determine if conferencing is required. If the species is ultimately listed, your agency may be required to reinitiate consultation.

Species of concern are those species whose conservation standing is of concern to the Service, but for which further status information is still needed. Conservation measures for species of concern are voluntary, but recommended. Protection provided to these species now may preclude possible listing in the future.

There may be other federally listed species that may occur in the vicinity of your project which are under the jurisdiction of the National Marine Fisheries Service (NMFS). Please contact NMFS at 360-753-9530 to request a species list.

In addition, please be advised that state regulations may require permits in areas where wetlands are identified. You should contact the Washington State Department of Ecology for state permit requirements.

Your interest in endangered species is appreciated. If you have additional questions regarding your responsibilities under the Act, please contact Bobbi Barrera (360/753-6048) or John Grettenberger of this office at the letterhead phone/address.

Sincerely,

James L. Thomas
for
Gerry A. Jackson
Supervisor

bb/es
Enclosure
SE/COE/1-3-99-SP-0459/King

c: COE
WDFW, Region 4
WNHP,Olympia

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 510 Desmond Drive SE, Suite 102, Lacey, WA 98503-1273.

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* "Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal action such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

APPENDIX C

Spreadsheet model of concentrations of contaminants the sediment over time for Mercury, Copper, Lead, 1-4 DCB, and PCB

sediment Concentration over [illegible]

Mercury

call COE & proceed w/ forward

Cell	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year10
Brandon	1.09E-01	8.08E-02	6.85E-05	0.00E+00	0.00E+00	0.00E+00	2.02E-04	2.48E-04	2.02E-04	1.74E-04
Duw/Diag	5.06E-02	4.65E-02	2.86E-02	9.91E-03	8.58E-04	8.15E-04	7.95E-04	5.31E-04	3.48E-04	2.95E-04
Chelan	5.88E-02	5.56E-02	4.67E-02	4.25E-02	3.94E-02	3.64E-02	3.25E-02	3.05E-02	2.89E-02	2.60E-02
Hanford	6.31E-01	6.01E-01	5.35E-01	4.91E-01	4.52E-01	4.08E-01	3.51E-01	3.11E-01	2.70E-01	2.28E-01
Lander	4.37E-01	4.22E-01	3.73E-01	3.43E-01	3.19E-01	2.91E-01	2.50E-01	2.25E-01	1.99E-01	1.73E-01
King St	5.19E-01	5.17E-01	5.15E-01	5.14E-01	5.13E-01	5.08E-01	5.07E-01	5.07E-01	5.05E-01	5.04E-01
Denny Off	3.06E-01	3.05E-01	3.04E-01	3.04E-01	3.03E-01	3.00E-01	3.00E-01	3.00E-01	2.99E-01	2.99E-01
Denny Ne	3.08E-01	3.07E-01	3.06E-01	3.06E-01	3.05E-01	3.02E-01	3.01E-01	3.02E-01	3.00E-01	3.00E-01

Contamination From Clean after 1-year (mg/kg)

Brandon	6.56E-04
Duw/Diag	1.69E-03
Chelan	4.35E-04
Hanford	2.64E-04
Lander	3.53E-04
King St	0.00E+00
Denny Off	0.00E+00
Denny Ne	0.00E+00

From Judy Cochran KC

2 NOV 99

Kevin shock 206-263-3160 lower part of ~~sheet~~ sheet indicates amt of contamination it project is built + after one yr of operation starting w/ clean sediment

Copper

Cell	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year10
Brandon	52.20	46.50	36.10	34.50	34.00	34.60	34.40	34.30	34.20	34.10
Duw/Diag	39.00	36.90	37.00	36.20	35.00	34.10	35.10	34.10	34.00	33.90
Chelan	37.80	36.40	35.80	35.10	34.50	33.80	33.70	33.20	32.90	32.40
Hanford	130.00	124.00	114.00	107.00	101.00	93.50	84.60	78.10	71.30	64.50
Lander	115.00	111.00	102.00	96.20	91.30	85.70	78.10	73.00	67.80	62.70
King St	88.60	88.00	87.40	87.00	86.40	85.40	84.90	84.70	84.00	83.50
Denny Off	42.00	41.90	41.70	41.60	41.50	41.10	40.90	41.00	40.80	40.70
Denny Ne	46.50	46.30	46.20	46.00	45.80	45.40	45.20	45.20	45.00	44.80

Contamination From Clean after 1-year (mg/kg)

Brandon	13.60
Duw/Diag	17.10
Chelan	7.00
Hanford	4.07
Lander	3.56
King St	0.22
Denny Off	0.18
Denny Ne	0.16

Y

Lead

Cell	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year10
Brandon	26.20	22.40	15.90	13.40	12.60	13.10	12.70	12.70	12.70	12.70
Duw/Diag	27.70	25.30	21.80	17.60	15.10	13.80	13.60	13.00	12.90	13.00
Chelan	68.70	64.70	56.30	52.00	48.80	45.70	42.10	40.00	38.30	35.30
Hanford	171.00	163.00	147.00	136.00	126.00	115.00	101.00	90.70	80.50	70.00
Lander	87.50	84.00	75.90	70.40	65.90	60.70	53.60	48.90	44.10	39.30
King St	72.20	72.10	71.70	71.60	71.40	70.80	70.50	70.50	70.20	70.00
Denny Off	37.80	37.90	37.90	37.80	37.80	37.40	37.40	37.50	37.30	37.30
Denny Ne	42.70	42.70	42.60	42.50	42.50	42.20	42.20	42.30	42.20	42.20

	Contamination From Clean after 1-year (mg/kg)
Brandon	7.14
Duw/Diag	10.50
Chelan	4.16
Hanford	2.53
Lander	2.18
King St	0.16
Denny Off	0.17
Denny Ne	0.14

1-4 DCB 1-4 Di Chloro di benzen

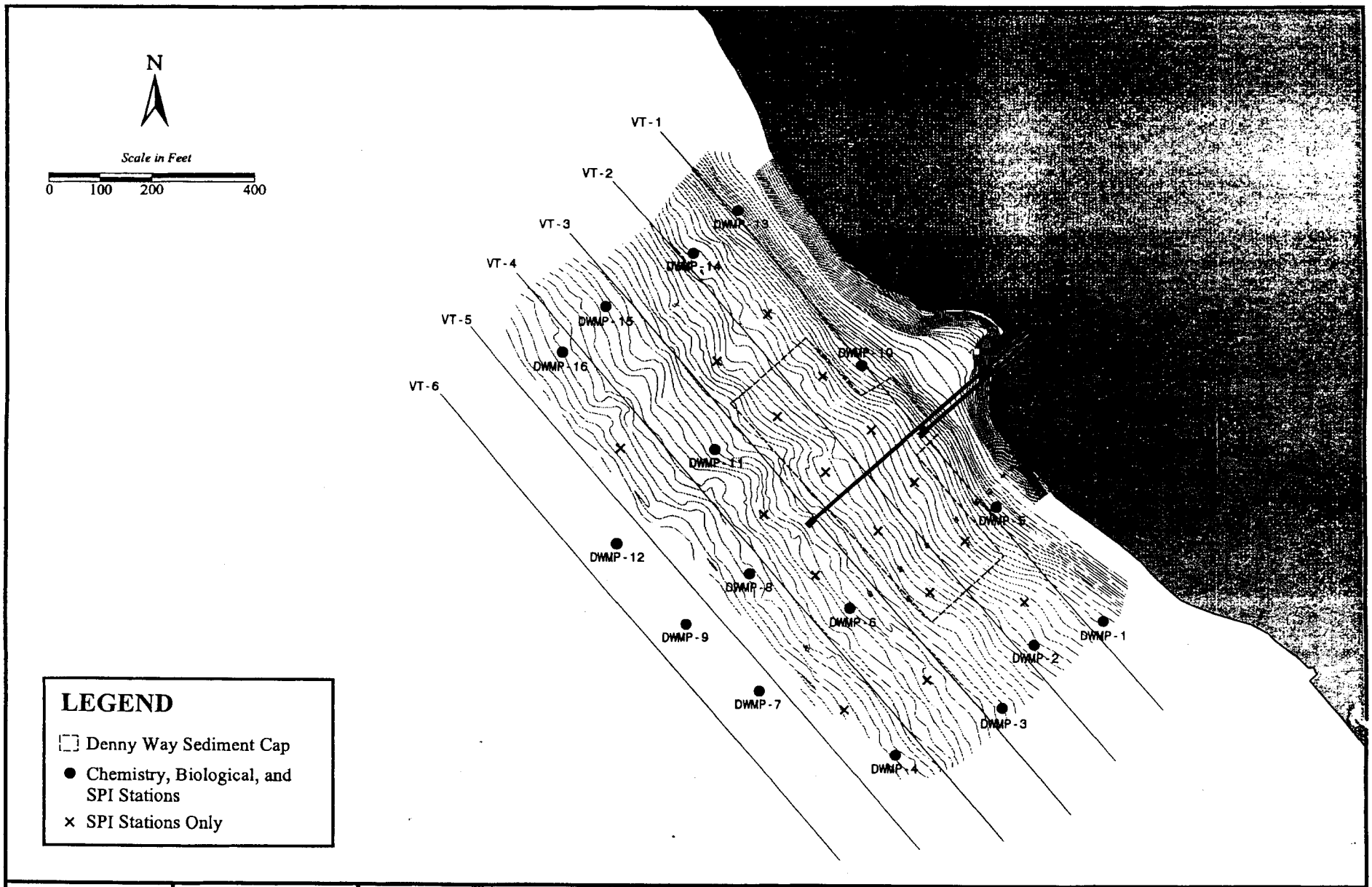
Cell	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year10
Brandon	3.21E-03	1.56E-03	2.13E-04	4.79E-05	1.05E-04	1.55E-04	1.64E-04	1.57E-04	1.54E-04
Duw/Diag	1.92E-03	1.40E-03	9.35E-04	5.85E-04	2.30E-04	1.99E-04	1.72E-04	1.69E-04	1.73E-04
Chelan	4.46E-04	3.89E-04	3.60E-04	3.33E-04	3.12E-04	2.87E-04	2.74E-04	2.63E-04	2.42E-04
Hanford	6.56E-02	5.89E-02	5.43E-02	5.03E-02	4.57E-02	3.99E-02	3.58E-02	3.16E-02	2.73E-02
Lander	4.73E-02	4.23E-02	3.92E-02	3.66E-02	3.38E-02	2.95E-02	2.69E-02	2.42E-02	2.15E-02
King St	4.95E-02	4.93E-02	4.93E-02	4.91E-02	4.87E-02	4.86E-02	4.86E-02	4.84E-02	4.84E-02
Denny Off	9.25E-03	9.24E-03	9.23E-03	9.20E-03	9.13E-03	9.12E-03	9.14E-03	9.10E-03	9.09E-03
Denny Ne	1.27E-02	1.27E-02	1.27E-02	1.27E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02	1.26E-02

	Contamination From Clean after 1-year (mg/kg)
Brandon	1.40E-04
Duw/Diag	3.56E-04
Chelan	1.04E-04
Hanford	9.73E-05
Lander	8.90E-05
King St	5.58E-06
Denny Off	5.63E-06
Denny Ne	5.57E-06

Kevin Shock
206 ~~[illegible]~~ 263 3161

Cell	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year10
Brandon	8.64E-02	4.26E-02	5.13E-03	4.76E-04	2.98E-04	6.17E-04	6.30E-04	5.70E-04	4.07E-04
Duw/Diag	1.23E-01	8.68E-02	5.48E-02	3.04E-02	5.67E-03	2.71E-03	1.20E-03	6.00E-04	6.02E-04
Chelan	6.55E-02	5.54E-02	5.05E-02	4.68E-02	4.31E-02	3.87E-02	3.63E-02	3.43E-02	3.13E-02
Hanford	8.92E-01	8.02E-01	7.41E-01	6.89E-01	6.29E-01	5.51E-01	4.96E-01	4.41E-01	3.84E-01
Lander	6.60E-01	5.88E-01	5.42E-01	5.05E-01	4.63E-01	4.02E-01	3.63E-01	3.24E-01	2.85E-01
King St	2.30E-01	2.29E-01	2.29E-01	2.28E-01	2.26E-01	2.25E-01	2.26E-01	2.25E-01	2.24E-01
Denny Off	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.24E-01	1.24E-01	1.25E-01	1.24E-01	1.24E-01
Denny Ne	1.46E-01	1.46E-01	1.46E-01	1.46E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01

	Contamination From Clean after 1-year (mg/kg)
Brandon	1.15E-02
Duw/Diag	5.97E-02
Chelan	2.36E-02
Hanford	1.34E-02
Lander	1.36E-02
King St	1.88E-03
Denny Off	2.06E-03
Denny Ne	1.60E-03



TRIPLIN Environmental Associates	Figure 1	Sampling Locations for the Denny Way CSO Marine Monitoring Plan	B97-07-06
			May 2000 / DWMP Figure 1.xar

APPENDIX D

Benthic (Sediment) Sampling Plan

ATTACHMENT A (Continued)

CANDIDATE

None.

SPECIES OF CONCERN

The following species of concern may occur in the vicinity of the project:

Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
River lamprey (*Lampetra ayresi*)

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CANDIDATE SPECIES AND SPECIES OF CONCERN WHICH MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED DENNY WAY/LAKE UNION COMBINED SEWER OVERFLOW PROJECT IN KING COUNTY, WASHINGTON

(T25N R03E S25;T25N R04E S30)

FWS REF: 1-3-99-SP-0459

LISTED

Bald eagle (*Haliaeetus leucocephalus*) - Wintering bald eagles may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Peregrine falcon (*Falco peregrinus*) - there is one peregrine falcon eyrie located in the vicinity of the project at T25N R04E S31, on the Washington Mutual Tower in downtown Seattle. Nesting activities occur from January 1 through August 15.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species are:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) which may result in disturbance to listed species and/or their avoidance of the project area.

PROPOSED

Bull trout (*Salvelinus confluentus*) - Coastal/Puget Sound population may occur in the vicinity of the project.