DONALD E. WEITKAMP, PH. D

AR 016822

POLLUTION CONTROL HEARINGS BOARD
FOR THE STATE OF WASHINGTON

AIRPORT COMMUNITIES COALITION and CITIZENS AGAINST SEA-TAC EXPANSION,

Appellants,

v.

DEPARTMENT OF ECOLOGY and THE PORT OF SEATTLE,

Respondents.

No. PCHB 01-160

PREFILED DIRECT TESTIMONY OF DONALD E. WEITKAMP, PH. D

Table of Contents

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

ORIGINAL

AR 016823

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

1. I have personal knowledge of the facts stated in this testimony and would be competent to testify to those facts.

2. Summary and Overview of Testimony. This testimony provides my views on the fish and aquatic habitat issues associated with the §401 Certification recently issued by the Washington Department of Ecology. My role relative to this project has been to review and provide expert opinions and advice with matters related to fish habitat and stream ecology. I have reviewed the Port of Seattle's planned projects at Seattle-Tacoma International Airport ("STIA") that are covered by the pending application for a §404 permit and the §401 Certification. I have assisted with preparation of the Biological Assessment for the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for the various projects at STIA.

3. Miller, Walker and Des Moines currently support a diverse and abundant fish fauna. However, these streams are disturbed and have been significantly altered by urban development over the past 140 years. This alteration has made the streams more suitable for exotic and introduced species than for salmonids. In my opinion, the Port's planned Master Plan Update improvements will result in improved conditions in these streams, based on the restoration of previously degraded habitat, treatment of stormwater entering the streams and the mitigation of low flow impacts.

4. Habitat conditions are currently improving in Miller Creek as a result of the removal of residences and commercial activities in conjunction with the Port's acquisition of properties adjacent to this stream. The removal of the effects of urbanization is allowing natural processes and the growth of native vegetation to begin the restoration of the watershed. This action and other improvements proposed by the Port in connection with its Master Plan update will likely improve conditions for salmon within the headwaters of both Miller and Des Moines Creeks.

5. The Port prepared a Biological Assessment in connection with the proposed Master Plan Update improvements. I assisted in the preparation of this document. The BA concluded that the Master Plan Update projects would not be likely to affect species listed under the Endangered Species

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

Act. Both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service have concurred in this conclusion.

6. In addition to the Biological Assessment, an analysis of Essential Fish Habitat was undertaken as required by federal law. This analysis also concluded that the Port's Master Plan Update projects would have no adverse effects on chinook or pink salmon, and that no long-term effects to coho salmon would occur.

7. Based on my review of the existing record and the evidence, it is my conclusion that it is not likely that the proposed Master Plan Update actions will adversely affect stream habitat. This conclusion includes impacts on stream flow. Stream flows of less than 1.0 cubic feet per second will impact anadromous and resident fish species. In those portions of Miller and Des Moines Creeks that fall within the STIA area, the summer low flows have already decreased to less than 1.0 cfs in every year for the past 47 years, except for one year for one creek. These normal low flow conditions establish the carrying capacity of the streams and demonstrate that the streams do not provide (either currently or in the past) desirable salmonid habitat in the vicinity of STIA. The project will not change these limiting flow conditions for any of the four area streams, nor will it make stranding or mortality of fish more likely.

8. The wetlands of the STIA area have previously been highly modified by urban development. It is not likely that the minor changes anticipated from the STIA improvements will result in measurable changes in the stream conditions that would be attributable to the changes in the wetlands. By contrast, constructing new wetlands in the lowlands of the Green River has the potential to provide substantially greater benefits than in the Miller and Des Moines Creek systems.

9. Finally, the capture, storage and later release of stormwater to support summer low flows for fish is not a new technique and has been shown to be reliable as a way to augment streamflow. This is the basic concept that has been has been practiced on a very large scale in the Columbia River since 1983.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

10. In summary, it is my conclusion that there is reasonable assurance that the STIA Master Plan Update projects will not be the cause of a significant adverse impact to fish and aquatic biota.

Each of the conclusions outlined above is explained in more detail below.

11. Resume and Experience. I am a fish biologist with experience in both freshwater and marine aspects of the biology of salmonids, resident fishes, and invertebrates of the Pacific Northwest. My experience has been with the freshwater spawning, rearing and migrations of salmonids, together with the estuarine rearing and migrations of juvenile salmonids. I have over 30 years professional experience working as a fisheries and resource biologist throughout the United States, Central America, and China. A copy of my professional resume is attached as Exhibit A to this declaration.

12. Involvement With Project. My role has been to review and provide expert opinions and advice with matters related to fish habitat and stream ecology. I have reviewed the Port of Seattle's planned projects at Seattle-Tacoma International Airport ("STIA") that are covered by the pending application for a §404 permit from the U.S. Army Corps of Engineers. I have assisted with preparation of the Biological Assessment for the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for the various projects at STIA. I am thoroughly familiar with existing stream conditions and flow conditions in the area of STIA, and have reviewed the existing and proposed stormwater management plans for STIA and the proposed low flow analysis and mitigation plan for the Port's projects.

13. Materials Reviewed. I have reviewed the Biological Assessment, Master Plan Update Improvements, Seattle-Tacoma International Airport (Parametrix 1999) that was prepared for the federal agencies, the Biological Opinion issued by the United States Fish and Wildlife Service, the Essential Fish Habitat assessment, the Low Streamflow Analysis and the Summer Low Flow Impact Offset Facility Proposal prepared for the STIA projects, the Natural Resources Mitigation Plan prepared for the Corps of Engineers, the Stormwater Management Plan for the STIA projects, and the §401 Certification

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

issued by the Department of Ecology. I have also reviewed the declarations and pre-filed testimony submitted by Dr. John Strand, Dr. Peter Willing, and Mr. William Rozeboom on behalf of the ACC.

14. STIA Area Streams Support Valuable Fish Fauna. Miller, Walker and Des Moines currently support a diverse and abundant fish fauna worthy of protection. My review of the various STIA master plan documents and analyses of these plans indicates the Port of Seattle proposes to protect and enhance the existing fish resources of these streams.

15. Existing Condition of Miller, Walker and Des Moines Creeks. These streams are currently in a highly disturbed condition caused by the removal of the natural forest habitat and subsequent urban development that have occurred over the last 140 years. The streams have been highly altered by urban development independent of STIA, although STIA contributes to this existing condition. Improved conditions in these streams will result from restoration of previously degraded habitat, treatment of a greater quantity of the stormwater entering the headwaters for those streams, and mitigation of low flow impacts arising from the construction of the MPU projects.

16. How will the STIA Master Plan Alter Existing Conditions? The water quality controls and conditions in the project design and those placed on the project by Ecology in the §401 Certification include best management practices, as well as site-specific water quality standards for the Port's stormwater runoff. These conditions will improve the existing conditions of the streams and aquatic resources of Miller and Des Moines Creeks. Water quality criteria are generally set in a conservative manner that prevents detectable impacts to aquatic resources. It is unlikely that the streams in the urban setting of the STIA vicinity are more sensitive than most northwest streams. The existing urban development has substantially changed the stream's hydraulic and chemical characteristics. Runoff from developed urban areas is highly altered from pre-development conditions. Urban development in drainage areas produces roadway pollutants, fertilizers and pesticides that alter the characteristics of urban streams. Treatment of STIA runoff prior to discharge to these streams avoids the impacts resulting from other urban development.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

17. Aquatic Habitat Improvements. Habitat conditions are currently improving in Miller Creek. The removal of residences and commercial activities from a substantial portion of the upper watershed is allowing natural processes to begin the restoration of the watershed. The removal of the former Exxon Station (Parcel 33R) has eliminated and cleaned up previous petroleum leaks in the Miller Creek drainage. Removal of the septic tank business from Parcel 289R has removed a source of high nutrient concentrations and coliform bacteria, as well as petroleum pollution. Nutrients and pollutants from residential, farming, and commercial activities have substantially decreased. Leaking septic tanks at some residences within the Miller Creek drainage area have been removed. More than 100 residential heating oil tanks have been removed as part of the Port's cleanup within the watersheds. In the absence of the Port's actions, each of the above would continue the urban degradation of the stream habitat or be sources of pollution to the STIA area streams.

18. Early Habitat Restoration. Native vegetation is improving along the riparian corridor of the stream where STIA has removed residences and commercial activities. The STIA Master Plan provides a riparian buffer where none has previously existed. The riparian habitat and stream are no longer disturbed on a frequent basis by human activity in this area. Lawns that extended to the edge of Miller Creek's water are no longer maintained, allowing native vegetation to begin growing in this valuable riparian zone. Human activities that removed natural riparian vegetation in the past, as evidenced by stumps of small trees and brush, are no longer occurring. In the near future, similar changes will begin along the upper watershed of Des Moines Creek within the STIA site such as on the Tyee Golf course, which currently has mowed grass extending to the stream edge in many areas.

19. Fish and Salmon in Miller and Des Moines Creeks. Coho and chum salmon are present in Miller and Des Moines Creeks. These species spawn and rear within the streams downstream from the STIA property. The portions of these streams within the STIA site and immediately downstream have several warm water fish species that are exotic or introduced species, including yellow perch, black crappie and pumpkinseed sunfish. These species commonly inhabit streams having characteristics

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

adverse to salmonids and are not commonly found in the same habitats as salmonids. In my opinion, the effects of urbanization have sufficiently altered the streams to make them more suitable for these warm water species than for salmonids. The presence of these warm water species together with the small size of the headwater reaches of Miller, Walker, and Des Moines Creeks provides evidence that salmonids are not likely to find that the streams in the vicinity of STIA provide suitable habitat under the conditions that were present prior to the Port's acquisition of property. The improvements currently occurring and others proposed to the headwaters of Miller and Des Moines Creeks are likely to improve habitat conditions for salmon within the headwaters of these streams.

20. Do Chinook Salmon Frequent the Mouths of Miller and Des Moines Creeks? I have not seen any direct evidence that juvenile chinook from other streams "frequent" the mouths (i.e., outfalls) of Miller, or Des Moines at the shoreline of Puget Sound during their outmigration. However, it is certainly possible young chinook do migrate along this shoreline and spend some brief time at the mouths of these streams. Based on general knowledge of the behavior of juvenile salmon, it is likely that chinook briefly hold near the mouth of those streams during migration along Puget Sound's shoreline. However, it is not likely that any would venture upstream past the vicinity of the stream mouth. It is not likely young salmon would return to the fresh water of these streams having acclimated to salt water flowing migration away from their natal stream. Young salmonids, including chum and chinook, commonly spend some time near the discharge of small tributaries into mainstem streams, lakes and estuarine areas. This association is likely due to the food sources the streams carry in their discharges. Stream discharges carry aquatic insects into estuarine habitats providing concentrated sources of prey the young salmon commonly have been consuming during their freshwater rearing phase.

21. Will STIA Master Plan Adversely Affect Young Chinook at the Mouth of the Streams? I have not detected any indication in the materials that I have reviewed that any of the alterations proposed in the headwater portions of Miller and Des Moines Creeks will result in detectable changes at

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

the mouths of these streams. Minor changes in nutrients, prey resources and fish population within the headwaters areas will most likely not be detectable at the mouths of the streams. Conditions at the mouths of the streams are predominately influenced by Puget Sound conditions as modified by the total volume of freshwater discharge during the migration period. In my opinion, upstream nutrient and prey conditions would need to change dramatically (an order of magnitude or more) within the STIA portion of the headwaters in order to produce detectable alterations at the Puget Sound shoreline.

22. Significance of Chinook in Gilliam Creek. The identification of juvenile chinook in Gilliam Creek is not evidence that this species is produced in Gilliam Creek. Young chinook are commonly planted by school rearing programs in a number of Puget Sound streams. Small numbers of young chinook also occasionally migrate upstream into tributaries from mainstem rivers for brief rearing in streams other than those where they were spawned. Gilliam Creek is a small stream that does not have the physical characteristics of a chinook spawning stream. It would be extraordinary for a stream of Gilliam Creek's size and characteristics to have a reproducing population of chinook salmon. Streams of this size and characteristics may have cutthroat trout, but are unlikely to support salmon reproduction. While the Biological Assessment prepared for the federal agencies does discuss Gilliam Creek, the characteristics of Gilliam Creek are of questionable relevance for the §401 Certification, because the stormwater discharges from the project elements listed in the JARPA for the §401 Certification all go to either the Miller, Walker or Des Moines Creek basins.

23. Assessment of Listed Species in STIA Area. The Port prepared a Biological Assessment (BA) for the actions being taken pursuant to the Port's Master Plan Update at STIA as required by the Endangered Species Act. This BA was submitted to the National Marine Fisheries Service and the U.S. Fish & Wildlife Service (collectively, the "Services"). The Services are the agencies with responsibility for protection of species listed under the Endangered Species Act. The BA concluded that the Master Plan Update projects at STIA will not be likely to adversely affect the species listed under the Endangered Species Act, which include chinook salmon.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

24. Concurrence by NMFS Concludes Not Likely to Adversely Affect. The National Marine Fisheries Service has issued a letter of concurrence with the finding in the BA that the project will be not likely to adversely affect chinook salmon.

25. USF&WS Concludes Not Likely to Adversely Affect. The U.S. Fish & Wildlife Service has issued a Biological Opinion indicating concurrence with the finding in the Port's BA that the project is not likely to adversely affect the species listed under their authority.

26. Essential Fish Habitat Study Concludes No Long-Term Adverse Affects. An analysis of Essential Fish Habitat ("EFH") complying with provisions of Section 305(b) of the Magnuson-Stevens Act has also been conducted by the Federal Aviation Agency ("FAA") and U.S. Army Corps of Engineers. The Port of Seattle, acting as the non-federal representative on behalf of the FAA, prepared the EFH assessment. See 50 C.F.R. § 600.920(b)-(c). In addition to species listed under the ESA, the EFH analysis included other, non-listed fish species such as coho salmon. That analysis concluded that the Port's Master Plan Update projects, including the projects covered by the §401 Certification, would have no adverse effects to chinook or pink salmon, and that no long-term effects will occur to coho salmon. Because of construction associated with the habitat restoration projects planned for Miller Creek as part of the Master Plan Update projects, there may by some short-term effects on coho salmon, but the EFH assessment concluded that those restoration projects would actually provide a long-term benefit to the species.

27. Cutthroat Trout in Miller, Walker and Des Moines Creeks. Cutthroat trout have been documented in these streams. The presence of cutthroat trout in these streams is not unusual or particularly significant. Cutthroat trout are present in most small urban streams in the Puget Sound region. Cutthroat trout appear to do well in conditions that are not advantageous to the salmon species. It is possible that some of these cutthroat trout are anadromous; however, we have not seen any scientific evidence that an anadromous cutthroat trout population occurs in these streams. It is not unusual for anadromous cutthroat trout to be present in any stream draining to Puget Sound.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

28. Is Turbidity in Stormwater Likely to Adversely Affect Fish Populations? It is not likely that turbidity levels in stormwater will have an adverse effect on fish in Miller, Walker and Des Moines Creeks. Turbidity is a natural part of the habitat occupied by young and adult salmon. Turbidity refers to light attenuation by mineral and biological materials suspended in the water column. Turbidity at moderate levels of about 25-110 nephelometric turbidity units (NTU) is common in rivers with rearing and migrating salmon. Turbidity has both beneficial and negative affects for fish. Turbidity can decrease predation on young salmonids. Gregory and Levings (1998) found that young salmon are less likely to be eaten by piscivorous fish at higher turbidities. Turbidity can also reduce the feeding efficiency of young salmonids. Gregory (1988) reported the reaction distance of young chinook to benthic prey decreased greatly between 0 and about 50 NTUs. However, from 50 to 250 NTUs there was little change in reaction distance, partially because the fish were only reacting to prey within about 8 cm at 50 NTU. Berg and Northcote (1985) demonstrated a similar decrease in the reaction distance of juvenile coho to pelagic prey at turbidities of 30 and 60 NTUs, as compared to 0 NTU. Growth of young steelhead and coho was reduced by chronic turbidity in the range of 20-50 NTUs in freshwater rearing (Sigler et al. 1984). However, turbidity in the range of 30-60 NTUs is common in natural rivers.

29. Conditions When Stormwater Discharge Characteristics Effect Fish. Stormwater will be discharged from the STIA treatment and detention facilities following the initiation of heavy precipitation. Stream levels will begin to increase during the initial stages of a storm, but it will take some time before stormwater will be discharged from the Port's treatment and detention facilities. Discharge of treated and detained storm water will continue following the later portions of the storm, when stream levels naturally remain moderately high. It is not likely that there will be substantial discharge from the treatment and detention facilities during the extreme low flow periods of late summer, absent storm events. Thus, the characteristics of the stormwater discharge from the STIA facilities will be relevant to fish primarily during periods of high and moderately high stream flow, and not during extreme low flows.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

30. Importance of Chronic Criteria. Maximum increases in concentrations of materials in the stormwater discharged from the STIA facilities will occur well after stream flows have been increased by the same precipitation passing through the treatment and detention facilities. Therefore, peak concentrations of materials in the discharges from the STIA facilities will occur for brief periods following the initiation of heavy precipitation, and extend into the high stream flow period following the storm. In the event of sequential storms, the stream flows will remain high and the highest concentrations of metals and organics typically occur during the early stages of the storm event.

31. There Will Be No Degradation of Stream Habitat by STIA Actions. It is not likely the proposed actions will adversely affect the existing stream habitat. As discussed above, the initial portions of the STIA actions are already resulting in improved stream habitat. Restoration of riparian vegetation together with protection of low stream flows in the late summer is likely to further improve rather than degrade existing stream habitat conditions.

32. Information Requirements for Environmental Evaluation. NEPA, SEPA and ESA evaluations require identification and disclosure of impacts related to the proposed action. Assessment of these impacts requires adequate information on biological resources for decision makers to make reasoned choices and decisions on the impacts. These regulatory processes do not required detailed quantitative investigations of fish and invertebrate populations present in a stream. Identifying the species present, the existing habitat conditions, and how the habitat conditions will be altered by the proposed action commonly satisfies the requirements of these regulatory processes.

33. Baseline Conditions in STIA Area Streams. The Port and others have expended considerable effort to document the baseline biological and habitat conditions within Miller, Walker and Des Moines Creeks as a basis for identification and disclosure of impacts. The Port has conducted numerous habitat surveys and incorporated other (non-Port) survey data into its analysis of conditions in Miller, Walker and Des Moines creeks. These surveys consist of data on fish, other aquatic species,

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

water quality, water quantity, habitat features, and stream stability. Surveys providing this information include:

- Ames 1970
- Trout Unlimited 1993
- Port of Seattle 1994
- Resources Planning Associates et al 1994
- Luchessa 1995
- Aquatic Resources Consultants, Inc. 1996
- Des Moines Creek Basin Committee 1997
- King County Surface Water Management 1997
- Herrera Environmental Consultants, Inc. 1995, 1996 and 1997
- Batchko 1999 personal communication
- Hillman 1999
- Parametrix, Inc. 1999a

These surveys establish the baseline conditions prior to the Port's Master Plan Improvements (which include the projects for which a §404 permit and §401 certification are required). Specifically, "baseline conditions" were established in the Biological Assessment (Parametrix 2000a) and Essential Fish Habitat Consultation (Parametrix 2000b) for salmonids and salmonid habitat. In its Biological Opinion, the United States Fish and Wildlife Service accepted the baseline conditions established by the Port in those documents.

34. Biological Information Avalailable. The fish species present have been identified, and appropriate information exists in the literature to identify and disclose the impacts of the proposed action and the appropriate actions to protect these species.

35. Effect of Stream Flow Changes on Fish. The fish population levels supported by streams are commonly determined by late summer low flows that occur for periods of weeks to months. These

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

low flows provide the maximum carrying capacity for resident fish that must remain within the stream. Stream flows of less than 1.0 cubic feet per second ("cfs") will impact anadromous and resident fish species. In those portions of Miller and Des Moines Creeks that fall within the STIA area, the summer low flows have decreased to less than 1.0 cfs for every year on record, except for one year for one creek. This record covering the past fifty years was examined by Parametrix and others in preparation of the Low Flow Analysis for the §401 Certification and the Biological Assessment for the federal agencies. The mean-annual summer low flows in the STIA-area streams are 0.75 cfs. These normal low flow conditions establish the carrying capacity of the streams and demonstrate that the streams do not provide (either currently or in the past) desirable salmonid habitat in the vicinity of STIA. The project will not change these limiting flow conditions for any of the four streams.

36. Primary Factors Determining Temperature and Dissolved Oxygen. During these low flow periods, temperature and dissolved oxygen are determined primarily by local weather and water source conditions, rather than by small changes in stream flow.

37. Potential Stranding and Mortality of Fish. Stranding and mortality of fish is likely to occur in any stream only during rapid and substantial changes in stream flow, and where stream substrate and channel conditions provide opportunity for stranding. Small decreases in stream flow are unlikely to cause stranding or mortality of any fish. The proposed STIA actions would not cause any rapid substantial changes in stream flow. Stormwater detention is designed to reduce this potential. Removal of residential and commercial development from the riparian zones of Miller and Des Moines Creeks, together with reestablishment of natural vegetation, will reduce the tendency for stream flows to rapidly increase.

38. Changes in Amount of Wetlands. Wetlands are a natural part of the aquatic ecosystem that provide habitat for fish and other aquatic organisms. The amount and characteristics of wetlands present as a part of a stream ecosystem is highly variable among streams. Stream ecosystems vary from extensive wetlands, particularly with low gradient streams, to meager wetlands associated with many

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

high gradient streams. It is not possible with our existing knowledge to determine a correct amount or nature of wetlands for any particular stream. The wetlands of the STIA area have previously been highly modified by urban development in both amount and character. Alteration of these previously disturbed wetlands will likely result in minor changes in hydrography and nutrient concentrations. It is not likely that the minor changes anticipated from the STIA improvements will result in measurable changes in the stream conditions that are attributable to the changes in the wetlands.

39. Value of Wetlands in Green River Basin. By contrast, constructing new wetlands in the lowlands of the Green River has the potential to provide substantially greater benefits than in the Miller and Des Moines Creek systems. The Green River supports much larger fish populations that have been impacted by substantial previous modifications to the lower river. Adding new wetlands to the previously channelized lower Green River has the potential to positively impact anadromous fish populations produced in this coastal stream. Like Miller and Des Moines Creeks, the Green River is a stream draining to Puget Sound that suffers from substantial modification by urban development. Construction of wetlands in the Green River basin has the potential to reverse some of these urban impacts by providing the same functions that wetlands would on Miller and Des Moines Creeks, but for a much larger population of fish and other aquatic organisms.

40. Monitoring the Biological Resource Present in STIA Area Streams. The Benthic Index of Biotic Integrity ("BIBI") monitoring is proposed as a means to assess impacts from project stormwater. The BIBI assessment has the potential to detect early impacts to the streams receiving the treated stormwater. The BIBI is a direct measure of the biological resource present in streams. Although BIBI is typically employed as a long-term monitoring technique, it is certainly capable of detecting annual changes in the lower levels of the food web within the monitored streams. The BIBI is a more direct measurement tool than bioassays for this resource, and the requirement by Ecology of such monitoring will provide reasonable assurance that the project stormwater is not having adverse effects

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

on the overall biological resource. In order to document the actual impacts of the Port's proposed development, techniques such as the BIBI are required.

41. Value of Bioassays. The suggested bioassays of storm water samples would be an indirect alternative for monitoring the effects of stormwater. Bioassays are an indirect indicator, rather than a direct measure of effects. Bioassays commonly employ organisms and conditions that are substantially different than those occurring in the real world. Bioassays are a conservative measure, and may be useful in determining when a more direct (and much more expensive) study of the biological resource (such as BIBI) is warranted. As an indicator, the criteria for passage or failure of a bioassay test are commonly set conservatively to indicate effects at lower levels than actually occur under natural conditions. Bioassay indications commonly need to be confirmed through monitoring of the real world conditions.

42. Stream Low Flow Augmentation Reliability. Capturing, storing and later releasing stormwater to support summer low flows for fish is not a new technique. This is the basic concept that has been has been practiced on a very large scale in the Columbia River since 1983. A regional program instituted by the Pacific Northwest Power Planning Council uses water stored in multiple storage reservoirs in the U.S. and Canada to augment spring and summer flows in the Columbia River as a means to improve habitat conditions for fish. Releases of this stored water for fish involve instantaneous amounts ranging from a few thousand cubic feet per second to tens of thousands of cubic feet per second.

43. References Cited.

Berg, L., and T.G. Northcote. 1985 Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Gregory, R.S. 1988. Effects of turbidity on benthic foraging and predation risk in juvenile chinook salmon. Pages64-73 in Simenstad, C.A. (ed.), Effects of dredging on anadromous Pacific Coast fishes. Workshop Proceedings. University of Washington, Seattle, Washington.

Gregoroy, R.S., and C.D. Levings. 1998. Turbidity reduces predation on migrating juvenile Pacific salmon. Transactions of the American Fisheries Society 127:275-285.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

Sigler, J.W., T.C. Bjornn, and F.H. Everest. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150.

44. Conclusion. I conclude there is reasonable assurance that the STIA Master Plan Update projects will not be the cause of a significant adverse impact to fish and aquatic biota. This conclusion is based on my review of the project and scientific evidence, the mitigation measures contained in the Port's proposed Master Plan Update projects and the additional requirements in Ecology's §401 Certification provide.

I declare under penalty of perjury under the laws of the state of Washington that the foregoing is true and correct.

Executed at Kirkland, Washington, this 7 day of March 2002.

Donald E. Weitkamp, Ph.D.

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

Don Weitkamp, Ph.D.

Ph.D., Fisheries Biology, 1976
Master of Science, Invertebrate Pathology, 1971
Bachelor of Science, Zoology, 1966

Dr. Weitkamp has been investigating fisheries and associated water quality issues in the Pacific Northwest River system since 1971. His initial research in this area dealt with the water quality issue of supersaturation through out the Columbia and Snake Rivers. He subsequently worked with various habitat, rearing and passage issues in rivers and estuaries of the Pacific Northwest. This work investigated the effects of various habitat and water quality alterations on fisheries resource. He has designed, managed and directed research investigating aquatic populations and habitat.

Don Weitkamp, Ph.D., is a Parametrix Principal responsible for projects dealing with salmon habitat issues in both estuarine and freshwater. He has conducted numerous salmon habitat projects in the streams and estuaries of the Northwest to analyze the habitat they use in port areas. These investigations have determined how young salmon behave in the habitats provided by altered shorelines such as piers, as well as along more natural shorelines. During the last two years Dr. Weitkamp has been conducting an intensive review of the literature dealing with the estuarine rearing requirements of young chinook and other salmon resulting in an extensive annotated bibliography and draft literature review.

ANALYSIS OF POTENTIAL RESTORATION MEASURES

In the 1970' s Dr. Weitkamp began assessing habitat restoration potential for chinook spawning and rearing in both freshwater and estuarine environments. He developed the design and guided monitoring of intertidal rearing habitat in Commencement Bay in 1988 after assessing potential restoration measures for a contaminated sediment site (Tacoma Kraft Mill). Recently he analyzed the habitat restoration potential for the Asarco shoreline site in Commencement Bay. For the past two years he has been analyzing the habitat restoration potential for the disposal site for sediments to be dredged from Thea Foss Waterway. In the Port of Seattle it was his responsibility to analyze and develop potential restoration measures for the southwest Harbor Project at the former Lockheed Shipyard site.

In the early 1980' s he helped to develop a chinook spawning area in the Columbia River and the use of pheromones to attract spawners to newly constructed habitat where they had not previously spawned. Recently he assisted the City of Seattle in evaluation of habitat conditions in the Lake Washington, the Green River, and Puget Sound. He is currently leading a project to assess the restoration of a natural flood plain on the Tolt River to provide improved habitat for salmon spawning and rearing.

BIOLOGICAL ASSESSMENTS

Recently Dr. Weitkamp prepared the Biological Assessments for the shoreline protection and habitat construction at the Asarco site, and the development of saltmarsh at the Tahoma site in Commencement Bay. He has prepared a draft BA for the St. Paul Waterway sediment disposal site that involved extensive habitat mitigation as part of the action to fill St. Paul Waterway. He has been serving as a representative for Simpson and Asarco to the EPA team preparing the Commencement Bay BA to support sediment cleanup actions. Recently he prepared draft BAs for a pier restoration project at Point Roberts and for the

AR 016841

Chinese Reconciliation Park development in Tacoma. He is currently working on the fisheries aspects of the BA for the Columbia River channel deepening project proposed by the U.S. Army Corps of Engineers. He has participated in a number of BA' s prepared for actions in fresh water habitats. He prepared an assessment of the status of summer chinook in the mid-Columbia region that assisted in preventing this species from becoming listed as threatened.

PARTICIPATION SALMON RECOVERY EFFORTS

Dr. Weitkamp served on the project selection panel for Washington State' s Salmon Recovery Funding Board. He was a member of the team working with the City of Seattle to identify limiting factors and potential restoration measures for the City. He is a member of the team selected to assist Snohomish County with ESA issues. Previously he served for two years on the panel of agency representatives and experts established to identify potential habitat restoration sites in Commencement Bay.

GREEN-DUWAMISH R. / ELLIOTT BAY EXPERIENCE

Dr. Weitkamp began conducting research for the Port of Seattle on salmon habitat issues in the early 1980' s with the project to construct Terminal 37. He has conducted analysis of spawning and flow requirements. as well as sampling and observational studies to determine the behavior of young salmon in shoreline habitats and the influence of factors such as prey availability and potential predation.

SALMON HABITAT RESTORATION

In recent years, his involvement in projects affecting aquatic resources has lead to the need to develop habitat restoration as an effective means to mitigate the impacts of shoreline development actions and stimulate public support for the actions. His role has been to work with agency representatives and public interest groups to identify and incorporate their interests into these restoration actions. By this means he has helped clients to efficiently get their projects permitted with public and agency support. This has proved to be an effective means to both accomplish development projects and restore previously lost resources.

Dr. Weitkamp has coordinated involvement of regulatory and special interest groups to develop consensus on solutions to allow development projects to proceed. Dr. Weitkamp has developed innovative habitat restoration actions as integral parts of sediment remediation and shoreline development to achieve pragmatic solutions.

HYDROELECTRIC PROJECTS & FISH RESOURCES

He has conducted numerous projects related to the dams in the Pacific Northwest. These include evaluation of the biological impact of implementation of Tacoma's second water right from the Green River, and a subsequent survey of chinook spawning during a low water year. He conducted a 15 year study of fall chinook spawning in the Hanford Reach for an area strongly influenced by dam operation. He has directed studies of survival studies at Wells, Rocky Reach, and Rock Island Dam for passage through spillways and turbines. He has directed studies of genetics and migration survival of hatchery population of salmonids in the mid-Columbia. His experience with dams includes involvement in the development of turbine intake screens, fish bypass and outfall systems, surface collection systems, and transportation of salmon smolts.

AR 016842

REPRESENTATIVE PROJECT EXPERIENCE

Green River Diversion
Evaluated the potential impacts on fisheries habitat in the Green River which would result from the increased withdrawal of water to serve City of Tacoma domestic requirements. This project included evaluating the adequacy of the Washington State Department of Ecology requirements for minimum flows and special conditions for instream flows within the Green River watershed. Dr. Weitkamp provided expert testimony before the State Shorelines Hearing Board on behalf of the City of Tacoma and the Washington State Department of Ecology concerning these water rights issues, the IFIM analysis, and the impact of instream flows on fisheries resources.

Elliott Bay Fish Studies
Conducted a number of studies in the harbor area of the Green-Duwamish River and the Port of Seattle to monitor juvenile salmon and resident fish populations and to evaluate the effects of dredging/filling and other shoreline modifications on marine invertebrates and fish populations. These studies of the benthos and fish have involved sampling to establish population densities and habitat types, measuring effects of habitat alterations and enhancement, and determining fish behavior to evaluate the impacts of dredging, filling and pier construction.

Cedar Falls Resource Evaluation Studies
Coordinated an investigation of fish abundance and distribution in Chester Morse Lake. The study investigated fish distribution both vertically and spatially throughout the lake to evaluate the potential fish entrainment impacts from a proposed power intake. In this project, Parametrix conducted or assisted in all facets of the project. We supplied the Oneida traps, gill nets, and boats used for the sampling and hydroacoustic surveys.

Cedar River Watershed Programmatic EIS
Assigned Principal and technical participant in a programmatic EIS and development of a secondary use plan for alternative uses of Seattle's municipal watershed. This EIS and plan evaluated recreation, education, wildlife, and timber harvest opportunities along with the need to protect water quality. Our role was to help clarify the vision of alternative opportunities and to assess both the benefits and impacts.

Water Supply Options Evaluation
Participated in an evaluation of potential water supply options for the City of Portland Oregon, by assessing potential impacts to aquatic resources. Options from construction of a new dam and reservoir on the Bull Run Watershed to aquifer storage options were evaluated, including withdrawal from the Columbia, Willamette and Clackamus rivers. Effects of water withdrawal, habitat alteration and intake screening options were evaluated.

METRO Water Supply EIS, Portland
Assigned Principal and participant in analysis of environmental impacts associated with various alternatives for increasing the water supply to the Portland metropolitan area. Evaluated fishery impacts to the Clackamas, Willamette, Columbia, and Bull Run Rivers. This project required maintenance of natural resource and recreational values as part of water development.

AR 016843

Yakima River IFIM Studies and Recommendations
Led the effort for a detailed review of instream flow studies to determine the adequacy of available information. Simultaneously, negotiations were conducted between resource agency experts and user group representatives to define biological criteria for the basin. These criteria defined the species and life stages utilizing specific segments of the river system. This information was then used to develop acceptable flow recommendations for the Yakima River Basin and its storage reservoirs.

Salmon Spawning Assessment Vernita Bar
He helped design and conducted extensive studies of fall chinook spawning for over 15 years at the largest natural spawning site in the U.S. (Hanford Reach). This FERC license study evaluated all factors potentially affecting spawning success with special emphasis on spawning habitat and flow fluctuations. It included development of an artificial spawning area to mitigate possible impacts due to flow regulation. These efforts resulted in operating criteria for Priest Rapids Dam, during the spawning period, that minimize the upper elevations at which the chinook spawn, resulting in lower required flows during crucial spring periods.

Habitat Restoration/Forbes Creek
Provided fish habitat analysis and design services to restore natural habitat characteristics to Forbes Creek, a Lake Washington tributary, previously channelized by a large gravel pit development. Habitat and flow control features were incorporated to provide natural stream habitat within a large residential development. This provided recreational opportunities by placing fish spawning habitat within a residential development.

Saltmarsh Habitat Restoration
Provided project management, technical design and agency coordination for habitat restoration on Middle Waterway in Commencement Bay. This joint project by natural resource trustees (state and federal agencies) and Simpson Tacoma Kraft Company is restoring saltmarsh habitat from a previously filled area adjacent to a tideflat. The project is mitigation for past damages to natural resources and sediments. Services included site investigation, design, coordination and monitoring.

Tahoma Salt Marsh Development
Don is currently leading a project to develop the Tahoma Saltmarsh habitat project for the City of Tacoma. This involves site investigations, coordination with Natural Resource Trustees, and design of habitat that will support saltmarsh vegetation along with protected habitat for juvenile salmon migrating along Commencement Bay' s shoreline. He is currently assisting with habitat development and preparation of a Biological Assessment for the Chinese Reconciliation Park proposed for the adjacent shoreline.

Sediment Remediation and Habitat Restoration
Managed confined capping of contaminated nearshore sediments associated with a large pulp and paper mill. Prepared sampling plans for characterizing extent of contamination, prepared monitoring plans for construction, and performed post-construction surveys to meet EPA consent decree criteria. Participated in disposal configuration design, which is intended to provide nearshore habitat for juvenile salmonids. Prepared technical documents in support of permit applications and conducted monitoring to verify the project's success since construction in 1988. Helped developed the public participation process that was key to the success of this project.

AR 016844

Southwest Harbor Redevelopment EIS
Assigned principal and leader of marine resource tasks on programmatic redevelopment of the 80-acre area in the southwest harbor (former Lockheed Shipyard). His primary responsibility was to analyze existing intertidal and subtidal habitat value and designed new intertidal habitat areas on a potential nearshore confined disposal site for contaminated sediments to benefit young salmon and other species. He led agency coordination/negotiation on habitat issues to develop acceptable mitigation alternatives. This project involved redevelopment of several sites that included both upland and in-water contamination (sediment contamination). The project became a combined EIS and Remedial Investigation to provide an opportunity for redevelopment in a relatively short time. He helped the Port develop public participation in planning and development of both alternative actions and mitigation.

Under-Pier Habitat, Commencement Bay
Designed and conducted studies of young salmon migrating and rearing under piers in the Port of Tacoma to determine their presence, food sources, and potential predation. Young salmon were found to commonly use areas under pier aprons with food production to be about 50% of that occurring in similar adjacent areas without aprons. Fish predators were not found in the shallow water depths under aprons where the young salmon were found.

Juvenile Salmon Use of St. Paul Waterway, Commencement Bay
Designed and guided sampling of young salmon and marine fishes using the shoreline habitats of St. Paul waterway and adjacent areas of Commencement Bay that will be altered by the proposed sediment containment facility. Young salmon were collected, identified and enumerated at various locations to identify their relative use of different shoreline habitats. He also conducted an extensive literature review to identify the habitat characteristics important to young salmon.

Remediation/ASARCO Smelter Sediments
Assigned Principal for remedial investigation and feasibility study of the upland and marine superfund site contaminated by a copper smelter. Designed marine sampling plan helped owner negotiate with the U.S. EPA, and resolve the area to be remediated. Prepared an underwater video to demonstrate to public and agencies the existing limit of biological effects. Helped develop alternative remediation plans for contaminated areas.

Habitat Restoration/NRDA
Assisted the City of Tacoma with development of a plan to construct new estuarine habitat to satisfy Natural Resource Damage Claims. His role is to develop alternative concepts, coordinate with Natural Resource Trustees and develop a specific habitat restoration plan for an area on Middle Waterway adjacent to a previous project he helped to develop.

Lavaca Bay Habitat Restoration
He helped develop a plan for a habitat restoration project to develop natural resources in both terrestrial and estuarine environments of a large bay on the Gulf of Mexico. This area has previously been contaminated with mercury and other metals as the result of industrial activities. He has prepared a conceptual plan and a video presentation to effectively communicate this concept to the involved panties. This concept will restore natural resource functions as a part of contaminant remediation and provide recreational opportunities for both residents and tourists.

AR 016845

Publications of Don Weitkamp

Weitkamp, D.E., and G.T. Ruggerone. 2000. Factors affecting chinook populations. background report. Prepared by Parametrix, Inc. Nartural Resources Consultants. and Cedar River Associates for City of Seattle, Washington. 224 p.

Weitkamp, D.E. 2000. Total dissolved gas supersaturation in the natural river environment. Rocky Reach Hydroelectric Project No. 2145. Unpublished report by Parametrix. Inc. to Chelan County Public Utility District, Wenatchee, Washington. 15 p.

Weitkamp, D.E., and B.D. Sullivan. 2000. Cabinet Gorge Dam spill gate evaluations. 2000. Unpublished report to Avista Corp. Spokane, Washington. 34 p. + Appendices.

Sullivan, B.D., AND D.E. Weitkamp. 2000. Gas bubble disease monitoring lower Clark Fork River, 2000. Unpublished report to Avista Corp. Spokane, Washington. 31 p. + Appendices.

Sullivan, B.D., and D.E. Weitkamp. 2000. Fish behavior evaluation lower Clark Fork River. 2000. Unpublished report to Avista Corp. Spokane, Washington. 47 p. + Appendices.

Sullivan, B.D., and D.E. Weitkamp. 2000. Total dissolved gas monitoring Cabinet Gorge And Noxon Rapids hydroelectric projects 2000. Unpublished report to Avista Corp. Spokane. Washington. 37 p. + Appendices.

Weitkamp, D.E. 2000. Estuarine habitat used by young salmon, an annotated bibliography. Unpublished report by Parametrix Inc. Kirkland, Washington. Available at http://www.parametrix.com/news/tech.htm.

Weitkamp, J.E., B.D. Sullivan, and D.E. Weitkamp. 1999. Gas bubble disease monitoring lower Clark Fork River, 1999. Unpublished report to Avista Corp. Spokane, Washington. 32 p. + Appendices.

Weitkamp, J.E., B.D. Sullivan, and D.E. Weitkamp. 1999. Fish behavior evaluation lower Clark Fork River, 1999. Unpublished report to Avista Corp. Spokane, Washington. 47 p. + Appendices.

Weitkamp, J.E., B.D. Sullivan, and D.E. Weitkamp. 1999. Total dissolved gas monitoring Cabinet Gorge and Noxon Rapids hydroelectric projects 1999. Unpublished report to Avista Corp. Spokane, Washington. 34 p. + Appendices.

Weitkamp, D.E. 1997. Designing a fish bypass to minimize predation downstream of dams. Hydro Review 26:120-127.

Chapman, D., C. Carlson, D. Weitkamp, G. Matthews J. Stevenson, and M. Miller, . 1997.

AR 016846

Homing in sockeye and chinook salmon transported around part of the smolt migration route. North American Journal of Fisheries Management 17:101-113.

Weitkamp, D.E. 1996. Ecotourism and environmental quality, watter resources. 96' International Symposium on Design & Development of Ecotourism, Wuhan, China. p 236-249.

Allen, M., J. Odgaard, L.J. Weber, R.A. Elder, D. Hay, and D. Weitkamp. 1996. (In press.) Evaluation of gatewell flows for fish bypass at a large hydroelectric plant. International Conference on Water Resources Engineering, American Society of Civil Engineers.

Weitkamp, D.E. 1996. Hydraulic models as a guide to fish passage designs. Issues and Directions in Hydraulics. Nakato and Ettema (eds). A.A. Balkema, Rotterdam, Netherlands. Pages 287-293.

Sweeney, C.E., W. Christman, and D.E. Weitkamp. 1995. Development of a prototype to test the attraction flow concept for juvenile fish bypass at Rocky Reach Dam. American Society of Civil Engineers. Proceedings Waterpower '95, pp 311-320.

Weber,L.J., D. Weitkamp. D. Hay, A.J. Odgaard, and C. Parameswar, 1995. Development of a juvenile fish outfall structure. American Society of Civil Engineers. Proceedings Waterpower '95, pp 47-56.

Weitkamp, D.E. and R.D. Sullivan. 1994. Spill caused supersaturation and potential biological impacts at Wanapum Dam. Unpublished report to Grant County Public Utilities, District No. 2, Ephrata, Washington. 12 p.

Weitkamp, D.E. and R. A. Elder. 1993. Fish screen developments Columbia River dams. Proceedings Hydraulic Engineering '93. American Society of Civil Engineers. p. 1314-1319.

Weitkamp, D.E. and R.D. Sullivan. 1993. Biological risks associated with John Day Reservoir drawdown. Unpublished report by Parametrix, Inc. to Northwest Irrigation Utilities, Portland, OR. 22 p.

Weitkamp, D.E. 1993. Juvenile salmon and light under pier aprons. Unpublished report by Parametrix, Inc. to Port of Seattle, Seattle, Washington. 25 p.

Weitkamp, D.E. and R.D. Sullivan. 1992. Reservoir drawdown biological issues, a discussion paper. Unpublished report by Parametrix, Inc. to Northwest Irrigation Utilities, Portland, OR. 9 p.

Weitkamp, D.E. 1992. Snake River transportation data summary. Report to Salmon Recovery Plan Team, National Marine Fisheries Services by Northwest Irrigation Utilities, Portland, OR. 7 p.

Olsen, D., J. Stevenson, and D. Weitkamp. 1992. Critical assumptions for Snake River drawdown fish benefits: a technical review paper. Unpublished report by Northwest Irrigation Utilities. Portland, OR.

Weitkamp, D.E., R.L. Shimek, and G.T. Williams. 1991. Monitoring of habitat restoration and sediment remediation, St. Paul Waterway. Pages 376 □ 382 in Puget Sound '91 Research Proceedings. Puget Sound Water Quality Authority, Olympia, Washington.

Williams, G.T. and D.E. Weitkamp. 1991. Epibenthic zooplankton production and fish distribution at selected pier apron and adjacent non-apron sites in Commencemnt Bay, Washington. Unpublished report by Parametrix, Inc. to Port of Tacoma, Tacoma, Washington. 32p + appendix.

Shimek, R.L, T.A. Thompson, T.H. Schadt, and D.E. Weitkamp. 1991. Interpreting conflicting biological and chemical results from a Puget Sound sediment data set. Pages 546 □ 552 in Puget Sound '91 Proceedings. Puget Sound Water Quality Authority, Olympia, Washington.

Whitman, R.P., S. Hammond, D.E. Weitkamp and R. A. Elder. 1990. Intake diversion screen development Priest Rapids Dam Hydroelectric Project No. 2114. Report to Grant County Public Utility District No. 2, Ephrata, Washington. 98 p.

Weitkamp, D.E. 1990. Concepts for reducing sediment contamination caused by stormwater discharge. 17 p. Leningrad Port Symposium. Leningrad State Institute for Projection, Investigations and Scientific Research of Merchant Marine.

Weitkamp, D.E. 1990. Contaminated sediment cleanup and habitat restoration. 24 p. Leningrad Port Symposium. Leningrad State Institute for Projection Investigations and Scientific Research of Merchant Marine.

Weitkamp, D.E. and R.D. Sullivan. 1990. Zero-age smolt studies, mid-Columbia River, 1987-89. Pages 79-84 in Park, D.L. editor. Status and future of spring chinook salmon in the Columbia River Basin -- conservation and enhancement. NOAA Technical Memorandum NMES FINWC-187. National Marine Fisheries Service, Seattle, Washington.

Odgaard, A.J., R.A. Elder, and D.E. Weitkamp. 1990. Turbine intake fish-diversion system. Journal of Hydraulic Engineering. 116:1301-1316.

Weitkamp, D.E. and R.L. Wallace. 1989. Under-pier habitat mitigation concept. Proceedings of World Dredging Congress XII, Western Dredging Association, Fairfax, Virginia. p.p. 965-972.

Elder, R.A., A.V. Odgaard, D.E. Weitkamp and D. Zeigler. 1987. Development of turbine intake downstream migrant diversion screen. Proceedings of the International Conference on

Hydropower. American Society of Civil Engineers. P. 522-531.

Chapman, D.W., D.E. Weitkamp, T.L. Welsh, M.D. Bell and T.H. Schadt. 1986. Effects of river flow on the distribution of chinook salmon redds. Transactions of the American Fisheries Society 115:537-547.

Weitkamp, D.E., D.H. McKenzie and T.H. Schadt. 1985. Survival of steelhead smolts, Wells Dam turbines and spillway, Report to Douglas County Public Utility District, East Wenatchee, Washington. 43 p. + app.

Weitkamp, D.E. and R.R. Loeppke. 1985. Physiological monitoring of smoltification and stress in mid-Columbia chinook and steelhead, 1983. Unpublished Report. Parametrix, Inc., Bellevue, Washington. 54 p.

Weitkamp, D.E., R.R. Loeppke and T.H. Schadt. 1985. Thyroxine, ATPase and behavior characteristics, 1982 mid-Columbia spring chinook and steelhead. Unpublished Report. Parametrix, Inc., Bellevue, Washington. 56 p.

McKenzie, D., D. Carlile, and D.E. Weitkamp. 1984. 1983 Systems mortality study. Report to Chelan, Douglas and Grant County Public Utility Districts, Battelle Pacific Northwest Laboratories, Richland, Washington. 25 p. + app.

Weitkamp, D.E., T.H. Schadt, and T. Hardin. 1984. Initial flow recommendations, Yakima River Basin. Report to U.S. Bureau of Reclamation. Boise, Idaho. 32 p. + app.

Weitkamp, D.E., T.H. Schadt, and T. Hardin. 1984. Review of existing IFIM data, Yakima River Basin. Report to U.S. Bureau of Reclamation. Boise, Idaho. 33p. + app.

McKenzie, D., D.E. Weitkamp, T. Schadt, D. Carlile and D. Chapman. 1984. 1983 Systems mortality study. Report to Chelan, Grant and Douglas County Public Utility Districts. Battelle Pacific Northwest Laboratories, Richland, Washington. 27 p. + app.

McEntee, D.M. and D.E. Weitkamp. 1984. 1983 Gatewell sampling Wanapum and Priest Rapids Dams. Report to Grant County Public Utility District No. 2 Ephrata, Washington. 41 p.

McEntee, D.M. and D.E. Weitkamp. 1984. 1982 Gatewell sampling Wanapum and Priest Rapids Dams. Report to Grant County Public Utility District No. 2, Ephrata, Washington. 42 p.

Loeppke, R.R., W.K. Hershberger, D.E. Weitkamp, and R.F. Leland. 1983. Genetic and age characteristics, 1983 Wells Dam Steelhead spawners. Report to Douglas County Public Utility District, East Wenatchee, Washington. 43 p.

Chapman, D.W., D.E. Weitkamp, T.L. Welsh and T.H. Schadt. 1983. Effects of minimum flow

regimes on fall chinook spawning at Vernita Bar, 1978-82. Report to Grant County Public Utility District. Ephrata, Washington. 123 p.

Weitkamp, D.E. 1982. Juvenile chum and chinook salmon behavior at Terminal 91, Seattle, Washington. Report to Port of Seattle, Seattle, Washington. 21 p.

Weitkamp, D.E. and T.H. Schadt. 1982. 1980 Juvenile salmonid study. Report to Port of Seattle, Seattle, Washington. 43 p. + app.

Weitkamp, D.E. 1981. Biological impacts of marinas, a literature review. Report to Port of Port Angeles. Port Angeles, Washington. 13 p.

Weitkamp, D.E. and J. Neuner. 1981. Juvenile salmonid monitoring. Methow River, Okanogan River and Wells Dam Forebay, April-May 1981. Report to Public Utility District No. 1 of Douglas County, East Wenatchee, Washington. 56 p.

Weitkamp, D.E. and T.H. Schadt. 1981. Fish, technical report. p. 1-93 In Commencement Bay Study, Volume III. U.S. Army Corps of Engineers, Seattle District. Seattle, Washington.

Weitkamp, D.E. and M. Katz. 1980. A review of dissolved gas supersaturation literature. Transactions of the American Fisheries Society 109: 659-702.

Weitkamp, D.E. and R.F. Campbell. 1980. Port of Seattle Terminal 107 fisheries study. Report to Port of Seattle, Seattle, Washington. 53 p.

Weitkamp, D.E. and M. Katz. 1977. Dissolved atmospheric gas supersaturation of water and gas bubble disease of fish. Water Resources Scientific Information Center, Department of Interior, Washington, D.C. 107 p.

Campbell, R.F. and D.E. Weitkamp. 1977. An oceanographic and biological survey of the waters off Condado and Ocean Park Beaches. San Juan, Puerto Rico. Report to Franqui and Associates, Hato Rey, Puerto Rico. 43 p.

Weitkamp, D.E. and M. Katz. 1976. Biological survey and assessment of impacts of alternative redevelopments. Report to Port of Seattle, Seattle, Washington. 79 p.

Weitkamp, D.E. 1976. Dissolved gas supersaturation: Live cage bioassays at Rock Island Dam, Washington. p. 24-36 In Proceedings of the Gas Bubble Disease Workshop. Battelle, Pacific Northwest Laboratories, Richland, Washington.

Weitkamp, D.E. 1976. Assessment of proposed New Mexico groundwater regulations: Mercury-Document #76-0609-54-FR. 28 p. Vanadium-Document #76-0609-55-FR. 17 p. Reports to Kerr-McGee Corporation, Oklahoma City, Oklahoma.

Peck, C.A., D.E. Weitkamp and R. Campbell. 1975. Mathematical model of three proposed Port Orchard System outfall sites. Parametrix, Inc., Bellevue, Washington. 23 p. + app.

DesVoigne, D.M., W. Bowen, M. Katz, R. Campbell, D.E. Weitkamp and R. Steele. 1975. Analysis of water characteristics and the biological resources of Commencement Bay relative to a need for secondary treatment. Report to St. Regis Paper Company. Jacksonville, Florida. 89 p. + app.

Weitkamp, D.E. 1975. An assessment of proposed New Mexico industrial effluent standards: Radium 226 and gross alpha activity. Gross beta particle and photon radioactivity from man-made radionuclides, 1975. Reports to Kerr-McGee Nuclear Corporation, Oklahoma City, Oklahoma. 20 p.

Weitkamp, D.E. 1975. Resource and literature review, dissolved gas supersaturation and gas bubble disease, 1975. Parametrix, Inc. Bellevue, Washington. 70 p.

Katz, M., D.E. Weitkamp and R. Campbell. 1975. Compensation for Elwha River game fish losses. Report to Crown Zellerbach Corporation, Port Angeles, Washington. 18 p.

Weitkamp, D.E. and R.F. Campbell. 1975. Temperature studies on the ASARCO cooling water effluent and Prickly Pear Creek, East Helena, Montana. Report to the American Smelting and Refining Company. East Helena, Montana. 30 p.

Weitkamp, D.E. p.H. Arend, and R.S. LeGore. 1975. Biological impact of fluid waste from the Nichols Fertilizer Plant. Report to Collier Carbon and Chemical Corp., Nichols, California. 51 p.

Weitkamp, D.E. 1974. Dissolved gas supersaturation in the Columbia River System: salmonid bioassay and depth distribution studies, 1973 and 1974. Report to Utility Cooperative, c/o Idaho Power Company. Boise, Idaho. 71 p.

Weitkamp, D.E. 1974. Dissolved oxygen profiles and fish present in the Snake River near Burley, Idaho, Oct. 31-Nov. 3, 1975. Report to J.E. Simplot Co. and Ore-Ida Foods. Burley, Idaho. 8 p.

Weitkamp, D.E. 1974. Final report, Snake River 1973 dissolved gas studies. Report to Idaho Power Co., Parametrix, Inc., Bellevue, Washington. 81 p.

Weitkamp, D.E. 1974. Evaluation of the adequacy of the Scott Paper Co. submarine outfall in Guemes Channel. Report to Scott Paper Co. Everett, Washington. 82 p.

Weitkamp, D.E. 1974. Dissolved gas supersaturation, Grand Coulee Dam Project, 1973. Report to Bureau of Reclamation. Parametrix, Inc., Bellevue, Washington.

Weitkamp, D.E. 1973. Resource and literature review, dissolved gas supersaturation and gas bubble disease. Parametrix, Inc., Bellevue, Washington. 60 p.

Weitkamp, D.E. 1971. The early life history of Mytilicola orientalis. M.S. Thesis, University of Washington. 91 p.

Weitkamp, D.E. and G. Tutmark. 1971. Preliminary survey of log dumps and log storage areas on the first five year logging plan. Admiralty Island. Report to U.S. Plywood-Champion Papers, Inc. 83 p.

Sparks, A.K., K.K. Chew, E.J. Jones, L. Schwartz, and D.E. Weitkamp. 1968. Epizootics in experimental marine shellfish populations. Research in Fisheries, University of Washington, Contribution No. 280.

Jones, E.J., D.E. Weitkamp, and A.K. Sparks. 1969. Oyster mortality investigations. Research in Fisheries, University of Washington, Contribution No. 300.

AR 016852

Fuel Pier Relocation RI/EIS
As assigned principal, Dr. Weitkamp helped the U.S. Navy develop shoreline alternatives and negotiate a sampling program with regulatory agencies. This program identified biological resources and contaminant distributions within an area to be dredged at the existing fuel pier before construction of a new fuel pier. This information and the EIS identified disposal options and mitigation for habitat alterations. He helped the Navy develop agency participation in identifying action alternatives and mitigation.

Hatchery Production Environmental Assessment
Oversaw a NEPA environmental assessment of a large salmon and steelhead hatchery program for a major Columbia River tributary, the Yakima River. Analysis of multiple proposed sites included potential effects on existing fisheries populations, water quality and quantity, land use and recreation, and wildlife. This hatchery system incorporates adaptive management strategies for program development and is being used as a prototype for the entire Columbia Basin.

Hatchery Effectiveness Survey
Assigned Principal for a comprehensive survey to identify non-published research projects conducted in the last 10 to 15 years on all aspects of salmon, trout, and sturgeon culture. The project developed a computerized database that summarizes this information and makes it readily available.

Sultan River Hydroelectric Impacts
Dr. Weitkamp participated in both phases of the evaluation of the Henry M. Jackson hydroelectric project. This included strategy on development of the IFIM analysis during the first phase prior to operation. During the second phase, he helped develop the study plan and analysis for evaluation of salmon passage and spawning to evaluate operational impacts.

Surface Collector Rocky Reach Dam
As a member of an engineering team, leading efforts to incorporate biological criteria in the design of a unique collector for juvenile salmon. This system will incorporate hydraulic characteristics with fish behavior tendencies to provide a practical bypass solution that avoids expensive installation of intake diversion screens. His role is to help develop and evaluate alternative designs by incorporating fish behavior characteristics with hydraulic evaluations.

Intake Screens Wanapum/Priest Rapids Dams
Provided biological expertise to help develop a unique turbine intake screen and bypass system for these hydroelectric projects. Directed prototype testing which has shown favorable results of high diversion rates, very high survival, and very low stress in diverted fish.

Fish Diversion Screen Analysis Rock Island/Rocky Reach Dams
Worked with hydraulic engineers and hydraulic laboratories to develop screen design and fish bypass criteria for these hydroelectric projects. Using biological information together with physical modeling, we developed the appropriate criteria to provide direction for engineers to design successful screens and bypass systems.

Orifice Collection Bypass Gallery
Responsible for biological evaluation of engineering alternatives for moving diverted fish efficiently from dam gatewells to downstream outfalls for Wanapum and Priest Rapids Dams. These evaluations involved

1:4 scale model evaluations of various orifice models together with modeling conduits and control gates. Models were assessed using both hydraulic parameters and small fish.

Fish Bypass Outfall Design
Biologist member of an interdisciplinary team to develop an outfall design and location to be constructed at Wanapum Dam. This effort involved field evaluations, construction of a 1:100 scale model of the dam and three miles of the river, and videotaping both the real site and the model to identify a location that will minimize predation. A 1:10 scale model of the outfall was constructed to evaluate the best means for discharging young salmon.

Rock Island Dam Fish Outfall
Providing biological analysis for the design and location of a fish bypass outfall to be built for the first powerhouse at Rock Island Dam. This assessment is being done through field studies and biological evaluation of the hydraulic conditions. Responsible for agency coordination to involve agency representatives in the development of this project.

Bulb Turbine Survival Study
Under agency direction, the new bulb turbines installed at Rock Island Dam were tested to identify survival rates of salmon and steelhead smolts passing through them. Responsible for designing the holding facilities and marking all smolts to be released. He was also responsible for downstream recovery of smolts by traps and seines.

Priest Rapids Smolt Transportation
Conducted a five-year transportation study of chinook and sockeye smolts that were carried by truck from Priest Rapids to below Bonneville Dam; helped design the studies and supervised the design of the handling/transport facilities, stress studies, and release strategies.

Mid-Columbia System Survival Studies
Controversy over the effects of hydroelectric projects in the mid-Columbia led to the conduct of system mortality studies (5 dams). Responsibilities included coordinating efforts to design the study, mark juvenile salmon, and evaluate the transport and release, stress and short-term survival.

Wells Dam Passage Survival
Designed, directed, and analyzed results for evaluating passage survival of juvenile salmonids passing through turbines and the spillway at Wells Dam. This involved catching and releasing approximately 300,000 juveniles and coordinating recovery of data from multiple downstream dams. The results demonstrated moderately high rates of survival during passage through the dam.

Smolt Bypass Development
Dr. Weitkamp has served as a member of a number of engineering teams developing various systems for bypass of juvenile salmon at hydroelectric projects on Pacific Northwest rivers. He has lead efforts to incorporate biological criteria in the design of a variety of collection and bypass systems, including the unique Rocky Reach collector. These systems incorporate hydraulic characteristics with fish behavior tendencies to provide practical bypass solutions. These projects have included the development of intake diversion screens, associated bypass conveyances, transportation systems, and surface collection systems. He has also helped to develop bypass outfall evaluation criteria and techniques that identify the best locations to release bypassed smolts. His role in these various projects has been to help develop and

AR 016854

evaluate alternative designs by incorporating fish behavior characteristics with hydraulic evaluations. These efforts have included hydraulic model interpretation, prototype design, and field evaluation of prototype systems.

Turbine-Spillway Survival Evaluations

Dr. Weitkamp has directed and participated in a variety of turbine and other hydroelectric survival evaluations. These have included the Rock Island Bulb Turbine, Wells Turbine-Spillway, Rocky Reach Spillway, Mid Columbia System Survival, and Wanapum Turbine-Spillway Survival tests. In these tests we have evaluated turbines and spillways to identify survival rates of juvenile salmon and steelhead passing through them. He has been responsible for designing the holding facilities, marking fish to be released, designing release facilities, downstream recovery of smolts by traps and seines, physiological monitoring of smolts, and interpretation of recovery data. He has provided expert testimony on these studies at a number of FERC hearings.

Priest Rapids Smolt Transportation

He helped design and conducted a five-year transportation study of chinook and sockeye smolts that were carried by truck from Priest Rapids to below Bonneville Dam. This included design of the studies and supervising the design of the handling/transport facilities, stress studies, and release strategies.

Sockeye and chinook smolts were collected from both Priest Rapids and Wanapum Dams, marked, and transported by truck to downstream of Bonneville Dam to several release points. Sockeye were also transported to McNary Dam and loaded onto Corps of Engineers barges for transport downstream. These studies included thorough evaluation of stress incurred by the smolts by evaluating blood chemistry parameters.

Dissolved Gas Supersaturation

Dr Weitkamp has designed long-term and short-term, site-specific monitoring programs for private and public hydroelectric operators in the Columbia River System (U.S. Bureau of Reclamation; Grant, Douglas, and Chelan County PUDs; and Idaho Power Company.) These monitoring studies identified levels of dissolved gas supersaturation, incidence of gas bubble disease, and causes of supersaturation. He conducted in situ bioassay experiments to determine maximum tolerable supersaturation levels under river conditions, and assisted computational modelers in developing a computer model of supersaturation dynamics for a hydroelectric spillway.

Clark Fork River Supersaturation Evaluation

Designed site-specific monitoring programs for the Water Quality Work Group of the interagency FERC relicensing team. Directed studies to monitor dissolved gas supersaturation and its biological effects during exceptionally high flow years. These monitoring studies identified levels of dissolved gas supersaturation, incidence of gas bubble disease, and operational methods to reduce supersaturation.

Columbia River System Supersaturation Monitoring

Designed long-term and short-term, site-specific monitoring programs for private and public hydroelectric operators in the Columbia River System (U.S. Bureau of Reclamation; PUDs for Grant, Douglas, and Chelan Counties; and Idaho Power Company.) These monitoring studies identified levels of dissolved gas supersaturation, incidence of gas bubble disease, and causes of supersaturation.

AR 016855

Supersaturation Bioassays
Designed and conducted two *in situ* bioassay studies in the Columbia River using juvenile salmon to evaluate the effects of supersaturation under natural conditions. These data provided the basis to revise dissolved gas criteria for hydroelectric projects. They demonstrated the differences between laboratory observations and field conditions encountered in the rivers.

Snake-Salmon Rivers Supersaturation Monitoring
Supervised monitoring efforts over a three-year period to identify dissolved gas levels caused by natural conditions and hydroelectric discharges in Hell's Canyon and the free flowing Salmon River. These efforts demonstrated that natural river conditions cause supersaturation at levels sufficient to produce gas bubble disease under laboratory conditions.

Reservoir Drawdown
Parametrix was retained by various port and irrigation interests to evaluate the biological effectiveness and impacts or proposed reservoir drawdowns to aid salmon survival. This effort assessed impacts to juvenile salmon, adult salmon, resident fish, reservoir habitat, wetlands, and water quality. Dr. Weitkamp also developed an innovative proposal for a mobile net pen system as a more effective and less destructive alternative to reservoir drawdowns.

John Wayne Marina EIS
Identified clam, eelgrass, and fish resources to be impacted by this Sequim Bay marina. Provided technical expertise and prepared EIS sections addressing biology and water quality and dredging issues. Helped the Port of Port Angeles negotiate reasonable mitigation actions which allowed the marina to be constructed.

AR 016856