Columbia Biological Assessments
1314 Cedar Avenue
Richland, WA 99352
(509) 943-4347
(509) 946-1467 (fax)
jstrand427@aol.com

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U.S. Army Corps of Engineers
Regulatory Branch
Post Office Box 3755
Seattle, Washington 98124-2255
ATTN: Jonathan Freedman, Project Manager

Washington State Department of Ecology
Shorelands and Environmental Assistance Program
3180-160th Avenue Southeast
Bellevue, Washington 98008-5452
ATTN: Ann Kenny, Environmental Specialist

Subj: Determining Whether the U.S. Army Corps of Engineers (USACOE) Has a Scientifically Adequate Basis to Issue a Permit, Under the Clean Water Act (CWA) Section 404, for the Port of Seattle's (Ports) Project Proposed in the Second Revised Public Notice No. 1996-4-02325.

Dear Mr. Freedman and Ms. Kenny:

On behalf of the Airport Communities Coalition (ACC), I have undertaken a review and evaluation of pertinent and readily available literature in an effort to answer the subject question. It is the USACOE's responsibility under the CWA to assure the public that the Port's proposed project will not harm the wetlands, surface waters, and fishery resources inhabiting the project site. The latter includes concern for chinook salmon, a federally threatened species in Puget Sound, known to frequent the estuarine reaches of streams that are affected by the Port's project. In undertaking this effort, I have relied on my relevant education, specialized training, and professional skills acquired over a 25-year career (post Ph.D.) as a fisheries biologist (see attached Curriculum Vitae).

I am concerned that the Port's declared future construction and operation will harm area fish and fish habitat in the proposed project area. There also is evidence that the Port's current operations already impact the fishery resources in project streams. Although disturbed, the project streams (Miller Creek, Walker Creek, Des Moines Creek) still support a diverse and abundant fish fauna and are worthy of protection. Both coho and chum salmon are known to spawn and rear in the Miller Creek, Walker Creek, and Des Moines Creek Watersheds (Hillman et al. 1999). Chinook salmon frequent the outfalls of

Miller and Des Moines Creeks in Puget Sound during their outmigration (Parametrix 2000a). Both watersheds are also exploited by resident cutthroat trout (Parametrix 2000a); Miller Creek may include an anadromous race of cutthroat trout. Warm water fish species including yellow perch, black crappie, large mouth bass, and pumpkinseed sunfish have been found in the upper reaches of both watersheds (Parametrix 2000a). Prickly sculpin, three-spined stickleback, and crayfish also occur throughout each watershed (Parametrix 2000a).

I approached this evaluation by first assessing the effects on fish and fish habitat of the proposed relocation of Miller Creek and associated instream enhancements. I next addressed the concern that fill already stockpiled at Seattle-Tacoma International Airport (STIA) to build a third runway is chemically contaminated and poses a risk for area streams, wetlands, and aquifers. Additionally, I determined whether water quality in surface waters near STIA is being degraded by stormwater runoff from the Port's ongoing operations at STIA. I addressed both historical and present conditions. I also looked at the Port's preferred alternative to augment flow in Des Moines Creek using Seattle Public Utility (SPU) water. I next looked at whether or not conditions in the receiving waters might improve following the subsequent installation and operation of proposed stormwater detention facilities downstream of the STIA. In a related assessment, I addressed possible low stream flows in summer and their associated impacts. Finally, I determined if the Port has addressed the potential cumulative impacts of the proposed construction projects.

My opinions in this matter are based primarily on reviewing the many assessments of impact prepared by the Port in support of their Section 404 Clean Water Act Permit Application. I evaluated each assessment by answering three questions: 1) did the Port or their consultant present the most appropriate information, 2) was the information complete and credible, and 3) was the information properly analyzed and interpreted? I also reviewed and included applicable citations from the scientific literature when the need arose. My conclusions and the detailed evaluations on which they are based can be found in the succeeding sections:

Conclusions

In my opinion, for the following reasons, the Port has not provided sufficient information to enable the USACOE to conclude, on a scientifically defensible basis, that current operation and declared future construction and operation will not harm area wetlands, streams, and fisheries resources in the project area.

- All impacts on fish and fish habitat from the proposed relocation of Miller Creek have not been addressed. Notable omissions include the likely impacts of elevated temperatures and lowered dissolved oxygen (DO) concentrations that will occur following construction because of insufficient shading and the failure to achieve design minimum flow depths in the stream channel during summer low flow conditions. This would likely displace fish to other reaches of Miller Creek and lead to fish stranding and mortality. The addition of spawning gravels without providing interstitial fine materials (sand and silt) could intermittently eliminate surface flow during summer low flow conditions, also increasing the likelihood of fish stranding and mortality. The rerouted Miller Creek could be vulnerable to additional dewatering due to its location over peat on the former Vacca Farm.

- The Port's Soil Acceptance Criteria remain seriously flawed and do not preclude the acceptance of chemically contaminated fill. There is evidence that fill, e.g., Hamm Creek Restoration Project sediments, already stockpiled at STIA, contains residual chemicals (PCBs, and DDT) that have the potential to percolate through the fill pile to groundwater, ultimately contaminating area wetlands and streams. Model Toxics Control Act (MTCA) Soil Cleanup Levels are not appropriately used as the criteria to screen soil for use in building the third runway.

- Violations of toxic substances (water quality) criteria in Miller Creek and Des Moines Creek, particularly for copper and zinc, occur as a result of stormwater discharged at STIA, and will continue, and potentially worsen as a result of the Port's proposed project. These violations occurred historically and occur currently. While the distances downstream in each stream where impacts still occur are not known, protection of resident and anadromous fish species, including federally threatened Chinook, known to occur at the mouths of project streams, require that the Port conduct transport, fate, and effects modeling of metals and other chemicals in their stormwater. This should be required before a decision on the Port's proposed project is made. The Port must also address the need for additional waste treatment beyond what has been proposed.

- The potential effects of de-icers in stormwater discharged to area surface waters cannot reasonably be quantified and assessed without collecting additional information and conducting toxicity tests during de-icing events. The data available to date and the scope of the proposed third runway project suggest that such effects will be harmful and have not been adequately addressed by the Port

- The proposed modification for the Port's *National Pollution Discharge Elimination System Waste Discharge Permit* does little to safeguard fish and other aquatic life in Miller Creek and Des Moines Creek, as each receives significant volumes of stormwater from the STIA. There is no requirement to sample stormwater above and below each outfall, nor is there a requirement to model the transport and fate of key chemicals contained in stormwater. By continuing to report the concentrations of chemicals and conventionals at each outfall prior to their discharge, the Port can maintain their claim that stormwater from STIA is no worst than what occurs in other urban areas, and has no effect on the aquatic life in Miller and Des Moines Creeks. The Port persists in this view without regard to whether or not their discharges, including those from the proposed third runway project, are degrading and will continue to degrade the water quality of project streams.

- The Port has offered several different flow augmentation plans for Des Moines Creek but has indicated that use of Seattle Public Utility (SPU) water is the preferred alternative. While the Port has decided to dechlorinate SPU water using sodium sulfate, the Port has neither assessed the efficacy of this treatment method nor the fate of chlorinated by-products that will surely form in Des Moines Creek if SPU water is used for augmentation. The Port's assertion that removal of chlorine is the only treatment required has not changed and remains inaccurate. Fluoride residual also found in SPU water can have both lethal and sublethal effects on fish and other aquatic life and may not be easily reduced to harmless levels employing current waste treatment technology. The Port should be required to model the transport, fate, and potential effects of chlorine residuals and fluoride over the greater length of Des Moines Creek including its outfall to Puget Sound. Only then can the Port provide reasonable assurance that the use of SPU water will not harm fish and other aquatic life inhabiting Des Moines Creek, including chinook salmon, a federally listed species, that occurs at the creek mouth during outmigration.

- New stormwater discharges on Miller Creek are not evaluated for their potential to cause increased local scouring that would diminish the quality of habitat for fish and other aquatic species. There also is no specific assessment of potential impacts on fish or fish habitat from either the construction or the operation of the proposed stormwater retention facilities.

- Flow reductions in project streams as a result of proposed airport construction and operation have not been established with any degree of certainty. Simulations conducted by the Port may underestimate summer low flow impacts and overestimate the contributions of proposed mitigation and natural mitigating factors. If flow in either project stream falls below 1.0 cfs, depth and wetted area will be reduced, resulting in increased temperatures and lowered DO tensions. Fish movement could be limited and conceivably lead to fish stranding and mortality of larger fish. While we don't know if these impacts will occur, neither does the Port because of flawed simulation modeling. The Port must review and revise their analyses as necessary, decreasing the uncertainty with which their results are presently viewed.

- Each of the proposed construction projects, as presently described and assessed, stand alone and are not evaluated for their overall (cumulative impact) on the aquatic resources of Miller Creek and Des Moines Creek. Aquatic ecological risk assessment could be used to characterize the cumulative risks from exposure of fish and other aquatic life to multiple chemicals and altered water quality factors.

The detailed evaluations on which the above conclusions are based are found in the following sections.

Miller Creek Relocation and Associated Instream Enhancements Do Not Protect Fishery Resources

The impacts on fish habitat of relocating Miller Creek are not even addressed by the Port. Clearly, relocation of Miller Creek will result in nearly total elimination of the fish and invertebrate communities presently found in the 980-feet of Miller Creek to be filled accommodating the embankment of the runway. The Port is remiss for not addressing the magnitude of this impact and instead, would rather dazzle us with their suggestion that the relocated Miller Creek, complete with new riffles, pools, and replacement of woody debris, will provide a net gain in fish habitat. It could be years before the relocated creek will attain the level of production achieved presently, assuming that the Port knows what level of fish production presently occurs. Unfortunately, neither the Port nor its consultants have recently undertaken a quantitative fishery survey in Miller Creek.

As described in the Natural Resource Mitigation Plan (NRMP) (Parametrix 1999) and the Joint Aquatic Resources Permit Application (JARPA) (Parametrix 2000b), the physical design (stream gradient, channel depth, size of gravel, placement of large woody debris, etc.) of the 980-foot Miller Creek Relocation Project is based on habitat requirements for cutthroat trout. The planned features include: shading with native plants to minimize temperature increases during the summer; higher velocity riffles to maintain oxygen levels and reduce sedimentation; and the placement of logs, rocks, and other structures to provide refuge.

While the proposed design appears to incorporate habitat requirements of cutthroat trout, the descriptions of the project found in both the NRMP (Parametrix 1999) and the JARPA (Parametrix 2000b) do not include scientific citations (references) in support of the proposed design standards. Also, no scientific data or calculations are provided to assure the scientific reviewer that the proposed design does, in fact, meet requirements for cutthroat trout, yet the scientific literature is replete with this information (Moore and Gregory 1988; Heggenes et al. 1991; Hall et al. 1997; Rosenfeld et al. 2000). In evaluating the proposed project design, I am left with the impression that I should simply "trust them to do the right thing." I must ask whose (which scientist's) fish habitat design standards are we using? This design was based on someone's studies, done where? Has this particular design been used elsewhere? Did it work? What were the shortcomings? How was this design changed to accommodate local features?

Clearly, there are elements of the proposed design that are suspect. For example, if Parametrix implements the design for relocating Miller Creek as presently conceived, summer water temperatures in the relocated reach will likely exceed the preferred summer maximums for cutthroat (Hall et al. 1997) and other species for several years following construction, and perhaps longer. Oxygen concentrations also will likely be depressed. In my opinion, it will take at least three to five years, perhaps longer, for riparian vegetation to grow tall enough to provide any meaningful shading (canopy) in this reach of Miller Creek, even if the introduced native shrubs and trees all survive and achieve average growth each season. As a result, cutthroat and other aquatic life will likely be displaced to other reaches of the stream where temperature and oxygen meet their preferences or tolerances. This condition could exist each summer for a few years or for a longer period of time, until the riparian vegetation grows tall enough to establish a functional stream canopy.

There also will likely be a problem achieving the performance standard of a minimum flow depth of 0.25 feet for the stream channel during 0.5-cfs summer low flow conditions (see page 5-4 of the NRMP [Parametrix 1999]). Mr. William Rozeboom of Northwest Hydraulic Consultants, Seattle, Washington (personal communication, November 2000), indicates that the NRMP documents do not include hydraulic calculations to determine whether or not the proposed low-flow channel would maintain the stated goal of a minimum 0.25 feet in depth at a 0.5-cfs flow rate. In the absence of such data, Mr. Rozeboom performed his own analyses of hydraulic characteristics presented on pages 5-7 and 5-9 of the NRMP (Parametrix 1999) for the proposed 6-inch deep low-flow channel, assuming a Manning "n" roughness value of 0.035, an average bed slope of 0.22%, and bed and top widths of 6 feet and 8 feet, respectively. Mr. Rozeboom determined that these hydraulic data presented in the NRMP would indicate a normal flow of about 0.15 feet for a flow of 0.5 cfs. He also determined that if pool and riffle conditions developed in the proposed channel geometry, the critical-flow depth of flow in 6-foot wide riffle sections (such as over the 6-foot wide notches in the weir logs) would be about 0.06 feet.

Mr. Rozeboom identified another feature of the proposed construction that could cause even lower depths of summer-period flow and a risk of the stream going dry through portions of the reconstructed reach. This risk comes from the proposal to shape a 6-inch deep low-flow channel on a 32-foot wide, two-foot thick "bed" of spawning gravels, which is to overlay a geotextile fabric that isolates the gravel from the underlying native soils. The spawning gravels are to consist of pebbles ranging from about 0.2 inches in diameter to 1.5 inches in diameter (see page 42 of Revised Implementation Addendum, NRMP [Parametrix, 2000c]). In Mr. Rozeboom's opinion, without interstitial fine materials (sand and silt), these gravels will have a high porosity and a correspondingly high capacity to convey (allow) subsurface flow. It was Mr. Rozeboom's opinion that this high subsurface flow capacity is likely to reduce, and might intermittently eliminate, surface flow through the relocated and reconstructed reach.

Mr. Rozeboom's findings indicate that the 0.5-foot minimum flow depth will not be maintained under summer low-flow conditions. Failure to achieve the design minimum flow depth supports my opinion that summer water temperatures in the stream could exceed preferred summer maximums for cutthroat trout (Hall et al. 1997) and other aquatic species. A reduction in depth to 0.15 feet in the relocated main channel and 0.06 feet in riffles could also limit movement of all but the smallest fish throughout the relocated reach and conceivably lead to stranding and mortality of larger fish. Use of spawning gravels without interstitial fine materials (sand and silt) to prevent subsurface flow could increase the potential for thermal stress and stranding.

Dyanne Sheldon of Sheldon & Associates, Inc., Seattle Washington (also working on behalf of ACC and submitting comments) suggests that the rerouted Miller Creek will be vulnerable to additional dewatering because the relocated stream bed will be located over peat on the former Vacca Farm. Ms. Sheldon indicates that this is the reason Parametrix proposed a geotextile liner. Peat does not allow for the creation of a stream channel with gravel substrates. If a liner wasn't used, the water would simply disappear into the peat until the peat became saturated, at which time, a pond would be formed.

Ms. Sheldon goes on to say that where this design was used previously (North Creek) to create a stream channel and floodplain wetlands, again over peat, "the weight of gravel, rocks, woody debris, plus the water on a fabric liner caused the peats in the floodplain wetland to rebound to approximately 18 inches higher in elevation than it was designed." She also says that the geotextile fabric will leak where cables attached to large woody debris pierce the fabric and are anchored to the substrate. If Ms. Sheldon is right, there is no reason to think that the proposed mitigation project will be successful.

The proposed instream enhancement projects, of which there are four, are located south of the former Vacca Farm on Miller Creek and include removing man-made structures (weirs, footbridges, driveways, riprap, and old tires), restoring the natural flow of the stream, and introducing large woody debris to the new stream channel.

For the most part, the Port's proposal to remove man-made structures (weirs, footbridges, driveways, riprap, and old tires) is appropriate for improving fish habitat in Miller Creek. At issue, however, is whether or not the overall project and, in particular, what is installed in lieu of man-made structures to stabilize the bank will be a net enhancement and, will remain during storm events. According to the 1999 NRMP (page 5-63), the existing condition of the mitigation site is characterized by riparian vegetation that consists primarily of lawns and some trees, which "does not provide shade, bank stabilization, or habitat complexity." Under existing conditions, the banks are stabilized by introduced measures including tire riprap that is proposed for removal as an instream enhancement project. Since the existing riparian vegetation is incapable of providing bank stabilization, it follows that removal of the existing bank protection works will cause an increase in bank erosion and stream sediment for whatever period it takes for stabilizing riparian vegetation to develop. The local turbulence caused by the proposed introduction of large woody debris to the channel will likely cause additional bank erosion and stream sediment loading during the period it takes for the stream channel to reach a new equilibrium.

The NRMP (Parametrix 1999) recognizes the need to implement erosion control measures to stabilize eroding banks but does not identify which specific measures would be employed, nor examine whether or not the measures would be effective. Table 5.2-6 (pg 5-64) referenced by the plan on page 5-71 does not provide proposed mitigation projects and appears to be cited in error.

In my opinion, what this means is that fish will try to make a living in a less fish-friendly environment, at least in the short-term. Miller Creek, as a result of storm-induced changes, will not likely meet cutthroat requirements (Hall et al. 1997). This could go on for years until the stream stabilizes and establishes a more or less permanent meander. As a consequence, it is likely that follow-up restoration will be required and that the stream will have to be monitored routinely.

Third Runway Fill Stockpile Contains Potentially Harmful Chemicals that Could Impact Wetlands, Surface Waters, and Fishery Resources at the Project Site

I have found nothing in my reading of the new Section 404 application materials that suggests the Port has adopted new and improved *Soil Fill Acceptance Criteria*. My concern is that chemical contaminants associated with fill materials at the fill placement site have the potential (if not the probability) to percolate through the fill pile to groundwater, ultimately contaminating wetlands and surface water that may be connected to the groundwater stream (see letters to Tom Luster, Washington Department of Ecology (WDOE), on August 31, 2000, and to Charles Findley, U.S. Environmental Protection Agency (USEPA), on December 19, 2000). Chemicals in the fill would also have the potential to directly contaminate wetlands and surface waters through runoff following seasonal rains.

At issue is the appropriateness of the Port's Soil Fill Acceptance Criteria, with particular interest in the process employed to certify that fill accepted by the Port is free of chemical contamination. Also at issue is whether or not fill already stockpiled is contaminated, constituting a risk for area streams, wetlands, and aquifers.

The fundamental purpose of MTCA and the MTCA Method A Soil Cleanup Levels is to clean up existing contaminated or hazardous waste sites. The law sets reasonable standards for the amount of toxic material that can be left in a contaminated site. This standard also recognizes that there is a certain level below which it is not practical or feasible to clean. These standards do not, nor have they ever, allowed the <u>contamination of clean property</u> up to some predetermined level. Further, the absence of a particular standard to screen soils for uplands placement does not excuse adopting one that is very likely to cause environmental harm. To the best of my knowledge, the STIA property where the fill is being placed was free of contamination prior to any fill placement. MTCA does not apply and should not be used for the purpose of screening soils or sediments for use on the STIA Third Runway Fill Project.

Among a number of requirements, the Port's Soil Fill Acceptance Criteria are supposed to preclude chemical contamination. However, they are fundamentally flawed in their lack of a consistent and statistically meaningful approach to determine the location and extent of any contamination contained in candidate fill materials. Statistically rigorous sampling approaches exist, e.g., systematic grid system (Gilbert 1982), over sampling and compositing (Skalski and Thomas 1984) and are used routinely to survey sites for buried waste, yet no such approach is adopted in the Port's Soil Fill Acceptance Criteria. While such an approach need not be undertaken at State-certified barrow pits, they should be required at all sites like the First Avenue Bridge and Hamm Creek where contamination is known to occur.

Reviewing the various sediment characterization reports or phase I or II environmental assessments for lands from which soils were already accepted by the Port indicates the significance of this problem. As an example, let's look at the 85,000 CY of soil from the First Avenue Bridge accepted by the Port from the Washington Department of Transportation (WDOT) in the Second Quarter 2000 (see letter from Paul Agid, Port, to Chung Yee, WDOE, dated July 27, 2000). It turns out that initially only five samples were analyzed for petroleum contamination and potentially toxic metals (see letter from Tom Madden, WDOT, to Beth Clark, Port, dated Nov.29, 1999). Significantly, one of those samples revealed total petroleum hydrocarbons (TPH) exceeding the Method A Soil Cleanup Level of 200 mg/Kg (actual value was 870 mg/Kg). The consultant then collected only three additional samples to delineate the apparent hotspot. These samples also contained TPH in excess of the Method A Standard but no other samples were collected. Even though the hot spot was not fully delineated, the vast majority of the soil was accepted and transferred to the Port. Some (an unspecified amount) was set aside for future testing. Eighty-five thousand cubic yards (85,000 CY), then, were accepted on the basis of only four samples. In this case, the Port is remiss for not fully delineating the hotspot found in the initial round of sampling. Because they did not follow a systematic sampling approach and collected so few samples, they also could not guarantee that other hotspots didn't exist and go undetected.

The Port also accepted 80,000 CY of sediments removed from Hamm Creek on the basis of only two samples (see letter from Elizabeth Clark, Port, to Roger Nye, WDOE, dated Feb. 4, 2000). Four samples were actually collected but composited down to two samples prior to chemical analyses. In a Memorandum to Paul Agid, Port, from Beth Doan, USACOE, dated March 24, 1999, a caveat is included that "indicates the samples were composited over large areas and depths, and that there is a potential for hotspots to go undetected." Although the Port's Mr. Agid has since written to the WDOE downplaying contamination concerns, this communication from USACOE, "purveyor" of the Hamm Creek fill warning of "hotspots", raises the question of how quality control (environmental safety) of the soil delivered on site can be assured if scientifically representative samples were not tested? In the case of the Hamm Creek dredge spoils from a known contaminated site, how can anyone assure the quality of 80,000 CY deposited on the airport site on the basis of only two composited, four total, samples?

In fact, it is likely that fill materials already stockpiled by Port are contaminated. The results of analyses of Hamm Creek sediments summarized in the Memorandum from Beth Doan to Paul Agid dated March 24,1999, show that the two composited samples analyzed were found to contain PCBs and DDT at 160 and 14 ug/Kg, respectively.

Sediments from the Hamm Creek site also failed follow-up bioassays indicating they were toxic to aquatic life, and could be toxic to aquatic life again, if they entered streams on the project site with runoff. Because so very little of the candidate dredged material for placement at STIA was analyzed (only four samples were analyzed by the USACOE from 80,000 CY dredged from Hamm Creek), there is considerable uncertainty as to the actual quantities of PCBs and DDT, and other chemicals contained in Hamm Creek sediments. Efforts to better understand the mobility, bioavailability, and toxicity of the PCBs and DDT known to contaminate these materials should have been undertaken. An additional 10,000 CY of candidate fill material from Hamm Creek were not even analyzed by the USACOE. Presumably, these sediments were included in the 80,000 CY transferred to the Port from the USACOE in 1999.

While the Port states that they used the results of both USACOE (1997) and later Boeing studies (1990) to certify the Hamm Creek sediments (see letter from Paul Agid, Port of Seattle, to Ray Hellwig, WDOE, dated Sept. 15, 2000), the Port appears to have relied more on the decade-old Boeing data. The Boeing study was completed in 1990 and was undertaken for a purpose other than screening candidate fill materials for the Third Runway at STIA. The Boeing study was designed and conducted as a Phase II Environmental Assessment in anticipation of a property transfer. In my opinion, the Boeing study is significantly out of date and only increases the uncertainty with which the chemical content of the Hamm Creek fill materials can be viewed. Concentrations of chemicals in wetland sediments at the Hamm Creek Restoration Project site could have increased appreciably in 10 years, attributable to transport and deposition by both tidal currents and annual flooding of the Duwamish River. Concentrations of chemicals in upland deposited (dredged) sediments at the Hamm Creek Restoration Project site also could have increased over this time period due to unauthorized dumping and runoff from West Marginal Way.

There are other problems in using the results of the Boeing study to certify the Hamm Creek sediments. The locations sampled by Boeing in their 1990 survey are not the same as the locations sampled by the USACOE in 1997. The detection limits for most chemicals analyzed by Boeing's chemists in 1990 were also higher than the detection limits for the chemicals analyzed by the USACOE chemists in 1997 (see letter from Paul Agid to Ray Hellwig, WDOE, dated Sept. 15, 2000). As well, the method of compositing sediment samples employed in the Boeing study could have diluted contaminated sediments with clean sediment, so that concentrations of chemicals in composited samples, those chemically analyzed, fell below applicable chemical detection limits. Any one, two, or all three explanations, might account for Boeing's failure to detect PCBs and DDT in Hamm Creek sediments, which is the key difference between the older Boeing and more recent USACOE studies, and which increases the uncertainty associated with the Boeing results.

For the above reasons, if we were to rely on only one study, it would <u>not</u> be the Boeing study. Further, in my opinion, the two studies do not complement each other, and beg the question, why wasn't a third, independent, sediment survey undertaken. Neither existing study was undertaken for the expressed purpose of screening sediments for the Third Runway. Clearly, such a study should have been undertaken.

There is evidence that fill, e.g., Hamm Creek Restoration Project sediments, already stockpiled at STIA, contains residual chemicals (PCBs, and DDT). This suggests that other fill materials stockpiled by the Port could also be contaminated. The MTCA Soil Cleanup Levels are not appropriately used as the criteria to screen soil for use in building the third runway. As a consequence, the Port's Soil Acceptance Criteria are seriously flawed and do not afford natural resources much protection from chemicals up to the MTCA Soil Cleanup Levels.

Metals Exceedences of State of Washington Toxic Substances Criteria Will Continue and Potentially Worsen if the Port's Proposed Project Is Approved

While there are several constituents (metals, fecal coliforms, turbidity) associated with STIA stormwater in Miller and Des Moines Creeks that have historically violated State of Washington Water Quality (Toxic Substances) Criteria (Chapter 173-201A WAC), the metals copper and zinc are of particular concern given their designation as toxic substances. In both creeks, the Port has presented metals data for stations at the STIA stormwater outfalls, upstream of the outfalls, and downstream of the outfalls.

Data presented by the Port (1997) indicated that concentrations of both copper and zinc in STIA stormwater discharges greatly exceeded applicable State/U.S. Environmental Protection Agency (EPA) Toxic Substances Criteria, in some instances by more than an order of magnitude. For example at the stormwater outfall to Miller Creek (see 1997 report page 35), total copper concentrations ranged from 4.2-82.9 ug/L. The EPA criterion is 4.4 ug/L. The Port's 1997 data also indicated that concentrations (4.7-14.8 ug/L) of total copper upstream of STIA were at or slightly exceeded the EPA metals criteria. That Miller Creek was unable to assimilate the STIA discharges, however, is confirmed by downstream sampling data showing total copper concentrations of 0.72-44 ug/L. For zinc in Miller Creek, the values at the outfall, upstream, and downstream were 15-525 ug/L, 37-69 ug/L, and 2.3-295 ug/L., respectively, again showing that the influence of zinc additions at the outfall persisted downstream. The EPA criterion for zinc is 33.7 ug/L.

The concentrations of copper and zinc downstream exceeded the applicable Toxic Substances Criteria. The Port's 1997 Report does not provide evidence that would support a scientifically valid conclusion that STIA does not impact Miller and Des Moines Creeks downstream of their respective stormwater outfalls. Persistence of an influence of stormwater downstream, and at the magnitudes illustrated above, also suggests the need for treatment of the waste streams before discharge to project streams.

Data presented by the Port in 1999 confirm that exceedences of toxic metals criteria continue to occur at the Port's stormwater outfalls to the creeks. In addition, the downstream stations, where sampled, show that the influences of STIA stormwater discharges persist in the receiving waters. What appears missing in the 1999 report, however, is any indication that the Port sampled upstream of STIA. The Port's failure to maintain the original sampling protocol in this regard greatly diminishes the value of their stormwater-monitoring program.

Unknown is how far downstream the impacts of copper and zinc occur in Miller Creek and Des Moines Creek. Unfortunately, the Port makes no effort to model the fate of their stormwater. Although much dependent upon the volumes of stormwater discharged, it is my opinion that potentially harmful concentrations of copper and zinc in stormwater could persist over the entire length of each creek, to their outfalls. Both resident and anadromous fish inhabiting Des Moines Creek and Miller Creek are vulnerable, including juvenile chinook, a federally threatened species, that occurs at the mouths of both creeks during outmigration.

The Port has failed to demonstrate that STIA stormwater does not adversely impact the water quality of Miller and Des Moines Creeks. The Port's own sampling data confirms that STIA stormwater greatly contributes to exceedences of toxic metals criteria in the receiving waters. The Port also cannot say that conditions in the project streams will not worsen if the project is approved. The addition of new impervious area will increase the volume of stormwater discharged to project streams and also increase the quantities of metals and other chemicals contained in stormwater that is discharged to project streams. While flow mitigation as proposed by the Port will decrease the effects of sediments and sediment bound metals and other chemicals, flow mitigation will do less to decrease the concentrations of metals and other chemicals that are already in solution; that have already partitioned to the aqueous phase. The Port's reminder on page 22 of their 1999 report that the Water Quality Standards (Toxic Substances Criteria) apply to receiving waters and not the discharges from their outfalls also is of little consequence if the Port fails to present data from both above and below their outfalls, over the greater length of each stream.

More recently (1999), Cosmopolitan Engineering Group (Cosmopolitan) reported the results of metals analyses at the Port's STIA outfalls (see Table 15, page 6-2). They indicated that the only metal to exceed historical highs was lead at 0.010 ug/L but this concentration did not exceed the receiving Water Quality (Toxic Substances) Criteria for lead of 0.032 mg/L (calculated at 56 mg/L total hardness). While the information on lead is not particularly important, to not include a parallel interpretation of the copper and zinc levels also reported in Table 15; that is, comparisons of copper and zinc levels to applicable water quality (toxic substances) criteria, is a serious breech of scientific ethics. If the authors did, they would have had to agree that many of the copper and zinc values did exceed their applicable water quality (toxic substances) criteria, e.g. the copper and zinc values for outfall SDN3 adjusted for 33.5 mg/L hardness (Feb-99); the copper and zinc values for outfall SDN4 adjusted for 34.2 mg/L hardness (Dec-98). The point is however, despite the Port's caveat that they should not be held to the applicable Water Quality (Toxic Substances) Criteria in their pipes (at their outfalls), it is intuitive that as the water runs off to the creeks from STIA's outfalls, that for some unspecified but substantial distance downstream of these outfalls, the concentrations of metals will exceed applicable Toxic Substances Criteria.

There is Still Insufficient Information to Say That De-Icers Pose No Risk to Surface Waters as a Result of Their Use at STIA

Activities associated with implementing the Master Plan Update Improvements, if approved, will include adding new impervious surfaces including a third runway, new taxiways and new aircraft parking area. This action to enlarge the airport, in my opinion, will result in greater use of de-icers with the potential for increased runoff of de-icer and anti-icer residues to project streams. De-icers (glycols, acetates) and their additives (sodium nitrite, sodium benzoate, borax, high molecular weight polymers, polyamines, triazoles) (Lokke 1984; MacDonald et al. 1992; Hartwell et al. 1995) are toxic to aquatic life at relatively low concentrations (1.8-8.7 mg/L) (Hartwell et al. 1995). De-icers, as they degrade, also increase biological oxygen demand (BOD) decreasing DO tensions.

Cosmopolitan (1999), during the winter of 1998-1999, studied the potential effects of de-icers (sodium or potassium acetate) on DO in downstream detention ponds (Lake Reba and Northwest Ponds) on Miller Creek and Des Moines Creek, respectively, after two runway deicer events (Dec 19-24, 1998; Feb 8-9, 1999) at STIA. Cosmopolitan's work was stimulated by earlier Port results (1999) that found high BOD in water samples from five stormwater outfalls (SDE4, SDS3, SDN1, SDN3, and SDN4 at STIA), which was attributed to acetate-based runway deicing chemical.

Cosmopolitan determined that trends in DO fluctuated widely over the course of the study but generally followed trends in rainfall. During dry periods, DO decreased to below saturation. Conversely, DO increased during periods of rainfall. De-icing chemicals were also found to pass rapidly through both Miller Creek and Des Moines Creek after rainfall and runoff began following deicing events. Cosmopolitan concluded that DO was not reduced in either Miller Creek or Des Moines Creek as a result of de-icing events.

In my opinion, Cosmopolitan (1999) cannot say unequivocally that the sag in DO, which follows each de-icing event by two weeks, is not due at least in part to the breakdown of de-icer in Northwest Ponds and Lake Reba. What the data in Figures 4 and 5 (pages 4-19, 4-20) indicate is that during dry periods, the BOD increases in response to bacterial decay of organic materials that have accumulated in the sediments of these water bodies during past runoff events. This we should expect. Then when it rains, DO in these water bodies increases due to aeration during runoff. One cannot separate the effects of the de-icer from other organic materials that enter the ponds as runoff, that also will eventually degrade and decay, increasing BOD, and decreasing DO concentrations. Despite Cosmopolitan's conclusion to the contrary, there is evidence of an impact (depression) on DO in Des Moines Creek at the Golf Course Weir following the Feb 8-9, 1999 deicing event (see Figure 4, page 4-19).

Further, de-icer does not pass through the system as quickly as Cosmopolitan suggests. The de-icer material as acetate will become associated (adhere to) soil and sediment particles as it runs off. As it enters the Northwest Ponds and Lake Reba, some or most of it will settle out to the bottom where the organic fraction will degrade and decay. Because it is winter and temperatures are relatively low, bacterial decay will be slow, which suggests that the two-week time lag before the oxygen sag was observed may not be unrealistic.

That sodium or potassium acetate entering the system as runoff is not the only material that can increase conductivity is also not convincing. Cosmopolitan's assertion that conductivity is a good tracer for de-icer chemicals requires further support. The metals Cu, Pb, and Zn, all common to stormwater, also could contribute to higher conductivity. Clearly, metals dynamics as well as the dynamics of de-icers are one and the same with the dynamics that stormwater exhibits.

I agree that rainfall does affect DO concentrations in the Northwest Ponds and in Lake Reba but this does not explain all the variation that is observed in the 1998-1999 data. To determine whether or not de-icing chemicals impact the system (depress DO) would require a better understanding of all the factors affecting DO in the system. Additional events will need to be followed and more data will need to be collected preceding deicing events. Cosmopolitan followed only two deicing events in the Winter 1998-1999. While Cosmopolitan (2000) also studied the potential effects of de-icers on DO concentrations during the Winter 1999-2000, too little deicer entered Northwest Ponds and Lake Reba to contribute much to our understanding of the problem.

Technically speaking, the Port has only begun to address the issues of de-icers. They have not addressed toxicity in any meaningful way, particularly with regard to the additives found in commercially available deicing chemicals. In the absence of toxicity testing during de-icing events, they have not provided information sufficient to eliminate the likelihood de-icers are a substantial detriment to surface water quality as a result of their use at STIA, and would be greater detriment if the third runway were built.

The Port's Proposed Modification to the National Pollution Discharge Elimination System (NPDES) Waste Discharge Permit Still Does Not Safeguard Fish and Other Aquatic Life in Project Area

The proposed NPDES Permit modification still does little to safeguard fish and other aquatic life in Miller Creek or Des Moines Creek, as each receives significant volumes of stormwater from the STIA. Any CWA Section 404 and 401 approvals, which assume that this permit will protect the waters and aquatic resources of project streams, would be flawed. The proposed permit modification changes very little when compared with the existing permit, yet the volume of stormwater will increase, as will the quantities of metals and other chemicals entering the project streams increase, if the Port's project is built.

There is no requirement in the permit to sample stormwater above and below each outfall, nor is there a requirement to model the transport and fate of key chemicals contained in stormwater in each watershed. By continuing to report the concentrations of chemicals and conventionals at each outfall prior to their discharge, the Port can maintain their claim that stormwater from STIA is no worst than what occurs in other urban areas, and that it has no effect on the aquatic life in Miller and Des Moines Creeks.

Des Moines Creek Flow Augmentation Preliminary Design Using SPU Water Still Leaves Too Many Unanswered Questions

While the Port has decided to employ sodium sulfite tablets to dechlorinate SPU water (Kennedy/Jenks 2000); that is, if they implement their preferred alternative, the Port has not presented any data on the efficacy of this treatment approach. With most dechlorination alternatives, there is residual free chlorine that can react with natural humic materials in the receiving waters to form a variety of chlorination by-products. In other words, most dechlorination systems are not 100 percent effective. As I stated in my initial reviews of the Port's plans forwarded to Tom Luster, WDOE, on August 21, 2000, and September 5, 2000, even with dechlorination, there is still a need to access (model) the fate, transport, and potential bioeffects of chlorine and chlorinated by-products with each treatment alternative the Port considers, because chlorine and chlorinated by-products are toxic to fish and other aquatic life at very low levels, i.e., 3-6 ug/L. Only in this way will the public be assured that the trout and salmon in Des Moines Creek will be protected.

The Port's assertion that removal of chlorine is the <u>only</u> treatment required has not changed and remains inaccurate. As I said in my earlier letters to Tom Luster at WDOE, fluoride is also found in SPU water at 1.0 mg/L, which is above the lethal or sublethal toxicity limits for many aquatic species. For example, using data from Angelovic et al. (1961) and Pimental and Bulkley (1983), the LC_{50} for rainbow trout exposed to sodium fluoride at a hardness of 12 mg/L (typical hardness of Des Moines Creek in wet season) was estimated to be 0.2 mg/L (Foulkes and Anderson 1994). Fluoride was also found to mask olfaction and adversely affect migration in salmonids (chinook and coho salmon) at concentrations < 1.0 mg/L (Damkaer and Dey 1989).

Fluoride also may not be reduced to harmless levels employing current waste treatment technology. Principal fluoride removal methods are precipitation by lime, absorption on activated alumina, or removal by an ion exchange process, all of which are expensive, and may not remove fluoride below 1-2 mg/L level (Liu et al. 1997). This level of efficacy, as determined in my previous assessment, will not be fully protective of fish and other aquatic life.

While the Port has acknowledged that there could be differences in temperature between SPU water and Des Moines Creek water, it only proposes to address the potential effects of different temperatures after flow augmentation begins. The Port's plan "includes monitoring and <u>testing during the first year of operation</u> to determine the effects of various temperature settings on downstream temperatures, and determining optimal augmentation rates to achieve desired results." Clearly, if it proceeds as it says, there could be serious impact (thermal shock to fish and other aquatic life) in Des Moines Creek during the first year of augmentation. The alkalinity and pH will be lower in drinking water when compared with Des Moines Creek and also may have to be adjusted upward to avoid osmotic shock.

The unknown is the extent to which changes in ambient water quality will occur over the length of Des Moines Creek if SPU water is used for augmentation. To address this unknown, the Port will need to complete its application and prior to agency approval, carefully model the transport and fate of chlorine residuals, fluoride, and other water quality parameters, taking into consideration differences in treatment efficacy, flow regime, and rate of augmentation. Only in this way, can the Port provide the agencies with sufficient scientific information to determine whether or not there is reasonable assurance that treated SPU water will not harm fish and other aquatic life, including federally threatened chinook, that occur in Puget Sound at the mouth of Des Moines Creek.

Discharge Velocities of Proposed Stormwater Detention Facilities Not Established

Additional temporary and permanent stormwater detention facilities and outfalls are to be constructed to allegedly mitigate impacts from the proposed third runway construction activities and new, impervious surfaces. Seven temporary ponds, four permanent ponds, and two treatment facilities are to be constructed and operated.

In my opinion, additional point-source discharges to Miller Creek will occur with the possibility of increased local impacts if all the proposed stormwater detention ponds and treatment facilities are built. Below each outfall on the creek, there will be an area of scoured substrate, which will likely increase or decrease in size as a function of discharge velocity. Scoured stream substrate is poor habitat for fish and other aquatic species.

While the Comprehensive Stormwater Management Plan prepared by Parametrix (2000d) includes the volumes and discharge velocities for existing detention facilities on Miller Creek, the discharge velocities for the proposed outfalls are not presented. It is suggested in the Preliminary Comprehensive Stormwater Management Plan (Parametrix 2000d) that flows and water quality from the proposed stormwater detention facilities will meet requirements of King County's Surface Water Design Manual (KCC 9.04) but there is no specific assessment of potential impacts associated with the construction of these facilities. Again I am left with the impression that I should simply "trust them" to build facilities that have little or no adverse impact but without the design data and analysis on which to base that trust.

Low Stream Flow Impacts are Underestimated

There are likely significant problems with the Port's Low Stream Flow Analyses (see Comprehensive Stormwater Management Plan [Parametrix 2000d]) in that the predictions may underestimate summer low flow impacts and overestimate the contributions of proposed mitigation and natural mitigating factors. For example, one option that the Port proposed in mitigation of predicted low stream flows is the use of "additional storage volume in the base of selected detention facilities, that can be used to store winter (wet) season runoff until needed to support low flows in the summer (dry) season." According to Mr. William Rozeboom of Northwest Hydraulic Consultants, Seattle, Washington (also working on behalf of ACC and submitting comments), some of the proposed detention facilities that are to be used in this way do not have "dead storage" capacity for reserve storm water release, with the result the total proposed storage falls short of the target volumes. Mr. Rozeboom also points out that the potential mitigating effect of the "fill infiltration discharge" from the proposed runway embankment to Miller Creek is overestimated, and that the "IWS lagoon lining improvements" would specifically reduce recharge for Walker and Des Moines Creeks. For these reasons and others (see the full text of Mr. Rozeboom's comments), the Port's conclusion indicating that base lows will not be diminished beyond the values presented in Table 5 (page 18) of the Biological Assessment – Supplement (Parametrix 2000) is in serious doubt. Clearly, flow reductions have not been established with any degree of certainty.

Again, we are left with the impression that we should simply "trust" the Port; that their analyses are accurate, and that declared future STIA development will not further diminish flows during the summer (dry) season. From a fish or fish habitat perspective, it is my opinion, that if flows fall below 1.0 cfs, impacts to anadromous as well as resident fish species will likely occur, and over the entire length of the streams on the project site. If flows diminish, depths will surely decrease resulting in elevated temperatures and lower DO tensions. Fish and other mobile aquatic life could be displaced to other reaches of the stream where preferred conditions persist. Diminished flow and depth could also limit movement of fish throughout the stream length and conceivable lead to stranding and mortality of larger fish.

There is increased likelihood that low stream flow impacts on fish and other aquatic life in project streams will occur. Because of flawed simulation modeling, the Port does not possess scientifically credible information to indicate that impacts will not occur. It is incumbent upon the Port to complete its application and prior to agency evaluation revise its analyses as necessary, addressing the issue raised above.

Cumulative Impacts Are Not Assessed

Unfortunately, there is no attempt to link any of the proposed construction projects on either the Miller Creek or Des Moines Creek Watersheds, yet there is potential for cumulative impacts. Each of the proposed construction projects or discharges in their respective watersheds, as presently described and assessed, stand alone and are not cumulative impacts. Each of the proposed construction projects or discharges in their respective watersheds, as presently described and assessed, stand alone and are not evaluated in the context of the overall change that Miller Creek, Walker Creek, or Des Moines Creek will undergo if the Port is permitted to build the third runway. Even if the Port does not believe there will be cumulative impacts, they are remiss for not considering this possibility and providing a rational assessment. Their work must be viewed as incomplete if they do not carry out this assessment.

One approach that could be taken to address the cumulative impacts of chemical additions and altered water quality is to conduct an aquatic ecological risk assessment. New risk characterization procedures are available that are quantitative, probabilistic, and provide community-level estimates for risks, and generate measures of uncertainty in the risk estimates. Estimates of risk for individual chemicals, as well as estimates of the total (cumulative) risk from multiple chemicals or conventional water quality factors can be calculated. What is required for this analysis is knowledge of the different organisms that inhabit the project streams, their toxic response to different chemicals (e.g., lethal dose to 50% of the test population [LD_{50}]), and their exposure (dose) to the same chemicals. One such risk assessment method, *Aquatic Ecological Risk Assessment, A multi-Tiered Approach* (Parkhurst et al. 1996) has recently undergone extensive validation and has been reviewed and accepted by the USEPA. The method performs well with metals, pesticides, other organic chemicals, where the exposure is in water, sediments, or from internally deposited chemical residues.

Thank you for the opportunity to comment on these issues. I am available by phone, email, or in person, to discuss any of my comments in greater detail.

Yours very truly,

John A. Strand, Ph.D.
Principal Biologist

Cc: Kimberly Lockhard
Peter Eglick

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Attachment

John A. Strand, Ph.D., Fellow A.I.F.R.B.
Fisheries Biologist

Dr. Strand is an internationally recognized fisheries biologist specializing in studies to determine potential effects of human activities on aquatic resources. During his 25 years of experience (post Ph.D.), he has conducted and managed a wide variety of projects, large and small, in Washington, California, Alaska, British Columbia, Guam, and Venezuela. These included field studies to evaluate environmental impacts of engineered structures, and field and laboratory studies to assess ecological risks from discharge of contaminants to surface waters, including sewage, storm water, oil, other organic chemicals, radionuclides, and heavy metals. Of key interest is the design of strategies to mitigate impacts on threatened, endangered, or sensitive aquatic species, and their habitats.

Address, Phone, and E-Mail:

1314 Cedar, Richland, WA
(509) 943-4347; jstrand427@aol.com, or jstrand@tricity.wsu.edu

Education:

Ph.D.; University of Washington; Fisheries Biology; 1975
M.S.; Lehigh University; Biology; 1962
B.A.; Lafayette College; Biology; 1960

Employment:

1999- Principal Biologist, Columbia Biological Assessments, Richland, WA. Also, Adjunct Faculty, Environmental Sciences and Regional Planning Program, Washington State University Tri-Cities, Richland, WA.
1996-1999; Water Quality Planner, King County Department of Natural Resources, Seattle, WA.
1993-1995; Senior Biologist and Group Leader, EA Engineering, Science, and Technology, Inc, Redmond. WA.
1990-1993; Manager and Co-Chair, *Exxon Valdez* Oil Spill Restoration Planning Working Group, NOAA/NMFS, Auke Bay, AK.
1969-1990; Senior Research Scientist and Manager, Battelle, Pacific Northwest Laboratory; Richland and Sequim, WA. Also, Affiliate Faculty (1987-1991), School of Fisheries, University of Washington, Seattle, WA.

Registration/Certification:

Fellow, American Institute of Fisheries Research Biologists; 1993
Certified Fishery Scientist (No. 442), American Fishery Society; 1969

Specialized Training:

Health and Safety Training for Hazardous Waste Sites; 1996; 1997; 1998
Wetland Delineation, Shoreline Community College; 1996
Litigation Support Short Course, EA Engineering, Science, and Technology, Inc.; 1994
Project Manager Training, EA Engineering, Science, and Technology, Inc.; 1994
NEPA Refresher Training, US Forest Service; 1991

Experience:

Resource Management and Planning--- From 1992-1993, was Federal Co-chair of *Exxon Valdez* Oil Spill Restoration Planning Work Group in Anchorage, Alaska. Responsible for developing a restoration plan, and for designing, implementing long-term restoration and monitoring projects for injured resources and human services. Served as member of the Sequim Bay Watershed Management Committee from 1987-1990 and helped prepare the *Sequim Bay Watershed Management Plan*. The Plan focused on mitigation of cumulative effects on salmon and other fishery resources of nonpoint source pollution from timbering, road building, agriculture, marina operations, and failed septic systems throughout the watershed. In 1999, served as member of King County Biological Review Panel with responsibility to evaluate King County policies and programs (e.g., Sensitive Areas Ordinance, Clearing and Grading Code, Surface Water Design Manual, and basin plans) most relevant to conservation of threatened chinook salmon.

Regulatory Compliance----From 1970 to 1990, conducted and managed numerous reviews of Section 316 (a) (b) Demonstrations of Compliance with the Clean Water Act. As a basis for applying Section 316 requirements and procedures, conducted assessments of power plant impacts on marine and estuarine resources. In 1988, performed chemical analyses and bioassays in support of National Pollution Discharge Elimination System (NPDES) Permit renewals at oil industry facilities in Port Valdez and Cook Inlet, Alaska. In 1994, designed monitoring plans to address "special conditions" of NPDES permit renewals at two coastal power plants in California. Following provisions of Endangered Species Act (ESA), in 1995 evaluated agency biological opinion and conducted field studies to assess potential impacts of construction and operation of a proposed gold mine on habitat use by endangered spring and summer run chinook salmon in the Salmon National Forest, Salmon, Idaho.

Environmental Impact Assessment----From 1970 to 1994, conducted and managed numerous studies to assess impacts of technology development on aquatic and terrestrial ecosystems, including wetlands. Assessed environmental impacts for nuclear power plants, petroleum and synthetic fuel refineries, mines and smelters, an acoustic measurement station, a marine mammal holding area, a solid waste management facility, an aviation fuels pipeline, and a bridge. In 1994, directed an environmental assessment of alternate sites for construction of replacement housing at McChord Air Force Base, Washington.

Aquatic Toxicology and Risk Assessment----From 1970 to 1999, studied fate and effects of chemical contaminants in aquatic systems. In 1980, developed exposure pathway models and determined potential ecological and human health risks associated with metals and radionuclides released from a hypothetical uranium mine and smelter at three locations in British Columbia. In 1989, studied persistence of spilled Bunker C fuel oil in beach sediments and in shellfish found intertidally in Olympic National Park, Washington. In 1990, evaluated survey design and sampling procedures to determine the fate of oil refinery and coking plant wastes in sediments and benthic biota in Amuay Bay, Venezuela. In 1995, prepared sampling plans to study fate of metals and organic contaminants in groundwater and marine sediments in Liberty Bay, Washington. From 1996 to 1998, studied ecological risks of combined sewer overflows in the Duwamish River and in Elliott Bay, Washington, with particular interest on potential impacts to out migrating chinook and chum salmon. From 1999 to the present, assessed risks to fish and other aquatic life from stormwater additions to the Miller Creek, Walker Creek, and Des Moines Creek Watershed, King County, Washington.

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