POLLUTION CONTROL HEARINGS BOARD
FOR THE STATE OF WASHINGTON

AIRPORT COMMUNITIES COALITION, Appellant, v. STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY; and THE PORT OF SEATTLE, Respondents.	No. 01-133 DECLARATION OF DR. PETER WILLING IN SUPPORT OF ACC'S MOTION FOR STAY (Section 401 Certification No. 1996-4-02325 and CZMA concurrency statement, issued August 10, 2001)

Dr. Peter Willing declares as follows:

1. I am over the age of 18, am competent to testify, and have personal knowledge of the facts stated herein.

2. My education and experience consists of a Master of Science degree and a Doctor of Philosophy degree, both from the Department of Natural Resources at Cornell University, Ithaca, New York. My graduate work concentrated on the relationships between land use and water quality of lakes and streams. I have taken specialized training courses in Applied Fluvial Geomorphology at the Wildland Hydrology Center, Pagosa Springs, Colorado, and on "Stormwater Treatment:

ORIGINAL

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

Biological, Chemical, and Engineering Principles" through the Professional Engineering Practice Program, University of Washington.

3. I am a Principal in the Bellingham firm of Water Resources Consulting, L.L.C., which I founded in 1989. The firm specializes in hydrology of surface and ground waters, water quality, monitoring network design, stormwater management strategy, and hydrologic basis of water rights. I have served in public sector positions including general manager of a mid-sized public water system and environmental manager for a municipal electric utility. I hold Adjunct Faculty appointments in Geology and in Huxley College at Western Washington University, Bellingham.

4. I am a member of the American Water Resources Association and the American Geophysical Union.

5. I have analyzed, reviewed, and commented on Port of Seattle proposals for Sea-Tac airport on numerous occasions since November 1999. These undertakings have all been on behalf of the Airport Communities Coalition. I have commented by letter on the implementation plan for the Des Moines Creek Flow Augmentation Facility (September 5, 2000 and September 26, 2000); the Sea-Tac Stormwater Master Plan (September 19, 2000); the Section 404 permit application (February 16, 2001); the NPDES permit major modification (March 12, 2001); supplemental information on the Section 404 permit application (Best Management Practices) (July 18, 2001); and

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

low flow analysis regarding the Section 404 permit application (August 6, 2001). Copies of these letters are attached.

6. I have reviewed the Department of Ecology's Water Quality Certification No. 1996-4-02325 for construction of a third runway at Sea-Tac Airport, issued on August 10, 2001. This certification contains numerous expectations of future performance, reliance on undefined not-yet-developed "contingencies," and general expectations that fall short of reasonable assurance that the construction will protect water quality standards. I will illustrate these deficiencies by reference to two specific problems. The first is the Port of Seattle's flawed analysis of low streamflows and its changing plans to augment these flows from different water sources. The second problem relates to water quality aspects of the Port's proposed stormwater management plans, which fail to offer assurance that the third runway project will not perpetuate the Port's consistent pattern of water quality violations. As discussed below, none of these plans offer a competent basis for certification that water quality standards will not be violated. The latest plan, relied upon in Ecology's 401 decision, is a last-minute stop-gap rather than a serious and technically sound plan for mitigating flow impacts caused by the Port's projects on Class AA streams.

7. My declaration relies in many places on previous analyses that I have made. Rather than repeat these analyses in their entirety, I have summarized them for

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

clarity and convenience. A compilation of the original letters and statements is attached, and should be consulted for detail and references to literature.

Low Flow Augmentation

8. The history of the Port of Seattle's inability to propose a reliable and convincing water source for flow augmentation in Des Moines Creek was one of four reasons why the Port was forced to withdraw its application for a 401 permit in 1998. Since then the Port's iterative analyses of the low flow behavior of the streams has led to expansion of the flow augmentation scheme to include the Miller and Walker Creek basins as well as Des Moines Creek. The following is a brief chronology of the Port's flow augmentation proposals:

- In July 2000, the Port's "preferred option" for augmentation was to use water from a Port-owned well. In August the Port maintained the preference for the well source, but also discussed Seattle Public Utilities water as an alternative. By September 2000, the Port had decided that "the primary source is water from Seattle Public Utilities."

- By December 2000 the Port's plan had reverted to the existing Port-owned well on the Tyee Golf Course as the source of augmentation water. However, in different documents at that same time, the Port also proposed to construct additional storage facilities that would hold stormwater for augmenting dry season low stream flows. In January 2001 the port was still "investigating other sources of water in the [Des Moines Creek] basin."

- Sometime after January 2001, the stormwater storage concept gained currency as the favored mode of flow augmentation. However, it required substantial retrofitting and revision of the December 2000 Stormwater Management Plan because the announced volumes of required stormwater storage did not agree with the volumes shown on the plans for individual detention facilities. Revisions continued with the July 2001 "Low Flow Analysis/flow Impact Offset

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

Facility Proposal," the most current rendition of the concept available prior to Ecology's issuance of its 401 decision in August 2001.

9. The two major flow augmentation schemes attempted and then rejected by the Port had serious defects that ultimately disqualified them as a water source for mitigation of low flows in Sea-Tac area streams. The third plan suffers its own set of defects, as described below.

10. The Port's first proposal involved acquisition of an existing well on the Tyee Golf Course. However, this well was not used at all for a period of years, and then was used without benefit of a water right for many more years. It is highly unlikely there is a valid water right for the well. Moreover, the well was not legally constructed under state law, exploiting three different aquifers in a common casing in contravention of state rules for protection of upper aquifer zones.

11. The Port next approached Seattle Public Utilities about providing augmentation water, however, it was determined that the import of water from the Cedar River presented both chemical and physical disqualifications. The temperature of Cedar River water is as high as 20 degrees C for much of the time when supplemental water is most needed, and 16 degrees C maximum is the water quality standard for Class AA streams. The scheme to use this water relied on technological inputs whose continuity could not be assured, and the water would also have had to be purged of drinking water conditioning chemicals such as chlorine and fluoride.

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

12. The present plan, carry-over storage of stormwater, was first suggested by the Port in its Low Streamflow Analysis (first version, December 2000). The Port settled on this plan to the apparent exclusion of the earlier ones in July, 2001. My comments on this plan were communicated to the Department of Ecology by letter of August 6, 2001 (attached). My conclusions were that the July 2001 "Low Flow Analysis/Flow Impact Offset Facility Proposal" was manifestly an incomplete effort, showing gaps in the text and missing essential figures and appendices. These defects and the resulting confusion were acknowledged by the Port in a clarification letter dated two days after its July report was released. Eglick Decl. at ¶ P. In sum, the proposal has the appearance of a stop-gap, even though stored stormwater is the third augmentation water source the Port has pursued since 1998.

13. The use of stormwater for streamflow augmentation clearly raises concerns about water quality. Nonetheless, the 401 Certification relies on promises that water quality problems will be resolved in the future, rather than on substantial plans to address the issue. The July 2001 low flow proposal makes general promises that, "if potential water quality violations are indicated," the Port will "install/maintain filters for sediments/turbidity/metals" and "install portable aerators for DO." However, these types of measures cannot be taken at the last minute, as an afterthought, with any expectation that they will work. They must to be designed, built, tested, and refined before the need for them arises. The Port's plan to install

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

something after the need becomes apparent, with no specific prior attention to what will be required and whether or how it will work, is likely to lead to stream degradation and falls short of the reasonable assurance required under the Clean Water Act.

14. This shortcoming is significant because of serious questions about the suitability of the stored stormwater proposed by the Port of Seattle as a flow augmentation source for the creeks around Sea-Tac airport. The Port's plan for this scheme indicates dead storage discharge lines in the bottom of the vault. If built as shown, the first discharge to the receiving Class AA streams, which would already be under stressed low flow conditions, would be an anoxic slug of sediment laden water carrying a six-month accumulation of pollutant load. The Port claims that pollutant species will be bound by adsorption to soil particles and rendered biologically inactive. To the contrary, under anaerobic conditions, which the Port concedes will occur, many bound inorganic compounds will go back into solution and become biologically available upon release of water to the streams. Other than sporadic references to re-aeration of the stormwater, the Port has not proposed any treatment to bring stormwater up to a standard appropriate for release to Class AA receiving waters.

15. Ecology's 401 decision acknowledges the contingencies in the Port's proposal and accepts them in lieu of specific plans demonstrating how the Port will

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

come up with water of adequate quantity and quality to assure local streams are protected. The 401 Certification simply tells the Port to come up with plans in the future to cover problems and obvious gaps in the existing plan:

a. to offset a less than anticipated recharge rate into the fill (Certification condition I.a.vii)

b. to address wetland impacts that manifest themselves after monitoring (Certification condition I.a.x)

c. to address the necessity of treating stormwater to bring it to a standard acceptable for release to streams (Certification condition I.e.v)

d. to cover the potential shortfall of water in June and July (Certification condition I.e.vi). The July 2001 Low Flow Analysis defined the flow enhancement schedule as starting in late July for only one creek, and the others were in August

16. This collection of undeveloped contingency plans does not add up to reasonable assurance that the Port's activities will not violate water quality standards. Two of these contingency situations (a and d, above) will require the Port to obtain more water for augmenting stream flow. Simply finding a source of water is a problem that has confounded the Port's past attempts to obtain a 401 certification for the Third Runway. The contingency conditions of this permit contain no more certainty than has been present in the vague and constantly changing plans of previous attempts.

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

17. King County Department of Natural Resources also identified numerous deficiencies in the Port's latest low flow augmentation scheme (letter of August 3, 2001 from Pam Bissonnette to Ann Kenny). These deficiencies include:

- no detailed design for constant discharge from stormwater vaults under varying head conditions
- need for mechanical aeration of stormwater while it is in storage in various vaults
- no provision for low flow events in July
- resorting to impervious surface to increase yield of surface runoff in order to maximize yield for flow augmentation, instead of allowing natural percolation, groundwater recharge, and discharge to streams
- need for water quality treatment at vaults
- difficulty of delivering water from the vaults to the intended receiving streams
- problems of maintenance, operation, monitoring, and design
- lack of complete conceptual drawings

18. The low flow mitigation plan is based on a low flow technical analysis that omits important hydrologic factors in its assessment of the impacts of the Third Runway. For example, hydrologic effects of reconstructing the third wastewater lagoon are omitted from calculations of groundwater base flow and consequent dry season streamflow. Ecology's 401 certification simply ignores this omission.

19. The 401 decision similarly disregards significant uncertainty in the Port's low flow modeling exercises. If there is a large chance of being wrong in the estimates of very small stream flows and augmentation requirements, then there is a high likelihood of degrading beneficial uses of the streams. And in fact, there is a large chance of being wrong. The Port's own data show that the error between

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

modeled and observed flows, or calibration error, is 100% for certain low flow periods.

20. In sum, the Port's low flow augmentation plan is based on flawed technical analysis and contingencies that do not befit a critical mitigation element. The augmentation plan is not likely to protect beneficial uses of Des Moines, Miller and Walker Creeks and unacceptable water quality degradation will result.

Stormwater management at Sea-Tac Airport

21. The Port's stormwater discharges have a long history of violations of water quality standards. Some of these show up in Discharge Monitoring Reports for 1998 and 1999. The Port's response to these violations has been to degrade the quality of the data so it no longer shows violations. It has reduced the frequency of sampling, eliminated upstream samples so upstream and downstream locations cannot be compared, and used median hardness values so the metal concentrations cannot be compared to water quality standards. These techniques have disguised the likelihood that metals concentrations are in violation by factors of 7 to 9 times the chronic toxicity standard. The effect of this distorted and selective use of the data is to make it look as though the metals analyses comply with the water quality standards, when in fact they do not.

22. As an example, the receiving waters of both Des Moines and Miller Creeks are already degraded below Class AA levels for copper. Discharges exceeding

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

the water quality criterion for copper at the end of the pipe are worsening the problem for the receiving waters. WAC 173-201A-040 (1) says that "toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent on those waters, or adversely affect public health . . ." Based on this requirement, the Port is violating water quality regulations and degrading water quality in Sea-Tac area streams.

23. Ecology has recognized the already degraded condition of Sea-Tac area streams: "From the available data, the ambient water quality generally does not meet the Class AA water quality criteria given in Chapter 173-201A WAC for copper (Miller Creek and Des Moines Creek), temperature and fecal coliform (Des Moines Creek). Des Moines Creek is listed on the Department's 1996 303(d) list for fecal coliform. The Department will use the Class AA water quality criteria for Des Moines Creek and Miller Creek in the proposed [NPDES] permit." (Fact Sheet accompanying Port's NPDES permit).

24. The Port's plans for managing the quality of stormwater at Sea-Tac Airport are summarized in Chapter 7, volume 1, of the Stormwater Management Plan. The plans describes a selection of appropriate Best Management Practices (BMPs) from the catalog of measures recommended by King County in its Stormwater Design Manual.

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

The manual's measures span a range from relatively simple devices designed to remove sediment, to more sophisticated facilities designed to remove chemical and biological constituents. The King County manual organizes the best management practices into five different "menus." The first is the Basic Water Quality Menu, which sets a treatment goal of removal of 80% of the suspended solids, or sediment, from the waste stream. Two of the seven options from the basic menu, which figure most heavily in the Port's planning for stormwater quality management, are filter strips and biofiltration swales.

25. A filter strip is a gently sloping grassed area intended to treat stormwater runoff from roads and other paving before it concentrates into discrete channels. A biofiltration swale is a low grassed ditch cover that is designed to increase friction on the flowing water, thereby reducing velocity and causing suspended materials to drop out. The height and quality of the grass cover are critical and require attentive maintenance. As discussed below, the Port's selection of these treatment BMPs is inappropriate given the pollutants found in the airport's stormwater waste stream.

26. The Port's stormwater treatment plans for metals may also be inferred from the Section 401 requirement to conduct a Water Effects Ratio Study (WERS). As set forth in WAC 173-201A-040(d), WERS are conducted in order to allow a pollutant discharger to deviate from the regulatory water quality criteria. The Port claims to

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

have previously conducted a WERS bench screening analysis, however, that analysis has not been made available for review by Ecology or the public as required by water quality regulations. Nonetheless, the Port has indicated that it intends to rely upon the WERS analysis to obtain less stringent, site-specific standards for its discharge points. This strategy seems a clear admission that the Third Runway Project will not comply with existing water quality criteria.

27. The Section 401 Certification calls for retrofit of existing stormwater facilities, but at the Port's option. The Port has already indicated that it plans to leave 80 acres of pollution-generating surface at the airport (i.e., without stormwater treatment facilities of any kind) in their current condition for the indefinite future. The draft Ecology Stormwater Manual requires application of stormwater requirements to the "maximum extent practicable" for the entire site. The Port, claiming compliance with the Ecology manual, has stated that, on the basis of cost, retrofitting of these areas is "not currently practicable," and intercepting the waste flow is not worth it. This conclusion is based on unverified Port claims of vault construction cost.

28. The Port also intends to rely upon existing bioswales to control and treat runoff caused by new Third Runway construction. I observed in an earlier comment letter that the Port's stormwater management plan does not contain any inventory of existing bioswales. The Port responded that "ground truthing and examination of

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

plans" was carried out, but no unified catalog of facilities has ever been offered for independent verification. Without appropriate detail, there is no basis for an outside observer or regulator to conclude that existing bioswales will meet water quality objectives.

29. The deficiencies of the Port's stormwater management proposal in controlling water quality are numerous. The Port proposes to apply Basic Water Quality BMPs to its stormwater, despite the complex assortment of pollutants, including metals, that do not respond to these measures. The only menu from the King County Stormwater Design Manual that is explicitly oriented to the removal of metal contaminants is the Resource Stream Protection menu, which sets 50% removal of zinc as its target on the assumption that measures from this menu will also remove other metals. The Manual recommends combinations of best management practices to treat metal-laden wastes, for example a biofiltration swale in series with a sand filter. The Port has not proposed, nor has Ecology required, that combination treatment measures identified in both the King County and Ecology stormwater manuals be adopted at Sea-Tac. King County's review of the Sea-Tac plan made clear that the third runway project would have been subject to large site drainage review if it were under full King County DNR jurisdiction, and consequently the Port would have been asked to adopt the more sophisticated provisions of the King County manual. Because King County had no jurisdiction to impose such a review, and Ecology has failed to do

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

so in its 401 certification, the result for Sea-Tac streams is that they will continue to receive contaminated stormwater such as has resulted in past water quality violations.

30. The Port has picked the simplest and cheapest methods of stormwater treatment, and then argued that bioswales and filter strips are accepted under the King County and draft Ecology stormwater management manuals for treatment of oil, grease, and metals. However this conclusion is not borne out by an inspection of either manual. The Port apparently did not follow the step-by-step treatment facility selection procedure in either manual. Had the Port done so, it would have found its way to enhanced treatment measures, combination treatment trains, and measures specifically designed to treat the pollutant load of Sea-Tac stormwater. The draft Ecology manual Enhanced Treatment Menu "applies to discharges from industrial, commercial, and multi-family sites, and from arterials and highways to fish-bearing streams, waters tributary to fish-bearing streams, or small lakes." It sets as a performance goal a higher rate of removal of dissolved metals than most Basic Treatment facilities.

31. Independent researchers have evaluated the efficacy of the Port's proposed BMPs such as filter strips and bioswales for removing pollutants of concern. They have found the type of BMPs proposed by the Port to be ineffective against many pollutants, including metals. The Port's plans consist of the same BMPs they have

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

used in the past, that have resulted in continued violation of water quality standards. There is no reason to anticipate a changed result.

32. In issuing its water quality certification, Ecology has joined the Port in ignoring the substantial body of technical literature that demonstrates the ineffectiveness of bioswales and filter strips in removing chemical pollutants. The issue has proceeded beyond the academic debate level: on June 20, 2001, the Washington State Chapter of the American Public Works Association wrote comments on the draft Ecology Stormwater Manual as follows: ". . . substantial concern exists over the performance of some of the approved BMPs, particularly swales and filter strips. These BMPs do not perform consistently in the field. They need a substantial factor of safety. . ."

33. In a review of 30 published monitoring reports on BMP effectiveness, a 1996 EPA funded study found that "Removal of soluble metals [in grass swales], however, was only 20 to 50% . . . many trace metals are primarily found in soluble forms (cadmium, copper and zinc), while others are mostly attached to sediment particles (iron and lead). Other researchers have found that swales were not very effective at adsorbing soluble metal species. Adsorption requires that a metal be present in runoff as a positively charged cation that can be adsorbed to a negatively charged particle in the soil or organic layer. Metals, however, can be found in a complex number of ion species depending on the prevailing acidity (pH) of runoff.

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

Some metals such as zinc readily adsorb to soil at pH levels typical of stormwater runoff of 6.5 to 8.0, but many others (aluminum, cadmium, copper, chromium and lead) show little tendency to adsorb to soils within this pH range. Consequently, the ability of swale soils to remove many soluble trace metals tends to be rather low."

34. Under a joint project between the American Society of Civil Engineers and the Environmental Protection Agency, an analysis of numerous studies of stormwater BMP effectiveness has been undertaken (citations to literature in my letter of July 18, 2001, attached). The results show low or even negative effective removal rates (remobilization) for many pollutant species, including metals. Some of the observations of this study are relevant. First, "In semi-arid climates, grass filter strips may need to be irrigated to maintain a dense stand of vegetation and to prevent export of unstabilized soil." Sea-Tac Airport may be considered a semi-arid climate for several months of the year. There is also a winter dormant period in most years when grass growth is inadequate to offer good filtration performance. Second, typical removal percentages for grassed swales and vegetated filter strips are 15-45%, and 30-65% respectively. Open channel vegetated systems show a very wide range of pollutant removal efficiency, including negative removals (i.e. more is detected going out than in). Third, "If open channel systems are not properly maintained, significant export of sediments and associated pollutants such as metals and nutrients can occur from eroded soil."

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

35. High coliform bacteria counts in Sea-Tac area streams have not been accounted for and may actually be originating in the Port's stormwater treatment facilities. The technical literature has abundant information on bacteria loading associated with biofiltration swales. Results compiled from a range of BMP performance monitoring efforts conclude that bioswales or open grassed channels have either low or negative removal efficiencies for fecal coliform. Negative removal efficiency means that more bacteria were measured in the discharge than were measured in the inflow to the BMP in question. This result was observed in the 1992 Metro study on which the Port relies, as well as numerous others. It appears that bioswales can support bacterial growth and behave as a source of bacteria themselves. The Port's stormwater treatment plan does not address this eventuality.

36. The Port's heavy reliance on biolfiltration BMPs as a stormwater quality control strategy is based largely on one study, the conclusions of which are no longer supported by King County. In 1992, King County (then Metro) published a document entitled *Biofiltration Swale Performance, Recommendations, and Design Considerations*; this guidance document was funded in part by Department of Ecology. The Port's reliance on this one study is misplaced. Since 1992 hundreds of other assessments of BMP performance have been carried out, few with the same optimistic conclusions reported for the Metro study. In its review of the Stormwater Management Plan for the Third Runway, King County DNR (the successor to Metro)

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

did not agree with the Port's account of the 1992 report: "removal of metals is not the performance goal of this [type of] facility. The existing relatively high Cu concentrations off the runways indicate they [bioswales] are not great at metals removal." The 1992 Metro study did not report dissolved copper, a major pollutant that does not respond well to bioswale treatment, which is a major Sea-Tac pollutant. A major nationwide survey of later studies, carried out by the American Society of Civil Engineering, reports that more than half the dissolved copper and other metals routinely pass through bioswales and remain in the waste stream.

37. The low effectiveness of the Port's strategy of conventional BMPs in removing pollutants is all the more serious given the low remaining flows in area creeks, which can provide very little dilution of incoming waste streams. The Port's low stream flow analyses show low flows for Miller, Walker, and Des Moines Creeks that will provide little if any dilution under typical low flow conditions. The "first flush" of accumulated pollutants in stormwater runoff from the next rainstorm will have severe water quality impacts on these streams.

38. The Port's stormwater quality control strategy does not constitute "all known and reasonable treatment" or AKART. The King County reviewer of the Port's stormwater plan agreed, noting in comments on Ecology's draft 401 water quality certification that the "CSMP (the stormwater plan) could easily be challenged as not

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

being AKART [all known and reasonable technology]. SWDM (King County Surface Water Design Manual) is not AKART ." Eglick Decl. at ¶ J .

39. Ecology's 401 Certification has acquiesced in the Port's Sea-Tac stormwater strategy, which is to say "we'll figure out a way to treat it if it is later proved that we have to." This defers the inevitable argument over whether or not they have to, until some later date, by which time the construction will have long since been completed, and the irreparable harm to local streams will have been done. There is a built-in assumption in the permit that violation of water quality standards is permissible, during the indefinite experimental period while they improvise solutions.

40. To contemplate inappropriate use of Best Management Practices for treatment of the acknowledged pollutant stream in the Sea-Tac stormwater, and release of stored stormwater without treatment into local streams, falls far short of the required reasonable assurance that the Port's projects will meet water quality standards.

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

DATED this 12th day of September, 2001, at Seattle, Washington.

Peter Willing, Ph.D.

G:\LU\ACC\PCHB\WILLING-DECL-STAY-0911

HELSELL FETTERMAN LLP
1500 Puget Sound Plaza
1325 Fourth Avenue
Seattle, WA 98101-2509

Rachael Paschal Osborn
Attorney at Law
2421 West Mission Avenue
Spokane, WA 99201

Attachments to the Declaration of Dr. Peter Willing

Exhibit A	Peter Willing, Ph.D., *Curriculum Vitae.*
Exhibit B	Letter Dated September 5, 2000, to Mr. Tom Luster, Washington State Department of Ecology
Exhibit C	Letter Dated September 19, 2000, to Mr. Ray Hellwig, Regional Director, Northwest Regional Office, Washington State Department of Ecology
Exhibit D	Letter Dated September 26, 2000, to Mr. Ray Hellwig, Regional Director, Northwest Regional Office, Washington State Department of Ecology
Exhibit E	Letter Dated February 16, 2001, to U.S. Army Corps of Engineers
Exhibit F	Letter Dated March 12, 2001, to Mr. Chung Yee, Washington State Department of Ecology
Exhibit G	Letter Dated July 18, 2001, to Washington State Department of Ecology and U.S. Army Corps of Engineers
Exhibit H	Letter Dated August 6, 2001, to U.S. Army Corps of Engineers and Washington State Department of Ecology
Exhibit I	Letter Dated August 3, 2001 from Ms. Pam Bissonnette to Ms.Ann Kenny, Senior Permit Specialist, Washington State Department of Ecology

EXHIBIT A

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ℘ Bellingham, Washington ℘ 98225 ℘ 360-734-1445 ℘ 360-676-1040 (fax) ℘ pwilling@telcomplus.net

EDUCATION

B.A., University of Washington, Seattle, Washington
M.S., Ph.D., Cornell University, Ithaca, N.Y.

PROFESSIONAL AFFILIATIONS

American Water Resources Association
American Geophysical Union

SELECTED SPECIALIZED TRAINING

Applied Fluvial Geomorphology: Wildland Hydrology Center, Pagosa Springs, Colorado

Stormwater Treatment: Biological, Chemical, and Engineering Principles. Professional Engineering Practice Program, University of Washington

SUMMARY

Dr. Willing is Principal in the Bellingham firm of Water Resources Consulting, L.L.C. Since founding the firm in 1989, he has carried out a wide variety of assignments for public and private clients seeking to solve water-related technical questions. Examples are: hydroelectric system design, flood frequency analysis on Northwest rivers, wellhead protection, surface water - ground water interactions, storm water management strategy, and hydrologic basis of water rights. In public sector positions, he has served as general manager of a medium sized public water system. He also served as chief environmental officer of a large municipal electric utility. Dr. Willing holds Adjunct Faculty appointments in Geology and Huxley College at Western Washington University, Bellingham.

SELECTED PROJECT EXPERIENCE

Review of surface and ground water hydrology associated with the possible construction of a third runway at Sea-Tac Airport. Questions under investigation include permeability and water storage characteristics of imported fill materials, effectiveness of stormwater management measures, compliance with water quality provisions of the King County Surface Water Design Manual, effect of fill on wetlands and stream flows, and project effects on anadromous fish. November 1999 - February 2001.

Water supply source investigation for determination whether the source is under the influence of surface water. Project includes multi-site water quality monitoring, source intake design, microscopic particulate analysis, and a geohydrologic investigation of a complex of juxtaposed unconsolidated glacial, metamorphic, and volcanic geological systems. Client: Puget Sound Energy

Design and implementation of geohydrologic investigation for new ground water supply, with special emphasis on hydraulic continuity between ground and surface waters. Project includes securing drill and test permit, engaging driller, logging the well, overseeing a pump test, high resolution surface water flow measurements, collecting and analyzing the data, geologic mapping, and writing completion report. 1997.

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ℘ Bellingham, Washington ℘ 98225 ℘ 360-734-1445 ℘ 360-676-1040 (fax) ℘ pwilling@telcomplus.net

Geohydrologic evaluation of Lummi Island public water supply wells in support of water rights application, including 24-hour pump test, monitoring observation wells, analysis of data, and project report. 1997.

Reconnaissance investigation of surface water storage potential of the Nooksack Basin, Washington. Project included a review of prior studies, hydrology, current water demands, and project costs. 1997.

Preparation and compliance monitoring of NPDES permits for industrial gas manufacturing facility. Responsibilities included both process wastewater and storm water permits, analysis and recommendations on process flow control, best management practices from regional surface water design manuals, and waste stream management. 1992-1997.

Alluvial fan and debris flow hazard element of Comprehensive Flood Hazard Management Plan, Lower Nooksack River, Whatcom County, Washington. This element consisted of field investigation in support of hydrologic and geomorphologic analysis of two high-gradient streams. 1995-6. Client: Whatcom County Flood Control Zone District

Assessment and expert testimony on hydrologic basis and technical adequacy of contested water rights application, San Juan Island, Washington. Case was heard by Washington Pollution Control Hearings Board as Fleming et al. v. Department of Ecology, 1994. Client: private party appellants.

Miscellaneous water rights investigations involving adequacy of water supplies, well interference, salt water intrusion potential, and hydraulic continuity between surface and ground waters. 1997. Clients: individual parties.

Hydrologic and geohydrologic data needs assessment in support of potential basinwide water rights adjudication. The preparatory work on this project is designed to support development of a hydrologic and water rights accounting model. Client: Nooksack Basin Water Users Steering Committee

Preparation of Wellhead Protection Programs for small cities and public water supplies.. Components include assessment and compilation of existing data, aquifer delineation, contaminant source inventory, storm water management design, and provision of alternative water supply. Clients: City of Everson, City of Sumas, Pole Road Water Association.

Hydrology element of Comprehensive Flood Hazard Management Plan, Lower Nooksack River, Whatcom County, Washington. This element consisted of a review of the adequacy of the stream flow record, previous flood frequency analyses, and potential error and uncertainty in flood frequency estimates. Client: Whatcom County Flood Control Zone District

Water rights review for industrial facility in Whatcom County. This assignment involved documentation of historical water use and claim to water that go back to before the turn of the century. The purpose of the effort was to position the client to advantage in the current climate of water rights regulation by the State of Washington.

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ℘ Bellingham, Washington ℘ 98225 ℘ 360-734-1445 ℘ 360-676-1040 (fax) ℘ pwilling@telcomplus.net

EXHIBIT B

Water Resources Consulting L.L.C.
Peter Willing, Ph.D.

September 5, 2000

Mr. Tom Luster
Washington State Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7001

RE: Implementation Plan for the Des Moines Creek Flow Augmentation Facility

Dear Mr. Luster,

Please take into account the following comments as you consider whether the Port of Seattle has provided reasonable assurance that its plans for expansion of SeaTac airport will meet the State's water quality standards. My analysis bears specifically on the proposed mitigation plan for Des Moines Creek, and are submitted on behalf of the Airport Communities Coalition. Page and paragraph references below refer to the Revised plan, dated August 18, 2000.

Summary of Comments

- The Port's Implementation Plan is not a specific plan but a bare concept.
- The Implementation Plan contains no supporting hydrologic analysis of extreme climatic conditions that the plan is intended to mitigate.
- The Des Moines Creek Basin Plan describes past damage and recommends remediation, but the Port's Implementation Plan would co-opt the entire mitigation package to offset the effects of the third runway.
- Temperature improvements claimed for the Implementation Plan cannot be realized with one of the Port's sources of water.
- The Implementation Plan relies on technological inputs whose continuity cannot be assured.
- One of the two proposed sources of water would require nearly a mile of construction trenching through the golf course area; there is no information about where or how the construction would be done.
- One of the two sources would have to be purged of drinking water conditioning chemicals, an undertaking that the Implementation Plan treats as no more than a concept.
- The Implementation Plan proposes the use of flow measurement devices that have poor fish passage characteristics.
- The preferred source of water is a well that exploits three different aquifers in a common casing, in contravention of state guidance on protecting upper aquifer zones.

The following pages will elaborate on each of these main points.

1903 Broadway
Bellingham, Washington
98225-3237 U. S. A.

Telephone 360-734-1445
FAX: 360-676-1040
email: pwilling@telcomplus.net

- The Port's Implementation Plan is not a specific plan but a bare concept.

The intent of the Implementation Plan presumably is to demonstrate to the Department of Ecology and the public in general that there is an assured plan for mitigating low flow and attendant water quality problems in Des Moines Creek. The Implementation Plan hardly lives up to its name. It does not contain a plan, but instead a vaguely defined concept of adding to the remaining natural flow from some other source. Two sources are suggested, but neither one has been secured nor has either of them any certainty of being secured.

After perusing the Implementation Plan we do not know if dechlorination will be needed, or if it is needed whether it will be passive or active (chemical based), or if it is chemical based, what chemical it will be based on; but "the technology exists and can be readily adapted for the flow augmentation project" (P 3 para 1). None of these critical elements, which would help to establish confidence in the implementation plan, have been finalized.

The revised plan describes the status of the plan as follows: " . . . because construction of the facility is not scheduled to begin until 2002, . . . the final decision on the source of water has not been made, the design has not progressed . . . no detailed design drawings . . ." Ecology has been invited to grant its approval now and allow the Port to leave the most critical elements for later. The Port will "commit to funding the design and construction of the Seattle water supply option, if the water rights issue cannot be resolved, and if final approval from SPU is obtained." Neither the Port nor Ecology have any idea what has been committed to here. The Port plan is a structure consisting of conditional assumptions and contingencies. State law requires a plan that has a reasonable certainty of actually working, with demonstrable performance measures, not vague commitments to spend money in the future while the Port casts about for solutions.

The revised Implementation Plan says that "The Port and the Des Moines Creek Basin Planning Committee are still considering two sources for the water . . ." (P 1 para 2) However, Des Moines Creek Basin Planning Committee members have informed the ACC that the Committee has never considered any alternative source but the former Highline Water District Well #1. Therefore this assertion makes it appear that the Port may be using the Committee's name for credibility. The idea of buying water from Seattle Public Utilities is an afterthought of relatively recent origin, which does not carry any approval or even knowledge of the Des Moines Creek Basin Committee.

- The Implementation Plan contains no supporting hydrologic analysis of extreme climatic conditions that the plan is intended to mitigate.

The Plan says, "The target flow is . . . 1 cfs; the maximum augmentation rate and duration is based on the most extreme climatic conditions." The Port has not submitted the information, so there is no way to tell whether there was any analysis of extreme climatic conditions. A reasonably curious reviewer would ask to see a low flow time series for Des Moines Creek, and a low flow duration curve. There is less than a 10-year record of flow data for Des Moines Creek, and some of the existing data are of low reliability because of recorder problems (King County Department of Natural Resources, 2000).

The Des Moines Creek Basin Plan (Des Moines Creek Basin Committee, 1997) contains the logic and the data supporting a 1 cfs minimum flow in the creek, for the purpose of mitigating past damage to the creek. The Basin Plan also says that future conversion of the basin to impervious surface will cause a further 20% reduction in base flows compared to forested conditions. The present flow

augmentation plan is not being scaled to deal with this future reduction, which could easily nullify all efforts under the present plan. The Port of Seattle has co-opted the Basin Plan's recommendation of 1 cfs augmentation flow and claimed it as mitigation for the third runway.

- Temperature improvements claimed for the Implementation Plan cannot be realized with one of the Port's sources of water.

The first iteration of an Implementation Plan (under cover letter from Keith R. Smith to Tom Luster, July 25, 2000) proposed a temperature target of 16°C for Des Moines Creek flows. The revised plan does not mention it. Even with cool water, attaining a target temperature of 16°C could require more than 1 cfs of augmentation water. But the Port is proposing to use Seattle Public Utilities water, which SPU staff have informed us sometimes reaches 20°C in September. Obviously, this will not work. The Port does not know what it will require, but just promises to figure it out empirically after it has all been built.

- The Implementation Plan relies on technological inputs whose continuity cannot be assured.

The Implementation Plan says that "Both sources will be able to provide water in perpetuity" (p 1 para 3). There is a fundamental weakness in a mitigation plan that depends on technological inputs, such as chemicals, electronic sensors, programmable controllers, and large horsepower pumps. This point has been raised by the Corps, in its comments: "We discourage the use of structures in a mitigation site that might need direct human interaction over long periods of time to operate." (Terzi and Freeman to J. Kelly, Parametrix, August 11, 2000). The Port has assumed that an SPU augmentation water supply would be non-interruptible (p. 2, top paragraph), but has not negotiated a water purchase agreement with the City of Seattle.

- One of the two proposed sources of water would require nearly a mile of construction trenching through the golf course area; there is no information about where or how the construction would be done.

Delivery of water from the Seattle Public Utilities source (p 2 para 3) would entail a 6" or 8" 4,500' pipeline from the present end of the distribution system to Des Moines Creek. This is a major construction project, that will require at least a 10' construction path, probably more; a pipe buried as much as 4 feet, bedded in pea gravel, the trench to be backfilled with pit run gravel. "No wetlands will be affected" is the summary of effects. The pipeline would have to be routed around wetland 28, which is 35 acres, is discontinuous, and surrounded by other non-jurisdictional wetlands. A plan sheet would be more convincing than a bland assurance. Likewise, the stilling basin, rock channel, constructed channel – are not accompanied by so much as conceptual drawings.

- One of the two sources would have to be purged of drinking water conditioning chemicals, an undertaking that the Implementation Plan treats as no more than a concept.

Dechlorination: "The chemical used will probably be sodium thiosulfate . . ." (p 2 para 3) This is an unlikely chemical for the purpose, because large volumes are needed and it is expensive. It is typically used in laboratories only. Other chemicals such as sodium bisulfite might work, but the Port and its consultants have hardly given the matter much thought. What they say is, "a mechanism . . . would have to be designed . . . the technology exists and can readily be adapted . . ." The Port of Seattle has clearly not done its homework. Obviously chlorine has a high toxicity to fish and cannot be tolerated in an augmentation flow. WAC 173-201A-040, the Washington State water quality

criteria, specifies a maximum of 19 µg/l maximum 1-hour concentration of chlorine in a 3-year period. For perspective, the City of Bellingham dechlorinates its sewer discharge of approximately 10 mgd using sodium bisulfite, and typically achieves a discharge concentration of 20 - 50 µg/l – which is well within its NPDES permit limits, but which is not low enough to meet the water quality criterion without the large dilution volume afforded by Bellingham Bay.

The City of Seattle follows standard practice in applying fluoride to its water supply system, at concentrations designed to achieve a concentration of 1 mg/l at the point of service (APHA-AWWA-WPCF, 1989). To achieve the target concentration at the customer's tap means that it has to be slightly higher in the distribution system. Fluoride is applied to Seattle's Highline wells at the wellhead. Fluoride at 1 mg/l has been shown to cause mortality and morbidity in salmonids and other aquatic organisms (Strand, 2000). Fluoride will have to be removed from the water used for flow enhancement, and the Port implementation plan is totally silent on the matter.

Passive dechlorination (p 3 para 2): the problem with this approach is that stripping the chlorine and keeping the temperature low are at odds with each other. What they have asked Ecology to imagine is a system that uses slightly lower temperature SPU system water containing chlorine, discharges it into a pond presumably exposed to sunlight, which will raise the temperature and lower the dissolved oxygen saturation; then run it over rocks to raise dissolved oxygen by aeration, which further raises temperature. It does not sound convincing, and they have made no demonstration to show that it would work. This is especially true in light of the fact that Seattle water is likely to be too warm to achieve any reduction in temperature at all, during the most critical part of the late summer. The Port concludes, "this option will be researched and developed further." This assurance is an inadequate basis for approval of the flow augmentation plan.

- The Implementation Plan proposes the use of flow measurement devices that have poor fish passage characteristics.

The Implementation Plan states that "The existing rectangular weir(s) will be modified by adding a V-notch or Parshall flume to achieve more accurate measurements during low flows" (p 3 para 3). V-notch weirs and Parshall flumes do not have desirable fish passage characteristics. There is a fundamental conflict in design of low flow measurement devices between measurement accuracy and ease of fish passage. The Washington Department of Fish and Wildlife has an upper limit of 3 feet per second on the velocity of flow through a structure such as the Port is proposing, but the Port "implementation" says nothing about how that will be achieved. To achieve a sufficiently low flow velocity, the flow through a weir has to be wide and shallow, and shallow flow in a weir is harder to measure accurately than a deeper one (Replogle, personal communication, 1999).

The brains of the flow mitigation proposal is apparently to be a programmable controller array (p 4 para 1) that will sense system conditions, know what augmentation flow to apply, and call for that flow as conditions demand. The system has not been designed however – "Logic to resolve this issue will be developed . . ." The Port realizes that all of its flow mitigation proposals are beset by questions: "Because of the current uncertainty over the source of the water, the resulting uncertainty over the need to construct a dechlorination facility, . . . the Port has decided to pursue a design utilizing the pond and constructed channel . . ." In other words, the Port doesn't know what it is going to do, so it doesn't know how to design for it.

- The preferred source of water is a well that exploits three different aquifers in a common casing, in contravention of state guidance on protecting upper aquifer zones.

The revised flow augmentation proposal contains several pages from an unidentified document with pages numbered 34 and 37, and some King County drawings. Page 34, 2nd para under "Assessment of Existing Well" has a description of well #1. There are several errors in this paragraph. It equates perforations with screens. They are not the same. "The second [set of perforations], between 190 and 243 feet, has an aquitard that makes it a confined aquifer." While there may be a large degree of confinement in this horizon, it is hardly an absolute – there is undoubtedly some degree of vertical leakage. The discussion neglects to discuss the third set of perforations that are described on the well log, between 511' and 541', and it does not show on Figure 13.

The Port would have us believe that 35' of screen on an 8" casing at a depth of 511' to 541' is out-producing a total of 141' of perforated 12" casing at much shallower depths. This is very difficult to believe: the longer, larger diameter, shallower open interval would produce most of the water . "The well is configured so that the lower aquifer contributes the most flow." Just how it is configured to achieve this feat is left to the reader's imagination.

It is interesting that the Port uses Highline Well #2 as a counter-example of production from the upper aquifer. Well #2 is screened in the upper aquifer, above 130' depth; Ecology is supposed to think this is different from Well #1, which is perforated from 72' to 160'. The same logic should apply to both: "Withdrawal from this aquifer would probably have an impact on Des Moines Creek recharge." The misconception that Highline Well #1 produces only from the deep aquifer found its way into the Des Moines Creek Basin Plan: "The existing well extends to a depth of 600 feet below the surface and is cased to over 200 feet, so water drawn from the well almost certainly has no effect on flow levels in the creek." This misinformation was echoed in Port consultants' response to questions raised by National Marine Fisheries Service in its review of the Biological Assessment (Parametrix, 2000).

The former Highline well #1 appears, from the Port's description, and from its own well log, to be a non-conforming well with respect to WAC 173-154; in other words it was completed in a way that might have been legal at the time, but would not be allowed now. The construction of this well appears to allow connections between three different aquifers.

> WAC 173-154-050 Protection of upper aquifer zones: In any multiple aquifer system, where the department determines that the uppermost aquifers or upper aquifer zone will not sustain large volume ground water withdrawals without exceeding the safe sustaining yield or causing . . . (5) depletions of spring or stream flows, the department shall require new or additional large volume withdrawals to be restricted to a lower aquifer zone.
>
> WAC 173-154-060 Inspections and tests: The department may require inspections and/or tests of withdrawal facilities prior to their use . . . If it is the determination of the department that the facilities are not properly constructed or that the facilities may adversely affect the upper aquifers or upper aquifer zone, the department may (1) require further construction and/or testing of the facilities, or (2) require abandonment of the facilities in accordance with chapter 173-160 WAC, or (3) revoke the permit.
>
> WAC 173-154-070 Rehabilitation of withdrawal facilities: The department may

> require the rehabilitation of existing withdrawal facilities if it finds that the facilities were not constructed or are presently not in accordance with the permit provisions, if any, or the applicable laws and regulations of the department which were in effect at the time of construction of the facilities, and that the withdrawal of waters from such facilities will adversely affect the upper aquifers or upper aquifer zone. . .

The foregoing language requires a detailed hydrogeologic analysis, inspection, testing, and in the end possibly even abandonment of the well. The Port of Seattle did not contemplate these requirements when it submitted its Revised Implementation Plan. Until these requirements are satisfied, they would prevent acceptance of the Implementation Plan as any fulfillment of "reasonable assurance."

The Port's Figure 13 has further discrepancies that do not agree with the well log. It shows a "lower aquitard" consisting of "clay" of indeterminate thickness below 245' depth. The well log shows "Sand, clay, gravel;" "Fine sand and clay;" for this part of the well. To interpret these descriptors, one must acknowledge the well driller's convention of listing the most abundant materials first in the lithologic characterization. The materials described to not constitute an "aquitard." The effect of this discrepancy is to understate the degree of hydraulic continuity between Des Moines Creek and the producing horizon proposed for an augmentation water source. In all likelihood, the aquifer is already connected to the creek, so why should the Port go to the trouble of pumping it into the creek and claiming credit for it?

The flow augmentation plan for Des Moines Creek is a trial-and-error approach to project mitigation. It can be approved only if the Port of Seattle can get Ecology to go along with a period of errors to figure out something that works. P 37 para 3: "the pump would be started and run till the conditions change . . ." They do not have any idea how much water will be required to meet the various parameters, what the probability of conditions is that would require pumping, etc. There is nothing in the submittal on flow augmentation that offers a reasonable assurance that water quality standards will be met.

Thank you for your attention to these observations, furnished on behalf of the Airport Communities Coalition.

Sincerely,

Peter Willing, Ph. D.
Enclosure: Curriculum Vitae

REFERENCES

APHA-AWWA-WPCF, 1989. Standard Methods for the Examination of Water and Wastewater. 17th ed.

Des Moines Creek Basin Committee, 1997. Des Moines Creek Basin Plan.

King County Department of Natural Resources, 2000. Surface Water Management Hydrologic Monitoring Report.

McKee, J.E. and Wolf, H.W. Water Quality Criteria. California Water Resources Control Board Publication 3-A.

Parametrix, Inc. 2000. Preliminary Response to National Marine Fisheries Service BA [Biological Assessment] Review, Master Plan Update Improvements, January 21, 2000.

Replogle, J.A., Research Engineer, U.S. Water Conservation Laboratory, Phoenix, AZ

Strand, J. A., 2000. Letter to Tom Luster, August 21, 2000 on Port of Seattle's Potential Use of Drinking Water to Augment Summer Low flows in Miller and Des Moines Creeks. Columbia Biological Assessments, Richland, Washington.

FAX TRANSMISSION

WATER RESOURCES CONSULTING LLC
1903 BROADWAY
BELLINGHAM, WASHINGTON 98225
360-734-1445
FAX: 360-676-1040

To: Tom Luster **Date:** September 5, 2000

Fax #: 360-407-6904 **Pages:** 12, including cover page.

From: Peter Willing, Ph.D.

Subject: Comment Letter, Port of Seattle 401 permit

COMMENTS:

Hello Tom –

Here is the fax version of my letter; email version to follow.

Regards,

Peter

Post-it® Fax Note 7671	Date 9-11	# of pages ▶ 8
To Michelle/P. Englick	From P. Willing	
Co./Dept.	Co.	
Phone #	Phone #	
Fax # 206 340 0902	Fax # (CV not included here)	

EXHIBIT C

Water Resources Consulting L.L.C.
Peter Willing, Ph.D.

September 19, 2000

Mr. Ray Hellwig, Regional Director
Northwest Regional Office
Washington State Department of Ecology
3190 160th Ave. S.E.
Bellevue, Washington 98008-5452

RE: Comments on SeaTac Stormwater Master Plan

Dear Mr. Hellwig,

The following review of the most recent version of the Stormwater Master Plan for SeaTac Airport comes to you at the request of the Airport Communities Coalition. This review is oriented to water quality considerations. I have had less than a week to make a review of an incomplete copy of the Plan. I am thus not in a position to say that my comments are complete and would not expand on further analysis.

I have referred to the following documents in the course of this review:

- Preliminary Comprehensive Stormwater Management Plan, Seattle Tacoma International Airport Master Plan Update Improvements. Prepared for the Port of Seattle by Parametrix, Inc. August 2000; Sections 1, 2, 4 (part), and 7; Appendices E, F, H, I, M, N, T, U, V. Hereinafter cited as "the Plan."
- NPDES Permit No. WA-002465-1, dated January 25, 1999, and its appurtenant Fact Sheet.
- Des Moines Creek Basin Plan, November 1997
- King County Surface Water Design Manual, September 1998
- National Pollutant Discharge Elimination System Discharge Monitoring Reports for SeaTac Airport, Port of Seattle, Permit no. WA-002465-1.

The following section is a summary of my analysis:

- A recurring theme in the Plan is that pollution problems will be dealt with by diverting the flow from the stormwater system to the industrial waste system. This in effect diverts it from the Des Moines and Miller Creek basins, through the Renton treatment plant discharge, to Puget Sound. This hydrologic redefinition of the SeaTac area watersheds has the effect of concentrating a modestly reduced pollutant load into a greatly reduced annual runoff volume. While this approach reflects one perspective on current stormwater management, it has the potential to aggravate water quality problems in streams that are already sorely pressed. It also contravenes Governor Locke's certification, which specified that the drainage divide between the two local creeks not be disturbed.

1903 Broadway
Bellingham, Washington
98225-3237 U. S. A.

Telephone 360-734-1445
FAX: 360-676-1040
email: pwilling@telcomplus.net

- A consistent direction in the Plan is the disposal of water-borne pollutants to biofiltration swales and filter strips. This approach anticipates permanent shallow soil disposal for long-lived pollutants. The consequences of this commitment have not been thought out in the Plan.

- Existing Best Management Practices at the airport are not working, and the Port of Seattle plans to install more that are just like them. The Port offers no inventory of dimensions or efficacy of the existing facilities, with data to show whether they work under storm conditions.

- The Port has failed to come to grips with a substantial pollution load from existing metal roofs, and the Stormwater Plan defers meaningful action on this problem into the indefinite future beyond the year 2007.

- A major study of the dissolved oxygen and biological oxygen demand problems around the airport was rejected by Ecology, and has not been upgraded and re-submitted to Ecology to substantiate the Port's case that it has the dissolved oxygen problem under control.

- Existing stormwater discharges from SeaTac Airport exceed the Washington State Water Quality Standards on a regular basis. These discharges are routed to Class AA streams that are on the 303(d) list of impaired waters. The streams themselves do not meet the state water quality standards, and many of the beneficial uses they should support have been compromised. There is no doubt that the state water quality standards are being violated. The stormwater plan embodies the acceptance of measures that will result in the future in the standards continuing to go unmet. Therefore the August 2000 version of the Stormwater Management Plan fails to constitute reasonable assurance that water quality standards will be met.

The next section of this letter sets forth comments in order of the parts of the plan that they refer to, rather than in order of importance.

Volume I, page 1-2 mentions the Port of Seattle's plan to supplement base flow in Des Moines Creek. This scheme is rudimentary at best, and neither of the two sources of water that have been proposed by the Port have been secured. One is a well that withdraws water in part from the upper unconfined aquifer, and is therefore interconnected with surface waters; the other is in the hands of the City of Seattle. Neither has a certainty of being approved, and both await the resolution of long procedural complications.

Page 2-7 reports in narrative form an optimistic and idealized view of stormwater quality at the Port:

> Source controls and treatment facilities are implemented throughout STIA for all activities. This infrastructure is continually updated via an adaptive management process by which (1) BMP's are implemented, (2) monitoring and inspections demonstrate BMP effectiveness, (3) BMP improvements are made when necessary, and (4) follow-up sampling demonstrates that the improvements are effective. . . .

This description greatly exceeds the actual experience, which is a record of permit violations, unmet water quality criteria, and 303(d) listings for SeaTac area streams.

The Plan details numerous facilities and practices that will be used to manage the quality of water running off airport properties. The Plan does not mention the loading rates, ultimate fates, and mass balance relationships for major pollutants. They are all treated as if they just go away. At anticipated rates of input, many pollutants will build up to substantial amounts. The dissolved air floatation sludge resulting from the industrial wastewater treatment process is classified as a hazardous waste, but the same materials in the stormwater system are simply disposed to land. Re-mobilization in relatively large slugs by heavy rains has not been assessed.

Page 4-13 says that 68% of the existing airport area that generates pollution is treated by facilities that are up to modern design standards. This would leave 32% that is not so treated, under existing conditions. These percentages do not agree with the accompanying table (4-6), which does not total treated and untreated acreages. If it did, it would show 55% treated and 45% not fully treated.

Page 4-15, Section 4.5.1.2, Subbasin PGIS Areas, informs us that "for the purposes of this initial assessment, roof tops were assumed to be non-PGIS [non-pollution-generating impervious surface]." Appendix T, however, shows building roof surfaces that add up to approximately 4.3 acres of bare metal roof, plus a substantial area that has not been inventoried. These areas are mostly in subbasin SDN1, which has shown numerous permit violations for zinc, copper, and lead. It is not clear how the metal roofs have been counted in Table 4-6. A plan based on the Port's assumption will inevitably underestimate the magnitude of the quality problem associated with the Port's storm water.

Page 4-15, Section 4.5.1.3, BMP Inventory, says that "Bioswales were conservatively assumed to be trapezoidal, 6-ft-wide at the base, 2-inch-deep flow (regularly mowed), with 3:1 side slopes." One would expect a Stormwater Management Plan to have more than "conservative assumptions" about the geometry of existing bioswales. A specific inventory of dimensions and treatment capacity would be a much more useful basis for subsequent computations.

Page 4-15, Section 4.5.2, SDS Water Quality, claims that

> overall, the data show that the concentration of various constituents in STIA stormwater are generally less than those in runoff from other residential, urban, and industrial areas in the region. For example, the median concentrations for STIA constituents are lower than those in urban stormwater , with the exception of total recoverable copper. These data provide evidence for the efficacy of BMP's that have been implemented by the Port . . .

This set of claims is misleading on four counts: 1) it deflects attention from the fact that there has been a consistent history of permit violations; 2) it is of no relevance how the airport compares to the region; 3) a median of reported values is a meaningless indicator of water quality performance; and 4) the efficacy of existing BMP's in meeting water quality standards has been unsatisfactory.

Table 4-8 (page 4-17) purports to back up the claim that SeaTac runoff is better than other developed areas in the region. However the metal values do not show any accompanying hardness values, in the absence of which they cannot be compared. Furthermore, they are "median" values for subbasin SDS3, which has a history of permit violations for metals.

On p. 4-18, the Port mentions only one specific discharge point, SDS1, for which "copper and zinc concentrations have dropped significantly," but shows no data to back up the claim. The Port does

not mention the other outfalls in the stormwater system, which have not had a clean record. A far more useful way to portray the relevant information would be a tabulation of outfalls, with a water quality summary of each, and the state water quality standards for comparison. This would let the reviewer see what the situation is, where the problems are, and what needs to be done about them.

Page 4-18, Section 4.5.2.1, Metals and Hydrocarbons, offers a summary of water quality results based on relative statistics:

> Concentrations of these pollutants in STIA runoff are typically lower . . . more than 95% were below levels found in urban runoff . . . 53% of samples have had concentrations less than the detectable limit . . . 75% of the lead . . . were below . . .comparable regional urban data . . . 97% of the zinc were below the median . . .

There is little information in this summary. Average and median values are meaningless, because they say nothing about total mass loading or extreme concentrations; the argument is like the driver of an automobile claiming to drive the speed limit more than other drivers.

Page 4-18, Section 4.5.2.2, Fecal Coliforms, says: " A fecal coliform genetic source tracing study found that bacteria from human sources dominated the identifiable strains of coliforms in the stream [Des Moines Creek], especially downstream of residential areas serviced by septic systems (Des Moines Creek Basin Plan Committee, 1997)." This conclusion applies an unwarranted interpretation to the data. It ignores the Des Moines Creek Basin Plan's warnings about the limitations of the rRNA method. A Department of Ecology technical publication (Sargeant, 1999) says of this method, "Quantification from each source is not possible at this time." The Port also ignored cautions about the small sample size and resulting low statistical validity of the results. A casual reading would allow one to arrive at the misleading conclusion that the Port deserves credit for cleaning up bacterial contamination sources.

Page 4-18, Section 4.5.2.3, Suspended Solids: The median values of Total Suspended Solids tell us nothing . The important number to notice is the water quality criterion, which for AA waters is 5 NTU or 10% over background . Without the background levels, the suspended solids information has little meaning.

Page 4-19, Section 4.5.2.6, Dissolved Oxygen and Biochemical Oxygen Demand, gives the impression that de-icing chemicals are a "potential source" of low dissolved oxygen problems, and that the Port is studying the matter. The first attempt at a study of this subject was rejected as unusable by Ecology: "Unfortunately, given the deficiencies of the final draft study, Ecology cannot make a fully informed decision as to whether or not the Port is properly managing de-icing agents in use at Sea-Tac International Airport to prevent water quality impacts to Miller and Des Moines Creeks." (Letter from K.C. Fitzpatrick to Tom Hubbard, October 21, 1999) With a whole year to remedy the defects of the study, a reviewer of the Stormwater Plan might expect to have definitive information about the problem and intended remedies. Ecology should not proceed to issue a water quality certification until it is satisfied that its concerns have been met on this important pollution source.

Page 4-20, Section 4.5.3, IWS [industrial waste system] Treatment Performance, announces that according to data from Port Discharge Monitoring Reports, effluent water quality limitations have been met since November 1996. There are two limitations to the statement that affect the quality of stormwater. One is that the discharge monitoring reports reflect composite samples on a routine

schedule, and do not represent higher values that would be collected during storm events. These events are when IWS overflows would be likely to happen. The second is that no recurrence intervals or volume estimates for bypass flows have been offered. The claim to be in compliance is notable for its absence in the part of the Plan that discusses stormwater. Nor does that part of the plan say anything about the violation record shown in the Discharge Monitoring Reports for the stormwater outfalls that drain to local streams.

Page 7-1 (last two lines) leaves the Port considerable unwarranted room to maneuver by defining a category of existing subbasins for which "retrofitting is not practicable." Also "For non-Port PGIS [pollutant generating impervious surface] draining to Port outfalls, nothing is proposed." without knowing what areas this description refers to, it becomes a potential contamination source of unknown dimension.

Page 7-3 announces that "water quality for the third runway drainage is expected to be similar to that measured in subbasin SDS3 in recent years." This news is not reassuring, in light of the fact that the Port's Discharge Monitoring Reports show that this discharge has a sustained record of violation of the copper and zinc water quality standards.

Page 7-4 describes proposed expansion of the south aviation support area (SASA). Of 93 acres of new impervious surface, 58 will be diverted out of the basin to the industrial wastewater system; 35 acres will be routed to Des Moines Creek either through biofiltration swales or through a new detention pond. These changes will bring about a massive hydrological redirection of the basin. Essentially 8 bioswales and a detention pond will replace the varied wetland functional values of the existing land use.

Page 7-10 reports that retrofitting over 80 acres in subbasins SDS3 and SDE4 with conventional treatment BMP's will be impracticable. These are two of the subbasins that have reported discharge permit violations for metals in the last two years. It appears that the Port plan is to continue to discharge flows above the water quality criteria into the stormwater system as before, and hope to encounter some cheap new BMP ideas that no one has thought of along the way. The same approach is anticipated for the Terminal drives.

Page 7-14 classifies road shoulders used primarily for emergency parking as non-pollution generating impervious surface, runoff from which therefore presumably does not require treatment. How one separates the flow from the non-polluting shoulder from the polluting road surface draining across it is not specified. Once the flows have been commingled, it will all have to be treated as polluted flow.

This page also proposes a scheme for rooftops under which they are either made out of a surface material that does not leach metals to rainwater, or the rainwater will be treated as a pollution-generating impervious surface, with BMP's from the King County Basic Water Quality Menu. The trouble with the second approach is that the Basic Water Quality Menu does nothing to remove metals, but is designed to remove suspended solids. Presumably there will be little suspended solids from roof tops, which means that the leaching metals will have few adsorption sites and will be predominantly in biologically active form. The measures in the King County Design Manual that deal with metals are in the Resource Stream Protection Menu, which has as a treatment goal the removal of 50% total zinc removal. This menu envisions sand filters, stormwater wetlands, and two-facility treatment trains including organic filter media, as BMP's. Even if 50% zinc removal were attained for some of the flows reported in the DMR's, the remaining concentrations would still

violate the discharge permit. The Plan wastes the reviewer's time and trouble with a dead-end alternative that will not work, and diverts attention from the one that will work; namely source control, i.e. replacing the roof surfaces. The Resource Stream Menu from the King County Design Manual should be applied in situations where source control has been applied and stormwaters still do not meet the water quality standards.

For the metal-leaching roofs shown in Appendix T, The Plan contemplates merely developing a retrofit schedule by the end of the next NPDES permit cycle, which is in 2007. Notwithstanding the record of water quality violations resulting in part from these roofs, any action that might be expected to remediate the problem is left till some indefinite time after that.

Page 7-15 lays out a plan for outfall SDN1, where there are two polluting rooftops (the number does not agree with Appendix T). This consists of retrofit coating, BMP's from the Basic menu, or roof replacement. "The Port is implementing the process described above . . ." This language is totally non-committal and vague about Port intentions for fixing a serious known water quality problem.

Page 7-18 discusses elimination of existing pollution sources from redevelopment areas. The Plan is inconsistent, because it neglects completely the loading effect of long-lasting water pollutants being skimmed off by various BMP's and essentially disposed to soils at shallow depths. Nonetheless the Port is quick to take credit for eliminating septic tanks. The presumption in the Plan is that all 380 septic tanks were failing, which is not likely. Presumably the single family land use in the acquisition area will be replaced by more dense pollution generating impervious surface, unless the Port intends to institutionalize the undeveloped state in some easement arrangement it has not described.

Page 7-21, Section 7.7.5, Baseflow Augmentation in Des Moines Creek: this brief description promises that the Port will "work with" the Des Moines Creek Basin Committee to implement the flow augmentation project. Mitigation for the third runway construction is a sole responsibility of the Port, and should not be confused with the purpose of the Committee's Basin Plan, which was to identify and remediate long-standing existing water quality problems.

Thank you for taking into account these thoughts on the adequacy of the Port of Seattle's Stormwater Management Plan to support your decision on its 401 water quality certification.

Sincerely,

Peter Willing, Ph. D.

Reference:

Sargeant, D. 1999. Fecal Contamination Source Identification Methods in Surface Water. Department of Ecology Report #99-345. 19 p.

EXHIBIT D

Water Resources Consulting L.L.C.
Peter Willing, Ph.D.

September 26, 2000

Mr. Ray Hellwig, Regional Director
Northwest Regional Office
Washington State Department of Ecology
3190 160th Ave. S.E.
Bellevue, Washington 98008-5452

TRANSMITTED BY FAX

RE: Further Supplemental Information, Des Moines Creek Flow Augmentation Facility

Dear Mr. Hellwig,

This letter comments on the latest addition to the accumulating documents relating to flow augmentation in Des Moines Creek. Please recollect that the flow augmentation plan for Des Moines Creek now consists of the following documents:

- Implementation Plan for the Des Moines Creek Flow Augmentation Facility, July 25, 2000. The "preferred option" in this version of the plan was to use water from a port-owned well.
- Revised Implementation Plan for the Des Moines Creek Flow Augmentation Facility, August 18, 2000. This version of the plan maintained the preference for the well source, but also discussed Seattle water.
- Flow Augmentation Update, email from Keith Smith to Tom Luster, September 6, 2000. This revision stated that "the primary source is water from Seattle Public Utilities."
- Des Moines Creek Flow Augmentation Preliminary Design," written by Kennedy/Jenks Consultants for the Port of Seattle, dated September 2000. This version says that water from SPU is "currently the preferred source" of flow augmentation water.

The series is evidently not complete yet, as the last one makes repeated reference to "the next submittal" and the "final submittal to Ecology." We have no idea when we shall see these future installments. The existing documents are all incomplete, inconsistent, and give a sense of haphazard planning to the Port of Seattle's approach to this important problem. I have commented on the first three submittals in letters of September 5th and September 15th, to Tom Luster of your department. Most of the defects I have previously identified still remain in the latest version. The most important ones are the following:

- The most serious drawback to all of the Port's submittals is that the Port of Seattle has secured no source of water for flow augmentation.

1903 Broadway
Bellingham, Washington
98225-3237 U. S. A.

Telephone 360-734-1445
FAX: 360-676-1040
email: pwilling@telcomplus.net

- The most recent submittal shows no apparent awareness that SPU water from the existing water main at the south end of runway 34R will not be of a suitable temperature for flow mitigation purposes during the season when it will be most needed.

- The Kennedy/Jenks submittal makes no mention of fluoride removal or of fluoride as a water quality concern in a natural stream. Fluoride toxicity to fish and other biota was amply discussed in a letter to Tom Luster from Dr. John Strand of August 21, 2000.

- The proposal suffers from being highly maintenance intensive and failure prone. By its own admission, solid sodium sulfate is hygroscopic, which makes it ill suited to discontinuous operation. The programmable control setup is prone to bad readings from the downstream weir, which is naturally subject to fouling by falling leaves and other floating debris.

- While showing chemical reactions for several common chlorine removal techniques, no chemical reaction is shown for the preferred compound. Thus the residual chemicals are not identified, nor are their effects assessed. It would be useful to know, for instance, what effect the preferred chemical would have on pH.

- The consultant claims experience in treating large flows, and in removing chloramines; but does not claim experience or satisfactory results with small flows and chlorine, which are the challenge in this application.

- The latest revision of the plan is a narrow and over-particularized engineering design for a water source that has not been secured.

Please consider these comments in your deliberations as to whether the Port's plans for augmenting Des Moines Creek contribute to a reasonable assurance that water quality standards will be met. I submit to you that a "preliminary design" with no secure water source will not meet that test.

Sincerely,

Peter Willing, Ph.D.

EXHIBIT E

Water Resources Co. ılting L.L.C.
Peter Willing, Ph.D.

February 16, 2001

U.S. Army Corps of Engineers
Regulatory Branch
P.O. Box 3755
Seattle, Washington 98124-2255
ATTENTION: Jonathan Freedman

Washington State Department of Ecology
3190 160th Ave. S.E.
Bellevue, Washington 98008-5452
ATTENTION: Ann Kenny

RE: Department of the Army Section 404 Permit Application, SeaTac Airport
Reference: 1996-4-02325

Dear Mr. Freedman and Ms. Kenny,

The following review of water quality and water management aspects of the plan for SeaTac Airport comes to you at the request of the Airport Communities Coalition. I base my statements on 30 years of experience in reviewing major projects for water quality and water quantity impacts. My resume summarizes this experience and is attached.

I have referred to the following documents in the course of this review:

- Comprehensive Stormwater Management Plan, Master Plan Update Improvements, Seattle Tacoma International Airport. Prepared for the Port of Seattle by Parametrix, Inc. December 2000; previous versions of August 2000 and November 1999.
- Annual Stormwater Monitoring Report for Seattle Tacoma International Airport, July 1, 1999 - June 30, 2000. September 28, 2000.
- Seattle Tacoma Airport Master Plan Update Low Streamflow Analysis. Earth Tech, Inc., December 2000.
- NPDES Permit No. WA-002465-1, dated January 25, 1999, and its appurtenant Fact Sheet.
- National Pollutant Discharge Elimination System Discharge Monitoring Reports for SeaTac Airport, Port of Seattle, Permit no. WA-002465-1. 1998-2000.
- Des Moines Creek Basin Plan, November 1997
- King County Surface Water Design Manual, September 1998

The following section is a summary of my analysis:

Since the August 2000 version of the Stormwater Plan, there has been a disturbing lack of improvement in the features of the airport plan that bear on water quality. These features will greatly diminish water quality in the streams and aquifers surrounding the SeaTac area. There is no basis

1903 Broadway
Bellingham, Washington
98225-3237 U. S. A.

Telephone 360-734-1445
FAX: 360-676-1040
email: pwilling@telcomplus.net

for Clean Water Act Section 401 certification or Section 404 approval. I will summarize the broad issues before proceeding to detailed comments.

- The Port of Seattle's plan for stormwater management is to divert flow from the stormwater system to the industrial waste system. This in effect diverts it from the Des Moines and Miller Creek basins, through the Renton treatment plant discharge, to Puget Sound. This hydrologic re-definition of the SeaTac area watersheds has the effect of concentrating a modestly reduced pollutant load into a greatly reduced annual runoff volume. By intercepting recharge, it has the potential to aggravate water quality problems in streams that are already heavily degraded. It also violates Governor Locke's certification of June 30, 1997 to the Secretary of Transportation, that "The Port of Seattle will design and construct the third runway such that the project will not cause changes in the location of the hydrologic divide between Miller and Des Moines Creeks in a manner that alters the average instream flow of either creek."

- A consistent direction in the Plan is the disposal of water-borne pollutants to biofiltration swales and filter strips. This approach anticipates permanent shallow soil disposal for long-lived pollutants. The harmful consequences of this decision have not been addressed in the Plan.

- The Low Streamflow Analysis reports a variety of modeling simulations. Estimates of low flow behavior were based on statistical analysis of the results of a model simulation. They were not based on actual flows, and thus they are an abstraction from reality. There are doubts about the applicability of the model calibration to actual low flow conditions. These results are used to develop low flow targets for stream systems that have been degraded by generations of man-made interference.

- The fate and transport of contaminants in SeaTac soils is an inescapable complication of any new construction at the airport. There is an acknowledged 50-year accumulation of contaminants, and proposed airport expansion activities will disturb and mobilize them. Instead of making systematic provisions for dealing with them, the Port appears to be counting on an ad hoc response when it can no longer be avoided.

- Existing Best Management Practices for stormwater at the airport have not been working, based on measured water quality parameters, partly because they were not designed for the water treatment problem at hand. Yet the Port of Seattle plans to install more facilities that, like the existing ones, come from the King County Basic Water Quality Menu. The plans will result in perpetuation of water quality violations. The Port offers no assurance that water quality violations will not continue and increase as a result of the proposed project.

- Existing stormwater discharges from SeaTac Airport continue to exceed the Washington State Water Quality Standards on a regular basis. These discharges are routed to Class AA streams that are on the 303(d) list of impaired waters. The streams themselves do not meet the state water quality standards, and many of the beneficial uses they should support have been compromised. There is no doubt that the state water quality standards are being violated. The stormwater plan relies on measures that will result in continuing future violations. Therefore the December 2000 version of the Stormwater Management Plan fails to constitute reasonable assurance that water quality standards will be met.

The above points are further explained below in comments on specific sections of the Stormwater Management Plan and accompanying documents.

Stormwater Management Plan

Volume I, page 1-2 describes a "specific objective" as follows:

> Enhance stream low flows by ceasing the exercise of existing surface water rights (obtained by the Port through property acquisitions) on Miller Creek, supporting and participating in the Des Moines Creek Basin Committee's flow augmentation project on Des Moines Creek, incorporating infiltration into stormwater detention facilities where feasible, and if necessary, supplementing low flow with stored stormwater.

The promises in this section deserve to be examined one at a time. Three out of four of the promises appear to be uncertain or exaggerated. Relinquishment of water rights in Miller Creek turns out to be a net loss of water if it is balanced against termination of water imports into the basin. The Des Moines Creek Basin Plan was developed to deal with past ills, and does not pretend to have the resources or intent to mitigate Port watershed damage in the future. Further, no source of water has been obtained for this project. All of the conceptual sources that the Port has proposed have fatal flaws, which will be discussed in a later section.

Page 2-7 section 2.2.1 (in language unchanged from the August version) reports in narrative form an optimistic and idealized view of stormwater quality at the Port:

> Source controls and treatment facilities are implemented throughout STIA for all activities. This infrastructure is continually updated via an adaptive management process by which (1) BMP's are implemented, (2) monitoring and inspections demonstrate BMP effectiveness, (3) BMP improvements are made when necessary, and (4) follow-up sampling demonstrates that the improvements are effective. . . .

This description greatly exceeds the actual experience, which is a record of permit violations, unmet water quality criteria, and 303(d) listings for SeaTac area streams. In the face of this situation, section 2.2.2 (p. 2-6) says "ongoing water quality monitoring may indicate the need for future water quality BMP's."

Page 2-7, Section 2.2.2.2 recites a variety of facilities from the King County Basic Water Quality menu that will be used to manage the quality of water running off airport properties. The Plan does not mention the loading rates, ultimate fates, and mass balance relationships for major pollutants. They are all treated as if they just go away. The filter strip section on page 2-8 talks about "removal of metals and organic compounds is also significant, as these pollutants typically bind to trapped particles and/or the organic material in the soil and vegetation." In fact, filter strips are not very effective at removing anything but sediment. King County pointed this out in its review of the last (September 2000) version of the plan, but it remains unchanged. King County made it clear that if the SeaTac plans had been processed under the Large Site Drainage Review, the Port would be expected to produce BMP's with performance standards specific to the proposed conditions and contaminants. The consequence of the Port's stormwater management strategy is a high level of contamination in the surface soils. At anticipated rates of input, many pollutants such as metals, organics, and petroleum products will build up to substantial amounts. The dissolved air floatation sludge resulting from the industrial wastewater treatment process is classified as a hazardous waste,

but the same materials in the stormwater system are simply disposed to land. Re-mobilization in relatively large slugs by heavy rains has not been assessed.

Page 4-13 says that 68% of the existing airport area that generates pollution is treated by facilities that are up to modern design standards. This leaves 32% that is not so treated, under existing conditions. These percentages do not agree with the accompanying table (4-6), which does not total treated and untreated acreages. If it did, it would show 55% treated and 45% not fully treated.

Page 4-15, Section 4.5.1.2, Subbasin PGIS Areas, informs us that "for the purposes of this initial assessment, roof tops were assumed to be non-PGIS [non-pollution-generating impervious surface]." Other documents make it plain that these surfaces do produce pollutants. Appendix T shows building roof surfaces that add up to approximately 5.2 acres of bare metal roof (an increase of one acre since the August estimate), plus a substantial area that has not been inventoried. These areas are mostly in subbasin SDN1, which has shown numerous permit violations for zinc, copper, and lead. The Annual Stormwater Monitoring Report that was completed in September 2000 says that Whole Effluent Testing (WET) led to zinc from two metal roofs as a suspected toxicant.

Page 4-15, Section 4.5.1.3, BMP Inventory, says that "Bioswales were conservatively assumed to be trapezoidal, 6-ft-wide at the base, 2-inch-deep flow (regularly mowed), with 3:1 side slopes." One would expect a Stormwater Management Plan to have more than assumptions about the geometry of existing bioswales, especially as there are only four of them shown. They total 0.53 acres, which are supposed to serve 99 acres of future PGIS. This ratio is hardly plausible, particularly if the characteristics of the swales are all assumed. The Plan lacks a specific inventory of dimensions, treatment capacity, and performance levels for the anticipated waste stream. Without it, we have no assurance that the waste stream is being treated at all.

Page 4-15, Section 4.5.2, SDS Water Quality, claims that

> overall, the data show that the concentration of various constituents in STIA stormwater are generally less than those in runoff from other residential, urban, and industrial areas in the region. For example, the median concentrations for STIA constituents are lower than those in urban stormwater , with the exception of total recoverable copper. These data provide evidence for the efficacy of BMP's that have been implemented by the Port . . .

This set of claims is misleading on three counts: 1) it deflects attention from the fact that there has been a consistent history of permit violations and an unsatisfactory track record for existing BMP's; 2) it is of no relevance in assessing water quality impacts how the airport compares itself to the region; 3) a median of reported values is a meaningless indicator of water quality performance.

Table 4-8 (page 4-17) has been changed from the August version only by showing lower "median" values for SeaTac. It purports to back up the claim that SeaTac runoff is better than other developed areas in the region. However the metal values do not show any accompanying hardness values, in the absence of which they cannot be compared. Furthermore, they are "median" values for subbasin SDS3, which has contributed part of a long history of violating state water quality criteria for metals. The Port's Annual Stormwater Monitoring Reports have showed these violations in the past, but the most recent one for July 1999 through June 2000 attempts to hide the fact more securely than the previous ones. Instead of showing hardness data that corresponds with the metal sampling sources, it substitutes an across-the-board hardness value of 56 mg/l which purportedly is the median of seven

samples collected in 1999 – data for which are not shown. Using a median value is a deception anyway, because it hides the violations in a pool of lower values. Besides, 56 mg/l is higher than any hardness values the Port has reported before: the median of 12 values reported in the last Monitoring Report is 14 mg/l. Under the State Water Quality Standards, even if one accepted the invalid notion of the 14 mg/l median, all of the five values shown in Appendix B are in violation, by up to 9 times the chronic toxicity standard for copper, and 7 times for lead. The effect of this distorted and selective use of the data is to make it look as though the metals analyses comply with the water quality standards, when in fact they do not.

On p. 4-18 (unchanged since August), the Port mentions only one specific discharge point, SDS1, for which "copper and zinc concentrations have dropped significantly," but shows no data to back up the claim. The Port does not mention the other outfalls in the stormwater system, which have not had a clean record. A far more useful way to portray the relevant information would be a tabulation of outfalls, with a water quality summary of each, and the state water quality standards for comparison. This would let the reviewer see what the situation is, where the problems are, and what needs to be done about them.

Page 4-18, Section 4.5.2.1, Metals and Hydrocarbons, offers a summary of water quality results based on relative statistics:

> Concentrations of these pollutants in STIA runoff are typically lower . . . more than 95% . . . were below levels found in urban runoff from other sources . . . 36% of the samples collected since March 1998 have had TPH concentrations less than the detectable limit . . . 75% of the lead, copper, and zinc . . . were below the median from comparable regional urban data.

There is little information in this summary. Average and median values are meaningless, because they say nothing about total mass loading or extreme concentrations; the argument is like the driver of an automobile claiming to drive the speed limit more often than other drivers.

Page 4-18, Section 4.5.2.2, Fecal Coliforms: the last two versions of the stormwater plan reported bacterial identification studies, but changed the conclusion. This section has been re-written to say that sanitary sewage is not the source of fecal contamination. The new evidence is not presented, nor are its contradictory conclusions explained, nor is a new candidate fecal source identified. If the Port has developed scientific data with sound methods, it should report the results so they can be evaluated. The substantial methodological limitations of bacterial source tracking techniques are reviewed in Sargeant (1999). The reviewer is forced to assess this section as an indefensible exercise calculated to shift responsibility for bacterial contamination away from the Port.

Page 4-18, Section 4.5.2.3, Suspended Solids: The median values of Total Suspended Solids tell us nothing. The important number to notice is the water quality criterion, which for AA waters is 5 NTU or 10% over background. Without the background levels, the suspended solids information is no more than empty statistics.

Page 4-20, Section 4.5.3, IWS [industrial waste system] Treatment Performance, announces that according to data from Port Discharge Monitoring Reports, effluent water quality limitations have been met since November 1996. The DMR's bias the picture however, because they show results from composite samples taken on a routine schedule, and do not show higher values that would be collected during storm events – when IWS overflows would be likely to happen. The analysis

purporting to show zero overflow events in a 50 year period depends on continuous full capacity operation of the wastewater pumping system during winter (King County comments on September Stormwater Plan, 2000, p. 2). Nor does the plan say anything about the violation record shown in the Discharge Monitoring Reports for the stormwater outfalls that drain to local streams.

Frequency of IWS overflow to the stormwater system is a major determinant of water quality in receiving streams. Runoff from a large land area has been diverted to the IWS. Overflow frequency is a function of treatment capacity and storage. The storage capacity has apparently been increased from 47 to 72 million gallons, but at the expense of 11.5 acres of open water within 2,500' of both runways 34L and 34R, and mostly within the runway protection zone of 34L (Kennedy/Jenks, Industrial Wastewater Lagoon 3 Expansion Project, drawing STIA 0009-G-2; approved for construction by Ecology, 7/24/2000). (Because the Port has furnished few design details, the 11.5 acre number has to be derived from a stage-storage relationship based on the plans.) This feature cannot be reconciled with FAA Advisory Circular 150/5200-33, which has a siting criterion that no waste water settling ponds will be created within 10,000' of a jet aircraft runway.

The Stormwater Management Plan has several sections that refer to flow augmentation. Comments on these sections will be found in a separate part of these comments that is reserved for that subject.

Page 7-3 announces that "water quality for the third runway drainage is expected to be similar to that measured in subbasin SDS3 in recent years." This news is not reassuring, in light of the fact that the Port's Discharge Monitoring Reports for 1998-2000 show that this discharge has a sustained record of violation of the copper and zinc water quality standards.

Page 7-4 describes proposed expansion of the south aviation support area (SASA). Of 93 acres of new impervious surface, 58 will be diverted out of the basin to the industrial wastewater system; 35 acres will be routed to Des Moines Creek either directly or through biofiltration swales. Although there are numerous references to a new detention pond, including a size of 33.4 acre-feet on page 6-5 and Figure 6.1, there are no detailed plans in any of the Appendices (such as D or H) where one would expect to find them. A footnote on p. 7-4 discloses only the cryptic information that "SASA stormwater runoff may be discharged directly to Des Moines Creek after treatment. The SASA pond will then be designed . . ." in the future. For the present, there appears to be no detention pond at all for 98 acres of new impervious surface in this basin. With over half of this acreage draining to the IWS, these changes will bring about a massive hydrological redirection of the basin, in violation of Governor Locke's certification. Essentially 8 bioswales are expected to replace the varied wetland functional values of the existing land cover, which consists largely of mature vegetation (NHC, 2001).

Page 7-10 reports that retrofitting over 80 acres in subbasins SDS3 and SDE4 with conventional treatment BMP's will be impracticable. These are two of the subbasins that have reported discharge permit violations for metals in the last two years. It appears that the Port plan is to continue to discharge flows that violate the water quality criteria into the stormwater system as before, and passively hope for new BMP ideas to emerge. The same approach is anticipated for the Terminal drives. These proposals are not an adequate basis for section 401 certification.

The retrofitting section lists as treatment BMP's "routing of rooftop runoff through a Basic Water Quality Menu treatment BMP." Sedimentation will do nothing whatsoever to treat the runoff, which has dissolved metals but few suspended solids. This deficiency was carefully explained by King

County (2000, p. 16) after the last version of the stormwater plan. No change has resulted. Without proper provision for the pollutant load of stormwater runoff, 401 approval must be denied.

Flow Augmentation for Des Moines Creek

The Port of Seattle's inability to propose a reliable and convincing water source for flow augmentation in Des Moines Creek was one of four reasons why the Port was forced to withdraw its application for a 401 permit in 1998 (see letter from T. Luster to E. Leavitz [sic] , September 25, 1998). The Port has not yet made up its mind how it plans to meet this obligation, much less "resolved" the issue beyond the narrow semantic terms of the facilitated negotiations in late 2000. The complete lack of certainty of outcomes for Des Moines Creek is underscored by the following chronology:

- Implementation Plan for the Des Moines Creek Flow Augmentation Facility, July 25, 2000. The "preferred option" in this version of the plan was to use water from a port-owned well.

- Revised Implementation Plan for the Des Moines Creek Flow Augmentation Facility, August 18, 2000. This version of the plan maintained the preference for the well source, but also discussed Seattle water.

- Flow Augmentation Update, email from Keith Smith to Tom Luster, September 6, 2000. This revision stated that "the primary source is water from Seattle Public Utilities."

- Des Moines Creek Flow Augmentation Preliminary Design," written by Kennedy/Jenks Consultants for the Port of Seattle, dated September 2000. This version says that water from SPU is "currently the preferred source" of flow augmentation water.

- The Port's Stormwater Management Plan of December 2000 says the water will come from the existing Port-owned well on the Tyee Golf Course.

- The Low Streamflow Analysis of December 2000 says that the Port proposes to construct additional stormwater storage facilities that would hold stormwater for later use in augmenting dry season low stream flows.

- The Port and Ecology appear to have agreed that there will be "no Separate Flow Augmentation Plan" for Des Moines Creek or any other creek; but that other documents produced for public comment will describe the facilities, monitoring, and operation (SeaTac Airport Third Runway 401 Permit Negotiations, Meeting Notes Summary; January 3, 2001). No such documents or description has emerged, however.

- The port is still "investigating other sources of water in the basin" (Dennis Ossenkop memorandum dated January 10, 2001 to Nancy Brennan-Dubbs; Response to USFWS Questions)

The existing documents are all incomplete, conflicting, inconsistent, and make it clear that no reliance can be placed on the Port of Seattle's handling of this important problem.

In the December 2000 Stormwater plan, p. 6-10, the "preferred plan" has reverted to the old Highline Water District well #1. The plan to use the well conflicts with information on p. 1-2, and in the Low Streamflow Analysis, which says (p. 15-20) that seasonal carry-over stormwater storage will be used for flow augmentation in Des Moines Creek. The Port of Seattle appears to be using whichever source suits the argument of the moment, hoping that several partial inconsistent plans will add up to one acceptable plan.

Page 6-11 of the Stormwater plan offers some details about how Des Moines Creek flows will be augmented according to monitoring instrumentation at the gauge at 200th St. This gauge is King County 11F, which has no rating curve. The weir is wide, so that a large variation in flows is represented by a very small increment of gauge height, leading to an insensitive control on the pump. The Port is proposing a delicately balanced feedback system to protect the flow in Des Moines Creek. As described, it will not work: it will fail to turn off and on at the right times. The proposed 19°C set point for temperature control is 3° above the water quality criterion. Reasonable assurance has to be based on a workable plan.

The December 2000 Stormwater plan, Page 7-21, Section 7.7.5, promises that the Port will "work with" the Des Moines Creek Basin Committee to implement the flow augmentation project. Mitigation for the third runway construction is a sole responsibility of the Port, and should not be confused with the purpose of the Committee's Basin Plan. The Committee Plan was developed to identify and remediate long-standing existing water quality problems, not to take on the new burdens on the Creek that the Port proposes.

All of the three major flow augmentation schemes that have been floated by the Port have serious defects that disqualify them as a contribution to the "reasonable assurance" the Port is required to provide. I will treat them one at a time.

Existing well on the Tyee Golf Course:

The Port came to an agreement with the Highline Water District about the former Highline well #1, on the golf course. This well was not used at all for a period of years, and then was used without benefit of a water right for many more years. It is highly unlikely there is a valid water right for the well. The administrative process to determine whether there is or not has not proceeded beyond the preliminary stages.

This well was not legally constructed under state law, the water right for it has probably expired, and it is not capable of making any contribution to reasonable assurance that the flow augmentation plan will work. The well exploits three different aquifers in a common casing, in contravention of state guidance on protecting upper aquifer zones. The revised flow augmentation proposal of August 18, 2000 contains several pages from an unidentified document with pages numbered 34 and 37, and some King County drawings. Page 34, 2nd para under "Assessment of Existing Well" has a description of well #1. There are several errors in this paragraph. It equates perforations with screens. They are not the same. "The second [set of perforations], between 190 and 243 feet, has an aquitard that makes it a confined aquifer." While there may be a large degree of confinement in this horizon, it is hardly an absolute – there is unquestionably some degree of vertical leakage. The discussion neglects to discuss the third set of perforations that are described on the well log, between 511' and 541', and it does not show on Figure 13.

The Port would have us believe that 35' of screen on an 8" casing at a depth of 511' to 541' is out-producing a total of 141' of perforated 12" casing at much shallower depths. This is very difficult to believe: the longer, larger diameter, shallower open interval would produce most of the water. "The well is configured so that the lower aquifer contributes the most flow." This statement is patent wishful thinking. Well #2 is screened in the upper aquifer, above 130' depth. The Port thinks this is different from Well #1, which is perforated from 72' to 160'. The same logic should apply to both: "Withdrawal from this aquifer would probably have an impact on Des Moines Creek recharge."

The Port's Figure 13 has further discrepancies that do not agree with the well log. It shows a "lower aquitard" consisting of "clay" of indeterminate thickness below 245' depth. The well log shows "Sand, clay, gravel;" "Fine sand and clay;" for this part of the well. To interpret these descriptors, one must acknowledge the well driller's convention of listing the most abundant materials first in the lithologic characterization. The materials described do not constitute an "aquitard." The effect of this discrepancy is to understate the degree of hydraulic continuity between Des Moines Creek and the producing horizon proposed for an augmentation water source. In all likelihood, the aquifer discharges naturally to the creek, and if the Port pumps it into the creek it will not be augmenting anything. In January 2001 the Port suggested "packing off" the upper cased intervals of the well. Clearance for this concept would have to follow a laborious showing that it will work. Before any reliance can be made of this well, it must be subjected to a detailed hydrogeologic analysis, inspection, and testing; in the end it still may not work.

Water from Seattle Public Utilities:

Temperature improvements claimed for the Implementation Plan cannot be realized with water from the Seattle distribution system. The first iteration of an Implementation Plan (under cover letter from Keith R. Smith to Tom Luster, July 25, 2000) proposed a temperature target of 16°C for Des Moines Creek flows. In fact 16°C is the water quality standard for Class AA streams. The revised plan does not mention the temperature criterion. Even with cool water, attaining a target temperature of 16°C could require more than 1 cfs of augmentation water. Seattle Public Utilities staff data show that Lake Youngs water sometimes reaches 20°C in September. When it does so, during the time when supplemental water is most needed, it will not be acceptable for flow augmentation.

The SPU scheme relies on technological inputs whose continuity cannot be assured. There is a fundamental weakness in a mitigation plan that depends on technological inputs, such as chemicals, electronic sensors, programmable controllers, and large horsepower pumps. This point has been raised by the Corps, in its comments: "We discourage the use of structures in a mitigation site that might need direct human interaction over long periods of time to operate." (Terzi and Freeman to J. Kelly, Parametrix, August 11, 2000). The point was made emphatically in the Battle Mountain Gold decision also (Pollution Control Hearings Board, 2000). The Port has assumed that an SPU augmentation water supply would be non-interruptible (p. 2, top paragraph), but negotiations for a water purchase agreement with the City of Seattle have been suspended.

Delivery of water from the Seattle Public Utilities distribution system would entail 4,500' of 6" or 8" diameter pipeline from the present end of the distribution system to Des Moines Creek. This is a major construction project, that will require at least a 10' construction path, probably more; a pipe buried as much as 4 feet, bedded in pea gravel, the trench to be backfilled with pit run gravel. Yet "No wetlands will be affected" is the Port's summary of effects of this project. The pipeline would have to be routed around wetland 28, which is 35 acres, is discontinuous, and surrounded by other non-jurisdictional wetlands.

The SPU water would have to be purged of drinking water conditioning chemicals. The Port of Seattle has clearly not done its homework on this score. Obviously chlorine has a high toxicity to fish and cannot be tolerated in an augmentation flow. WAC 173-201A-040, the Washington State water quality criteria, specifies a maximum of 19 μg/l maximum 1-hour concentration of chlorine in a 3-year period. Fluoride is also a problem: the City of Seattle follows standard practice in applying fluoride to its water supply system, at concentrations designed to achieve a concentration of 1 mg/l at the point of service (APHA-AWWA-WPCF, 1989). To achieve the target concentration at the customer's tap means that it has to be slightly higher in the distribution system. Fluoride is applied to Seattle's Highline wells at the wellhead. Fluoride at 1 mg/l has been shown to cause mortality and morbidity in salmonids and other aquatic organisms (Strand, 2000). Fluoride will have to be removed from the water used for flow enhancement, and the Port implementation plan is totally silent on the matter.

Carry-over storage of stormwater:

The Port's Low Streamflow Analysis of December 2000 proposes a heretofore unmentioned scheme to use carry-over stormwater storage to augment streamflows in Des Moines and Miller Creeks. The scheme is to capture and store 8.9 acre feet in the Miller Creek Basin and 7.1 acre-feet in the Des Moines Creek basin. The storage facilities will presumably have to consist of additional depth in underground vaults, because open ponds would attract birds. The December plans (Appendix D, figures C139, C150, C151) show 7.2 acre feet of carry over storage in two vaults in the Miller Creek basin, but there is no indication of where the remaining 1.7 acre-feet will be stored. The plans show 1.8 acre-feet in the SDS4 vault on Des Moines Creek, but do not account for the remaining 5.3 acre feet of required storage in that basin. The drawings show a dead storage discharge line in the bottom of the vault. If built as shown, the first discharge to the receiving Class AA streams which would already be under stressed low flow conditions, would be an anoxic slug of accumulated silt and sediment carrying a year's worth of adsorbed pollutant load. Contrary to the facilitated arrangement with Ecology in December, there is not a word about operational procedures to make this approach to flow augmentation effective. Because this idea has never come up before, and because it has no design or operational details, one is forced to assume that the concept is an afterthought. It by no means has the strength to carry the burden of reasonable assurance.

The Stormwater Management Plan, p. 6-3, section 6.1.4, "Water quality of stormwater stored in vaults" is optimistic that stormwater stored for as much as six months will be of adequate quality to discharge to streams during low flow periods. No examples of successful installation or operation of such a scheme are offered. The scheme has not been developed to the point of design or operational specificity.

The Port has careened from one concept to another, encountering difficulties, and responding by thinking up another augmentation water source. None of them has been proven up, and none of them offers a reasonable assurance that water quality standards will be met in Des Moines Creek.

Low Streamflow Study

The Low Streamflow Analysis reports a variety of modeling simulations, and non-modeling tweaks to improve these simulations where the models are known to be inadequate. Estimates of low flow behavior were based on statistical analysis of the results of a model simulation; not based on actual flows; thus they are an abstraction from reality, and as such are speculative and uncertain. There are no estimated error bands or confidence limits on the analysis, that would show how far off it could

be. There is a very short record of actual flows, and no indication of if, or how, they were used as a reasonableness check on the model-based results. These results are used to develop low flow targets for stream systems that have been degraded by generations of man-made interference.

The flow diagram that illustrates the HSPF model structure (Appendix D, Figure 3) shows an increase in Des Moines Creek effective impervious area between 1994 and 2006 of 198 acres. It also shows the basin increasing by 16 acres. These figures do not agree with the Stormwater Plan, which says that the Des Moines Creek basin will experience 128 acres of new impervious surface. Des Moines Creek's share of the 111 acres of new IWS tributary area is not specified. For Miller Creek, these two sources of information show a discrepancy of 27 acres of impervious surface and the Miller Creek basin loses 44 acres of overall tributary area. These discrepancies are sufficient to undermine any confidence in the predictions of effects on low flow behavior that will result from airport expansion.

The Low Streamflow Analysis claims that most of the runway runoff will infiltrate into neighboring grassed filter strips as "secondary recharge." No specific analysis of these filter strips or their infiltration capacity has been carried out since the last version of the Stormwater Plan. There is a danger that the infiltration capacity of the filter strips could be occupied by direct precipitation on the strips themselves, so the soil reaches saturation, and will accept no further infiltration from offsite; then the runoff from the runways will be forced to continue on the surface.

Fate and transport of contaminants in SeaTac soils

There is a 50-year history of spills and intentional land disposal of jet fuel, aviation gasoline, other petroleum wastes, and of a variety of other contaminants around the SeaTac Airport Operations and Maintenance Area (Agreed Order of May 25, 1999 pursuant to the Model Toxics Control Act ("MTCA," RCW 70.105D). Specific contaminants found on the airport site include numerous known sites with multiple dozens of compounds such as benzene-ethylene-toluene-xylene, heavy metals, volatile organics, and total petroleum hydrocarbon (TPH) species. Some of these materials have found their way into the local groundwater. Some are lying in wait below the surface, for the next subsurface construction job to expose them. Port contractors have identified the City of Seattle Highline wellfield; the Highline Water District; King County Water District 54; private drinking water wells; Des Moines Creek; and Miller Creek as "potential local receptors" of exposure to these materials (AESI, 2000b).

Numerous major construction projects are both underway and proposed at the airport in areas that are known to contain contaminated soils above MTCA cleanup levels. One example is the Aircraft Hydrant Fueling System. Environmental review of this project consisted of a Declaration of Non-Significance and accompanying Environmental Checklist dated respectively October 6 and 5, 2000. This one project entails construction of approximately 7,000 lineal feet of pipeline, with as much as 350,000 cubic yards of excavation and corresponding backfill. The route transits an area of known soil contamination left over from the old Continental Airlines hydrant system (AESI, 2000b, figure 2). Other areas of contamination are not precisely known, and the first specific knowledge of them will come from a backhoe operator.

Trench backfill for the hydrant piping will most likely consist of coarse-grained gravelly material. Shallow infiltrated stormwater, and any contaminants in the shallow soils, will readily follow the outside of the pipe in the permeable backfill material. The backfill can also act as a french drain, enhancing recharge into the shallow groundwater. Current and future construction activities will

create preferential pathways for contaminant transport around the SeaTac site. The groundwater flow directions in the shallow (Qva) aquifer in the AOMA vicinity are to the west and northwest, which would lead the contaminant pathways toward the headwaters of Miller and Walker Creeks (AESI 2000b, Figure 7; Stormwater Management Plan, Appendix Figure B1-3).

The Port has adopted two approaches to dealing with contaminated sediments. One is to abandon the materials in place and assume that if they don't go away on their own, at least they will not go anywhere else. The other is to spread them out and dilute them below clean-up action levels, as was done with petroleum contaminated soil from the Crawford Fuel Tank Parking Area Remediation Project. The material from that site was "landfarmed," i.e. mixed with clean surface soils, at the IWS Lagoon 3 site (letter from Kathy Bahnick, Port of Seattle, to Chung Yee, Department of Ecology, August 29, 2000).

Environmental evaluation of the fuel hydrant system was dismissed with a Declaration of Non-Significance. The major groundwater modeling study that was required under the Agreed Order, and which was intended to evaluate potential groundwater pollution from the operations area, is in suspension because the Port has not allocated the funding to complete it. For an airport expansion plan whose cost is now estimated at $6 billion, the lack of $60,000 for a groundwater study is hardly believable. Until the Port completes a comprehensive evaluation of contaminant fate and transport, as it promised to do under the Agreed Order, there can be no assurance that transport of existing contaminants will not violate water quality standards or pose a threat of environmental harm to local receptors.

Conclusions

In order to approve the expansion plans at Sea Tac Airport, the State of Washington must certify that there is a reasonable assurance that the project will not result in violations of state water quality standards. In order to allow the project to proceed with the filling of jurisdictional wetlands, the Corps of Engineers must receive the State's certification, and it must establish independently that the project is in the public interest based on, among other considerations, the project's environmental impact. My intensive review of the Port of Seattle's case, which I have conducted over the last fifteen months, leads me to the conclusion that the project does not meet its burden of proof in either case.

Thank you for taking into account these thoughts on the adequacy of the Port of Seattle's application for Section 401 and 404 approvals for its proposed SeaTac developments.

Sincerely,

Peter Willing, Ph. D.
Enclosure

References:

AESI, 2000a. Hydrogeologic Study, Industrial Waste System Plant and Lagoons, Seattle-Tacoma International Airport. Project BV98112. June 21, 2000.

AESI, 2000b. Seattle-Tacoma International Airport Groundwater Study. Project Overview/Conceptual Fate & Transport Model Presentation, October 4, 2000.

APHA-AWWA-WPCF, 1989. Standard Methods for the Examination of Water and Waste Water. 17th ed.

King County Department of Natural Resources. Enclosure 2. Final Review Comments on SeaTac Stormwater Management Plan.

Northwest Hydraulic Consultants, 2001. Comments on stormwater, hydrology, and hydraulics aspects of proposed 3rd runway and related development actions at Seattle-Tacoma International Airport. Comment letter provided to Washington Department of Ecology and Corps of Engineers.

Sargeant, D. 1999. Fecal Contamination Source Identification Methods in Surface Water. Department of Ecology Report #99-345. 19 p.

Strand, J. A., 2000. Letter to Tom Luster, August 21, 2000 on Port of Seattle's Potential Use of Drinking Water to Augment Summer Low flows in Miller and Des Moines Creeks. Columbia Biological Assessments, Richland, Washington.

Pollution Control Hearings Board, 2000. Okanogan Highlands Alliance et al. v. Ecology and Battle Mountain Gold Company. PCHB No. 99-019.

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ✦ Bellingham, Washington ✦ 98225 ✦ 360-734-1445 ✦ 360-676-1040 (fax) ✦ pwilling@telcomplus.net

EDUCATION

B.A., University of Washington, Seattle, Washington
M.S., Ph.D., Cornell University, Ithaca, N.Y.

PROFESSIONAL AFFILIATIONS

American Water Resources Association
American Geophysical Union

SELECTED SPECIALIZED TRAINING

Applied Fluvial Geomorphology: Wildland Hydrology Center, Pagosa Springs, Colorado

Stormwater Treatment: Biological, Chemical, and Engineering Principles. Professional Engineering Practice Program, University of Washington

SUMMARY

Dr. Willing is Principal in the Bellingham firm of Water Resources Consulting, L.L.C. Since founding the firm in 1989, he has carried out a wide variety of assignments for public and private clients seeking to solve water-related technical questions. Examples are: hydroelectric system design, flood frequency analysis on Northwest rivers, wellhead protection, surface water - ground water interactions, storm water management strategy, and hydrologic basis of water rights. In public sector positions, he has served as general manager of a medium sized public water system. He also served as chief environmental officer of a large municipal electric utility. Dr. Willing holds Adjunct Faculty appointments in Geology and Huxley College at Western Washington University, Bellingham.

SELECTED PROJECT EXPERIENCE

Review of surface and ground water hydrology associated with the possible construction of a third runway at Sea-Tac Airport. Questions under investigation include permeability and water storage characteristics of imported fill materials, effectiveness of stormwater management measures, compliance with water quality provisions of the King County Surface Water Design Manual, effect of fill on wetlands and stream flows, and project effects on anadromous fish. November 1999 - February 2001.

Water supply source investigation for determination whether the source is under the influence of surface water. Project includes multi-site water quality monitoring, source intake design, microscopic particulate analysis, and a geohydrologic investigation of a complex of juxtaposed unconsolidated glacial, metamorphic, and volcanic geological systems. Client: Puget Sound Energy

Design and implementation of geohydrologic investigation for new ground water supply, with special emphasis on hydraulic continuity between ground and surface waters. Project includes securing drill and test permit, engaging driller, logging the well, overseeing a pump test, high resolution surface water flow measurements, collecting and analyzing the data, geologic mapping, and writing completion report. 1997.

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ✦ Bellingham, Washington ✦ 98225 ✦ 360-734-1445 ✦ 360-676-1040 (fax) ✦ pwilling@telcomplus.net

Geohydrologic evaluation of Lummi Island public water supply wells in support of water rights application, including 24-hour pump test, monitoring observation wells, analysis of data, and project report. 1997.

Reconnaissance investigation of surface water storage potential of the Nooksack Basin, Washington. Project included a review of prior studies, hydrology, current water demands, and project costs. 1997.

Preparation and compliance monitoring of NPDES permits for industrial gas manufacturing facility. Responsibilities included both process wastewater and storm water permits, analysis and recommendations on process flow control, best management practices from regional surface water design manuals, and waste stream management. 1992-1997.

Alluvial fan and debris flow hazard element of Comprehensive Flood Hazard Management Plan, Lower Nooksack River, Whatcom County, Washington. This element consisted of field investigation in support of hydrologic and geomorphologic analysis of two high-gradient streams. 1995-6. Client: Whatcom County Flood Control Zone District

Assessment and expert testimony on hydrologic basis and technical adequacy of contested water rights application, San Juan Island, Washington. Case was heard by Washington Pollution Control Hearings Board as Fleming et al. v. Department of Ecology, 1994. Client: private party appellants.

Miscellaneous water rights investigations involving adequacy of water supplies, well interference, salt water intrusion potential, and hydraulic continuity between surface and ground waters. 1997. Clients: individual parties.

Hydrologic and geohydrologic data needs assessment in support of potential basinwide water rights adjudication. The preparatory work on this project is designed to support development of a hydrologic and water rights accounting model. Client: Nooksack Basin Water Users Steering Committee

Preparation of Wellhead Protection Programs for small cities and public water supplies.. Components include assessment and compilation of existing data, aquifer delineation, contaminant source inventory, storm water management design, and provision of alternative water supply. Clients: City of Everson, City of Sumas, Pole Road Water Association.

Hydrology element of Comprehensive Flood Hazard Management Plan, Lower Nooksack River, Whatcom County, Washington. This element consisted of a review of the adequacy of the stream flow record, previous flood frequency analyses, and potential error and uncertainty in flood frequency estimates. Client: Whatcom County Flood Control Zone District

Water rights review for industrial facility in Whatcom County. This assignment involved documentation of historical water use and claim to water that go back to before the turn of the century. The purpose of the effort was to position the client to advantage in the current climate of water rights regulation by the State of Washington.

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ✦ Bellingham, Washington ✦ 98225 ✦ 360-734-1445 ✦ 360-676-1040 (fax) ✦ pwilling@telcomplus.net

Snoqualmie River Shallow Aquifer Evaluation. This project consists of a two-year investigation of hydraulic continuity between the pool behind Snoqualmie Falls and the local shallow aquifer. Key questions are effect of river stage on sewer inflow, wetlands, building foundations, and construction conditions. Client: Puget Sound Power & Light.

Primary technical witness in siting of industrial landfill in Whatcom County. This project consisted of an independent review of the geohydrology report submitted by the landfill applicant in support of the application for the landfill, and expert testimony on that review. Client: Private landowner.

Hydrogeologic evaluations of sand and gravel mining and landfill proposals in glacial outwash deposits on the margins of the Nooksack River in Whatcom County, Washington. These investigations have established local gradients and flow directions in the vicinity of gravel mining operations. Different projects have been completed, both for gravel mining clients and others who perceived themselves to be affected.

Review of rainfall and runoff hydrology in support of design of small hydroelectric installation on Baranof Island, Alaska. Project involved use of HEC-1, HEC-2, WaterWorks, and other hydrologic models. Client: City and Borough of Sitka.

Principal investigator for low flow frequency and water supply risk study on the Nooksack River, Whatcom County, Washington. Client: Whatcom County Public Utility District #1.

Consultant for aquifer recharge area delineation, Whatcom County, Washington. Project undertaken in support of Critical Areas Ordinance to be adopted pursuant to the Washington State Growth Management Act.

Project manager and surface water hydrology investigator for groundwater resource evaluation, for Lummi Indian Business Council, Whatcom County, Washington.

Project manager for review of power operations plan and fish and wildlife mitigation plan for Kerr Dam, Flathead River, Montana. Client: Bureau of Indian Affairs.

Preparation of Initiating Memorandum and preliminary scope of work for US $3M investigation of Southern African river basins. The project is designed to provide water resources focus to major World Bank grant-in-aid program.

Project manager and client liaison for runoff forecast model development project, for the Cedar and South Fork Tolt Rivers, King County, Washington. Work carried out for the Seattle Water Department.

Project manager for hydroelectric power plant efficiency improvements for Puget Sound Power and Light Company's White River plant. Project consists of application of linear and dynamic programming and optimization techniques to interactions between hydraulics, energy value, and hardware.

Analyst for hydrologic and environmental screening of 1,200 potential small-scale hydroelectric sites in British Columbia, on behalf of independent power producer with interests in B C Hydro's resource acquisition program.

Peter Willing, Ph.D.
Water Resources Consulting, L.L.C.
1903 Broadway ✦ Bellingham, Washington ✦ 98225 ✦ 360-734-1445 ✦ 360-676-1040 (fax) ✦ pwilling@telcomplus.net

System planning, operations efficiency, and source evaluation for water supply and hydroelectric facilities.

Contributor to Coordinated Water Supply System Plan for six-utility area with 250,000 population. Project elements consisted of demand projections, evaluation of existing and planned capacity expansion, and evaluation of alternatives for meeting projected demand.

Researcher for assessment of U.S. groundwater management strategies and their suitability for the Puget Sound lowland.

Participant in oversight of lake restoration program for Lake Whatcom, Whatcom County, Washington. Reviewed water quality sampling regime, interim findings, and final analysis and interpretation. Participated in steering committee deliberations, final drafting of Watershed Management Plan, and presentation to local government.

Chief administrative officer for water and sewer utility, which included responsibility for raw surface water source monitoring and protection. Devised watershed management policies and documented land use - water quality interactions.

Expert witness in litigation concerning adequacy of Environmental Impact Statements prepared under Washington State Environmental Policy Act. Witness before the Pacific Northwest Power Planning Council on fish and wildlife aspects of implementing the Pacific Northwest Electric Power Planning and Conservation Act.

Visiting Lecturer, upper division courses in surface water hydrology and water resources policy; Department of Geology and Huxley College, Western Washington University.

Investigator for design and implementation of an analysis of the interactions between watershed land use and receiving lake water quality for a 205-square-mile lake basin in Cayuga County, New York. Participated in water quality sampling and analysis program. The lake in question is the water source for the City of Auburn.

Principal researcher for report on costs of fish and wildlife mitigation and enhancement measures in the Columbia River Basin.

Team participant in multi-national effort to research and recommend coal transportation environmental standards for Pacific Rim developing countries.

Responsible official for preparation of Environmental Impact Statement on Copper Creek Dam, Skagit County, Washington. Important issues included anadromous fisheries, riparian habitat, power generation, hydrologic effects, and water rights.

Team manager for preparation of environmental documents in support of FERC application for a hydroelectric installation on the South Fork Tolt River, King County, Washington.

Supervisor of analysis of environmental aspects of rehabilitating the Cedar Falls hydroelectric project, King County, Washington.

EXHIBIT F

The Port of Seattle's Annual Stormwater Monitoring Reports for SeaTac Airport have the same problem as the DMR's. The annual reports are intended to "present the analytical data, the Port's conclusions as to what is being learned from the data, and any new initiatives to be undertaken as part of the Stormwater Pollution Prevention Plan . . ." (Draft Permit, Section S2.E). The most recent Annual Stormwater Monitoring Report for July 1999 through June 2000 defeats this purpose by submerging the airport monitoring data in a sea of irrelevant data from other jurisdictions. It also makes the metals concentrations impossible to interpret by separating them from the hardness data. Instead of showing hardness data that corresponds with the metal sampling sources, it substitutes an across-the-board hardness value of 56 mg/l which purportedly is the median of seven samples collected in 1999 – data for which are not shown. Using median values dilutes the observations downward and dilutes the criterion upward, in both cases hiding water quality violations. 56 mg/l is higher than any hardness values the Port has reported before: the median of 12 values reported in the previous Annual Monitoring Report is 14 mg/l. Under the State Water Quality Standards, if one accepted the 14 mg/l median as valid, all of the five values shown in Appendix B are in violation, by up to 9 times the chronic toxicity standard for copper, and 7 times for lead. The effect of this distorted and selective "cooking" of the data is to make it look as though the metals concentrations comply with the water quality standards, when in fact they constitute a significant contribution to the violation of those standards. This interpretive sleight of hand could be dispensed with if the monitoring requirements were written so as to require straightforward reporting of relevant data.

The proposed NPDES Permit modification requires revision. The Department of Ecology must not issue it until all discharge locations, discharge sources, and receiving waters are identified in the permit, with appropriate opportunity for public comment.

Thank you for considering these comments on the Major Modification of the Port of Seattle's NPDES Permit for SeaTac Airport.

Sincerely,

Peter Willing, Ph.D.

EXHIBIT G

Water Resources Consulting L.L.C.
Peter Willing, Ph.D.

July 18, 2001

Washington State Department of Ecology
3190 160th Ave. S.E.
Bellevue, Washington 98008-5452
ATTENTION: Ann Kenny

U.S. Army Corps of Engineers
Regulatory Branch
P.O. Box 3755
Seattle, Washington 98124-2255
ATTENTION: Muffy Walker, Gail Terzi

RE: Supplemental Information, Department of the Army Section 404 Permit Application, SeaTac Airport. USACE Reference 1996-4-02325

Dear Ms. Kenny, Walker, and Terzi:

My comments in the meeting on July 10th between Airport Communities Coalition representatives and the Department of Ecology elicited some questions from Ms. Kenny about the performance record of stormwater Best Management Practices (BMP's). This letter provides clarifying detail and documentation in response to these questions. It also provides elaboration of previous comments on stored stormwater for flow augmentation.

The first question concerned bacteria loading associated with biofiltration swales. Results compiled from a range of BMP performance monitoring efforts (Claytor et al., excerpt enclosed) conclude that bioswales or open grassed channels have either low or negative removal efficiencies for fecal coliform. Both the enclosed EPA 1999 compilation and the work by Adolfson (1999, excerpt enclosed) concur in these results. Negative removal efficiency means that more bacteria were measured in the discharge than were measured in the inflow to the BMP in question. This result was observed in the 1992 Metro study on which the Port relies, as well as numerous others. These results have not been rigorously accounted for, but one opinion is that bioswales can exhibit bacterial growth and behave as a source of bacteria themselves.

Strecker et al. (enclosed) developed recommended parameters for assessing BMP performance. The Department of Ecology and Corps of Engineers should require the Port of Seattle to provide the recommended information on the BMP's that it is proposing at SeaTac, and rigorously review them, before accepting claims that the BMP's will effectively treat airport stormwater.

As I mentioned in the meeting, there is a serious concern about the suitability of the stored stormwater proposed by the Port of Seattle as a flow augmentation source for the creeks around SeaTac airport. The Port proposes to capture and store 8.9 acre feet in the Miller Creek Basin and 7.1 acre-feet in the Des Moines Creek basin. The December 2000 Stormwater Management Plan

1903 Broadway
Bellingham, Washington
98225-3237 U. S. A.

Telephone 360-734-1445
FAX: 360-676-1040
email: pwilling@telcomplus.net

(Appendix D, figures C139, C150, C151) has not been changed in this particular; it shows 7.2 acre feet of carry over storage in two vaults in the Miller Creek basin, but there is no indication of where the remaining 1.7acre-feet will be stored. The plans show 1.8 acre-feet in the SDS4 vault on Des Moines Creek, but do not account for the remaining 5.3 acre feet of required storage in that basin. The drawings show a dead storage discharge line in the bottom of the vault. If built as shown the first discharge to the receiving Class AA streams, which would already be under stressed low flow conditions, would be an anoxic slug of sediment laden water carrying a six-month accumulation of pollutant load. The Port argues that pollutant species will be bound by adsorption to soil particles and rendered biologically inactive. Under anaerobic conditions, which the Port concedes will occur, many bound inorganic compounds will go back into solution and become biologically available again. Other than sporadic references to reaeration of the stormwater, the Port has not proposed any treatment to bring it up to a standard appropriate for release to Class AA receiving waters. It is noteworthy that the Port's plans for maintenance of stormwater detention vaults (HNTB, 2001) show no consideration or mention of flow augmentation.

To contemplate inappropriate use of Best Management Practices, and release of stored stormwater without treatment into local streams, falls considerably short of the required reasonable assurance that the Port's projects will meet water quality standards.

Sincerely,

Peter Willing, Ph. D.
Attachment

REFERENCES

Adolfson Associates, 1995. Pilot Evaluation, Subsurface Stormwater Disposal Facilities, Clover/Chambers Creek Basin. Final Report to Tacoma-Pierce County Health Department.

Claytor, R.A and T.R. Schueler, 1996. Design of Stormwater Filtering Systems. Center for Watershed Protection, Silver Spring, MD. Supplemental funding by USEPA Region 5.

EPA, 1999. Preliminary Data Summary of Urban Stormwater Best Management Practices. EPA-821-R-99-012.

HNTB, 2001. Memorandum from Alan Black to Michael Cheyne, April 26, 2001. Yellow D6 version.

Strecker, E., Quigley, M.M., and Urbonas, B.R.. Undated. Determining Urban Stormwater BMP Effectiveness. URS Greiner Woodward Clyde, Portland, Oregon.

EXHIBIT H

Water Resources Consulting L.L.C.
Peter Willing, Ph.D.

August 6, 2001

U.S. Army Corps of Engineers
Regulatory Branch
P.O. Box 3755
Seattle, Washington 98124-2255
ATTENTION: Muffy Walker, Gail Terzi

Washington State Department of Ecology
3190 160th Ave. S.E.
Bellevue, Washington 98008-5452
ATTENTION: Ann Kenny

RE: Department of the Army Section 404 Permit Application, SeaTac Airport
Reference: 1996-4-02325

Dear Ms. Walker, Terzi, and Kenny:

The Port of Seattle has submitted to Ecology a document entitled "Low Flow Analysis - Flow Impact Offset Facility Proposal," written by Parametrix, dated July 2001. This letter comments on behalf of the Airport Communities Coalition on that document, within the constraints of a very short review period. Please also refer to letters from Water Resources Consulting dated September 19, 2000; February 15, 2001; March 12, 2001; and July 18, 2001.

Although the new low flow study is more substantial in terms of sheer weight than the December 2000 Low Streamflow Analysis, it is not more substantial in terms of reasonable assurance that the Port's SeaTac plans will meet water quality standards in the three main creeks. The Department of Ecology and the Corps of Engineers have been asked to accept a monstrous 15 pounds of unnecessary paper print-out of hourly stream flow calibration data in lieu of a mature and well considered proposal.

The text of the document is not finished. Missing information is shown by "wild card" dummy figure numbers referring to figures that do not exist, essential appendices are missing, cross references are not functional, sections end with the announcement "section not complete." The Port's acknowledged confusion necessitated a clarification letter dated July 25, 2001. The whole effort has the appearance of a desperate effort to submit something, regardless of quality. This characteristic makes it consistent with previous submittals from the Port. Please remember that this is the Port's third augmentation water source, and its third application for 401 certification, since 1998.

The cover letter says that "the vaults will include features (both structural and operational) for managing water quality to ensure there are no adverse impacts from discharges from the flow impact offset facility." No structural features are shown on any drawings; so far they warrant only a conceptual description. The section on operation says "The Final Plan will include the details and specificity that is not available at the present time" (p. 25). The "proposed general operating

1903 Broadway
Bellingham, Washington
98225-3237 U. S. A.

Telephone 360-734-1445
FAX: 360-676-1040
email: pwilling@telcomplus.net

schedule" (p. 27) says that "if potential water quality violations are indicated," the Port will "install/maintain filters for sediments/turbidity/metals" and "install portable aerators for DO." These steps cannot be done at the last minute, as an afterthought, with any expectation that they will work. They have to be designed, built, tested, and refined before the need for them arises. A loose plan to install something after the need becomes apparent, falls short of reasonable assurance.

Reference (p. 14, 15) is made to work in progress, and data that has not been submitted. The Port is currently investigating filtration of stormwater, including the effectiveness of several filtration media; the data will be available before final design but are not available now. The Port also recently started recording temperature in several stormwater vaults, but does not care to share the data so the public can evaluate it.

The new low flow analysis says that there is a requirement for a total of 46 acre feet of storage in the three watersheds, consisting of 18.8 acre feet in the Miller Creek watershed, 15 acre feet in Walker Creek, and 12.2 acre feet in Des Moines Creek. The plan offers no allocation of these volumes to specific stormwater vaults. It has no drawings showing where these volumes will be stored. The December 2000 Stormwater Management Plan and its subsequent modifications show specific capacities for 8.7 acre feet in Miller Creek and 1.8 acre feet in Des Moines Creek, which is less than a quarter of what is needed. The location of the remaining three quarters is left up to the reader's imagination. Obviously temporary language on page 19 suggests that the carry-over storage vaults have not been selected. Ecology is being asked to accept an incomplete concept, rather than a mature design, as a basis for issuance of a 401 certification for the airport.

The Port has argued energetically in the past for consideration of non-hydrologic impacts (p.4). Repeated refinements of the analysis have resulted in a decrease in the amount of water the Port wishes to take credit for from the cessation of pre-buy-out withdrawals. Now the effect of stopping these withdrawals appears to be slightly outweighed by the negative low flow effects of Port construction. The Port now proposes to remove from consideration all non-hydrologic effects (facilitated meeting notes, July 9, 2001). When the net effect looked positive, the Port was keen to include it; now that it looks negative, the Port wants to set it at zero. It is possible that further analysis will result in more negative effects from airport construction on low stream flows. The Port is not able to provide reasonable assurance that it will protect low flows.

Our previous letters have commented extensively on the adequacy of proposed best management practices, observing in particular that grassed swales are unproven and reliance on them unwarranted for the intended pollutant stream. The Port has now referred to structural features that include (p. 6) sediment traps, settling areas, vents, and passive aeration. "Provisions" for additional filtration and aeration have supposedly been made, but they are not available for agency or public review as a basis for a permit decision. The Port is evaluating various active aeration techniques, but they are still presented in a tentative mode, which might be paraphrased thus: "they won't be necessary, but if they are, we will explore them further." P. 19 extolls the virtues of microbubble diffusers, but the Port has offered no performance data on them or explained how they would work on the specific flow volumes and quality they are proposing to treat. The plan sheets available for review show only 25% of the storage volume they profess to require, and none of the purported design details that might influence the quality of the discharge. As far as the reviewer is concerned, it is all imaginary. Instead of reasonable assurance, the Port offers unquantifiable unenforceable promises.

Page 20 says "the operation of BMP's on the airfield (biofiltration swales) would reduce the opportunity and concentrations of any nutrients that exist prior to the stormwater entering the vaults." We have pointed out before, as has King County DNR, that the BMP's the port is talking about are not very good at removing nutrients: over a large number of monitoring studies, the best performance for removal of nitrogen and phosphorus is 45%, and the worst is 15% (EPA 1999, p. 5-82; Claytor,1996 p. 3-5). (Note: excerpts from these authorities were sent to you with my supplemental letter to Ann Kenny, dated July 18, 2001). In spite of the documentation of inadequate performance, and demonstrably erroneous assumptions, the Port proposes to assume the stormwater flows will be devoid of nutrients and does not propose to sample for them. How they will implement a treatment scheme when they will not even know what they are treating for remains a mystery. Claytor et al. do not reach the same conclusions the Port reaches from its data that show metals "associated with particulates." To the contrary, they find that large portions of metals, particularly copper, zinc, and cadmium tend to favor the dissolved state, especially in low turbidity waters (Claytor, 1996 p. 4-20; Minton, 2001) These findings also show that remobilization of metals is a significant process.

Several references to an "adaptive management strategy" are made in the low flow documents (One example is on p. 8 of the "executive summary.") While it may be wise for the Port to anticipate that unforeseen problems will force new solutions, the Department of Ecology should not rely on future "adaptive management," or attempts to figure it out later, as a present substitute for reasonable assurance that the Port's water quality protection scheme will actually work.

Page 17 has an elaborate argument as to why elevated biological oxygen demand due to runway de-icing episodes should not affect the dissolved oxygen levels in stored stormwater. While comforting if taken at face value, it has no substance and misrepresents what is taking place at the airport. We have already observed that the Port does not know which facilities or outfalls will host ¾ of the stored stormwater. In addition, the Port's Discharge Monitoring Report for the first quarter of 2001 shows propylene glycol at SDS3 (Des Moines Creek) of 407 milligrams per liter. This was presumably related to de-icing conditions on February 8 and 16, when 15,000 and 19,000 gallons of glycols respectively were used for aircraft de-icing. One of the reasons the Port hopes for no effect is that de-icing "typically happens during the early winter months when reserved stormwater releases from the [vaults] would not take place." This statement indicates that the Port has not thought out what it is doing. Elsewhere in the report, they say they will continue releasing stored stormwater until it is all gone even if that is past October 15. There are only three months a year in which daily use of glycols does not exceed 100 gallons per day (Aircraft Deicing Report April 2000 through March 2001).

The Port of Seattle's regular submission of quantities of new materials in support of its Section 401/404 application, including the most recent low flow study, has not raised the quality of the application to the point of providing reasonable assurance that the Port's projects will meet water quality standards.

Thank you for taking into account the enclosed views.

Sincerely,

Peter Willing, Ph.D.

REFERENCES

Claytor, R.A and T.R. Schueler, 1996. Design of Stormwater Filtering Systems. Center for Watershed Protection, Silver Spring, MD. Supplemental funding by USEPA Region 5.

EPA, 1999. Preliminary Data Summary of Urban Stormwater Best Management Practices. EPA-821-R-99-012.

Minton, G. 2001. Stormwater Treatment: Chemical, Biological and Engineering Principles. Professional Engineering Practice Liaison Program, University of Washington. February 8 and 9, 2001.

AR 008119

EXHIBIT I

King County
Department of Natural Resources
Director's Office
King Street Center
201 South Jackson Street, Suite 700
Seattle, WA 98104-3855

August 3, 2001

Ann Kenny, Senior Permit Specialist
Washington Department of Ecology
Northwest Regional Office
3190 – 160th Avenue Southeast
Bellevue, WA 98008-54552

Dear Ms. Kenny:

King County is pleased to have had the opportunity to assist the Department of Ecology by making its technical review capacity and knowledge of local stormwater conditions available for the review of the Port of Seattle's *Comprehensive Stormwater Management Plan* (SMP) for Master Plan Improvements at SeaTac International Airport. This effort has set an excellent example of how state and local government can work cooperatively in addressing pressing issues facing the region.

As with our previous reviews of this project, it is important to keep in mind the limitations of the work that we have performed. First, this review is limited to ascertaining whether the SMP attained minimum compliance with the 1998 *King County Surface Water Design Manual.* Compliance with the technical provisions of the Design Manual does not mitigate all potential impacts of development and may not provide sufficient information to allow for approval under other codes and regulations. Compliance with the Design Manual is, however, a good start towards mitigating the impacts of this large and complex project.

It is also important to remember that this review is limited to those development activities identified by the Port of Seattle as being Master Plan Update Improvements. While other projects of varying magnitude are being proposed for this area, only those projects included in the formal SMP submission were reviewed for this comment letter. No assumption of concurrence with the technical details or effectiveness of additional projects should be assumed without our specific written comment.

Our reviewers found this version of the SMP is consistent with the technical requirements of the *King County Surface Water Design Manual.* The SMP demonstrates a feasible conceptual strategy for complying with the technical provisions of the *King County Surface Water Design Manual* and effectively demonstrates that the proposed improvements could fully comply with Design Manual requirements.

Enclosure 1 provides general commentary on how the SMP responds to the specific core and special requirements of the *King County Surface Water Design Manual*, as well as an overview of the review scope and limitations.

Enclosure 2 provides a summary of the various surface water facilities proposed for construction, along with specific information on each facility, such as the volume of the facility, the drainage area served, and the amount of impervious area tributary to each facility.

Thank you for this opportunity to work together on behalf of the region. If you have any questions, please contact David Masters, Senior Policy Analyst, or Kelly Whiting, Senior Engineer, both with the Water and Land Resources Division. David can be reached at (206) 296-1982 or via e-mail at david.masters@metrokc.gov. Kelly can be reached at (206) 296-8327 or via e-mail at kelly.whiting@metrokc.gov.

Sincerely,

Pam Bissonnette
Director

PB:tv F968

Enclosures

cc: The Honorable Ron Sims, King County Executive
Ray Helwig, Northwest Regional Director, Washington Department of Ecology
Paul Tanaka, County Administrative Officer, Department of County Administration
Tim Ceis, Chief of Staff, King County Executive Office
Kurt Triplett, Deputy Director, King County Department of Natural Resources (DNR)
Nancy Richardson Ahern, Manager, Water and Land Resources Division (WLRD), DNR
Debbie Arima, Assistant Manager, WLRD, DNR
Curt Crawford, Supervising Engineer, Drainage Services Section, WLRD, DNR
Kelly Whiting, Senior Engineer, Engineering Studies and Standards, WLRD, DNR
Joanna Richey, Manager, Strategic Development Section, WLRD, DNR
David Masters, Senior Policy Analyst, Watershed Coordination Unit, WLRD, DNR

ENCLOSURE 1
OVERVIEW OF REVIEW SCOPE AND LIMITATIONS

The December 2000 Comprehensive Stormwater Management Plan (SMP), as revised in July, 2001 has been reviewed for consistency with the technical provisions of the 1998 King County Surface Water Design Manual (KCSWDM). The review has concluded that the SMP has demonstrated that the mitigations proposed in the SMP are consistent with the standards set forth in the KCSWDM. This enclosure details key findings regarding this compliance assessment.

Review has been limited to those development activities identified by the SMP as being Master Plan Update (MPU) Improvements (see SMP Table A-3). Projects not included in the SMP were not reviewed and therefore no presumption of consistency with KCSWDM should be drawn for these projects. Review was performed per the KCSWDM technical requirements which would have applied under Full Drainage Review (see KCSWDM excerpts in text box on page 2), except where the SMP identifies performance goals exceeding the KCSWDM standards. Compliance with King County's technical standards may not be sufficient for project approval under other codes and regulations, and these standards are known to be insufficient to fully mitigate all potential impacts of development. Specifically excluded from the review scope are all procedural requirements of the KCSWDM.

Review and concurrence of a stormwater management plan is primarily a review of design concepts and assumptions to determine if the proposed mitigations demonstrate a feasible approach to comply with the identified performance goals. As the proposed MPU development projects move from the planning stages to development of construction plans, the proposed stormwater mitigations may need to be updated to reflect any changed conditions. Prior to construction of specific projects, additional review and approval of the final construction drawings and associated technical information report is typically required. Oversight and monitoring are key elements to successful implementation of any stormwater management plan. It is recommended that Ecology and the Port develop a plan to oversee and monitor compliance with the mitigations set forth in the SMP. One option is to create an Ecology "Compliance Team", representing the necessary disciplines, to work with the Port to achieve compliance with the goals and objectives laid out in the SMP and related documents.

It has not been determined what legal vesting an Ecology approved SMP affords the future development activities identified within. The SMP includes projects where specific flow control and water quality mitigation approaches and conceptual plans have been identified, but which may be adjusted during final design. The SMP also lists other development projects which do not have specific mitigations identified (see SMP Table A-3). Ecology and King County are working on updated stormwater standards needed to implement Clean Water Act and Endangered Species Act protection objectives. Review of the SMP against these draft standards was not performed. If final facility designs include revised on-site performance goals, Ecology may wish to review the final proposed facilities against the standards in effect at that time.

EXCERPT FROM 1998 KCSWDM

1.1.4 DRAINAGE DESIGN BEYOND MINIMUM COMPLIANCE

This manual presents King County's minimum standards for engineering and design of drainage facilities. While the County believes these standards are appropriate for a wide range of development proposals, compliance solely with these requirements does not relieve the professional engineer submitting designs of his or her responsibility to ensure drainage facilities are engineered to provide adequate protection for natural resources and public and private property.

Compliance with the standards in this manual does not necessarily mitigate all probable and significant environmental impacts to aquatic biota. Fishery resources and other living components of aquatic systems are affected by a complex set of factors. While employing a specific flow control standard may prevent stream channel erosion or instability, other factors affecting fish and other biotic resources (such as increases in stream flow velocities) are not directly addressed by this manual. Likewise, some wetlands, including bogs, are adapted to a very constant hydrological regime. Even the most stringent flow control standard employed by this manual does not prevent increases in runoff volume which can adversely affect wetland plant communities by increasing the duration and magnitude of water level fluctuations. Thus, compliance with this manual should not be construed as mitigating all probable and significant stormwater impacts to aquatic biota in streams and wetlands, and additional mitigation may be required.

In addition, the requirements in this manual primarily target the types of impacts associated with the most typical land development projects occurring in the lowland areas of the County. Applying these requirements to vastly different types of projects, such as rock quarries or dairy farms, or in different climatic situations, such as for ski areas, may result in poorer mitigation of impacts. Therefore, different mitigation may be required.

OVERVIEW OF CORE AND SPECIAL REQUIREMENTS

Core Requirement #1 Discharge at Natural Location
The Master Plan Update (MPU) development activities will result in modifications to the constructed and natural drainage systems within the Seattle-Tacoma International Airport (STIA) area. Below is a summary of STIA areas per the landuse tables in Appendices A and B. The differences in basin sizes can mostly be attributed to the collection and conveyance of potentially polluted stormwater runoff to the Industrial Waste Treatment System (IWS).

Summary of Drainage Basin Areas (acres)

	Calibration	PreDev	PostDev
Des Moines STIA	1672	1585	1577
Walker STIA	234	234	234
Miller STIA	1247	1212	1184
Total STIA Storm	3153	3031	2995
Des Moines IWS	285	331	375
Walker IWS	0	0	0
Miller IWS	0	86	80
Total STIA	3438	3448	3450

Note: numbers taken from landcover tables dated 12/00

Core Requirement #2: Downstream Analysis
Downstream analysis is provided in Appendix P of the document. Identified downstream problems include channel erosion and potential existing flooding problems in Miller Creek. The associated on-site mitigations for these problem types include,

Channel erosion - apply Level 2 streambank erosion standard

- The Level 2 standard is the base standard being applied across the project site. The entire airport site is being retrofitted back to predevelopment conditions corresponding to 75% forested, 15% grass, and 10% effective impervious. This will serve to reduce the existing rates of erosion, although the benefit will be diminished further downstream due to other existing development not having been retrofitted to the same level of protection. Implementation of the Des Moines Creek Basin Plan and development and implementation of a Miller/Walker Creek Basin Plan will help address stormwater needs across the entire basins.

Existing flooding problem - match 100-year peak flows in addition to the Level 2 standard.

- The SMP includes the matching of 100-year peak flows as a specific performance goal and was achieved through the flow control mitigations proposed.

Core Requirement #3: Flow Control
The SMP uses a flow control performance standard equivalent to the KCSWDM Level 3 standard. This includes the control of the duration of high flow discharges between 50% of the 2-year and the full 50-year peak flows. In addition, the 100-year peak discharge is controlled to the predeveloped 100-year level.

The SMP predevelopment landcover assumptions of 75% forest, 15% grass, and 10% maximum impervious provides a target flow regime that is more protective than the current "Existing Site Condition" requirements of the KCSWDM. Using general stream stability guidelines a basin consisting of 75% forest, 15% grass and 10% impervious would provide a flow regime predicted to be geomorphically stable, but

which may have some water quality and base flow concerns. However, since the airport drainage areas comprise a small portion of the entire stream basin, the instream benefits will be less than if all properties in these basins were retrofitted to this standard. Additional mitigations are being proposed to address summer low-flow impacts through a series of low-flow augmentation vaults. Water quality treatment and monitoring is proposed to help ensure that water quality standards would be met.

Under the KCSWDM, flow controls (detention/infiltration) would only be required for new added impervious. Under the draft updates to the Ecology stormwater manual and KCSWDM currently in preparation, flow control retrofits would likely be required for any replaced impervious surfaces. The Port is providing flow control retrofits for all impervious surfaces to the 75/15/10 landcover conditions described above, although this would not be required by the Ecology manual or by KCSWDM.

The enclosed table (Enclosure 2) provides an overview of the storage reservoirs reviewed under the SMP and the associated landcover (impervious and pervious) assumptions used to size these facilities. Enclosure 2 also provides a list of MPU projects identified to be served by each proposed facility.

The detention ponds located around the toe of the fill embankment could potentially be deep enough to intercept seasonal high groundwater. The SMP proposes that final facility design may be altered to maintain the live storage volume above the groundwater level. If this occurs, it may require raising of berm heights, increasing side slopes, or as a last resort, expanding the facility footprint. Facility footprints may not be able to increase due to site constraints. Modifications to SDN3A may result in that facility exceeding the threshold of State Dam Safety regulations.

The SMP uses a special PERLND calibration for the embankment fill. This calibration was based on limited monitoring data collected from a 1998 embankment area. The effect of this calibration is for fill soils to produce higher runoff than till-grass, but less than impervious. The SMP assumption is that the final embankment will react hydrologically similar to the smaller 1998 embankment area. The SMP has not changed this assumption since it was first proposed during the Miller Creek calibration meetings in Spring of 2000. Ecology's June, 2000 PGG report provides a range of expected soil characteristics for the fill embankment. The expectation is that fill soils will have a hydrologic response more similar to outwash grass with flat slopes than to the previous embankment fill calibration work. At this point in time there was a separation in assumptions between how the fill is characterized in the embankment modeling (used primarily for low stream flow assessment and wetland mitigation) and the SMP modeling (used primarily for high flow assessments, and flow control mitigation sizing). Based on the June 2000 characterization of the embankment's hydrologic response, the SMP assumptions would provide some conservatism in the design of flow control mitigations.

The SMP hydrologic models have assumed that all airport impervious areas are 100% effectively connected to the downstream drainage system. Therefore, the modeled impervious areas equal the total impervious areas. This assumption was used consistently in the HSPF models for all 3 stream basins for the calibration, future and predeveloped (meaningful where use of an effective impervious fraction would result in less than 10% effective impervious) landcover assumptions. If runoff from the runway does infiltrate into the fill embankment as indicated by the June 2000 PGG report, the effective impervious assumptions would provide some conservatism in the design of flow control mitigations.

Core Requirement #4: Conveyance Systems

The SMP indicates that all existing conveyance systems provide at least a 10-year level of capacity. All new conveyance systems will be designed to at least a 25-year level of capacity and will meet the spill containment provisions of the KCSWDM.

The project site includes the challenge of conveying flows down from the runway elevation to the detention and sediment control ponds at the foot of the embankment. The SMP provides, in Appendix W, conceptual designs for energy dissipation structures that will be used to control the high velocity flows at those outfalls.

Core Requirement #5: Erosion and Sediment Control
The SMP provides preliminary erosion and sediment control plans for the proposed 3rd runway embankment. Additionally, the SMP indicates that an erosion control specialist will be responsible for overseeing the installation and performance of these facilities. This is an important aspect of achieving effective erosion/sediment controls on projects of this size.

Of concern is the close proximity of some sediment ponds to the stream channels. However, this cannot be avoided due to the close proximity of the final embankment to the stream channels. Any overtopping, bypassing, or failure of these ponds may result in sediment being discharged to Miller Creek due to the short flowpaths from the ponds to the stream. Extra diligence on erosion control is warranted to minimize sediment transport from disturbed soils (e.g., the embankment fill) to the final sediment ponds. This would include, but is not limited to,

- soil stabilization and cover measures on all disturbed soils.
- minimizing the "open" (without cover measures) areas to only those portions of the project site which are being actively worked.
- further minimizing the areas being actively worked during the wet season (October 1 through April 30), and before forecasted precipitation events.
- frequent inspections of the erosion and sediment control facilities by the erosion control specialist.
- daily inspections of the sediment ponds in close proximity to the stream channels during the wet season, and
- contingency plans developed beforehand to address potential problems which may be encountered with any of the erosion and sediment control BMPs, with emphasis on the sediment ponds serving as the last line of defense prior to discharge to stream.

Core Requirement #6: Maintenance and Operation
This KCSWDM Core Requirement is mostly procedural in nature, written specifically to implement King County's policies and codes. This review is limited to compliance with the technical aspects of the KCSWDM and specifically excludes procedural requirements specific to King County. Therefore, Ecology should ascertain that adequate provisions and agreements are made to ensure the proper maintenance and operation of stormwater facilities on this project site.

The following is the reviewers understanding of maintenance and operation responsibilities at the project site: All facilities on the project site are to be maintained by the Port of Seattle, or their designee. Where maintained by others, Port of Seattle is ultimately responsible for proper maintenance and operations under their NPDES permit.

Some of the deeper vaults exceed the maximum allowable depth to invert (measured from final surface grade) of 20 feet. The SDS7 vault is proposed as an above ground storage structure. An assessment of maintenance feasibility has been provided which supports the SMP position that the Port will be able to perform necessary maintenance activities.

Core Requirement #7: Financial Guarantees and Liability
This SWDM Core Requirement is specific to procedures required under King County policy and code. The intent is to ensure that there is adequate funding available to ensure completion of the required mitigations. It requires that construction be completed, or the posting of bonds and other financial guarantees occur prior to final permit approval.

There are substantial costs associated with the proposed mitigations. Many of the facilities are proposed as underground vaults to avoid the wildlife attraction associated with open ponds. The largest of the eight flow control vaults will have 88 acre-feet of storage, nearly 4 acres in area at 25 feet of live storage depth. The Port has provided a memo indicating the feasibility of the structural design of this facility. A commonly used estimate of vault construction costs is $5- per cubic-foot. With a total volume for new vaults for flow control (347.1 acre-feet), water quality (4.5 acre-feet), and reserve storage (46.1 acre-feet) of 397.7 acre-feet, the total cost in vaults is at $86.6 million. Note: SMP uses a vault cost of about $12- per

cubic foot in assessing feasibility of some water quality retrofits. This value would put the total estimated total vault cost at $207.9 million.

Core Requirement #8: Water Quality
The SMP has provided conceptual designs for water quality treatment facilities consistent with those found in the KCSWDM Basic Water Quality Treatment Menu. The performance goal of basic water quality treatment is 80% TSS removal. The SMP proposes to provide treatment for all new pollution generating surfaces and for all existing pollution generating surfaces through a combination of biofiltration, wetvaults and reroutes to IWS system. Review of these conceptual designs has concluded that they are sized appropriately for the assumed service areas and that they can feasibly be constructed consistent with KCSWDM design standards. STIA areas not proposed for water quality treatment include:

- Approximately 80 acres of existing pollution generating impervious surfaces as shown in SMP Figure 4.4 and Table 7-8. The SMP indicates that the high cost and disruption to airport operations associated with construction of underground wetvaults for these areas make water quality retrofits impractical.

Two instances where source controls are proposed in-lieu of water quality treatment include;
- Landscape Management Plans which implement the source control objectives of the KCSWDM are proposed for all managed landscaped areas, including the runway/taxiway infields.
- Uncoated Metal Roofs are proposed to be coated to prevent leaching. Although not specifically mentioned as an option in the KCSWDM, this approach is consistent with the intent of requiring water quality treatment only for uncoated metal roofs. If the coating process is not successfully completed, water quality treatment would be required.

The above approaches were determined to be consistent with the KCSWDM application of water quality treatment standards for new and redeveloping properties. SMP Table 7-8 provides an overview of the proposed water quality treatment facilities for new and existing pollution generating impervious surfaces.

Previous comments have been provided in regards to copper (Cu) concentrations from some of the existing STIA outfalls. The SMP indicates that the stormwater collection and conveyance system design can accommodate additional water quality treatment measures if deemed necessary through continued monitoring.

The STIA Industrial Wastewater System (IWS) is regulated by Ecology under the Clean Water Act Section 402. The KCSWDM does not set standards for industrial wastewater systems, such as the IWS. The TSS removal efficiency of the IWS is not presented in the SMP. Evaluation of the IWS storage capacity using future landcover, storage capacity, and processing rates indicated that the IWS lagoons are not predicted to overtop to stream. The biggest concern is the sustainability of the assumed future processing rate. As the IWS outfall is proposed to be redirected to the sanitary sewer which may include constraints on allowable processing rates, the issue of potential overtopping should be addressed once future maximum discharge rates to sanitary sewer have been determined. The SMP results do not support the contention of the IWS feasibility report that sufficient storage exists to allow the IWS discharge to be slowed or stopped during storm events. It may be necessary for the Port to retain the use of the current outfall to Puget Sound depending on conditions placed on the proposed connection to sanitary sewer. Since specific future storm volumes cannot be reliably predicted, the IWS operation appears to require near maximum processing rates (3.2 to 4.0 mgd) whenever lagoon #3 is receiving inflows. Any additional areas being rerouted to IWS and not included in the analysis would also warrant evaluation. Note: The modeled future IWS service area includes approximately 410 acres of impervious and 24.6 acres of grassed pervious area. The ultimate storage volume is modeled as 76.9 million gallons, and the maximum sustained processing rate is assumed whenever lagoon #3 is storing wastewater.

Special Requirement #1: Adopted Area Specific Requirements
This would include the Des Moines Creek Basin Plan. The SMP mitigations do not rely on construction of the regional detention facility, or low flow augmentation facility for mitigating existing or new impervious

areas. However, the SMP indicates that if conditions change (e.g., the regional facility is constructed prior to MPU development), that the SMP mitigations may be revised. Since this alternative approach was not analyzed by the SMP, Ecology review and approval of the plans and sizing for final construction may be necessary. The Port is an active member of the Des Moines Creek Basin Committee.

Special Requirement #2: Floodplain/Floodway Delineation
A copy of the floodplain analysis on Miller Creek is included in SMP Appendix J. MPU development has been identified within the floodplain delineation, specifically the 156th/154th roadway realignment in the Vacca farm area, and a relatively small displacement from the 3rd runway embankment near where Miller Creek turns west towards SR509. Calculations provided demonstrate that the roadway realignment is fully compensated for in the Vacca farm area at the 100-year level flood. The embankment calculations indicate that an additional 5 cubic yards is displaced by the embankment footing. The indication is that the base floodplain elevation was determined to not rise due to this amount of displacement, which in turn will not affect the flood carrying capacity of the stream.

Special Requirement #3: Flood Protection Facilities
This special requirement is not applicable as none of the streams are restrained by levees or revetments in the vicinity of the project site.

Special Requirement #4: Source Control
The SMP proposes the use of source control BMPs, many of which are currently being applied to maintenance and operations of the site. Two new source control BMPs are proposed for the site under the SMP. These include retrofitting of existing non-coated metal roofs to prevent leaching of metals, and the implementation of improved landscape management guidelines to minimize the use of pesticides and fertilizers to managed landscape areas including the infield areas surrounding the runways and taxiways. Both of these source control BMPs are consistent with the requirements of the KCSWDM.

Special Requirement #5: Oil Control
Several areas within the project site meet the threshold for high-use sites under the KCSWDM criteria. Most of these areas are being, or are proposed to be, diverted to the IWS which has oil control and spill containment provisions and is regulated as an industrial wastewater discharge rather than a stormwater discharge. One additional area was identified under the SMP as meeting the high-use threshold, the Terminal Drives. The SMP proposes to either install treatment BMPs to this area, or to divert these areas to the IWS. Both alternatives appear to be feasible and consistent with the requirements of the KCSWDM.

'acility

l in	Year Project to be Constructed	Comments	Effective Impervious or Total Area	Existing Conditions 1994	Predeveloped Conditions (flow control targets) PRE	Future Conditions (Area Served by Facility) FUTURE	Existing/Replaced Impervious to be Retrofitted RETROFIT (=1994 - PRE)	Post-1994 and Future Added Impervious (Controlled) NEW (=FUTURE-1994)	Impervious Surfaces Mitigated TOTAL (=FUTURE - PRE)
			LANDCOVER ASSUMPTIONS BY FACILITY (acres) EIA = Effective Impervious Area				IMPERVIOUS SURFACES (acres) (MITIGATION BREAKDOWN)		
	1996	retrofit	EIA	19.2	6.5	32.5	12.7	13.3	26.0
	10 -- 15	retrofit	Total Area	64.6	64.6	64.6			
	06 -- 10	retrofit and new							
	1995	retrofit	EIA	178.3	37.6	203.4	140.8	25.0	165.8
	1997	new	Total Area	376.0	375.7	375.9			
	1998	new	****includes SDS3 and SDS5 landcover						
	1999	new							
	1998	new	EIA	7.1	7.0	35.1	0.1	28.1	28.2
	1999	new	Total Area	69.8	69.8	69.8			
	04 -- 06	new	EIA	13.8	10.5	40.4	3.3	26.6	29.8
			Total Area	117.2	117.1	117.1			
	00 -- 00	retrofit	EIA	141.2	21.8	176.7	119.4	35.5	154.9
	00 -- 02	retrofit	Total Area	218.2	218.2	218.2			
	02 -- 04	retrofit							
nal)	99 -- 04	retrofit							
nts, ntry									
	1998	retrofit	DES MOINES						
	04 -- 07	new	TOTALS	1994	PRE	FUTURE	RETROFIT	NEW	TOTAL
	02 -- 04	retrofit	EIA	359.6	83.3	488.0	276.3	128.4	404.7
nal)	02 -- 05	retrofit and new	Total Area	845.7	845.5	845.6			
			Total Live Storage		161.4 Ac-Ft				
nts, ntry									
	02 -- 05	retrofit and new							
	04 -- 06	new							
SA)	04 -- 06	new							
ex to									
	04 -- 06	new							
ty									
	01 -- 05	retrofit							
)	06 -- 08	retrofit							
	06 -- 08	retrofit							
	06 -- 07	retrofit							
r									
	06 -- 08	retrofit and new							
	06 -- 09	retrofit							
ier)	06 -- 10	retrofit							
	06 -- 10	retrofit							

			LANDCOVER ASSUMPTIONS BY FACILITY (acres) EIA = Effective Impervious Area				IMPERVIOUS SURFACES (acres) (MITIGATION BREAKDOWN)		
ed in	Year Project to be Constructed	Comments	Effective Impervious or Total Area	Existing Conditions 1994	Predeveloped Conditions (flow control targets) PRE	Future Conditions (Area Served by Facility) FUTURE	Existing/Replaced Impervious to be Retrofitted RETROFIT (=1994 - PRE)	Post-1994 and Future Added Impervious (Controlled) NEW (=FUTURE-1994)	Impervious Surfaces Mitigated TOTAL (=FUTURE - PRE)
	04 -- 05	new	EIA	32.5	7.0	49.7	25.5	17.2	42.7
	1995	retrofit	Total Area	92.1	88.9	88.9			
	1998	new							
	1999	new							
way 16L	2000	retrofit							
acilities th	01 -- 05	retrofit	EIA	1.1	0.8	8.1	0.3	7.1	7.3
	06 -- 10	new	Total Area	8.1	8.1	8.1			
und	01 -- 06	retrofit and new	EIA	41.2	6.4	13.2	34.9	-28.0	6.9
			Total Area	65.3	65.3	21.6	****includes diversion to IWS		
	1995	retrofit	EIA	14.5	4.8	24.3	9.7	9.8	19.5
	1998	new	Total Area	73.2	73.2	73.2			
	1999	new							
	1998	retrofit	EIA	0.9	4.2	32.3	-3.4	31.4	28.1
			Total Area	42.3	42.3	42.3	**** more EIA in PRE than 1994		
							****effectively 90% retrofit of NEPL		
	04 -- 06	new	EIA	0.9	0.9	15.4	0.0	14.6	14.6
			Total Area	52.8	53.0	52.8			
	04 -- 06	new	EIA	4.3	4.3	27.0	0.0	22.6	22.6
			Total Area	96.9	96.9	96.9			
	04 -- 06	new	EIA	1.9	1.9	8.2	0.0	6.4	6.4
			Total Area	30.5	30.5	30.5			
	01 -- 04	new	EIA	1.0	0.1	0.8	0.8	-0.1	0.7
			Total Area	3.9	3.9	3.9			
	02 -- 03	154th/156th providing flow control for 10% of NEPL							
	02 -- 03	154th/156th							
	2	temporary not included in SMP							
			MILLER TOTALS	1994	PRE	FUTURE	RETROFIT	NEW	TOTAL
			EIA	98.2	30.4	179	57.8	80.7	138.7
			Total Area	465.1	462.0	417			
			Total Live Storage		176.3 Ac-Ft				

			LANDCOVER ASSUMPTIONS BY FACILITY (acres) EIA = Effective Impervious Area			IMPERVIOUS SURFACES (acres) (MITIGATION BREAKDOWN)		
d in	Year Project to be Constructed	Comments	Effective Impervious or Total Area	Existing Conditions 1994	Predeveloped Conditions (flow control targets) PRE	Future Conditions (Area Served by Facility) FUTURE	Existing/Replaced Impervious to be Retrofitted RETROFIT (=1994 - PRE)	Post-1994 and Future Added Impervious (Controlled) NEW (=FUTURE-1994)	Impervious Surfaces Mitigated TOTAL (=FUTURE - PRE)
	04 -- 06	new	EIA	3.3	2.2	9.5	1.1	6.2	7.3
			Total Area	44.6	44.9	44.5			
	1	temporary not included in SMP							
	no impervious								
	no impervious								
	no impervious								
	no impervious								
acation	impervious removed								
		TESC ponds							
		TESC ponds							
	mid-project	TESC ponds							
	mid-project	TESC ponds							
	mid-project	TESC ponds							
	00--05	IWS							
East	2000	IWS							
	02--05	mid-project							
s	project cancelled								
rage	01--05	IWS							
	01 -- 05	not included in SMP							
	06 -- 10	not included in SMP							
age	06 -- 10	not included in SMP							
	06 -- 10	not included in SMP							
	10 -- 13	not included in SMP							
	10 -- 20	WSDOT project							
	02 -- 04	not included in SMP							