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**BEFORE THE POLLUTION CONTROL HEARINGS BOARD
STATE OF WASHINGTON**

AIRPORT COMMUNITIES
COALITION,

Appellant,

CITIZENS AGAINST SEA-TAC
EXPANSION,

Intervenor/Appellant,

v.

STATE OF WASHINGTON,
DEPARTMENT OF ECOLOGY; and
PORT OF SEATTLE,

Respondents.

PCHB No. 01-160

DIRECT TESTIMONY OF KELLY
WHITING SUBMITTED ON
BEHALF OF THE DEPARTMENT OF
ECOLOGY

AR 003026

ORIGINAL

1 Kelly Whiting declares as follows:

2
3 **I. My Background**

4 1. I am an Engineer III (Senior Engineer) employed by the King County
5 Department of Natural Resources and Parks. I have held that position since June 1, 1994. My
6 duties include the development and maintenance of an HSPF based continuous hydrologic
7 computer model, development and implementation of stormwater regulations, basin plan
8 implementation, development of subbasin compliance program, preparation of engineering
9 studies of complex drainage problems, training and technical support on hydrologic/hydraulic
10 modeling and mitigations for review engineers, designers, hydrologists, and regulators from
11 other jurisdictions (e.g., Ecology, local cities), and lead technical staff for development of the
12 1998 King County Surface Water Design Manual (Manual). I also provided technical support
13 for Ecology's 2001 stormwater manual update. I have 11 years of experience in stormwater
14 management including the review of stormwater management plans for compliance with the
15 Manual. My educational background is a Bachelor of Science in Civil Engineering,
16 University of Washington, 1990. I am a licensed professional civil engineer in Washington
17 State with expertise in hydrology and surface water management. My resume is attached
18 hereto as Attachment A.

19 **II. My Review**

20 2. Pursuant to a contract between the Department of Ecology and King County, I
21 reviewed the Port of Seattle's (Port) Comprehensive Stormwater Management Plan (SMP) for
22 Master Plan Update Improvements at SeaTac International Airport (STIA) on behalf of
23 Ecology. I also reviewed the Port's Low Flow Impact Analysis-Low Flow Impact Offset
24 Facility proposal on behalf of Ecology (Low Flow Plan). These two plans are related because
25 the hydrologic computer models used for purposes of the SMP also were used to model low
26 flows resulting from the STIA expansion project. Also, the facilities designed by the Port to
manage stormwater are related to the facilities designed to offset the low flows. I have spent

1 hundreds of hours providing review services and in technical meetings with Ecology staff, the
2 Port's consultants, and others, discussing and reviewing these plans. Many of those meetings
3 were facilitated by Floyd and Snider and the substance of the meetings are documented in
4 facilitated meeting notes.

5 3. My review of the SMP was limited to determining compliance with the
6 performance standards in the Manual. The scope of my review and my comments on the SMP
7 are set forth in a letter from King County to Ecology dated August 3, 2001 signed by Pam
8 Bissonnette. In general, I concluded that the SMP meets the technical performance goals of
9 the Manual for both flow control and water quality treatment. In some instances, the SMP
10 goes beyond the requirements of the Manual.

11 III. The Stormwater Management Plan

12 4. The Port's SMP proposes to manage stormwater by identifying and sizing flow
13 control and water quality treatment facilities for both new and existing development at STIA.
14 The flow control facilities include primarily ponds and vaults. The water quality treatment
15 facilities include filter strips, wetvaults, bioswales and similar facilities that filter and treat
16 stormwater before it discharges to area streams. The Port's storm drain system (SDS) has a
17 number of outfalls that are designated by number and location. Thus, "SDN1" refers to a
18 storm drain outfall in the north part of the airport, "SDS3" refers to an outfall in the south part
19 of the airport, while "SDW1" refers to an outfall on the west side of the airport. The location
20 of the Port's proposed and existing outfalls, and stormwater detention facilities, is shown on
21 maps and figures in the SMP. See, for example, Figure 6-1.

22 5. The Port utilized the Hydrologic Simulation Program - Fortran (HSPF)
23 computer model to develop the SMP. This model is well accepted in the field of stormwater
24 management. Basically, what the model does is simulate stormwater flows and stream flows
25 based on given data about land coverage, soil type, rainfall, groundwater movement, and other
26 factors. The HSPF model includes settings which control the hydrologic response

1 characteristics of different combinations of soil and landcovers. These data are referred to as
2 the model's input parameters. For example, for a given year, the hourly rainfall for that year
3 may be obtained and input into the model along with information regarding land coverage and
4 hydraulic routing to obtain a simulated hydrograph of area streams. The land coverage data is
5 expressed in terms of acreage of various soil and landcover types, such as effective
6 impervious, till soils with forest cover, and outwash soils with grass cover. The intent is to
7 develop a model of the tributary drainage area (basin) that mimics the observed hydrology.
8 Within the framework of the calibrated model, the project site's landcover assumptions can be
9 run backwards or forwards in time to simulate pre- and post-project conditions. The pre-
10 project simulated flows establish the target flow regime to be met by the SMP. Flow control
11 facilities may then be designed, using post-project simulated flows, to match the target flow
12 regime.

13 6. In the case of the Port's SMP, the 1994 base year condition was chosen and the
14 regional average HSPF input parameters were adjusted through a model calibration process to
15 improve the ability of the model to mimic the observed hydrology. Pre-project conditions
16 were defined using a theoretical set of conditions of 75% forested, 15% grass, and 10%
17 maximum impervious. This theoretical condition is more restrictive than would be required
18 by the Manual, which generally uses a base year of 1979. The theoretical condition used by
19 the Port is more restrictive because it means that the Port's flow control facilities must meet a
20 target flow regime based on essentially predevelopment conditions. Under such conditions,
21 stormwater flows generally are released to the streams at a slower rate than under existing and
22 future developed conditions. Using the theoretical pre-developed condition in the Port's SMP
23 results in detention facilities that are sized much larger than would normally be required by
24 the Manual. In addition, the Port's SMP proposes to retrofit existing outfalls to meet this
25 more stringent target flow regime.

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1 were sufficiently calibrated for the purpose of sizing flow control facilities in the SMP. The
2 Des Moines Creek model is based on the existing basin planning model used in the Des
3 Moines Creek Basin Plan. Minor refinements were made to model parameters in the SMP, in
4 conjunction with updated landcover and groundwater routing information. The Miller Creek
5 model is based on the model used for the Port's Environmental Impact Statement. This stream
6 model was recalibrated in 2000 using improved landcover information and field data. At the
7 same time, a unique calibration for Walker Creek was developed, which resulted in a
8 substantially different calibration than had been previously used (previously assumed to be
9 same as Miller Creek). These calibration efforts have been demonstrated to provide improved
10 accuracy over previous modeling efforts and over the usually accepted regional average
11 parameters.

12 **V. Water Quality Treatment**

13 10. With respect to water quality treatment, the Port's SMP for STIA proposes to
14 utilize various source control and treatment BMPs for treatment of stormwater. The BMPs set
15 forth in the SMP satisfy the requirements of the Manual's basic water quality treatment menu.
16 The particular BMPs proposed for each new and existing outfall at STIA are set forth in the
17 SMP in Table 7-8. The Manual contains additional treatment menus, such as the resource
18 stream protection menu, which include enhanced water quality treatment facilities. However,
19 these enhanced treatment menus are not typically applied to projects in Miller, Walker and
20 Des Moines creeks, as those creeks are not known to meet the criteria for application of these
21 menus. Nevertheless, the SMP states that "on-going water quality monitoring may indicate
22 the need for future additional water quality BMPs. Technology in the field is continually
23 improving the effectiveness and application of new water treatment systems. While the
24 airport has unique operational requirements (i.e. wildlife control), the proposed drainage
25 design would allow the application of future stormwater treatment technology to the proposed
26 drainage system." Sec. 2.2.2. It is my understanding that Ecology may require the Port to

1 institute additional treatment BMPs. It is my opinion that doing so is feasible under the
2 proposed SMP.

3 11. The treatment goal in the Manual under the basic menu is 80% removal of total
4 suspended solids (TSS). Based on my review of the Port's SMP, the proposed facilities can
5 be designed consistent with the Manual's design criteria which should meet that goal.
6 Concern has been expressed by the ACC regarding dissolved metals in the Port's stormwater
7 discharges. The Manual's basic menu is not designed to remove dissolved metals; however,
8 the treatment BMPs proposed by the Port should be partially effective at removing metals
9 because some of those metals will be associated with solid particles. The monitoring data
10 provided in the SMP does not provide sufficient information to determine the breakdown of
11 particulate and soluble fractions. The Manual's Full Drainage Review application of treatment
12 menus would not require additional treatment for dissolved metals in these stream basins.
13 Additionally, the Manual would not require water quality retrofits for existing pollution
14 generating surfaces not being redeveloped, yet the Port's SMP proposes such retrofits. For
15 example, section 7.1.4 of the SMP states: "Additional BMPs were identified to provide runoff
16 treatment to the maximum extent practicable for subbasins where existing BMP coverage is
17 not consistent with the Ecology Manual."

18 12. The ACC contends that the Port's STIA Master Plan Update projects SMP
19 does not comply with the King County Manual because it did not go through large site
20 drainage review as it would have been required to do had the procedural aspects of the Manual
21 been applied to the project. Large site drainage review is a process set forth in the Manual to
22 tailor stormwater mitigations to specific landuses and natural resources. The performance
23 standards established in the Manual that would otherwise apply to a project may be varied
24 through this process. In this case, the large site drainage process was not followed because the
25 Manual does not directly apply to the project, and my scope of review specifically excluded
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1 any procedural requirements of the Manual. It is not possible to predict what the outcome
2 would have been in terms of performance standards, had that process been followed.

3 VI. The Low Flow Plan

4 13. The Port's Low Flow Plan proposes to offset annual low flow impacts to
5 Walker, Miller, and Des Moines creeks by treating, capturing, and storing stormwater during
6 winter storm events and then releasing the water in a controlled manner to the streams during
7 annually occurring low flow periods. The plan proposes to provide three months of late-
8 summer/early-fall flow augmentation via actively managed reserve storage vaults. On behalf
9 of Ecology, I reviewed the Port's July 2001 Low Flow Plan and the Port's revised December
10 2001 Low Flow Plan. My comments with regard to the July 2001 Plan were set forth in a
11 letter from Pam Bissonnette to Ecology dated August 3, 2001. In my August 3 comments, I
12 expressed several concerns regarding the Low Flow Plan. Many of these concerns have been
13 resolved or rendered moot by the December 2001 plan. The December plan represents a
14 substantial improvement in level of detail and documentation over the July plan.

15 14. Both the December and the July plan utilize HSPF modeling to determine the
16 extent of low flows to be experienced in the creeks after project completion. In particular, the
17 Port utilized the 1994 calibration model to simulate preproject flows and then modeled the
18 2006 conditions to simulate post project flows. The 1994 model used by the Port for the
19 December Low Flow Plan differed in its land cover assumptions and groundwater routing
20 from the 1994 calibration model developed for the SMP. It is not known whether this
21 redefining of 1994 existing conditions would alter the base model calibrations, or whether a
22 refined calibration would make a difference to the proposed low flow offset mitigation.
23 Therefore, one of my comments on the December low Flow Plan is that the Port prepare a
24 validation report to verify the base calibration work under the revised 1994 existing condition
25 assumptions. If this validation report confirms the use of the existing calibrations, it is my
26 opinion that the calibration of the models is sufficient to accurately predict low flow impacts

1 in Miller and Walker creeks, provided some adjustments and checks are performed as will be
2 explained more fully below. The Des Moines creek calibration matches the basin plan model
3 with two exceptions. The HSPF input parameter DEEPFR, controlling the lose of
4 groundwater to a deeper aquifer, was reduced which would be associated with a higher impact
5 (per pervious acre lost) than the basin plan model. Secondly, the IRC parameter, which
6 controls the discharge of shallow groundwater, was increased which would not be expected to
7 have much effect on the simulation of low flows.

8 15. The December plan proposes to offset low flows in Walker and Des Moines
9 creeks using stormwater captured in reserve storage vaults. The conceptual vault designs
10 include a number of design features used in standard wetvaults used to provide water quality
11 treatment. These include passive aeration, long flowpath lengths, depths not greater than
12 eight feet, along with water quality monitoring prior to discharge. Water will be delivered
13 from the vaults to the streams via pipes and open channels discharging to wetlands adjacent to
14 the streams. My review comments recommend evaluation of a more direct outfall location for
15 Des Moines Creek.

16 16. I have reviewed the December 2001 plan in detail and it is my conclusion that
17 the low flow offset mitigations proposed can be feasibly implemented. However, I have
18 several outstanding comments. Included in my comments are the recommendations that the
19 Port re-evaluate reserve storage fill times in the Walker creek vault to insure sufficient water
20 can be collected in a timely manner to offset the predicted low flow impacts in Walker Creek,
21 and that the Port correct modeling inconsistencies in Miller Creek prior to determining
22 whether there are low-flow impacts to Miller Creek. My specific comments are set forth in
23 draft form in a memorandum I prepared dated February 23, 2002. Since preparing that
24 memorandum, I have received additional information from the Port that, as of this date, I have
25 not had the opportunity to fully review. It appears that the material is intended to address a

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1 portion of my comments but I have not reviewed it in detail. It is expected that Ecology will
2 receive additional related materials from the Port.

3 VII. Comments on ACC's Testimony

4 17. I have reviewed the declarations filed by the Airport Communities Coalition
5 (ACC) in the above-referenced case. I can offer the following comments related to those
6 declarations. The calibrations were first presented to me in the 11/99 SMP. The Port revised
7 the calibration for Miller/Walker a few times in 2000. The last of these revisions included
8 "real-time" review by myself and an experienced HSPF modeling consultant working on my
9 behalf. Substantial improvements were made to those stream models as a result of this direct
10 oversight, as acknowledged in ACC comments from that period. At the completion of that
11 process, the HSPF models for Miller and Walker creeks were accepted for use in the design of
12 stormwater mitigations included in the SMP. At the same time, the Des Moines Creek
13 calibration was accepted based on the finding that it was substantially unchanged from the
14 model developed by King County for the Des Moines Creek basin plan, which is being used
15 to develop regional stormwater mitigations for both peak and low flow conditions. While
16 these calibrations fall short of providing a perfect match to observed data, they constitute an
17 improvement over the regional average parameter settings used by most development
18 proposals subject to the Manual.

19 18. A comparison of the Des Moines Creek simulated low flows to observed data
20 was first provided in the December 2001 report, and does show a pronounced underestimation
21 of low flows at Tyee Pond. While my scope of review focused on ensuring consistency
22 between the SMP modeling and the low-flow plan modeling, my comments do include the
23 recommendation that the problems be investigated and there be a validation report prepared
24 which looks at the KC gauge 11F and compares the results of the current calibration against
25 the original basin plan calibration work. In general, it is my opinion that the low flow
26 mitigations being proposed constitute a substantial amount of mitigation beyond the minimum

1 requirements of the Manual. In some years the Des Moines Creek low flow offset will be
2 providing 25% of the in-stream low flow. Groundwater routing assumptions are often
3 speculative, but the SMP includes groundwater mapping that supports the contention that
4 there is a substantial amount of groundwater tributary to Walker Creek that comes from areas
5 providing surface runoff to adjacent streams. A reassessment of GIS data performed in
6 November 2001 appears to have resolved problems with overlap of tributary groundwater
7 areas.

8 19. The modeling of the embankment using Hydrus under future conditions was
9 done due to the inability of the HSPF model to simulate the hydrologic response of the deep
10 embankment material. The Hydrus runs were reportedly conducted using assumptions
11 consistent with previous modeling work performed for Ecology, from which the resulting
12 instream flows are compared to the basin specific runoff response of the existing soils as
13 defined by the HSPF calibrations. This was the recommended approach of the consultant who
14 conducted the independent embankment study for Ecology. My draft review comments
15 include recommendations that the groundwater seepage from the Miller Creek embankment
16 be introduced to the stream model at a point further downstream, consistent with previous
17 modeling work. The SR509 point of compliance is also recommended to be moved one
18 stream reach further downstream to coincide with the furthest upstream point at which all
19 hydrologic changes associated with STIA activities are accounted for in the model. This may
20 actually result in reduced simulated impacts as it often becomes harder to distinguish project
21 related impacts further downstream due to mixing of project flows with additional off-site
22 flow contributions from lakes and other baseflow sources.

23 20. My review comments recommend the correction of the direct precipitation
24 onto PERLND80, consistent with ACC findings, in addition to other modeling inconsistencies
25 found during my review. My review also raised concerns related to the ability of the proposed
26 monitoring to assess the hydrologic performance of the embankment. The use of hourly

1 timesteps was recommended by the modelers, and is an improvement on the previous
 2 embankment recharge analysis, and was accepted due to the long, relatively flat dispersed
 3 flowpaths provided by the extra long filter strip areas. It is my understanding that these
 4 review comments are currently being addressed and that a revised impact analysis will be
 5 submitted to Ecology.

6 21. The ACC assertion that water quality retrofits have not yet been determined is
 7 not entirely correct. The SMP identifies water quality treatment retrofits to the Manual's basic
 8 water quality treatment standard for all but 80 acres of pollution generating surfaces. These
 9 80 acres were presented as being impractical for retrofits at this time, consistent with
 10 provisions of the Ecology manual. It is worth noting that the King County manual does not
 11 require retrofits (water quality or flow control) of existing developed areas not being
 12 redeveloped. Also, the SMP does not propose deferring decisions on flow control (detention)
 13 retrofits. However, the SMP does indicate that if regional detention is constructed that the
 14 SMP detention facility needs may be reassessed, which presumably would be subject to
 15 Ecology review.

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

18 DATED this 7th day of March, 2002.

19
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 21 _____
 22 KELLY WHITING

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 25
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Kelly R. Whiting

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Seattle, WA 98103
W: (206) 296-8327
H: (206) 784-5955

Summary of Qualifications

- ⇒ *Professional Civil Engineer, State of Washington*
- ⇒ *Experience in performing hydrologic/hydraulic analyses of complex drainage systems*
- ⇒ *Knowledgeable in local and state stormwater regulations*
- ⇒ *Able to manage multiple projects to completion.*
- ⇒ *Computer experience with the following programs: KCRTS-Runoff Files, KCBW-Backwater, SBUH based models, ArcView, Word, Excel, Powerpoint, FORTRAN-90, HSPF, Annie, HEC2, d-Base.*

Professional Experience

King County, Surface Water Management Seattle, WA

June 1994 to Present

Senior Engineer-Engineering Studies and Standards. Managed the development and implementation of an HSPF-based continuous hydrologic computer model including the instruction of computer workshops. Senior lead staff providing engineering and hydrologic modeling support for the development, implementation, and State NPDES equivalency review for the 1998 updates for the Surface Water Design Manual. Oversee and support a pool of engineers in providing technical support for the County's stormwater standards and hydrologic/hydraulic models. Provided technical input and review for the Tri-County ESA 4d proposal and State Ecology SWM manual update. Provide stormwater expertise and review services to local jurisdictions and state agencies. Provide support for the preparation and implementation of large- and small-scale basin plans through technical assistance in developing mitigation measures consistent with protection goals, implementation of regulatory standards, and hydrologic modeling support for CIP design. Developing program for the completion of Subbasin Compliance Plans (small-scale basin plans) in response to anticipated NPDES Phase I permit requirements. Responsible for the maintenance of hydrologic/hydraulic model source code, GIS coverages for geographic-based stormwater standards, stormwater management standard drawings, and drainage webpages. Perform engineering studies of complex drainage problems, and case study analyses for proposed stormwater standards.

King County, Surface Water Management Seattle, WA

March 1992 to June 1994

Engineer- Engineering Studies. Apply engineering principles and methodologies to analyze complex drainage problems. Conduct hydraulic and hydrologic analyses of complex drainage problems. Identify alternative solutions and perform cost-benefit analysis on alternatives. Coordinate involvement of other work units, such as survey or ecological review. Prepare written report and engineering sketches and transmit the most cost effective solution to construction or final design. Monitor progress until completion.

King County, Building and Land Development Bellevue, WA

May 1990 to March 1992

Engineer-Engineering Review. Review of engineering plans in conjunction with urban development in the following areas, hydraulic analysis of drainage systems, floodplain analysis, roadway design, and sensitive area protection. Review and recommend conditions of approval for subdivisions applications, right-of-way use permits and Surface Water Management variances. Produce staff reports and provide testimony at public hearings. Work and communicate directly with technical/clerical staff, other departments, developers, design engineers, property owners and concerned citizens.

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Kelly R. Whiting

A d d i t i o n a l E n g i n e e r i n g E x p e r i e n c e

**University of Washington, Environmental
Engineering Department**
Seattle, WA

January 1990 to July 1990

Research Assistant. Conduct research experiments on ion absorption kinetics, collect and analyze samples using ICP atomic emission spectrophotometer, compile and present data.

**City of Ellensburg, Public Works (Water)
Department**
Ellensburg, WA

June 1985 to September 1989

Student Summer Intern. Performed fire hydrant, mainline and service installation and repair, design and installation of thrust blocks, contractor oversight on two street projects, valve inspection and mapping project, installation and maintenance of automated sprinkler systems, park maintenance.

Department of Energy, Richland Operations Office
Richland, WA

January 1988 to June 1988

Engineering Student Intern. Transmitted monthly NPDES discharge monitoring reports to regulatory agencies, oversaw sanitary landfills, modified and implemented a division-wide commitment control system in d-Base, participated in audit of contractor's groundwater monitoring program, coordinated site-wide review and comments on proposed DOE directives.

**Central Washington Univ., Engineering
Department**
Ellensburg, WA

September 1985 to September 1986

Surveyor/Engineering Aide. Conducted radial surveys and mapping projects, field inspections, soil and concrete tests. Drafted As-Built diagrams and bid proposals.

E d u c a t i o n , T r a i n i n g a n d O r g a n i z a t i o n s

Bachelor of Science Civil Engineering University of Washington 1990

**Blackberry Creek
Futures Project (pending) Presenter USEPA, Kane County, IL Dec. 2001**

Low Impact Development 2-day Puget Sound WQ Action Team 2001

Urban Stream Protection Presenter Canada Fisheries and Oceans 1997

HEC-2 Backwater 3-day West Consultants 1994

HSPF10 2-day Aqua Terra Consultants 1993

Volunteer King County Flood Warning Center 7 years

Professional Civil Engineer State of Washington 1995

Member American Society of Civil Engineers 1988

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