

D. Garland

AR 015610

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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

**REVISED DIRECT TESTIMONY OF
DAVE GARLAND SUBMITTED ON
BEHALF OF THE DEPARTMENT OF
ECOLOGY**

AR 015611

1 **I. My Background**

2 1. I am employed by the Department of Ecology in the Water Quality Program in
3 the Northwest Regional Office. I am a hydrogeologist and supervisor of the Watershed Unit at
4 Northwest Region Water Quality. The Watershed Unit is responsible for surface water cleanup
5 planning (TMDLs), implementation of the Forests and Fish Agreement, and Water Quality
6 Financial Assistance. I have been a hydrogeologist for 24 years and employed by Ecology
7 since October, 1979. My duties as a hydrogeologist during my tenure with Ecology have
8 included investigating and preparing findings for water right applications, defending
9 controversial water right decisions before the Pollution Control Hearings Board, providing
10 expert testimony at EFSEC hearings for proposed Northern Tier pipeline river crossings,
11 investigating and reporting on groundwater quality impacts at dairies, gravel mines and at
12 wastewater land application sites. I also served on a state personnel committee which
13 established the state Hydrogeologist employee classification.

14 2. During my tenure with Ecology, I authored or co-authored the following reports
15 and publications; Seawater Intrusion on South Camano Island, Washington, Water Rights near
16 Lake Sawyer, King County Washington, High Rock Aquifer Break of 1993 (co-authored),
17 Groundwater Quality Survey near Edaleen Dairy, Whatcom Co., WA(1994), Groundwater
18 Contamination at Plowman Dairy near Yelm, Washington, Groundwater Impacts at Alger
19 Rock Quarry, Bellingham Frozen Foods Response Summary, and San Juan Watershed Water
20 Quality Needs Assessment.

21 3. During most of the year 2000, I was Ecology's lead in managing special
22 legislature mandated SeaTac Runway Fill and Maury Island gravel mining studies. Managing
23 the studies involved developing the Request for Proposals, selection of a consultant, periodic
24 briefings on study results, news releases, fact sheets, stakeholder meetings with legislators &
25 Port of Seattle, and public meetings to present the study results. The lead consultants selected
26 to conduct the studies were Pacific Groundwater Group (PGG) of Seattle. Charles Ellingson

1 was the Runway Fill Studies Project Manager for PGG. The studies culminated in reports
2 which contained data, analyses, modeling results and findings of the consultants and
3 recommendations for the proposed projects; a proposed Maury Island gravel mine and the
4 SeaTac third runway fill embankment. The study results pertinent to the third runway are
5 found in PGG's SeaTac Runway Fill Hydrogeologic Studies Report dated June 19, 2000
6 (PGG, 2000).

7 4. During my management of these studies for Ecology, I became familiar with the
8 Hydrus and Slice models being used by PGG to characterize hydrologic impacts of the runway
9 fill embankment. The models proved to be useful in depicting the delay and dampening effects
10 of the fill on water infiltrating into the embankment. Since the Maury and SeaTac studies were
11 completed, I have been involved to a lesser degree as a reviewer in Ecology's SeaTac Third
12 Runway Project 401 Certification. Primarily, I have provided hydrogeological expertise and
13 assistance to Ecology's Project Manager for the Runway Project; Ann Kenny. In 2001, the
14 Port of Seattle hired PGG in order to utilize the PGG embankment model for the Port's 401
15 application process. In my capacity as reviewer for some of the 401 submittals, I reviewed
16 wetland impacts from proposed excavation in Borrow Area 3 and subsequent versions of the
17 PGG embankment model. The results of my reviews have been documented in memos to Ann
18 Kenny and others dated March 9, 2001, May 5, 2001, and August 7, 2001.

19 5. My educational background is a Bachelor of Science degree in Geology from
20 the University of Puget Sound and undergraduate studies at University of Washington,
21 Michigan State University and Western Washington University. The work with Michigan
22 State University involved glaciological geological studies on the Juneau Icefield, Alaska under
23 a National Science Foundation Grant. Other training courses include aquifer analysis,
24 groundwater modeling, geochemistry, stream gaging and hydrologic instrumentation, and
25 water quality field techniques. A copy of my resume is attached hereto as Attachment A.

26 **AR 015613**

II. PGG's Embankment Fill Hydrologic Study

6. In 1999, public concerns prompted the Washington State Legislature and Governor Locke to approve this study, which focused on aquifers, wetlands, and Des Moines, Miller, and Walker Creeks, which drain the area. The study was conducted under the Washington State Department of Ecology's oversight by a team of consultants: Pacific Groundwater Group (PGG); Earth Tech, Inc.; and Ecology and Environment, Inc., (E & E).

7. The scope of work for this project contained the following tasks: reviewing existing documents; interviewing Port staff, community organizations, individuals, and consultants; collecting additional field data; reviewing models used by Port consultants to assess hydrologic impacts; providing independent evaluation of certain hydrologic effects using new and existing data; reviewing Port mitigation proposals; informing stakeholders and the public on project progress; and reporting.

8. Existing data were compiled and analyzed to characterize land use, surface water flow, geologic conditions, groundwater flow, groundwater recharge, wetlands, and fish in the study area. These data were used to assess potential impacts associated with the proposed runway construction. Where existing data were insufficient or required independent confirmation, additional data were collected in the field, including borehole data, streamflow quantity and quality, wetland delineations and functions, and fish population and habitat information. This study also reviewed impact assessments previously completed by the Port.

9. The Ecology PGG study limited characterization of hydrogeology to the embankment and borrow areas. Existing data were used to characterize deep geology and groundwater conditions. Shallow conditions were observed by team personnel during drilling of boreholes and collection of groundwater measurements. PGG developed a "slice" model to quantify the behavior of the fill over a characteristic cross section. The study found that local shallow aquifers are recharged by precipitation and, in the buy-out area west of the embankment, they were also recharged by water that discharged from septic drain fields. The

1 quantities of precipitation recharge, infiltration of onsite effluent and other factors affecting
2 recharge were estimated in the PGG report.

3 10. One of the significant findings of the 2000 PGG study pertained to the predicted
4 impact of the embankment on the local hydroperiod. A hydroperiod is the seasonal change in
5 the timing of groundwater discharge to wetlands and streams. For the PGG project, effects to
6 the hydroperiod were evaluated using a cross section of the proposed embankment fill near
7 Miller Creek. The timing changes would generally benefit the local wetlands that remain after
8 filling and would slightly moderate seasonal low base flows and temperatures in Miller Creek.
9 Also, since the embankment is a small part of the Miller Creek watershed, the overall effect on
10 streamflow is small. If the modeled fill is siltier than it is under actual built conditions, the lag
11 may be overestimated and the recharge volume may be underestimated.

12 III. December 2001 Low Flow Analysis

13 11. There were several concerns with the drainage estimates presented in the
14 prior report and these concerns were expressed in my memo to Ann Kenny and Kevin
15 Fitzpatrick dated March 9, 2001.

16 12. The most significant concern with the earlier Low Streamflow Analysis
17 (Earth Tech, 2000) was the use of an unrepresentative 'slice' or cross section, which was then
18 integrated over the length of the runway. Since the 'slice' used for integration was taken at the
19 thickest portion of the fill, this method of characterizing embankment drainage had high
20 potential for overstating the delayed drainage most relevant to low flows.

21 13. Consultants for the Port of Seattle modeled the hydrology of watersheds in
22 the regional study area around the SeaTac Airport Master Plan Improvements using the HSPF
23 streamflow model. The PGG scope in this modeling effort was limited to the area to be
24 underlain by the proposed fill. Their task was to model recharge, infiltration and redistribution
25 of water within the fill embankment. The PGG study focused on a modeled fill area (MFA)
26 that was excised from the larger regional study area modeled using HSPF. The MFA did not

1 include the steeper perimeter slopes along the western and northern edges of the embankment.
2 The HSPF model was used over the MFA to calculate runoff from impervious surfaces and
3 infiltration into pervious areas, and was also used to account for evapotranspiration on the
4 MFA. Total infiltration calculated by HSPF at the MFA surface was then used as input to the
5 subsurface Hydrus and Slice models. The HSPF modeling team used PGG's study results to
6 evaluate low-stream-flow impacts in Miller and Walker Creek basins.

7 14. PGG used the specifications for Phase 1 fill (installed in 1998 and 1999) to
8 characterize the texture of fill soils in their embankment model. Two types of fill were used;
9 General Fill made up of predominantly sand and silt and a coarser 'Type 1' fill used as drain
10 layers behind the retaining walls and beneath runways and taxiways. Of the two types of fill,
11 the sand-plus-silt matrix or 'General Fill' was deemed to be controlling in terms of the
12 dampening and delaying effects of the fill on drainage. The hydraulic conductivity value used
13 in Hydrus for the General Fill was calculated as 1.35×10^{-4} cm/sec. This conductivity value
14 is reasonable based on being near the mid-range of published values of conductivities for silty
15 sand. The approach used by PGG to characterize fill soils is reasonable given the existing
16 design of the embankment fill and the fact that final geometries and stratigraphic subtleties of
17 the fill are not known prior to construction.

18 15. To accurately characterize the overall embankment hydrology, the thickness
19 and extent of the fill needed to be determined along its length. Fill thickness was determined
20 by subtracting pre-fill topography from "built" topography. The topographic fill thickness was
21 then approximated for the purposes of the model into block increments of 10, 20, 30, 50, 70,
22 90, 110, 130, and 150 feet thick. This improved, spatially variable characterization of fill
23 thickness is much more representative of the amounts and thicknesses of fill in each stream
24 basin than the 'prism' fill block used in the previous calculation.

1 General Fill is an important parameter because it is considered to be a controlling factor in
2 terms of the dampening and delaying effects of the fill on drainage.

3 19. Dr. Lucia's assertion that there will be a time lag of several years before the
4 embankment toe begins draining is disproved by the drainage currently emanating from the
5 existing SeaTac Third Runway 1998 fill. The 1998 fill was draining in 1999, one year
6 following beginning of construction and continues to drain on an annual basis. Drainage from
7 the 1998 fill also refutes Dr. Lucia's model and model results as depicted in his accompanying
8 illustratives in Figure 6.

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

11 DATED this 26th day of March, 2002.

12 
13 _____
14 DAVE GARLAND

Post-It* Fax Note		7671	Date	# of pages
To	Tanya Rose		From	Dave Garland
Co./Dept.			Co.	
Phone #			Phone #	
Fax #			Fax #	

Dave Garland
Department of Ecology
425-649-7031 or dgar461@ecy.wa.gov
Statement of Qualifications and Experience
for NWRO Water Quality Watershed Unit Supervisor

U.S. Geological Survey Water Resources Division
Hydrologic Assistant - Hydrologist

1976 - 79

In 4 years working in the Washington District office of USGS in Tacoma, I obtained the following experience:

- Constructing and calibrating stream gaging stations and stream gaging equipment, taking stream discharge measurements, maintaining stream discharge rating curves, and developing stream discharge statistics.
- Collecting groundwater and surface water quality samples, and working up field laboratory preparation and analyses for dissolved oxygen, total organic carbon, total and fecal coliform, temperature and pH.
- Report writing, computer modeling, statistics
- Publications; Coal Mine Drainage in Washington: Data Supplement.

Washington State Dept. of Ecology
Water Resources Hydrogeologist

1980 - 86

Wrote water right findings and reports of investigations for controversial water allocation situations over 6 years with Northwest Regional Office Water Resources including:

- Interacting with public in water use controversies
- Wrote findings and made water right permit decisions.
- Dealt with numerous appeals at Pollution Control Hearings Board.
- Provided expert testimony at EFSEC hearings for proposed Northern Tier pipeline river crossings
- Publications; Seawater Intrusion on South Camano Island, Washington, Water Rights near Lake Sawyer, King County Washington.

Washington State Dept. of Ecology
Water Quality Hydrogeologist

1987 - 2000

During 13 years as Northwest Region Water Quality hydrogeologist, conducted numerous short-term and long-term investigations and studies including;

- Groundwater impacts at dairies
- Groundwater impacts of gravel mining
- Groundwater impacts and monitoring conditions for wastewater land application state waste discharge permits
- Personnel: served on committee to establish state Hydrogeologist classification
- Project Management - SeaTac and Maury Island gravel mining studies: technical water quantity and quality studies in context of intense public opposition and political pressure. Projects included Fact Sheets, stakeholder meetings with legislators & Port of Seattle, and public meetings with strong agendas and hostility.

AR 015619

- EAP: worked directly with EAP to propose, design and help conduct water quality studies and helped interpret and report results.
- Publications and reports: High Rock Aquifer Break of 1993, Groundwater Quality Survey near Edaleen Dairy, Whatcom Co., WA(1994), Groundwater Contamination at Plowman Dairy near Yelm, Washington, Groundwater Impacts at Alger Rock Quarry, Bellingham Frozen Foods Response Summary, and San Juan Watershed Water Quality Needs Assessment document (also involved in Nooksack, Kitsap, Skagit/Stillaguamish, and Snohomish/Island scoping efforts).

Washington State Dept. of Ecology
Acting Water Quality Unit Supervisor

2000 – 2001

Since assuming duties of Nonpoint Unit Supervisor for NWRO Water Quality, I have;

- Supervised 11 – 12 technical staff
- Completed one round of Employee Development and Performance Plans(EDPP) for 11 staff.
- Instituted staff presentations at monthly staff meetings
- Instituted regular 'Team Meetings' for TMDL Team and Dairy Regulation Team.
- Developed CQs, put out job announcement bulletins, conducted interviews, and hired 2 staff.
- Obtained training in EDPP, Hiring Process, Resolving Interpersonal Conflict, Corrective Action, Decision Making, and Completed Staff Work. Training in 'Basics of Supervision' is scheduled for this fall.
- TMDLs – attended training and conferences for over 2 years, exposure to process, worked directly with HQ TMDL team to group 303(d) listings into potential TMDL water quality studies and plan public processes relating to TMDLs.

References available on request.

Dave Garland

Department of Ecology

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Redmond, WA 98052

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**BEFORE THE POLLUTION CONTROL HEARINGS BOARD
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AIRPORT COMMUNITIES
COALITION,

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Intervenor/Appellant,

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

Respondents.

PCHB No. 01-160

DIRECT TESTIMONY OF DAVE
GARLAND SUBMITTED ON
BEHALF OF THE DEPARTMENT OF
ECOLOGY

AR 015621

I. My Background

1
2 1. I am employed by the Department of Ecology in the Water Quality Program in
3 the Northwest Regional Office. I am a hydrogeologist and supervisor of the Watershed Unit at
4 Northwest Region Water Quality. The Watershed Unit is responsible for surface water cleanup
5 planning (TMDLs), implementation of the Forests and Fish Agreement, and Water Quality
6 Financial Assistance. I have been a hydrogeologist for 24 years and employed by Ecology
7 since October, 1979. My duties as a hydrogeologist during my tenure with Ecology have
8 included investigating and preparing findings for water right applications, defending
9 controversial water right decisions before the Pollution Control Hearings Board, providing
10 expert testimony at EFSEC hearings for proposed Northern Tier pipeline river crossings,
11 investigating and reporting on groundwater quality impacts at dairies, gravel mines and at
12 wastewater land application sites. I also served on a state personnel committee which
13 established the state Hydrogeologist employee classification.

14 2. During my tenure with Ecology, I authored or co-authored the following reports
15 and publications; Seawater Intrusion on South Camano Island, Washington, Water Rights near
16 Lake Sawyer, King County Washington, High Rock Aquifer Break of 1993 (co-authored),
17 Groundwater Quality Survey near Edaleen Dairy, Whatcom Co., WA(1994), Groundwater
18 Contamination at Plowman Dairy near Yelm, Washington, Groundwater Impacts at Alger
19 Rock Quarry, Bellingham Frozen Foods Response Summary, and San Juan Watershed Water
20 Quality Needs Assessment.

21 3. During most of the year 2000, I was Ecology's lead in managing special
22 legislature mandated SeaTac Runway Fill and Maury Island gravel mining studies. Managing
23 the studies involved developing the Request for Proposals, selection of a consultant, periodic
24 briefings on study results, news releases, fact sheets, stakeholder meetings with legislators &
25 Port of Seattle, and public meetings to present the study results. The lead consultants selected
26 to conduct the studies were Pacific Groundwater Group (PGG) of Seattle. Charles Ellingson

1 was the Runway Fill Studies Project Manager for PGG. The studies culminated in reports
2 which contained data, analyses, modeling results and findings of the consultants and
3 recommendations for the proposed projects; a proposed Maury Island gravel mine and the
4 SeaTac third runway fill embankment. The study results pertinent to the third runway are
5 found in PGG's SeaTac Runway Fill Hydrogeologic Studies Report dated June 19, 2000
6 (PGG, 2000).

7 4. During my management of these studies for Ecology, I became familiar with the
8 Hydrus and Slice models being used by PGG to characterize hydrologic impacts of the runway
9 fill embankment. The models proved to be useful in depicting the delay and dampening effects
10 of the fill on water infiltrating into the embankment. Since the Maury and SeaTac studies were
11 completed, I have been involved to a lesser degree as a reviewer in Ecology's SeaTac Third
12 Runway Project 401 Certification. Primarily, I have provided hydrogeological expertise and
13 assistance to Ecology's Project Manager for the Runway Project; Ann Kenny. In 2001, the
14 Port of Seattle hired PGG in order to utilize the PGG embankment model for the Port's 401
15 application process. In my capacity as reviewer for some of the 401 submittals, I reviewed
16 wetland impacts from proposed excavation in Borrow Area 3 and subsequent versions of the
17 PGG embankment model. Most recently, I reviewed PGG's updated modeling of the
18 embankment for the December 2001 Low Stream Flow Analysis and Summer Low Flow
19 Impact Offset Facility Proposal submitted by the Port of Seattle. The results of my reviews
20 have been documented in memos to Ann Kenny and others dated March 9, 2001, May 5, 2001,
21 August 7, 2001, and March 6, 2002.

22 5. My educational background is a Bachelor of Science degree in Geology from
23 the University of Puget Sound and undergraduate studies at University of Washington,
24 Michigan State University and Western Washington University. The work with Michigan
25 State University involved glaciological geological studies on the Juneau Icefield, Alaska under
26 a National Science Foundation Grant. Other training courses include aquifer analysis,

1 groundwater modeling, geochemistry, stream gaging and hydrologic instrumentation, and
2 water quality field techniques. A copy of my resume is attached hereto as Attachment A.

3 **II. PGG's Embankment Fill Hydrologic Study**

4 6. In 1999, public concerns prompted the Washington State Legislature and
5 Governor Locke to approve this study, which focused on aquifers, wetlands, and Des Moines,
6 Miller, and Walker Creeks, which drain the area. The study was conducted under the
7 Washington State Department of Ecology's oversight by a team of consultants: Pacific
8 Groundwater Group (PGG); Earth Tech, Inc.; and Ecology and Environment, Inc., (E & E).

9 7. The scope of work for this project contained the following tasks: reviewing
10 existing documents; interviewing Port staff, community organizations, individuals, and
11 consultants; collecting additional field data; reviewing models used by Port consultants to
12 assess hydrologic impacts; providing independent evaluation of certain hydrologic effects
13 using new and existing data; reviewing Port mitigation proposals; informing stakeholders and
14 the public on project progress; and reporting.

15 8. Existing data were compiled and analyzed to characterize land use, surface
16 water flow, geologic conditions, groundwater flow, groundwater recharge, wetlands, and fish
17 in the study area. These data were used to assess potential impacts associated with the
18 proposed runway construction. Where existing data were insufficient or required independent
19 confirmation, additional data were collected in the field, including borehole data, streamflow
20 quantity and quality, wetland delineations and functions, and fish population and habitat
21 information. This study also reviewed impact assessments previously completed by the Port.

22 9. The Ecology PGG study limited characterization of hydrogeology to the
23 embankment and borrow areas. Existing data were used to characterize deep geology and
24 groundwater conditions. Shallow conditions were observed by team personnel during drilling
25 of boreholes and collection of groundwater measurements. PGG developed a "slice" model to
26 quantify the behavior of the fill over a characteristic cross section. The study found that local

1 shallow aquifers are recharged by precipitation and, in the buy-out area west of the
2 embankment, they were also recharged by water that discharged from septic drain fields. The
3 quantities of precipitation recharge, infiltration of onsite effluent and other factors affecting
4 recharge were estimated in the PGG report.

5 10. One of the significant findings of the 2000 PGG study pertained to the predicted
6 impact of the embankment on the local hydroperiod. A hydroperiod is the seasonal change in
7 the timing of groundwater discharge to wetlands and streams. For the PGG project, effects to
8 the hydroperiod were evaluated using a cross section of the proposed embankment fill near
9 Miller Creek. The timing changes would generally benefit the local wetlands that remain after
10 filling and would slightly moderate seasonal low base flows and temperatures in Miller Creek.
11 Also, since the embankment is a small part of the Miller Creek watershed, the overall effect on
12 streamflow is small. If the modeled fill is siltier than it is under actual built conditions, the lag
13 may be overestimated and the recharge volume may be underestimated.

14 III. December 2001 Low Flow Analysis

15 11. The report by Pacific Groundwater Group (PGG) of November 27, 2001
16 titled, "*Port of Seattle Sea-Tac Third Runway Embankment Fill Modeling in Support of Low-*
17 *Streamflow Analysis*", which occurs as Appendix B in Low Streamflow Analysis and Summer
18 Low Flow Impact Offset Facility Proposal (Port of Seattle, December 2001) presents
19 significant drainage estimate improvements for the proposed runway fill embankment over
20 drainage estimates presented in "*Sea-Tac Airport Master Plan Update Low Streamflow*
21 *Analysis*" (Earth Tech, 2000). There were several concerns with the drainage estimates
22 presented in the prior report and these concerns were expressed in my memo to Ann Kenny and
23 Kevin Fitzpatrick dated March 9, 2001.

24 12. The most significant concern with the earlier Low Streamflow Analysis
25 (Earth Tech, 2000) was the use of an unrepresentative 'slice' or cross section, which was then
26 integrated over the length of the runway. Since the 'slice' used for integration was taken at the

1 | thickest portion of the fill, this method of characterizing embankment drainage had high
2 | potential for overstating the delayed drainage most relevant to low flows. The improvement
3 | contained in the current report is a 'fill-depth sensitive' integration of the proposed
4 | embankment fill hydrology, which sums the drainage contribution from the embankment over
5 | the entire length of the runway. PGG accomplished this integration by using Hydrus and Slice
6 | models operating on three hydrogeologic cross sections, which were representative of the range
7 | of proposed embankment geometries.

8 | 13. Consultants for the Port of Seattle modeled the hydrology of watersheds in
9 | the regional study area around the SeaTac Airport Master Plan Improvements using the HSPF
10 | streamflow model. The PGG scope in this modeling effort was limited to the area to be
11 | underlain by the proposed fill. Their task was to model recharge, infiltration and redistribution
12 | of water within the fill embankment. The PGG study focused on a modeled fill area (MFA)
13 | that was excised from the larger regional study area modeled using HSPF. The MFA did not
14 | include the steeper perimeter slopes along the western and northern edges of the embankment.
15 | The HSPF model was used over the MFA to calculate runoff from impervious surfaces and
16 | infiltration into pervious areas, and was also used to account for evapotranspiration on the
17 | MFA. Total infiltration calculated by HSPF at the MFA surface was then used as input to the
18 | subsurface Hydrus and Slice models. The HSPF modeling team used PGG's study results to
19 | evaluate low-stream-flow impacts in Miller and Walker Creek basins.

20 | 14. PGG used the specifications for Phase 1 fill (installed in 1998 and 1999) to
21 | characterize the texture of fill soils in their embankment model. Two types of fill were used;
22 | General Fill made up of predominantly sand and silt and a coarser 'Type 1' fill used as drain
23 | layers behind the retaining walls and beneath runways and taxiways. Of the two types of fill,
24 | the sand-plus-silt matrix or 'General Fill' was deemed to be controlling in terms of the
25 | dampening and delaying effects of the fill on drainage. The hydraulic conductivity value used
26 | in Hydrus for the General Fill was calculated as 1.35×10^{-4} cm/sec. This conductivity value

1 is reasonable based on being near the mid-range of published values of conductivities for silty
2 sand. The approach used by PGG to characterize fill soils is reasonable given the existing
3 design of the embankment fill and the fact that final geometries and stratigraphic subtleties of
4 the fill are not known prior to construction.

5 15. To accurately characterize the overall embankment hydrology, the thickness
6 and extent of the fill needed to be determined along its length. Fill thickness was determined
7 by subtracting pre-fill topography from "built" topography. The topographic fill thickness was
8 then approximated for the purposes of the model into block increments of 10, 20, 30, 50, 70,
9 90, 110, 130, and 150 feet thick. This improved, spatially variable characterization of fill
10 thickness is much more representative of the amounts and thicknesses of fill in each stream
11 basin than the 'prism' fill block used in the previous calculation.

12 IV. Comments on Dr. Lucia's Testimony

13 16. Dr. Lucia commented for the ACC on two aspects of runway construction;
14 the embankment fill screening criteria, and the low streamflow analysis. Several of Dr. Lucia's
15 assertions, however, are based on erroneous assumptions or mis-characterizations of the PGG
16 modeling.

17 17. One of Dr. Lucia's assertions is that existing analyses for the 3rd runway do
18 not consider the ability of the embankment to store water prior to discharging water into the
19 underlying gravel drain. Lucia asserts there will be a period of up to six years where actual
20 drainage will be less than predicted because of the time it will take between the end of
21 construction and the initial arrival of drainage out of the embankment. It is not anticipated,
22 however, that construction of the embankment will be instantaneous nor that the fill will be
23 absolutely dry at the time of emplacement. The third runway fill will likely be placed over a
24 five to six year period and will receive infiltrating rainfall during the period of construction. In
25 addition to rainfall, imported water may be applied to the embankment fill elevations for dust
26 control and compaction purposes.

AR 015627

1 18. Dr. Lucia criticizes PGG and the Port for relying in their model on a single set
2 of soil parameters to represent the drainage characteristics of the embankment. He asserts that
3 by relying on a single fill type in their model, PGG does not derive modeling results that are
4 representative of the "potential range of behavior". The goal of the embankment hydrology
5 modeling, however, is not to represent a "range of behavior" so much as to characterize the
6 preponderance of quantity and timing of flow from the embankment. In my opinion, PGG has
7 done this by using the sand-plus-silt matrix (or characteristics of the 'General Fill') as having
8 the controlling conductivity in their model. The saturated hydraulic conductivity of the silty
9 sand was calculated as 1.35×10^{-4} cm/sec which is deemed reasonable because it is mid-range
10 among the published conductivity values for silty sand. The hydraulic conductivity of the
11 General Fill is an important parameter because it is considered to be a controlling factor in
12 terms of the dampening and delaying effects of the fill on drainage.

13 19. Dr. Lucia's assertion that there will be a time lag of several years before the
14 embankment toe begins draining is disproved by the drainage currently emanating from the
15 existing SeaTac Third Runway 1998 fill. The 1998 fill was draining in 1999, one year
16 following beginning of construction and continues to drain on an annual basis. Drainage from
17 the 1998 fill also refutes Dr. Lucia's model and model results as depicted in his accompanying
18 illustratives in Figure 6.

19 V. Conclusions

20 20. In summary, although I have not reviewed the computations of the Hydrus-
21 Slice model in detail, it is my opinion based on my familiarity with the model's development,
22 my experience as a hydrogeologist, and my previous reviews, that the assumptions used in the
23 model are reasonable. Further, PGG's December 2001 version of the Hydrus-Slice
24 embankment fill model contains significant improvements over the December 2000 Low
25 Streamflow Analysis offered by the Port. With the above mentioned improvements to the
26 embankment hydrology model, I have reasonable assurance that drainage from the proposed

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fill embankment is adequately characterized for modeling purposes to protect low streamflows in Miller and Walker Creeks.

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

DATED this 7th day of March, 2002.



DAVE GARLAND

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ENVIRONMENTAL
HEARINGS OFFICE

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

DATED this 7th day of March, 2002.



DAVE GARLAND

DIRECT TESTIMONY OF DAVE GARLAND

ATTORNEY GENERAL OF WASHINGTON
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Dave Garland
Department of Ecology
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Statement of Qualifications and Experience
for NWRO Water Quality Watershed Unit Supervisor

U.S. Geological Survey Water Resources Division
Hydrologic Assistant - Hydrologist

1976 – 79

In 4 years working in the Washington District office of USGS in Tacoma, I obtained the following experience:

- Constructing and calibrating stream gaging stations and stream gaging equipment, taking stream discharge measurements, maintaining stream discharge rating curves, and developing stream discharge statistics.
- Collecting groundwater and surface water quality samples, and working up field laboratory preparation and analyses for dissolved oxygen, total organic carbon, total and fecal coliform, temperature and pH.
- Report writing, computer modeling, statistics
- Publications; Coal Mine Drainage in Washington: Data Supplement.

Washington State Dept. of Ecology
Water Resources Hydrogeologist

1980 – 86

Wrote water right findings and reports of investigations for controversial water allocation situations over 6 years with Northwest Regional Office Water Resources including:

- Interacting with public in water use controversies
- Wrote findings and made water right permit decisions.
- Dealt with numerous appeals at Pollution Control Hearings Board.
- Provided expert testimony at EFSEC hearings for proposed Northern Tier pipeline river crossings
- Publications; Seawater Intrusion on South Camano Island, Washington, Water Rights near Lake Sawyer, King County Washington.

Washington State Dept. of Ecology
Water Quality Hydrogeologist

1987 – 2000

During 13 years as Northwest Region Water Quality hydrogeologist, conducted numerous short-term and long-term investigations and studies including;

- Groundwater impacts at dairies
- Groundwater impacts of gravel mining
- Groundwater impacts and monitoring conditions for wastewater land application state waste discharge permits
- Personnel: served on committee to establish state Hydrogeologist classification
- Project Management – SeaTac and Maury Island gravel mining studies: technical water quantity and quality studies in context of intense public opposition and political pressure. Projects included Fact Sheets, stakeholder meetings with legislators & Port of Seattle, and public meetings with strong agendas and hostility.

AR 015631

- EAP: worked directly with EAP to propose, design and help conduct water quality studies and helped interpret and report results.
- Publications and reports: High Rock Aquifer Break of 1993, Groundwater Quality Survey near Edaleen Dairy, Whatcom Co., WA(1994), Groundwater Contamination at Plowman Dairy near Yelm, Washington, Groundwater Impacts at Alger Rock Quarry, Bellingham Frozen Foods Response Summary, and San Juan Watershed Water Quality Needs Assessment document (also involved in Nooksack, Kitsap, Skagit/Stillaguamish, and Snohomish/Island scoping efforts).

Washington State Dept. of Ecology
Acting Water Quality Unit Supervisor

2000 – 2001

Since assuming duties of Nonpoint Unit Supervisor for NWRO Water Quality, I have;

- Supervised 11 – 12 technical staff
- Completed one round of Employee Development and Performance Plans(EDPP) for 11 staff.
- Instituted staff presentations at monthly staff meetings
- Instituted regular 'Team Meetings' for TMDL Team and Dairy Regulation Team.
- Developed CQs, put out job announcement bulletins, conducted interviews, and hired 2 staff.
- Obtained training in EDPP, Hiring Process, Resolving Interpersonal Conflict, Corrective Action, Decision Making, and Completed Staff Work. Training in 'Basics of Supervision' is scheduled for this fall.
- TMDLs – attended training and conferences for over 2 years, exposure to process, worked directly with HQ TMDL team to group 303(d) listings into potential TMDL water quality studies and plan public processes relating to TMDLs.

References available on request.

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