LINN GOULD

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.	PCHB No. 01-160 **PREFILED DIRECT TESTIMONY OF C. LINN GOULD**

AR 016420

Outline of Testimony

Page

ORIGINAL

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

AR 016421

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

INTRODUCTION

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

2. I am a Risk Assessor and soil scientist by training, having received my BA in geology and an MS in soil science. I have additional post-graduate training in risk assessment, toxicology, and wetland evaluation. For the past 10 years I have been focusing my expertise on the application of the Model Toxics Control Act ("MTCA"), Chapter 70.105D RCW, to contaminated sites. I recently participated in the MTCA Policy Advisory Committee process, which prioritized risk assessment in the development of the new MTCA regulations. More specifically, I was technical project manager and facilitator for the Department of Ecology and other Washington State stakeholders in the development of a new risk-based strategy for Total Petroleum Hydrocarbon ("TPH") remediation in Washington State, which is now a part of the newly issued MTCA regulation, chapter 173-340 WAC (August, 2001). Insuring protection of water quality has been a routine aspect of all risk assessment projects that I have been involved in. A copy of my *curriculum vitae* is attached as Attachment 1.

3. Since 1993 I have worked on numerous Port of Seattle projects as a risk assessment specialist and project manager, primarily focusing on the assessment and remediation of contaminated sites. Since January, 2001, my work for the Port has concentrated on Third Runway issues, principally a risk analysis of the potential for imported fill to impact aquatic and other receptors and the subsequent strategy and generation of appropriate fill criteria for the embankment.

4. In the following testimony, I explain how the embankment for the Third Runway will be constructed. I then explain how water flows through the embankment fill. Next, I explain the development of numeric criteria designed to ensure that fill used in the embankment will protect water quality. As explained further below, the U.S. Fish and Wildlife Service (FWS) first developed fill criteria as part of the Biological Opinion it issued for the Third Runway project. The Department of Ecology (Ecology) reviewed the

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

methodology developed for deriving the fill criteria in the Biological Opinion when it developed fill criteria for the 401 Certification. I explain the differences between the August 2001 and the September 2001 401 Certifications issued by Ecology as they relate to fill criteria. Finally, I respond to some of Dr. Patrick Lucia's criticisms of the fill criteria in the 401 Certification.

DESIGN OF EMBANKMENT

5. The embankment is designed to create an elevated, relatively flat surface upon which the Third Runway will be built. The total length of the embankment will be approximately 8,700 feet, bounded by the relocated S. 154th Street to the north and extending beyond S. 176th Street to the south. The width of the fill ranges from 40 feet at its narrowest point in the south end to approximately 1,400 feet at the widest point. The east margin of the fill will abut the existing airfield; the west margin of the fill will either be sloped or bounded by a mechanically stabilized earth (MSE) wall, depending on the location. The fill thickness will range from several feet to 165 feet. The volume of the fill that is required for the construction of the Third Runway embankment is approximately 17 million cubic yards. Embankment soil placement is designed to be both geotechnically suitable as foundation material for the Third Runway and to accommodate infiltration of water through the fill in all seasons. Fill will consist of approximately 40 percent sand and gravel that is relatively silt-free and about 60 percent silty sand and gravel mixtures.

6. A bottom drainage layer, consisting of an approximate 3-foot thickness of free-draining sand and gravel, has been included in the fill embankment design (Attachment 2). This drainage layer will generally be laid on the existing ground surface. It will prevent groundwater pressures from building up within the embankment when the groundwater table rises from below during winter months. The drainage layer will also direct groundwater flow away from the embankment fill to prevent geotechnical instability. Water may enter the drainage layer from above, due to infiltration through the embankment fill, and from below as

AR 016423

BROWN REAVIS & MANNING PLLC.
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

groundwater inflow in the form of seepage from the existing slope or existing shallow groundwater discharge zones that will be buried beneath the embankment.

7. A "drainage layer cover," consisting of a zone of "ultra-clean fill" will be established directly above the drainage layer as shown in Attachment 2. It will measure at least 40 feet thick at the face of the embankment and its top surface will slope downwards to the east at a rate of 2 percent. The overall thickness of the drainage layer cover will decrease away from the face of the embankment and will vary based on underlying topography. The drainage layer cover has been added as a soil layer along the edge of the embankment closest to wetlands and creeks to adsorb any chemical constituents that might be leaching through from higher up in the embankment. Adsorption occurs when constituents in solution adhere to the surfaces of soil particles.

FLOW PATHS THROUGH THE EMBANKMENT FILL

8. I performed a risk analysis, which determined that the most sensitive receptors to protect from any potential contamination in the Third Runway embankment are organisms residing in the neighboring creeks. Thus, it is important to understand how water flows through the embankment and eventually reaches the creeks. Rainfall will infiltrate through the embankment and percolate down to the drainage layer. As water percolates through the fill, some naturally occurring minerals or other chemical constituents (if present) in the fill may pass into solution and then re-adsorb onto other soil particles.

9. Depending on location, the water that flows through the completed embankment fill will take one of two flow paths. First, some water will percolate down to the drainage layer and flow laterally to discharge from the embankment toe. This water may include a portion of groundwater that will emerge from below the embankment during the rainy season to mix with the embankment seepage. The water will discharge from the drainage layer and enter collection swales or replacement drainage channels that generally run along or near the toe of the embankment or re-infiltrate through the soils into ground water.

AR 016424

BROWN REAVIS & MANNING PLLC.
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

10. Second, some water will percolate downward through the drainage layer and into the underlying soil, entering the existing body of shallow groundwater beneath the embankment, in much the same manner as the water would flow under pre-construction conditions. Water in this second flow path will flow slowly through either the uppermost water table or the regional groundwater aquifer and most of it will discharge through or beneath wetlands to Miller and Walker creeks; a smaller portion will continue to percolate downward to recharge deeper aquifers. It is my understanding that approximately 7% of the water will follow the first flow path, and the remaining 93% will follow the second flow path. Contrary to ACC's assertions, therefore, the drainage layer will not act as a "pipe" or "conduit" for all water passing through the embankment.

11. As constituents in the embankment seepage move through soils and groundwater, they are subjected to naturally-occurring physical, chemical, and biological processes that tend to reduce the original concentration of the constituent that might be contained in the embankment fill. These natural processes (which occur as water moves through any soil or rock mass, whether an embankment is made of fill or undisturbed soil) include adsorption onto soil and aquifer media, chemical transformation, biological degradation, and dilution, all of which occur everywhere between the embankment and the neighboring creeks.

12. The Port is screening the fill it imports to build the Third Runway to ensure that potential chemical constituents do not pose a risk to ecological receptors in neighboring Miller and Walker Creeks when water passes through the fill and flows into the creeks via the two flow pathways discussed above.

U.S. FISH & WILDLIFE SERVICE BIOLOGICAL OPINION

13. The U.S. Fish & Wildlife Service (FWS) performed an analysis of the potential effects that the Port's Master Plan Update improvement projects, including the Third Runway, might have on threatened and endangered species. The FWS reported the results of

AR 016425

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

its analysis in its Biological Opinion (BO), issued in May 2001. The BO includes the following conditions for the acceptance of fill to be used in the Third Runway embankment.

Drainage Layer Cover

14. The BO established the drainage layer cover as a zone of "ultra clean" fill as described above and shown in Attachment 2. The FWS required screening of fill for 8 metals (arsenic, barium, cadmium, total chromium, lead, inorganic mercury, selenium, silver) according to numeric criteria set forth in Table 1 in Attachment E of the 401 Certification. These numeric fill criteria were developed for the drainage layer cover to be protective of aquatic receptors. In developing the numeric criteria for this "ultra clean" fill, FWS borrowed and adapted some accepted methodologies outlined in Ecology's Model Toxics Control Act (MTCA) regulation, chapter 173-340 WAC, as described in the following paragraphs. In the process of developing a regulatory system for assessing contaminated sites, the MTCA program has developed technical protocols and tools for evaluating the behavior of contaminants and naturally-occurring constituents in soil and groundwater. The applicability of these technical protocols and tools is not strictly limited to contaminated sites.

Backcalculated Fill Criteria

15. MTCA provides a conservative calculation method known as a "fixed parameter three-phase partitioning model," whose purpose is to establish soil concentrations that will be protective of applicable ground water concentrations. (WAC 173-340-747)(4)). The three-phase partitioning model performs what is often referred to as a "back-calculation" because it starts with the numeric water quality criteria for the receiving water and works backwards to derive a soil concentration that is protective of water quality. In other words, it determines how much of a particular constituent can exist in the soil without causing an exceedance of the appropriate standard in the receiving water. This "back-calculation" model was adapted for the Third Runway embankment by substituting applicable surface water standards in place of groundwater standards. The FWS used the criteria in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) as the

BROWN REAVIS & MANNING PLLC.
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

backcalculation starting point. In the cases where surface water quality criteria were not available (barium and total chromium), drinking water concentrations were used in the back-calculation model, in accordance with WAC 173-340-747, to derive a protective soil concentration for the fill.

Background Concentrations

16. Where sufficient data were available to select 90th percentile background concentrations of constituents in soil (arsenic, cadmium, total chromium, lead, inorganic mercury), the FWS used Puget Sound Background concentrations (Natural Background Soil Metals Concentrations in Washington State, Ecology, 1994, Pub. # 94-115) as numeric criteria for fill to be placed in the drainage layer cover instead of the backcalculation concentrations described above. Substitution of background concentrations resulted in raising the criteria for some constituents and lowering criteria for others.

Practical Quantitation Limits

17. The fill criteria for two constituents in the drainage layer cover (selenium and silver) were set at the Practical Quantitation Limits ("PQL") because their backcalculated values were lower than the PQL. The PQL is the concentration below which a particular constituent cannot be reliably measured in a laboratory. As a practical matter, therefore, it would not make sense to set criteria below the PQL because the Port could not measure with certainty whether the criteria were being met. For that reason, MTCA regulations state that when a calculated constituent level is lower than a level that can be reliably measured, the concentration "shall be established at a concentration equal to the practical quantitation limit (PQL) or natural background concentration whichever is higher." WAC 173-340-700(6)(d).

Synthetic Precipitation Leaching Procedure

18. The BO allows use of the Synthetic Precipitation Leaching Procedure (SPLP) to confirm suitability of fill that exceeds the screening criteria described above. The SPLP test, EPA SW-846 Method 1312, is an accepted laboratory leaching test, as discussed in MTCA, WAC 173-340-747(7). It was designed to simulate the leaching of chemicals from

BROWN REAVIS & MANNING PLLC.
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

soils by acid rain. It therefore determines the potential for mobility of both organic and inorganic constituents from soils into ground water under conditions in which constituents are most likely to be mobilized. The SPLP test uses site-specific information to test the potential for constituents to leach from fill. While the backcalculation method described above is a theoretical approach to determining whether fill is protective of water quality, the SPLP procedure is an empirical approach involving a direct measurement to answer the same question.

19. When the SPLP is performed, material to be used as fill is collected, then exposed to water simulating acid rain, and the concentrations of any leaching constituents are measured. If the SPLP results for a specific fill sample, analyzed in accordance with the BO requirements, exceed water quality criteria, the fill will be rejected for use in the embankment. However, if the SPLP results for a fill sample meet water quality criteria, that fill may be acceptable for use in the embankment. This is appropriate because the constituent(s) at issue cannot leach from that fill soil at a rate sufficient to cause or even threaten to cause violation of applicable water quality standards.

20. In short, the SPLP can show not only that existing fill criteria are conservative but also that constituent concentrations exceeding the fill criteria are protective of water quality. In my opinion, the site-specific SPLP test does not represent a relaxation of the numeric criteria contained in the 401 certification. To the contrary, SPLP is a safe and conservative option for evaluating the protectiveness of proposed fill material.

21. The FWS adopted use of the SPLP test for two reasons. First, the three-phase backcalculation model uses default assumptions that are very conservative. The three-phase model frequently yields criteria in concentrations that are lower than normal Puget Sound Background concentrations. As a result, even "pristine" soils, soils that have never been exposed to human "contamination," could be rejected as potential fill sources. The SPLP test is used to determine if a fill source that exceeds backcalculated criteria could, in fact, cause a water quality problem.

AR 016428

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

22. Second, although ACC contends that only background soils should be used in the embankment, use of background levels as screening criteria is not as simple a solution as it sounds. In fact, use of criteria based solely on background concentration levels will lead to pristine soils from Puget Sound being rejected as potential fill sources. As mentioned above, the 401 Certification's fill criteria for some constituents are based on Puget Sound Background concentrations. These background concentrations were set at the 90th percentile of concentration for each constituent from all samples used to calculate the value. This means that 90% of the samples used to calculate the background value had concentrations lower than the established concentration. It also means that 10% of the samples had concentrations higher. Stated another way, when evaluating a single soil constituent, 10% of the soils that have not been influenced by human activities will exceed the constituent value established as the Puget Sound Background concentration. For example, in the Puget Sound Basin, total chromium ranges naturally from 12 to 235 mg/kg (Natural Background Soil Metals Concentrations in Washington State, Ecology, 1994, Pub. # 94-115). If the 90th percentile (48 mg/kg) is used as a criterion, soil with natural background concentrations of chromium between 49 and 235 mg/kg – 10% of the sample set -- will fail. If the same soil is tested for multiple constituents, any one of which can disqualify the soil for use as fill, the probability of that soil being excluded goes up significantly, even though it is "naturally-occurring" soil unaffected by human activities. Use of the SPLP test is scientifically justified, since it allows a site-specific assessment by accepted methodologies of whether a potential fill source that exceeded the criteria set at natural background actually poses a risk to water quality.

Ecological Criteria for the Top 3 Feet of the Embankment

23. The BO established more stringent numeric criteria for fill to be used in the top three feet of the embankment, which is the biologically active zone. The criteria are drawn from Table 749-2 of MTCA's Terrestrial Ecological Procedures section (WAC 173-340-7490) and are meant to protect terrestrial ecological receptors residing in surficial soils (i.e., soil biota, plants, and wildlife such as burrowing animals) from exposure to potentially

BROWN REAVIS & MANNING PLLC.
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

contaminated soil. It was determined that the depth of the biologically active zone would not extend beyond 3 feet for two reasons: 1) FAA regulations require hazing of animals within a 10,000 foot radius of the airport, which would prevent significant burrowing and/or residence on top of the runway; and 2) the opportunity for significant plant growth in the same area is limited by the nature of airport operations (i.e., paved runway, grass strips, etc). These criteria are not designed to protect aquatic organisms, have very little to do with the quality of water in nearby wetlands or streams, and are not applicable in the bottom of the embankment.

DEVELOPMENT OF FILL CRITERIA FOR THE 401 CERTIFICATION

August 10, 2001 401 Certification

24. Ecology issued a 401 Certification to the Port on August 10, 2001 (August 401 Certification). Conditions relating to the acceptance of fill are contained in Section E of the August 401 Certification.

25. Ecology's numeric fill criteria apply to all of the metals listed in the BO (except barium), plus 7 constituents (antimony, beryllium, copper, nickel, thallium, zinc and total petroleum hydrocarbons) not addressed by the BO. To the best of my knowledge, Ecology developed metals fill criteria for the Third Runway Embankment using an approach that started with the three phase backcalculation model described above in Paragraph 15. Ecology then compared the three phase backcalculation model results to other available criteria, including the MTCA terrestrial ecological soil concentrations in Table 749-2 (WAC 173-340-900), 90th percentile natural soil background concentrations, MTCA Method A unrestricted land use soil cleanup levels in Table 740-1 (WAC 173-340-900), and PQLs.

26. The fill criteria in the 401 Certification for total petroleum hydrocarbons (TPH) are set at the MTCA Method A concentrations from Table 740-1 (WAC 173-340-900). The Method A TPH soil concentration of 2000 mg/kg for diesel range organics and heavy oils in this table is the most conservative (lowest) concentration that was calculated for TPH after considering multiple pathways of exposure (soil ingestion, dermal contact, leaching to ground water, residual saturation, etc). The lowest concentration determined to be

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

protective of a variety of pathways was based on residual saturation, which is defined as the concentration of TPH in soil where no free drainage to groundwater and/or accumulation on groundwater will occur at equilibrium conditions (WAC 173-340-747 (10)) in gravelly or coarse sand soils. The MTCA Method A concentration of 2000 mg/kg for diesel range organics and heavy oils is intended to be protective of ground water, and would also be protective of surface water quality since Method A ground water and surface water cleanup levels for TPH are the same, as described in WAC 173-340-730(C).

September 21, 2001 401 Certification

27. The Port noted a series of inconsistencies between the August 401 Certification and the FWS BO that were difficult to reconcile. The Port brought these inconsistencies to Ecology's attention. On September 21, 2001, Ecology withdrew the August 401 Certification and reissued a new 401 Certification (September 401 Certification).

28. The September 401 Certification resulted in a more stringent screening process and numerical criteria for fill than was established in the August 401 or the BO. The September 401 Certification incorporated several components of the BO, including the drainage layer cover concept, the ecological criteria applicable to the top three feet of fill, and use of the SPLP procedure, as explained above in Paragraph 15. Attachment E of the September 401 Certification is the SPLP Work Plan. It requires that all SPLP test results be submitted to Ecology and, even where a fill constituent has satisfied the SPLP test, Ecology has reserved the right to disapprove of the use of that fill. *See* 401 Certification, Condition E(1)(b). In my opinion, the new provisions of the September 401 Certification provide more protection than the original August 401 Certification.

29. As explained above, most of the fill criteria are set either at concentrations that have been backcalculated from water quality criteria, or at 90th percentile Puget Sound background concentrations. The backcalculated fill criteria are very conservative for the following reasons. First, they have been derived assuming that the receptor point is immediately underneath the embankment. However, Miller and Walker Creeks are over one

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

hundred feet away from the embankment at its closest location. In other words, the backcalculated criteria are conservative because the Port has applied the surface water quality criteria directly underneath the embankment where surface water receptors do not reside.

30. Second, the most sensitive variable in the backcalculation equation is called the Kd or the distribution coefficient (or the soil-water partitioning coefficient). The Kd describes the relationship (ratio) between the concentration of a constituent in soil and the concentration of the same constituent in water. The higher the Kd, the more likely it is that the constituent will remain in soil versus mobilizing to water. The Kds used in the backcalculations were default values taken from MTCA, and are generally applicable to contaminated soils. However, since the fill soils that the Port is importing for the Third Runway embankment are uncontaminated, their ability to adsorb chemical constituents is extremely high (i.e., chemical constituents will remain adhered to these soils rather than mobilizing in groundwater). Consequently, site-specific Kd values within the embankment are significantly higher, and therefore are able to attenuate any chemical constituents that might be introduced into the embankment.

31. Third, the backcalculated criteria have not accounted for the significant dilution and attenuation that will occur between the embankment and the neighboring creeks.

RESPONSE TO TESTIMONY OF DR. PATRICK LUCIA

32. Dr. Lucia states in his prefiled testimony that "the requirements of the Fish and Wildlife Service (FWS) Biological Opinion are not being fully adhered to in the September 21, 2001 401 Certification." Lucia Testimony at ¶ 13. Specifically, Dr. Lucia states that the BO requirement for "more stringent control over the surficial three feet is not clearly incorporated" in the September 401 Certification. *Id.* Dr. Lucia has misunderstood Table 1 of Attachment E, the SPLP Work Plan. The BO ecological criteria that apply to the surficial three feet of the embankment are not mentioned in the SPLP Work Plan because it is not appropriate to apply the SPLP to soils to be placed in the surficial three feet of the embankment. This does not mean that the Port will not adhere to the ecological requirements

BROWN REAVIS & MANNING PLLC.
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

from the FWS BO. As Elizabeth Leavitt explains in her testimony, the Port fully intends to meet all requirements of the BO.

33. Dr. Lucia also states that because the Port is not required to use Attachment E to the September 401 Certification, "the drainage layer cover can consist of materials that are more 'contaminated' than the naturally occurring area soils. Lucia Testimony at ¶ 14. As explained above, Attachment E states that "Because the FWS and Ecology soil criteria differ, the Port will use the most stringent criteria of the two for the drainage layer cover (shown in column 4) and for the remainder of the Embankment (shown in column 5)." Since issuance of the September 401 Certification, the Port has been using Attachment E for the fill screening process and adhering to its requirement that the most stringent of the two sets of fill criteria be met. Thus, Dr. Lucia's concern that the Port will not be adhering to the BO drainage layer criteria is unfounded. In the same paragraph, Dr. Lucia testifies that some of the fill criteria in the 401 Certification exceed the Puget Sound Background levels for the constituents in question, and suggests that the fill criteria are therefore not protective. Since the Port is meeting the FWS's numeric fill criteria for the drainage layer cover, his argument is not valid.

34. Dr. Lucia presents a PQL table in paragraph 14 of his testimony and states that "none of the constituents are set at the Practical Quantitation Limits (PQL) identified in DOE Technical Memorandum #3 PQLs as Cleanup Standards (November 23, 1993)." He also states that "none of the contaminants listed in the 401 certification are set to the lowest PQL identified in Ecology Memorandum #3." Lucia Testimony at ¶ 15. Dr. Lucia's criticism is not valid. First, Ecology's Implementation Memo #3 is a guidance document intended for project managers, not a regulatory standard. The Implementation Memo provided a range of PQLs that labs in Washington State could routinely achieve, according to a survey conducted by Ecology. I am not aware of any expectation or requirement in MTCA or anywhere else that a party must achieve the lowest PQLs in the memorandum. More importantly, it is irrelevant whether some of the fill criteria could have been set at a lower PQL. This is because site-specific modeling has shown that all of the fill criteria, including those set at higher PQLs, are

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101
(206) 292-6300

fully protective of water quality standards. Dr. Michael Riley explains these modeling results in his prefiled direct testimony.

35. Finally, Dr. Lucia states that the changes to fill criteria in the September 401 Certification result in an "increased risk that state water quality standards will not be met." Lucia Testimony at ¶ 8. Dr. Lucia does not offer any evidence that fill criteria in the September 401 Certification are not protective of water quality. On the other hand, the Port has developed two models (the backcalculation model and a groundwater flow and transport model described in Dr. Michael Riley's testimony), along with multiple safeguards in the embankment fill acceptance process, which show that the 401 Certification criteria are fully protective of applicable water quality standards for surface waters of the State of Washington.

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 at Seattle, Washington.

C. Linn Gould

AR 016434

BROWN REAVIS & MANNING PLLC
1191 SECOND AVENUE, SUITE 2200
SEATTLE, WASHINGTON 98101

A

AR 016435

C. LINN GOULD

2015 14th Avenue East, Seattle, WA 98112

ErdaEnv@aol.com (206) 324-0297

PROFESSIONAL EXPERIENCE:

Risk Assessment/Management and Wetlands Consultant 7/91 to present
Erda Environmental Services, Inc, Seattle, WA, President
Owner and operator of environmental consulting firm since its inception in 1991.

- Assist the Port of Seattle with Third Runway project issues including risk based development of soil criteria for embankment.
- Acted as technical project manager and facilitator for Washington State stakeholders in developing a risk-based environmental policy for petroleum contamination and in re-writing petroleum regulations for the state from 1996-2000.
- Assist public and private clients in implementing cost effective remediation of contaminated sites and returning them to productive use in Washington, Oregon, and Alaska. Received Project Team of the Year Award (1996) in remediation of Southwest Harbor Project for the Port of Seattle.
- Delineate and evaluate wetlands with focus on mitigation of degraded wetlands and use of wetlands for wastewater disposal and improving water quality.

Risk Assessment Task Manager and Soil Scientist 01/90 to 7/91
CH2M Hill, Bellevue, WA

- Conducted risk assessments and developed successful strategies in remediating hazardous waste sites in the Pacific Northwest using risk-based methods.
- Delineated wetland boundaries and prepared wetland reports with focus on regulatory issues, permitting, and mitigation measures.

Research Specialist 09/85-09/88
Water Resources Center, University of Wisconsin, Madison, WI

- Studied the effects of septic systems on water quality in both the field and laboratory.
- Assisted in the preparation of water quality reports to be distributed for educational purposes in Wisconsin.

Engineering Geologist 10/81-07/82
Rittenhouse-Zeman & Associates, Bellevue, WA

- Worked in field, laboratory, and office in preparing foundation reports for airports and buildings in the Pacific Northwest.

Laboratory Technician 10/79-08/80
Geology Department, Smith College, Northampton, MA

- Assisted professor in soils laboratory on the effects of acid rain on lakes in the Adirondacks, N.Y.

PUBLICATIONS:

- Pascoe, GA; Riley, MJ; Floyd, T.A; Gould, C.L; Use of a Risk-Based Hydrogeologic Model to Set Remedial Goals for PCBs, PAHs, and TPH in Soils during Redevelopment of an Industrial Site, Environ. Sci. Technol. 1998, 32, 813-820.
- Erda Environmental Services, Inc. Risk Assessment for Unocal Former Bulk Fuel Facility,

Soldotna, Alaska, February 1998.

- Erda Environmental Services, Inc; Remediation Technologies, Inc, Southwest Harbor Project: Shoreland Public Access Exposure Analysis, Pacific Sound Resources Superfund Site, December 1995
- University of Wisconsin Water Resources Center and the Wisconsin Department of Natural Resources (joint publication, Potential Sources of Pollution for Lulu Lake (Status of Beach Contamination in Wisconsin, 1986.

EDUCATION:

- University of Washington, Seattle, WA

MPH candidate Public Health, 2000-

- University of Wisconsin, Madison, WI

MS Soil Science, 1988. Thesis on the potential for detergent formulation to affect nutrient movement through septic drainfields.

- University of Washington, Seattle, WA

Post-graduate research, 10/1982-5/1984. Graduate courses in risk assessment, soil science, and toxicology.

- Smith College, Northampton, MA

B. A. Geology, 1981. Research and senior thesis on the movement of acid precipitation through Adirondack, NY soils.

CONTINUING EDUCATION:

- French immersion program for 8 hours per day for two months - "Avance 1" in December 1999 and "Avance 2" in March 2000, Institut de Francais, Villefranche, France.
- "Wetland Vegetation of Western Washington", University of Washington, Seattle, WA, 1995
- "Hazardous Waste Site Operations", Seattle, WA, 1995
- "Creating and Using Wetlands for Wastewater Disposal and Water Quality Improvement", University of Wisconsin, Madison, WI, 1993
- "Creating Wetlands for Habitat Enhancement and Mitigation", University of Wisconsin, WI, 1993
- "On-Site Wastewater Treatment", University of Washington, Seattle, WA, 1992

PERSONAL:

- Memberships: Society for Risk Analysis, National Society of Consulting Soil Scientists, Society for Wetland Scientists, Soil Science Society of America
- Skills: Working knowledge of French; volunteered for two years as counselor in reproductive issues and sexually transmitted diseases at Planned Parenthood; computer literate; coaching experience
- Interests: Traveling, camping, hiking, biking, wine, reading, basketball

REFERENCES:

Available on request.

B

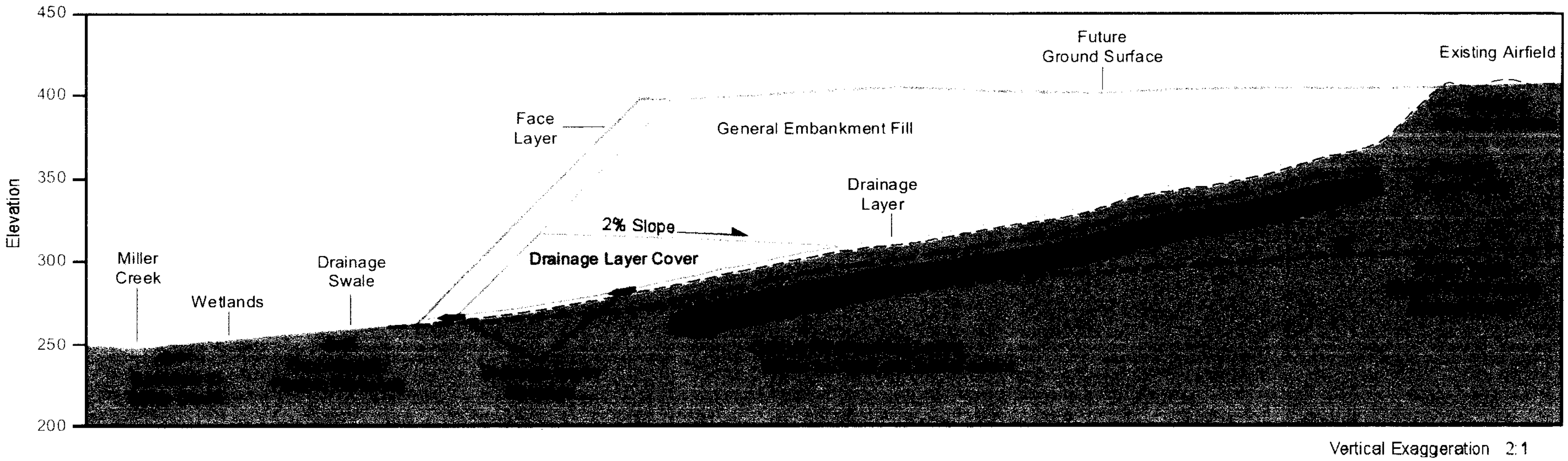

Figure 2 Typical Cross-Section Through the Embankment Fill

AR 016439