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SUBJECT TO REVISION

DATE 12-23-98

HARTCROWSER

Earth and Environmental Technologies

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MEMORANDUM

DATE: December 23, 1998

TO: Ms. Barbara Hinkle, Port of Seattle

FROM: Michael Bailey P.E., and Michael Kenrick, P.E.
Hart Crowser, Inc.

RE: Summary of Hydrologic Issues
Borrow Areas 1, 3, and 4
Third Runway Project
Seattle-Tacoma International Airport
J-4978-03

In response to your request this memorandum discusses potential hydrologic effects related to proposed development of Borrow Areas 1, 3, and 4. Borrow Areas 1, 3, and 4 consist of about 200 acres of forested land, immediately south of the airport. Area 1 includes 0.34 acre of wetlands north of South 208th Street. Area 3 includes about 2.3 acres of wetlands. There are no wetlands in Area 4. Locally, shallow perched water zones are likely to be encountered in excavating surficial soils, but the borrow excavations would not extend into the underlying Shallow Regional Aquifer.

Summary

You asked Hart Crowser to discuss 1) how will borrow area operations impact base flows to Des Moines Creek and riparian wetlands?, and 2) what will the long-term effect be on local hydrology after reclamation of the borrow areas? In general, excavation of Borrow Areas 1, 3, and 4 will expose relatively more permeable, sandy soils which underlie the existing silty, glacial till surface soils. During operations, on-site runoff would be controlled in accordance with an approved storm water pollution prevention plan. Infiltration, groundwater recharge, and baseflow to Des Moines Creek would increase. After reclamation, on-site runoff would be reduced, and the increased infiltration, groundwater recharge, and baseflow would remain as long-term benefits.

Background information on soils and groundwater is provided in the documents listed at the end of this memorandum. The two questions you asked are discussed below in more detail.

Question No 1. How will borrow area operations impact baseflows and riparian wetland?

The most substantial changes in the hydrologic balance caused by excavation in the borrow areas will be to the interdependent components of runoff, infiltration, and interflow. These changes will have a net positive increase in baseflow to Des Moines Creek.

Runoff. The removal of vegetative cover, topsoil, and surface soils will significantly change runoff characteristics during borrow source development and operation. Generally, the amount of water available will increase due to reduction in evapotranspiration that results from the removal of vegetation. The extra water available potentially increases both runoff and infiltration.

Runoff will be significantly reduced by removal of low-permeability surficial glacial till soils, to expose relatively high-permeability outwash deposits with higher infiltration rates. Borrow operations will include an erosion and sedimentation control plan and a storm water management plan, which will be designed to manage storm water on site. Ultimately, runoff may no longer be able to flow across the site as overland flow toward Des Moines Creek, due to topographic changes created by the borrow excavations.

Infiltration. The infiltration of direct precipitation and run-on will increase within the borrow areas due to the exposure of higher permeability subsoils upon removal of the glacial till mantle that occurs over parts of Borrow Areas 1, 3, and 4.

The removal of till soils from the ground surface will result in substantially increased recharge to the underlying groundwater. The amount of increased groundwater recharge occurring in each borrow area as a result of till removal has been estimated by AGI (1996). For Areas 1 and 4, AGI estimate an increase of 188,471 gpd (0.3 cfs) and 23,849 gpd (0.04 cfs), respectively, based on deep percolation of 31 inches per year through an area of 10.3 acres where till is removed.

Explorations by Hart Crowser (1998) indicated approximately 21 acres of till cap in Area 3. Allowing for buffer areas around the proposed excavations, we estimate that approximately 80 percent of the till cap could be removed for full utilization of the borrow areas. Using the approach taken by AGI, we estimate the increase in groundwater recharge due to till removal would be on the order of 70,000 gpd (0.1 cfs).

Enhanced infiltration of runoff may also occur as runoff collects in the lower parts of the active borrow areas. Mining is planned to result in relatively flat areas which are more or less closed depressions. The post mining topography will encourage infiltration and retain more runoff than current site conditions, and add to groundwater recharge. Additionally, the Port may manage storm water in on-site detention ponds which include discharge to groundwater.

Interflow. The shallow lateral movement of water in the root zone will be effectively eliminated when vegetation is cleared from the borrow areas. This change in interflow is unlikely to impact riparian wetlands or baseflow in Des Moines Creek, due to the distance separating the borrow areas from the creek.

Baseflow Increase. Increased infiltration within Borrow Areas 1, 3, and 4 will increase groundwater discharge from the Shallow Aquifer into Des Moines Creek, improving baseflow in the creek. The increase in baseflow will be roughly proportional to the extent and size of borrow source development. The baseflow increase is anticipated to benefit riparian wetlands along Des Moines Creek.

The increase in groundwater recharge through Area 4 will be primarily to the perched water-bearing zone immediately underlying the base of the proposed excavation, with some corresponding increase in seepage down to the underlying Shallow Aquifer. Increased infiltration in the perched zone may result in increased seepage within Area 3, and in the interflow zone south and east toward Des Moines Creek.

The seasonal variations in groundwater levels and baseflow under the developed borrow sources will likely show somewhat higher peaks when compared to existing conditions. Higher groundwater levels and increased baseflows will be observed primarily in the winter/early spring. Depending on the buffering effect of storage provided within the aquifer, some increased baseflow will extend into the early and possibly late summer, and could have beneficial effects on the watershed over the full year.

Question 2. What will be the long term effect on local hydrology after the borrow areas are closed and reclaimed?

The short term changes described above, will generally persist after reclamation of the borrow areas.

Overview of Borrow Site Reclamation

Reclamation of the borrow areas has three principal components:

- Site preparation;
- Seasonal shutdown; and
- Termination of use.

Site Preparation. Erosion and sediment control measures would be implemented prior to clearing or other soil disturbance. Topsoil would be stockpiled for reclamation after mining, with potential erosion of stockpiled materials controlled through BMPs. Except for materials stockpiled for final site reclamation, the excavated soils would be used in the runway embankment.

Interim Reclamation. During borrow operations, active slopes would be developed and maintained in a stable configuration.

The borrow areas are anticipated to provide "fair weather fill," soils which are most suitable for use in the late spring to early fall period. Seasonal regrading and revegetation are anticipated in the late summer as excavations are completed and the borrow areas prepared for seasonal shutdowns. Depending on moisture available for germination, revegetation of recontoured slopes, benches, and floor of the borrow excavation would generally occur in September before the start of the fall growing season. Runoff and sediment controls would be maintained through the winter months.

Final Reclamation. The ultimate configuration of the final excavation surfaces, on-site detention, and infiltration areas will be determined as part of mine plans developed for the borrow permit processes. After mining, the resulting final slopes, benches, and floor surface grades would be recontoured to blend in with surrounding topography.

Surface regrading would be accomplished so that slopes are left in a permanently stable position, to control or prevent sheet-wash and erosion, and to promote effective self-sustaining revegetation.

Post-Reclamation Site Hydrology

Upon completion of reclamation, the borrow areas will have been restored to support a stable self-sustaining vegetative cover. Reduced runoff and increased transpiration will occur as the vegetation is established.

Over the long-term, the improved infiltration, baseflow, and groundwater recharge resulting from removal of the glacial till cap and exposure of the underlying more permeable soils will persist. Any subsequent on-site development would be subject to its own environmental review process.

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REFERENCES

AGI Technologies, 1995. *Borrow Source Study,* Proposed New Runway, Seattle-Tacoma International Airport, SeaTac, Washington. Draft Report prepared for HNTB, April 3.

Hart Crowser, 1998a. *Hydrologic Issues, Prospective Development of Borrow Areas 1,3, and 4, Third Runway Project, Seattle-Tacoma International Airport,* November 17, 1998.

Hart Crowser, 1998b. *Resource Evaluation and Conceptual Development for Borrow Areas 3 and 4,* Draft Report prepared for HNTB, December 1998.

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Vita

Michael Bailey, P.E., is a registered Professional Engineer in the States of Washington and Alaska. He received his Master of Science Degree in Civil Engineering in 1976 from Purdue University, and his Bachelor of Science Degree in Civil Engineering, with Honors, in 1974 from Michigan Technological University. Mr. Bailey is a Principal in the Seattle-based geotechnical and environmental engineering firm Hart Crowser, Inc. where he has worked as a geotechnical engineer since 1980.

Michael Kenrick, P.E., is a registered Civil Engineer in the State of Washington. He received a Bachelor of Science degree in Civil Engineering, with Honors, at the University of Manchester, England (1973) with senior-year emphasis on soil mechanics, hydrology, and structural engineering. In 1977, he received a Master of Science degree in Hydrogeology at the University of Birmingham, England. He has over 12 years of experience in engineering project work in the Puget Sound area, and currently holds the position of Senior Associate Hydrogeologist in the Seattle-based geotechnical and environmental engineering firm Hart Crowser, Inc.