Sea-Tac Runway Fill Hydrologic Studies

WASHINGTON STATE DEPARTMENT OF ECOLOGY

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This Mid-Study Fact Sheet is the second of three that the Washington State Department of Ecology (Ecology) is producing to provide information to the public about the status of the Sea-Tac Runway Fill Hydrologic Studies project. This Fact Sheet provides interim project results and future objectives, a schedule for the final public workshop, and contact information. The project consists broadly of three stages: existing data review, collection of new data, and analyses. Results of the project to date are mostly from the first two stages, existing data review and collection of new data. In most cases, analyses of these data, and conclusions drawn from the analyses, will not be complete until later this year.

Ecology will produce a Project Completion Fact Sheet with a summary of findings and conclusions at the end of these studies, which are required by the Washington State Legislature to be finished by June 30, 2000.

Technical terms presented in this Mid-Study Fact Sheet are defined in the Glossary of Terms on page 7 of this Fact Sheet **(the terms are printed in italics in the text)**.

Background

The Port of Seattle (Port) has proposed to place a fill embankment in an area west of the existing Sea-Tac Airport complex to build a third runway. In 1999, public concerns prompted the Washington State Legislature and Gov. Locke to fund independent studies to investigate the hydrologic impacts of the fill project on aquifers; wetlands; and Des Moines, Miller, and Walker Creeks. With Ecology's oversight, consultants Pacific Groundwater Group (PGG); Earth Tech; and Ecology and Environment, Inc., (E & E) have been evaluating the potential impacts of the proposed project, including effects on groundwater, streams, wetlands, and fish. Because time and budget limitations did not allow for a study of all impacts of the third runway embankment, the hydrologic studies are focused on impacts that are most likely to be significant. The study area includes the fill area and adjoining wetlands, streams, and aquifers potentially impacted by the proposed runway project.

Progress and Highlights of Hydrologic Studies

Surface Water

Progress: 60 percent complete. Completed tasks include a review of existing information regarding surface water hydrology, meetings with Port and community technical consultants, fall and winter measurements of streamflows and water chemistry, and an initial evaluation of the stormwater model used by the Port to design stormwater facilities. Further evaluation of the model, permanent stormwater facilities, and water controls during construction is under way.

Groundwater

Progress: 50 percent complete. Completed tasks include a review of existing groundwater information, *geologic logging* of boreholes, measurement of water levels in wells, and a review of the Port's well inventory. The well database includes well logs generated from public and private water supply wells and Port-commissioned borings. Wells were discovered in the *buyout area* that were not in the database. In addition, some wells in the database appear mislocated or mislabeled. Development of the conceptual groundwater flow model and further evaluation of groundwater impacts from the fill embankment are in progress.

Possible Contaminated Fill

Progress: 90 percent complete. The consultant team gathered and analyzed available data regarding the metals chemistry of Maury Island fill. The data were compared to established background levels, State of Washington Model Toxics Control Act (MTCA) standards, and state freshwater sediment standards. The review indicates that the Maury Island fill meets state soil cleanup standards (MTCA Level A) and is below Puget Sound background levels and/or state freshwater sediment standards for metals. Based on this comparison, metals in the Maury Island soil being considered for fill should not pose an unacceptable risk to humans or the environment.

Wetland Ecology

Progress: 50 percent complete. Completed tasks include a wetland literature review and fieldwork. Field biologists conducted surveys within the proposed Sea-Tac Airport Expansion project area from November 29 to December 1, 1999. The purposes of the surveys were to:

- Understand the ecological setting and context of the project area;
- Review the previous *wetland delineations*;
- Obtain a qualitative understanding of the wetlands; and
- Review the identified proposed mitigation sites to compensate for the loss of wetlands.

Wetland mapping by the Port reflects the field conditions within the airport impact areas. Wetlands 18 and 37 provide a significant contribution to the overall ecological value of the Miller Creek watershed within the airport third runway impact area. However, fragmentation of available habitat and influence of non-native plant species indicate a decline of the existing ecosystem in the Miller Creek watershed relative to predevelopment conditions. Elimination of residential impacts has potential to increase the value of the remaining ecosystem.

Fish and Wildlife

Progress: 50 percent complete. A fisheries literature review was completed except for a Biological Assessment, which is ongoing. A habitat and carcass (dead fish) survey also was completed. Analysis of the fieldwork results is ongoing. A survey of juvenile salmon in Miller, Walker, and Des Moines Creeks will be conducted in late March 2000.

Summary of Interim Findings

Surface Water Flow Characterization

Project team consultant PGG measured stream flows at several locations in Miller, Walker, and Des Moines Creeks during dry periods in October, November, and January. Figure 1 (on page 3) shows the fall and winter streamflow measurements for Miller Creek. The measurements indicate that flow increases downstream at both times of year. However, the flow rate varies depending on the season. At every measurement station along Miller Creek, flows were substantially higher in January than in October. Between Lora Lake and South 156th Street, and between SR-509 and the Kiwanis Club, flow increases substantially in the absence of surface water contributions, indicating groundwater flow to the creek. About half of the increase at the Kiwanis Club appears to be water from the Miller Creek Detention Facility. The other half comes from shallow groundwater flow to the stream in the project area.

Surface Water Chemistry

The water quality in Miller, Walker, and Des Moines Creeks was analyzed for a wide range of parameters that help define the environmental health of a creek. Surface water quality parameters, including oxygen, temperature, and *turbidity*, were measured at every streamflow station in the field. Figure 1 summarizes the turbidity measurements for Miller Creek. For both rounds of measurements, turbidity was highest just downstream of the Miller Creek Detention Facility (labeled as "Lora Lake" on Figure 1) and improved downstream. Groundwater and wetland water are typically very low in turbidity; therefore, Miller Creek turbidity improves as groundwater and wetland water flow into the creek downstream of the detention facility.

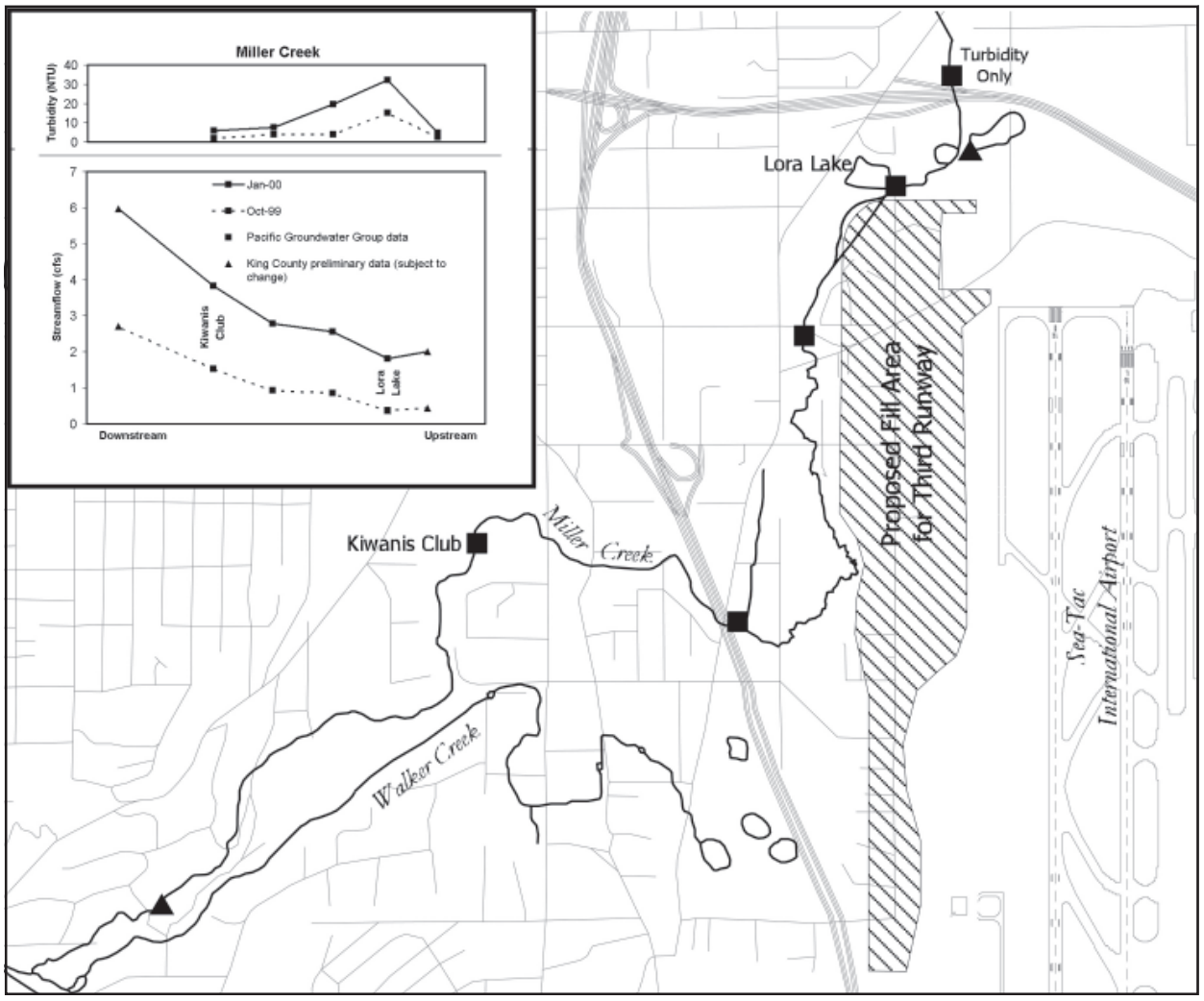

Figure 1

Surface Water Modeling

Target Flow Regime Analysis

In its Stormwater Management Plan, the Port proposes a stormwater flow control strategy that intends to reduce storm flows in Miller, Des Moines, and Walker Creeks below rates that existed in 1994. The Port proposes to store runoff in detention ponds and vaults, and to slow the rate of stormwater released downstream. To determine how slowly the water should be released, the Port estimated flow rates that occurred in the creeks when the watersheds were developed lightly with approximately 10 percent of the ground surface covered with pavement or buildings. These lower flow rates are termed the target flow regime in the Port's Stormwater Management Plan, and were estimated using the *Hydrologic Simulation Program-FORTRAN (HSPF)* models. The Port has estimated how much stormwater storage capacity would be needed to capture the runoff from the existing and proposed airport facilities and to release it at approximately the same rates as the historic flow rates in these creeks. This strategy relies on construction of on-site flow control (detention) facilities and expansion and construction of large regional ponds in Miller and Des Moines Creeks.

After analyzing the target flow regime proposal, project team consultant Earth Tech agrees with basing target flows for the stormwater management proposal on theoretical basin development of 10 percent. If this approach is developed using reliable HSPF models and implemented, the reductions in peak flows should be beneficial in maintaining stable stream channels.

Miller Creek/Walker Creek Model

Earth Tech evaluated hydrologic models of Des Moines, Miller, and Walker Creeks, created by the Port to size stormwater facilities to control runoff from existing and proposed airport facilities. Earth Tech found significant limitations in the HSPF model of the Miller and Walker Creek watersheds. These limitations make this model inappropriate for certain uses. The first problem is that the model does not achieve a balanced *water budget* throughout the watershed, indicating that the model is not well-calibrated. Some model parameters describing how the watershed responds to rainfall appear to be inconsistent with basin features.

The water imbalance may be attributed to how the model simulates the infiltration of rainfall into the shallow groundwater zone and the discharge of groundwater to the stream systems. The HSPF program is capable of tracking the portion of rainfall that infiltrates to the shallow and deep groundwater zones. This feature is important to the analysis of the baseflows and flow durations of Miller and Walker Creeks, because the model can account for water in the groundwater zones available to resurface in the creek downslope. As rainfall patterns vary over time, the stored groundwater volume changes correspondingly, which influences the baseflows in the streams. However, rainfall that percolates to groundwater is not tracked within the model constructed for the Miller and Walker Creek watersheds. Instead, the groundwater contribution to flow in the creeks is simulated by a constant year-round flow rate introduced to a lower reach of Miller Creek. By constructing the model this way, the baseflows modeled in the stream are disconnected from the amount of shallow groundwater that has been accumulated from prior rainfall. The Port-modeled baseflows are also not representative of the distributed and varied spring flows observed in the watersheds.

Des Moines Creek Model

A review of the Des Moines Creek HSPF model did not reveal serious limitations, and the calibration of the model appears to be reasonable for the purpose of making relative comparisons of flow volumes and rates. The review of the model has identified selected parameters and features that could be adjusted to improve the model's calibration.

Proposed Stormwater Control Facilities Evaluation

No specific designs have been prepared for flow control facilities in the Port's Stormwater Management Plan; therefore, a detailed evaluation of the facilities cannot be performed at this time. However, for the purposes of stormwater master planning, the Port estimated the required volumes of *stormwater detention* and water quality treatment facilities in each watershed. This approach to approximate sizing of the facilities is appropriate for master planning purposes, but the reliability of results in this case requires further consideration, given the limitations of the HSPF model. It is expected that detailed analyses would be performed by the Port later in the project to evaluate each facility's predicted performance.

Geologic Data and Well Review

Geologic Borehole Logging and Measurement of Water Levels

PGG observed the drilling of several soil borings and well construction that were commissioned by the Port. The borings and wells were located near areas that the Port proposes to fill for the third runway. PGG also measured the depth to water in numerous wells and observed the procedures used to collect water levels by Port consultants. Port consultants and the drilling company generally followed accepted procedures for well construction and soil and groundwater data collection. Procedures for estimating the density of soils, collecting soil samples, describing the texture and type of soils, and measuring the depth to water were generally consistent with accepted professional practice.

In February 2000, water levels were measured in wells located in the proposed fill areas and borrow source for the fill that are south of the airport. Calculated groundwater elevations will be grouped by soil layer and interpreted to evaluate the relationships between aquifer zones, and the relationships between groundwater, wetlands, and streams.

Well Inventory

PGG evaluated the well database and geologic interpretations compiled by Port consultants as a basis for constructing the Port's regional groundwater model. PGG identified wells on database maps that may be mislabeled or mislocated. PGG's independent interpretation of selected geologic data is consistent with the Port's interpretation; however, interpretations regarding geologic layering differ in certain areas between PGG and the Port. PGG will discuss concerns about the well database and geologic interpretations with Port consultants. The Final Report will address these concerns, along with general review comments.

PGG performed a one-day field survey of wells in the buyout area west of the existing runways. The purpose of this work was to assess how the Port was handling water supply wells during demolition of the houses. Two drilled wells and 10 wells dug by hand were found during the survey, which covered about half of the buyout area. The wells were abandoned, but were not decommissioned in accordance with state well abandonment regulations. Abandoned wells should be sealed properly to prevent groundwater contamination and safety risks.

Fill Chemistry

Fourteen million cubic yards of sand and gravel fill from Maury Island may be used in the proposed third runway embankment. The top 18 inches of soil at Maury Island contains high levels of arsenic, cadmium, and lead as a result of aerial deposition from the historic ASARCO copper milling operation in Tacoma. Only soil material below the upper 18 inches is being considered as potential third runway fill. Available soil quality data of the Maury Island fill were tabulated and compared to established background levels and State of Washington standards. These standards define acceptable levels for metals in soils. Based on this comparison, metals in the potential Maury Island fill soil should not pose an unacceptable risk to humans or the environment.

Wetland Field Survey Results

E & E field biologists performed a site reconnaissance of the project area to evaluate previous wetland delineations. Where reviewed, E & E found the previous delineations to be accurate. The United States Army Corps of Engineers has also verified the delineations. Several wetland types, depression, slope, and riparian, would be impacted by the proposed expansion activities. The proposed runway fill embankment would account for most of the wetland impact, with only minimal impacts outside the runway expansion area. Wetlands 18 and 37, which form a single large complex, would be the most significantly impacted wetlands. Wetlands 18 and 37 are located south of South 160th Street, east of Miller Creek, and west of 12th Avenue South. Portions of this complex would be permanently lost from filling in conjunction with the new third runway. Side slope seepage into Miller Creek provides most of the water to these wetlands. Urban encroachment and local land use (i.e. residential) have noticeably impacted this wetland. Several other large wetland complexes that exhibit significantly less impact from urbanization were identified in the surrounding areas. Nonetheless, from a project area evaluation standpoint, Wetlands 18/37 represent one of the larger, more significant wetland complexes, because of its relative size within an urban environment. An evaluation of the dominant vegetation within these communities demonstrates a strong influence from non-native/exotic plant species, which reduces the overall wildlife habitat value of the wetlands.

Currently, E & E is assessing the quality of the wetlands, which potentially are impacted in the project area. E & E's evaluations are based on the Washington State Wetlands Rating System (Ecology Publication #93-74).

The site reconnaissance also included an evaluation of the mitigation projects that are proposed in conjunction with the proposed activities. Historically, low areas on the old Vacca Farm site would have been classified as wetlands. However, given agricultural practices undertaken on the property, and the longevity of the operation, parts of this parcel no longer are governed under federal wetland regulations. The area is highly degraded and provides only limited wetland functions. Parts of Vacca Farm meet the criteria for wetlands, as defined in the State of Washington Wetland Delineation Manual. Because *hydric* soil conditions are still present on the site, the proposed mitigation activities have a reasonable opportunity to be successful. The Auburn mitigation site would use abandoned agricultural land close to the Green River. The mitigation design requires excavation into the water table to provide a better opportunity for mitigation success. The proposed wetland elevations were based on extended monitoring of the existing groundwater table.

The wetlands in the project area will be evaluated to assess the impacts resulting from construction of the third runway embankment. This evaluation will be based on a more detailed qualitative analysis to be

completed. Pending the findings of this analysis, the impacts will be evaluated to assess whether the expected impacts can be mitigated, whether mitigation would be able to compensate for wetland loss, and whether sufficient and appropriate mitigation has been proposed.

Fish

Carcass Survey Results for Miller, Walker and Des Moines Creeks

E & E performed carcass surveys on Miller, Walker and Des Moines Creeks to identify the percentage of Washington Department of Fish and Wildlife (WDFW) hatchery fish in the annual salmon return. The absence of the *adipose fin* on returning salmon identified WDFW hatchery fish because WDFW clips the adipose fin on its juvenile fish, and this fin does not grow back. Miller Creek Trout Unlimited Hatchery does not clip the adipose fin on its fish, nor uses any other distinguishing marks, so identification of that hatchery's fish was not possible. E & E collected fish species, sex, and *egg voidance* data during the surveys.

The carcass surveys were performed by walking upstream from the creek mouth to a predetermined boundary. First Avenue South was the upstream boundary of Miller and Walker Creeks, and Marine View Drive was the Des Moines Creek upstream boundary. Most female fish appeared to void most of their eggs, although the range of egg voidance was from 0 percent to 100 percent. The observed egg voidance percentages are likely overestimates of the actual percentages, because significant decay and subsequent washout of the carcasses had occurred since the fish expired and the survey was performed.

Most of the fish in all of the surveyed streams were coho salmon (Oncorhynchus kisutch). Two chum salmon (O. keta) were observed in Des Moines Creek. In Miller Creek, six female coho salmon and three male coho were observed. Eight fish were identified as WDFW hatchery fish, while one fish possessed its adipose fin. In Walker Creek, 12 female and 12 male coho salmon were observed. Twelve fish were identified as WDFW hatchery fish, six fish possessed adipose fins, and six were undetermined because of decayed conditions. In Des Moines Creek, one female coho, four male coho, and one female chum salmon were observed. Only one fish was identified as a WDFW hatchery fish, and five fish possessed adipose fins.

Redd counts originally were planned but were not performed for Miller, Walker, and Des Moines Creeks. A significant amount of time had elapsed since salmon had entered the creeks and completed any spawning. Visual indicators, such as spawning behavior or freshly overturned gravel, were absent; therefore, conclusive determination of redd locations was impossible.

Results of water quality data for Walker Creek do not indicate any significant water quality concerns at the time of the survey. The turbidity measurement in the Normandy Park residential area upstream of Thirteenth Avenue was high compared to that in other stations, although the reason for the high measurement is unknown. Water quality data collected during the habitat surveys are consistent with water quality data collected by Earth Tech. Slight differences noted in the two data sets can likely be attributed to differences in the sample locations and the times of year data was collected. Earth Tech's water quality data identified a concern related to the quality of fish habitat. The dissolved oxygen levels in the upper reaches of Miller, Walker, and Des Moines Creeks are in the low range of those levels preferred by trout and salmon.

Overview of the Remainder of the Project

Until the end of June 2000, the project team will finalize analyses of hydrologic impacts as described in this Fact Sheet. A Final Report will be generated to summarize the findings. The findings also will be communicated in a final Fact Sheet and public meeting; both scheduled for June 2000.

Project Completion Public Workshop

June 27, 2000
7 p.m. to 9 p.m.
Highline Performing Arts Center
(206) 433-2292
401 South 152nd Street, Burien

GLOSSARY OF TERMS (as they appear in the text)

Geologic logging is describing soils encountered by a drill as it advances into the earth.

Buyout area is the area west of the current runways, that the Port has purchased, or is attempting to purchase, to facilitate construction of the third runway.

Wetland delineation is the establishment of wetland boundaries using evidence of vegetation, soils, and wetland hydrology. The United States Army Corps of Engineers and the Washington State Department of Ecology have published wetland delineation manuals.

Turbidity is a measure of the amount of soil particles suspended in water.

Hydrologic Simulation Program-FORTRAN (HSPF) is a computer model used to simulate the hydrologic response of a drainage basin to rainfall. By using a long period of continuous rainfall data, the model is capable of accounting for longer term trends in baseflows and peak flows.

Water budget is an accounting of the input and output of water within a drainage basin, including rainfall, groundwater flows, stream flows, water stored in ponds or lakes, and evaporation and transpiration.

Stormwater detention involves ponds or underground vaults constructed to store storm runoff from a development site and to release it at a slower rate. These facilities are designed with outlets to release stormwater at a rate equal to or less than the rate of runoff from the site before occurrence of development.

Hydric is a soil condition of being saturated, flooded, or pooled long enough during the growing season to develop conditions that are anaerobic (lacking oxygen) in the upper part.

Adipose fin is the small, fleshy fin located on the back of a fish near the tail.

Egg voidance is the number of eggs that a female fish expels during spawning season.

Redd is the area in the streambed where fish deposit fertilized eggs.

Contact Information

Questions about the Sea-Tac Runway Fill Hydrologic Studies project may be directed to *Dave Garland, Water Quality Program, Washington State Department of Ecology, Northwest Regional Office, 3190 160th Avenue S.E., Bellevue, WA 98008; telephone, (425) 649-7031; or e-mail, dgar461@ecy.wa.gov.*

If you need this Fact Sheet in an alternative format, please call Dave Garland at (425) 649-7031 (voice) or (425) 649-4259 (Teletype Device for the Deaf [TDD]).

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