Maury Island Gravel Mining Impact Studies

Mid-Study Fact Sheet – January 2000

Background

Glacier Northwest (formerly Northwest Aggregates Company), a subsidiary of Lone Star Northwest, Inc., has applied to increase its rate of gravel extraction from a mine located on the eastern shore of Maury Island. This proposed action is currently in review under the State Environmental Policy Act (SEPA) process. The Department of Ecology has the responsibility to manage studies conducted by Pacific Groundwater Group and its subconsultants, Herrera Environmental Consultants and EVS Consultants. This Fact Sheet summarizes the interim findings of these studies. A *Project Completion Fact Sheet* will also be issued to summarize their conclusions.

Progress and Highlights of Mine Studies

Groundwater

- *Progress: 50 percent complete.* Completed tasks include monitoring well construction, water-level survey, groundwater flow analysis, and review of existing hydrogeologic data. The hydrogeologic impact analysis, which includes a recharge and a groundwater flow model, is in progress.
- *Highlights*. Groundwater in the Principal Aquifer flows toward the perimeter of the island. A groundwater divide lies in the center of the northwest part of the island.

Surface Water

- *Progress: 60 percent complete.* Completed tasks include field reconnaissance and collection of samples for water-quality analysis. The assessments of the stormwater infiltration/detention facility and of sediment runoff are in progress.
- *Highlights*. Samples of water from on-site springs met Washington State standards for Class AA (extraordinary) surface waters.

Nearshore Environment

- *Progress: 50 percent complete.* Completed tasks include the sea-floor survey, a side-scan survey, sediment profiling, and sediment sampling. The evaluation of project-related impacts to species of concern is in progress.
- *Highlights*. Nearshore sediments consist mostly of well sorted sands. Eelgrass beds were identified, along with other features that may provide marine habitats.

Contaminated Soils

- *Progress: 95 percent complete.* Completed tasks include the data review and assessment of the proposed soil-containment system.
- *Highlights*. The results of leachability testing reveal that arsenic in soil poses a minimal threat to groundwater. Some recommendations have been made for the proposed soil-containment system.

Publication Number 00-10-007

Summary of Interim Findings

Investigations are ongoing in the areas of groundwater, surface water, nearshore environment, and contaminated soils to assess the potential impacts of the proposed mining expansion. Work conducted to date and interim findings for each topic are summarized below. The final impact assessment will be completed by June 2000.

Groundwater

Five tasks were implemented to better characterize groundwater flow conditions at Maury Island:

- Literature Review
- Conceptual Model Assessment
- Aquifer Exploration and Analysis
- Well Inventory and Water Level Survey
- Hydrogeologic Impact Assessment

Literature Review

Seven reports on the hydrogeology of the mine site vicinity were reviewed to identify areas requiring further assessment. The results of this review were then summarized in a report entitled *Document Summaries and Areas of Further Investigation*, posted on Ecology's web site. This summary report was used along with the project work plan to design the groundwater impact studies.

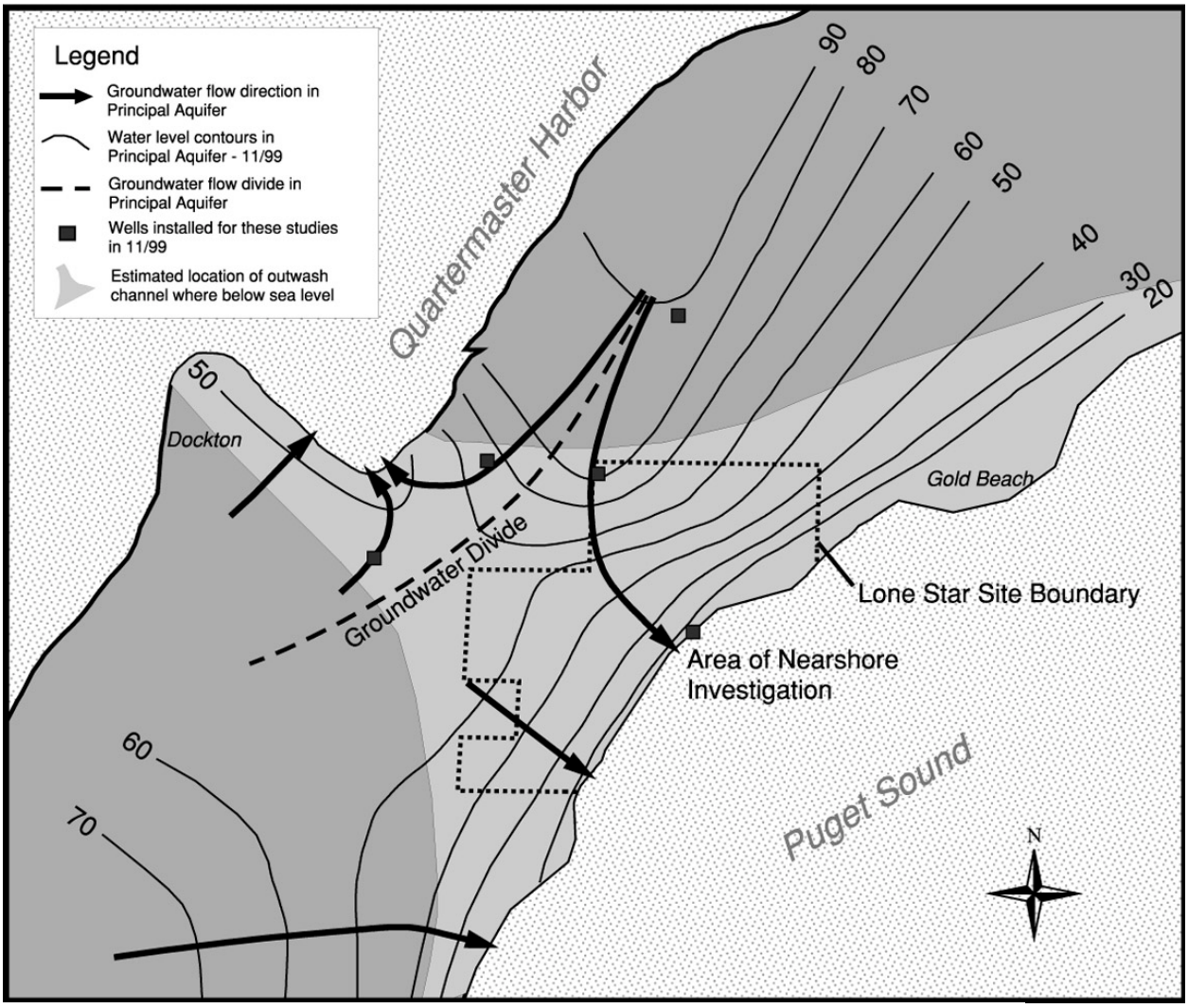
Visit Ecology's web site www.wa.gov/ecology for more information.

Conceptual Model Reassessment

Using both new and existing data, the conceptual understanding of groundwater flow on Maury Island was reassessed, yielding a better understanding of groundwater flow in the *Principal Aquifer*. This aquifer consists of "outwash"—sand derived from glacial melt waters about 14,000 years ago. It is the water-bearing portion of a subsurface channel that locally extends southeast from Dockton Park through the Lone Star site. The *Principal Aquifer* is underlain by finer-grained sediments that form a hydraulic boundary along the bottom of the aquifer, controlling groundwater flow. The flanks of this subsurface outwash channel are generally thinner and higher in elevation, causing groundwater flow into the center of the channel.

Aquifer Exploration and Analysis

A total of five new observation wells were installed in November 1999 to better characterize subsurface conditions and evaluate groundwater flow directions in the *Principal Aquifer*. Well depths ranged from 60 to 200 feet. Two new wells were completed on Lone Star property near existing wells. In general, the sediment types described by previous investigators correlate with materials observed at these wells. The three remaining wells were completed off site. These wells provide new information about the nature, extent, and thickness of the outwash sediments. They are also used for measuring water levels in the *Principal Aquifer*. Soil samples were collected from each well to identify any previously unidentified zones of saturation.



Groundwater Contours and Flow Direction in Principal Aquifer Near Lone Star Mine Site.

Well Inventory and Water-Level Survey

Water-supply wells and springs within a 4,000-foot radius of the Lone Star site were located in the field using records from Ecology, information from previous studies, and mail-in responses from the *Startup Fact Sheet*. After surveying the coordinates and elevations of the 47 accessible wells, water levels were measured. These data were used to estimate the direction of groundwater flow in the *Principal Aquifer* and to characterize the relationship between groundwater in the *Principal Aquifer* and in the *Sub Sea Level Aquifer*.

The survey results indicate that groundwater in the *Principal Aquifer* generally flows toward the perimeter of the island. A groundwater "divide" lies near the center of the aquifer; water flows southeast on one side of this divide and northwest on the other. Water levels are generally higher in

wells along the northwestern portion of Maury Island near Quartermaster Harbor and lower in wells at the Lone Star site. The survey results also suggest that the main source of recharge to Dockton Springs lies outside of the mine site.

Hydrogeologic Impact Assessment

The hydrogeologic impact assessment consists of two main analyses that are currently under development: a groundwater recharge analysis and a groundwater flow model. The recharge analysis will estimate recharge to the *Principal Aquifer* under current and proposed mining conditions using a model that estimates the rate and amount of downward water movement into soils, along with local land use, soil type, surficial geology, and precipitation data. It will also assess the timing of recharge. The groundwater flow model will simulate flow in the *Principal Aquifer* near the site under current and proposed mining conditions. This model is based on hydrogeologic data collected during recent and previous investigations. Both assessments use the conceptual hydrogeologic model as the basis for quantifying groundwater flow.

Surface Water

Three tasks were implemented to better understand surface water near the Maury Island mine site:

- On-Site Spring Assessment
- Stormwater Infiltration/Detention Facility Evaluation
- Sediment Runoff Assessment

On-Site Spring Assessment

Two site visits were made to assess the flow and quality of springs in the mine area under both dry-weather and early wet-weather conditions. Samples were collected and analyzed for temperature, pH, conductivity, total dissolved solids, nitrate, nitrite, arsenic, cadmium, and lead. No metals were detected in any sample. All samples met Washington State water-quality standards for Class AA (extraordinary) surface waters. They also met State drinking water standards.

Because the quality of the springs is good, it appears that contaminants have not leached from the mine area under current conditions. Since contaminated soils will be transported and stored in containment facilities, the possibility of leaching will be further reduced, although contaminants could be mobilized if it rains during excavation and transport.

Stormwater Infiltration/Detention Facility Evaluation

Since no specific designs have been proposed for a stormwater infiltration/detention facility at the mine site, a detailed evaluation could not be performed. A preliminary review, however, indicates that the "sole source" designation of the aquifer underlying the site poses special concerns for the design of this facility. One concern is that the infiltration rate must be less than 2.4 inches per hour, unless the soil beneath the facility has certain physical and chemical properties that enable effective treatment with faster infiltration rates. Another concern is the potential for clogging by fine-grained materials, which

could result in overflows of untreated water to Puget Sound.

Sediment Runoff Assessment

The results of a site visit indicate that very little surface runoff currently occurs at the mine site, that runoff does not currently flow to a designated stormwater control area, and that there are no areas with significant accumulations of sediment. Consequently, stormwater and related sediment samples could not be collected as originally planned for this assessment. The lack of sediment is due to the granular nature of the geologic materials present on site, materials that promote infiltration and do not provide a significant source of mobile, fine-grained sediment. This finding is supported by the results of grain-size analyses for samples collected during the drilling of on-site monitoring wells.

The effects of sediment runoff are being evaluated using a different approach, which involves reviewing leaching data for metals in soil in the most contaminated parts of the site. It also involves reviewing available groundwater and surface-water quality results, which indicate that little leaching has occurred under current conditions. The potential for finer-grained soils to erode and enter runoff on the mine site will be assessed qualitatively. Results of this investigation will be summarized in the final report.

Nearshore Environment

Two tasks were implemented to better understand the nearshore environment of Maury Island:

- Literature Survey
- Baseline Characterization

Literature Survey

The literature was surveyed to identify resources and similar studies documenting the effects of project-related impacts to the nearshore resources and species of concern. The findings of this survey are reported in a technical memorandum entitled *Literature Review for Nearshore Assessment*. The document discusses potential uses of the nearshore area by the Puget Sound chinook salmon and the Pacific herring. It also discusses potential impacts of the project construction and presents a list of published scientific studies that will provide the basis for the nearshore assessment.

Baseline Characterization of Nearshore Habitat

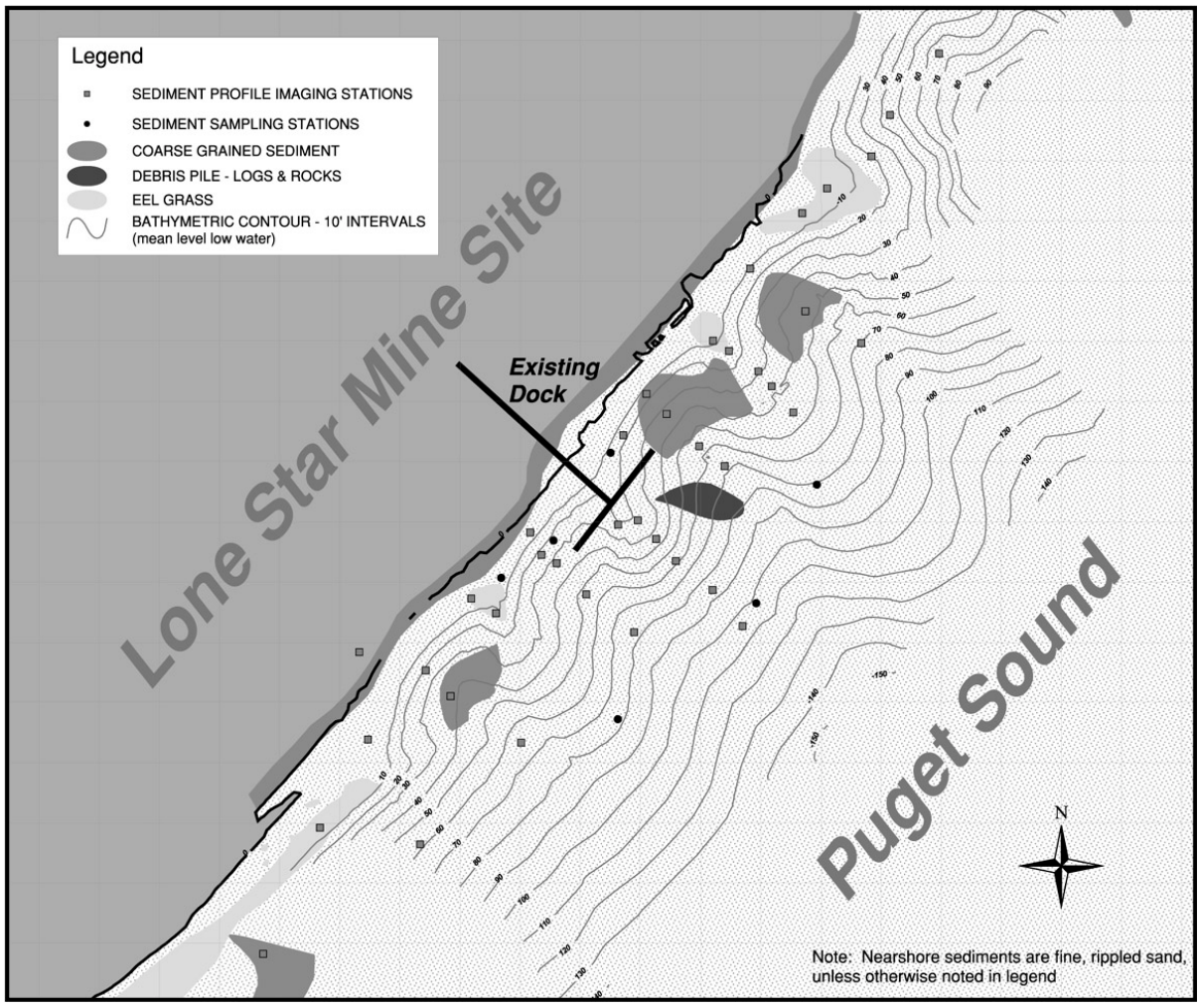
A series of field investigations was completed to document approximately 3,000 feet of Maury Island coastline, centering on the Lone Star dock. The investigations comprise the most comprehensive characterization of nearshore sediment conditions to date and included:

- A survey to characterize the topography of the seafloor

- A high-frequency, side-scan sonar survey to document sediment type and seafloor features such as eelgrass beds
- Sediment profile images from 39 locations at depths ranging from 5 to 105 feet to document physical and biological seafloor properties
- Sediment grab samples from six locations immediately inshore and offshore of the dock facility to document baseline sediment chemistry

The results of the field investigations indicate that the nearshore is characterized by a series of submerged beach cusps with alternating hills and valleys that run perpendicular to the shoreline. The hill crests lie approximately 300 feet apart. The Lone Star dock is located on one of these crests.

The surface sediments primarily consist of fine to medium, well-sorted sands, although several patches of small rocks and cobble of both natural and anthropogenic origin were



Nearshore Features at the Lone Star Site, Maury Island.

observed. No evidence of fine-grained muds or organic loading was found in any of the areas surveyed.

Eelgrass beds are confined to areas of the nearshore that are less than 20 feet deep. Some relatively small eelgrass patches lie near the dock, an extensive bed runs along the shore 500 feet to the southwest of the dock, and another large bed runs 400 feet to the northwest. Two sunken barges and a small vessel were identified southwest of the dock. A debris pile of logs and rocks was identified just off the northwest face of the dock, along with a few isolated sunken logs.

Contaminated Soils

Two tasks were implemented to assess contaminated soils at the Lone Star site:

- Data Summary and Review
- Soil Containment System Assessment

Data Summary and Review

The nature and extent of soil contamination at the Lone Star site were assessed using soil chemistry and leaching data presented in the DEIS and other documents. The data were reviewed and summarized in a technical memorandum.

Arsenic concentrations are highest in surface soils but decrease with depth. The highest concentrations are found in the western portion of the Lone Star site, where they exceed 200 parts per million (ppm). The maximum measured arsenic concentration is 477 ppm. These values are greater than the Washington State cleanup levels for both industrial and residential sites. Arsenic concentrations in deeper soils (from the mined portion of the site) are generally below the residential cleanup level of 20 ppm; in other areas, they are below this cleanup level in samples collected from a depth of 24 inches. Lone Star plans to remove all soil that is contaminated above residential cleanup levels and construct a containment cell to store it on site.

Laboratory leachability tests indicate that arsenic and other metals in the most contaminated surface soils are relatively immobile. Consequently, the metals are not expected to present a risk to groundwater when disturbed during mine expansion. This laboratory finding is supported by field observations—the background concentrations of metals in groundwater at the mine site meet State drinking water standards. Since the metals in these soils are mostly non-leachable, they pose a minimal threat to long-term groundwater quality.

Soil Containment System Assessment

The design of the proposed containment system for contaminated soils was evaluated, along with the potential environmental impacts of the system. The results of this evaluation are summarized in a technical memorandum that identifies contaminant pathways and impacts in case of a containment system failure. The following measures are strongly recommended if the soil-containment system is permitted.

- A "linear low-density polyethylene" geomembrane should be used to line and cover the cell instead of bentonite clay. This will minimize potential leakage and improve constructability.
- Additional sand should be used in the cell liner and cover system to preserve impermeable materials during construction.
- A berm should be constructed at the toe of the cell. It should have a minimum of 3 feet of freeboard in case the leachate collection system becomes clogged or plugged.
- The slope angles and drainage properties of the cover system should be carefully reevaluated to ensure that it does not fail, causing off-site erosion.
- The site grading plan should be revised to eliminate the direct-runoff pathway to Puget Sound at the cell's east end.

Preliminary seismic modeling predicts that materials in the cell would be stable against catastrophic gravity-driven sliding under static and post-earthquake conditions.

Public Workshops

The final study results will be discussed at a Public Workshop in June 2000. Details will be provided at a later date.

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