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Geologic and Hydrogeologic
(CARA) Report
Aggregate Resource Evaluation
The Wahl Extraction Area
Jefferson County, Washington
Job No.FredHill.01RR

INTRODUCTION AND HISTORY

Fred Hill Materials, Inc. (FHM) currently mines and processes aggregate resources at the existing Shine Pit site located south of SR 104 and west of the Hood Canal Bridge in Jefferson County, Washington. The existing Shine Pit and the proposed Wahl Extraction Area are situated within the Thorndyke Mineral Resource area, MLA-02-235, an approved Mineral Resource Land Overlay (MRL) designation for 690 acres. The Wahl Extraction area and MRL are located approximately one mile southwest of FHM's existing Shine Pit area. The Shine Pit, Wahl Extraction, and MRL area, all located within the Thorndyke Resource Operations Complex (T-ROC), are located within an approximate 21,000-acre Thorndyke Block, which is a portion of the Pope Resources 72,000-acre Hood Canal Tree Farm. These areas are located in Jefferson County on the Tornados Peninsula, which is south and west of the Hood Canal Bridge. This portion of the Peninsula is locally known as the Upper Coyle Peninsula. The general location of the site is shown on the Vicinity Map, Figure 1. The proposed Wahl Mine site layout is shown on the Site Plan, Figure 2.

The Shine processing area will function as the Operations Hub for the Wahl Extraction site. Material from the Wahl Extraction area will be transported to the Shine processing area by the Wahl Conveyor system. The Wahl Extraction area is located southwest of the existing Shine mine and processing area. The proposed 1.25-mile Wahl Conveyor originates at the southeast corner of the proposed Wahl Extraction Area, travels northeast through the Thorndyke Block (within an approximately 9-acre easement), and terminates at the southwest corner of the existing Shine Pit.

The Wahl Conveyor's route was specifically selected to avoid and/or minimize impacts to environmentally sensitive areas (steep slopes, wetlands, streams, and their associated buffers). SEPA documents are being prepared for the project. This report will be utilized as part of the submittal package.

The Thorndyke Block has been utilized for the production of forest products with logging as early as the 1900s. Currently, the area is managed as commercial forestland with periodic logging of acreage units and predominant replanting of Douglas fir. More than half of the proposed Wahl Extraction area and Conveyor route will be located in forestlands that have been logged within the past 10 years.

Mining of sand and gravel in the general area of the Shine site began in 1959 to supply materials for the building of the Hood Canal Bridge revetment on the Jefferson County side. Since that time, various operators have mined the aggregate resources in the same vicinity and provided truck delivery of the processed materials. Mining has also occurred in the Thorndyke area since the 1930's for the construction and maintenance of logging roads and since the 1980's for Pope Resources plat development.

In December 1979, FHM took over operation of the Shine Pit and obtained a Surface Mine Reclamation Permit (No. 70-011936) issued by the Washington State Department of Natural Resources (WSDNR). Since then, FHM has continuously operated the pit.

In addition to the WSDNR surface mining reclamation permit, FHM operates under a Washington State Department of Ecology (WSDOE) Sand and Gravel General Permit (No. WAG 50-1120), which regulates the treatment and control of stormwater. All stormwater that falls on the existing 144-acre Shine Pit is prevented from leaving the site through application of infiltration techniques.

In June 1999, Ace Paving obtained a Jefferson County Conditional Use Permit (No. ZON98-0041) to operate a portable asphalt batch plant located on five acres within the 144-acre Operations Hub/Shine Pit. Ace Paving operates under its own Washington State Department of Ecology (WSDOE) Sand and Gravel General Permit (No. WAG 50-1237). The stormwater that runs off the asphalt batch plant site goes directly into FHM's central stormwater treatment and control system.

In March 2001, to prepare for the impending depletion of sand and gravel supplies at the existing Shine Pit, FHM submitted to WSDNR a preliminary application for the 165-acre Wahl Extraction Area as an expansion of the existing Shine Pit mine area. In April 2002, FHM submitted a Mineral Resource Lands Overlay (MRL) application to Jefferson County. The submission complied with the new requirements (effective January 2001) of the Jefferson County Unified Development Code (UDC). In September 2002, WSDNR determined that the March 2001 FHM application for the Wahl Extraction Area would need to be resubmitted as a new permit, independent of the existing permit. In addition, Jefferson County UDC requirements will be applicable.

In December 2002, Jefferson County approved a modified application for MLA-02-235, a Mineral Resource Land Overlay (MRL) designation for 690 acres, located approximately a mile west and south of FHM's existing T-ROC Operations Hub (Shine Pit). This MRL designation formally recognizes the existence of commercially viable deposits of sand and gravel; provides for appropriate notification of adjacent landowners regarding likely future mineral resource activities in this designated area; and allows FHM to apply for specific excavation permits greater than 10 acres in size under the requirements of the Jefferson County UDC. As previously discussed, the Wahl Extraction Area is located within the approved MRL.

This report summarizes our site observations and subsurface exploration data and provides our conclusions and opinion with regard to the geologic conditions and aggregate resource present in the Wahl Extraction portion of the T-ROC area. Our evaluation and opinions are provided at your request.

GEOLOGIC CONDITIONS

Interpretation of the geologic conditions at the Wahl site are based on our site observations, soil exposures in the area, test pits and borings completed at the site, and our review of the available geologic literature. In general, the soils in the region consist of, from oldest to youngest, undifferentiated pre-Vashon glacial and interglacial sediments, overlain by Vashon advance outwash, glacial till (hardpan) and recessional

outwash sediments. Locally ice marginal or ice contact deposits also occur along ridge and shoreline slopes. A generalized geologic map of the area is included as Figure 3.

The older glacial sediments are exposed along portions of the Puget Sound shoreline bluff located east of the site area. These soils typically consist of bedded sands and gravels and occasional till deposited by pre-Vashon glaciers. The interglacial deposits typically consist of bedded silt, sand and occasional clay. These older sediments are in a very dense or very hard condition where undisturbed.

The Wahl Extraction area is situated within a generally north-south trending Vashon glacial outwash area that is located west of the Hood Canal Bridge. During the Vashon glacial period, approximately 10,000 to 15,000 years ago, the pre-glacial geomorphic conditions of the Thorndyke area combined with the advancing and receding glacial ice conditions to deposit a thick deposit of high quality aggregate (sand and gravel) material within a confined area. These aggregate materials were generally deposited in front of the advancing glacial ice, and as the ice melted and receded. The geomorphology or topography of the area and the high energy of glacial melt waters resulted in the thick layers of clean sand and gravel material being concentrated in this geographic area.

Based on our site observations and data review, several large glacial outwash channels extended through the Thorndyke area in a general north-south direction. Within the outwash channel areas, the glacial till is absent, either not deposited or removed through erosion by the scouring melt water. Where this occurred, thick recessional sand and gravel deposits were deposited directly over the advance sand and gravel deposits, resulting in a thick or deep section of high quality aggregate material.

Thick deposits of clean high quality sand and gravel material, like those that occur in the Thorndyke area, are unique. Aggregate resource deposits of this nature are rare throughout the world. Although the Puget Sound area is blessed with several of these larger aggregate deposits, to date, none have been identified in the Kitsap or Olympic Peninsula areas. The Thorndyke MRL area is a valuable resource that will provide aggregate resource material to the region on a long-term basis. The location of the Thorndyke MRL in a remote area reduces the impacts to developed civic areas.

SUBSURFACE CONDITIONS

General

Subsurface conditions at the site were evaluated by excavating over 100 track-hoe test pits and completing nineteen borings in the Thorndyke MRL area. Observations wells were installed in the borings to monitor groundwater conditions in the site area. The approximate locations of the borings/observation wells is shown on the Outwash Channel Map, Figure 4. The test pits extended to depths of several feet to approximately 20 feet. Many of the test pits encountered sand and gravel to the full depth explored. The borings were completed with an air-rotary drilling rig to depths ranging from approximately 25 feet to 420 feet below the existing ground surface. Soil samples were collected on a 10-foot interval for further evaluation. Laboratory analyses (sieve tests) of select soil samples were completed from both the test pits and borings. Exploration and laboratory data for the MRL and Wahl Extraction areas will be maintained in our files and can be selectively provided based on approval from the owner and Fred Hill Materials.

Aggregate Quality

Based on our site observations throughout the region, excavation of the trackhoe test pits, and completion of the borings, the sand and gravel deposits located within the Wahl Extraction area consist of high quality commercial sand and gravel with cobbles

and occasional boulders. The fines content (material passing the US. No. 200 Sieve) varies, but is typically less than 5 percent. This aggregate material is suitable to produce high quality commercial pit run and a variety of select commercial aggregate products. Any reject material that cannot be exported from the site will be utilized for reclamation of the site.

Adequate coarse gravel, cobbles and boulders occur in the aggregate material observed/encountered to produce commercial crushed products. Sufficient fine to medium sand occurs as lenses and at depth to provide for material binder and select concrete and commercial specialty sand products.

Aggregate Quantity

Based on the results of our subsurface explorations and data review, the aggregate resource quantity within the Wahl Extraction area is capable of supplying a variety of quality commercial aggregate products to the Kitsap and Olympic Peninsula region on a long-term basis, approximately 20 years. There are no other know aggregate resources of this quality or quantity in the Peninsula area.

HYDROGEOLOGIC CONDITIONS

Hydrogeologic conditions at the Wahl Extraction area were evaluated by reviewing available geologic literature and previous work in the area, our observations, and data from monitoring of over 100 test pits and nineteen borings at and near the site. The test pits ranged in depth from approximately 5 to 20 feet. The borings ranged in depth from approximately 2-5 feet to 420 feet (to Elevations 300 to 15 feet above sea level). Observation wells were installed in the borings and have been monitored on an intermittent basis. The locations of the borings/observation wells are shown on the Outwash Channel Map, Figure 4.

As previously discussed, the soils in the region consist of (from oldest to youngest): undifferentiated pre-Vashon glacial and interglacial sediments (Double Bluff and Whidbey Formations) that are overlain by Vashon advance outwash, glacial till (hardpan) and recessional outwash sediments. During the last 13,000 years, weathering of the soils has resulted in the accumulation of alluvial silts and organic debris in localized valley floor areas near the toe of slopes.

Surface water in the site area also occurs as perched near-surface water in localized wetland and lakes in and near the east portion of the site. The near surface water is perched above accumulated silt, clay and organic materials. These materials have a low permeability and perch surface water that accumulates in these low-lying areas. These wetlands and lakes are not in direct continuity with the underlying aquifer systems. Mining will be setback from these areas. A schematic section is included as Figure 5.

Within the Wahl Extraction and adjacent areas, surface water occurs seasonally within Thorndyke Creek. Thorndyke Creek is located west of the Wahl Extraction area. Mining will be setback from Thorndyke Creek several hundred feet. Based on the results of our explorations and review of mine plan, the lower mining limits will be above the nearby channel bottom elevations of Thorndyke Creek. This is illustrated in cross sections A, B and C, Figures 6a, 6b and 6c. Mining will not be conducted within this groundwater table, but remain a minimum of 10 feet above the seasonal high level.

Two aquifers were encountered in Wahl Extraction and MRL areas borings/observation wells and test pits. Water supply wells in the area typically produce water from the lower of the two aquifers encountered in the site area, or from even deeper pre-Vashon sediments, like those at the Squamish, Bridgehaven and Thorndyke

community wells, located east and south of the site. The upper aquifer encountered over most of the site occurs within the Vashon outwash materials. Based on the water levels measured in the observation wells, the surface of the Vashon aquifer is at approximately Elevation 320, in the north sloping down to Elevation 150 in the south (T27N, R1W, Section 12). The seasonal groundwater fluctuation is approximately 10 feet. Wells completed in the south portion of the Wahl Extraction and MRL area did not encounter this aquifer. The groundwater flow of this aquifer is to the south. We expect that this aquifer provides spring flow along portions of Thorndyke Creek and the south shoreline of Hood Canal (approximately Elevation 100). The approximate extent of the Vashon aquifer and the estimated groundwater flow direction is shown on Figure 7.

The deeper pre-Vashon aquifer system encountered in the site area is overlain by a generally impermeable lacustrine silt/clay layer (aquitard) and is a confined aquifer. This is evidenced by water levels in Boring 14 (located near Wahl Lake) and the Fred Hill process area water well. The water levels in these wells rose to Elevations 83 and 93 respectively (artesian condition), after well completion. This aquifer was not encountered in a deep well completed in the southeast portion of the MRL, south of the Wahl Extraction area (Boring 18). This indicates that this aquifer is not continuous throughout the Thorndyke area. Groundwater levels in the wells are listed in Table 1, Wahl Extraction & MRL Area Groundwater Levels.

The Squamish, Bridgehaven and Thorndyke area wells are completed in an aquifer that is at approximately Elevation –50, an additional 100 feet or more below the pre-Vashon aquifer beneath the site. Based on our data review, the water-producing unit is the Double Bluff Formation and may or may not extend laterally through the region. This aquifer is overlain by the generally impervious Whidbey Formation, an aquitard that restricts the downward movement of the groundwater. The static water elevations of these wells range from approximately –10 to +30 and typically have head pressures of between 50 and 60 feet, a confined aquifer. Based on previous work completed in the area by Robinson & Noble, Inc., a 10 year horizontal capture zone for the Bridgehaven well, which is completed within this aquifer, would extend west-northwest approximately 7, 000 feet (Appendix A). This is east of the proposed Thorndyke area. The 10-year capture area for this well is shown on Figure 7. The capture zone does not include travel time for the vertical migration of the water from the ground surface to the aquifer (through the overlying soils and/or aquitards).

CONCLUSIONS

Based on the results of our site reconnaissance, subsurface explorations, groundwater monitoring, review of the available data and our experience, it is our opinion that the proposed mining activity at the Wahl Extraction area will have no adverse impact to the surface or groundwater systems in the area. Mining will be conducted in accordance with DNR and Jefferson County Regulations. Conventional 2 to 1 or flatter cut slopes will be utilized for the mining area. All structures can be founded on conventional foundations. Temporary and Permanent erosion control measures will be installed and maintained, as appropriate. In general, all stormwater runoff will be retained on-site.

EROSION AND SEDIMENTATION CONTROL

The erosion hazard for disturbed soils ranges from slight to moderate depending on the slope inclination. It is our opinion that the potential erosion hazards at the site are not a limiting factor for the proposed mining activity. Removal of natural vegetation at the site should be minimized and limited to the active mine area. Temporary and permanent

erosion control measures should be installed and maintained during mining to limit the additional influx of water to exposed areas and protect storm ponds and potential receiving waters. Erosion control measures should include but not be limited to berms and swales with check dams to manage surface water run-off. Graded areas should be shaped to avoid concentrations of runoff water onto cut or fill slopes, natural slopes or other erosion-sensitive areas. In addition, ground cover/protection should be used in exposed or disturbed areas and silt fences where appropriate. Temporary ground cover/protection may include hydro-seeding, various mulches, jute matting, excelsior matting, wood chips or clear plastic sheeting. These temporary measures should be used until the permanent erosion protection is established.

EARTHWORK

Site Preparation

All areas to be graded/mined should be cleared of deleterious matter including existing debris and vegetation. The organic-laden strippings should be stockpiled on-site and later used for reclamation purposes

Prior to placement of any fill material, the exposed subgrade areas should then be compacted to a firm and unyielding surface. In fill areas, we recommend that trees be removed by overturning so that a majority of the roots are removed.

Any soft, loose or otherwise unsuitable areas should be recompacted, if practical, or overexcavated and replaced with structural fill.

Structural Fill

No significant fill material is expected at the site. The following is provided in the event that your plans change. All fill material used to achieve design grades within the structural areas should be placed as structural fill. The structural fill should be placed in horizontal lifts of appropriate thickness to allow adequate and uniform compaction of each lift. Structural fill should be compacted to at least 90 percent of MDD (maximum dry density as determined in accordance with ASTM D-1557). Where the fill will be used for structural support of structures or roadways, the upper 2 feet should be compacted to 95 percent MDD.

The appropriate lift thickness will depend on the fill characteristics and compaction equipment used. We recommend that the appropriate lift thickness be evaluated by our field representative during initial placement.

The suitability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. During wet weather conditions, it may be necessary to stockpile the imported soils until appropriate moisture conditioning can take place. Material placed for structural fill should be free of debris, organic matter and trash. Particle sizes larger than 6 inches should be excluded from the top 1-foot of fill. The moisture content of the fill material should be adjusted as necessary for proper compaction.

CUT AND FILL SLOPES

Temporary cut slopes may be necessary during mining/grading operations. As a general guide, temporary slopes of 1 to 1 (horizontal to vertical) or flatter may be used for temporary cuts in the upper 3 to 5 feet of the recessional gravels or glacially consolidated soils that are weathered to a loose/medium dense condition. Temporary slopes of 1/2 to 1 or flatter may be used in the unweathered dense sand and gravel soils at the site. These

guidelines assume that the temporary cut slopes will not exceed 30 feet in height (without appropriate benching), and that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the slope. In addition, the slope inclination should be flattened where significant seepage occurs on the slope face.

We recommend a maximum of 2 to 1 for permanent cut and fill slopes, in accordance with DNR regulations. Where 2 to 1 slopes are not feasible, retaining structures should be considered.

Fill placed on slopes that are steeper than 5 to 1 should be "keyed" into the undisturbed native soils by cutting a series of horizontal benches. The benches should be 1½ times the width of equipment used for grading and a maximum of 3 feet in height. Subsurface drainage may be required in seepage areas. Surface drainage should be directed away from all slope faces. Some minor raveling may occur with time. All slopes should be planted as soon as practical to facilitate the development of a protective vegetative cover or otherwise protected.

SURFACE WATER - POENTIAL IMPACTS

Surface water in the project area will not be impacted by the proposed mining activity. The mining depth will not extend laterally to or below the nearby Thorndyke Creek channel. A minimum 200-foot buffer has been established from Thorndyke Creek so that no mining will occur in that area. Mining will remain a minimum of 10 feet above the Vashon water table that potentially discharges to Thorndyke Creek as seeps or springs.

Seasonal perched wetlands in the project area will not be affected by the proposed mining activity at the Wahl Extraction site. The localized wetlands in and east of the site area are perched on accumulated silt/clay and organic material. Setbacks from the wetland areas will preserve these perching layers, thereby protecting the wetland environments.

Lost Lake is also in a perched condition, but on glacial till (hardpan). Lost Lake is a classic kettle lake, formed in a depression in the surface of the glacial till. Kettle lakes are typically formed by a large block of glacial ice separated from the glacier during its retreat. Buffers and mining setbacks will adequately protect Lost Lake.

Mining will be incremental with segmental reclamation and replanting of the vegetation. Changes in surface water infiltration are expected to be similar to changes that have historically occurred during timber harvesting at the site. The BMPs' for aggregate resource sites are included in Appendix B.

GROUNDWATER – POTENTIAL IMPACTS

It is our opinion that there will be no adverse impacts on groundwater as a result of the proposed mining activity in the site area. The potential groundwater impacts for sites like this are related to the relationship between precipitation, surface water, shallow subsurface runoff, evapotranspiration, ground water recharge and the proposed site activities. Mining activity at the site will be conducted in accordance with the BMPs (Best Management Practices) for the gravel mining industry, and the regulations of Jefferson County and Washington State. The BMPs' for aggregate resource sites are included in Appendix B.

Groundwater in the site area will be protected from potential impacts from mining activity. Mining will remain a minimum of 10 feet above the underlying water table levels and will not extend into the aquifers below the site. The observation wells completed in the area will be utilized to monitor groundwater levels prior to and during mining operations. Mining will not extend into the groundwater table. A minimum 10 feet of

undisturbed native sand and gravel will remain above the groundwater system at the site to act as a filter and protect the groundwater system. Therefore no significant changes in groundwater flow will occur. Monitoring wells were installed in the test borings at the site to allow for the monitoring of the groundwater systems in the site area. The wells have and will be monitored on a seasonal basis.

As the site is developed, a portion of the natural vegetative cover will be replaced with active mine surface and reclaimed (revegetated) areas. The replacement of the natural cover with revegetated reclamation area and mine will result in a slight, but temporary, decrease in evapotranspiration because of the localized temporary loss of vegetation. This temporary change in site conditions will result in a potential consequent increase in runoff and/or groundwater recharge in the active/unvegetated portions of the site. The permeable soils at the site will allow rapid infiltration of any runoff and/or precipitation. The net result of the proposed mine activity will essentially be a temporary minor increase in total groundwater recharge at the site. Therefore, relative to the shallower groundwater system, no significant impact is expected.

We do not expect any adverse affects on the recharge condition of the deep aquifers. As stated above, recharge to the deeper aquifers occurs by infiltration of rainfall through the overlying aquifers and aquitards. Because the recharge of the perched aquifer will not be significantly affected, the recharge of the deep aquifers will not be adversely affected. It should also be noted that the recharge area for the aquifers, in particular the deeper aquifers, essentially occurs over the entire east Peninsula area. This surface area of the site relative to the total recharge area is insignificant.

Relative to mining activity at the site, potential water quality impacts are generally related to equipment operation and stormwater runoff. No fuel or hazardous material storage is planned to occur at the Wahl Extraction site. Fuel for on-site equipment will be provided by service trucks. The on-site equipment and site activities will be closely monitored. The mine/process staff will be trained and spill prevention plans and kits will be kept on-site. The remaining undisturbed native soils, minimum of 10 feet, above the groundwater system at the site will provide a buffer against potential contamination from equipment/site activities. The deeper aquifers are protected from possible contamination by the filtering effect of the overlying sand and gravel and fine-grained silt and clay that occur below the site and surrounding area.

Storm runoff collected at the site will be directed to infiltration areas located at the site. Based on the results of the subsurface explorations, the soils in this area have adequate storage and permeability to infiltrate the stormwater runoff. This is discussed below in the **"Stormwater Control"** section of this report.

Typically, stormwater runoff from gravel mine sites is minimal. The granular nature of the soils allows for rapid infiltration of any precipitation that falls on them. The native soils disperse the infiltrated water over the site and recharges the shallow groundwater system similar to what is occurring at the site now. The only significant difference is the temporary reduction in the vegetative cover in the active mine areas. Once reclaimed, the new vegetation will closely match the effects of previous site vegetation.

Storm water infiltrated at the site will disperse into the underlying sand and gravel soils. The local direction of flow for the underlying groundwater system is generally to the south. Thorndyke creek is located approximately 200 feet or more south and west of the proposed mine site. The native soils will act to filter the infiltrated stormwater. Based on the nature of the sand and gravel soils, the distance from the infiltration areas and the direction of groundwater flow, no adverse impact to Thorndyke Creek is expected.

The deeper pre-Vashon aquifer within the Wahl Extraction site and adjacent area is separated from the Vashon aquifer and the overlying minable sand and gravel soils by a thick sequence of lacustrine silty fine sand, silt and clay materials. These soils form an aquitard that restricts the downward migration of the overlying groundwater and thereby protects the underlying pre-Vashon aquifer.

The still deeper aquifer that supplies water to the Squamish, Bridgehaven and Thorndyke area wells along the shoreline areas east and south of the site area is situated below an additional layer/thickness of impermeable silt and clay soils of the Whidbey Formation. This deeper aquifer is over two hundred feet below the proposed mining depth at the Wahl Extraction area. The Bridgehaven wells, which are the closest off-site wells to the site, are situated more than 1.5 miles east-southeast of the proposed Wahl Extraction mine site.

As previously discussed, in addition to the above geologic and hydrologic conditions that will preclude any significant adverse impact to the underlying aquifer systems, mining operations at the site will be conducted in accordance with BMPs (Best Management Practices) and current regulatory requirements. The active mining area will be limited in surface area. As new areas within the site are opened to mining, previously mined areas will be reclaimed and replanted in accordance with the required DNR Reclamation Permit. This is encouraged through the application of the reclamation bond, which is based on the amount of disturbed area, unreclaimed.

No adverse impacts to the groundwater systems have been identified since mining began at the Shine and Thorndyke sites, greater than 40 years ago. Mining and processing activity at the Shine and Wall Extraction sites is and will be monitored by a variety of State and Jefferson County regulatory agencies on an on-going basis. Monitoring of the existing observation wells will continue during mining activity at the site.

The aggregate resources identified and historically mined within the site area are high quality and of sufficient quantity to be considered a long-term commercial aggregate resource. The aggregate materials observed at the site are suitable for use in the production of a variety of select aggregate and crushed rock products.

SITE DRAINAGE

All ground surfaces should be sloped away from structures and erosion sensitive areas. Surface water runoff should be controlled by a system of berms, drainage swales, and or catch basins, and conveyed to an appropriate discharge point. Surface water should not be discharged into subdrains in fills and roadways, or near/on slopes. Drains should be provided behind all retaining walls.

Permanent drainage systems should be installed at the top and/or bottom of cut and fill slopes to intercept surface runoff and prevent it from flowing in an uncontrolled manner across the slopes. Surface water should not be discharged over the undisturbed slopes outside the grading areas.

In the event significant seepage is encountered in cut and/or fill slope areas, appropriate drainage control measures should be taken to collect and convey the water to an appropriate discharge point. Sub-drains in fills, where required, should be constructed as cut-off drains.

STORMWATER CONTROL

Based on our observations, a large portion of the precipitation on the site currently percolates into the surficial sand and gravel soil. Infiltration of the storm runoff at the site will closely match the existing conditions.

Soils in the mined area of the site will likely consist of permeable sand and gravels,

which will extend to at least 10 feet below the surface and remain 10 feet above the high groundwater level. It is our opinion that infiltration of storm runoff water is feasible at the site where this condition occurs. Areas of soil with higher silt content may require special design considerations or rerouting to more permeable areas. Specific design criteria for infiltration systems will be provided, as appropriate.

In general, ground surface infiltration (percolation ponds) is preferred over percolation trenches because maintenance is easier and less costly. Where percolation trenches are used, the stormwater should be treated in accordance with current Jefferson County regulations.

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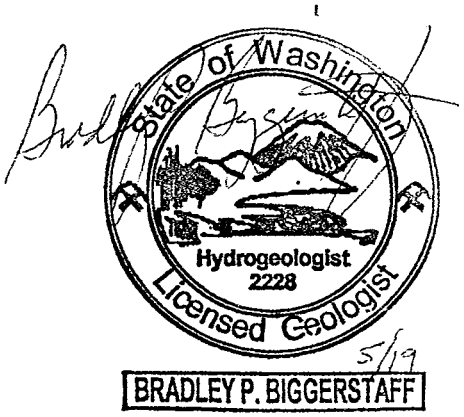
We have prepared this report for Fred Hill Materials and their representatives for use in evaluating the potential aggregate resources of the above-described area. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared.

If you have any questions regarding this report or need additional information please call.

Yours Very Truly,

GeoResources, LLC



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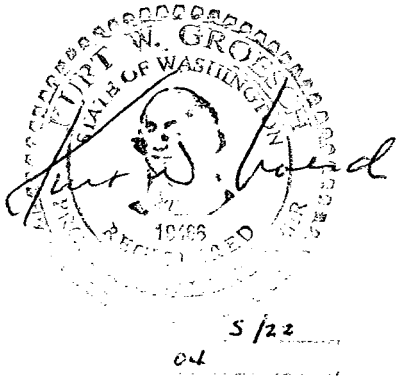

Kurt Groesch, PE
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Attachments