Hos Bros. Construction, Inc.
Snoqualmie 5-Mile Project
Permit No. L04C6431

Geotechnical Narrative for Proposed Six Phase Expansion

Prepared By:

Bennett Consulting, PLLC
46129 SE 130th Street
North Bend, WA 98045
425-785-8390

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1) INTRODUCTION

On behalf of Hos Bros. Construction, Inc., Bennett Consulting PLLC has prepared this geotechnical narrative for the expansion of the Hos Bros Construction, Inc. 5-Mile Gravel Pit and Soil Backfill Project. The purpose of the expansion is to extend the area and life of the project for another 30 years. We expect little change in the scope of the operation as it will continue to operate in the same manner as it has for more than 20 years.

Hos Bros. leases the property underlying the existing operation and expansion area from Weyerhaeuser Company. It consists the south half of Section 11 and all of Section 14, Township 24 North, Range 8 East, Willamette Meridian (Figures 1 & 2). The site is five air miles northeast of the City of Snoqualmie in unincorporated King County. Access to the site is from SR 202 via the Snoqualmie Forest Mainline Road, a privately maintained logging road that serves as the principal access for the forest operations in the surrounding area. The current operation was started in 1998 and consists of an 80-acre permit area that was developed in four phases, each lasting about 5 years. Under the proposed expansion, the project will continue for another 30 years under a 6-phase mining plan developed on adjacent property east of the current operation. The surrounding area for many miles in all directions is commercial forest land controlled by Campbell Global, a Timber Investment Management Organization (TIMO).

2) SITE CONDITIONS AND HISTORY

The subject site lies within an upland plateau at an elevation of about 1,000 feet. The area surrounding the project is relatively flat forestland containing dense stands of second to third growth Douglas fir, Western hemlock, scattered hardwoods with an under story of low growing native vegetation. The project area is underlain by a six-inch thick zone of organic topsoil and forest duff that has developed atop well-drained subsoil consisting of gravelly sandy loam. Gravelly outwash has been encountered beneath the site to depths of more than 35 feet. Underlying the gravel is lodgment (glacial) till and metamorphic bedrock (Tabor et al 1993). The site is crossed by secondary forest access roads and crude King County Biosolids trails. A truck scale, wheel wash and two job trailers are the only developments at the site.

The project began in 1998, when it received a King County grading permit for 10-acres to backfill an old forestry pit with excavated soils from the then new Snoqualmie Ridge residential development. With the discovery of significant gravel resources beneath site the scope of the project changed the from a simple backfill area to a gravel mine and backfill operation. King County issued a new clearing and grading permit in 2006 expanding the project to 80 acres. A Surface Mine Reclamation Permit was issued the same year by the Washington State Department of Natural Resources (DNR) as was a Sand and Gravel General Permit by the Washington Department of Ecology (DOE). In the past the site has accepted tunnel boring soils from various Seattle underground projects, and since 2014 the project has been permitted through Seattle-King County Public Health to operate as an inert waste landfill. The project no longer accepts tunnel boring soils and the landowner, Weyerhaeuser Company, has specifically prohibited other materials typically associated with an inert waste landfill, such as construction debris.

After nearly 23 years in operation, the gravel resources within the existing permit area are nearly exhausted, as is the available space for backfill soil. Thus, an expansion of the permit area is needed to keep the operation viable into the future.

3) PHASED DEVELOPMENT PLAN

The proposed expansion area comprises 175 acres and has been divided into six phases as shown of Figure 3. Each phase makes up approximately 30 acres and will be developed over a period of about five years. Development generally consists of segmental clearing, segmental gravel excavation and fill placement, followed by hydroseeding and re-vegetation (Plates 1-3). Details are provided in the following paragraphs.

Typically, each phase will contain about 500,000 cubic yards of gravel that will be excavated and subsequently backfilled with about 2,000,000 cubic yards of imported soil. The thickness of the gravel within each phase varies from about 20-feet thick to more than 50-feet thick, so exact volumes will be determined at the time of development. The gravel will be mined down to a depth of where glacial till or bedrock is encountered prior to backfilling. Where the gravel is especially thick ground water could be encountered before till or bedrock is reached. In such areas the excavation will stop 3-feet above the seasonal high-water table per King County guidelines. Based on 15 years of monitoring, the seasonal high-water table is at an elevation of 950 feet in the winter months, falling to below 947 feet in the summer months.

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1) *Site Preparation:* Development of a new segment or phase consists of timber harvesting, topsoil/overburden stripping followed by the construction of a perimeter containment berm, access road and rock lined infiltration ditches. The original development plan, prepared in 2004, divided the project into four phases of excavation and backfilling. Phases 1 and 2 are nearly complete, having been hydroseeded prior to final tree planting. Phase 3 has been fully excavated and nearly backfilled, and the final Phase 4 is undergoing rapid excavation and backfilling. Under the proposed expansion, the six new phases for excavation and backfilling will be developed in the same manner as the existing operation.

   Because this project is primarily an imported soil backfill site there is no need to store topsoil and overburden for reclamation, as these materials are always in excess. Historically more than four cubic yards of soil have been imported for every cubic yard of gravel that is mined and exported.

2) *Gravel Excavation and Fill Placement:* Typically, clean fill soil is imported from excavation projects in the area by 25-yard tandem truck and trailer rigs that enter the site via the existing private access road and transport their loads to the active excavation/fill area. Depending on the job, the trucks may then backhaul excavated gravel. Peak production usually occurs during winter months when other sites in the County are unable to take fine grained moisture sensitive soils. Under the proposed expansion all aspects of the existing operation will stay the same, with a maximum of up to 200 truckloads, or 5,000 yards of fill placed daily. During the drier times of the year truck volumes are typically much lower.

   Temporary mine slopes are cut to a maximum 1H:1V gradient using a conventional track-mounted excavator prior to backfilling. The backfill material typically consists of fine-grained native soil that is inspected, monitored, and tabulated per the existing Clean Fill Acceptance Agreement prior to onsite transport. The fill soil is generally transported to the lowest portion of a depleted mine area and pushed into place in loose lifts with a bulldozer. The fill is then dozer-walked to achieve preliminary compaction. Once the soil is consolidated enough to accommodate heavy equipment travel, a layer of crushed rock is placed along the top of the fill soil to provide a driving surface. Final compaction is achieved by driving loaded dump trucks across the imported fill. Once a given lift of fill has been placed and compacted the

process will be repeated, layer upon layer until the desired elevation and slope gradient (max 2H:1V) have been achieved. Up to a 90-foot thickness of backfill soil is placed against the pre-constructed containment berms (Plate 2).

As soon as a given segment has been filled to a level of about 50-feet above the forest floor at the final 2H:1V or gentler slope gradient, the exposed slopes are hydro-seeded with a deep rooting grass/forb mixture (Plate 3). Eventually each completed phase will be planted with trees as discussed below.

3) *Slope Assessment*: The long completed and hydroseeded slopes along the Phase 1 portion exiting operation were judged stable. They are covered with tall grasses and deep-rooted forbs. No signs of instability, such as bulging, or slumps have been observed through the several wet seasons. Elsewhere, the slopes in Phases 2 and 3 are in various stages of completion, with Phase 4 still undergoing gravel excavation. If any slumping is encountered during the final grading of slopes, such areas should be backfilled with quarry spalls or equivalent coarse aggregate for stabilization. Since backfilling is completed against a containment berm or pit wall, any potential slope failure should be contained within the permit boundaries. To date, all slopes have been completed according to Washington DNR guidelines as inspected by the State mine inspector.

Under its reclamation permit DNR will allow a slope gradient of up to 50% (2H:1V) for backfilled slopes that will revert to forest production. The DNR guidelines for forestland sites were designed for slopes that are planted with trees. Tree roots increase slope stability and tree canopies intercept precipitation, thus decreasing the potential for storm water runoff. Under DNR Forest Practices rules, forested slopes typically do not pose a concern until gradients exceed approximately 70% (Powell et al 2010). Thus, based on the existing condition of the slopes already completed on Phase 1, the final backfilled slopes completed per DNR guidelines should be stable, provided that they are properly graded to provide positive drainage, compacted as described above, and revegetated, as discussed below.

4) *Drainage:* Because the project area is underlain by a highly permeable gravelly subgrade, offsite drainage and sediment transport have never been an issue here. The current operation utilizes rock-lined perimeter infiltration ditches that drain towards three infiltration ponds, each approximately 400-feet long, 50-feet wide and 30-feet deep. This system has been more than sufficient to handle stormwater on the completed portions of the project. The proposed six phased expansion will also employ infiltration ditches and three additional infiltration ponds as shown on Figure 3. It is anticipated that the first three phases will utilize an infiltration pond located along the eastern boundary of the current operation, in an area currently undergoing excavation. Phases 4 will require a new infiltration pond located along the boundary of Phases 1 and 4 and Phase 5 will utilize a pond along the boundary of Phases 2 and 5. The pond for Phase 6 will utilize an infiltration pond located within an old forestry gravel pit along its western boundary.

An updated Technical Information Report will be prepared as each new phase is developed and will consider any changes to King County's storm water management requirements that have occurred since the original grading permit was approved. The flat topography and permeable subgrade suggest that onsite storm water infiltration is still the best option for all of the additional phases of this project.

4) REVEGETATION

1) Initial Erosion Control: Completed backfilled slopes are hydroseeded with a grass legume mix at 20 pounds per acre to promote wildlife forage. Fertilizer will be broadcasted at a rate of 200 lbs./acre in these areas on an as-needed basis. The seed mix identified in Table 1 is a combination of native and non-native species recommended by Washington Department of Fish and Wildlife to provide effective soil stabilization, soil nutrients and wildlife forage. Seeding will also achieve temporary erosion control and long-term reclamation goals for the site. This prescription can be substituted with a comparable mix. Where practical, large woody debris will be randomly scattered in the open space areas to provide additional wildlife habitat and shelter.

TABLE 1

Open Space Revegetation Specifications

Species Common Name	Scientific Name	Planting Method	Planting Density	Planting Season
Big bluegrass	*Poa ampla*	broadcast	4 %	spring/fall
Columbia brome	*Bromus vulgaris*	broadcast	20 %	spring/fall
Orchard grass	*Dactylis glomerata*	broadcast	19 %	spring/fall
Timothy	*Phleum pratense*	broadcast	10 %	spring/fall
Tall fescue	*Festuca arundinacea*	broadcast	9 %	spring/fall
NZ White clover	*Trifolium repens*	broadcast	10 %	spring/fall
W. Dutch clover	*Trifolium repens*	broadcast	19 %	spring/fall
Ladak alfalfa	*Medicago sativa*	broadcast	4 %	spring/fall
Burnet	*Sanguisorba sp.*	broadcast	5 %	spring/fall

2) Final Tree Planting As a given phase is completed trees will be planted as the site will eventually revert to commercial forest. Planting will be done per the recommendations of the landowner, Weyerhaeuser Company, and is anticipated to consist of mixed conifers and hardwoods planted at a density of 435 trees/acre. Table 2 identifies vegetation to be installed to establish pre-existing flora and enhance vegetative diversity, wildlife habitat, slope protection and erosion control. Bareroot trees will be supplied by a local nursery from within the proper seed zone.

In addition, existing mature vegetation within the permanent setbacks and undisturbed portions of the property will be preserved to maintain a portion of existing wildlife habitat and allow for natural vegetation propagation to occur.

TABLE 2

Upland Forest Revegetation Specifications

Species Common Name	Scientific Name	Planting Method	Planting Density	Planting Season
Douglas fir	*Pseudotsuga menziesii*	Bareroot	435 per acre	Spring
Red alder	*Alnus rubra*	Bareroot	435 per acre	Spring

We trust that the information contained in this report satisfy your current needs. If you have questions or need further information, please contact us.

Sincerely,
Bennett Consulting, PLLC

George H Bennett LHG
Licensed Hydrogeologist

List of Attachments.

Figure 1	Regional Map
Figure 2	Vicinity Map
Figure 3	Aerial Site Plan
Figure 4	Mine Phasing Plan
Figure 5	Cross Sections
Plates 1-3	Operation Photographs

SELECTED REFERENCES

Booth, D.B., 1990, *Surficial Geologic Map of the Skykomish and Snoqualmie Rivers Area, Snohomish and King Counties, Washington*, U.S. Geological Survey Miscellaneous Investigations Map I-1745.

Powell, Jack; Lingley, Leslie and Anderson, Garth, 2010, *Reconnaissance Study of Landslides related to the January 2009 Storm in the Acme Watershed,* Washington State Department of Natural Resources, Forest Practices Division Special Report, 46p.

Tabor, R.W., Frizzell, V.A. Jr., Booth, D.B., Waitt, R.B., Whetten, J.T. and Zartman, R.E., 1993, *Geologic Map of the Skykomish River Quadrangle*, *Washington*, U.S.G.S. Map I-1993.

Maud Lake

Klaus Lake

Ten Creek

Property/Permit Boundary

Weyerhaeuser Mainline Rd

Gate 4

SR 202

Tate Creek

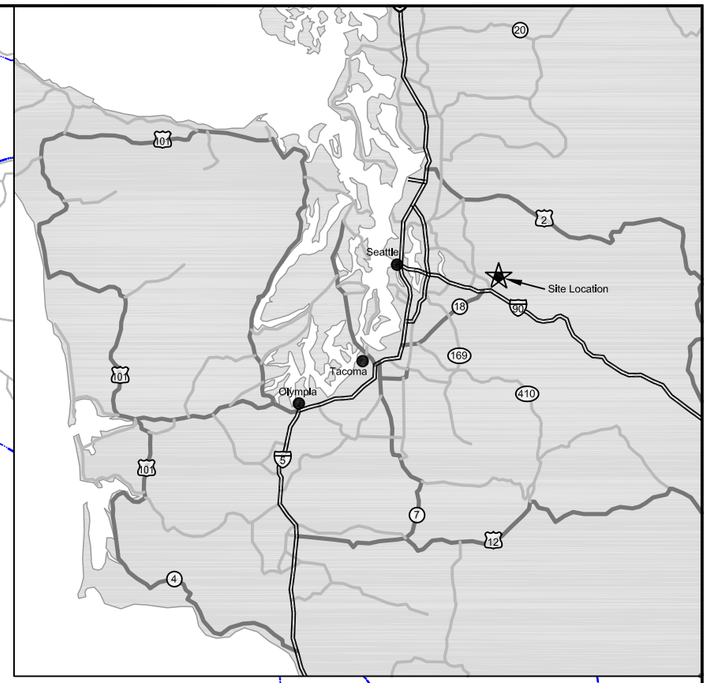
City of Snoqualmie

Snoqualmie River

Middle Fork Snoqualmie River

North Bend Way

I-90



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0 4000' 8000'

LEGEND

= Property / Permit Boundary

= Private Access Road

= Lakes / Water Bodies

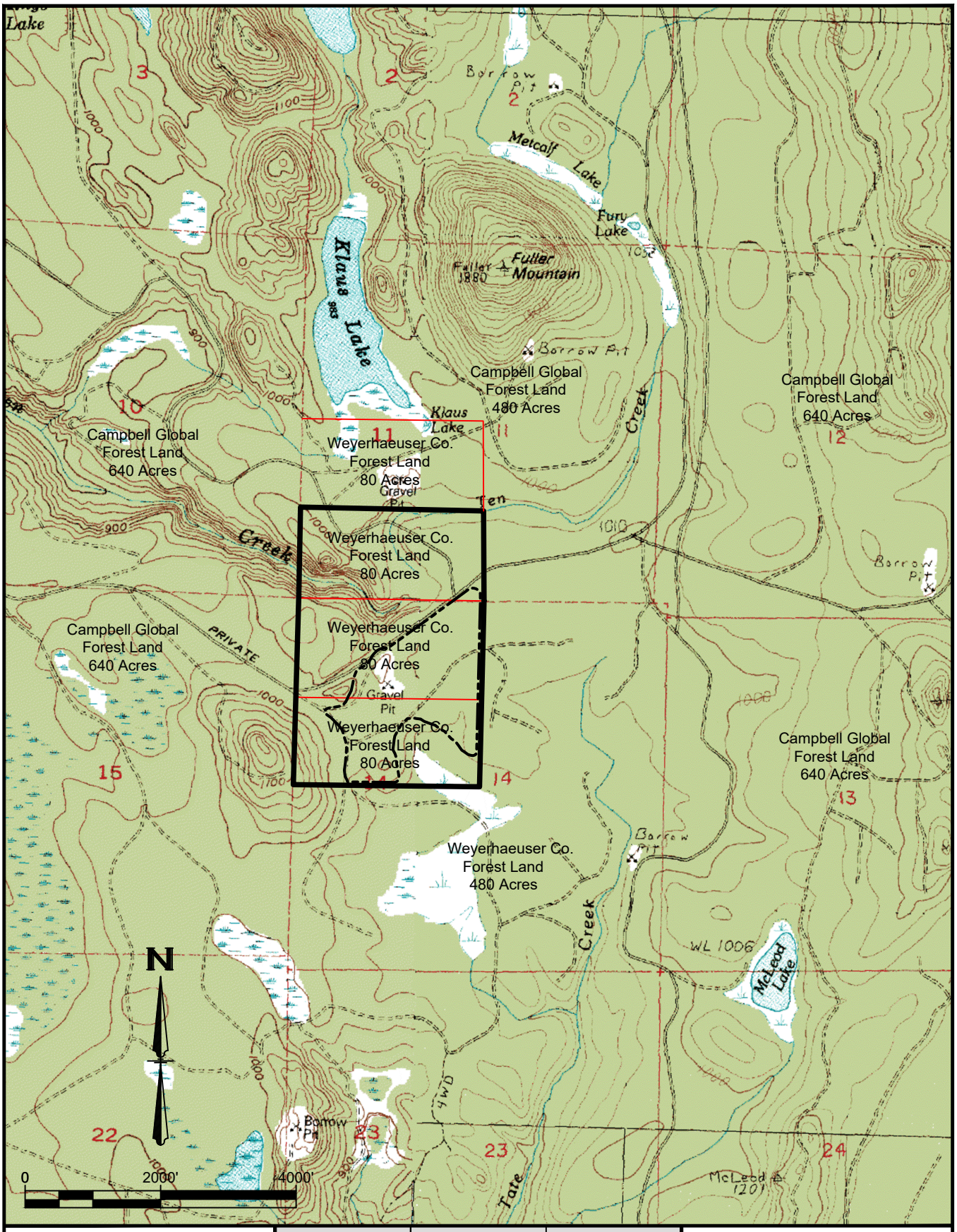
= Streams / Rivers

DESIGNED		SCALE	1"=4000'
DATE	02-15-07		
BY	GHB		
DRAWN			
DATE	02-15-07		
BY	JLL		

Bennett Consulting, PLLC
46129 SE 130th Street
North Bend, WA 98045
(425) 831-4690

Figure 1
Hos Brothers
5-Mile Mainline Fill Site
Location Map

GBC0608 - Hos Brothers - 5-Mile Mainline Fill Site\DNR Update 01-13-08\Fig1 Vicinity Large.dwg 01/14/2008 04:26:30 PM PDT



LEGEND	DESIGNED	SCALE	1"=2000'
——— = Property Boundary	DATE 11-01-18	**Bennett Consulting, PLLC**	**Figure 2**
— - - - = Permit Boundary	BY GHB	46129 SE 130th Street	5-Mile Mainline
	DRAWN	North Bend, WA 98045	Vicinity Map
	DATE 11-01-18	(425) 785-8390	
	BY JLL		

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6/1/2021 2:36 PM Z:\Bennett Consulting\GBC0608 - Hos Brothers\5-Mile Mainline Fill Site\Expansion 2020\5-Mile Expansion Fig2.dwg right

Infiltration Basin Phase 4-5
Infiltration Basin Phase 1-3
300' Buffer
Voluntary Buffer
Wetland A
Seepage
Tate Creek PIP
Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Phase 6
A
A'
B
B'
C
C'
MW-1 Dry
MW-2 948.2
MW-3 948.87
MW-4 947.77
EP-23 948.77
S1
S2
WG-1
WG-2
WG-3
EB-1 90'
EB-2 45'
EB-3 35'
EB-4 60'
EB-5 38'
19-1 11' gvl
19-2 16' gvl
19-3 20' gvl
19-4 16' gvl
19-5 17' gvl
19-6 9' gvl
19-7 9' snd
19-8 18' gvl
19-9 +20' gvl
19-10 9' gvl
19-11 20' gvl
19-12 +18' gvl
19-13 +17' gvl
19-14 +17' gvl
19-15 +14' gvl
19-16 +20' gvl
19-17 10' gvl
19-18 4' gvl
19-19 15' gvl
19-20 16' gvl
19-21
19-22
19-23
19-24
4-3 25' gvl
4-5 17' gvl
4-9 +14' gvl
4-10 +17' gvl
4-12 BR @ 6'
1000'
1010'
970'
980'
990'
1040'

LEGEND

= Property Boundary
= Permit Boundary
= Parcel Lines
= Wetlands
= Sensitive Area Buffer(s)
= Rivers/Streams
MW-1 = Monitoring Well w/ Ground Water Elevations
WG-1 = Wetland Gauge
S1 = Storm Water Monitoring Point
= Direction of Mining & Backfilling
4-3 = 2004 Test Pit
19-10 = 2019 Test Pit
+17' gvl = Gravel or Sand Thickness
EB-1 = 2020 Sonic Drill Hole
40' = Depth
= Proposed Infiltration Basin

N

0 600' 1200'

DESIGNED	SCALE	1"=600'
DATE 05-31-21	**Bennett Consulting, PLLC**	
BY GHB	46129 SE 130th Street	
DRAWN	North Bend, WA 98045	
DATE 05-31-21	(425) 785-8390	
BY JLL		

Figure 3
5-Mile Mainline
Mine Sequence Map

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3/14/2021 2:06 PM Z:\Bennett Consulting\GBC0608 - Hos Brothers\5-Mile Mainline Fill Site\Expansion 2020\5-Mile Expansion Fig3.dwg right

Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Phase 6
A
A'
B
B'
C
C'
MW-1
Dry
S1
S2
MW-2
948.2
MW-4
947.77
WG-1
WG-2
300' Buffer
Voluntary Buffer
Wetland A
1040'
1030'
1020'
1010'
1000'
990'
980'

LEGEND

= Property Boundary
= Permit Boundary
= Parcel Lines
= Wetlands
= Sensitive Area Buffer(s)
= Rivers/Streams
MW-1 = Monitoring Well w/ Ground Water Elevations
WG-1 = Wetland Gauge
S1 = Storm Water Monitoring Point

N

0 600' 1200'

DESIGNED	SCALE	1"=600'
DATE 03-14-21	**Bennett Consulting, PLLC**	
BY GHB	46129 SE 130th Street	
DRAWN	North Bend, WA 98045	
DATE 03-14-21	(425) 785-8390	
BY JLL		

Figure 4
5-Mile Mainline
Phase 1 & 2 Completion Map

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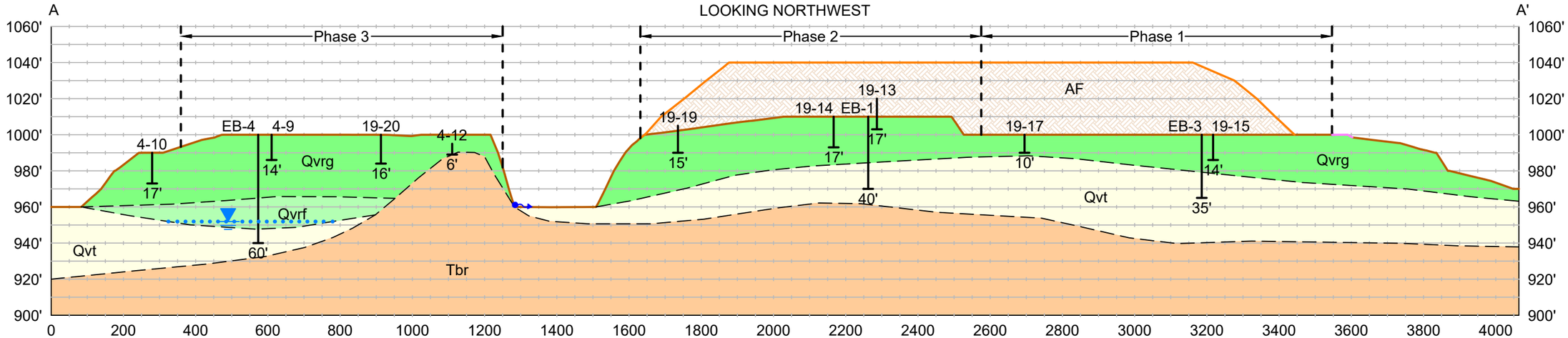

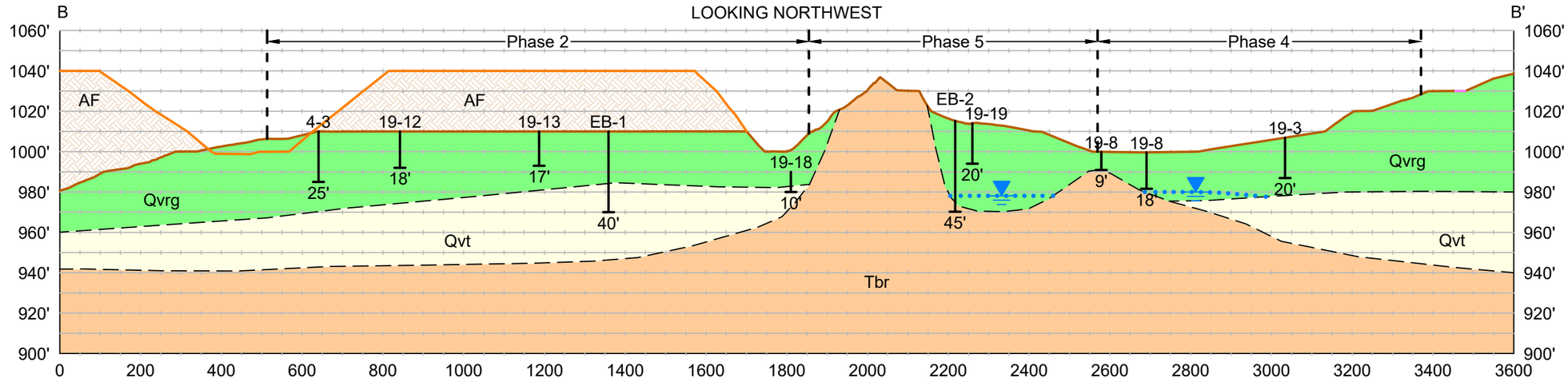

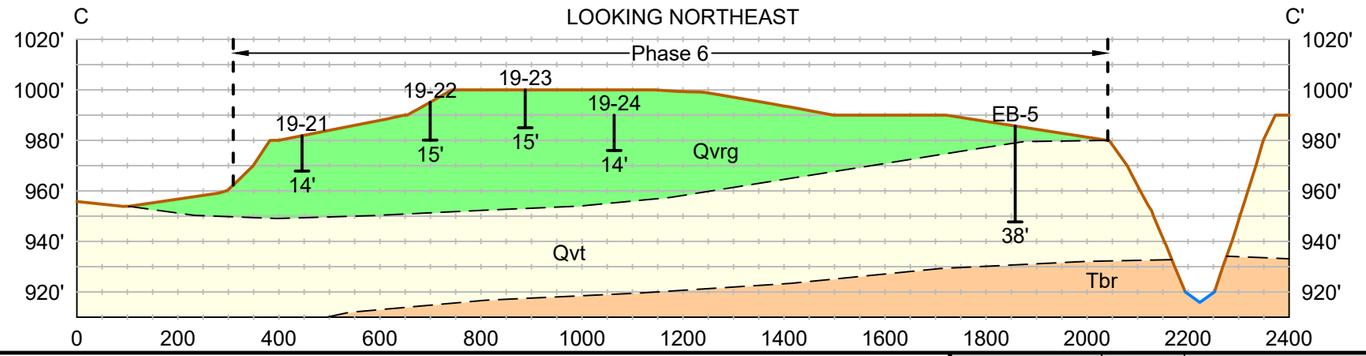

LEGEND

= Property Boundary
= Parcel Lines
= Wetlands
= Sensitive Area Buffer(s)
= Rivers/Streams

= Permit Boundary
4-3 = 2004 Test Pit
19-10 = 2019 Test Pit
+17' gvl = Gravel or Sand Thickness

AF = Backfill Soil
Qvrg = Vashon Outwash Gravel
Qvrf = Vashon Outwash Sand
Qvt = Vashon Lodgement Till
Tbr = Tertiary Bedrock

= Water Table

N

0 300' 600'

DESIGNED	SCALE	H:1"=300' V:1"=60'
DATE 04-26-21		
BY GHB		
DRAWN		
DATE 04-26-21		
BY JLL		

Bennett Consulting, PLLC
46129 SE 130th Street
North Bend, WA 98045
(425) 785-8390

Figure 5
5-Mile Mainline
Cross Sections

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Photo 1A. New mine segments are stripped and grubbed followed by mining pit-run gravel to 40-feet below the existing grade.

Photo 1B. Following pit-run mining, backfill soil unloaded by dump trucks and placed by bulldozer into the mined out segment Up to a 80-foot thickness is placed to backfill the pit and raise the final floor elevation to 40-feet above pre-existing grade.

Plate 1

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Photo 2A. Once the backfill soil has been pushed into place, a driving surface consisting of a 2-3 foot thickness of pit-run gravel is placed to allow dump truck access to allow further soil dumping to advance the fill prism.

Photo 2B Final backfilled slopes are seeded with deep rooted grasses and forbs to stabilize soil and limit erosion. Eventually the site will be planted with trees and revert to commercial timberland.

Plate 2

Photo 3A. Rock-lined ditches are constructed at the base of backfill slopes to convey storm water to one of three infiltration ponds.

Photo 3B. Newly constructed perimeter berm and drainage ditch along revised permit boundary. Here the ditch defines the permit boundary with the forest access road along its outside edge.

Plate 3