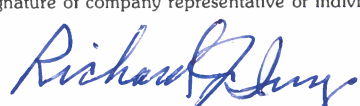
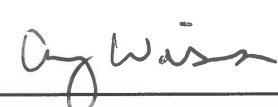




WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**

**COUNTY OR MUNICIPALITY
APPROVAL FOR
SURFACE MINING
(Form SM-6)**

RECEIVED
SEP 14 2023
WASHINGTON GEOLOGICAL SURVEY

NAME OF COMPANY OR INDIVIDUAL APPLICANT(S) Same as name of the exploration permit holder. (Type or print in ink.) Twin Sisters Olivine Ltd.		TOTAL ACREAGE AND DEPTH OF PERMIT AREA (Include all acreage to be disturbed by mining, setbacks, and buffers, and associated activities during the life of the mine.) (See SM-8A.) Total area permitted will be <u>35.80</u> acres Maximum vertical depth below pre-mining topographic grade is <u>260</u> feet Maximum depth of excavated mine floor is <u>2,860</u> feet relative to mean sea level				
MAILING ADDRESS P.O. Box 649 Carnegie, PA 15106		COUNTY <u>Whatcom</u> No attachments will be accepted. Legal description of permit area:				
Telephone (412) 276-8890		1/4	1/4	Section	Township	Range
		NE	NE	34	38N	6E
		NW	NW	35	38N	6E
Proposed subsequent use of site upon completion of reclamation Forestry / Note: slopes are 1 foot horizontal to 1.25 vertical, but are recognized as geologic/topographic characteristics of the site and are acceptable for the subsequent use of the land.						
Signature of company representative or individual applicant(s) 		Name and title of company representative (please print) Richard J. Ivy, President			Date signed 9-5-23	
TO BE COMPLETED BY THE APPROPRIATE COUNTY OR MUNICIPALITY:						
Please answer the following questions 'yes' or 'no'.						
1. Has the proposed surface mine been approved under local zoning and land-use regulations? <i>use pre-dates local zoning give non-conforming APW</i>						<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Is the proposed subsequent use of the land after reclamation consistent with the local land-use plan/designation?						<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
When complete, return this form to the Department of Natural Resources.						
Name of planning director or administrative official (please print) Andrew Wiser			Address Whatcom County Planning 5820 Northwest Drive Bellingham, WA 98229			
Signature 						
Title (please print) Planner / Geologist						
Telephone 360-778-5945		Date 9/13/23		DNR Reclamation Permit No. 70-012069		
				FOR DEPARTMENT USE ONLY:		



**APPLICATION FOR
RECLAMATION PERMIT AND PLAN
(Form SM-8A)**

Check appropriate box(es): new permit revision of existing permit transfer of permit expansion

NOTE: Do not attempt to complete this form until you have carefully read "Instructions for Form SM-8A".

1. NAME OF APPLICANT/PERMIT HOLDER(S) Twin Sisters Olivine, Ltd.			
2. MAILING ADDRESS P.O. Box 649 Carnegie, PA 15106			
3. Telephone 412-276-8890		Email christy@millbankmat.com	
4. NAME OF MINE Swen Larsen Quarry			
5. Street address and milepost of surface mine Section 34, Twp 38N, Range 6E			
6. Distance (miles) 10	7. Direction from SE	8. Nearest community Deming, WA	
9. COUNTY Whatcom No attachments will be accepted. Legal Description of permit area:			
1/4	Section	Township	Range
NE	34	38N	6E
NW	35	38N	6E
10. Do you or any person, partnership, or corporation associated with you now hold, or have you held, a surface mining operating or reclamation permit? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no If you answered yes to the above, please list: 70-012069			
11. Are all of these mines now in compliance with RCW 78.44, WAC 332-18, and conditions of the permits? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no Have you ever had a surface mine operating or reclamation permit revoked? <input type="checkbox"/> yes <input checked="" type="checkbox"/> no Have you ever had a reclamation security forfeited? <input type="checkbox"/> yes <input checked="" type="checkbox"/> no If you answered yes to either of the above, give permit number(s):			

12. TOTAL ACREAGE OF PERMIT AREA APPLIED FOR: (Include all acreage to be permitted. See Form SM-6.) 35.80 acres	
13. Total disturbed acreage (Include all acreage to be disturbed by mining and reclamation during the life of the mine.) Total area to be disturbed: 35.80 acres. Area to be disturbed in next 36 months: 0 acres.	
14. Maximum vertical depth (thickness) mined below pre-mining topographic grade will be 260 feet.	
15. Lowest elevation of excavated mine will be 2860 feet relative to mean sea level. Highest elevation of excavated mine will be 3350 feet relative to mean sea level.	
16. Type of proposed or existing mine: <input type="checkbox"/> pit <input checked="" type="checkbox"/> quarry	
17. Material(s) to be mined: <input type="checkbox"/> sand and gravel <input type="checkbox"/> rock or stone <input type="checkbox"/> clay <input type="checkbox"/> metal <input type="checkbox"/> limestone <input type="checkbox"/> silica <input checked="" type="checkbox"/> other Olivine	
18. Deposit type: <input type="checkbox"/> glacial <input type="checkbox"/> river floodplain (alluvial) <input type="checkbox"/> river channel deposits <input type="checkbox"/> talus <input checked="" type="checkbox"/> bedrock <input type="checkbox"/> lode <input type="checkbox"/> other _____	
19. Expected start date of mining: 1963 Started	20. Estimated number of years: 100
21. Total quantity to be mined over life of mine (estimated): 5,000,000 <input checked="" type="checkbox"/> tons or <input type="checkbox"/> cu yds	22. Estimated annual production: 25,000-50,000 <input checked="" type="checkbox"/> tons or <input type="checkbox"/> cu yds
23. Subsequent land use: <input type="checkbox"/> industrial <input type="checkbox"/> commercial <input type="checkbox"/> residential <input type="checkbox"/> agricultural <input checked="" type="checkbox"/> forestry <input type="checkbox"/> wetlands and lakes <input type="checkbox"/> other	
County or Municipality Approval for Surface Mining (Form SM-6) attached? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no	
24. Reclaimed elevation of floor of mine: 2870 feet relative to mean sea level Reclaimed elevation is shown on cross sections? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no	
25. SEPA Checklist required? DNR will adopt NEPA Process. <input type="checkbox"/> yes <input checked="" type="checkbox"/> no	
26. Application fee for a new reclamation permit is herewith attached? <input type="checkbox"/> yes <input checked="" type="checkbox"/> no	

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June 6, 2024
Washington Geological Survey

APPLICATION FOR RECLAMATION PERMIT AND PLAN

22. SEGMENTAL RECLAMATION		
Permit area has been divided into segments for mining and a mining schedule has been developed?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If no, explain:		
Permit area has been divided into segments for reclamation and a reclamation schedule has been developed?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If no, explain:		
23. SITE PREPARATION		
23A. Saving Topsoil, Subsoil, and Overburden for Reclamation		
Thickness of topsoil is <u>1 inch</u> feet	Thickness of subsoil is <u>0</u> feet	Depth to bedrock is <u>1 inches</u> feet
Total volume of topsoil is <u>500</u> cubic yards	Total volume of subsoil is <u>0</u> cubic yards	
Volume of stored topsoil/subsoil is <u>500</u> cubic yards and will require <u>1/4</u> acres for storage.		
Storage areas are shown on maps and will be marked on the ground with permanent boundary markers?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
Topsoil will be salvaged?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If no, explain:		
Topsoil and overburden will be moved to reclaim an adjacent depleted segment?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If no, explain:		
Before materials are moved, vegetation will be cleared and drainage planned for soil storage areas?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If no, explain:		
Soil storage areas will be stabilized with vegetation to prevent erosion if materials will be stored for more than one season?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If no, explain:		
23B. Permit and Disturbed Area Boundaries		
Boundary of the permit area will be marked on the ground with permanent boundary markers?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
Explain boundary markers: Survey Stakes		
23C. Setbacks Screens and Buffers		
Are Screens required and are shown on maps?	<input type="checkbox"/>	yes <input checked="" type="checkbox"/> no
The reclamation setback for this site will be <u>0</u> feet wide.		
Is a permanent, undisturbed buffer planned for this site?	<input type="checkbox"/>	yes <input checked="" type="checkbox"/> no
If no, explain: No permanent undisturbed buffers are required for this site		
Setbacks and buffers are shown on maps and have been marked on the ground with permanent boundary markers?	<input type="checkbox"/>	yes <input checked="" type="checkbox"/> no
If no, explain: No permanent undisturbed buffers are required for this site		
23D. Buffers to Protect Streams and Flood Plains		
Will the site include a stream or flood plain?	<input checked="" type="checkbox"/>	yes <input type="checkbox"/> no
If yes, see "Additional Requirements for Mines in Flood Plains" in "Instructions for SM-8A".		
If no, skip to 23E.		
A stream buffer of at least 200 feet has been marked on the ground with permanent boundary markers?	<input type="checkbox"/>	yes <input checked="" type="checkbox"/> no
A buffer of at least 200 feet from the 100-year flood plain has been marked on the ground with permanent boundary markers?	<input type="checkbox"/>	yes <input checked="" type="checkbox"/> no
If no, explain: The stream is a season channel. The seasonal channel would have a minimum of a 50 - foot buffer in place. Quarry activities would not enter the 50-foot buffer until mining phase 2 when it will be excavated. See narrative for additional details.		
Copy of Shoreline Permit from local government or the Department of Ecology is attached?	N/A	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Hydraulic Project Approval from the Department of Fish and Wildlife is attached?	N/A	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no

APPLICATION FOR RECLAMATION PERMIT AND PLAN

23E. Conservation Buffers	
Are there any conservation buffers?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If no, skip to 23F	
Conservation buffers will be established for the following purpose(s): <i>(Check all that apply)</i> <input type="checkbox"/> unstable slopes <input type="checkbox"/> wildlife habitat <input type="checkbox"/> water quality <input checked="" type="checkbox"/> other	
Describe the nature and configuration of the conservation buffer(s): A seasonal channel exists in the expansion area that resides on the United States National Forest Service Mt. Baker-Snoqualmie National Forest. Based on Forest Service approval, a 50-foot buffer will be in place to help protect the health of the channel. This is part of the proposed project's 2-phase approach. Refer to the Plan of Operations / Reclamation Narrative for more information.	
Conservation buffers are shown on maps and have been marked on the ground with permanent boundary markers?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
23F. Ground Water	
High water table depth is _____ feet <input type="checkbox"/> relative to mean sea level, <input type="checkbox"/> below original surface, or <input checked="" type="checkbox"/> unknown. Low water table depth is _____ feet <input type="checkbox"/> relative to mean sea level, <input type="checkbox"/> below original surface, or <input checked="" type="checkbox"/> unknown. Annual fluctuation of water table is from _____ feet on _____ to _____ feet on _____.	
Are well logs attached?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
The shallowest aquifer is <input type="checkbox"/> confined <input type="checkbox"/> unconfined N/A	
The site will be mined: <input type="checkbox"/> wet <input checked="" type="checkbox"/> dry <input type="checkbox"/> both	
Describe mining method: Bench quarry system and blasting.	
The site is in a: <input type="checkbox"/> critical aquifer recharge area <input type="checkbox"/> sole source aquifer <input type="checkbox"/> public water supply watershed <input type="checkbox"/> wellhead protection area <input type="checkbox"/> special protection area <input type="checkbox"/> designated aquifer protection area	
<i>If checked above, see "Additional Requirements for Mines in Hydrologically Sensitive Areas" in "Instructions for SM-8A".</i>	
Ground water study attached?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
If no, explain: No ground water aquifer interaction	
23G. Archeology	
Are archeological/cultural resource sites present?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
If yes, describe how you will protect these resources:	
24. MINING PRACTICES TO FACILITATE RECLAMATION	
24A. Soil Replacement	
Topsoil and (or) subsoil will be restored?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If "no", explain:	
Subsoil will be replaced to an approximate depth of <u>0 Inches</u> feet on the pit floor and a depth of <u>0</u> feet on slopes. Topsoil will be replaced to an approximate depth of <u>6 Inches</u> on the pit floor and a depth of <u>0 feet</u> on slopes.	
If topsoil is in short supply, it will be strategically placed in depressions and low areas in adequate thickness to conserve moisture and promote revegetation?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If no, explain:	
Topsoil will be moved when conditions are not overly wet or dry?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If no, explain:	
Topsoil will be restored to promote effective revegetation and to stabilize slopes and mine floor?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If "no", explain:	
Topsoil will be replaced with equipment that will minimize compaction, or it will be plowed, disked, or ripped following placement?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If no, explain:	

APPLICATION FOR RECLAMATION PERMIT AND PLAN

Topsoil will be immediately stabilized with grasses and legumes to prevent loss by erosion, slumping, or crusting? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Segmental topsoil removal and replacement is shown on maps? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Topsoil will be imported? If yes, describe source. Estimated volume is _____ cubic yards.	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Synthetic topsoil made from compost, biosolids, or other amendments will be used and (or) made on site to supplement existing topsoil?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Materials such as till, loess, and (or) silt are available on site that could be used to supplement topsoil for reclamation. If yes, explain: Silt from settling ponds may be used to supplement topsoil.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Silt from settling ponds or a filter press will be used for reclamation?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Settling pond clay slurries will be pumped or hauled to other segments for reclamation? If yes, explain:	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
24B. Removal of Vegetation	
Vegetation will be removed sequentially from areas to be mined to prevent unnecessary erosion? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Small trees and other transplantable vegetation will be salvaged for use in revegetating other segments? If yes, give details. If no, explain: Some will be salvaged.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Wood and other organic debris will be: <input type="checkbox"/> recycled <input type="checkbox"/> removed from site <input checked="" type="checkbox"/> chipped <input type="checkbox"/> burned <input type="checkbox"/> buried <input checked="" type="checkbox"/> used to synthesize topsoil or mulch <input type="checkbox"/> other (<i>explain</i>) Solid waste disposal, burning, and land use permits are attached?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Some coarse wood (logs, stumps) and other large debris will be salvaged for fish and wildlife habitats? If yes, give details. If no, explain: Course wood and other large debris will be used for slope stability and erosion control.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
24C. Stormwater and Erosion control for Reclamation	
Pit floor will slope at gentle angles toward highwall, sediment retention pond, or proper drainage? If yes, give details. If no, explain: See Plan of Operations / Reclamation Narrative.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Revegetation, sheeting, and (or) matting will be used to protect areas susceptible to erosion? If yes, give details. If no, explain: Seeded matting used on slopes. See Plan of Operations / Reclamation Narrative.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Water control systems used during segmental reclamation will: Divert clean water around pit? Trap sediment-laden runoff before it enters a stream? Be established to prevent erosion of setbacks and neighboring properties? Be removed or reclaimed? If any answers are no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input checked="" type="checkbox"/> yes <input type="checkbox"/> no

APPLICATION FOR RECLAMATION PERMIT AND PLAN

Stormwater system design will be capable of carrying the peak flow of the 25-year, 24-hour precipitation event? (Data are available at the National Oceanic And Atmospheric Administration (NOAA))	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no
If yes, are calculations attached?	
If yes, give details. If no, explain: The nearest NOAA data for Northwest River Forecast Center -- Peak Flow Forecasts -- is at MF NOOKSACK--NEAR DEMING (MFNW1) which would not apply to where the mine is located	
Natural and other drainage channels will be kept free of equipment, wastes, stockpiles, and overburden? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
25. RECLAMATION TOPOGRAPHY	
25A. Final Slopes	
Final slopes will be created using the cut-and-fill method? Explain procedure to be used: Talus slope created	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Slopes will be created by mining to the final slope using the cut method? Explain procedure to be used: Talus slope created	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Slopes will vary in steepness? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Slopes will have a sinuous appearance in both profile and plan view? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Large rectilinear (that is, right angle, or straight, planar) areas will be eliminated? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Where reasonable, tracks of the final equipment pass will be preserved and oriented to trap moisture, soil, and seeds, and to inhibit erosion? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
25B. Slope Requirements for Pits and Overburden/Waste Rock Dumps (non-saleable products)	
<i>If the mine is a quarry or in hard rock, skip to Quarry section (25C).</i>	
Slopes will vary between 2 and 3 feet horizontal to 1 foot vertical or flatter, except in limited areas where steeper slopes are necessary to create sinuous topography and control drainage? If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no
For pits, slopes will not exceed 2 feet horizontal to 1 foot vertical except as necessary to blend with adjacent natural slopes? Give details:	<input type="checkbox"/> yes <input type="checkbox"/> no
Review "Additional Requirements for Mines with Steep or Potentially Unstable Slopes" in "Instructions for SM-8A".	
Slope stability analysis required? If yes, attach analysis.	<input type="checkbox"/> yes <input type="checkbox"/> no
25C. Slope Requirements for Quarries and Hardrock Metal Mines	
<i>If mine is a pit in unconsolidated materials covered by Section 25B, go to Section 25D</i>	
Check the appropriate box(es)	
<input type="checkbox"/> Slopes will not exceed 2 feet horizontal to 1 foot vertical. <input type="checkbox"/> Slopes steeper than 1 foot horizontal to 1 foot vertical are an acceptable subsequent land use as confirmed on Form SM-6. <input type="checkbox"/> Hazardous slopes or cliffs are indigenous to the immediate area and already present a potential threat to human life. Photo and maps attached to document presence of cliffs. <input checked="" type="checkbox"/> Geologic or topographic characteristics of the site preclude slopes being reclaimed at a flatter angle and are an acceptable subsequent land use as confirmed on Form SM-6.	
Review "Additional Requirements for Mines with Steep or Potentially Unstable Slopes" in "Instructions for SM-8A".	

APPLICATION FOR RECLAMATION PERMIT AND PLAN

Slope stability analysis required? If yes, attach analysis.	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Measures will be taken to limit access to the top and bottom of hazardous slopes? Describe measures, or if no, explain: Locked Gated Access Road.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Selective blasting will be used to remove benches and walls and to create chutes, buttresses, spurs, scree slopes, and rough cliff faces that appear natural? Blasting plan attached? If no, explain: Longhole drilling from top, shoot to create talus slope	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Reclamation blasting will be used to reduce the entire highwall to a scree or rubble slope less than 2 feet horizontal to 1 foot vertical? Blasting plan is attached? If no, explain: Simple drill and shoot operation	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Access to benches will be maintained for reclamation blasting? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Small portions of benches will be left to provide habitat for raptors and other cliff-dwelling birds?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
25D. Backfilling	
The site will require backfilling? If no, skip to 25E. Maximum depth of backfilling is 10 feet.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Backfill will be <input checked="" type="checkbox"/> onsite materials <input type="checkbox"/> imported materials <input type="checkbox"/> both Provide a written screening method that ensures importation of acceptable soil for reclamation.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Backfilling plan is attached? If no, explain: The backfilling has been completed to shape the ground for drainage. There will not be any future backfilling.	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Backfill stockpiles are shown on maps and will be marked on the ground with markers?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
All grading/backfilling will be done with non-noxious, non-combustible, and relatively incompactible solids? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Backfill will require compaction? If no, explain:	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Will you be backfilling to create slopes? Is slope stability analysis attached? If no, explain. The quarry has been in operation for over 50 years. Experience has shown that there are no slope stability issues due to the type of materials and general approach to managing slopes. In addition, the risks are minimal on the site.	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no
25E. Mine Floors	
Flat areas will be formed into gently rolling mounds? If yes, give details. If no, explain: Quarry floor will be mounded	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Mine floor will be gently graded into sinuous drainage channels to preclude sheetwash erosion during intense precipitation? If yes, give details. If no, explain: Quarry floor will include drainage channels	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Mine floor and other compacted areas will be bulldozed, plowed, ripped, or blasted to foster revegetation? If yes, give details. If no, explain: Ripper cat to rip quarry floor	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no

APPLICATION FOR RECLAMATION PERMIT AND PLAN

25F. Lakes, Ponds, and Wetlands	
Is water currently present in the area or will the mining penetrate the water table? <i>If no, go to Section 25G.</i>	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Reclaimed areas below the permanent low water table in soil, sand, gravel, and other unconsolidated material will have a slope no steeper than 1.5 feet horizontal to 1 foot vertical? If yes, give details. If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no
If not already present, soils, silts, and clay-bearing material will be placed below water level to enhance revegetation? If yes, give details. If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no
Some parts of pond and lake banks will be shaped so that a person can escape from the water?	<input type="checkbox"/> yes <input type="checkbox"/> no
Armored spillways or other measures to prevent undesirable overflow or seepage will be provided to stabilize bodies of water and adjacent slopes? If yes, give details. If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no
Wildlife habitat will be developed, incorporating such measures as: Sinuous and irregular shorelines? Varied water depths? Shallow areas less than 18 inches deep? Islands and peninsulas? Give details:	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no
Ponds or basins will: Be located in stable areas? Have sufficient volume for expected runoff? Have an emergency overflow spillway? Spillways and outfalls will be protected (for example, rock armor) to prevent failure and erosion? If any answers are no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no
Proper measures will be taken to prevent seepage from water impoundments that could cause flooding outside the permitted area or adversely affect the stability of impoundment dams or adjacent slopes? If yes, give details. If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no
Written approval from other agencies with jurisdiction to regulate impoundment of water is attached? If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no
25G. Final Drainage Configuration	
Drainages will be constructed on each reclaimed segment to control surface water, erosion, and siltation? Result in essentially natural conditions of volume, velocity, and turbidity? Clean runoff is directed to a safe outlet? If yes, give details. If no, explain: The current stormwater system treats runoff through a system of channels and settling ponds. Mature vegetation and other reclamation activities will provide natural stormwater treatment upon completion of quarry operations.	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Are these shown on maps? The removal of all water control systems will take place upon final reclamation of the quarry. Instead, water will disperse naturally, as done prior to quarry operations taking place.	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
26. SITE CLEANUP AND PREPARATION FOR REVEGETATION	
26A. Dealing with Hazardous Materials	
Hazardous materials are present at the mine site? <i>If no, go to Section 26B</i>	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
The final ground surface drains away from any hazardous natural materials? If yes, give details. If no, explain:	<input type="checkbox"/> yes <input type="checkbox"/> no

APPLICATION FOR RECLAMATION PERMIT AND PLAN

Plan for handling hazardous mineral wastes indigenous to the site is attached?	<input type="checkbox"/>	yes	<input type="checkbox"/>	no
If no, written approval from all appropriate solid waste regulatory agencies attached?	<input type="checkbox"/>	yes	<input type="checkbox"/>	no

26B. Removal of Debris

All debris (garbage, 'bone piles', treated wood, old mining equipment, etc.) will be removed from the mine site?	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no
All sheds, scale houses, and other structures will be removed from the site?	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no

If either answer is yes, give details. If no, explain: **All debris and equipment are removed from the site annually. No structures are present at the quarry.**

27. REVEGETATION

The mine site is in:	<input type="checkbox"/> eastern Washington	Revegetation area is:	<input checked="" type="checkbox"/> wet	<input type="checkbox"/> dry	<input type="checkbox"/> both
	<input checked="" type="checkbox"/> western Washington				

The average precipitation is **65"** per year.

Revegetation will start during the first proper growing season (fall for grasses and legumes, fall or late winter for trees and shrubs) following restoration of mine segments?	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no
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If yes, give details. If no, explain: **See Plan of Operations / Reclamation Narrative.**

The site will not be revegetated because:

It is a rural area with a rainfall exceeding 30 inches annually and erosion will not be a problem (requires approval of DNR).

Revegetation is inappropriate for the approved subsequent use of this surface mine.

Explain: **N/A**

27A. Recommended Pioneer Species

In the Sections below, check the species that will be planted at your mine site:
** indicates nitrogen-fixing species*

Western Washington Dry Areas

<input type="checkbox"/> alfalfa*	<input type="checkbox"/> lupine*	<input type="checkbox"/> clover*	<input type="checkbox"/> orchard grass
<input type="checkbox"/> cereal rye	<input type="checkbox"/> perennial rye	<input type="checkbox"/> colonial bent grass	<input type="checkbox"/> ponderosa pine
<input type="checkbox"/> creeping red fescue	<input type="checkbox"/> red alder*	<input type="checkbox"/> Douglas fir	<input type="checkbox"/> shore pine
<input type="checkbox"/> ground cover	<input type="checkbox"/> shrubs	<input type="checkbox"/> other	

Western Washington Wet Areas

<input checked="" type="checkbox"/> birdsfoot trefoil	<input type="checkbox"/> sedges	<input checked="" type="checkbox"/> cedar	<input type="checkbox"/> tubers
<input type="checkbox"/> cottonwood	<input type="checkbox"/> wetland grasses	<input checked="" type="checkbox"/> creeping red fescue	<input type="checkbox"/> willow
<input checked="" type="checkbox"/> red alder*	<input checked="" type="checkbox"/> other See Plan of Operations / Reclamation Narrative.		

Eastern Washington Dry Areas

<input type="checkbox"/> alder*	<input type="checkbox"/> grasses	<input type="checkbox"/> alfalfa*	<input type="checkbox"/> juniper
<input type="checkbox"/> black locust	<input type="checkbox"/> lodgepole pine	<input type="checkbox"/> clover	<input type="checkbox"/> lupine*
<input type="checkbox"/> deciduous trees	<input type="checkbox"/> ponderosa pine	<input type="checkbox"/> shrubs	<input type="checkbox"/> deep-rooted ground cover
<input type="checkbox"/> diverse evergreens	<input type="checkbox"/> other		

Eastern Washington Wet Areas

<input type="checkbox"/> alder*	<input type="checkbox"/> cottonwood	<input type="checkbox"/> poplar	<input type="checkbox"/> sedges
<input type="checkbox"/> serviceberry	<input type="checkbox"/> tubers	<input type="checkbox"/> willow	
<input type="checkbox"/> other			

Give planting details (stems/acres of trees and shrubs, see [Forest Practices manual](#); lbs/acre of grass, legume, or forb mixture):
See Plan of Operations / Reclamation Narrative.

Describe weed control plan:
Appropriate measures such as chemical treatment of known species would take place prior to the commencement of ground disturbance activities in the expansion area.

APPLICATION FOR RECLAMATION PERMIT AND PLAN

27B. Planting Techniques	
Revegetation at this site will require:	
Ripping and tilling?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Blasting to create permeability?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Mulching?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Irrigation?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Fertilization?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Importation of clay- or humus-bearing soils?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Other soil conditioners or amendments?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Give details: Chip slash and slash pile, mix with fines, distribute and plant	
Trees and shrubs will be planted in topsoil or in subsoil amended with generous amounts of organic matter?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
If yes, give details. If no, explain: See Plan of Operations / Reclamation Narrative.	
Mulch will be piled around the base of trees and shrubs?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
High quality stock will be used?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Trees and shrubs will be planted while they are dormant?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Stock will be properly handled, kept cool and moist, and planted as soon as possible?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Seeds will be covered with topsoil or mulch no deeper than one-half inch?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
If any answers are no, explain: Seeds are in matting	
28. FINAL CHECKLIST	
All required maps are attached? (<i>See "Instructions for SM-8A" for detailed requirements.</i>)	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
All required cross sections are attached? (<i>See "Instructions for SM-8A" for detailed requirements.</i>)	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Geologic map attached (if required)? (<i>See "Instructions for SM-8A" for detailed requirements.</i>)	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
All documents submitted have the date, the name and address of the permit holder, and the application number?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Have you completed the SM-6 and has it been signed by the local jurisdiction?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Have you provided the SEPA checklist?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Have you provided a copy of the SEPA determination (DNS, MDNS, or DS)? SEPA is currently under review.	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Have you attached photographs (as needed)?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Are additional supplemental studies included?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
If yes, check the appropriate box(es) below:	
<input type="checkbox"/> Archeological	<input type="checkbox"/> Geohydrologic
<input type="checkbox"/> Topsoil	<input type="checkbox"/> Flood plain
<input type="checkbox"/> Other Mineral Specialist Report	<input type="checkbox"/> Backfill
	<input type="checkbox"/> Conservational
	<input type="checkbox"/> Slope stability
	<input type="checkbox"/> Vegetation
Other permits required? <input type="checkbox"/> yes <input checked="" type="checkbox"/> no	
If yes, check the appropriate box(es) below:	
<input type="checkbox"/> Shoreline Permit	<input type="checkbox"/> Water Discharge Permit
<input type="checkbox"/> Air Quality Permit	<input type="checkbox"/> NPDS or General Discharge Permit
<input type="checkbox"/> Special or Conditional Use Permit	<input type="checkbox"/> Solid Waste Permit
<input type="checkbox"/> Other	<input type="checkbox"/> Hydraulic Project Approval

APPLICATION FOR RECLAMATION PERMIT AND PLAN

IDENTIFICATION OF LANDOWNER(S)

Identify names and addresses of all landowners. Provide written evidence of landowner approval of the extraction of minerals by surface mining methods and of the reclamation plan and/or provide the signature of all landowners below. If landownership has been severed between surface and mineral rights ownership, identify all affected mineral rights owner(s) and provide their approval. *(Attach signed copies of this page if more than one.)*

Print Name(s): **Twin Sisters Olivine, Ltd., Richard J. Ivy (President)**

Address(es): **Twin Sisters Olivine, Ltd.
P.O. Box 649
Carnegie, PA 15106**

RECEIVED
June 6, 2024
Washington Geological Survey

APPLICANT ACKNOWLEDGMENT

By signing this application, the applicant acknowledges the following:

- **Application's Information True.** The applicant verifies that all information on this application and reclamation plan is true.
- **Reclamation Plan Contents.** The applicant's reclamation plan consists of this document (SM-8A), SM-6, associated maps, cross sections, reclamation narrative, and other attachments. The department's approval of this application would reflect approval of the applicant's reclamation plan.
- **Applicant/Permit Holder Must Comply.** If the department approves this application, the applicant shall be the permit holder and shall be responsible for compliance with Chapter 78.44 RCW, Chapter 332-18 WAC, the terms and conditions of the permit, and the approved reclamation plan and attachments. *The permit holder shall comply with the permit and may not significantly deviate from the reclamation plan without prior written approval by the department for the proposed change.* Revised permits or modified plans might be necessary following significant deviations.
- **Applicant/Permit Holder Consents to Inspection.** All permitted surface mines are subject to regular inspection. See RCW 78.44.161 and WAC 332-18-050. The applicant verifies that it has authority to consent to department inspections on behalf of itself and the landowner(s). *Applicant authorizes the department to enter and inspect any property covered by this application during any day or time determined necessary by the department to ensure compliance with the Surface Mining Act, Surface Mining Rules, the Reclamation Permit, and the Reclamation Plan.*

APPLICANT

Signature of surface mine permit applicant or applicant's company representative

Richard J. Ivy

Name and Title of Company Representative
(Please print)

Richard J. Ivy, President

Date signed

12-24-2023

LANDOWNER(S)

As landowner, I **Richard J. Ivy on behalf of Twin Sisters Olivine, Ltd.** authorize the applicant to extract minerals from my land using surface mining methods and I approve this reclamation plan.

Signature: *Richard J. Ivy* Date signed: *12-24-2023*

FOR DEPARTMENTAL USE ONLY

Date accepted

Accepted by:

Title:

Reclamation Permit No.

APPLICATION FOR RECLAMATION PERMIT AND PLAN

IDENTIFICATION OF LANDOWNER(S)

Identify names and addresses of all landowners. Provide written evidence of landowner approval of the extraction of minerals by surface mining methods and of the reclamation plan and/or provide the signature of all landowners below. If landownership has been severed between surface and mineral rights ownership, identify all affected mineral rights owner(s) and provide their approval. *(Attach signed copies of this page if more than one.)*

Print Name(s): **Louis "Ted" Neff, District Ranger**

Address(es): **US Department of Agriculture
Forest Service
Mt. Baker-Snoqualmie National Forest
Mt. Baker Ranger District
810 State Route 20
Sedro-Woolley, WA 98284**

RECEIVED
June 6, 2024
Washington Geological Survey

APPLICANT ACKNOWLEDGMENT

By signing this application, the applicant acknowledges the following:

- **Application's Information True.** The applicant verifies that all information on this application and reclamation plan is true.
- **Reclamation Plan Contents.** The applicant's reclamation plan consists of this document (SM-8A), SM-6, associated maps, cross sections, reclamation narrative, and other attachments. The department's approval of this application would reflect approval of the applicant's reclamation plan.
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- **Applicant/Permit Holder Consents to Inspection.** All permitted surface mines are subject to regular inspection. See RCW 78.44.161 and WAC 332-18-050. The applicant verifies that it has authority to consent to department inspections on behalf of itself and the landowner(s). ***Applicant authorizes the department to enter and inspect any property covered by this application during any day or time determined necessary by the department to ensure compliance with the Surface Mining Act, Surface Mining Rules, the Reclamation Permit, and the Reclamation Plan.***

APPLICANT

Signature of surface mine permit applicant or applicant's company representative



Name and Title of Company Representative
(Please print)

Richard J. Ivy, President

Date signed

12-24-2023

LANDOWNER(S)

As landowner, I, **Louis "Ted" Neff, District Ranger** authorize the applicant to extract minerals from my land using surface mining methods and I approve this reclamation plan.

Signature:

**LOUIS
NEFF**

Digitally signed by LOUIS NEFF
Date: 2024.04.15
13:46:21 -07'00'

FOR DEPARTMENTAL USE ONLY

APPLICATION FOR RECLAMATION PERMIT AND PLAN

Date accepted	Accepted by: _____ Title: _____	Reclamation Permit No.
---------------	------------------------------------	------------------------

**Swen Larsen Quarry
Twin Sisters Olivine, Ltd.**

Plan of Operations & Reclamation Narrative
December 2023

Introduction

This Plan of Operations and Reclamation Narrative (Plan) has been prepared as a required component of an application for a proposed expansion, only on Forest Service Land, of the Swen Larsen Quarry (quarry) in Whatcom County, Washington. The quarry occupies private land currently owned by Twin Sisters Olivine, Ltd. and public land in the Mt. Baker-Snoqualmie National Forest managed by the USDA Forest Service (USFS). The proposed expansion area includes 9.98 acres wholly located on USFS land. The Plan is intended to meet USFS requirements including federal mining laws and Title 36 of the Code of Federal Regulations (CFR). The Plan is also intended to meet the requirements of the Washington State Department of Natural Resources (DNR) pursuant to Chapter 78.44 Revised Code of Washington (RCW). The Plan has been designed to meet both federal and state requirements due to the multi-jurisdictional oversight of the United States Forest Service (USFS) and Washington State Department of Natural Resources (DNR). The combination of the two agencies has created chaos and confusion in the granting and administration of this permit. The permit cost and time has greatly exceeded expected estimates.

Site Description

Site Location

The quarry (DNR Permit #70-012069) is located approximately 10 miles east-southeast of Deming, Washington. Access to the quarry is from Mosquito Lake Rd., USFS 38 Road and then existing private forest roads. The quarry site is located in Sections 34 and 35 of Township 38 North, Range 6 East, W.M. in the Middle Fork Nooksack River drainage. The site is upstream from a City of Bellingham diversion dam that has been removed.

Background

The quarry has been in operation since 1963 at the site of an established road building borrow pit. The borrow pit had been established in approximately 1951. The first DNR Operating Permit was issued in May 1991. The quarry's current footprint makes up an approximate 23.19 acres (13.76 acres of private land and 9.43 acres of US Forest Service land). The 13.76 acres of private land includes one acre that has been reclaimed. There are 2.45 acres that exist adjacent to the present quarry site that was disturbed prior to 1971 for road ballast. This area is not considered part of the ongoing quarry operations.

The quarry is currently owned and managed by Twin Sisters Olivine (formerly known as United Western Supply). Portions of the quarry site on USFS land are on mining claims Olivine #20 (ORMC 170741) and Olivine #21 (ORMC 170742). Quarry operations are seasonal and occur for approximately 2 months of each year. The primary method for mineral extraction is ripping. Occasional blasting (no more than once or twice per season, although historically less frequent) is used to allow for consistent quarry practices and benching. A portable crushing and screening plant is brought to the quarry at the beginning of the season and removed after completion. No permanent facilities are located at the quarry. Material that has been crushed and screened is transported by truck 8 miles to the Mosquito Lake Road Reload Site for storage and further distribution.

Olivine ore is mined at the site. This mineral is used primarily for foundry sand castings and refractory liners of combustion chambers.

The quarry site occupies a steeply sloped ridgeline and side slope approximately one mile to the north of North Twin in the Twin Sisters Range. The surrounding area is primarily commercial forestland.

The proposed expansion area is within the Mt. Baker West Block Inventoried Roadless Area. The inventoried roadless rule allows access for the exploration of locatable minerals and reasonable access for the development of valid claims pursuant to the General Mining Law of 1872. Mining claims for the quarry are discussed above. The proposed expansion area of 9.98 acres is a small fraction of the overall Mt. Baker-Snoqualmie National Forest inventoried roadless area (.0025%) and will occur on the western edge of the national forest. An existing network of forest roads provides primary access to the quarry.

A geophysical investigation for future expansion of the quarry was permitted by USFS in 2010 (Decision Memo, Olivine Geophysical Investigation, 8/20/10). The Decision Memo recognizes that a potential quarry expansion of 20-30 acres is possible based on the extent of the olivine deposit.

Project Description

The current DNR permit provides for an estimated total of 20 acres to be surface mined. The proposed expansion will increase the total acreage of disturbed area to 35.8 acres. The proposed area of expansion for mineral extraction will be entirely on USFS land. Expansion will allow for additional mineral extraction at the site over an estimated 20-year period. The proposed action involves the following key activities:

- Excavate, crush, and screen approximately 25,000 to 50,000 tons of olivine production rock a year.¹
- Removal of vegetation from the expansion area during excavation.
- Chip a portion of the removed trees for reclamation activities and retain for slope stability, erosion control, and nutrient enhancement. Disposition of trees will be at Forest Service discretion.
- Haul approximately 25,000 to 50,000 tons of olivine production rock a year to the Mosquito Lake Road Reload Site (off-site).
- Excavation will continue on the pre-expansion portion of the mine.

Two-Phase Approach in Excavation

A two-phase approach in excavation would take place due to the presence of a seasonal channel within the expansion site. There is also material extraction planned for areas within the currently permitted area.

Phase 1

Phase 1 includes all areas to be mined to the west of the existing Stream Channel as shown on the Reclamation Plan Maps. The seasonal channel would have a minimum of a 50-foot buffer in place. Phase 1 quarry activities would not enter the 50-foot buffer.

Phase 2

Phase 2 quarry operations would continue past the seasonal channel to the expansion area's boundary line. The seasonal channel would be excavated during Phase 2 quarry operations, and reconstructed post operations. More information is provided in the Water Resources section below.

Vegetation Removal

The proposed expansion area is currently forested. Trees will be removed during excavation of the expansion area. Based on USFS approval, trees on USFS land will be used for reclamation activities. Most will be chipped. The remaining wood (including any large wood found on private land) will be retained and used for slope stability, erosion control and nutrient enhancement during reclamation. Wood chips will be stored on-site and spread over reclamation areas or mixed with topsoil and fine rock as a revegetation medium. Topsoil and organic material from the proposed expansion area will be stripped in phased efforts as necessary to access mineral deposits for extraction. This material will be contained on-site in designated storage areas and mixed with wood chips and fine rock for reclamation.

Stormwater and Erosion Management

¹ This tonnage is the calculated amount of crushed and screened rock planned for delivery to the Mosquito Lake Road Reload Site. This is dependent on market demand and extraction rates.

There is an existing system of stormwater diversion channels, berms, and settling ponds designed to reduce erosion, contain sediment, and increase infiltration at the site. Expansion of the existing stormwater system and development of new systems will be completed as necessary during the proposed expansion.

Attached Maps

The associated map set includes existing and proposed site boundaries, topography, reclamation segments, cross sections, topsoil storage areas, and other required information.

The locations of the topsoil storage areas identified on the map set are tentative based on expected mineral extraction activities. All topsoil storage areas will be within the site boundary.

The “Approximate Pre-mining Ground Surface” shown on map sheet 8, cross section C-C includes a bench at an approximate elevation of 2,805 feet mean sea level. This bench was a landing for a tower and was used as a borrow pit in the 1950s. No additional mining has occurred within that location since that time, and the excavations are not associated with this permit but have been added to the map to accurately depict the pre-mining ground surface.

Geology

The Twin Sisters Range contains one of the largest Dunite mineral bodies in the world, referred to as the Twin Sister's Dunite. DNR identifies the geologic unit as pre-tertiary ultramafic rocks. The USGS Geologic Map of the Mount Baker 30- by 60-Minute Quadrangle, Washington describes the rock type as Twin Sisters Dunite of Ragan (1961, 1963) of the Welker Peak and Excelsior nappes. A portion of this mineral body is the olivine deposit being mined. Ultramafic rocks are igneous rocks composed primarily of magnesium and iron silicate.

Soils in the proposed expansion area are thin gravelly loams derived from highly fractured rock or sandy silt derived from glaciers and the northern face of North Twin Mountain. There are outcroppings of rock throughout the area and vicinity of the quarry. From a plant nutrition perspective, Dunite is the least likely to cause deleterious substances of ultramafic substrates because of the weathering products of the rock (the soil) contain less heavy metals and more nutrient materials such as calcium (Ca) and potassium (K) than the other serpentine minerals (Pentec, 1991).

Hydrogeology

The quarry lies within the Middle Fork Nooksack River (MFNR) drainage. A seasonal channel and Mae Creek, also known as Seymour Creek, are the two streams in closest proximity to the

proposed project area. The seasonal channel flows through the proposed expansion area. Mae Creek is located 200 feet to the west of the existing quarry site.

The seasonal channel, which resides within the expansion area, is characterized by a thin veneer of soil over rock and is a seasonal stream that functions primarily for snowmelt and extended rainfall events. Mae Creek is a small tributary that exists northwest of the expansion area. Mean annual flow in Mae Creek is 3-4 cubic feet per second (USDA, 1992). Both tributaries flow north into the Middle Fork Nooksack River.

The current maximum quarry depth is 260'. The Whatcom County "Critical Aquifer Recharge Areas" map identifies estimated depth to water in the proposed expansion area at greater than 290 feet. To date, no groundwater has been encountered by mining operations on the current project site, although numerous seeps have been identified in the area. There are no delineated Wellhead Protection Areas, Critical Aquifer Recharge Areas, or Sole Source Aquifers within the quarry or the expansion area. These are all mechanisms used to provide safe drinking water to a community.

Mitigation Measures for Two-Phase Approach in Excavation

Due to the presence of the seasonal channel, the quarry would implement certain mitigation measures to help protect the seasonal channel throughout the two-phase approach.

Phase 1:

The seasonal channel would have a minimum of a 50-foot buffer in place. Phase 1 quarry activities would not enter the 50-foot buffer. This would help protect the health of the channel in the following ways:

- Prevent sedimentation from occurring by filtering sediment in an established buffer bordered with silt fencing or straw bales.
- Maintain cooler temperatures by preserving the dense vegetation that borders the channel.
- Protect seasonal flow, where the tributary can continue to function primarily for temporary time frames such as during snow melt episodes and/or extended rainfall.

The buffer would be implemented on the west side of the channel where quarry operations would occur. The objective would be to protect the seasonal channel Riparian Reserve's core zone across the entire length of the expansion area.

Under this phase, adverse impacts to water resources would be unlikely with a ground disturbance free zone and a lack of operations contributing debris to groundwater within the expansion area.

Phase 2:

Phase 2 quarry operations would continue past the seasonal channel to the expansion area's boundary line. The seasonal channel would be excavated. Prior to excavation of the channel, a stream diversion design and channel reconstruction design (for post-operations) would be developed and carried out in consultation with an engineering firm and the Forest Service. Based on the proposed diversion design, the quarry would coordinate with the US Army Corps of Engineers to determine if fill discharge, such as rock and dirt discharge would take place and if a nationwide level permit or individual permit action is needed prior to operations.

For this phase, the diversion would ensure the channel's flow would stay the same and water quality was preserved. After quarry operations are completed, application of the necessary steps required to reconstruct the seasonal channel would be carried out.

Solid Wastes

The only solid waste that is produced at the quarry is inert fine rock from the crushing process. Quantities of fine rock are variable dependent on the quality of the mined ore. Fine rock is stored on site and currently used as a reclamation medium. Stored topsoil and wood chips from tree removal during quarry expansion will be mixed with the fine rock and used for revegetation of the reclamation segments. Fine rock will be used to regrade non-quarry face portions of the site at the end of mining.

Reclamation

Reclamation is an integral and ongoing component of the operation. The final quarry face configuration will be blasted to create a talus slope or series of smaller scree slopes to match the high, non-forested cliff faces and talus slopes indigenous to landscape features near the quarry. A few small benches may remain after blasting. The final topography provides for a slope ratio of approximately 1:1.25 for the quarry face. The following measures will be taken:

- Remaining bench and vertical rock faces will not exceed 50' high
- Blasts will be strategically placed to match original topography/terrain in project vicinity

No setback will be established around the perimeter of the quarry site. The land shared with the Forest Service does not require a setback.

Remaining areas of the quarry site (non-quarry face) will be reclaimed segmentally through grading, erosion control, organic material enhancement, and revegetation. The stockpile and crushing level benches will be regraded and revegetated.

The mine floor will be bulldozed into gently rolling mounds including sinuous drainage channels to preclude sheet-flow erosion during intense precipitation. Material on the mine floor, as well as other compacted areas will be bulldozed, ripped or blasted to foster revegetation prior to application of soils. Backfill will be Cat compacted on site materials.

To date one area of the quarry has been reclaimed. Four additional reclamation areas (segments) are scheduled to complete. The reclamation schedule is estimated and based on operational considerations. Reclamation planning is described in Table I below:

Table I - Reclamation Schedule - Estimated

Reclamation Segment	Acreage	Estimated Start	Reclamation Process	Estimated Completion
1	1.4	Summer 2024	In-sloping of road grades, organic material enhancement, additional chipped log debris, revegetation	Approximately 5 years from the estimated start date*
2	3.4	Summer 2025	Erosion control, organic material enhancement, additional chipped log debris, revegetation phased from lower slope to haul road	Approximately 5 years from the estimated start date*
3	3.6	Summer 2026	Bench retention, revegetation, additional chipped log debris (Includes organic material enhancement)	Approximately 5 years from the estimated start date*
4	33.17	End of mining operations	Bench retention with revegetation. Bench grading, erosion control, organic material enhancement and revegetation, additional chipped log debris, and *reconstruction of the seasonal channel (if phase 2 of the 2-phase approach takes place) Forested slopes, cliff faces, and talus slopes will be the final product.	Approximately 5 years' post operation*

*The already reclaimed area has demonstrated the difficulty to attain substantial growth for post operational revegetation. The ultramafic soils do not lend well to conventional planting. An application of straw or hay starts the process. Seed and fertilizer is added the next year.

After good ground cover is achieved, tree seedlings are introduced. The whole process takes five years.

Reclamation monitoring by the permit holder will occur annually at the site until an area has been deemed reclaimed by the appropriate agency. Reclamation monitoring will include an assessment of stormwater management, erosion control and slope stability. Vegetation monitoring is discussed in the Revegetation Plan section below.

Replacement soil depth for reclamation and revegetation efforts is expected to be at a minimum depth of 6 inches. Depths up to 18 inches may be appropriate in certain circumstances. This revegetation material (soil mixture) will be a combination or mixture of topsoil overburden, wood chips from forest clearing in the proposed expansion area and fine rock. Existing soils in the area are of limited depth and poor for vegetative growth. This soil mixture will allow for sufficient volume and quality to revegetate identified reclamation areas. Micro-terraces will be established and retention of equipment tracks in the material will promote moisture retention, sediment recruitment and vegetative success. Overburden and soil mixture will only be handled during the dry season. Scheduled completion of reclamation segments is based on the success of revegetation efforts. Given site conditions the growth rate may be slower than anticipated.

Upon final reclamation, existing water control systems will be modified. Stormwater ponds will be filled in and revegetated. (The stormwater ponds and culverts depicted on the Final Excavation and Reclamation Map will be removed for final reclamation.) Any remaining water from the stormwater ponds will be distributed on the convex face of the eastern slope below the quarry access road in reclamation segment 2 (see Reclamation Sequence Map). The water will disperse naturally into the soil prism of the slope. A specific design to preclude discharge to surface waters will be created prior to closure of the quarry. The stormwater plan has demonstrated infiltration of all runoff water, so no discharge reaches water of the state.

Final reclamation will restore the site to a similar condition as prior to commencement of mining. The site will consist of forested slopes, areas of talus and cliff faces. Quarry related roads would be rehabilitated so that the roadless character of the site will not be impacted.

Revegetation Plan

The subsequent use of the quarry site is forestry. Application of this plan will apply to the existing quarry site and the proposed expansion area. The focus of the revegetation strategy is to return the site to conditions prior to the commencement of quarry operations. Reclamation planning includes revegetating the quarry to minimize erosion, provide slope stability, restore wildlife habitat and reduce aesthetic impacts.

Initial revegetation efforts would focus on seeding the appropriate reclamation segments (i.e., reclamation areas 1, 3, and 5; areas 2 and 4 are excluded) with a mix of grasses and legumes that are genetically appropriate native species or are a non-native non-persistent seed-mix in the project area (see Table 3). For revegetation efforts that take place on Forest Service lands,

refer to the *starred species for what seeds will be applied to the expansion area. The second phase of revegetation includes planting tree species such as Alder and conifers (see Table 4). A two-step process will allow for the establishment of ground cover while tree seedlings and saplings are provided the necessary time to become established and mature. Grasses and legumes will provide the initial ground cover for improved slope stability and erosion control while the tree species mature.

Table 2 - Ground Cover Seed Mixture

Species	Common Name	Pounds/Acre
Festuca Rubra	Creepingred Fescue	4
Lolium multiflorum	Annual Ryegrass	7
Festuca arundinacea	Alta Tall Fescue	7
Festuca commutata	Chewings Fescue	4
Triolium repens	White Dutch Clover	3
Lotus coniculatus	Birdsfoot Trefoil	3
*Vaccinium ovalifolium	*Alaskan Huckleberr	Varies
*Gaultheria shallon	*Salal	Varies
*Polystichum munitum	*Sword fern	Varies
*Rubus pedatus	*Five-leaf bramble	Varies
*Lonicera involucrata	*Twinberry	Varies
*Cornus canadensis	*Bunchberry	Varies
		28 lbs/acre

A hydroseeder may be used to apply the groundcover seed mixture and fertilizer on reclamation segments and topsoil/overburden storage areas. Reclamation segments will be seeded in the spring when access to the site opens up from snowmelt. Seed will be sprayed on the topsoil/soil mixture and covered with hay to promote moisture retention and growth.

Topsoil storage areas will be seeded as material is added during clearing for mineral extraction. Seed sprayed on topsoil storage areas would also be covered by weed-free straw. Annual application of the seed mixture and fertilizer will continue until ground cover has reached at least 80% of the application area.

If the seed mixture described in Table 2 does not achieve the revegetation goals for ground cover, an adaptive management approach will be used. Additional recommended species for ground cover from the 1992 Pentec, Olivine Mine Rare Plant Survey identified in Table 3 would be used to reach ground cover goals (aside from FS lands):

Table 3 Other Recommended Ground Cover Species Seed Mixture

Species	Common Name	Pounds/Acre
<i>Agropyron spicatum secar</i>	Bluebunch wheatgrass	6
<i>Deschampsia caes itosa</i>	Tufted hairgrass	1
<i>Eragrostis lehmanniana</i>	Lehmans love grass	0.1
<i>Festuca lon ifolia durar</i>	Hard fescue	0.5
<i>Poa sandbergii</i>	Sandberg bunchgrass	0.25
<i>Achillea mille olium</i>	White arrow	1
<i>Anahalis margarticae</i>	Pearly everlasting	0.25
<i>Medicago sativa ranger</i>	Alfalfa	1
<i>Melilotus alba</i>	White sweetclover	1.5
<i>Vicia villosa</i>	Hai vetch	5

Phase 2 tree planting will commence the year following the first application of ground cover seed. This phased approach will allow the ground cover to take root without competition from tree species and impacts from human disturbance after hydroseeding.

Table 4 identifies recommended genetically appropriate native tree species based on completed reclamation efforts at the site.

Table 4 – Recommended Tree Species for the Revegetation Plan

Species	Common Name
* <i>Pinus contorta</i>	*Lodgepole pine
* <i>Abies amabilis</i>	*Pacific silver fir
* <i>Cupressus nootkatensis</i>	*Alaska cedar
* <i>Alnus rubra</i>	*Red Alder

Red alder is a pioneer species and nitrogen fixer that can play a valuable role in improving soil fertility for future growth of conifers. Alder also provides forage for deer and elk. Red alder has been observed at the site growing in disturbed soils and roadbeds through natural regeneration. An appropriate mix of alder and conifers will be planted in reclamation areas.

Reforestation requirements in the Washington State Forest Practice Rules (WAC 222-34010) defines tree planting distribution as an average of 190 well distributed seedlings per acre on the west side of the Cascades summit. Undisturbed forest adjacent to the quarry has a stem density of approximately 50% - 65% of the 190 per acre required under the Forest Practice Rules. Tree planting of 100 well-distributed seedlings per acre will be used for revegetation of the quarry

reclamation segments. Species composition will be defined to allow for alder improved soil condition without hindering coniferous growth or success.

Tree species survival will be monitored annually. Successful revegetation will be achieved when individual trees have reached an age of 3-4 years old with spacing no greater than 10 20 feet. Trees that have not survived to the spring season following planting will be replaced. An adaptive management strategy will be used related to the selection of tree species, tree growth and success. Tree species selection and distribution may have to be modified dependent on soil condition, slope aspect and success rates for individual reclamation segments or sections of these areas.

For the expansion area, tree distribution and density will be dictated under Forest Service jurisdiction. This will be prescribed under the Forest Service silvicultural prescription guidelines at that time.

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