



# **AZURITE MINE 2011 REMOVAL ACTION OVERVIEW**

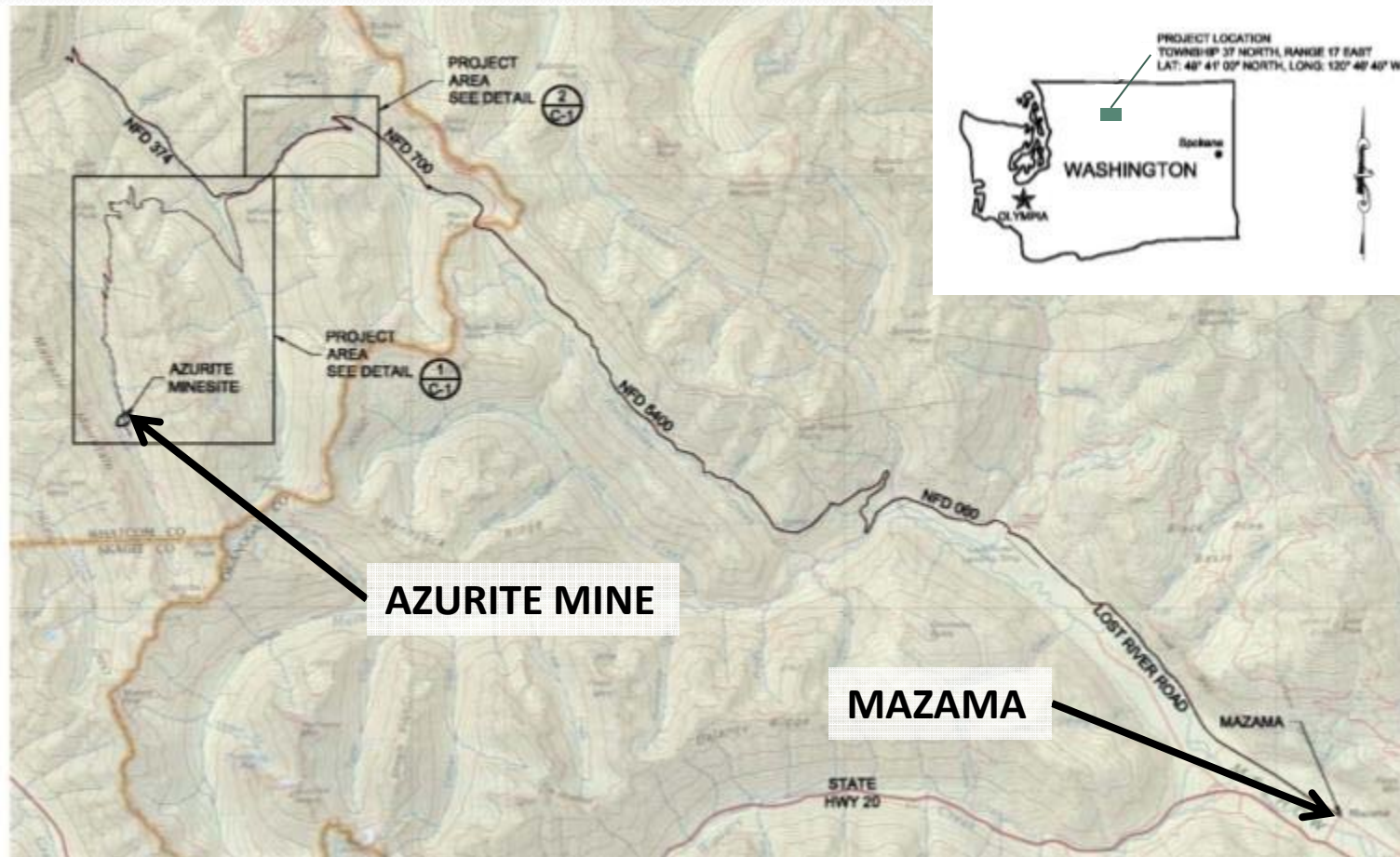
**Dustin G. Wasley, PE, Principal – CES**  
**2012 Montana Mine Design, Operation & Closure Conference**  
**May 2, 2012**



# Azurite Mine Overview

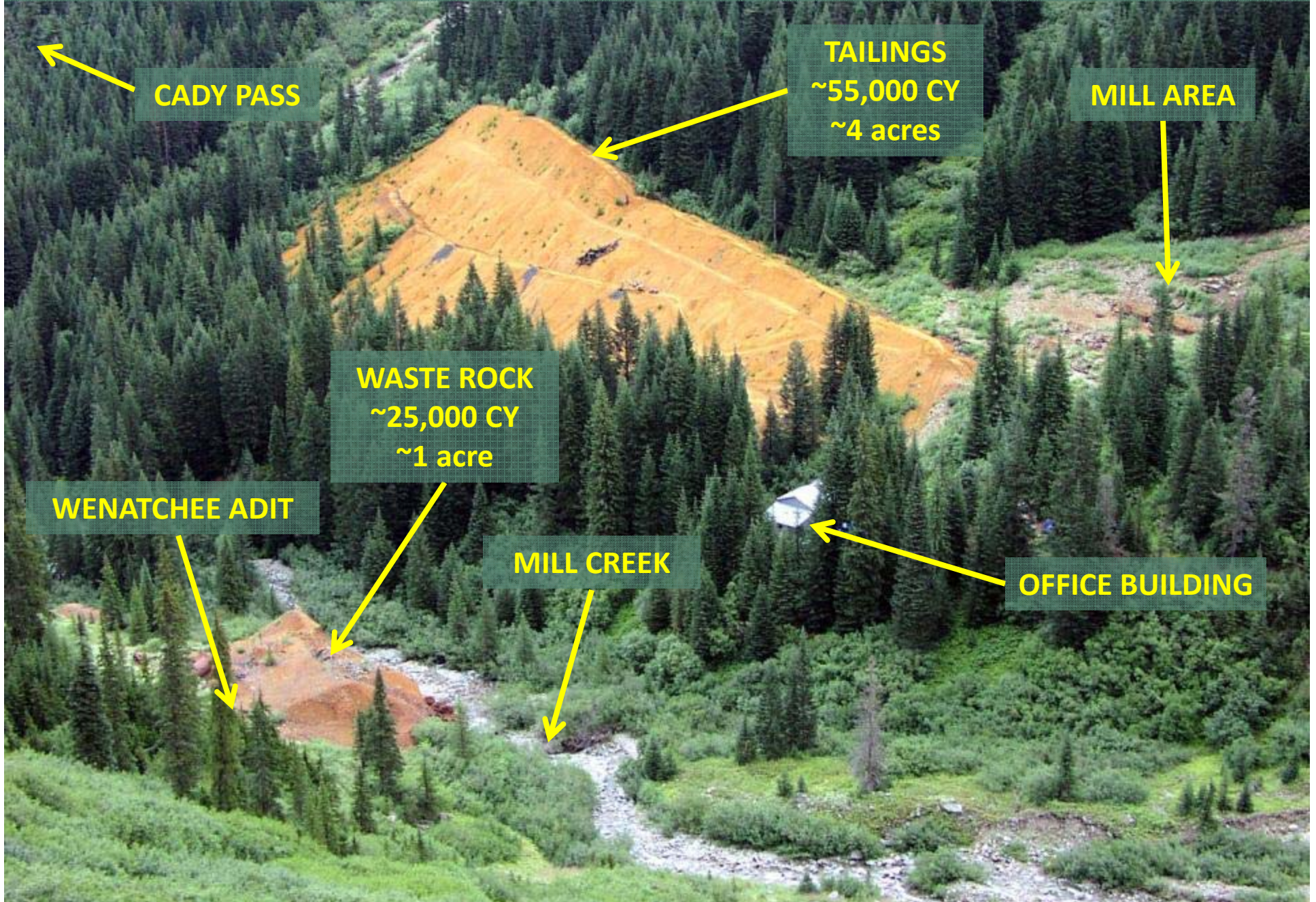
- Abandoned Underground Gold Mine, Located in North-Central WA on USFS-Administered Land
- Northwest of Mazama, Near Harts Pass Recreation Area & Pacific Crest Trail
- Remote with Poor Access, Steep Terrain
- Several RTE Species – Aquatic and Terrestrial
- Inventoried Roadless/Non-Motorized Management Area
- High Value for Potential Wilderness Area in Future

# Azurite Mine Location





# OVERVIEW OF AZURITE MINE FROM TINSON ADIT



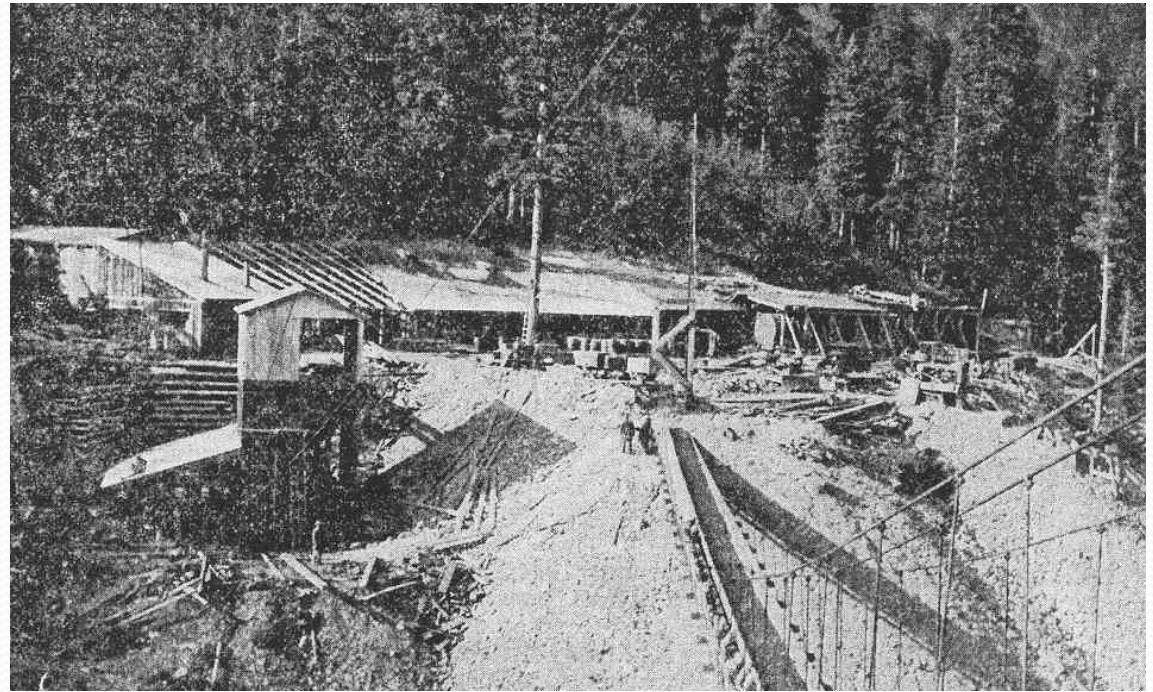
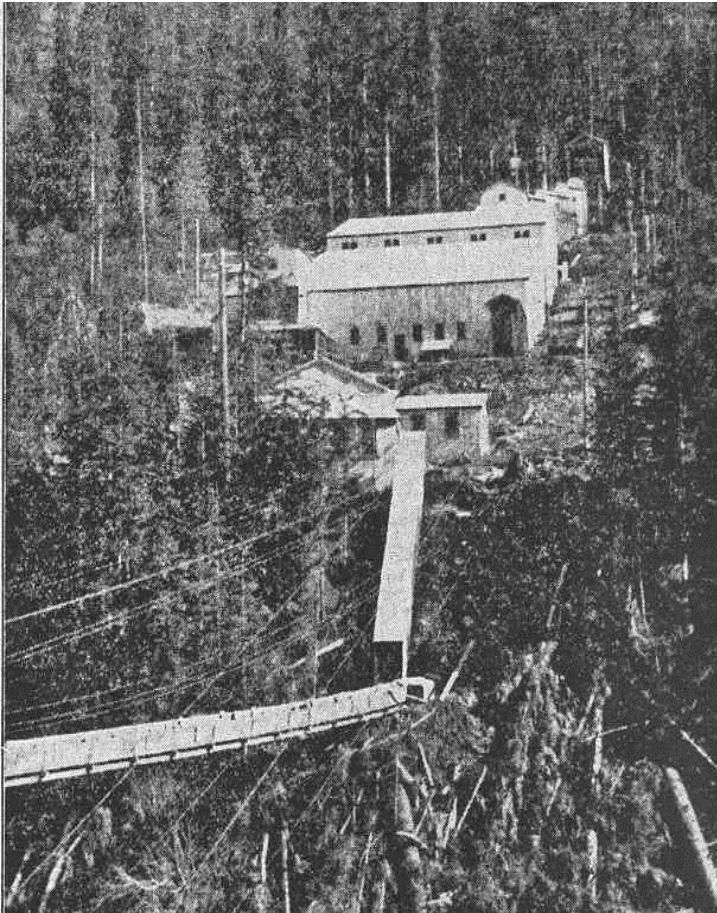


# Azurite Mine – Early History

- 1915 – 31 Claims Staked
- 1916 – Azurite Copper Company (renamed Azurite Gold)
- 1918 to 1931 – Underground Development
- 1934 – ASARCO Leased Mine
- 1934 to 1936 – 100 TPD Mill and Infrastructure
- 1936 to 1942 – Development, Production
  - ~73,000 tons @ 0.38 opt gold
- 1942 – ASARCO Removes Equipment



# Historic Photos - 1936





# Azurite Mine – Recent History

- 1995 – Discovery Assessment (USFS)
- 2002 – IAM Open File Report (WA DNR)
- 2004/2005 – CERCLA Site Inspection (USFS/CES)
- 2005 – Reprocessing Study (USFS/CES);  
– PRP Report (USFS)
- 2006 to 2007 ASARCO Bankruptcy Claim/Settlement
- 2006 to 2008 – EE/CA & Risk Assessment (ASARCO/MFG)
- 2007 to 2010 – Data Gaps/Removal Design (USFS/CES)
- 2011 – Removal Action Activities



# Final Removal Action Alternative

- Access Road Improvements / Bridge Replacement (2010)
- Temporary Access Road Across Mill Creek (2011)
- Mill Creek Diversion Away from Waste Rock Pile (2011)
- Onsite Covered Repository (2011)
  - Waste Rock and Mill Area Blended with Tailings
  - Reinforced Stabilized Slope/Repository Toe Berm
  - Multi-Layer Cover, HDPE Membrane, and Talus/Rock Cover
- Physical Hazard Closures (2011)
- Revegetation (2011) – USFS Lead



# Construction Challenges

- Weather Conditions (rain, snow, heat)

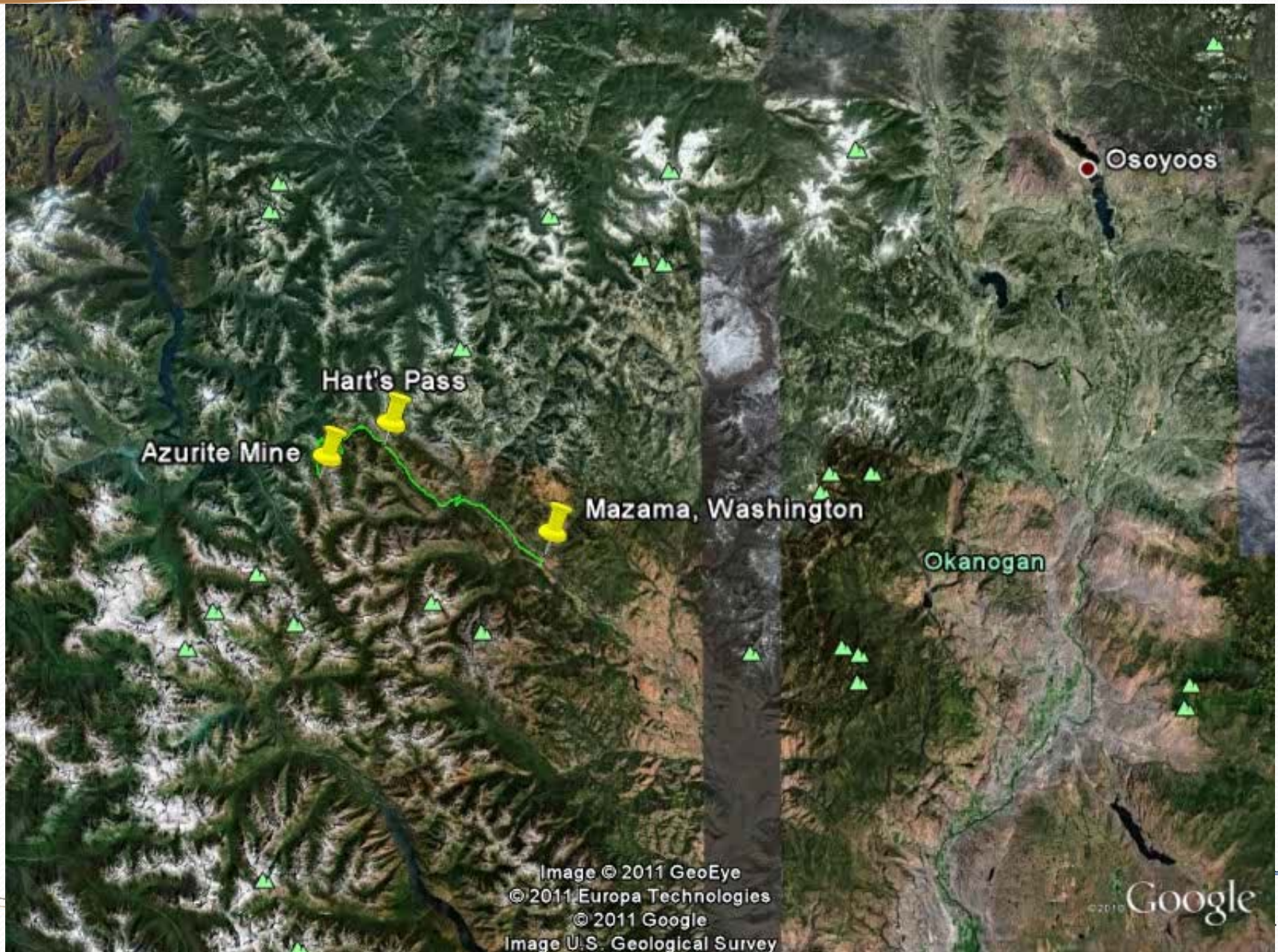




# Construction Challenges

- Weather Conditions (rain, snow, heat)
- Typical Construction Window (late June – early October)
- Steep Slopes / Difficult Terrain
- Limited Onsite Staging Areas
- All Borrow Material from Onsite
- Remote Access/Logistics/Communication







# 2011 Removal Action Summary

- Turnkey Design/Build Contract Structure
  - CES – Prime Contractor
  - Palm Construction – Main Subcontractor (Local)
- Mobilization – July 11, 2011 – 3 weeks late (weather)
- Continuous Work Schedule, CES and Subs
- Demobilization – September 26, 2011 – 1 week early



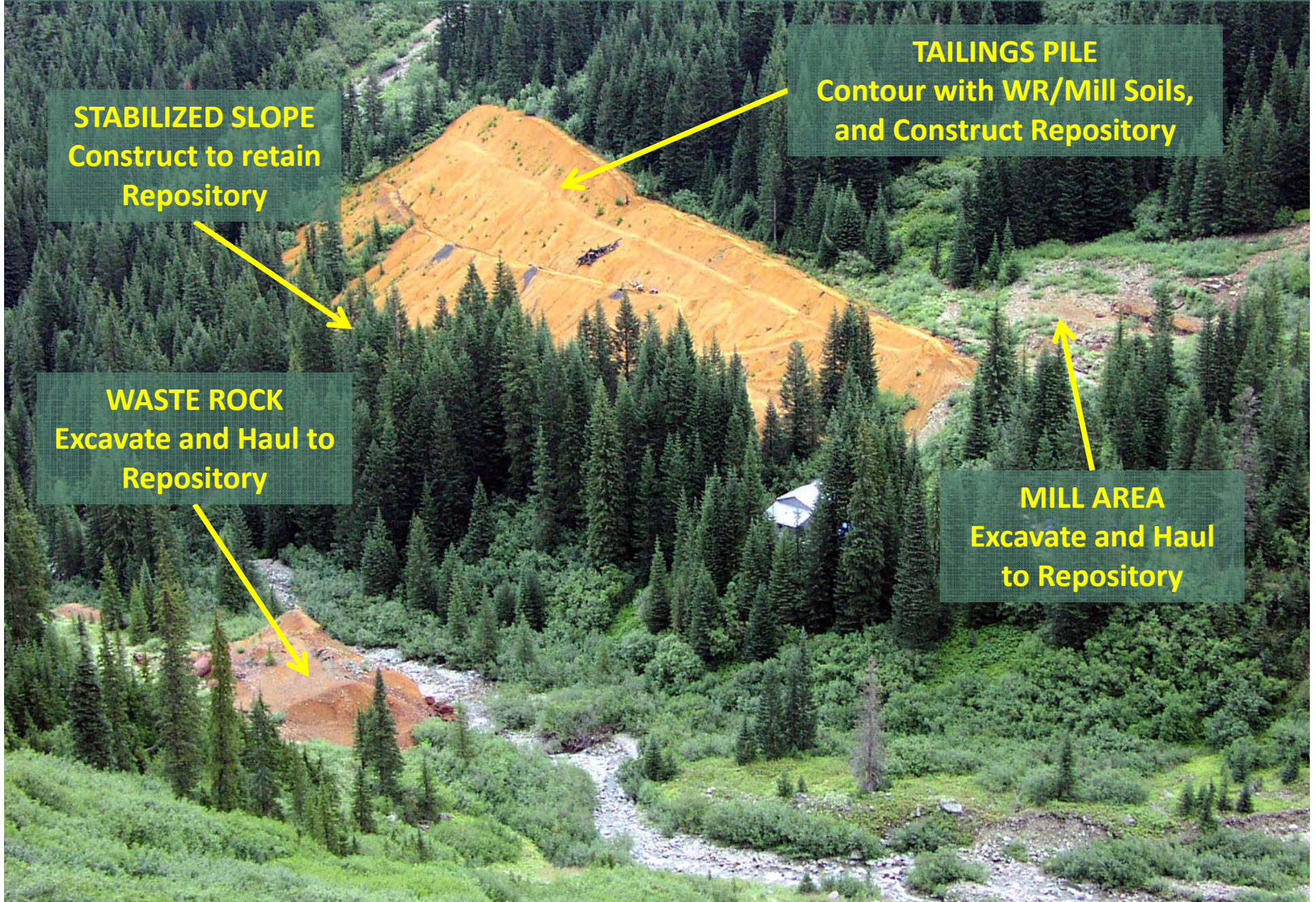
# OVERVIEW OF AZURITE MINE REMOVAL ACTION

**STABILIZED SLOPE**  
Construct to retain  
Repository

**TAILINGS PILE**  
Contour with WR/Mill Soils,  
and Construct Repository

**WASTE ROCK**  
Excavate and Haul to  
Repository

**MILL AREA**  
Excavate and Haul  
to Repository





# Camp, Equipment and Manpower

- Remote Camp (internet, phones, running water, flushing toilets, showers, washer/dryer, cook, tents/campers)
- 3 Excavators
- 2 Loaders
- 3 Dozers
- 2 Off-Road, Articulated Haul Trucks
- Roller Compactor, Water Truck, Misc. Work Trucks
- Bear Proof Storage Containers
- Manpower – 10 to 20 (Palm/Subs) / 1 to 3 (CES)



# Equipment





# Remote Camp – Overview





# Remote Camp – Facilities





# Remote Camp – Lodging





# Remote Camp – Fuel Storage





# Erosion and Sediment Control

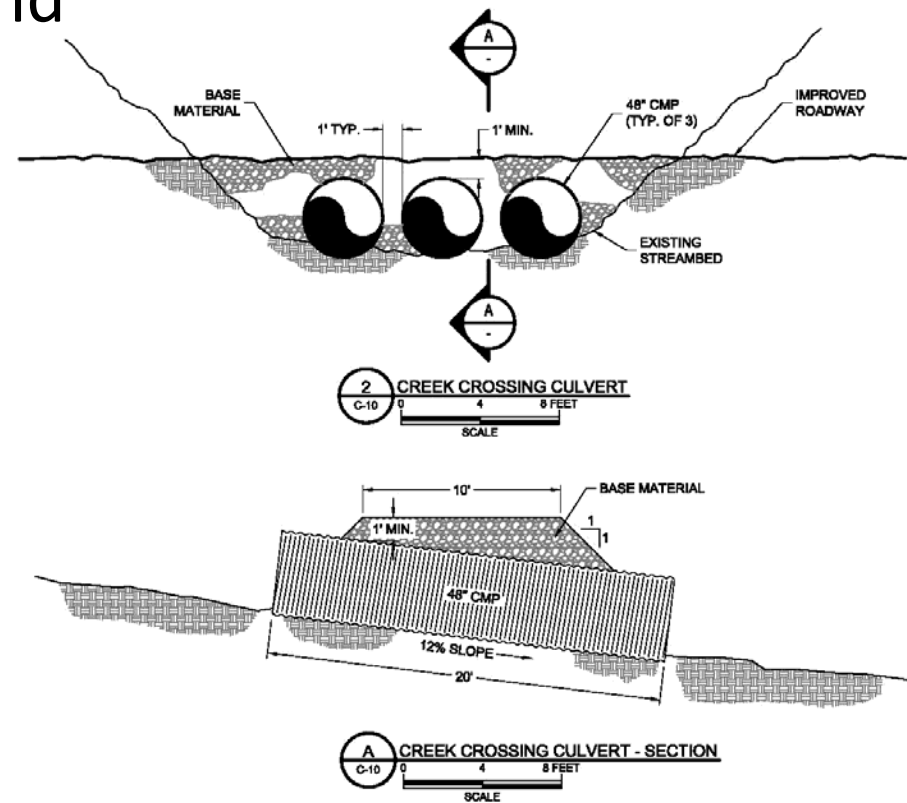
- Run-On Ditches
  - Waste Rock / Tailings
- Silt Fence
  - Borrow Area / Waste Rock
- Filter Berms
  - Borrow Area / Waste Rock
- Sedimentation Pond
  - Tailings / Repository





# Mill Creek Crossing and Diversion

- Access Waste Rock Pile, and Transport to Repository
- Three, 48-inch CMPs
- Temporarily Divert Mill Creek Away From Waste Rock Pile





# Mill Creek Crossing





# Borrow Area Development

- Onsite Source for Screening / 3 Products
- 2-inch minus
  - Stabilized Slope Fill, Road Bed/Base, Fill Material
  - 40,000+ cubic yards used, more remains onsite
- 2-inch to 36-inch
  - Repository cover, rocked diversion ditches
  - ~20,000 cubic yards
- 36-inch plus
  - Misc. Placement, armoring



# Borrow Area Development





# Borrow Area Development





# Underground Working Closures

- Planned for 5 Closures (4 Adits / 1 Vent)
- Pre-Cut Steel and Culverts Delivered to Site
- Final Onsite Fabrication
- Installation with Helicopter and Onsite Welder
- 4 Closures
  - Burnham, Tinson, and Discovery Adits
  - Discovery Vent
- Wenatchee Adit
  - Collapsed - No Bat Gate Installed





# Burnham Adit – Before





# Burnham Adit – After





# Tinson Adit – Before





# Tinson Adit – After





# Discovery Adit – Before





# Discovery Adit – After



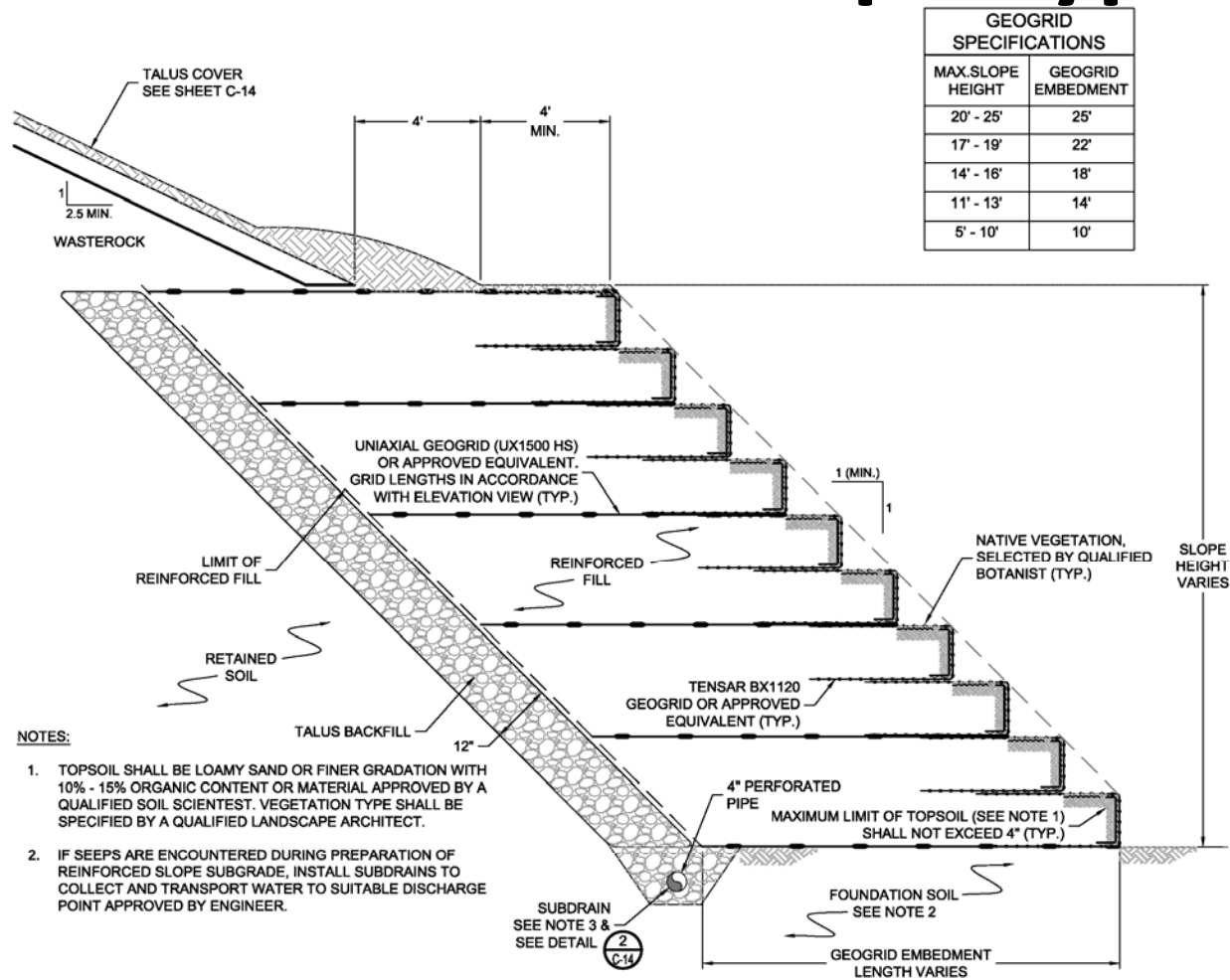


# Reinforced Stabilized Slope

- Designed to Stabilize/Retain the Repository
- Original Design was 15-feet (H) x 15-feet (W) – 12 lifts
- Final Layout was 22-feet (H) x 25-feet (W) – 17 lifts
  - Competent Soil Deeper Than Planned
  - Increased Quantities For Borrow Material/Geogrid
- Onsite QA/QC Testing – All Final Tests Met Compaction Requirements (95% of Proctor)
- 23 days to build
  - Bottom lifts ~ 1.5 days to complete
  - Upper lifts ~ 1 day to complete



# Reinforced Stabilized Slope Typical





# Reinforced Stabilized Slope – Lift 1





# Reinforced Stabilized Slope – Lift 4





# Reinforced Stabilized Slope – Lift 8





# Reinforced Stabilized Slope – Lift 12





# Reinforced Stabilized Slope – Lifts 14/15



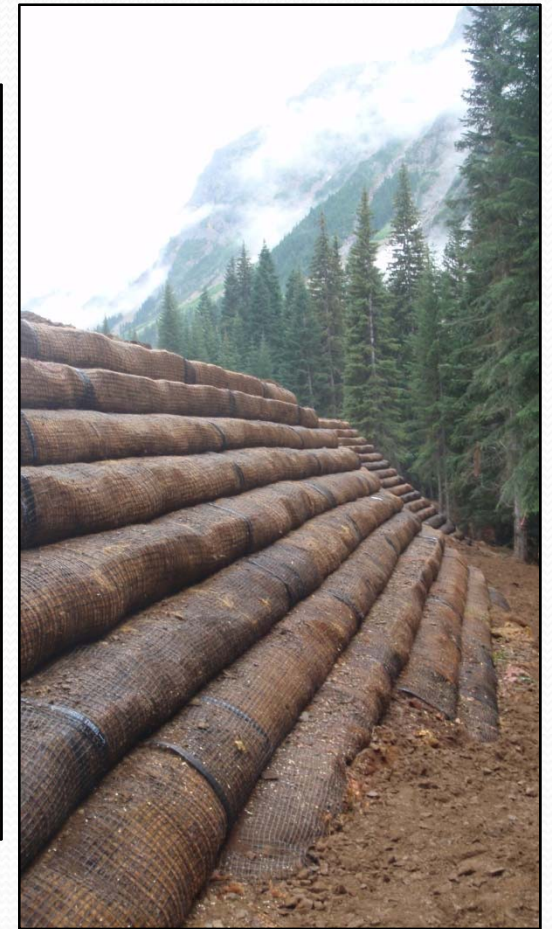


# Reinforced Stabilized Slope – Complete





# Reinforced Stabilized Slope – Complete





# Waste Rock Excavation and Placement

- Design Estimate was 22,000 bcy of Waste Rock
  - 16,000 bcy – Upper / 6,000 bcy – Lower
- Risk Assessment Cleanup Goal – 104 mg/kg Total Arsenic
- Revised Cleanup Goal – 204 mg/kg Total Arsenic
  - Additional Background Soil Sampling
  - Used MTCA Stat 3.0 to Calculate Natural Background
- In-Field Screening with Niton XRF (RPDs  $\leq$  33%)
- Final Quantities
  - 13,500 bcy – Upper WR
  - 2,900 bcy – Lower WR



# Waste Rock Pile – Before





# Waste Rock Pile – Removal





# Waste Rock Pile – Removal





# Waste Rock Pile – Final





# Onsite Repository

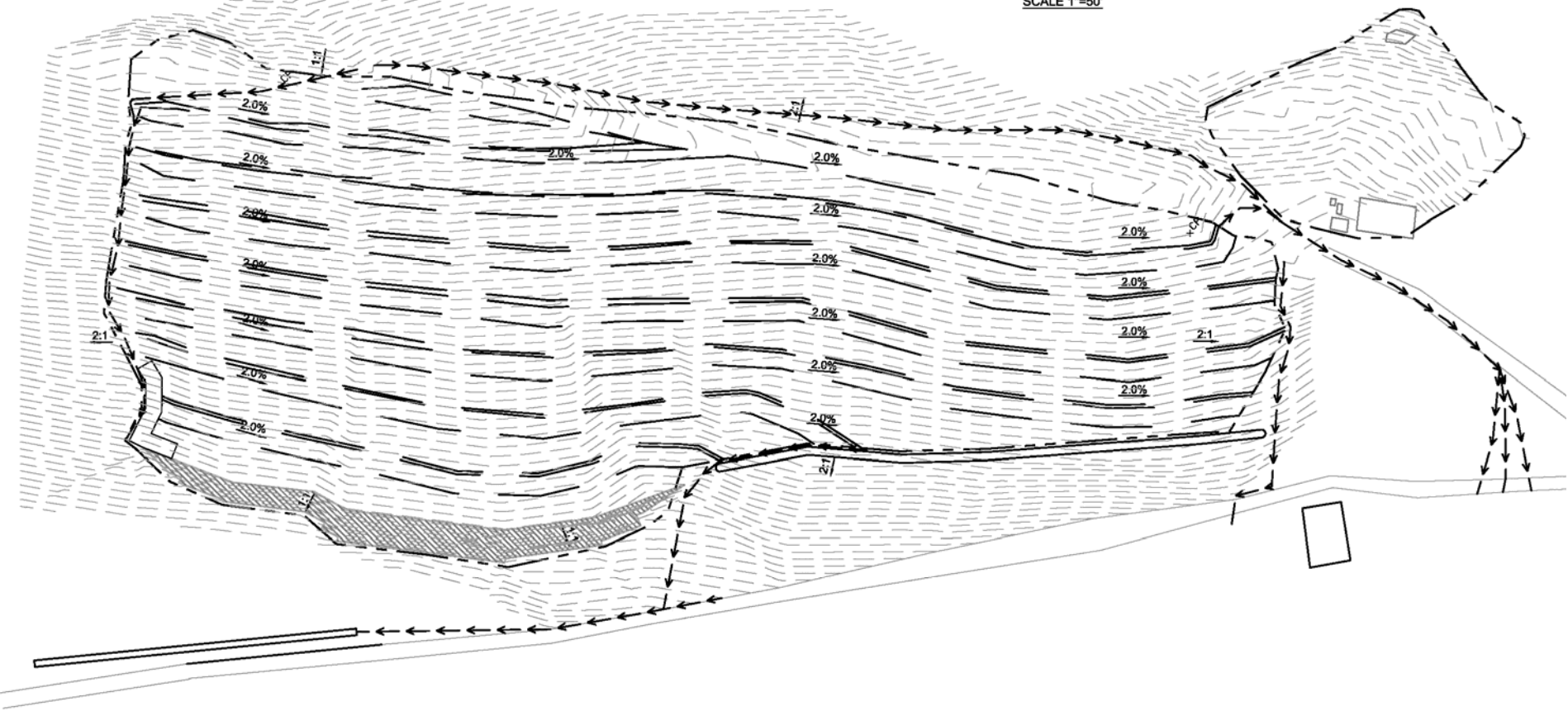
- Overall Slope = 2.5:1
- Reinforced Slope and Berm to Stabilize Repository
- Waste Rock Blended with Tailings to Achieve Slope
- In-sloped Benches Every 9 Vertical Feet to Relieve Precip
- Repository Cover (Multi-Layer)
  1. Talus/Rock Cover – Top
  2. Geogrid
  3. 12-oz Nonwoven Geotextile
  4. 40-mil HDPE Membrane
  5. 12-oz Nonwoven Geotextile
  6. Waste Rock/Tailings – Bottom



# Repository Grading Plan

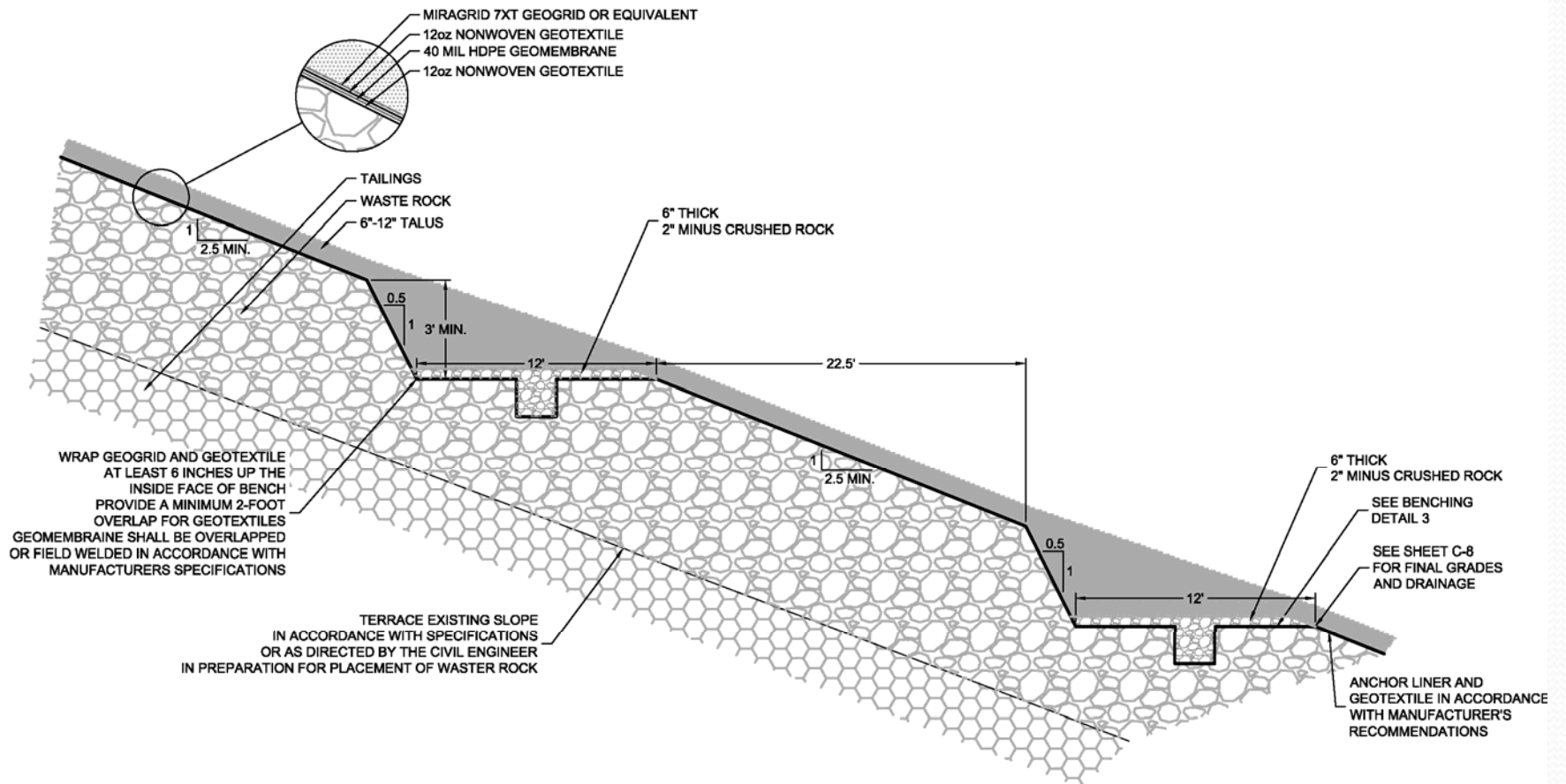


SCALE 1"=50'





# Repository Cross Section Detail





# Tailings Pile - Before





# Tailings Pile - Before





# Tailings Pile – Oxidation Profile





# Repository Benching / Grading





# Repository Benching / Grading





# Repository Benching / Grading





# Repository Benching / Grading





# Repository Benching / Grading





# Liner Installation





# Liner Layers





# Liner Installation





# Liner Installation





# Liner / Cover Installation





# Liner / Cover Installation





# Liner / Cover Installation





# Repository – Final





# Repository – Final





# Repository / Tailings Pile – Before





# Repository – Final



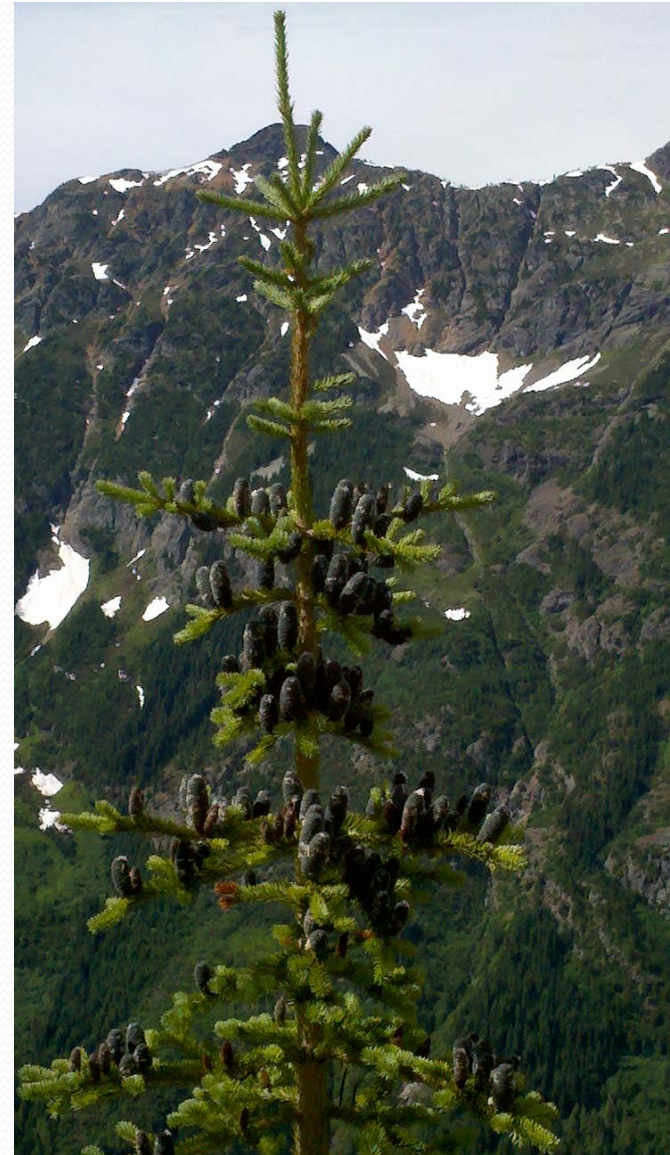






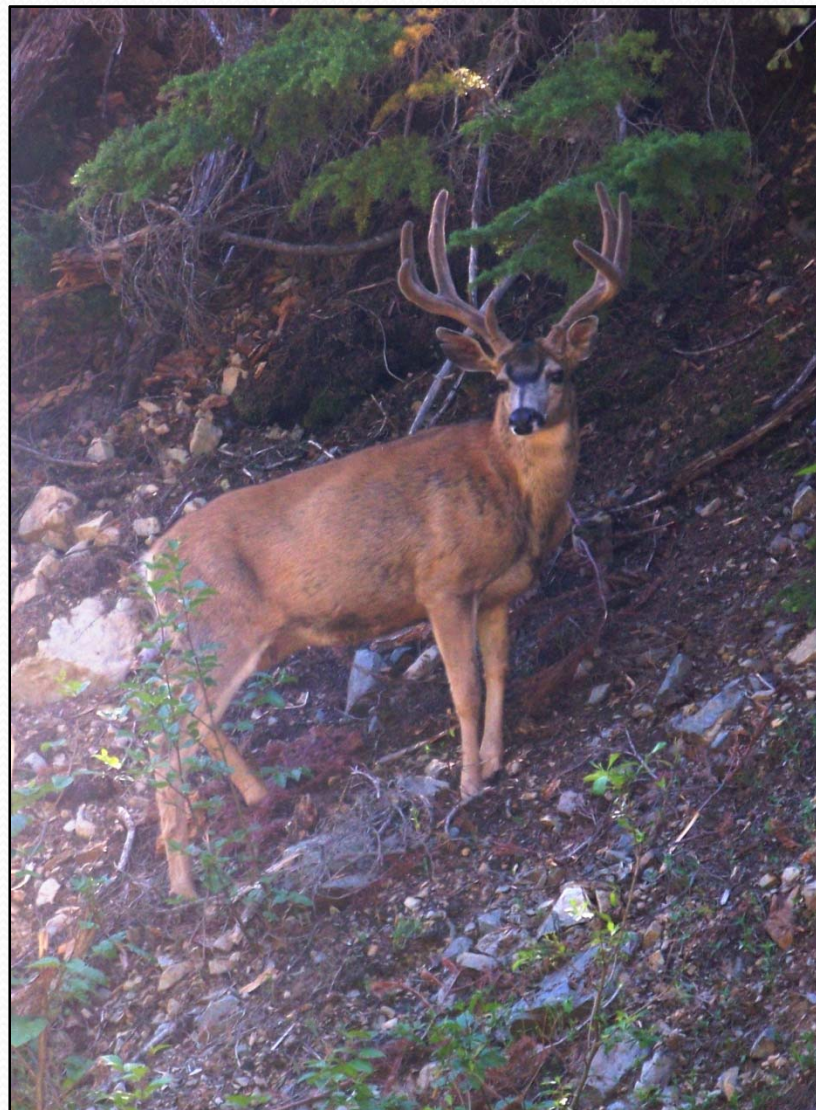
# Summary

- Completed 4 Weeks Ahead of Schedule
- Field Changes Easily Made with Continuous Oversight & Communication
- No Health/Safety Concerns
- 3-Years of Long-term O&M Inspections, & Monitoring
- Cost - \$2.5M Capital





# QUESTIONS





- Extra Slides



# Upper Mill Creek





# Lower Mill Creek/Canyon Creek





# Waste Rock Pile – Before





# Waste Rock Pile – Removal





# Waste Rock Pile – Removal





# Tailings Pile





# Tailings Pile





# Mill Area / Office Building





# Waste Rock Pile





# Waste Rock Pile





# CERCLA Site Inspection Review

- Surface Water Pathway
  - Aquatic Stations (Surface Water, Pore Water, Sediment, & Benthic)



# Aquatic Stations

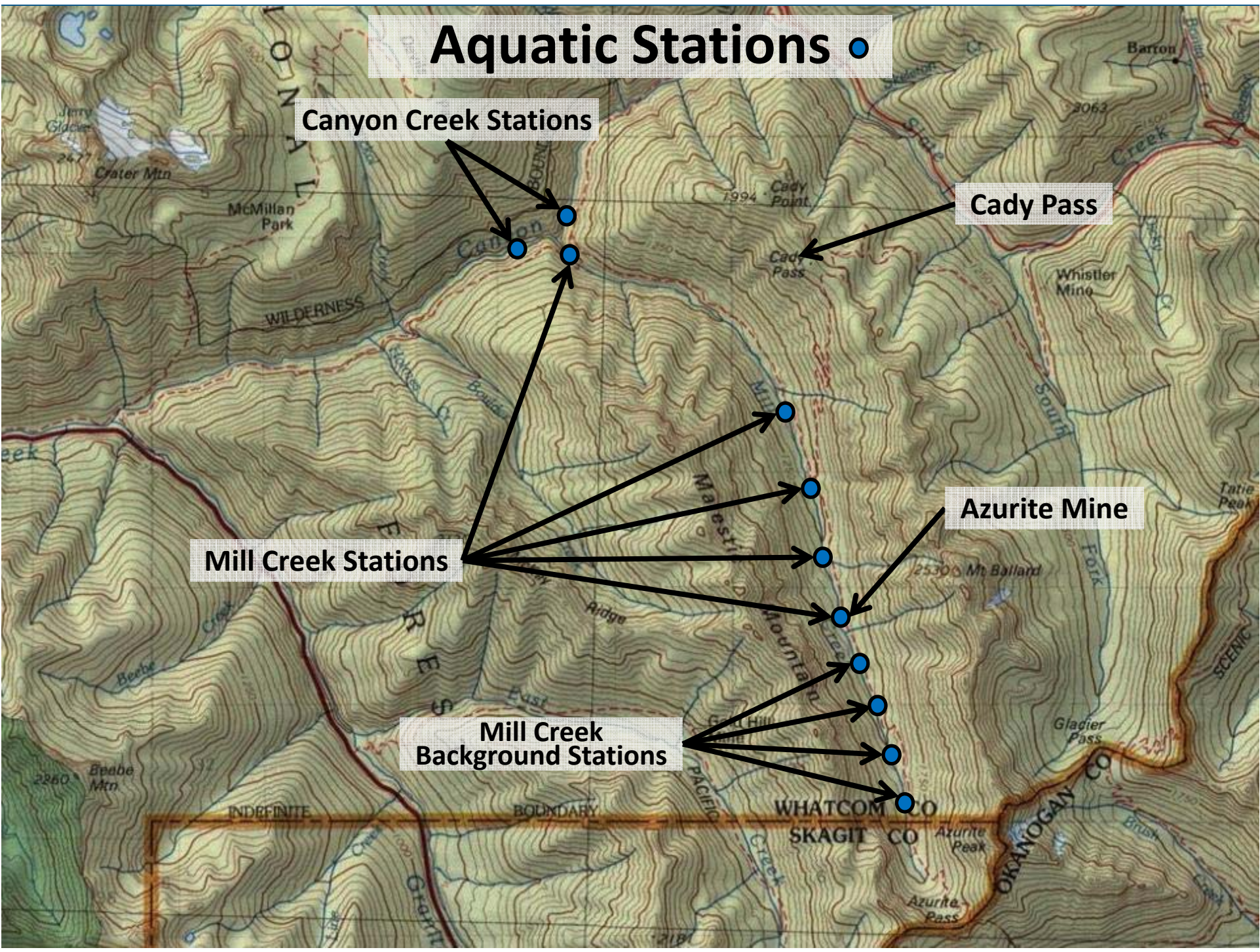
Canyon Creek Stations

Cady Pass

Mill Creek Stations

Azurite Mine

Mill Creek Background Stations





# CERCLA Site Inspection Review

- Surface Water Pathway
  - Aquatic Stations (Surface Water, Pore Water, Sediment, & Benthic)
  - Minimal impacts to Surface/Pore Water/Benthic
  - Sediments impacted Near Mine (COCs: As, Cd, Cr, Cu, Ni, Zn)
  - Complete Pathway for Receptors
- Soil Pathway
  - 17 Test Pits - 40 Tailings/WR/Soil Samples (COCs: As, Cu, Hg, and Pb)
  - Tailings/WR ARD Potential - ABP as low as -230 t CaCO<sub>3</sub>/Kt
  - Background Soil Elevated with COCs
  - Complete Pathway for Receptors



# CERCLA Site Inspection Review (cont.)

- Air Pathway
  - Complete Pathway for Receptors
- Groundwater Pathway
  - Adit discharge/seeps (3) impacted (COCs: Al, As, Cu, Mn, Zn)
  - Incomplete Pathway for Receptors
- Topographic Survey of Tailings, Mill Site, and WR
- Ecological Survey
  - RTE species expected (Bull Trout, Spotted Owl)
- Engineering Evaluation / Cost Analysis (EE/CA) Recommended



# Reprocessing Study

- Four tailings samples
- Gravity – Poor Gold/Sulfide Recovery (14-28%/29-41%)
- Floatation – Poor Gold/Sulfide Recovery (21-35%/16-27%), Excellent Recovery for As, Cu, and Zn.
- Historic Lime/ $\text{CN}^-$  used interferes with floatation tests
  - Better gold recovery (60%) after lime/ $\text{CN}^-$  pretreatment
- Bottom Line
  - Gravity – Not economical
  - Floatation – Better recovery after pretreatment, but cons not marketable (low gold, high arsenic/base metals).



# Engineering Evaluation/Cost Analysis

- Lead by ASARCO (MFG) with USFS/Ecology Oversight
- Additional Sampling
- Risk Assessment (Human and Ecological)
  - Human – Carcinogenic Risk for Recreational Exposure (Cleanup Goal – 104 mg/kg total arsenic)
  - Ecological – Multiple Risks and COCs, Source Control Will Mitigate Risks
- Removal Objectives
  - Isolate Wastes from Human and Ecological Receptors
  - Eliminate Erosion and Mass Failure Potential



# EE/CA (cont)

- Recommended Alternative

## Onsite Consolidation and Closure

- Place Waste Rock and Mill Soils Over Tailings Pile
- Construct Retaining Wall at Toe of Tailings Pile
- 1-foot Soil Cover, then 1-foot Talus/Rock Cover
- Erosion Controls/Physical Hazard Mitigation
- Cost Estimate
  - \$4.6M – Capital
  - \$5.7M – 30 Yr Net Present Worth



# Removal Action Data Gaps – 2007

- Mill Creek Fish Barrier Survey
  - Multiple Fish Barriers, No Fish Within 2.5 Miles





# Removal Action Data Gaps – 2007

- Mill Creek Fish Barrier Survey
  - Multiple Fish Barriers, No Fish Within 2.5 Miles
- Borrow Material Assessment
  - Onsite Talus/Rock Areas





# Removal Action Data Gaps – 2007

- Mill Creek Fish Barrier Survey
  - Multiple Fish Barriers, No Fish Within 2.5 Miles
- Borrow Material Assessment
  - Onsite Talus/Rock Areas
- Access Road Improvement Assessment
  - Bridge Replacement/Repair, Culverts, and Switchbacks
- Repository Cover and Geotechnical Assessment
  - Completed with GeoEngineers
  - Recommended 2.5:1 Repository Slope with Retaining Wall
  - Recommended a Multi-Layer HDPE Liner, and Talus Cover



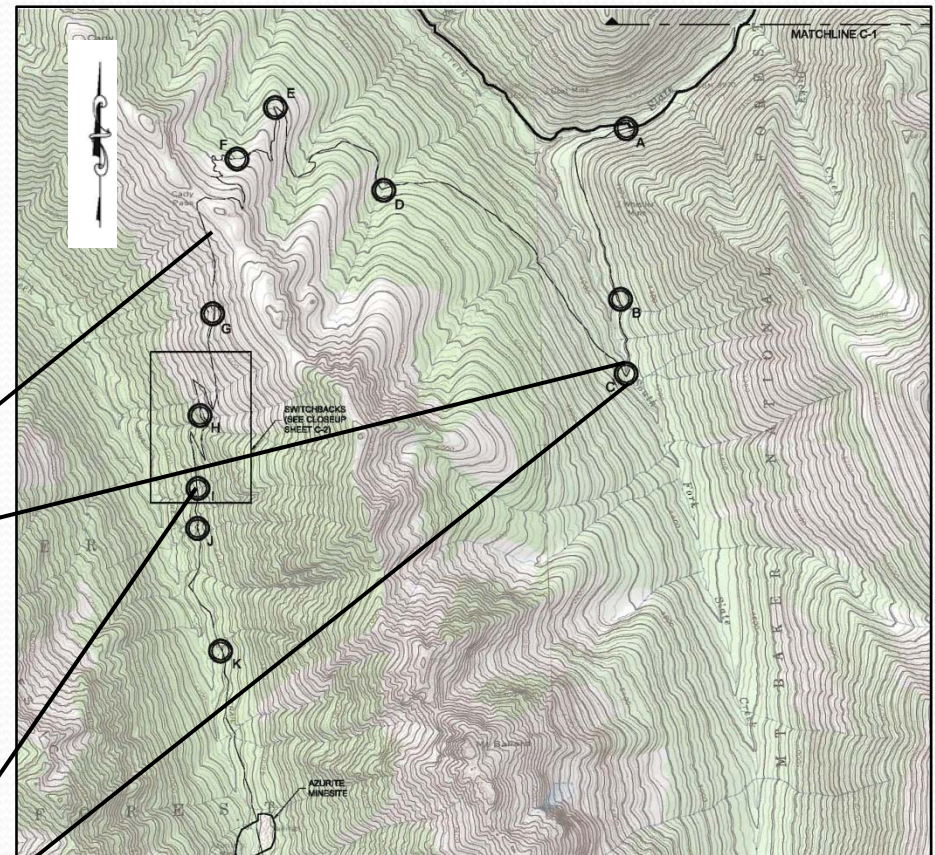
# Removal Action Sequence – 2011

- Mobilization, Remote Camp and Staging Areas
- Erosion/Sediment Control
- Mill Creek Crossing and Diversion
- Borrow Area Development
- Underground Working Closures
- Reinforced Stabilized Slope Construction
- Waste Rock Excavation and Placement
- Repository Grading, and Liner/Cover Installation
- Revegetation/Demobilization

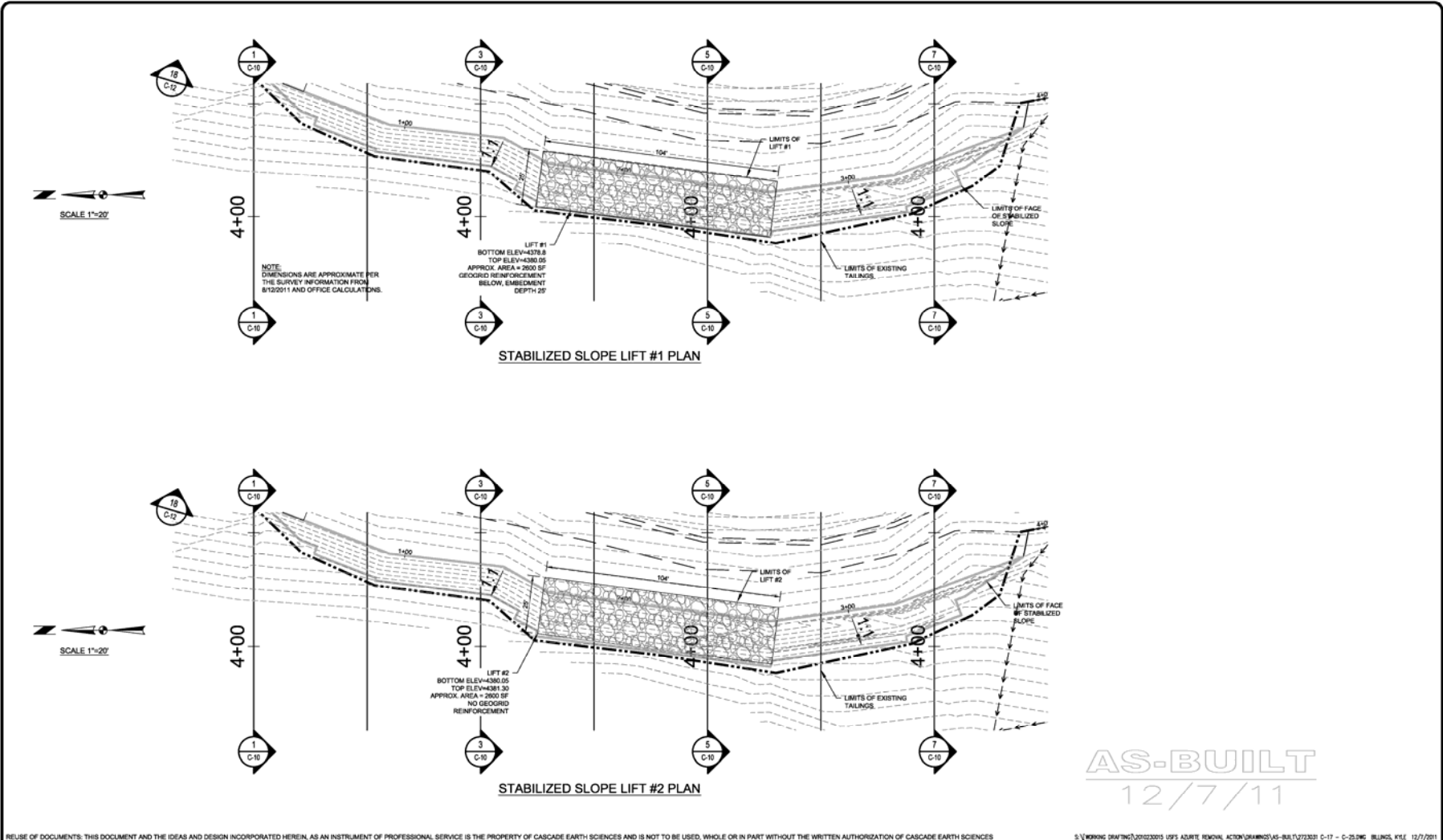
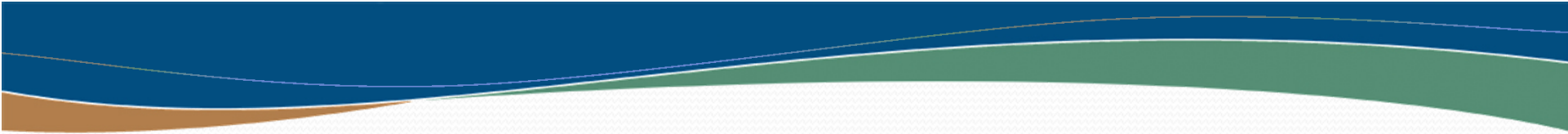


# 2010 – Access Road Improvements

- CES Design, Palm Construction/USFS
- Bridge Installation
- Road Widening/Grading
- Switchback Improvements
- Culvert Installation







AS-BUILT  
12/7/11

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\WORKING DRAWINGS\2012\2012 USFS AZURITE REMOVAL ACTION\2012\10-10-12\1212131 C-17 - C-25.DWG JLUNGS, KYE 12/7/2011

**AZURITE MINE**  
OKANOGAN NATIONAL FOREST, WASHINGTON

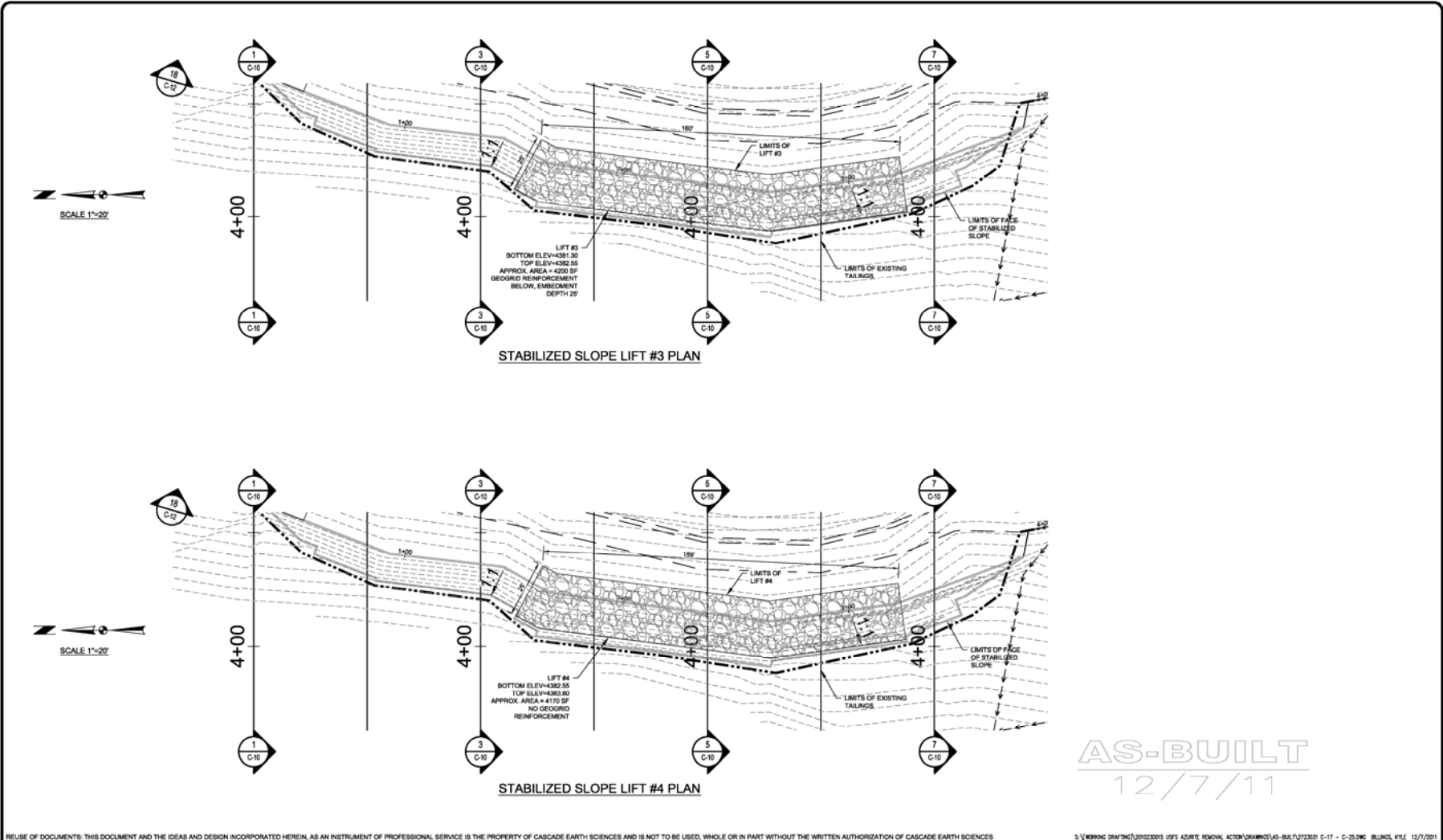
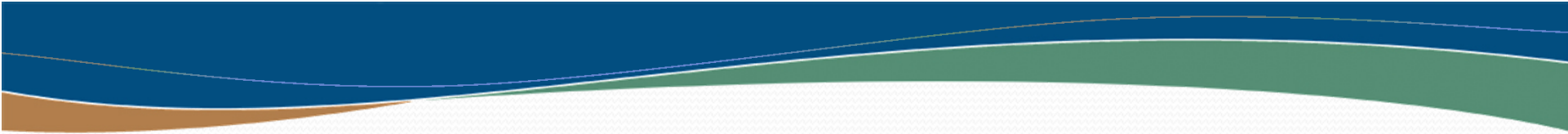
REV #	DESCRIPTION	BY	DATE	CHK. BY	DATE
1	As-Built		12/07/11		
2			03/24/12		
3			03/24/12		
4			03/24/12		
5			03/24/12		

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
CALL 1-800-728-8322  
FOR NATIONAL OFFICE LOCATIONS

**GRADING DETAILS**  
REMOVAL ACTION

SHEET  
**C-17**





REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\WORKING DRAWINGS\2012\2012 USFS AZURITE REMOVAL ACTION\2012\12-07-11\C-17 - C-25.DWG BILINGS, KYE 12/7/2011

**AZURITE MINE**  
**OKANOGAN NATIONAL FOREST, WASHINGTON**

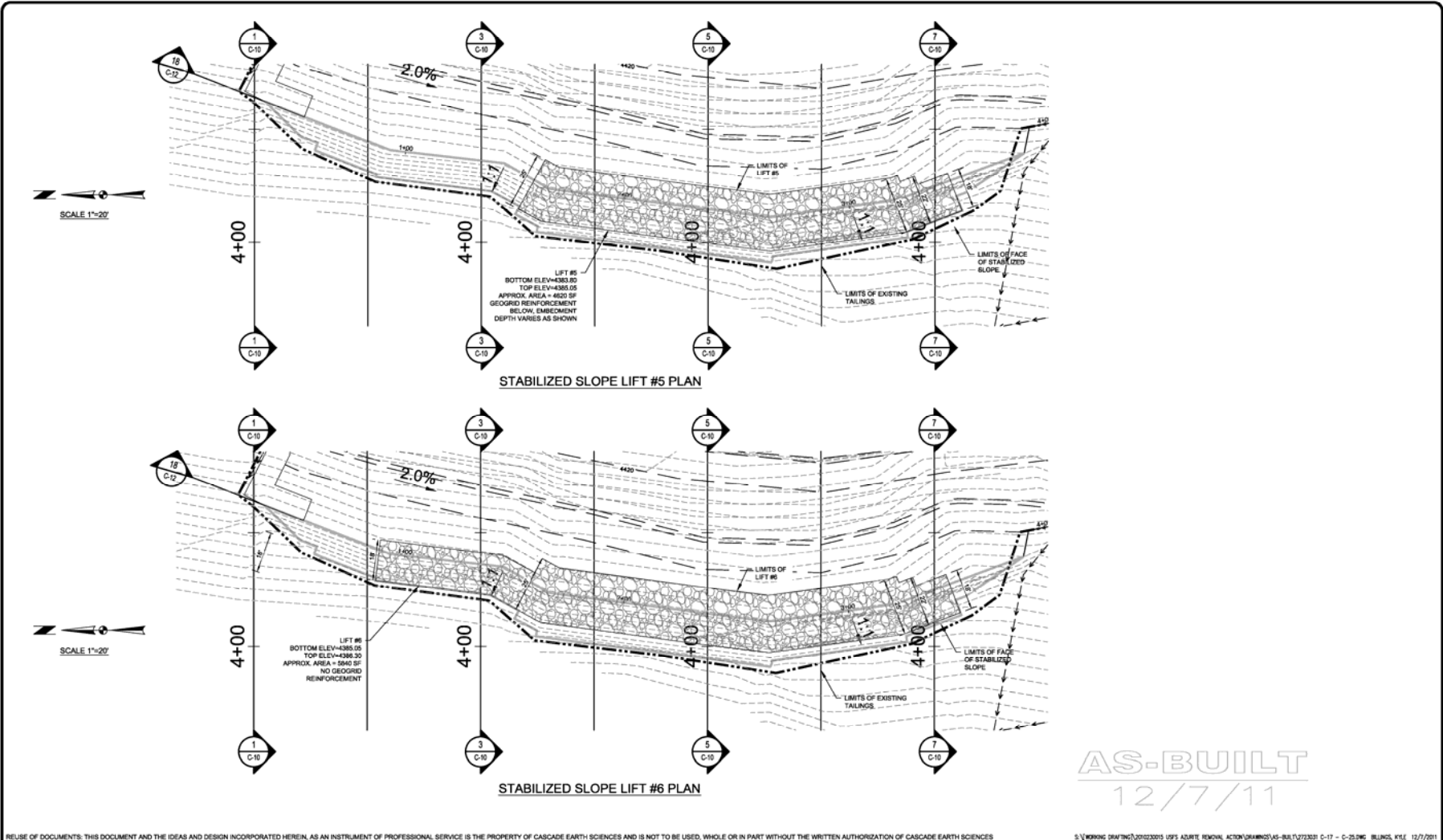
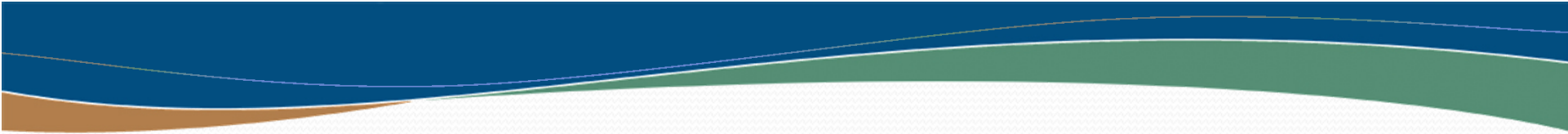
REV #	DESCRIPTION	BY	DATE	CHK. BY	DATE
1	As-Built		12/07/11	DRG. BY	MRS
2			03/24/12	CHK. BY	JM
3			03/24/12	DATE CHECKED	12/09/11
4			03/24/12	JOB No.	272801
5			03/24/12		

**CES** CASCADE EARTH SCIENCES  
 A Valmont Industries Company  
 CALL 1-800-778-8322  
 FOR NATIONAL OFFICE LOCATIONS

**GRADING DETAILS**  
 REMOVAL ACTION

SHEET **C-18**





AS-BUILT  
12/7/11

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\WORKING DRAWINGS\2012\2012 USFS AZURITE REMOVAL ACTION\2012\10-17-11\12-7-11\C-17 - C-25.dwg BILINGS, KYLE 12/7/2011

**AZURITE MINE**  
OKANOGAN NATIONAL FOREST, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	As-Built		12/07/11
2			03/24/12
3			03/24/12
4			03/24/12
5			03/24/12

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
CALL 1-800-778-8322  
FOR NATIONAL OFFICE LOCATIONS

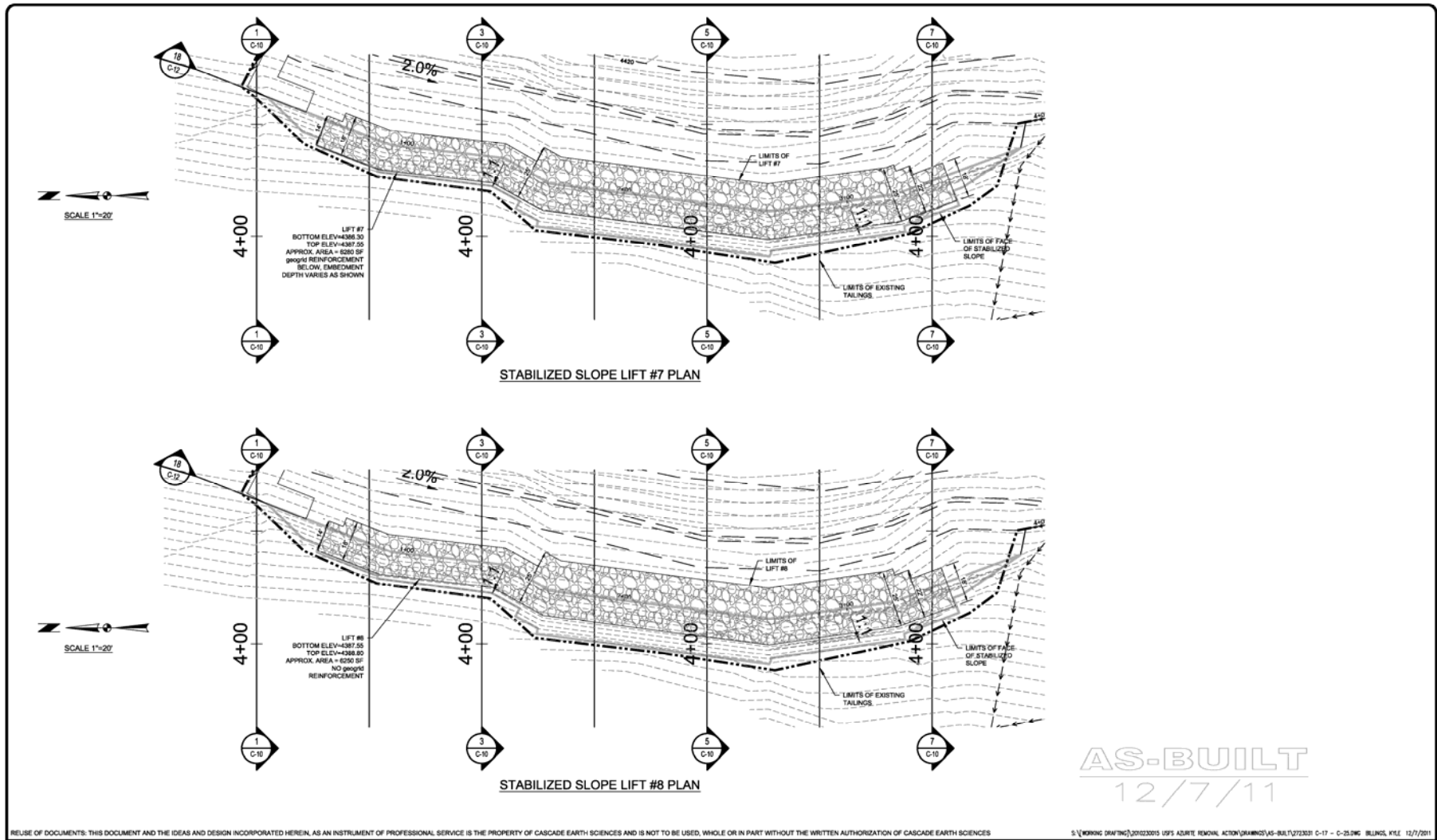
DES. BY: MRS  
DWC. BY: MRS  
CHK. BY: JN  
DATE CREATED: 10/20/11  
JOB No. 272801

**GRADING DETAILS**

REMOVAL ACTION

SHEET  
**C-19**





REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\WORKING DRAWINGS\2012\2012 USFS AZURITE REMOVAL ACTION\2012\12-07-11\12-07-11 C-17 - C-20.dwg BILINGS, KYLE 12/7/2011

**AZURITE MINE**  
OKANOGAN NATIONAL FOREST, WASHINGTON

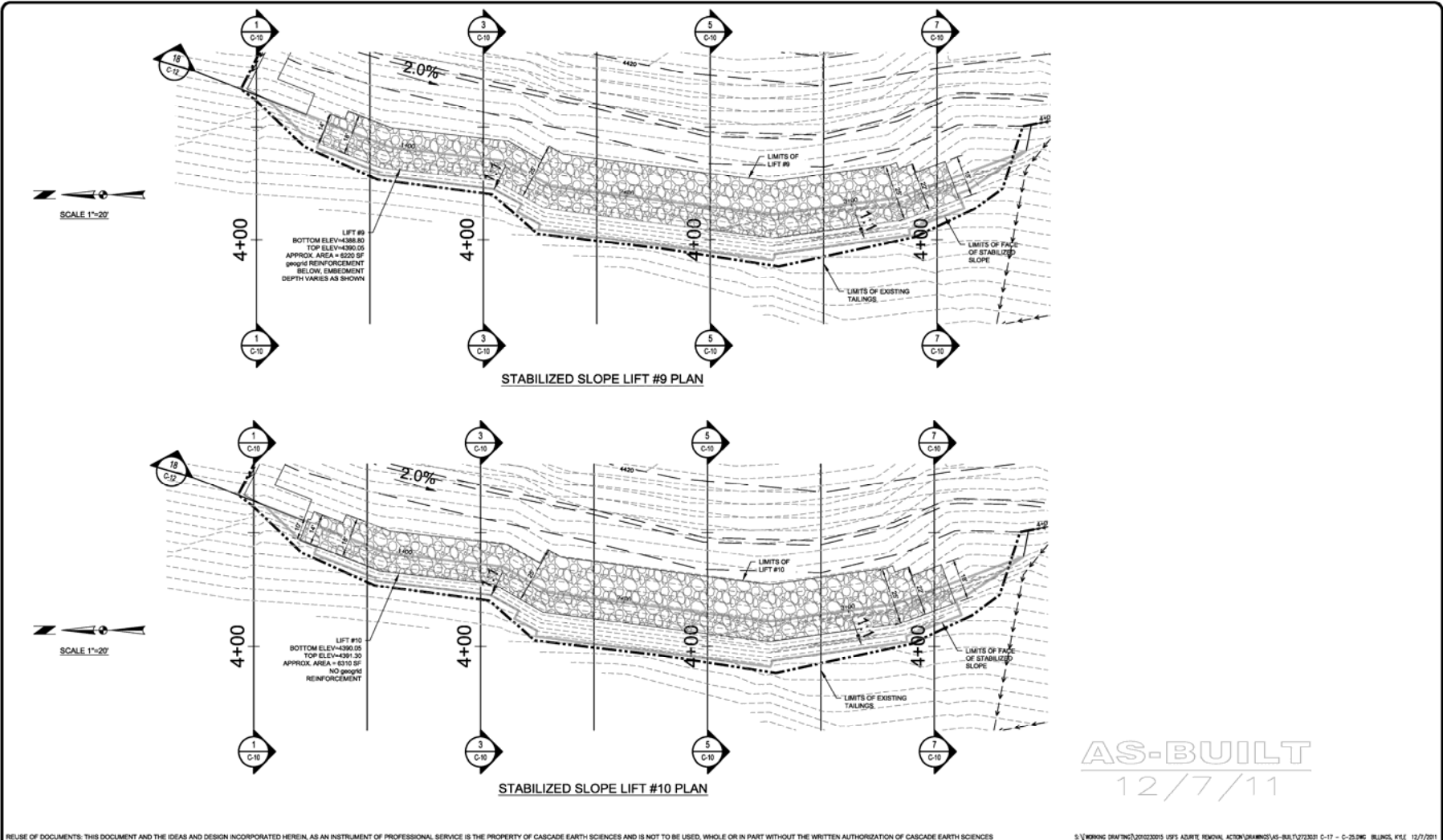
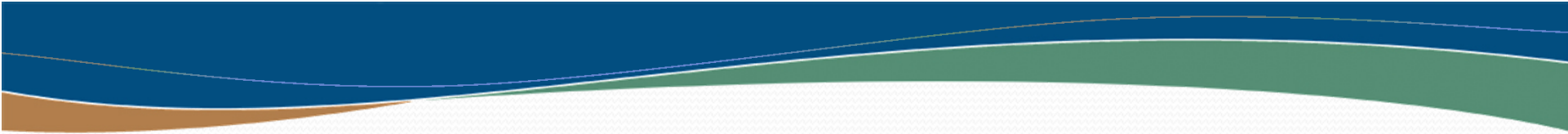
REV #	DESCRIPTION	BY	DATE	CHK. BY	DATE
1	As-Built		12/07/11	ENG. BY	MRS
2			03/24/12	CHK. BY	JM
3			03/24/12	DATE CREATED	12/07/11
4			03/24/12	JOB No.	272801
5			03/24/12		

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
CALL 1-800-726-8322  
FOR NATIONAL OFFICE LOCATIONS

**GRADING DETAILS**  
REMOVAL ACTION

SHEET  
**C-20**





**AS-BUILT**  
12/7/11

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

**AZURITE MINE**  
OKANOGAN NATIONAL FOREST, WASHINGTON

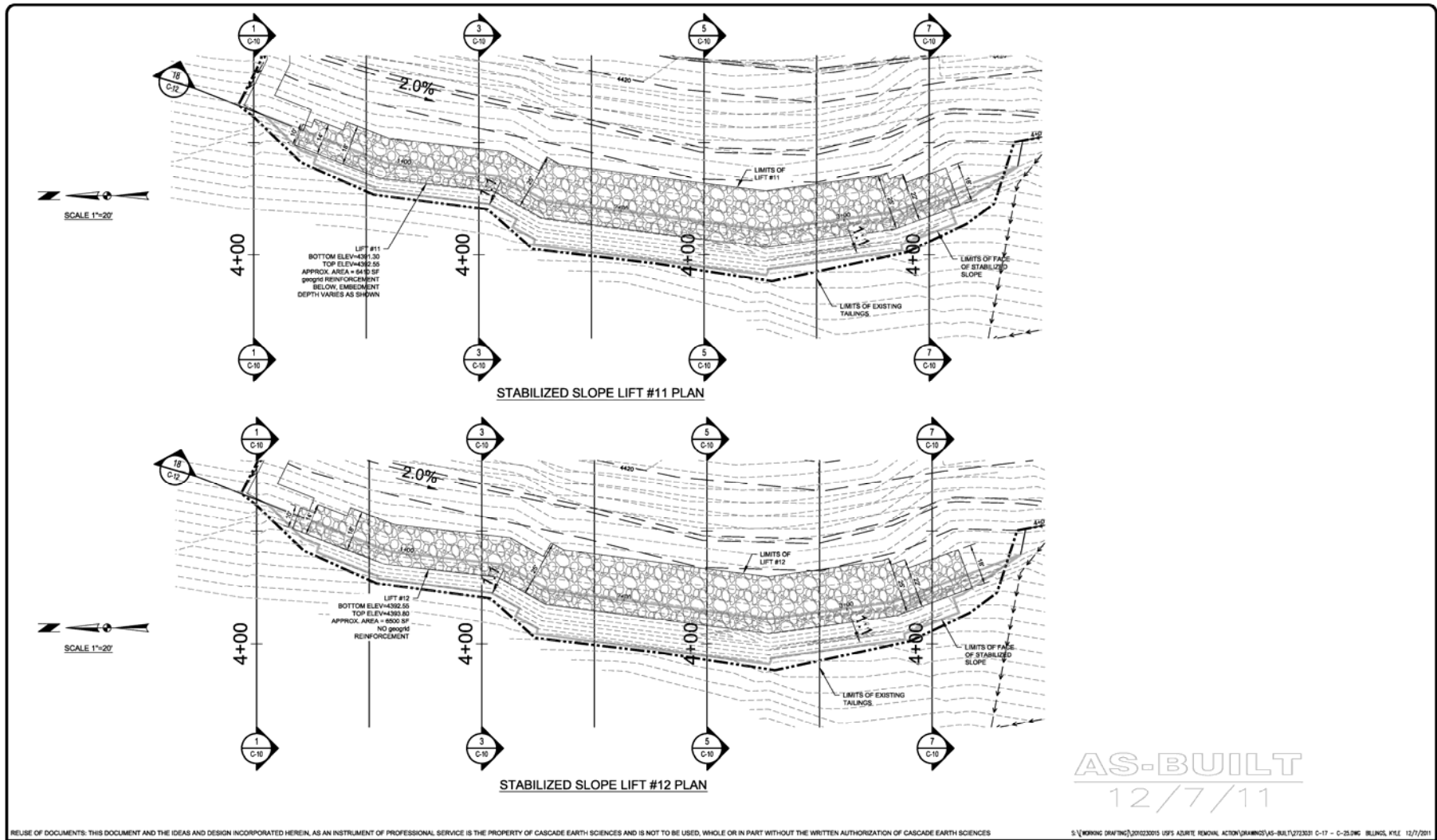
REV #	DESCRIPTION	BY	DATE	CHK. BY	DATE
1	As-Built		12/07/11	ENG. BY	MRS
2			03/24/12	CHK. BY	JM
3			03/24/12	DATE CREATED	1/28/2011
4			03/24/12	JOB No.	272801
5			03/24/12		

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
FOR NATIONAL OFFICE LOCATIONS  
CALL 1-800-778-8322

**GRADING DETAILS**  
REMOVAL ACTION

SHEET **C-21**





RELIEF OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\WORKING DRAWINGS\2012\2012 USFS AZURITE REMOVAL ACTION\2012\10-15-11\2012\10-15-11 - C-22.dwg JLK/ML 12/7/2011

**AZURITE MINE**  
OKANOGAN NATIONAL FOREST, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	As-Built		12/07/11
2			03/24/12
3			03/24/12
4			03/24/12
5			03/24/12

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
FOR NATIONAL OFFICE LOCATIONS

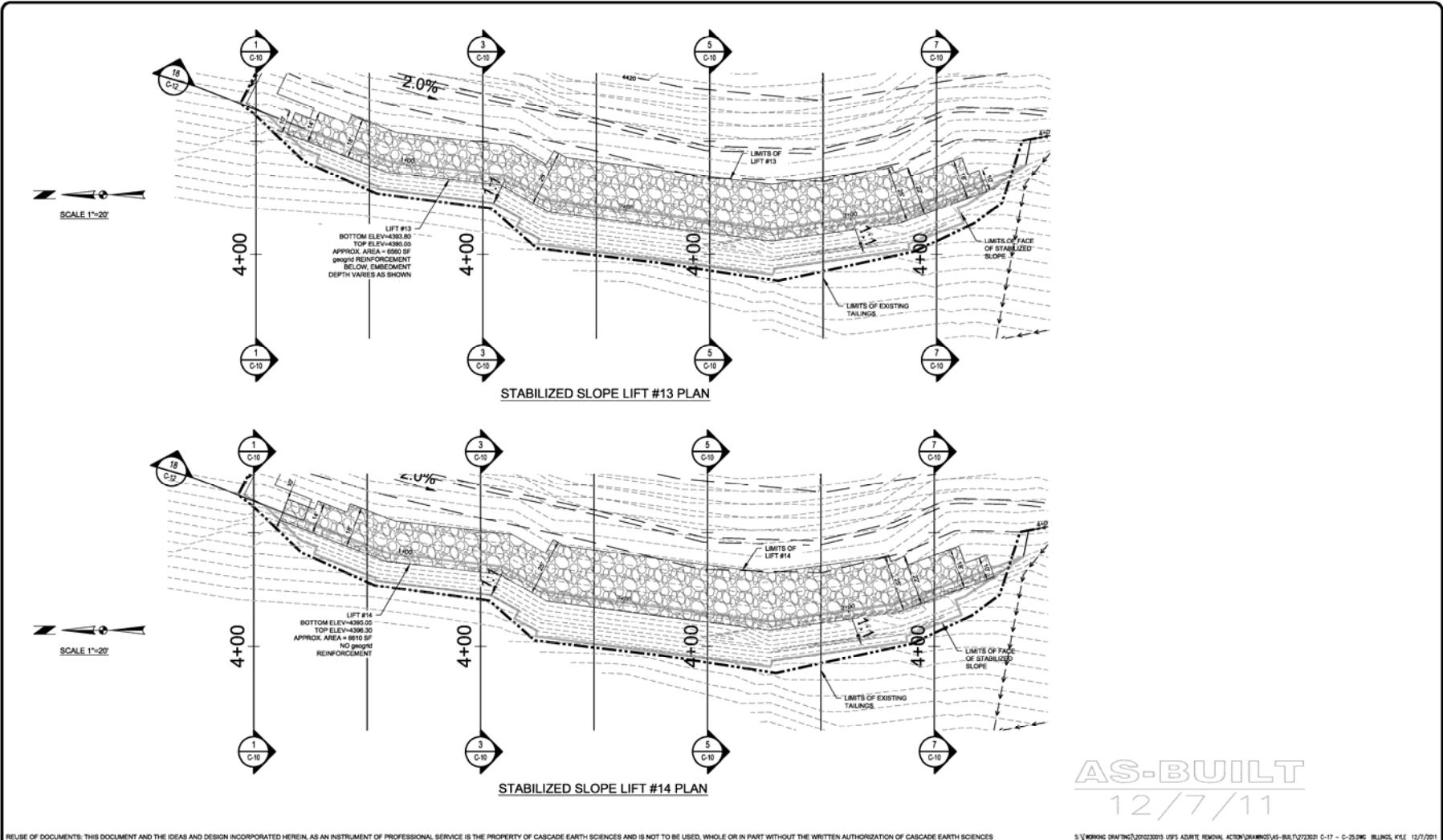
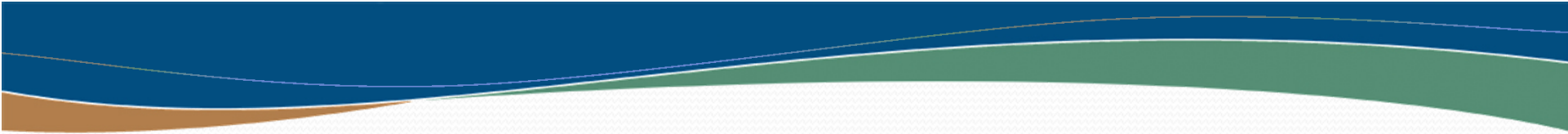
DES. BY: MRS  
DWC. BY: MRS  
CHK. BY: JN  
DATE CREATED: 10/20/11  
JOB No. 272801

**GRADING DETAILS**

REMOVAL ACTION

SHEET  
**C-22**





AS-BUILT  
12/7/11

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

AZURITE MINE  
OKANOGAN NATIONAL FOREST, WASHINGTON

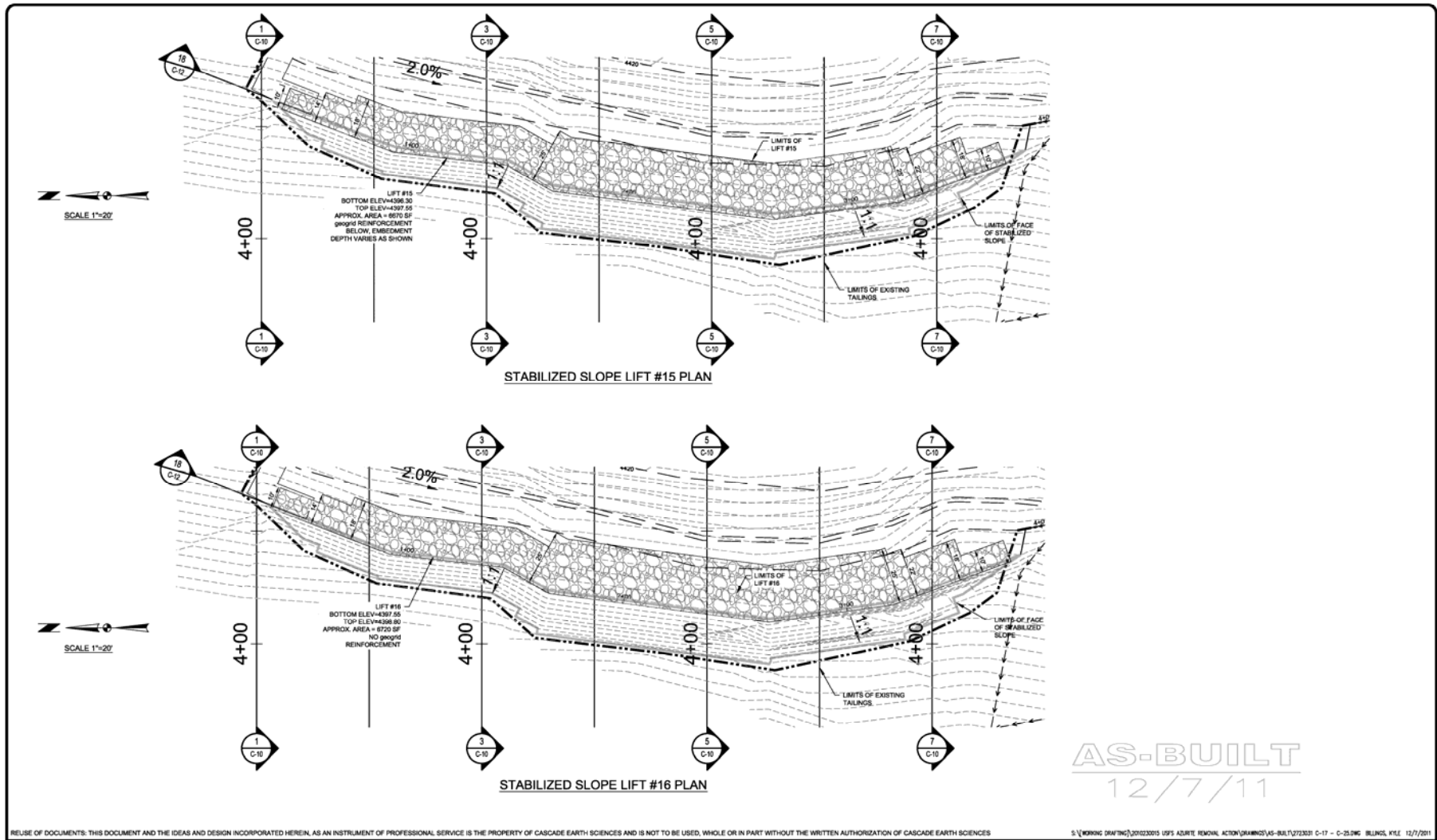
REV #	DESCRIPTION	BY	DATE	CHK. BY	DATE
1	As-Built		12/07/11	ENG. BY	MSS
2			03/24/12	CHK. BY	JW
3			03/24/12	DATE CREATED	1/26/2011
4			03/24/12	JOB No.	272801
5			03/24/12		

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
FOR NATIONAL OFFICE LOCATIONS

GRADING DETAILS  
REMOVAL ACTION

SHEET  
C-23





REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\WORKING DRAWINGS\2012\2013 USFS AZURITE REMOVAL ACTION\2012\12\11\AS-BUILT\12723231 C-17 - C-25.DWG BILKINS, KYLE 12/7/2011

**AZURITE MINE**  
OKANOGAN NATIONAL FOREST, WASHINGTON

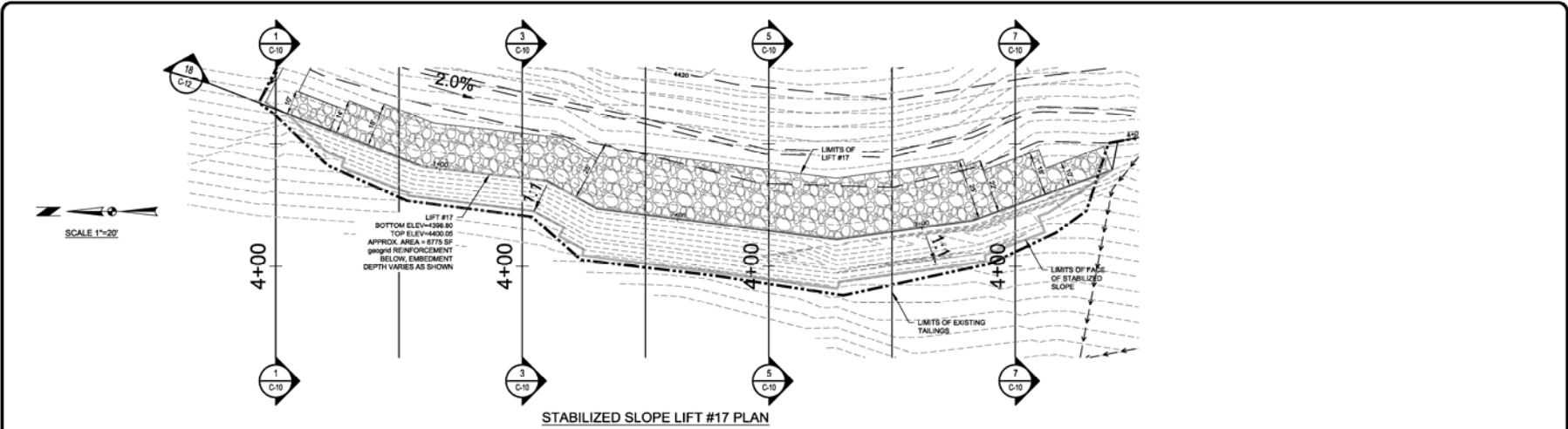
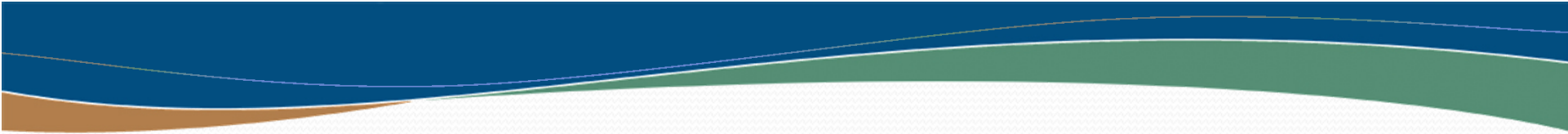
REV #	DESCRIPTION	BY	DATE	CHK. BY	APP. BY
1	As-Built		12/07/11		
2			03/24/12		
3			03/24/12		
4			03/24/12		
5			03/24/12		

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
CALL 1-800-778-8322  
FOR NATIONAL OFFICE LOCATIONS

**GRADING DETAILS**  
REMOVAL ACTION

SHEET  
**C-24**





STABILIZED SLOPE LIFT #17 PLAN

ESTIMATED QUANTITIES FOR STABILIZED SLOPE

	AREA (SF)	ROCK (CY)	GEOGRID (SY)
LIFT #1	2600	120	289
LIFT #2	2600	120	-
LIFT #3	4200	195	467
LIFT #4	4170	193	-
LIFT #5	4620	214	513
LIFT #6	5420	251	-
LIFT #7	6280	291	698
LIFT #8	6250	289	-
LIFT #9	6220	288	691
LIFT #10	6310	292	-
LIFT #11	6410	297	712
LIFT #12	6500	301	-
LIFT #13	6560	304	729
LIFT #14	6610	306	-
LIFT #15	6670	308	741
LIFT #16	6720	311	-
LIFT #17	6775	314	752
TOTALS		4394 (CY)	5592 (SY)

NOTE:  
LIFT HEIGHT OF 1.25' (15") TO CALCULATE VOLUMES.  
GEOGRID AREA SHOWN IS THE MINIMUM REQUIRED FOR EMBEDMENT ONLY.

AS-BUILT  
12/7/11

RELEASE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

AZURITE MINE  
OKANOGAN NATIONAL FOREST, WASHINGTON

REV #	DESCRIPTION	BY	DATE	CHK. BY	DATE
1	As-Built		12/07/11	ENG. BY	MRS
2			03/04/12	CHK. BY	JM
3			03/04/12	DATE CREATED	1/28/2011
4			03/04/12	JOB No.	272801
5			03/04/12		

**CES** CASCADE EARTH SCIENCES  
A Valmont Industries Company  
CALL 1-800-728-8322  
FOR NATIONAL OFFICE LOCATIONS

GRADING DETAILS  
REMOVAL ACTION

SHEET  
C-25



# Mill Creek Diversion





# Mill Creek Diversion





# Discovery Vent – Before





# Discovery Vent – After





# Reinforced Stabilized Slope – Lift 1



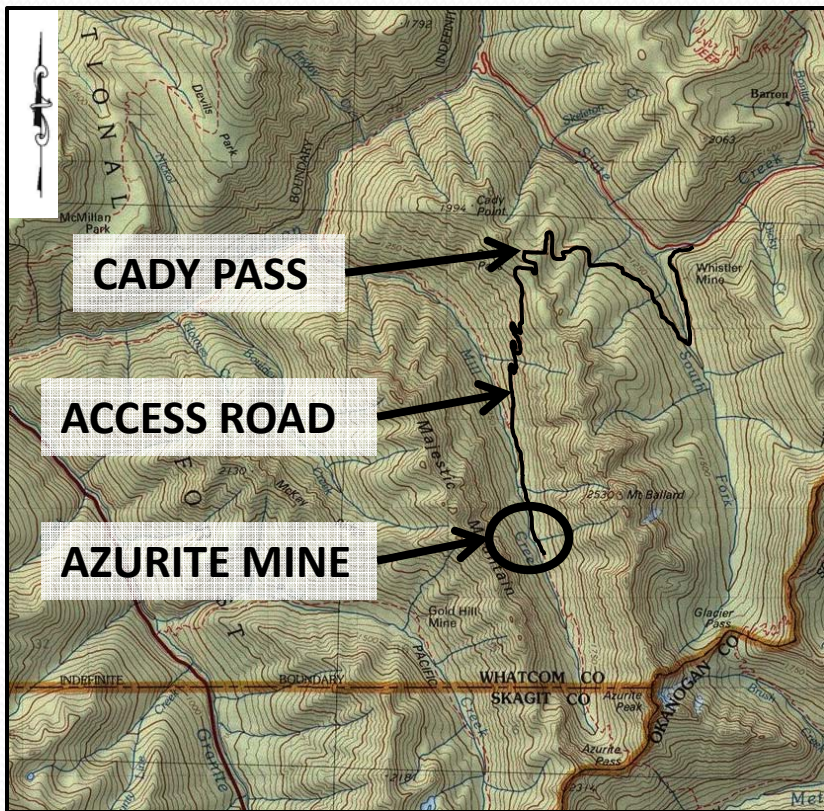


# Reinforced Stabilized Slope – Lifts 12/13





# Azurite Mine Location



LOOKING SOUTH FROM CADY PASS