

Faro Mine Closure Planning

An aerial photograph of a mine site. In the foreground, there is a dense forest of tall evergreen trees. In the middle ground, a large, light-colored, rectangular tailings pond is visible, surrounded by a mix of green vegetation and brown earth. In the background, rolling hills covered in a thick forest of evergreen trees stretch towards the horizon under a clear sky.

Example Alternatives
for Closure & Reclamation

Faro Site Overview



March 26, 2006

Faro Mine Closure Planning

Slide 2

Vangorda/Grum Site Overview



March 26, 2006

Faro Mine Closure Planning

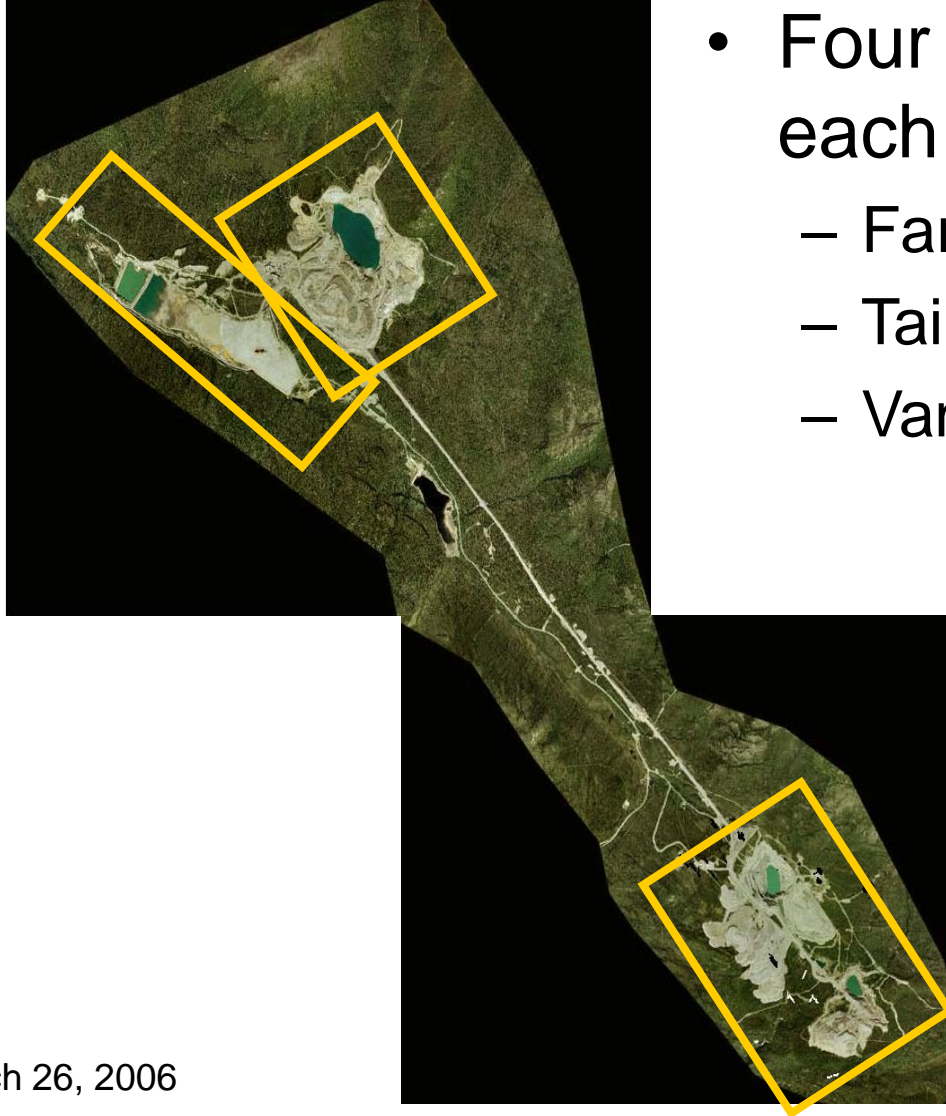
Slide 3



Example Alternatives

- Purposes:
 - Present closure alternatives that establish the range of what is technically and practically possible.
 - Changes, combinations and substitutions are still possible
 - Summarize the results of the technical studies in terms of concrete options
 - Can be compared to closure objectives
 - Provide focus for community feedback

Example Alternatives



- Four alternatives in each area
 - Faro Mine Area
 - Tailings Area
 - Vangorda/Grum Area



Example Alternatives Tailings Area

1. Stabilize tailings in place
2. Relocate all tailings
3. Relocate Intermediate tailings and stabilize remainder
4. Minimize up-front construction and rely on collection & treatment of all contaminated water



Example Alternatives

Faro Mine Area

1. Divert Faro Creek into the pit and use biological treatment to treat water
2. Continue diverting Faro Creek around pit and treat water in a conventional treatment plant
3. Minimize up-front construction and rely on collection & treatment of all contaminated water
4. Increase up-front construction to minimize requirements for long-term water treatment



Example Alternatives Vangorda/Grum

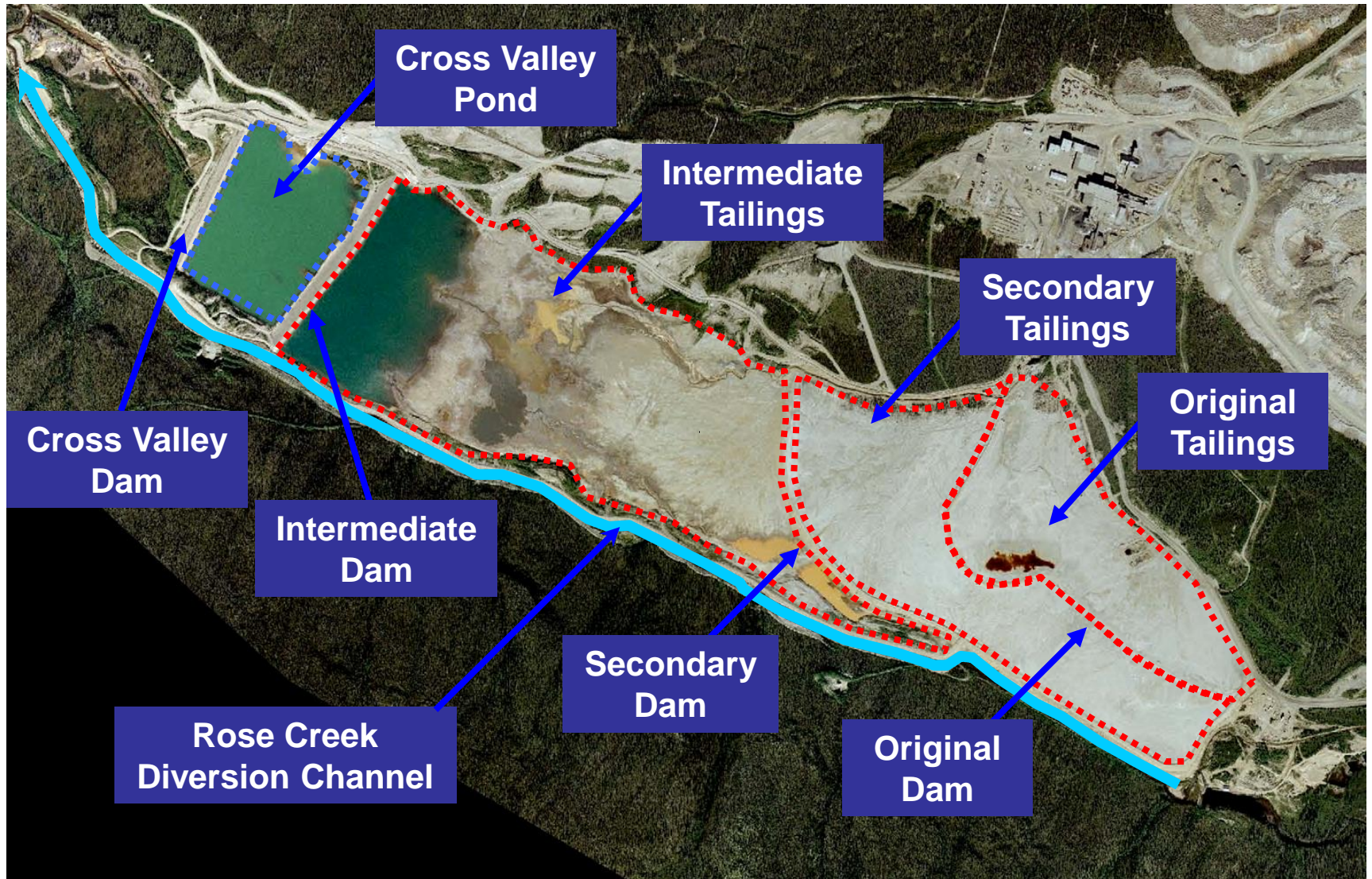
1. Backfill Vangorda waste rock into pit
2. Re-build Vangorda Creek diversion around pit and leave waste rock in place
3. Minimize up-front construction and rely on collection & treatment of all contaminated water
4. Increase up-front construction to minimize requirements for long-term water treatment



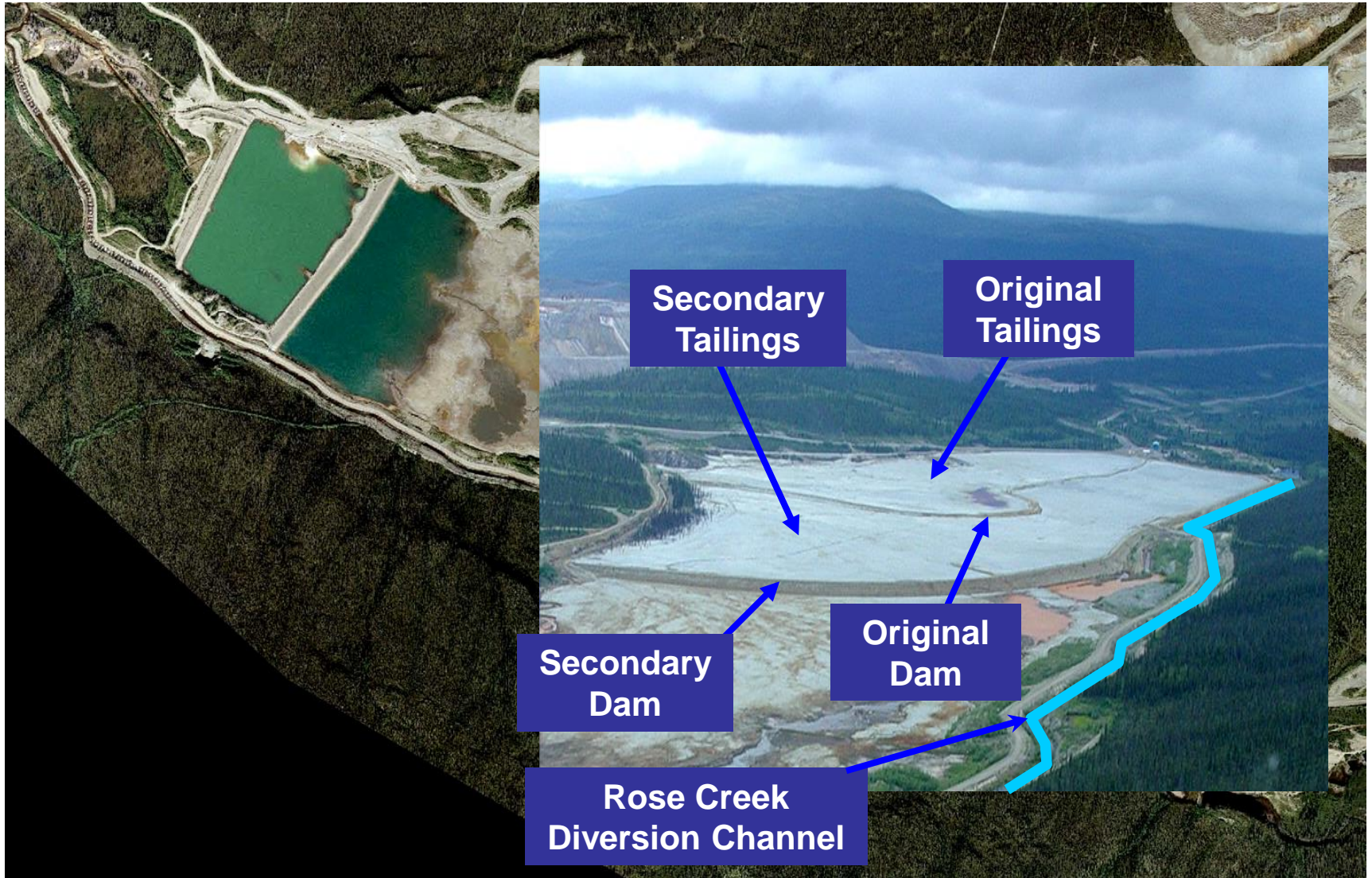
Tailings Area Example Alternatives

- Description of Tailings Area
 - Major components
- Each Example alternative
 - Major components
 - Long-term requirements

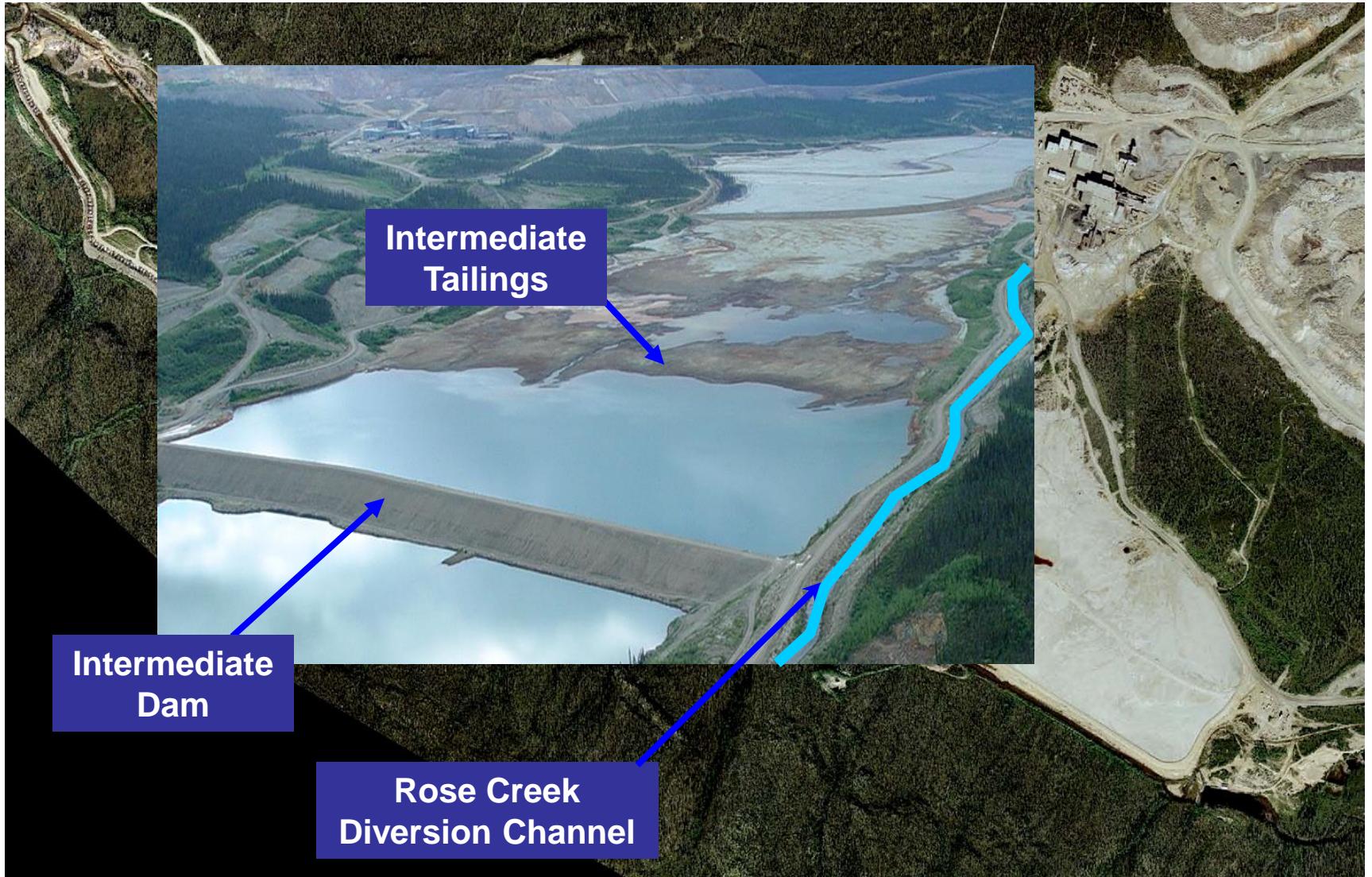
Tailings Area Components



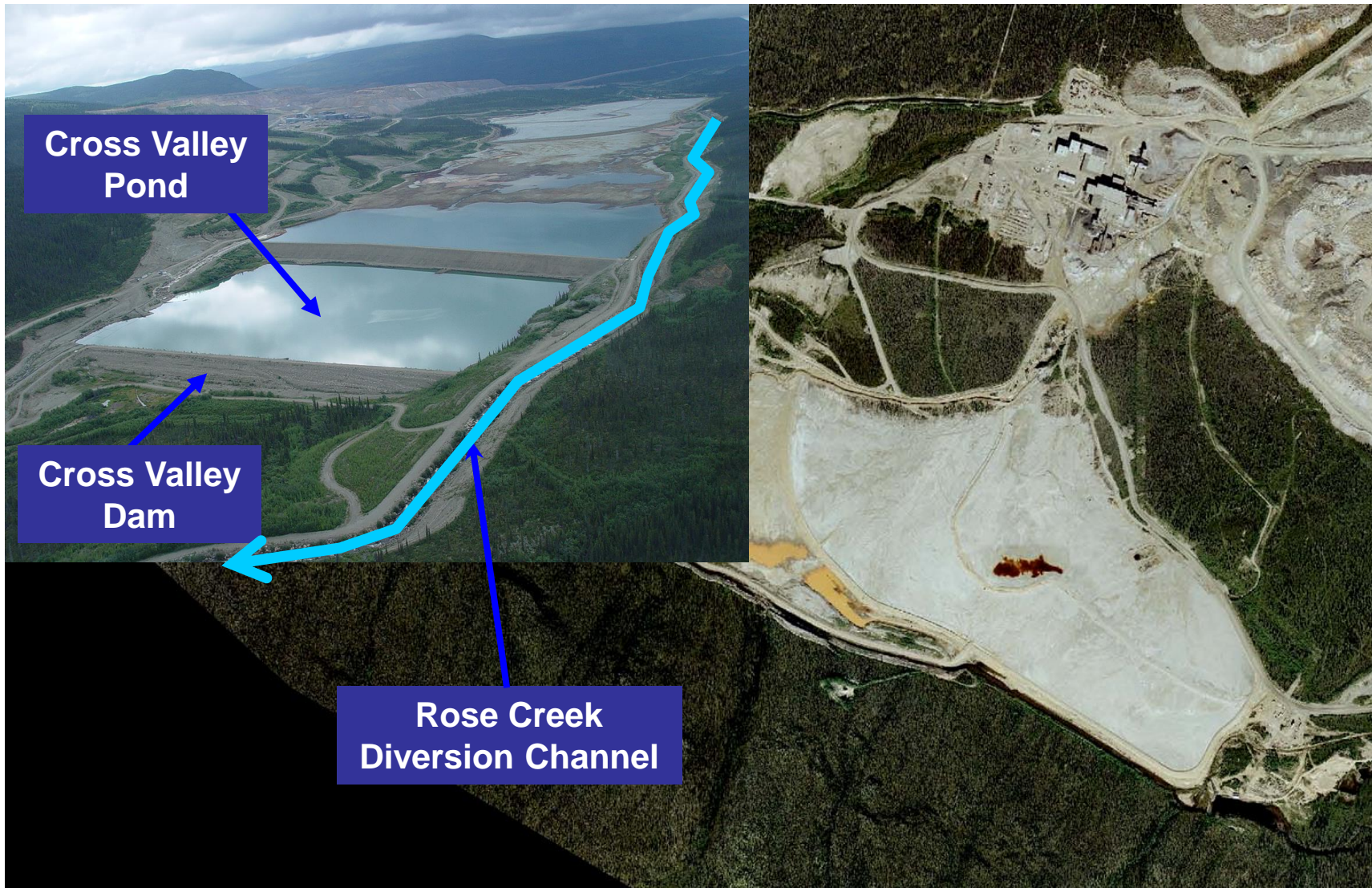
Original & Secondary



Intermediate



Cross Valley



Tailings Area Groundwater

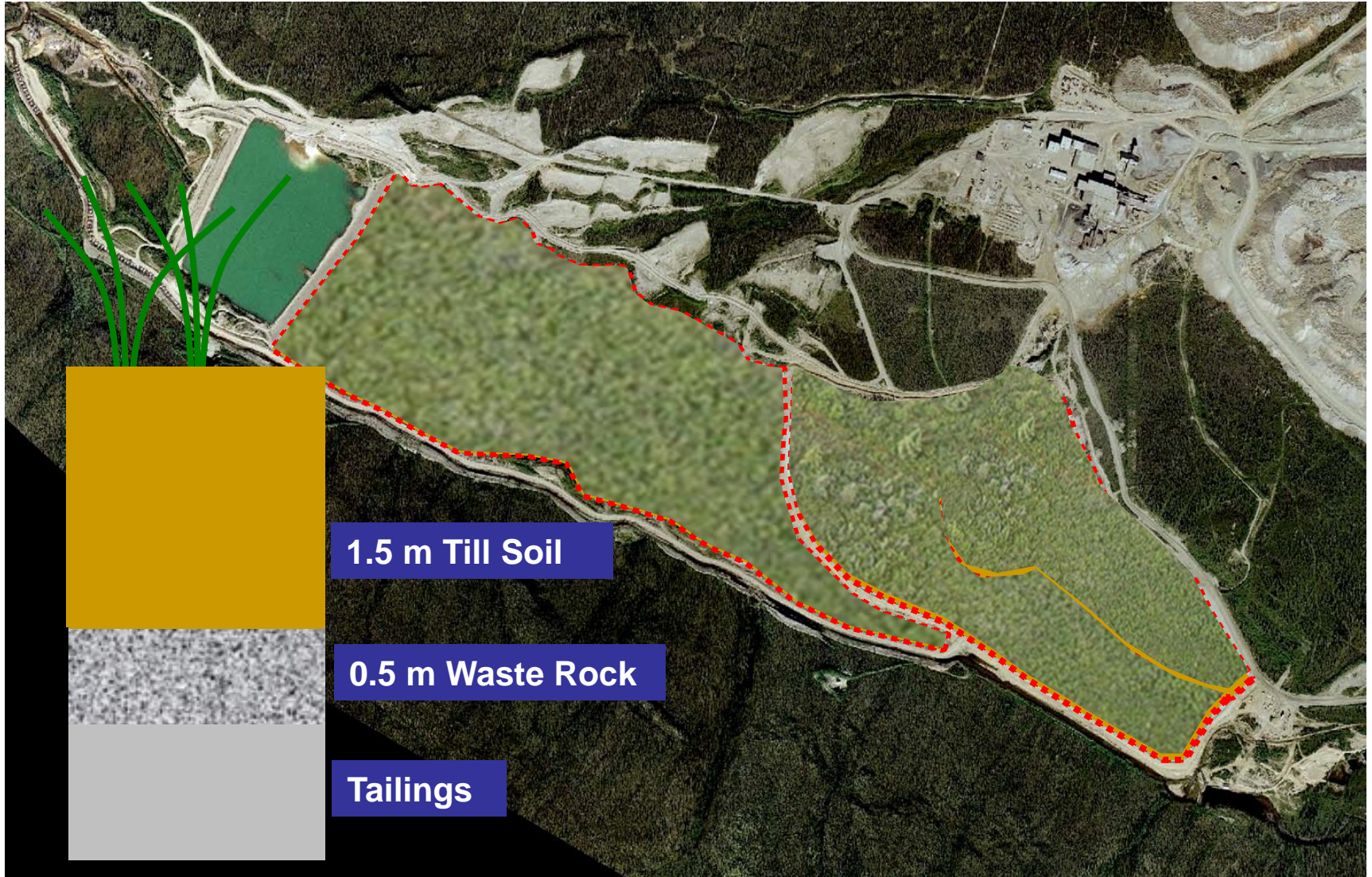




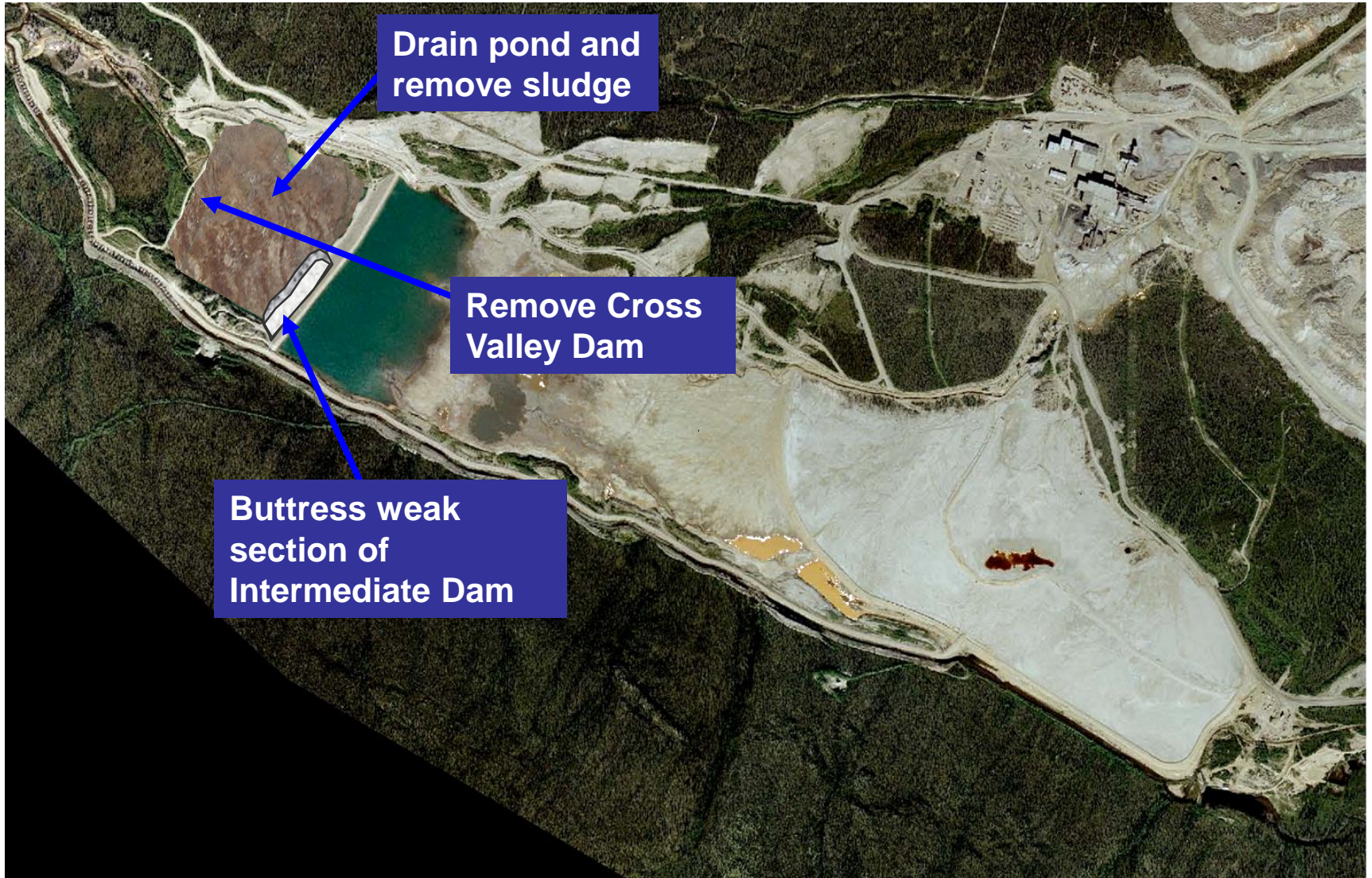
Tailings Example Alternative 1

- “Stabilize in Place”
 - Construct rock and soil cover on tailings
 - Stabilize Intermediate Dam
 - Remove Cross Valley Dam
 - Improve Rose Creek Diversion
 - Construct or improve other diversions
 - Collect and treat contaminated groundwater

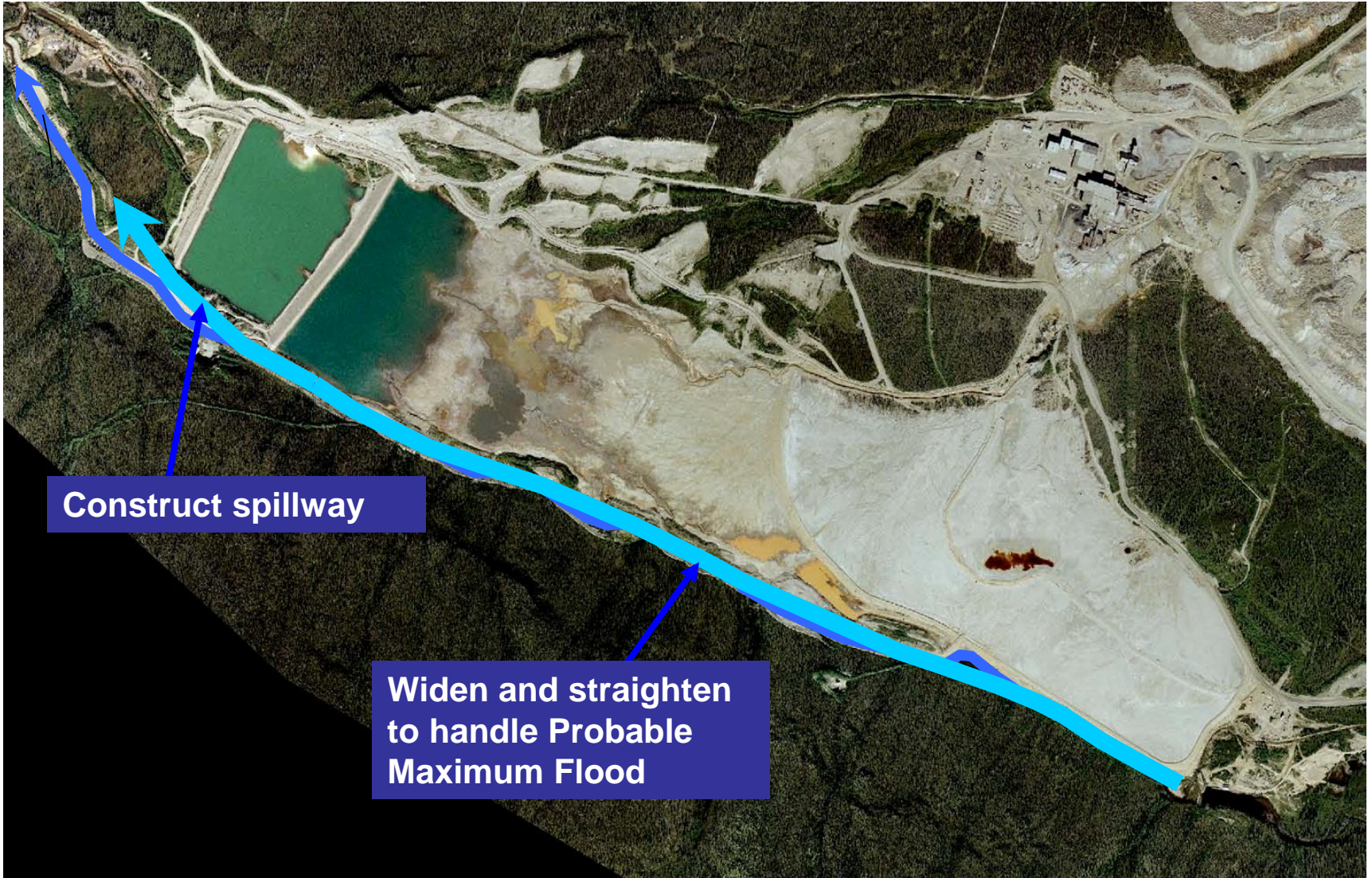
Tailings Cover



Stabilize / Remove Dams



Improve Rose Creek Diversion



Construct spillway

**Widen and straighten
to handle Probable
Maximum Flood**

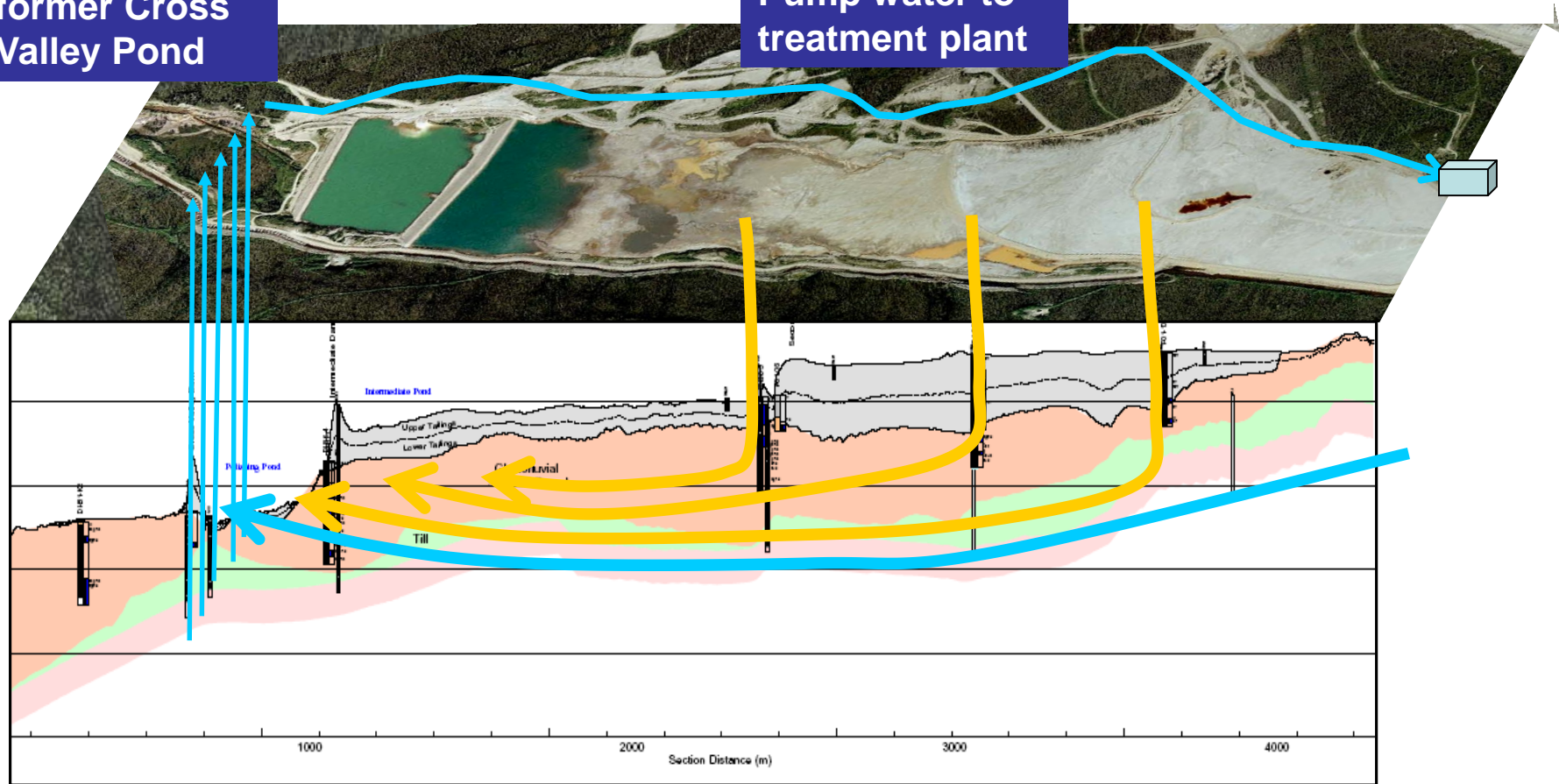
Improve Other Diversions



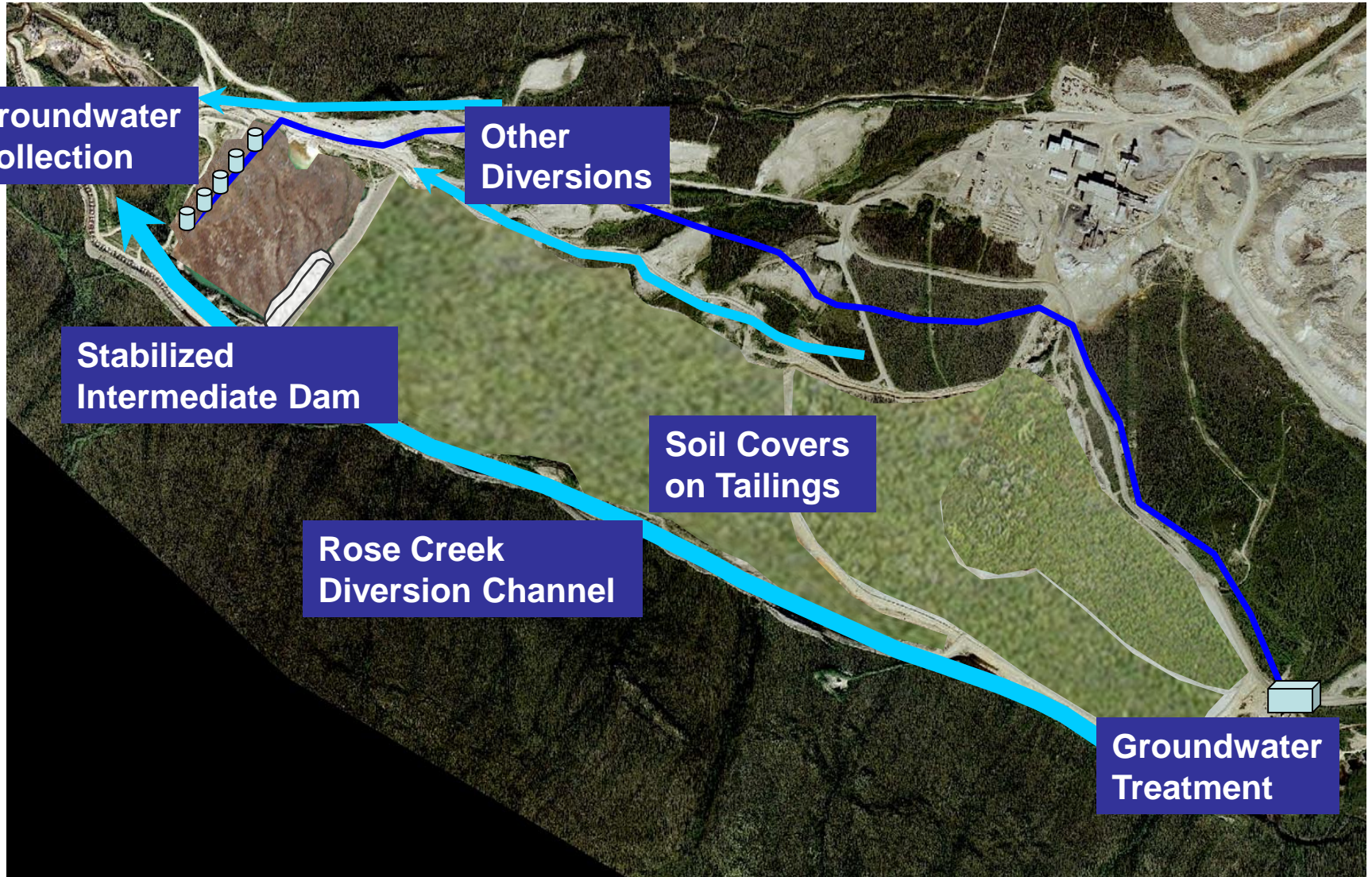
Install Groundwater Collection

Install wells in former Cross Valley Pond

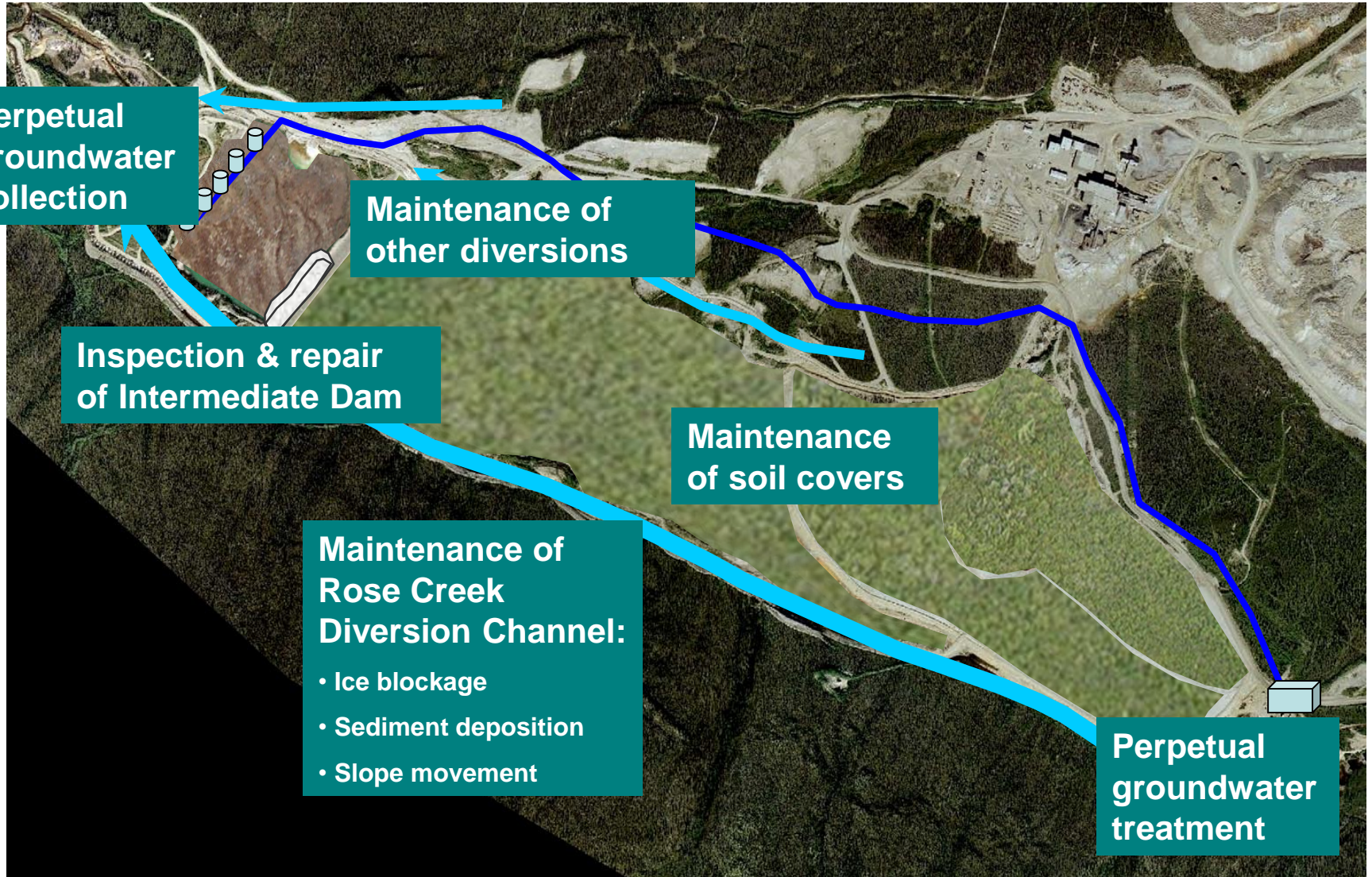
Pump water to treatment plant



Post-Closure Components



Post-Closure Requirements





Tailings Example Alternative 2

- “Complete Relocation”
 - Remove all tailings to Faro Pit
 - Breach all dams
 - Collect and treat contaminated groundwater below relocated tailings for ten years or more
 - Return Rose Creek to its natural alignment

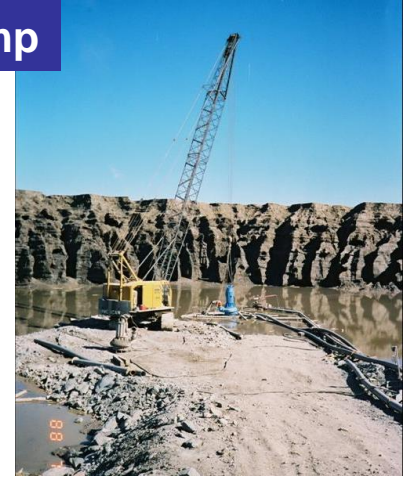
Tailings Relocation



Hydraulic monitor



Operators control panel

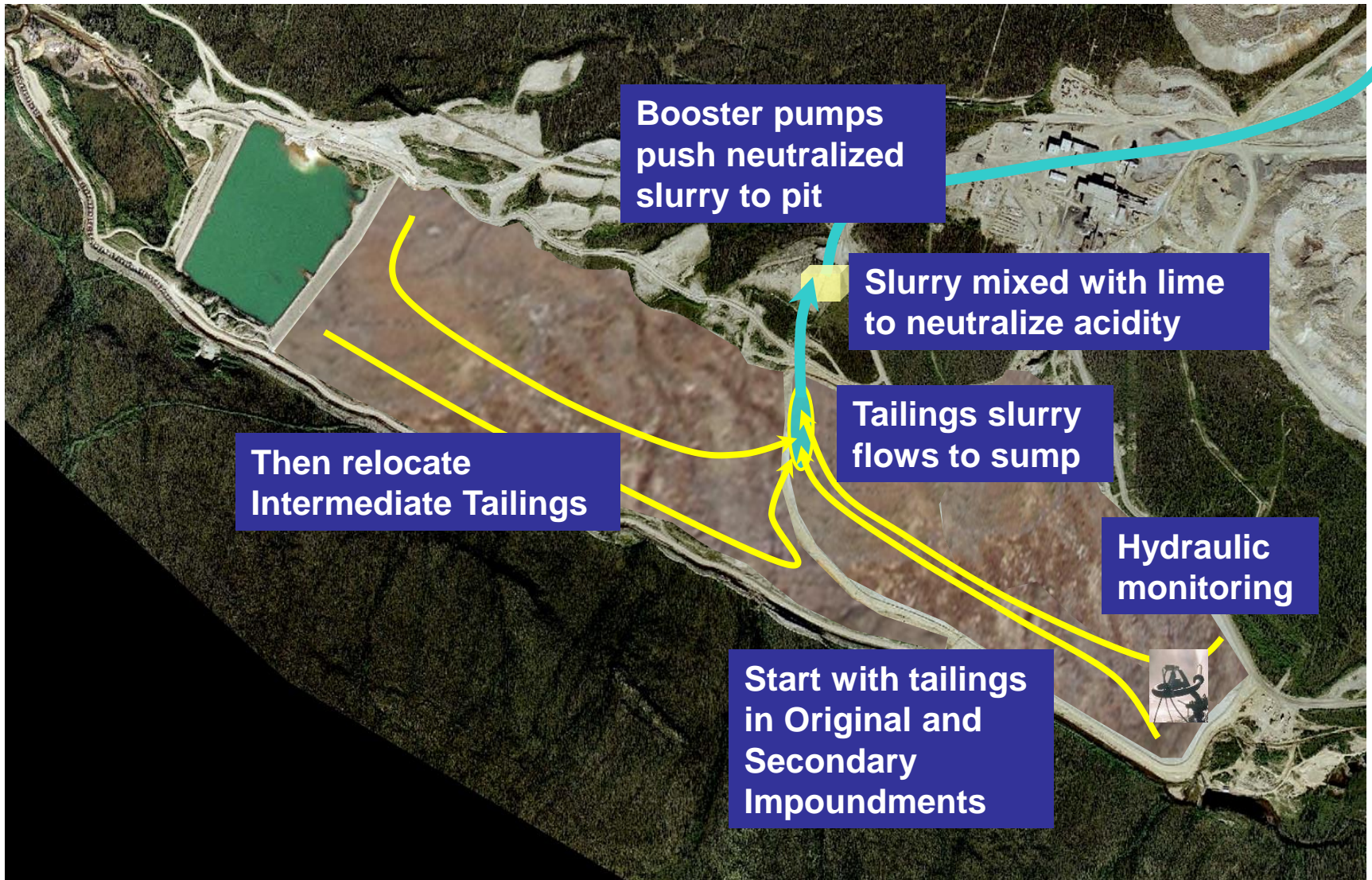


Crane & pump

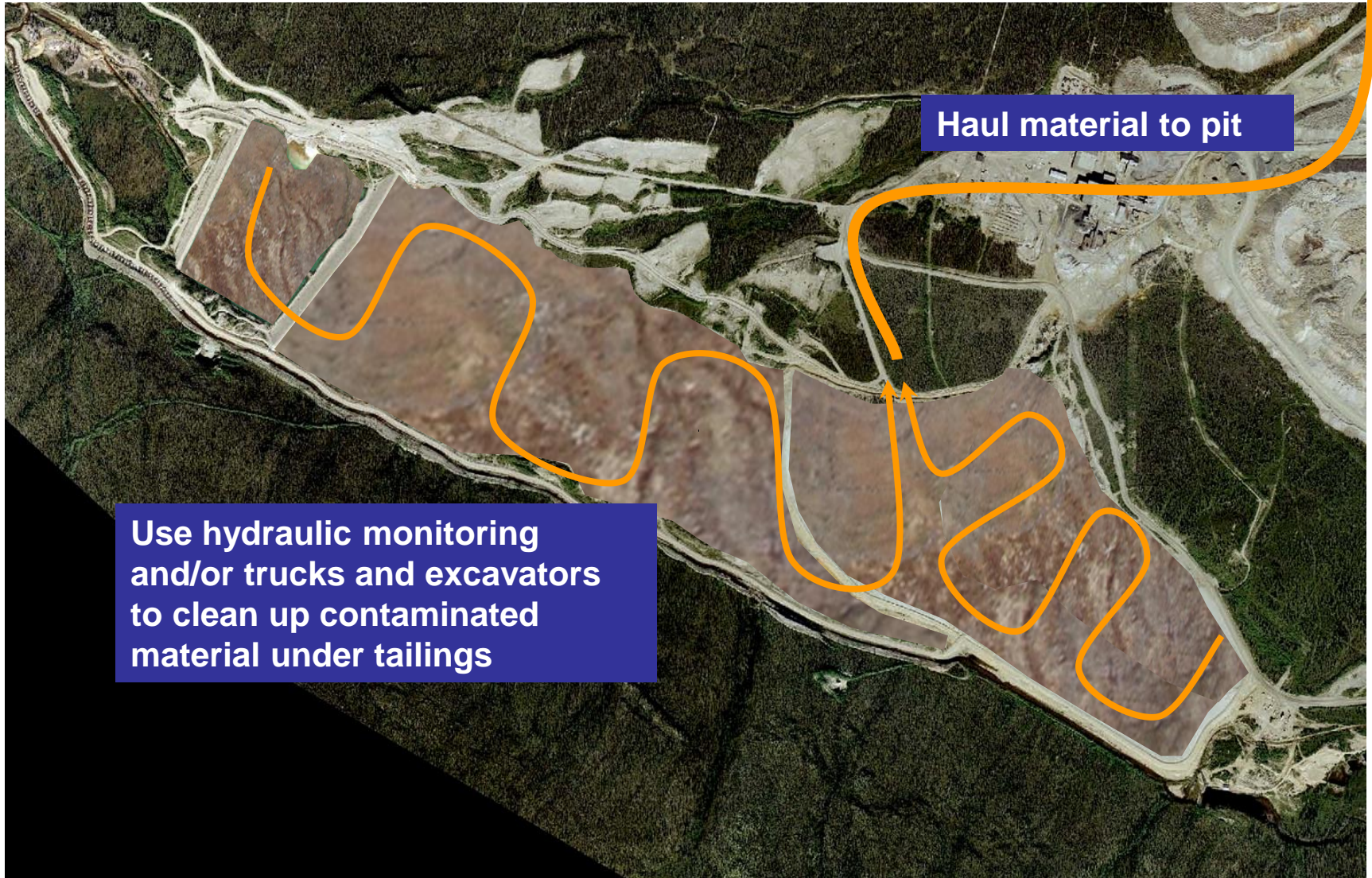


Complete system in operation at Giant Mine, Yellowknife

Tailings Relocation



Footprint Cleanup



Haul material to pit

Use hydraulic monitoring
and/or trucks and excavators
to clean up contaminated
material under tailings

Groundwater Collection

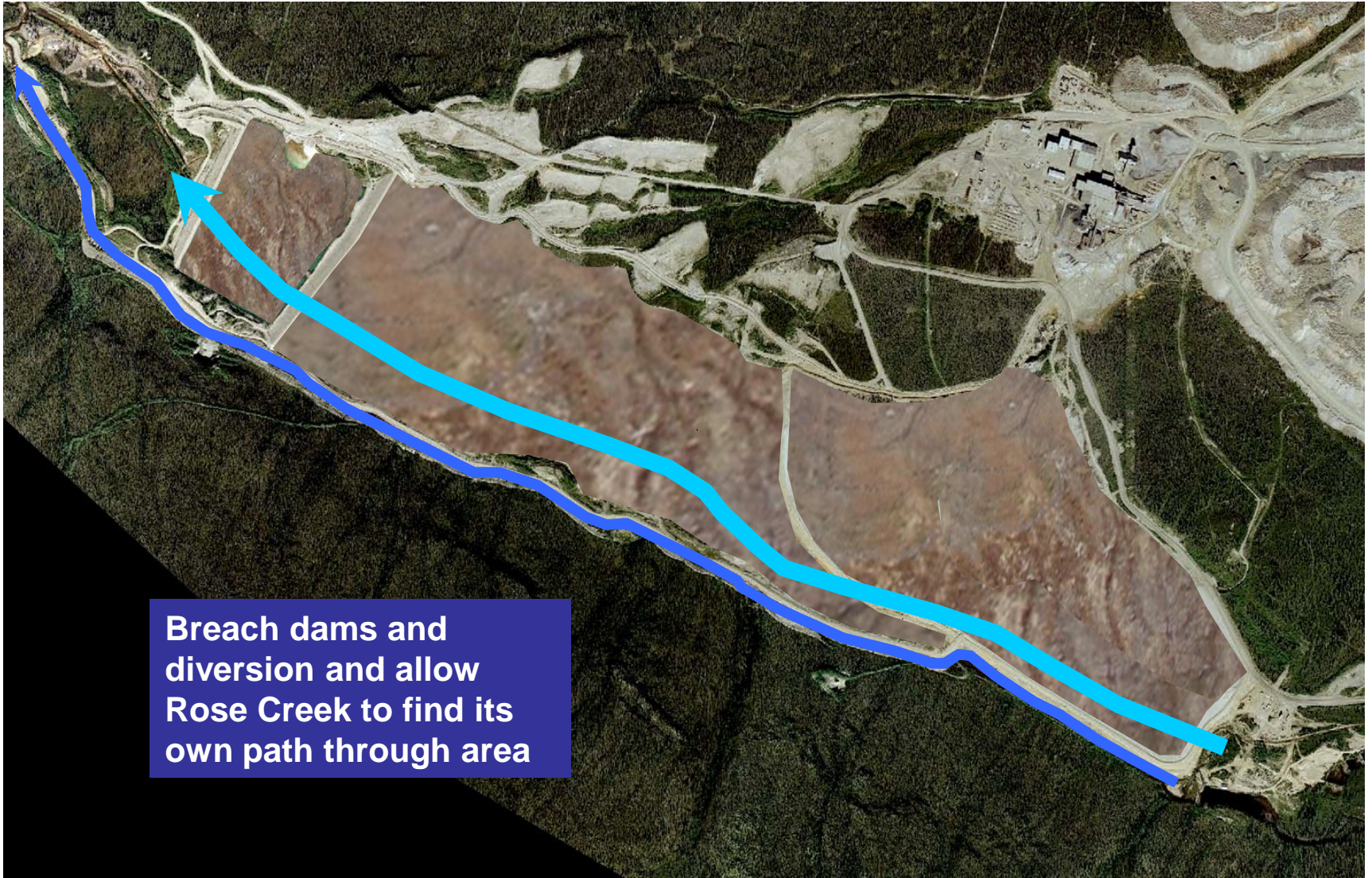


Install wells where needed below relocated tailings

Assume 10-20 years of groundwater treatment before area is clean

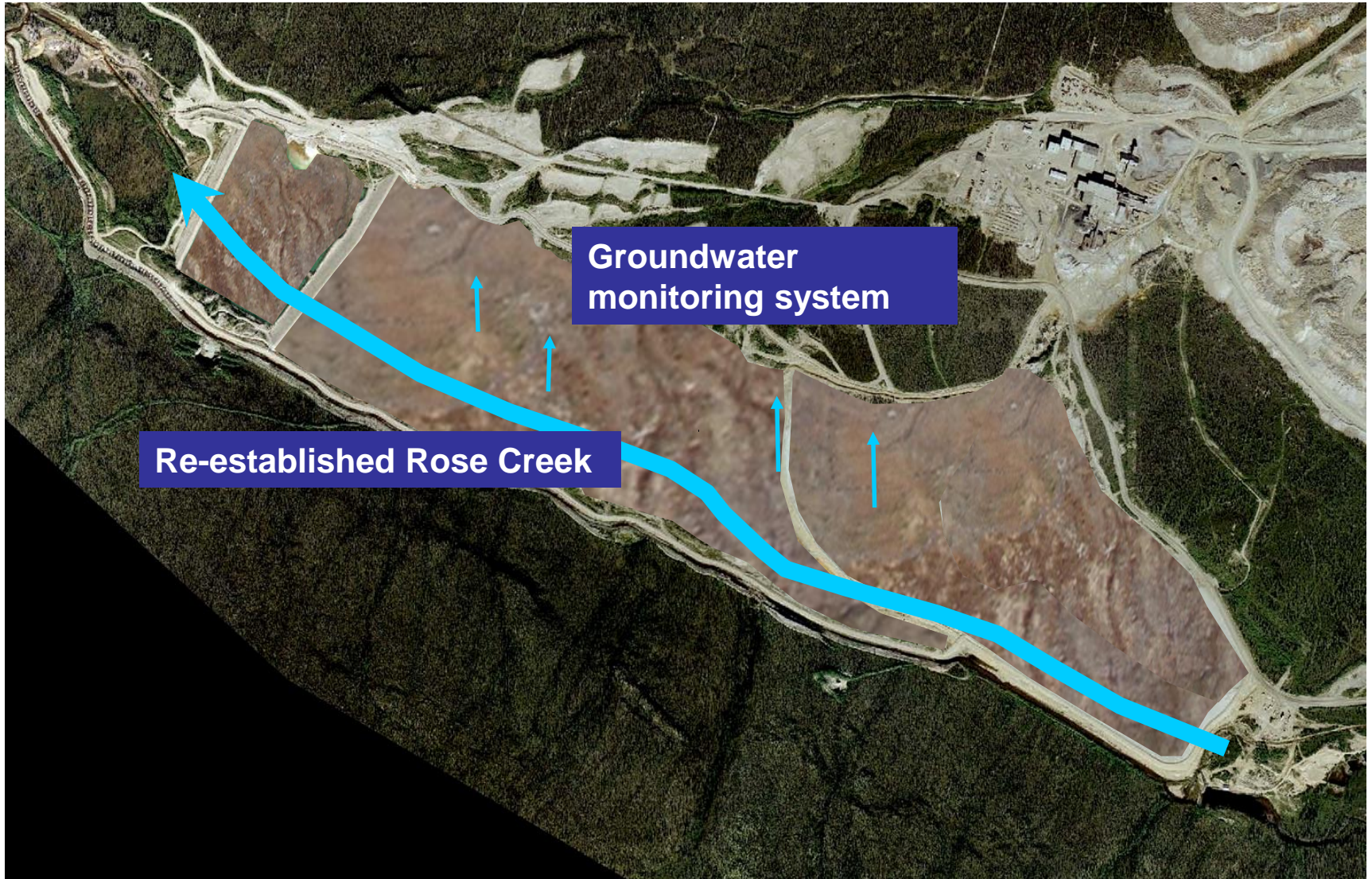
Pump water to treatment plant

Re-Establish Rose Creek

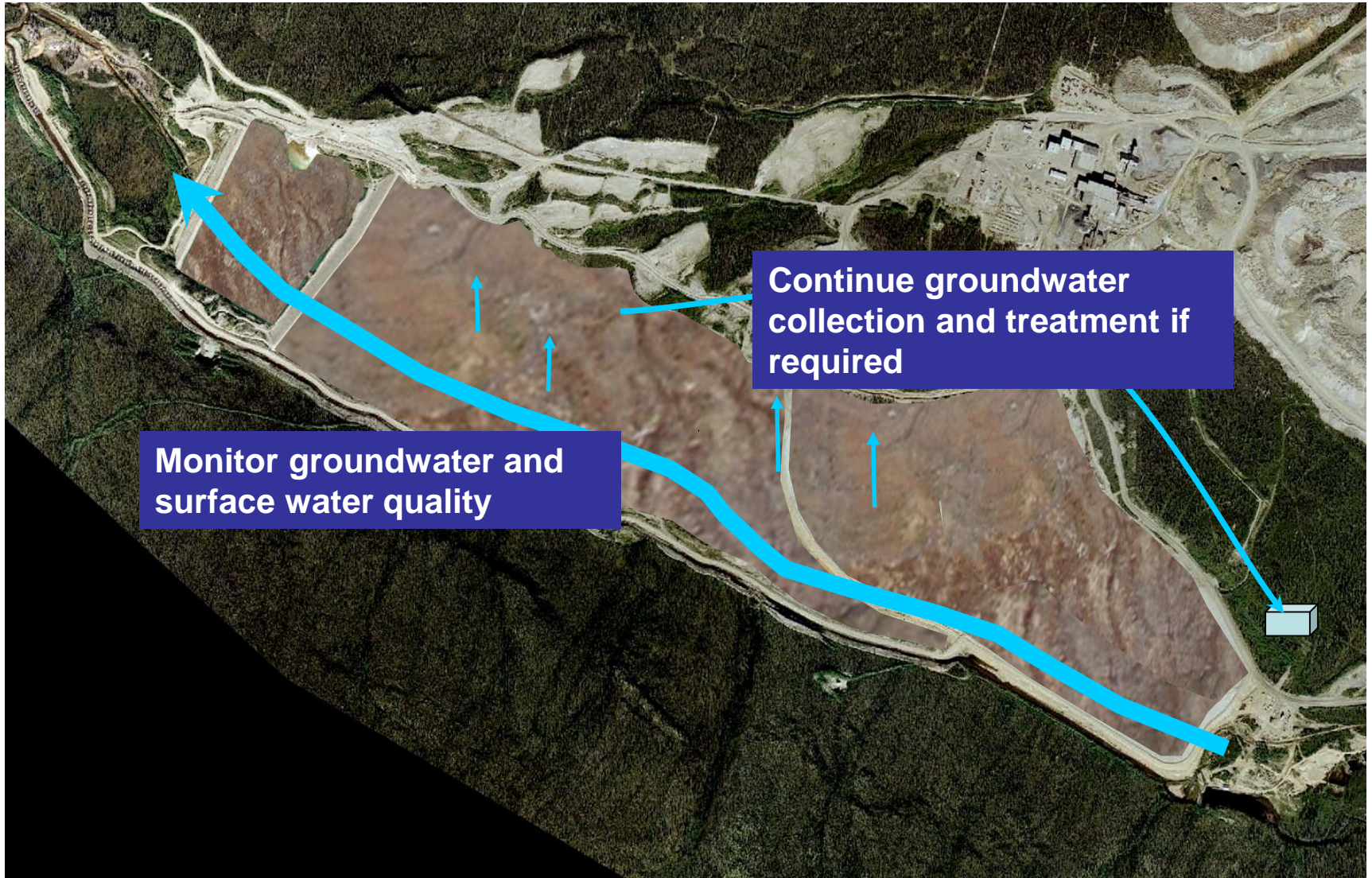


**Breach dams and
diversion and allow
Rose Creek to find its
own path through area**

Post-Closure Components



Post-Closure Requirements





Tailings Example Alternative 3

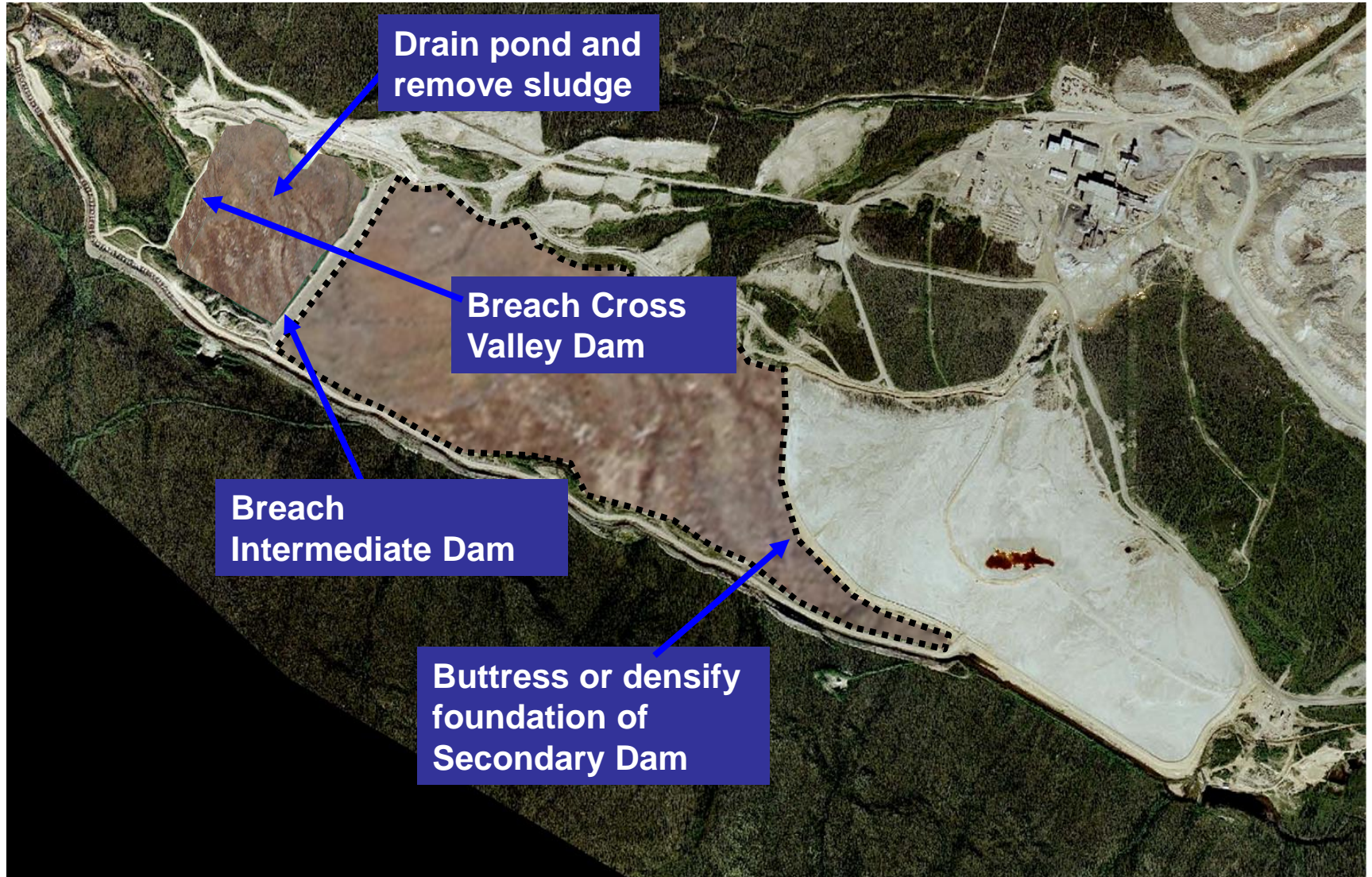
- “Partial Relocation”
 - Remove intermediate tailings to Faro Pit
 - Breach Intermediate Dam
 - Remove Cross Valley Dam
 - Stabilize remaining tailings in place
 - Construct rock and soil cover on tailings
 - Improve Rose Creek Diversion around Original and Secondary impoundments
 - Collect and treat contaminated groundwater
 - Below relocated tailings for ten years or more
 - Perpetual collection & treatment from below Secondary Dam

Tailings Relocation

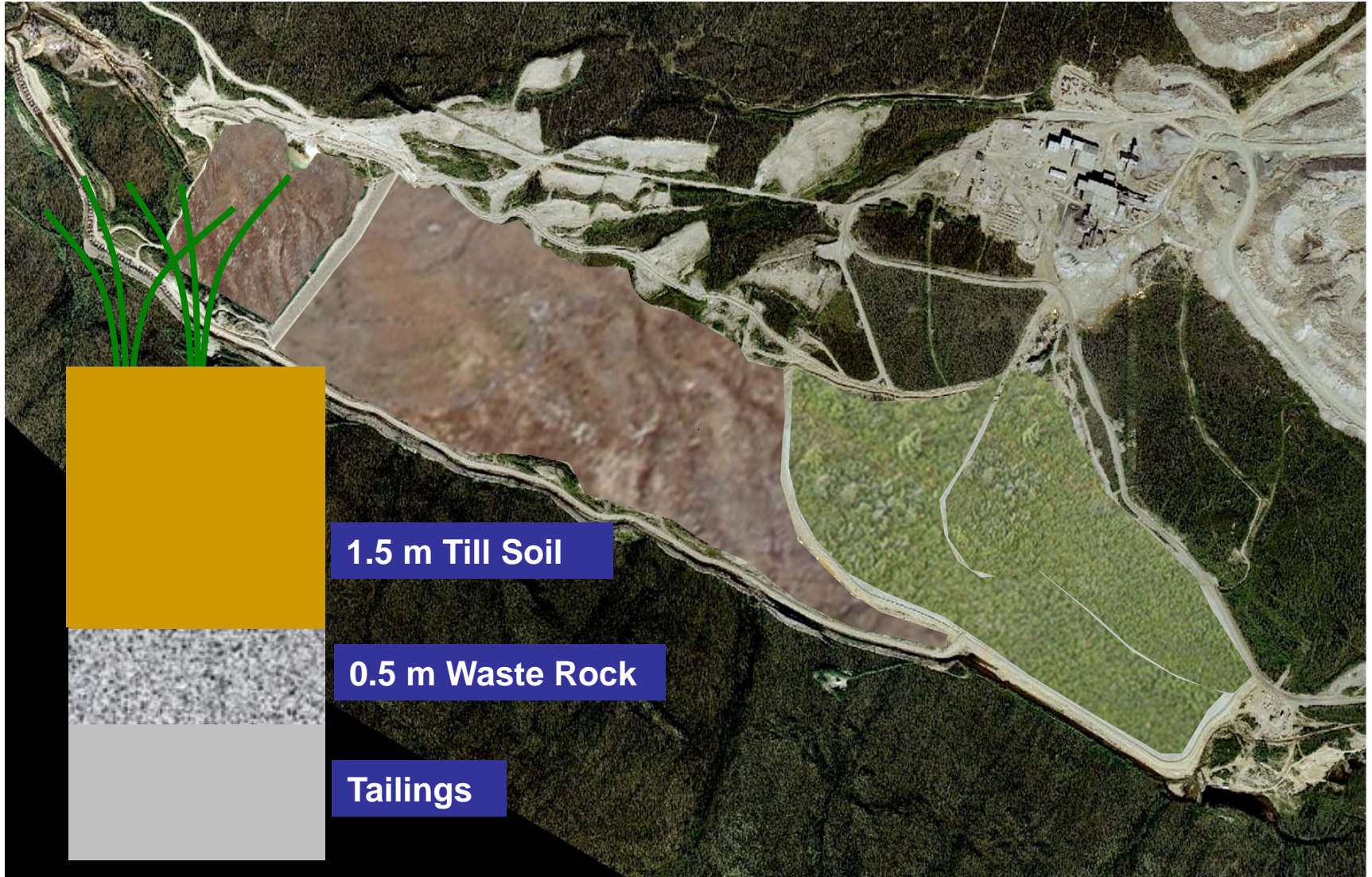
Hydraulically mine and relocate Intermediate Pond tailings to Faro Pit



Stabilize / Remove Dams



Cover Remaining Tailings



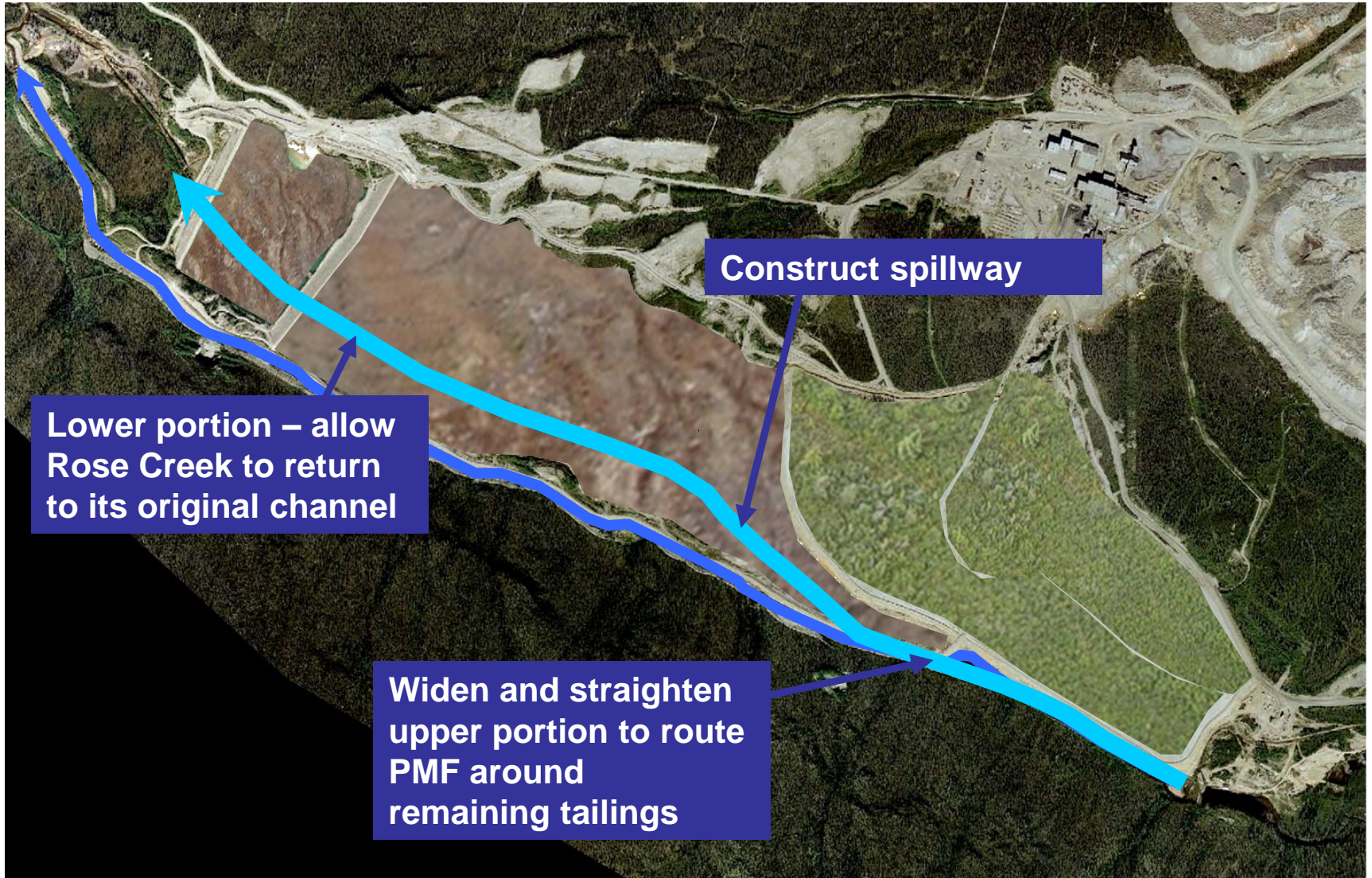
Install Groundwater Collection



Install wells where needed below relocated tailings, and below second dam

Pump water to treatment plant

Re-Route Rose Creek Diversion

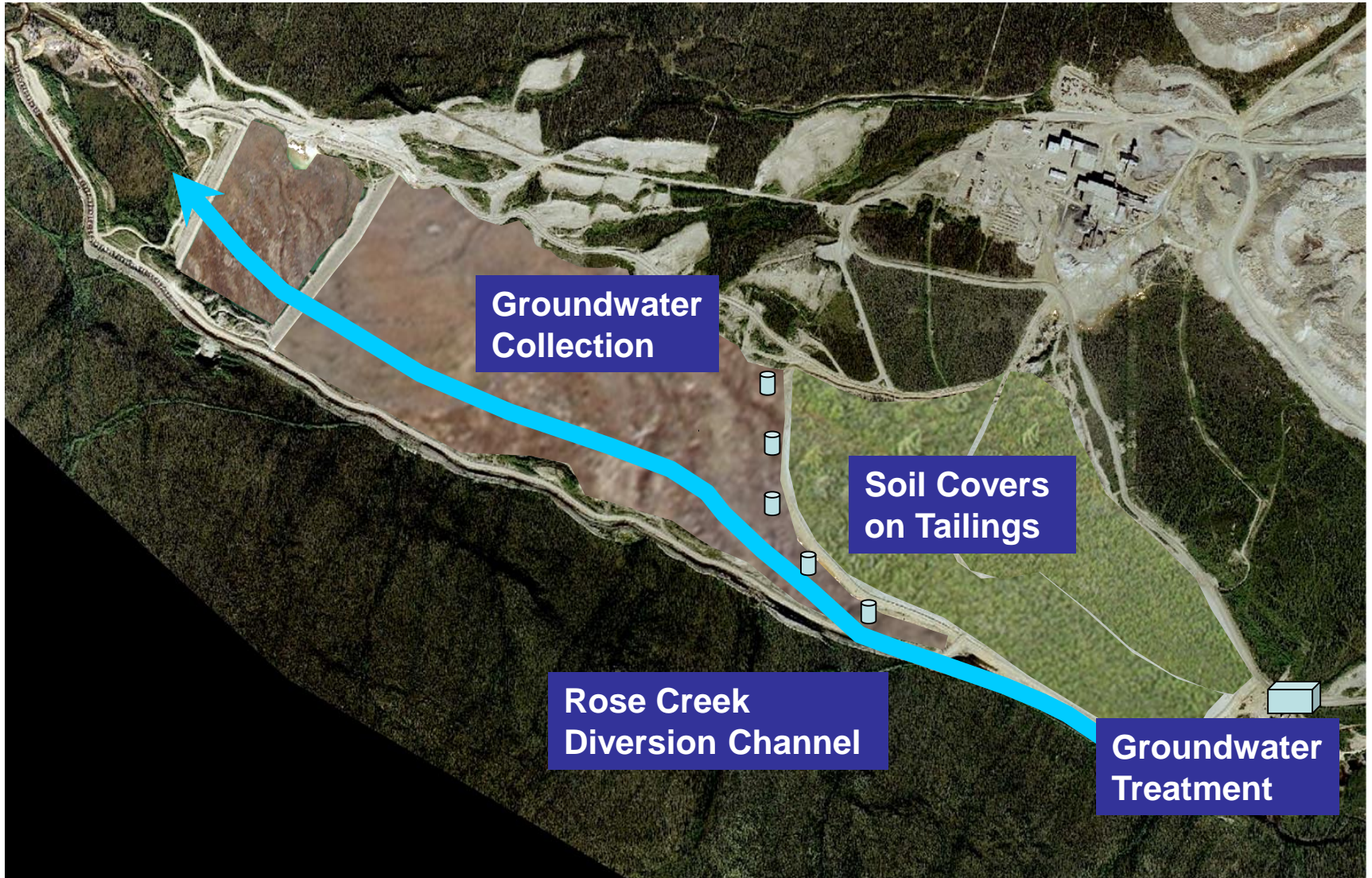


Construct spillway

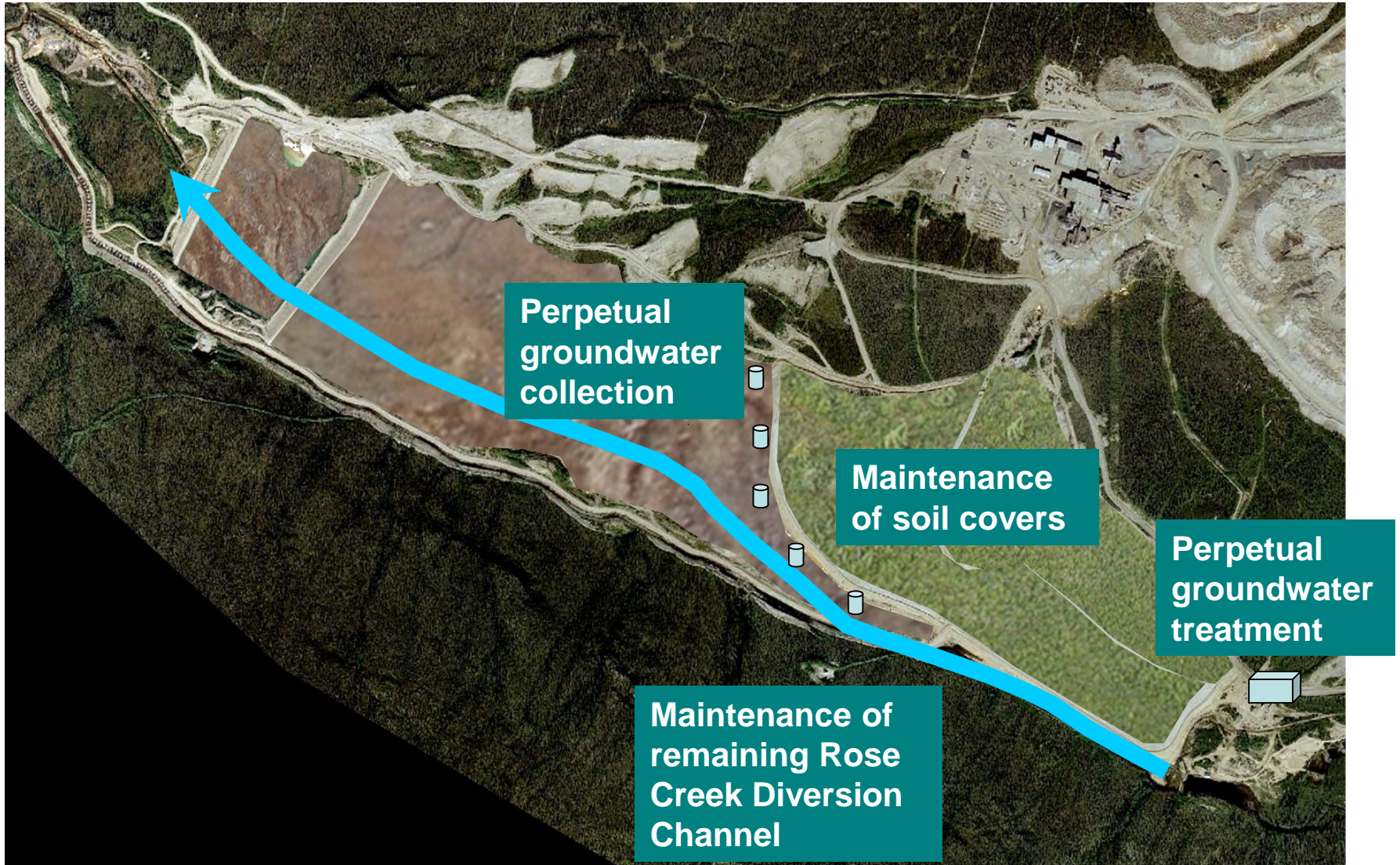
Lower portion – allow Rose Creek to return to its original channel

Widen and straighten upper portion to route PMF around remaining tailings

Post-Closure Components



Post-Closure Requirements

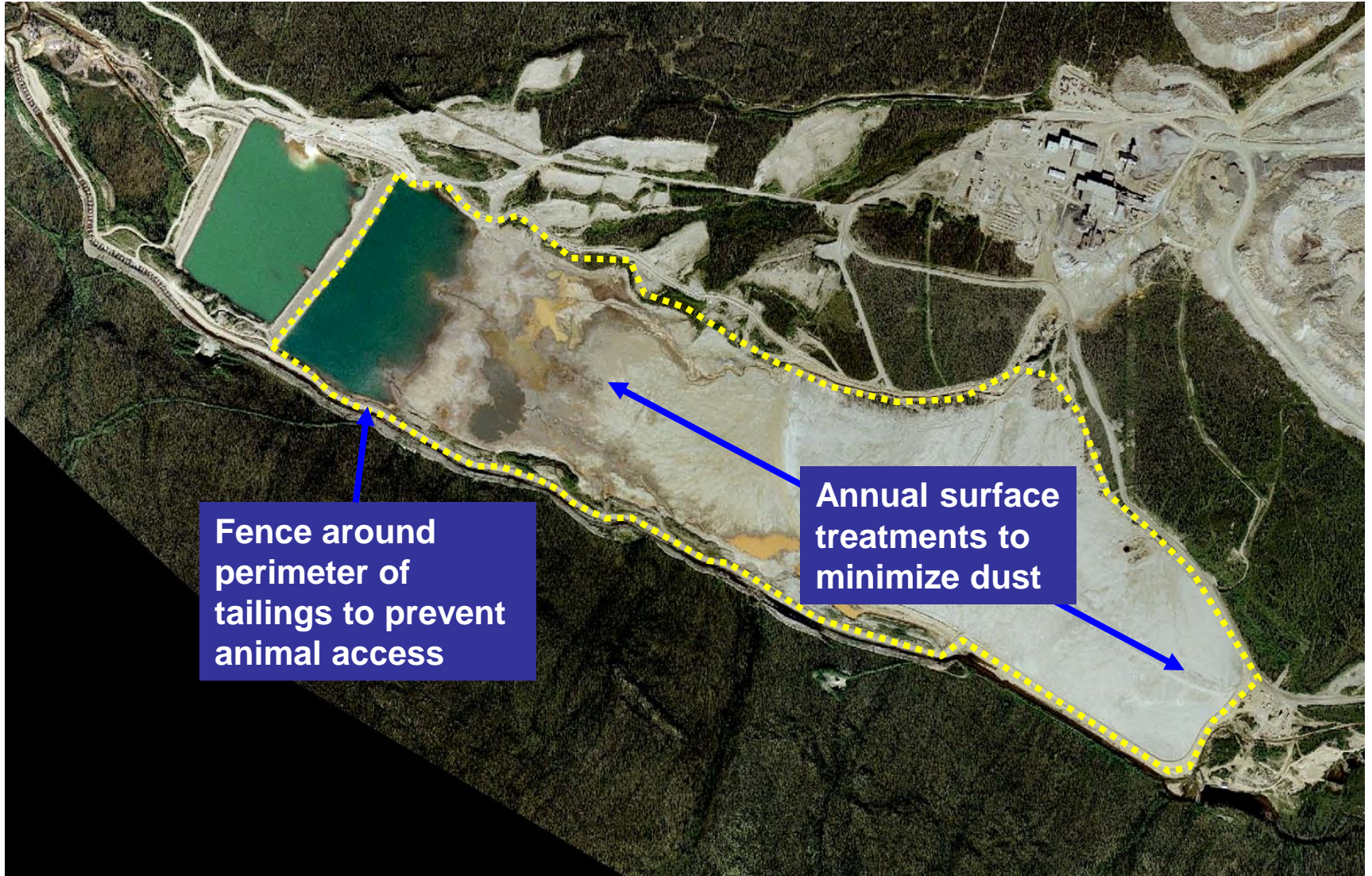




Tailings Example Alternative 4

- “Minimize Up-Front Construction”
 - Construct fence around tailings
 - Surface treatment on tailings
 - Stabilize Intermediate Dam
 - Remove Cross Valley Dam
 - Improve Rose Creek Diversion
 - Collect and treat contaminated groundwater

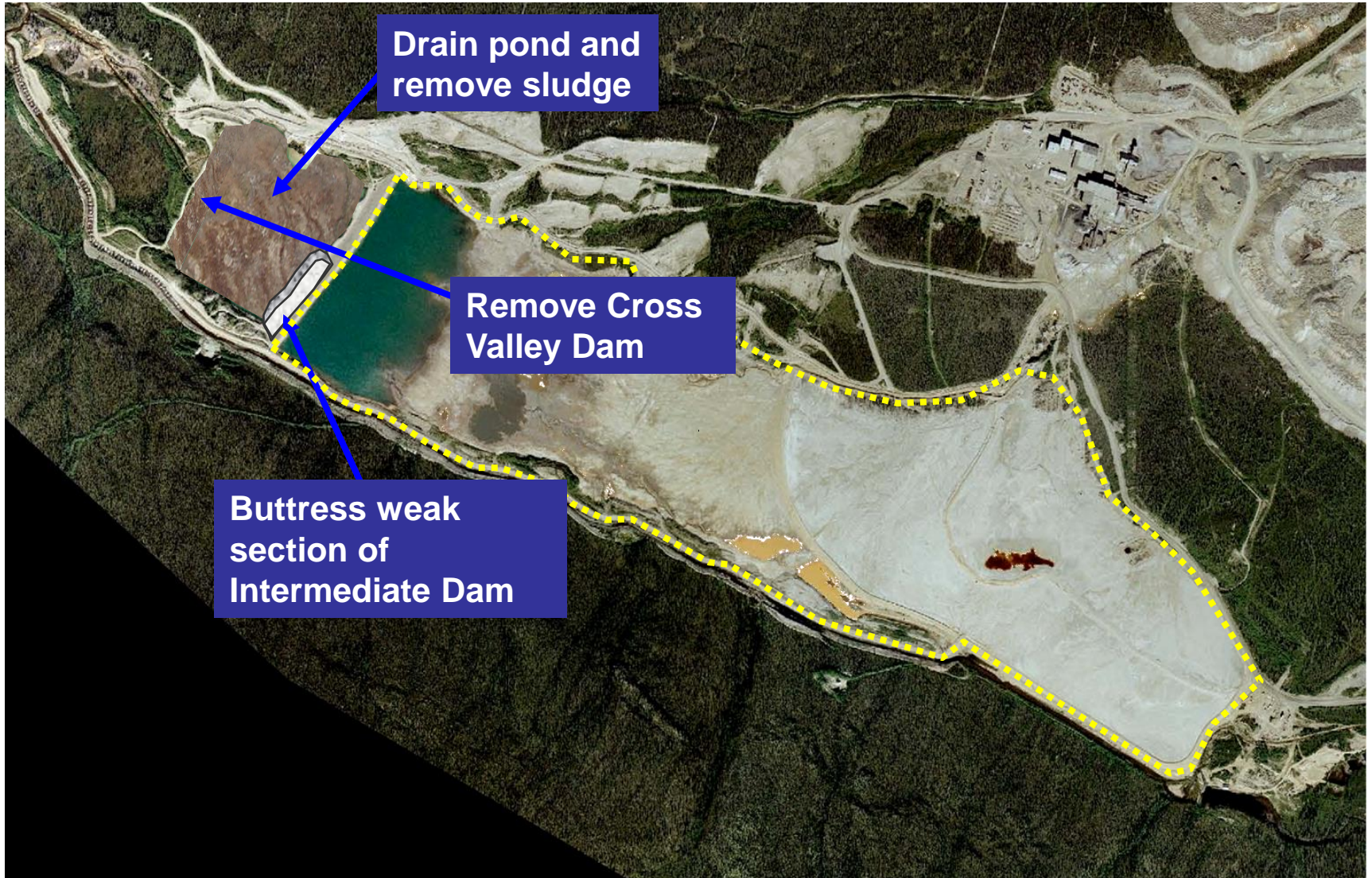
Tailings Fence & Surface Treatment



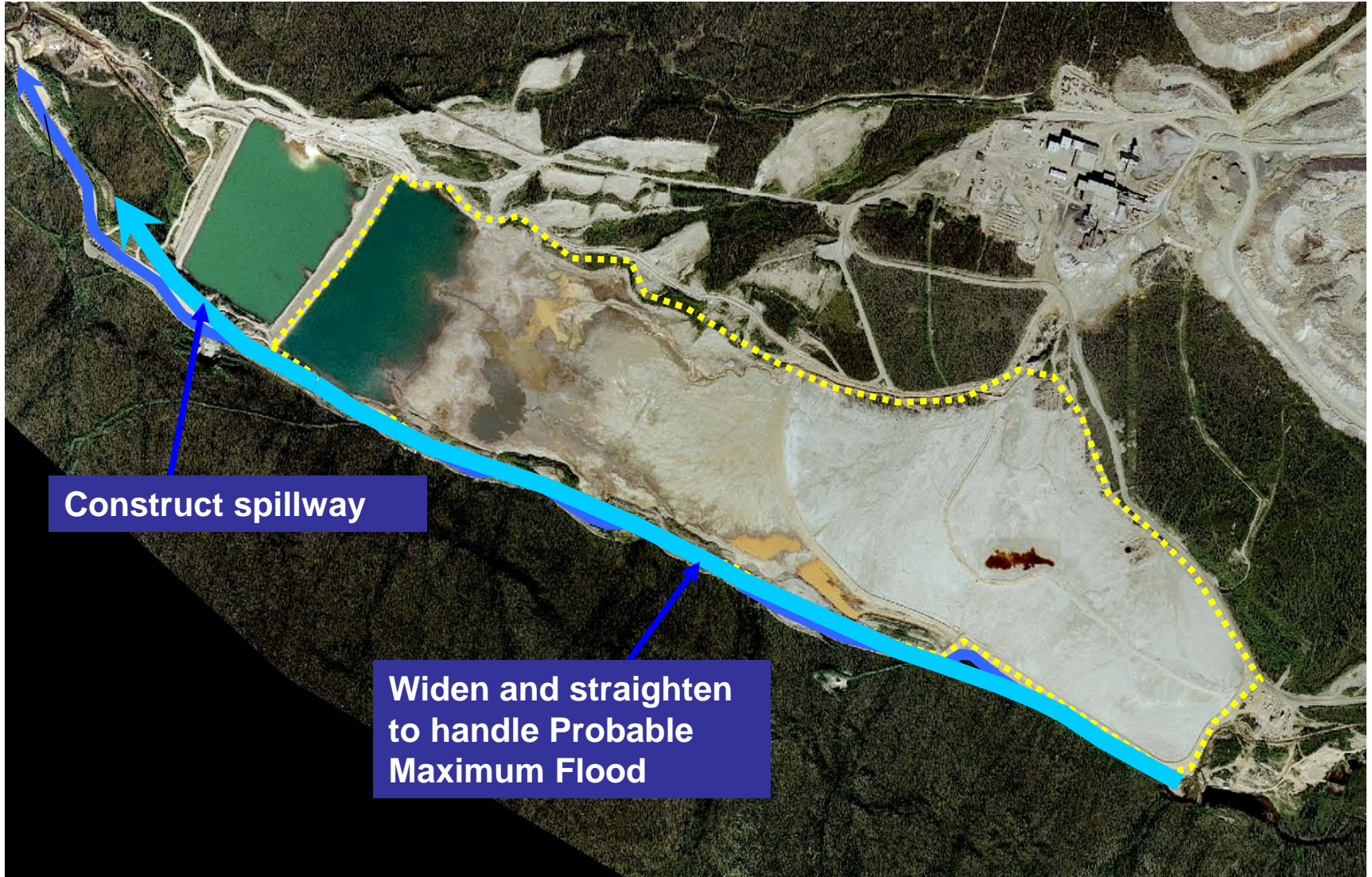
Fence around perimeter of tailings to prevent animal access

Annual surface treatments to minimize dust

Stabilize / Remove Dams



Improve Rose Creek Diversion



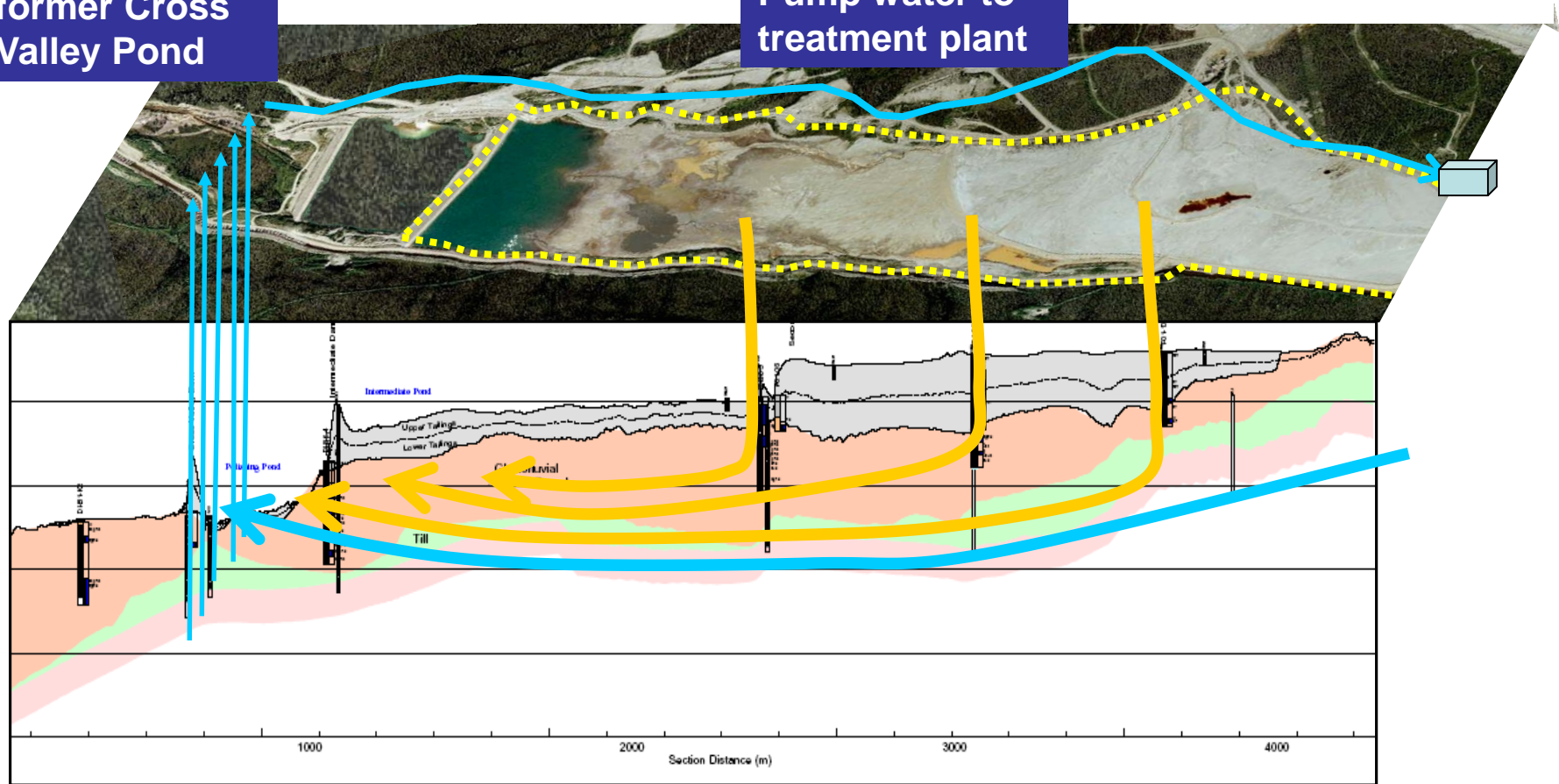
Construct spillway

**Widen and straighten
to handle Probable
Maximum Flood**

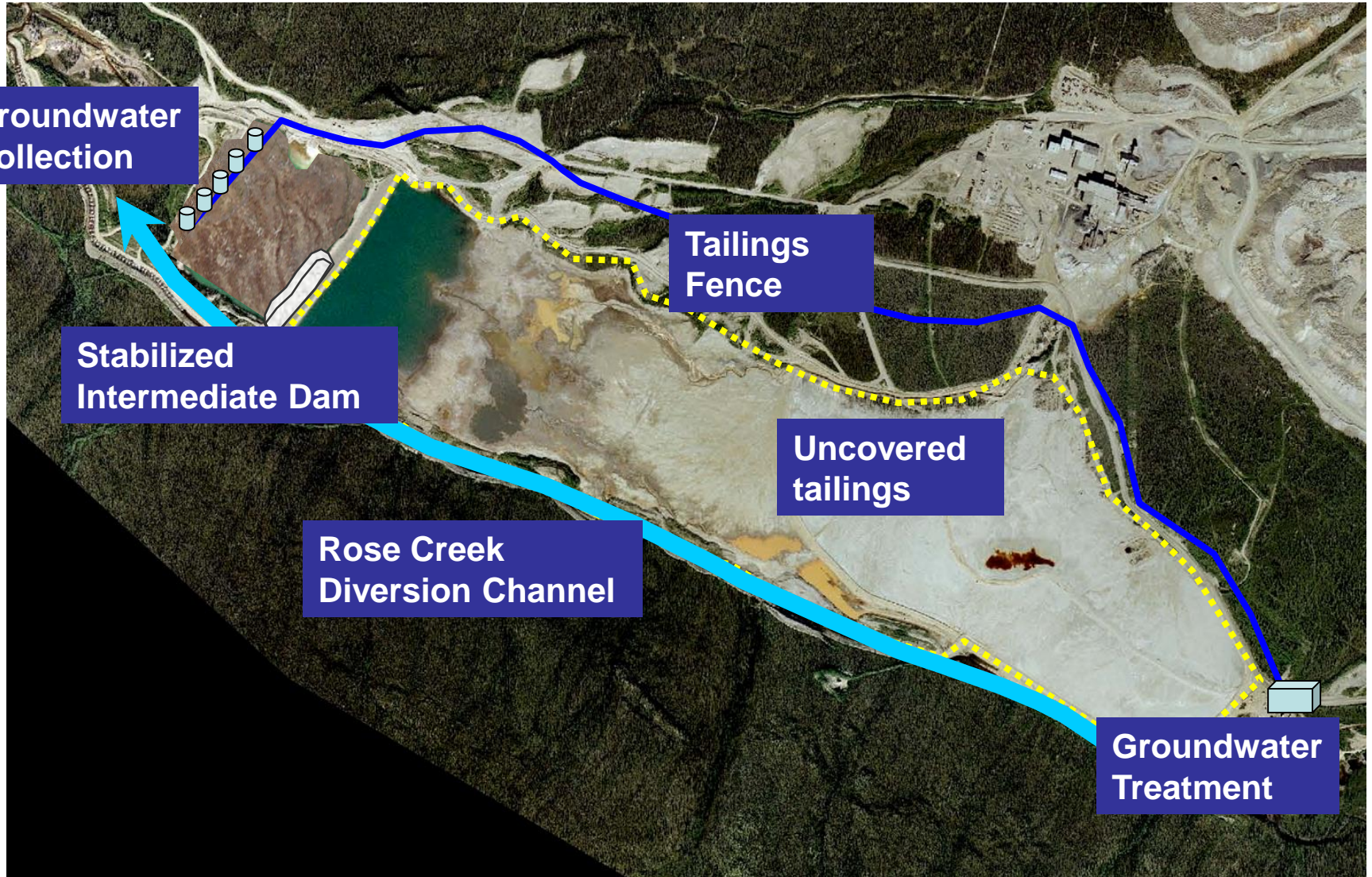
Install Groundwater Collection

Install wells in former Cross Valley Pond

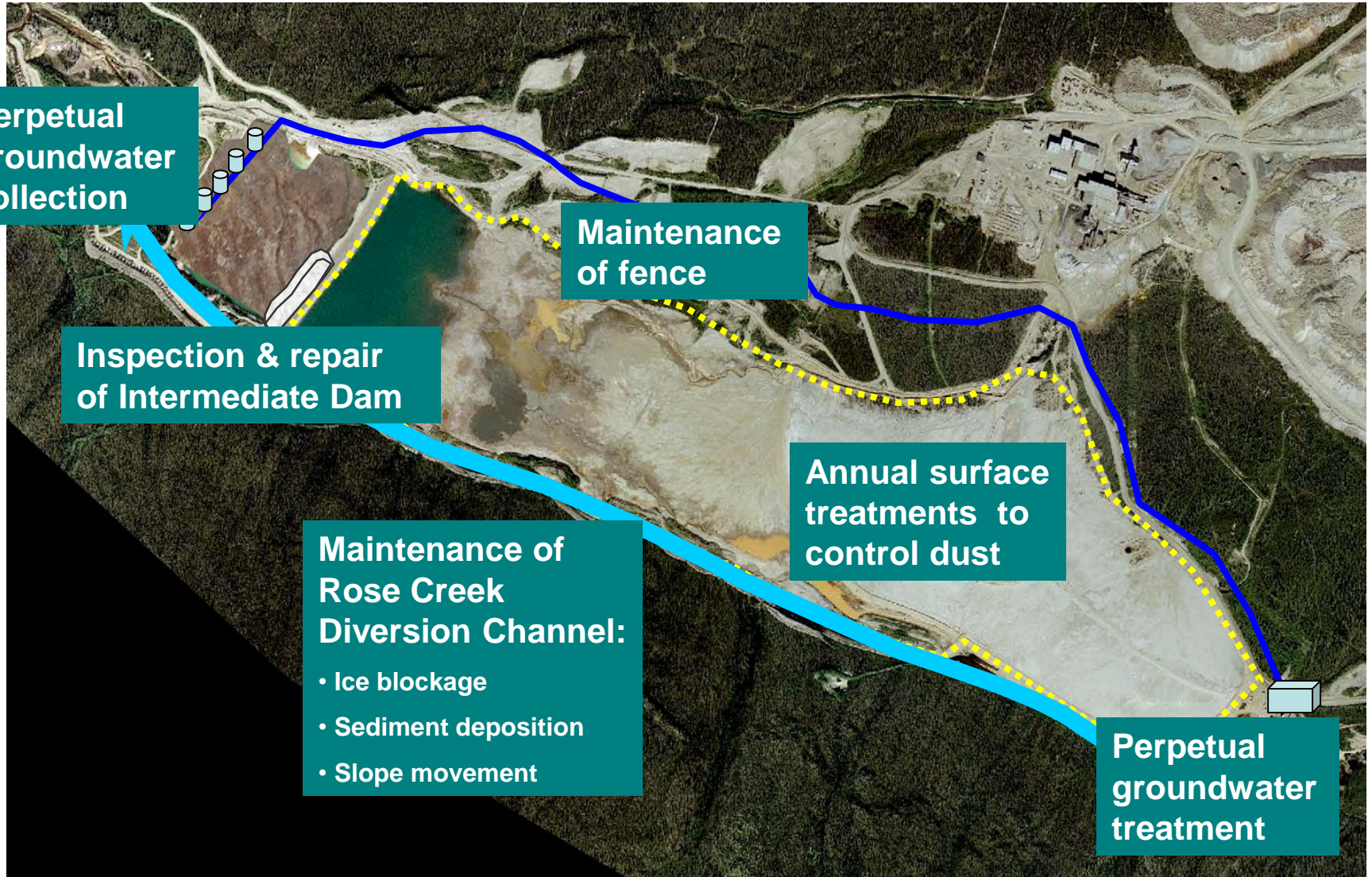
Pump water to treatment plant



Post-Closure Components



Post-Closure Requirements





Faro Mine Area Example Alternatives

- Description of Faro Mine Area
 - Major components
- Each example alternative
 - Major components
 - Long-term requirements

Faro Mine Area

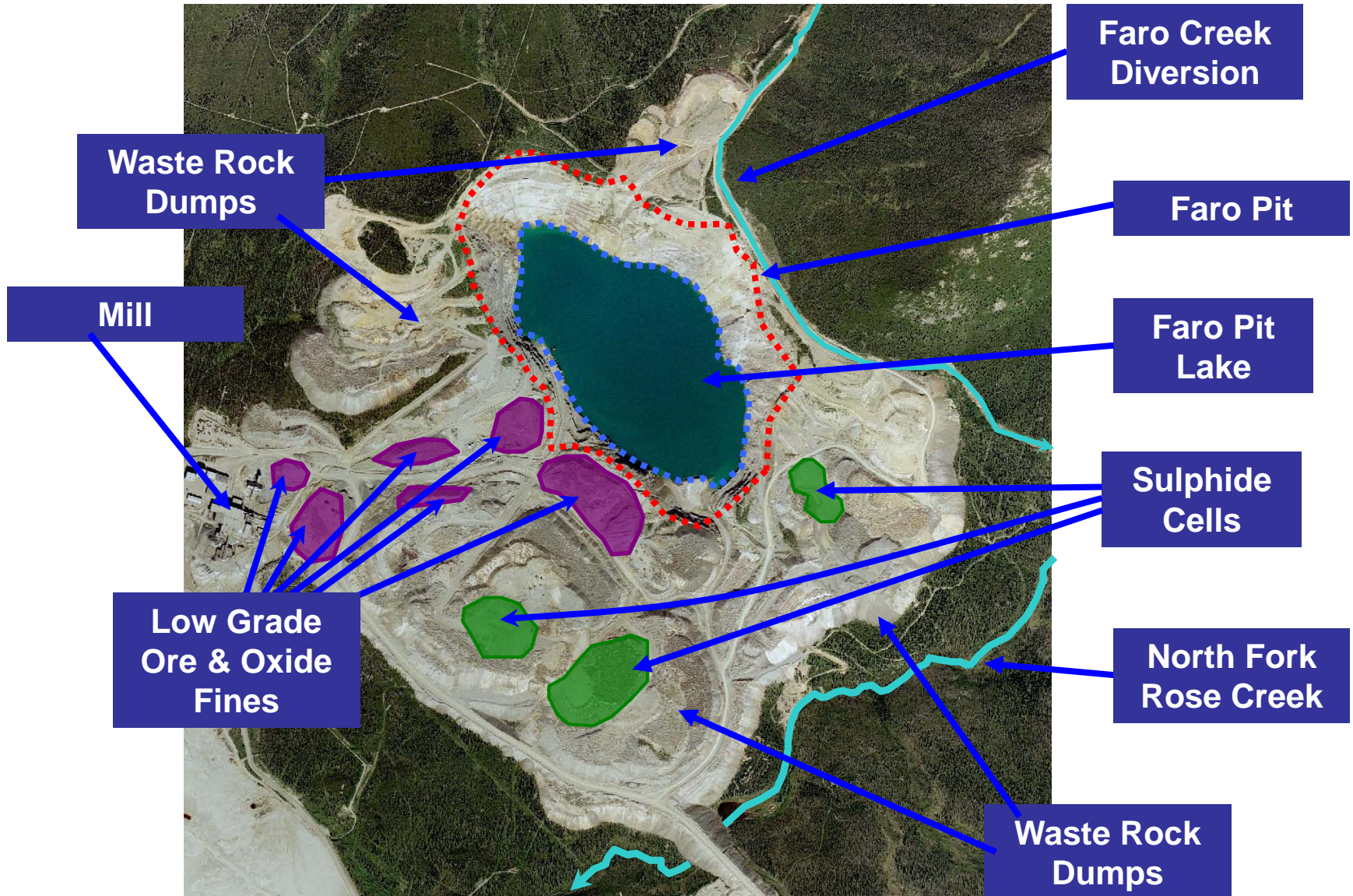


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Faro Mine Area Components



Faro Creek Diversion

Faro Creek
Diversion



Faro Pit & Pit Lake

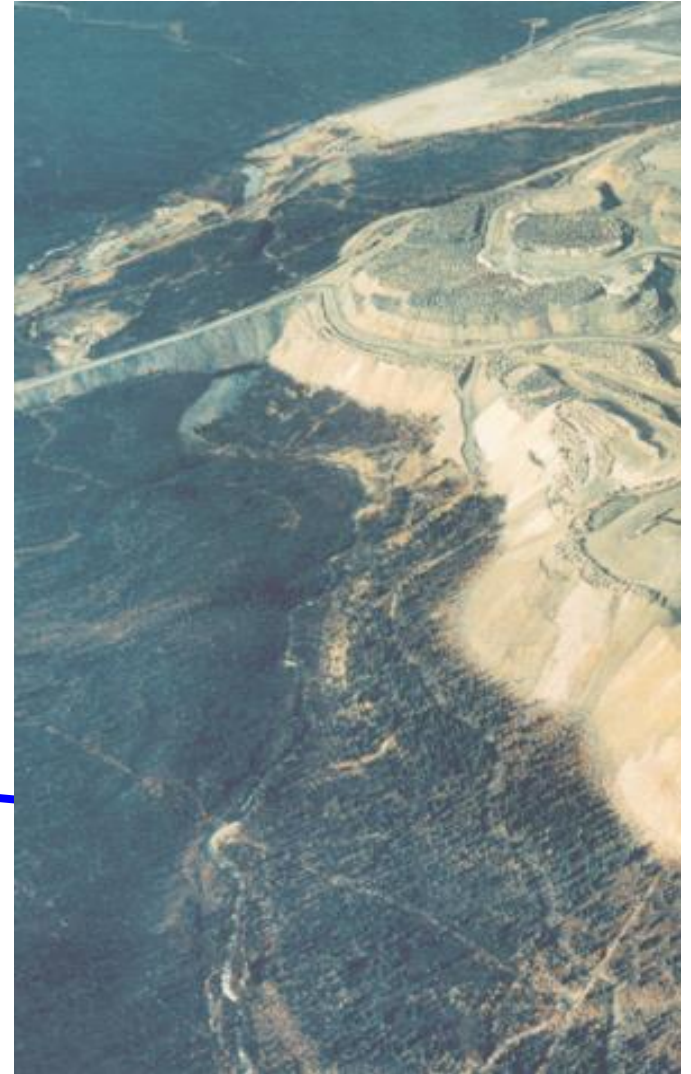


2002

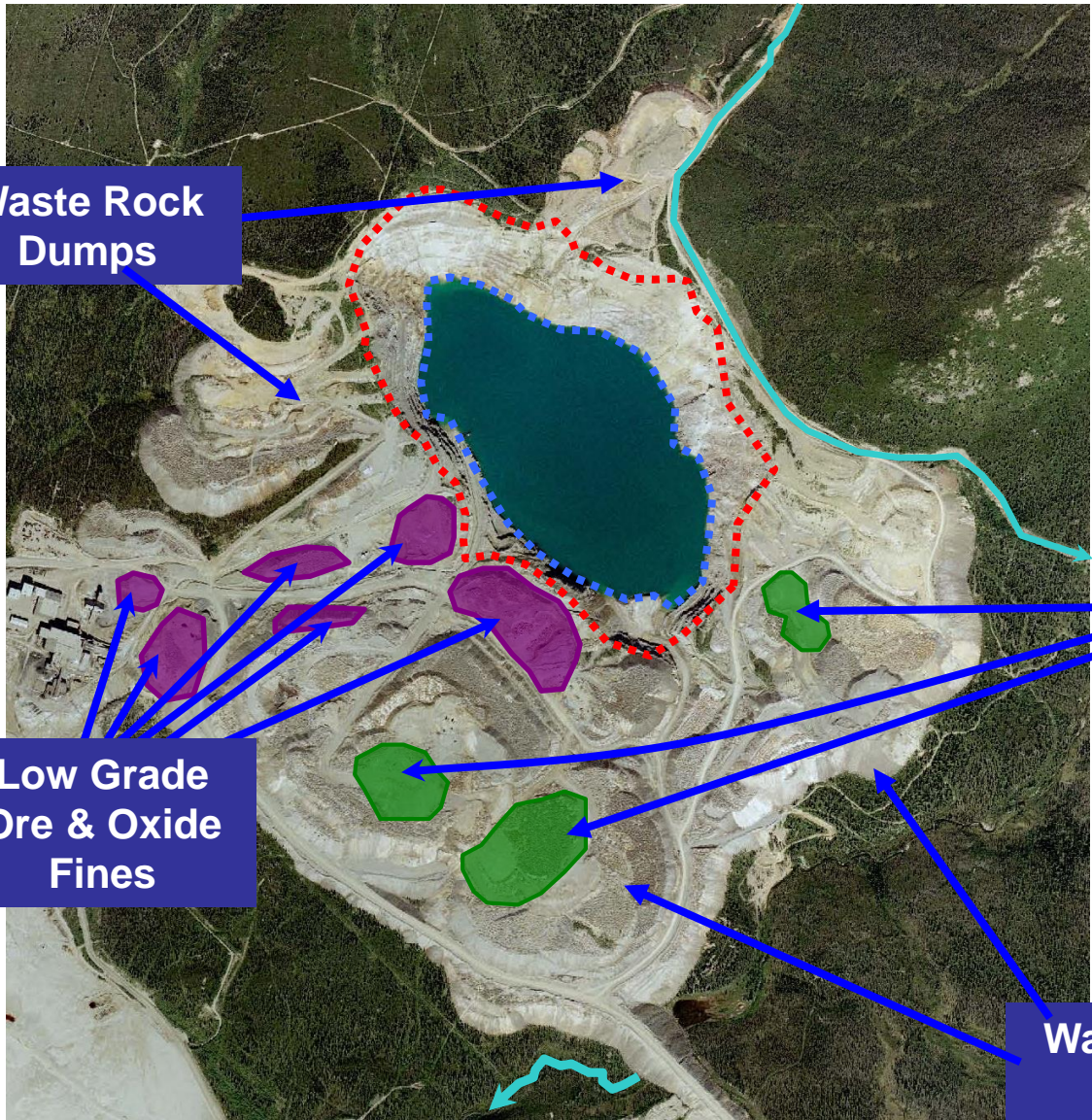
13. 7. 2002

13. 7. 2002

North Fork Rose Creek



Faro Rock Dumps



Waste Rock Dumps

Low Grade Ore & Oxide Fines

Sulphide Cells

Waste Rock Dumps



Faro Rock Dumps



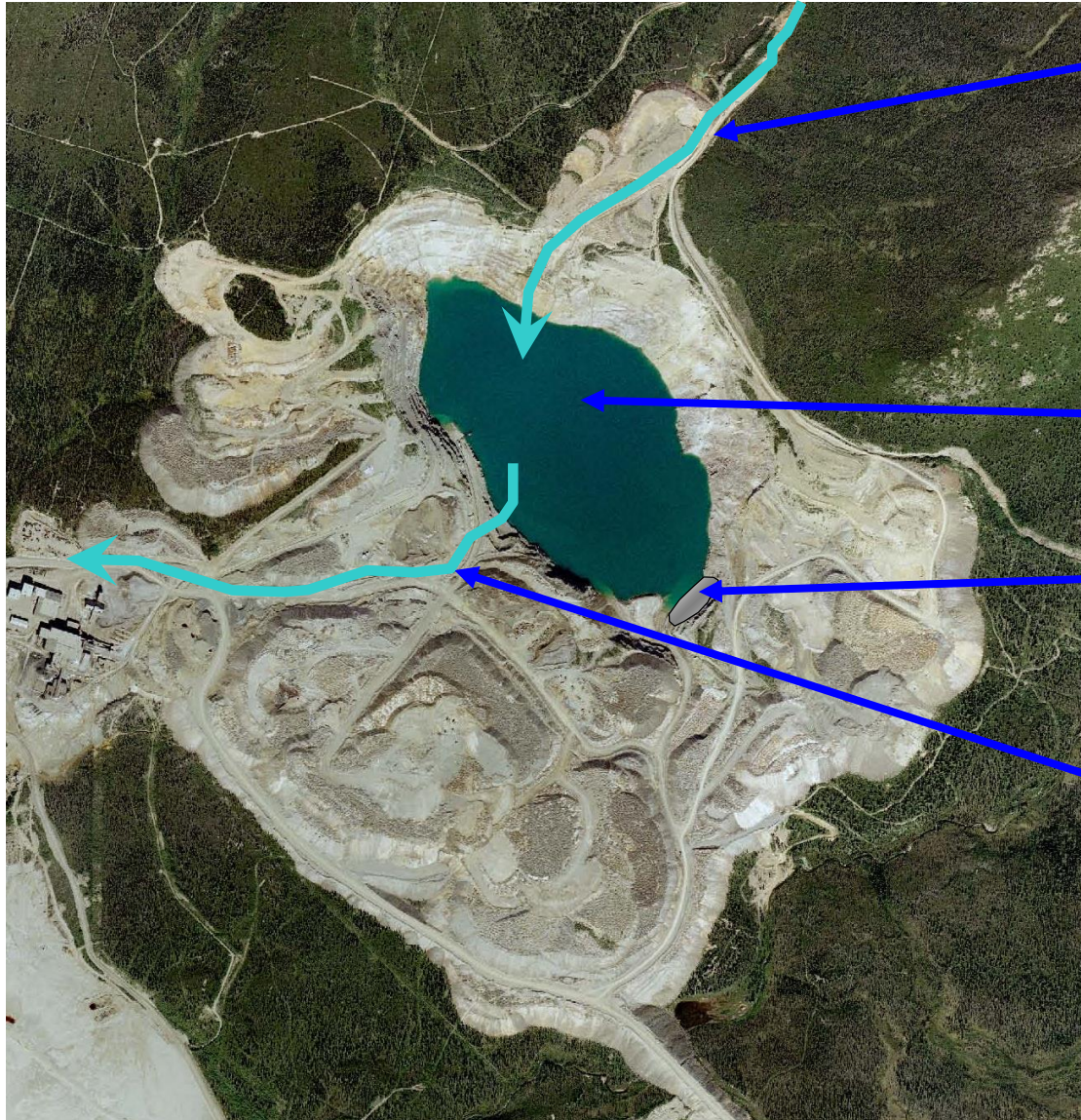


Faro Mine Area

Example Alternative 1

- “Flow-Through Pit”
 - Route Faro Creek into Faro Pit
 - Treat pit water using biological methods
 - Pump treated water out each summer
 - Cover all rock dumps
 - Install groundwater collection systems below dumps
 - Collect groundwater and pump it back to pit for biological treatment

“Flow-Through Pit” & Biological Treatment



Re-route Faro Creek into pit

Add phosphate to stimulate biological removal of zinc

Construct plug dam to raise water level

Pump treated water out of pit each July-August-September

Low Grade Ore & Oxide Fines



Consolidate to larger areas

Cover consolidated piles with very low infiltration cover



1.0 m Till Soil



HDPE membrane



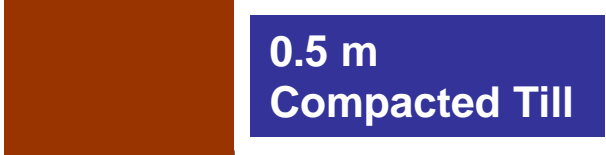
Rock

Or relocate all low grade ore and oxide fines to pit

Sulphide Cells



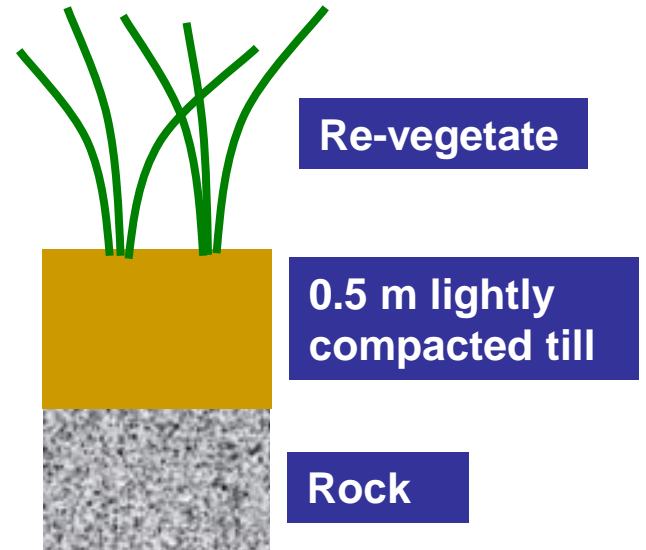
Cover sulphide cells with low infiltration cover



Other Waste Dumps



Reslope and cover all other waste rock with rudimentary reclamation cover



Groundwater Collection



Pump all collected groundwater to pit

Install groundwater collection systems below waste dumps

Breach rock drain and place North Fork Rose Creek in elevated channel

Post-Closure Requirements



Water management

- Pump contaminated groundwater to pit year-round
- Add phosphate and monitor treatment each year
- Pump treated water out each summer

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches
- Inspect, maintain and repair Rose Creek elevated channel dam
- Inspect and maintain plug dam

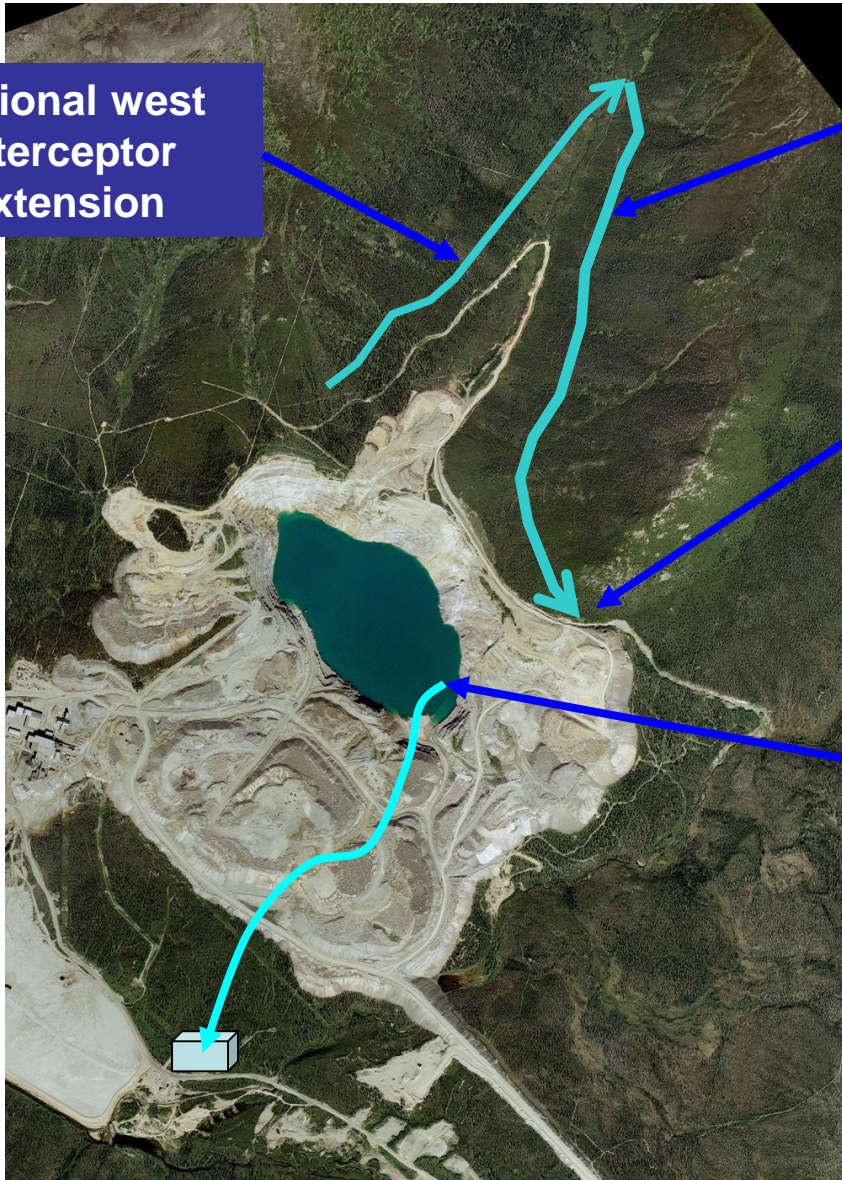


Faro Mine Area

Example Alternative 2

- “Upgrade Faro Creek Diversion”
 - Upgrade Faro Creek Diversion
 - Treat pit water in a new treatment plant
 - Cover all rock dumps
 - Install groundwater collection systems below dumps
 - Treat groundwater and excess pit water in new treatment plant

Upgrade Diversion



Optional west
interceptor
extension

Construct new diversion
upstream of current Faro
Creek Diversion

Discharge clean water into
the present diversion north of
the Northeast Waste Dump

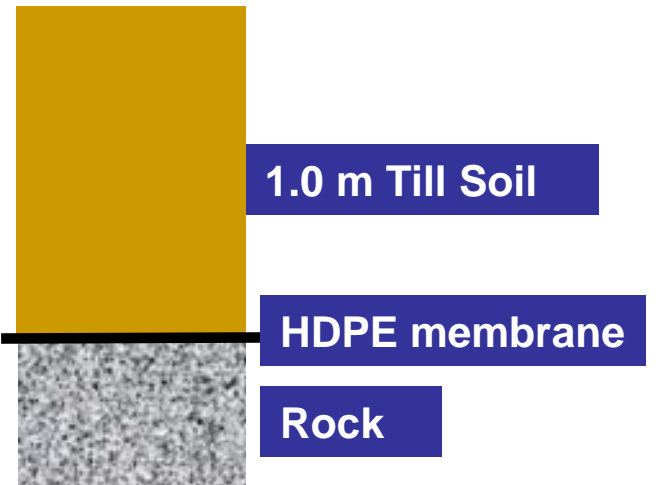
Pump excess water to
treatment plant each
summer

Low Grade Ore & Oxide Fines



1. Consolidate to larger areas

2. Cover consolidated piles with very low infiltration cover

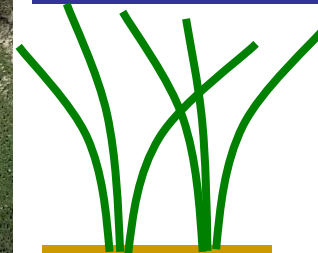


Or relocate all low grade ore and oxide fines to pit

Sulphide Cells



Cover sulphide cells with low infiltration cover and revegetate



1.5 m
Uncompacted Till



0.5 m
Compacted Till

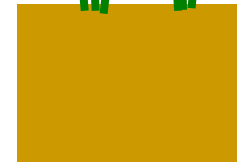
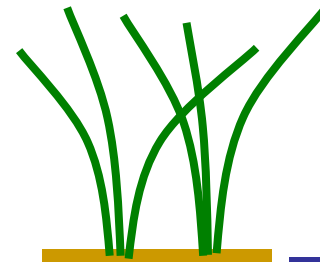


Rock

Other Waste Dumps



Reslope and cover all other waste rock with rudimentary reclamation cover and revegetate



0.5 m lightly compacted till



Rock

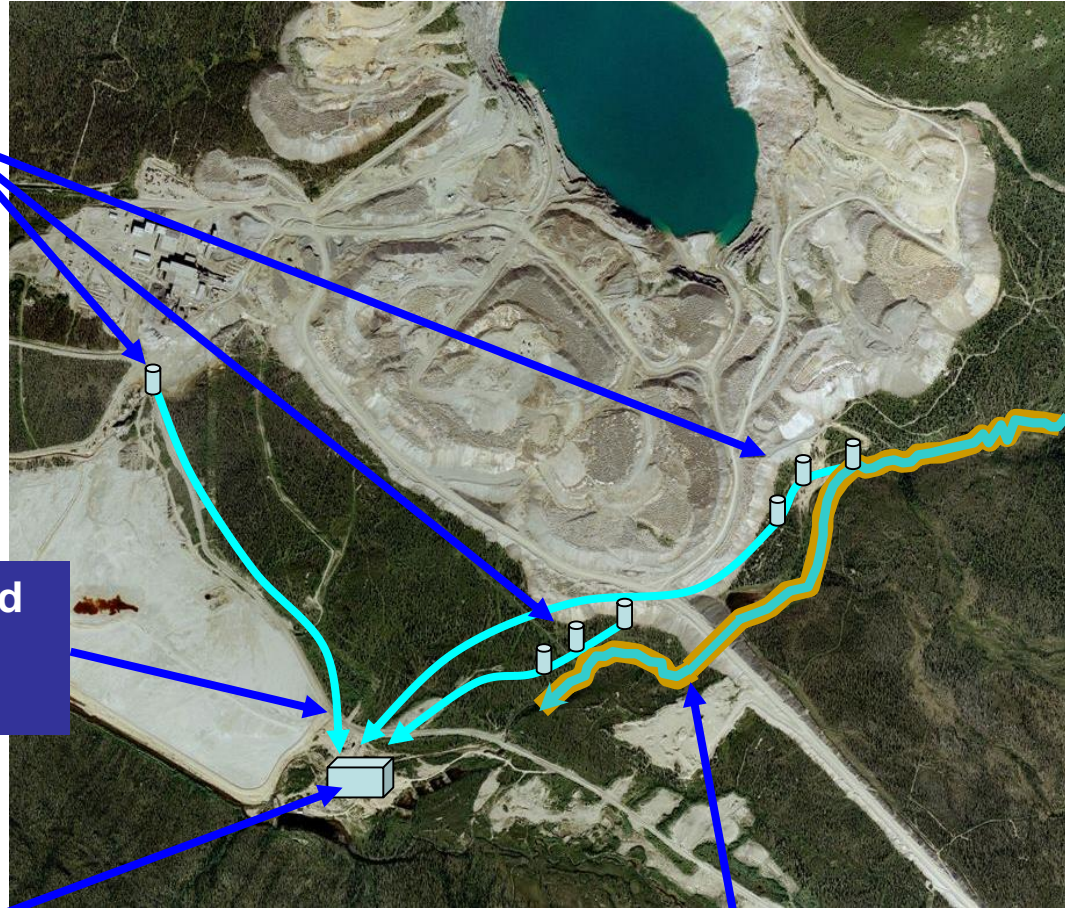
Groundwater Collection & Treatment

Install groundwater collection systems below waste dumps

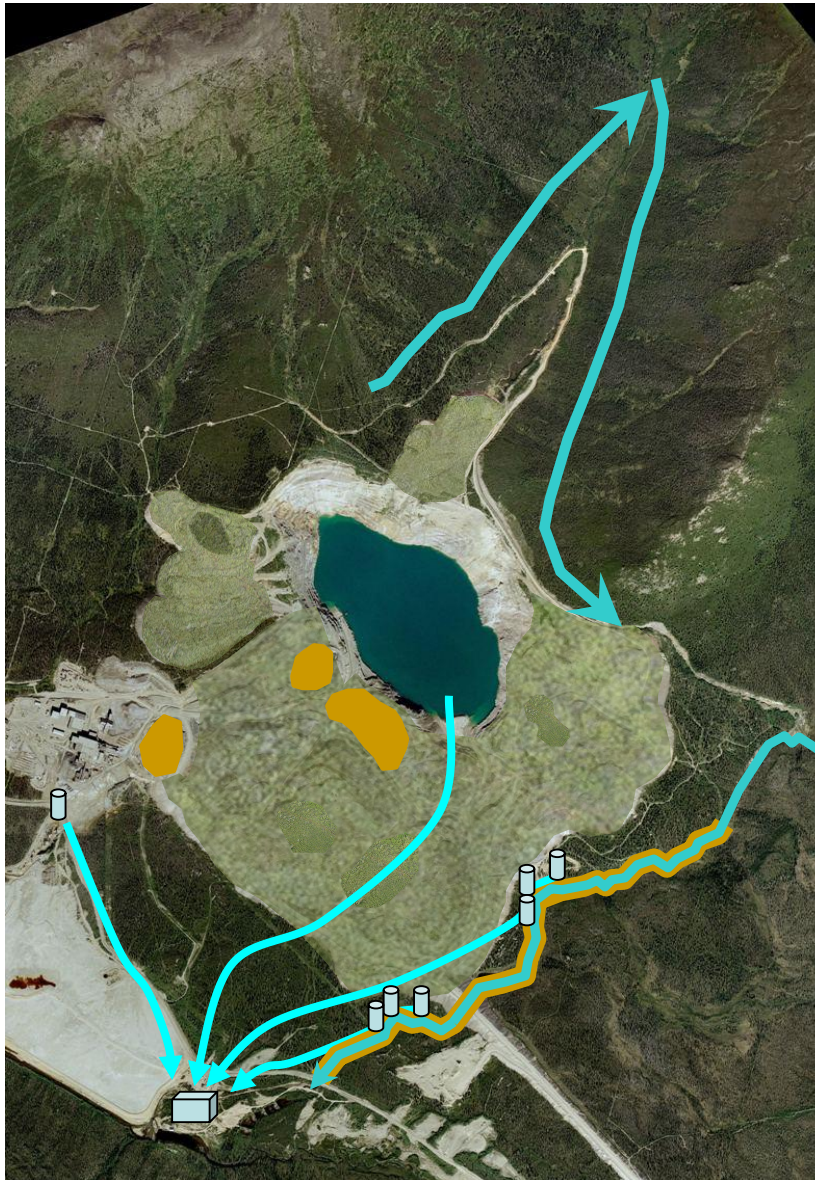
Pump all collected groundwater to treatment plant

Construct and operate High Density Sludge treatment plant

Breach rock drain and place North Fork Rose Creek in elevated channel



Post-Closure Requirements



Water management

- Pump contaminated groundwater to treatment plant year-round
- Pump additional contaminated water from pit each summer
- Operate and maintain treatment plant year-round

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches
- Inspect, maintain and repair Rose Creek elevated channel



Faro Mine Area

Example Alternative 3

- “Minimize Up-Front Construction”
 - Keep Faro Creek in its current diversion
 - Construct a water treatment plant
 - Place rudimentary cover on waste rock only where slopes are less than 2H:1V
 - Install groundwater collection systems below dumps
 - Treat groundwater and excess pit water in new treatment plant

Maintain Current Diversion



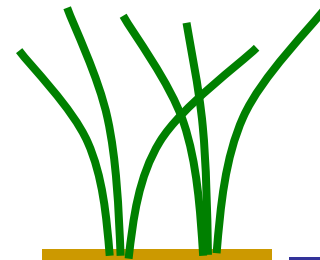
Maintain current Faro Creek diversion

Pump water out of pit and treat each summer

Waste Dumps



Place a rudimentary reclamation cover over all waste rock with a slope less than 2H:1V and revegetate



0.5 m lightly compacted till

Rock

Groundwater Collection & Treatment



Install groundwater collection systems below waste dumps

Pump all collected groundwater to treatment plant

Construct and operate High Density Sludge treatment plant

Post-Closure Requirements



Water management

- Pump contaminated groundwater to treatment plant year-round
- Pump additional water from pit for treatment each summer
- Operate and maintain treatment plant year-round

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches

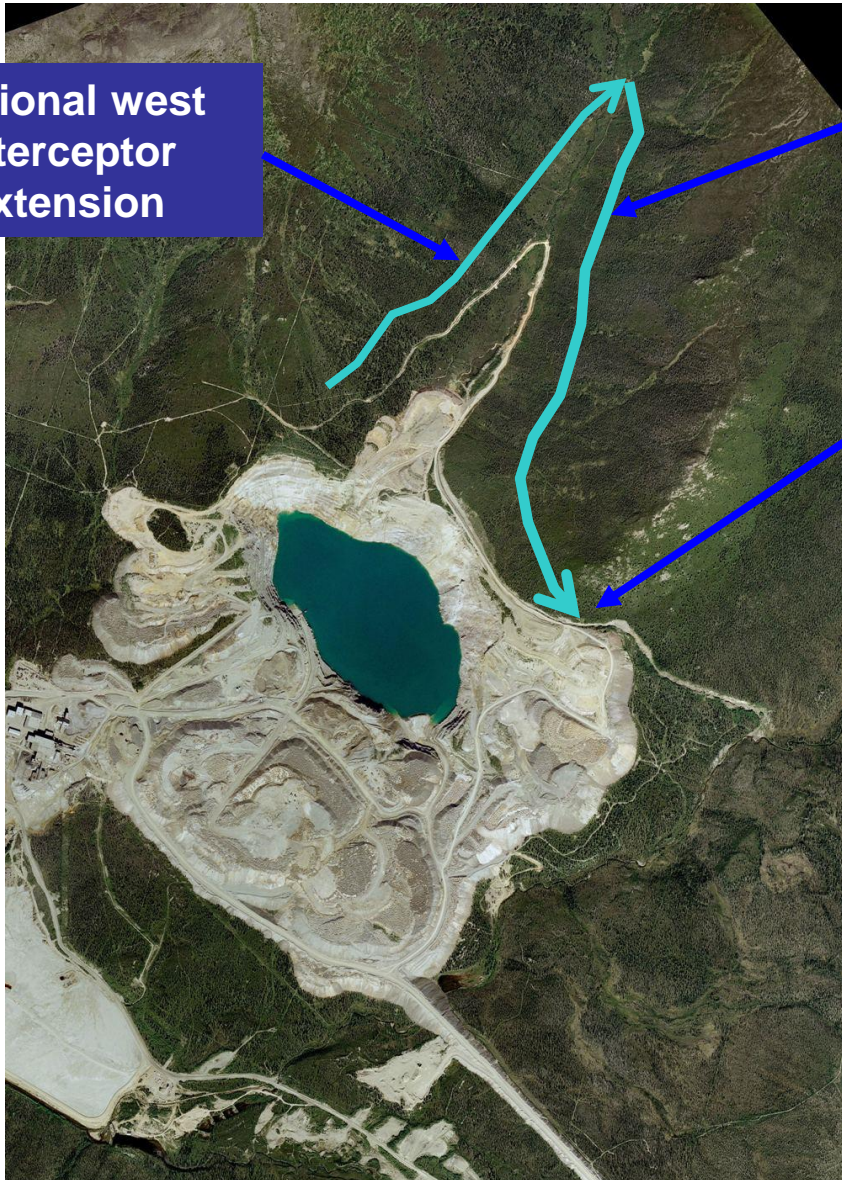


Faro Mine Area

Example Alternative 4

- “Minimize Water Treatment”
 - Upgrade Faro Creek Diversion
 - Add lime and relocate oxide fines and low grade ore to pit
 - Consolidate sulfide cells
 - Cover all rock dumps
 - Install groundwater collection systems below dumps
 - Treat groundwater and excess pit water in new treatment plant

Upgrade Diversion



Optional west
interceptor
extension

Construct new diversion
upstream of current Faro
Creek Diversion

Discharge clean water into
the present diversion north of
the Northeast Waste Dump

Low Grade Ore & Oxide Fines



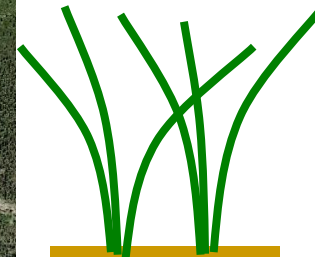
Add lime and relocate all low grade ore and oxide fines to the Faro Pit

Sulphide Cells



Consolidate East Sulphide cell to Main Sulphide Cell

Cover sulphide cells with a very low infiltration soil cover



**1.5 m
Uncompacted Till**

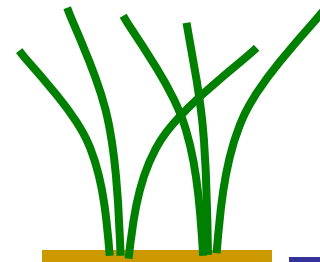
**1.0 m Compacted
Till**

Rock

Other Waste Dumps



Reslope and cover all other waste rock with a low infiltration cover



1.5 m lightly compacted till

0.5 m Compacted Till

Rock

Groundwater Collection

Install groundwater collection systems below waste dumps

Construct and operate High Density Sludge treatment plant

Pump all collected groundwater to treatment plant

Breach rock drain and place North Fork Rose Creek in elevated channel



Post-Closure Requirements



Water management

- Pump contaminated groundwater to treatment plant year-round
- Pump additional water from pit for treatment each summer
- Operate and maintain treatment plant year-round

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches
- Inspect, maintain and repair Rose Creek elevated channel



Vangorda/Grum Mine Area Example Alternatives

- Description of Vangorda/Grum Area
 - Major components
- Each example alternative
 - Major components
 - Long-term requirements

Vangorda/Grum Area



Grum Pit &
Pit Lake

Till Dump

Grum
Waste Rock

Grum
Sulphide
Cell

Vangorda
Creek
Diversion

Vangorda Pit
& Pit Lake

Vangorda
Waste Rock

Vangorda Creek Diversion



Vangorda Pit



Vangorda Waste Rock Dump



Grum Pit



Till Dump



Grum Dump



Grum
Dump

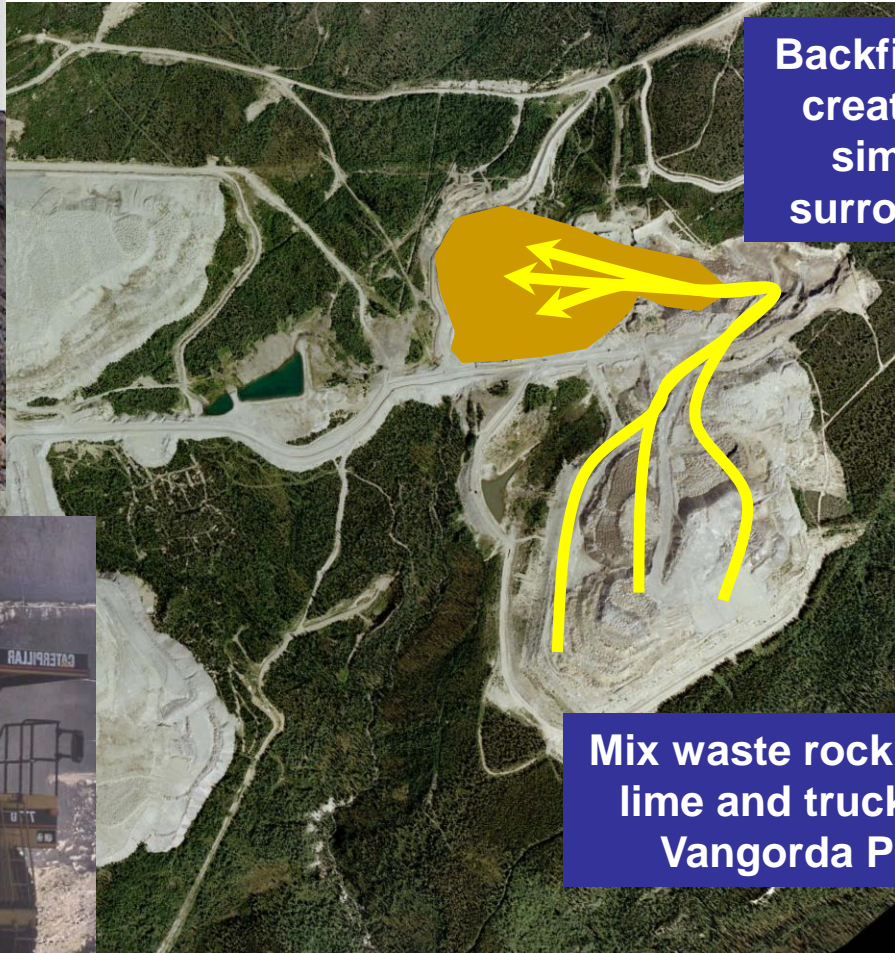




Vangorda/Grum Area Example Alternative 1

- “Backfill Vangorda Pit”
 - Relocate Vangorda Waste Rock into Vangorda Pit
 - Add lime to rock during relocation to neutralize acidity
 - Route Vangorda Creek over backfilled pit
 - Cover Grum Waste Rock & Sulphide Cell
 - Install groundwater collection systems below Grum dumps
 - Collect groundwater and pump it back to Grum pit for biological treatment

Backfill Vangorda Pit



Backfill pit and create slope similar to surroundings



Mix waste rock with lime and truck to Vangorda Pit

Re-Build Vangorda Creek Diversion

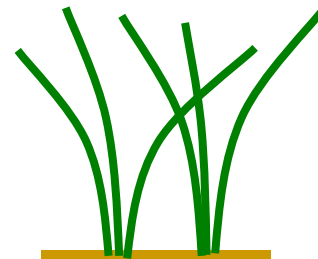


Re-route Vangorda
Creek in new channel
over backfilled pit

Grum Sulphide Cell



Cover sulphide cells with low infiltration cover



1.5 m
Uncompacted Till

0.5 m
Compacted Till

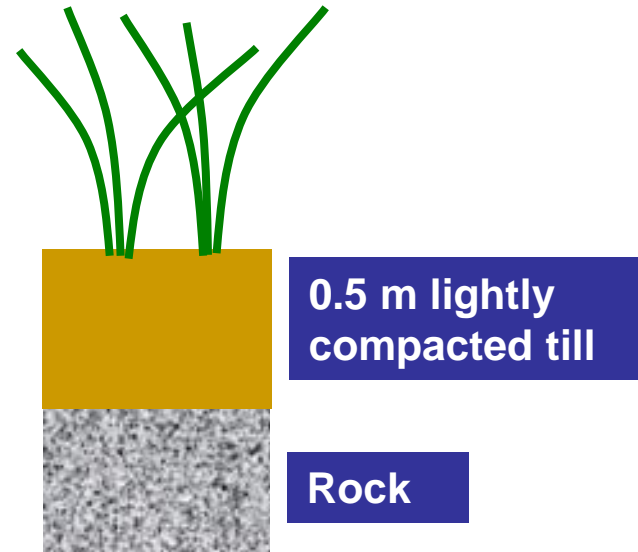
Rock



Grum Waste Rock



Reslope and cover all other waste rock with rudimentary reclamation cover



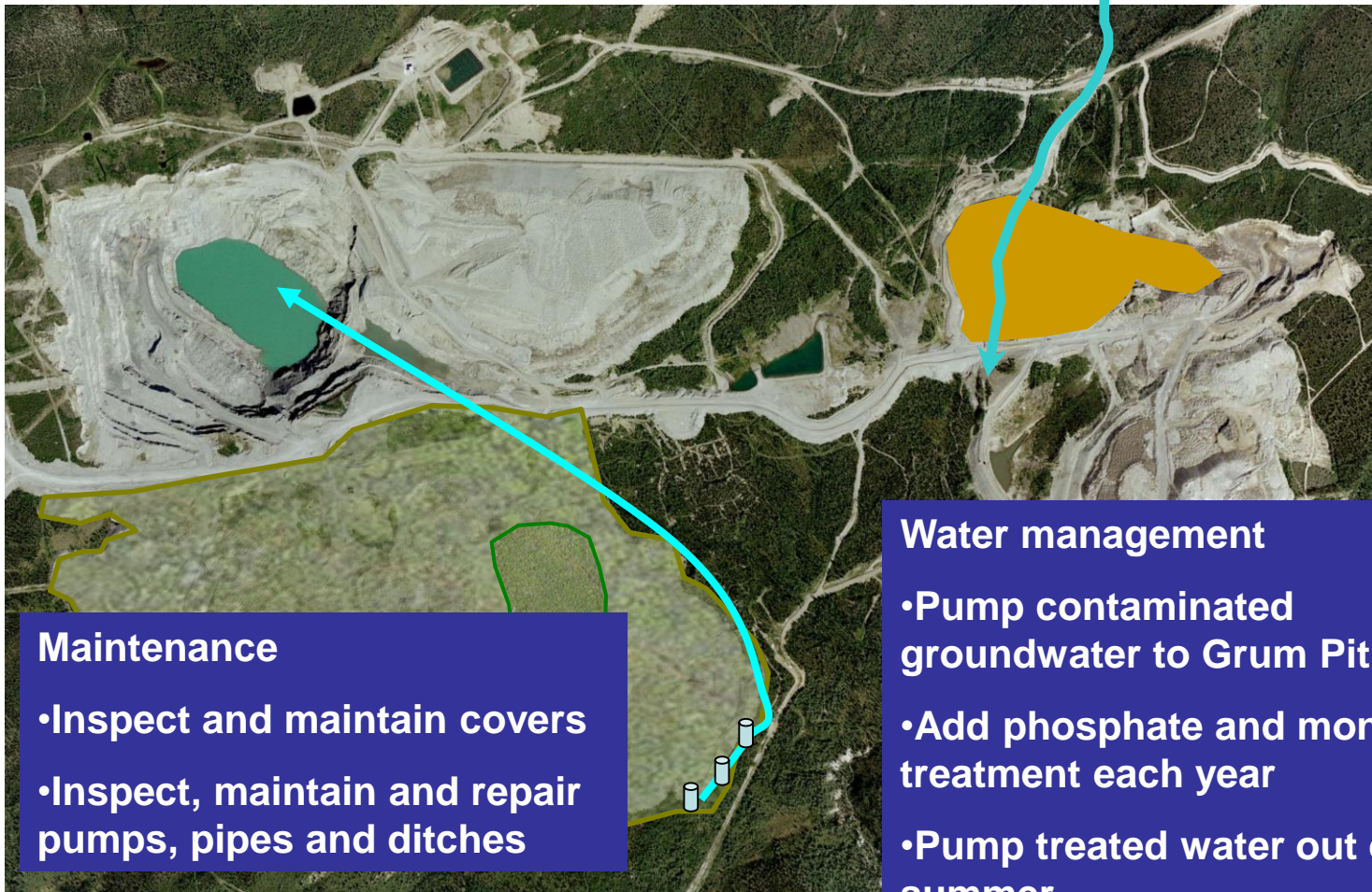
Groundwater Collection & Treatment



Pump collected groundwater to Grum Pit for biological treatment

Install groundwater collection along toe of Grum Dump

Post-Closure Requirements



Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches

Water management

- Pump contaminated groundwater to Grum Pit
- Add phosphate and monitor treatment each year
- Pump treated water out each summer



Vangorda/Grum Area Example Alternative 2

- “Stabilize in Place”
 - Construct a new water treatment plant
 - Route Vangorda Creek north of pit in an upgraded channel
 - Cover Vangorda and Grum Waste Rock & Sulphide Cell
 - Install groundwater collection systems below Grum dumps
 - Collect water below Vangorda dump
 - Collect groundwater and pump it back to Vangorda Pit

Upgrade Vangorda Creek Diversion



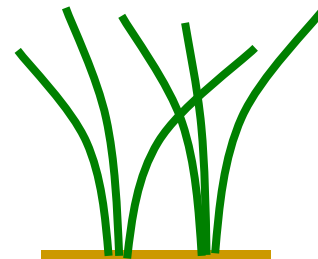
**Re-route Vangorda Creek
North of pit in new re-
aligned, deepened channel**

**Discharge clean water into
Vangorda Creek**

Grum Sulphide Cell



Cover sulphide cells with low infiltration cover



1.5 m
Uncompacted Till

0.5 m
Compacted Till

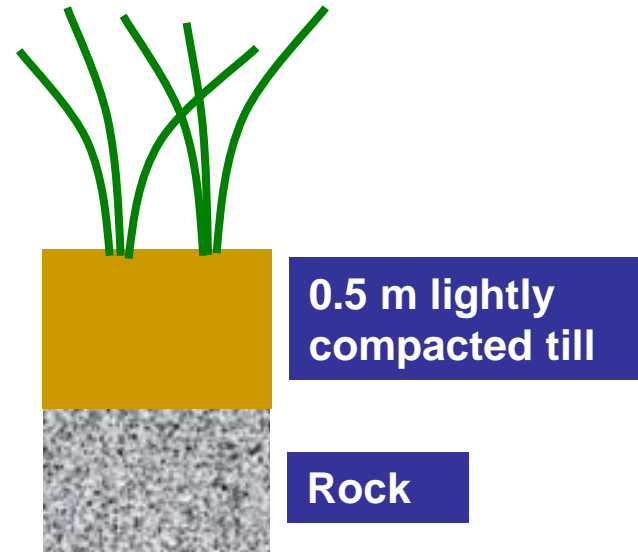
Rock



Grum Waste Rock

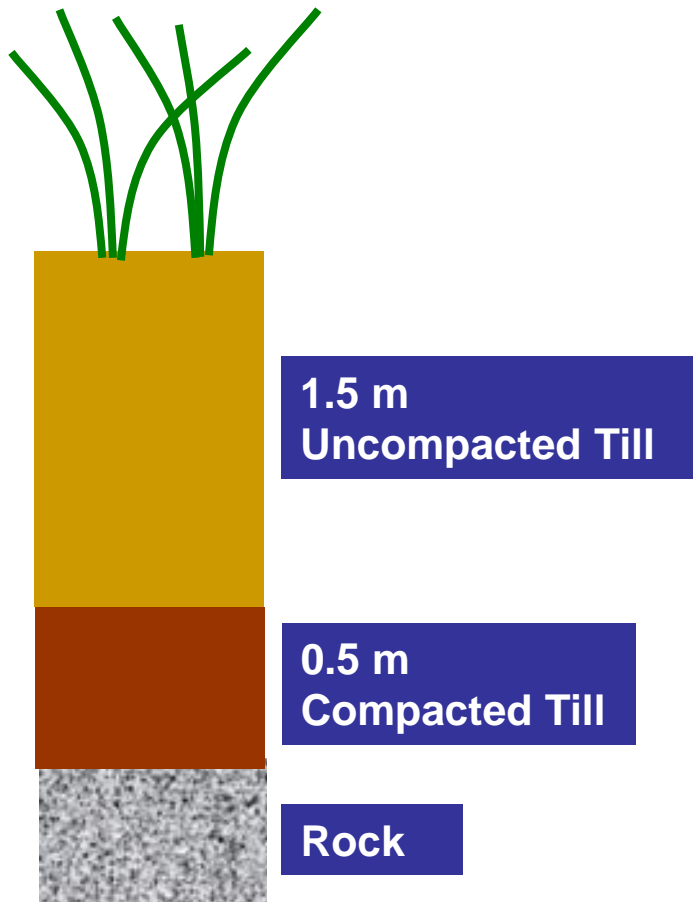


Reslope and cover all other waste rock with rudimentary reclamation cover

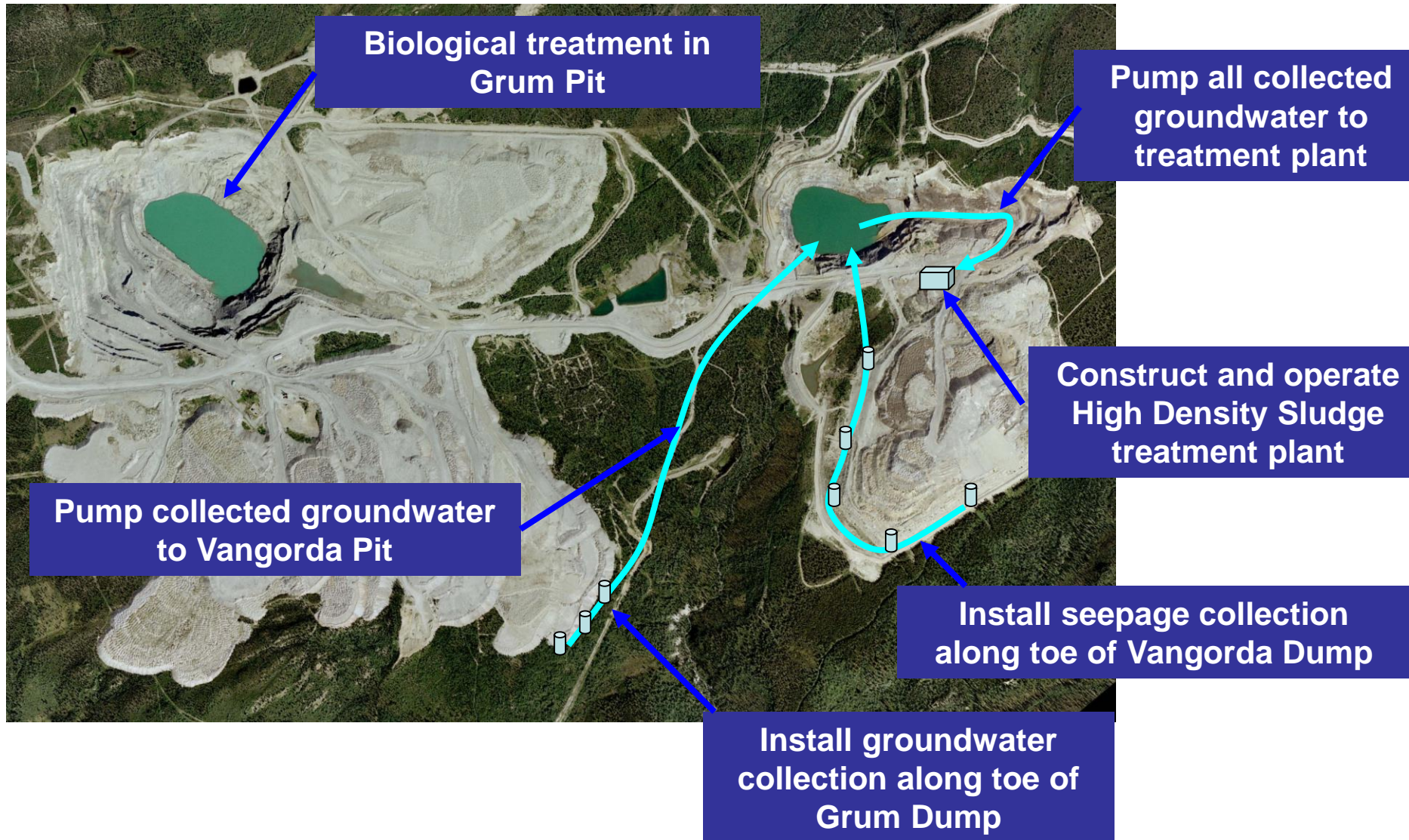


Vangorda Waste Rock

Reslope and cover waste rock with
low infiltration cover



Groundwater Collection & Treatment



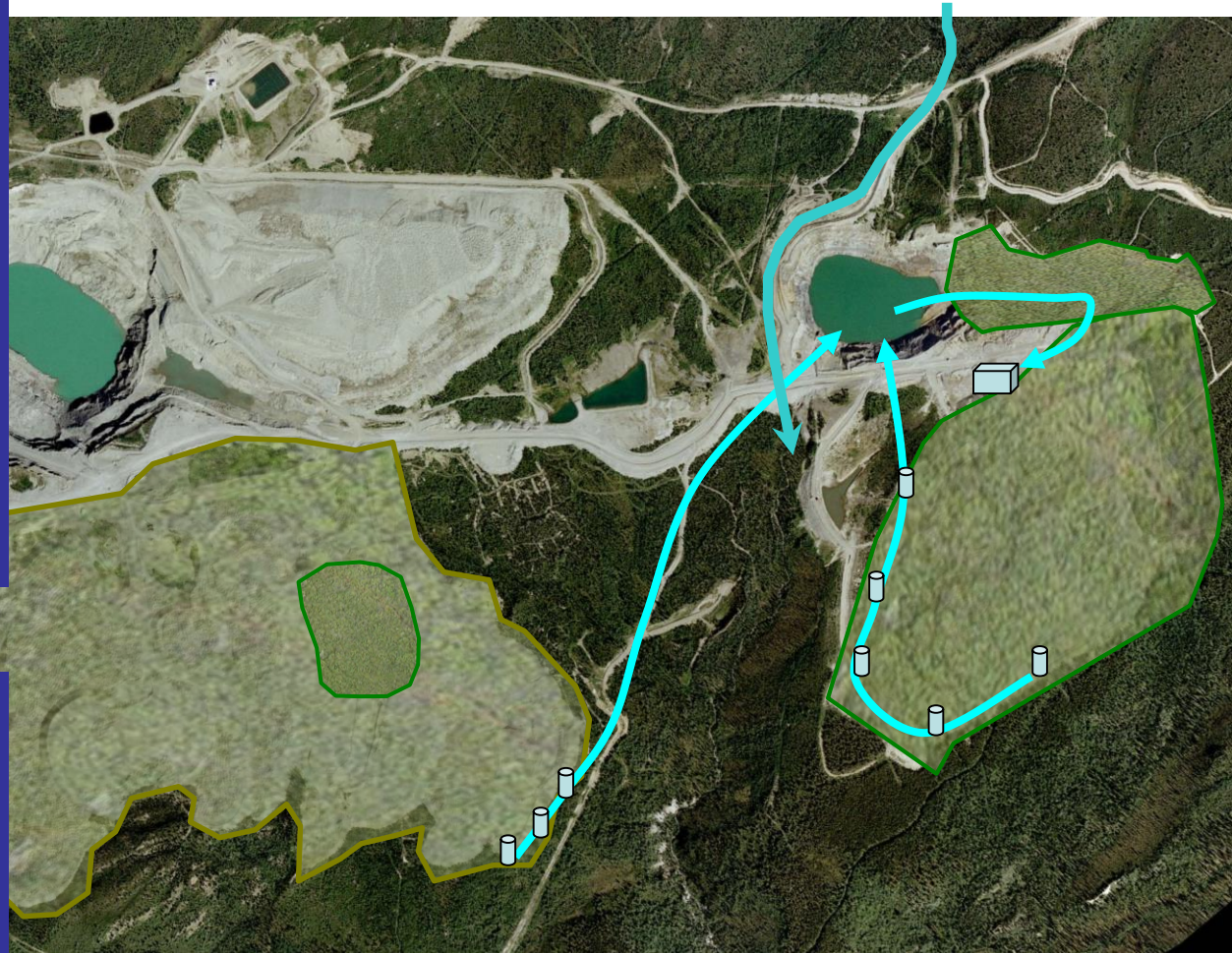
Post-Closure Requirements

Water management

- Pump contaminated groundwater to Vangorda Pit
- Grum Pit: Add phosphate, monitor treatment and pump treated water out each year
- Operate and maintain treatment plant

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches





Vangorda/Grum Area Example Alternative 3

- “Minimize Up-Front Construction”
 - Construct a new water treatment plant
 - Construct minor upgrades to current Vangorda Creek Diversion
 - Place rudimentary cover on Vangorda Waste Rock
 - Install groundwater collection systems below Grum dumps
 - Collect water below Vangorda Dump
 - Collect groundwater and pump it back to Vangorda Pit

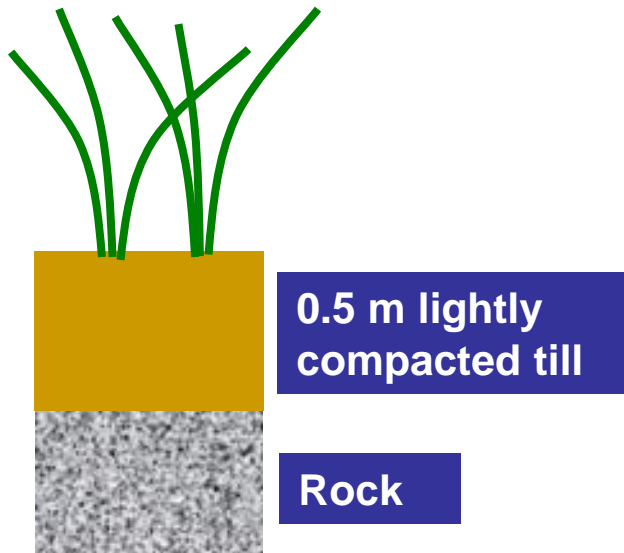
Vangorda Creek Diversion



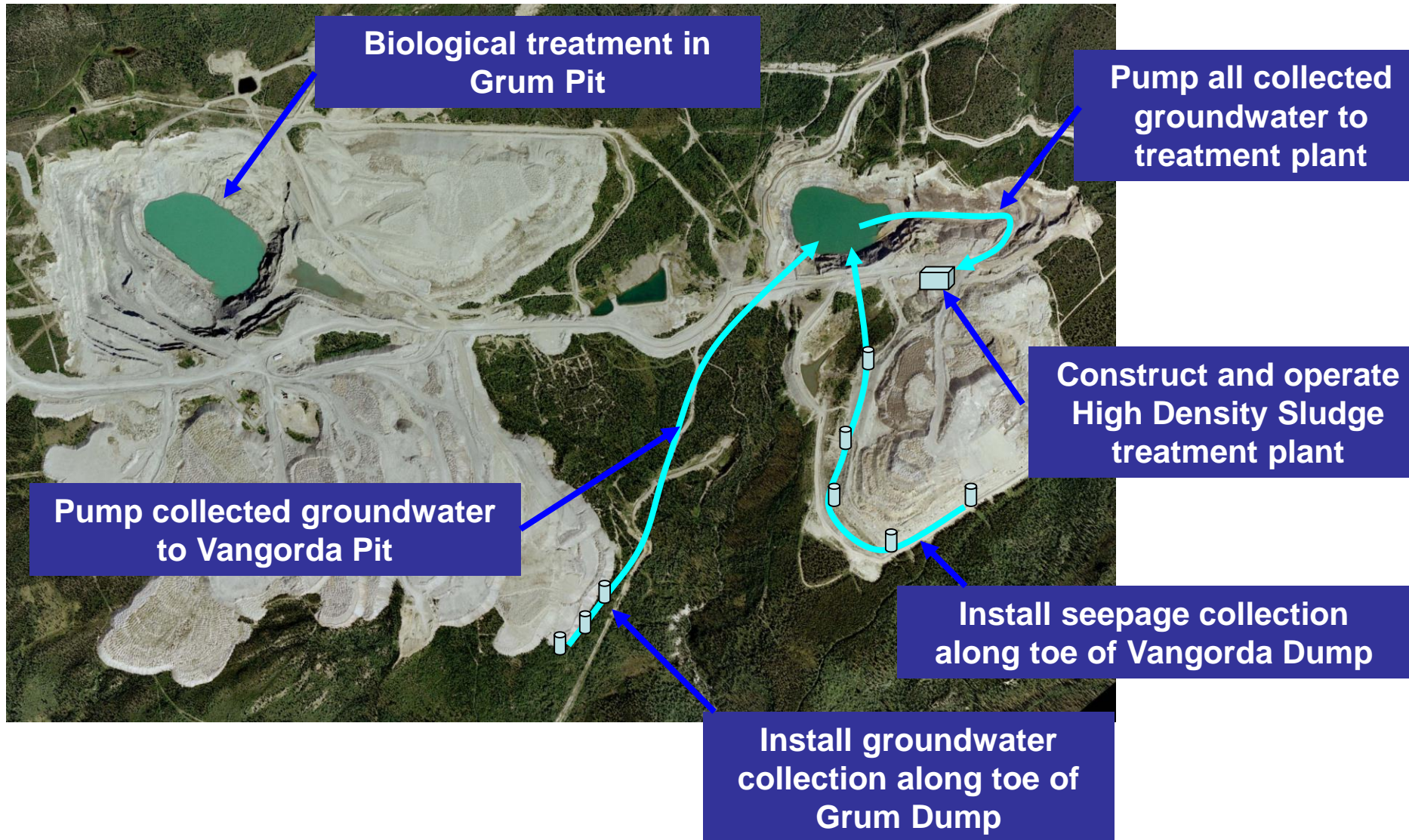
Minor upgrades to Vangorda
Creek in current alignment

Vangorda Waste Rock

Reslope and cover waste rock with rudimentary cover



Groundwater Collection & Treatment



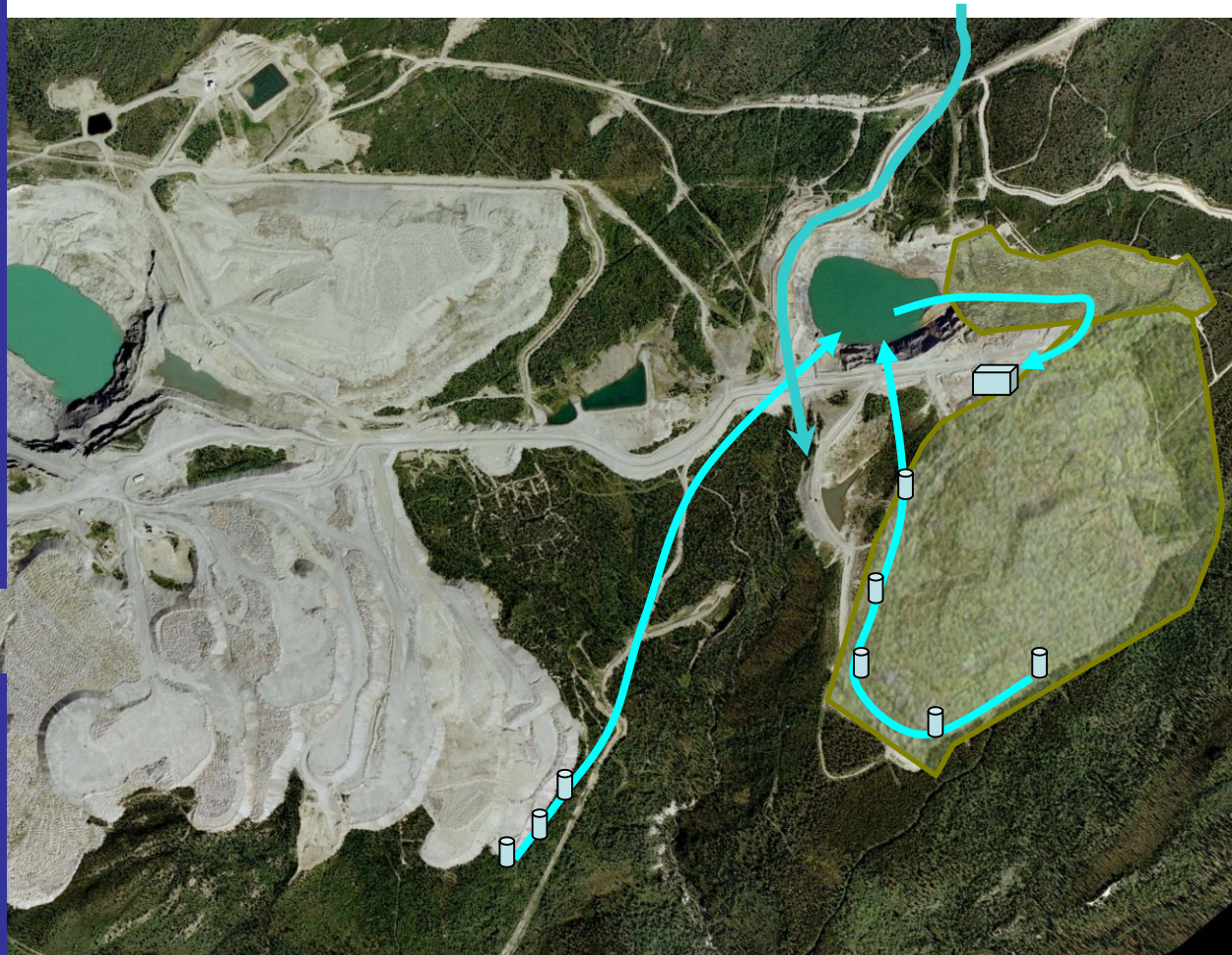
Post-Closure Requirements

Water management

- Pump contaminated groundwater to Vangorda Pit
- Grum Pit: Add phosphate, monitor treatment and pump treated water out each year
- Operate and maintain treatment plant year-round

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches

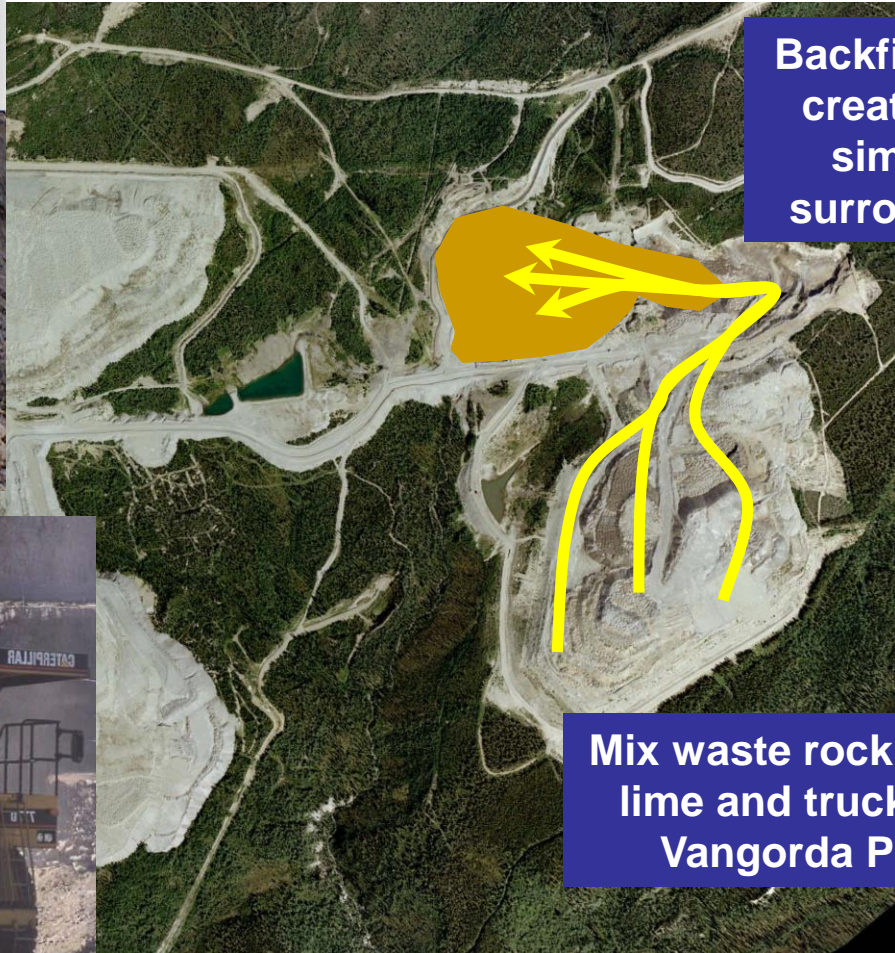




Vangorda/Grum Area Example Alternative 4

- “Minimize Water Treatment”
 - Relocate Vangorda Waste Rock into Vangorda Pit
 - Add lime to rock during relocation to neutralize acidity
 - Route Vangorda Creek over backfilled pit
 - Cover Grum Waste Rock & Sulphide Cell with low infiltration covers
 - Install groundwater collection systems below Grum dumps
 - Collect groundwater and pump it back to Grum pit for biological treatment

Backfill Vangorda Pit



Backfill pit and create slope similar to surroundings



Mix waste rock with lime and truck to Vangorda Pit

Re-Build Vangorda Creek Diversion

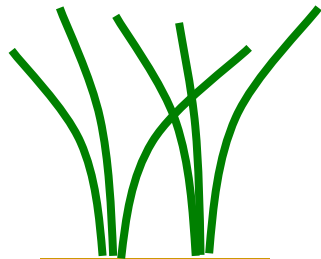


Re-route Vangorda Creek in new channel over backfilled pit

Grum Sulphide Cell



Cover sulphide cells with very low infiltration cover



1.5 m
Uncompacted Till

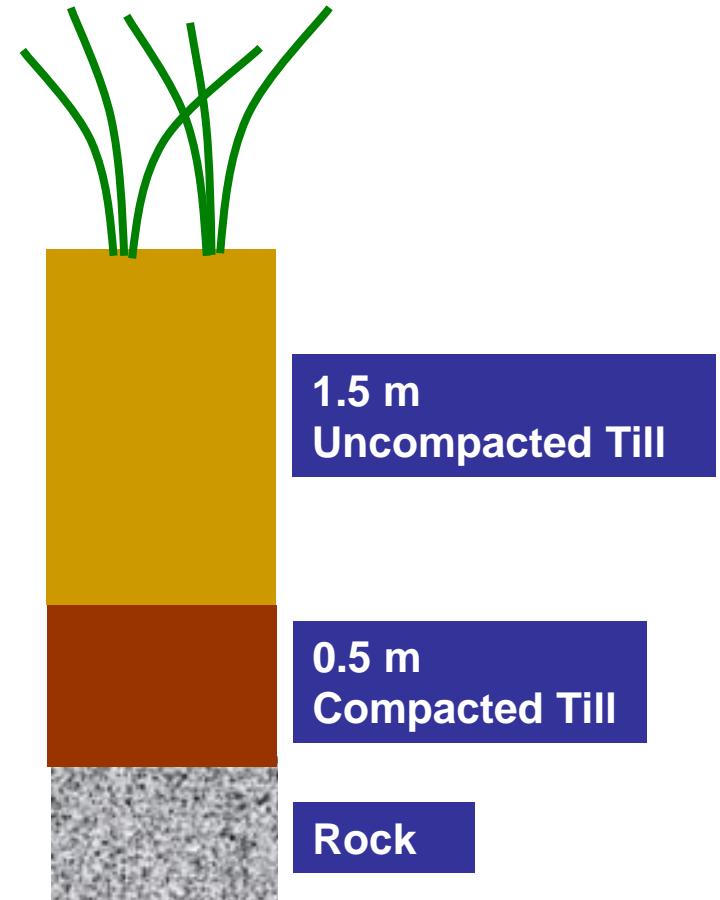
1.0 m
Compacted Till

Rock

Grum Waste Rock



Reslope and cover all other waste rock with low infiltration cover



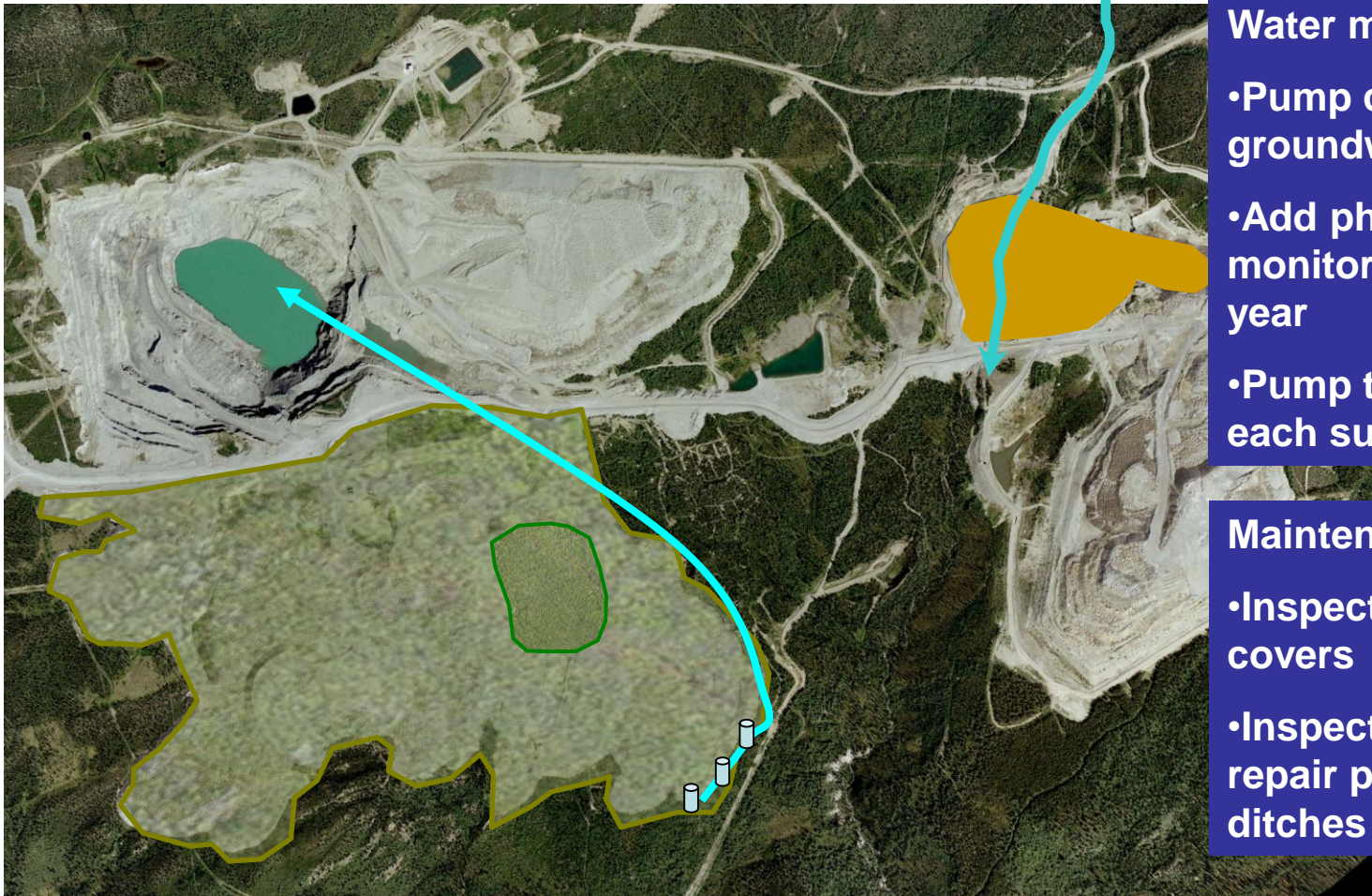
Groundwater Collection & Treatment



Pump collected groundwater to Grum Pit for biological treatment

Install groundwater collection along toe of Grum Dump

Post-Closure Requirements



Water management

- Pump contaminated groundwater to Grum Pit
- Add phosphate and monitor treatment each year
- Pump treated water out each summer

Maintenance

- Inspect and maintain covers
- Inspect, maintain and repair pumps, pipes and ditches



Summary

- Four example alternatives for each area
- Information sharing & feedback
 - Three meetings
 - This meeting
 - Introduce alternatives
 - Next two meetings
 - Review alternatives and provide more details
 - Costs, Risks, Socio-economics
 - Ask for more feedback

END

