

Lessons from Feasibility and Conceptual Design Studies for a Potential Groundwater Underdrain Remedy

*Nelson Tunnel / Commodore Waste Rock Superfund Site
Colorado*



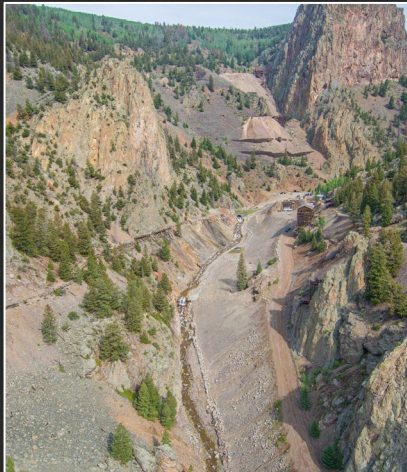
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DCHWS West 2025



January 26 – January 28, 2026

AGENDA

January 27, 2026



01

Site Setting and
Background



02

Conceptual Site
Model



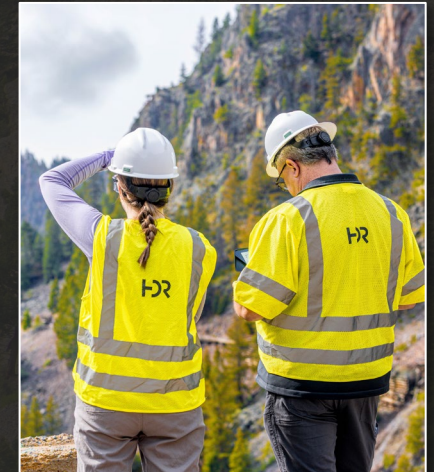
03

Feasibility Study
Purpose and
Design



04

Implementation and
Results



05

Findings and
Lessons Learned



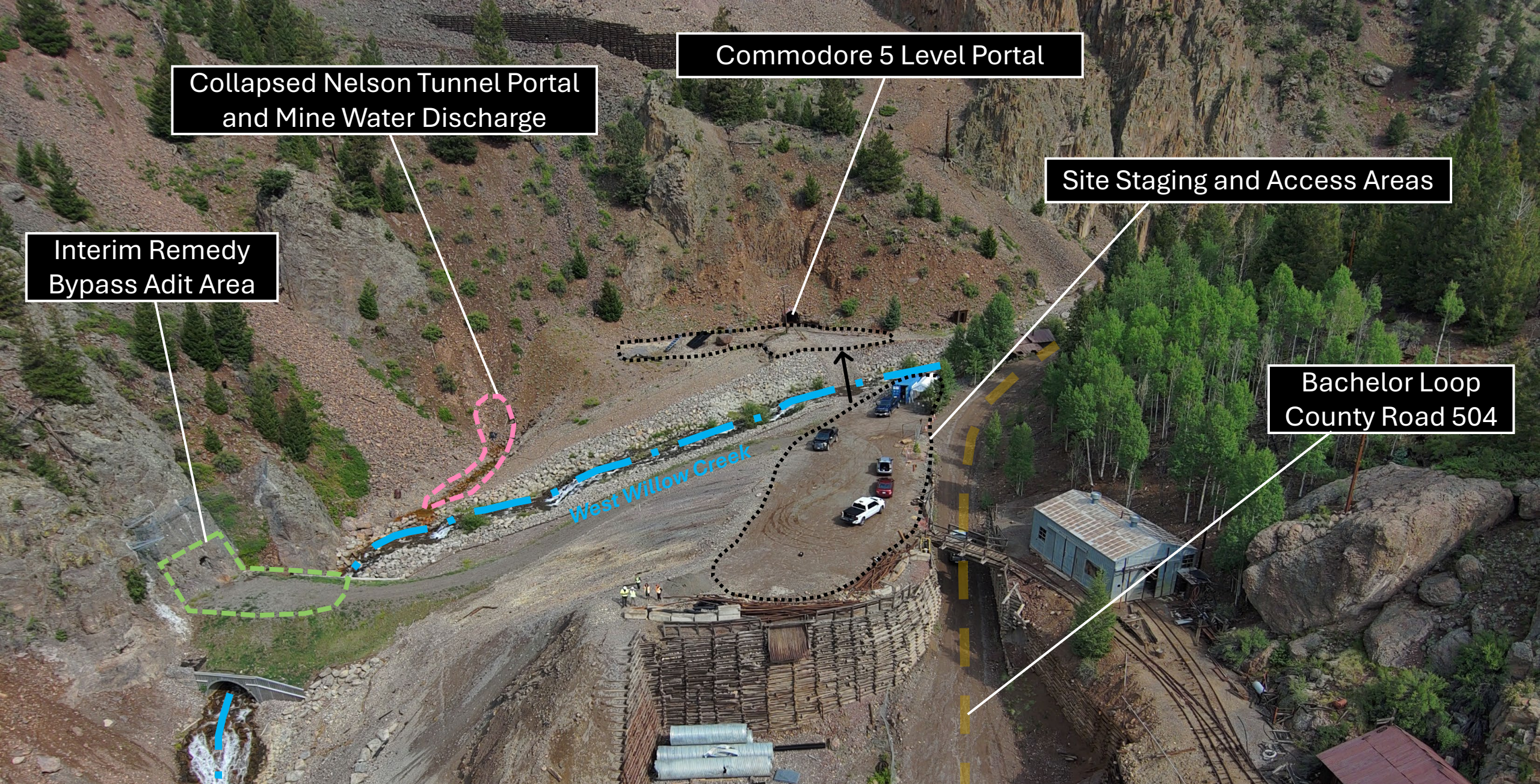
01

Site Setting and Background

Nelson Tunnel

- Historical silver mining district (1890s – 1970s)
- EPA Superfund site located in Creede, southwestern CO
 - Acid mine drainage (cadmium, copper, lead, manganese, zinc)
 - ~20 million gallons of metals-impacted mine water impounded in historical mine workings/tunnels
 - Discharge to West Willow Creek at consistent 350 gallons per minute
- Interim Remedy – Bypass Adit
- Final Remedy
 - Active Mine Water Treatment/Discharge?
 - Passive Mine Water Treatment/Discharge?
 - **Underdrain?**





Collapsed Nelson Tunnel Portal
and Mine Water Discharge

Commodore 5 Level Portal

Site Staging and Access Areas

Interim Remedy
Bypass Adit Area

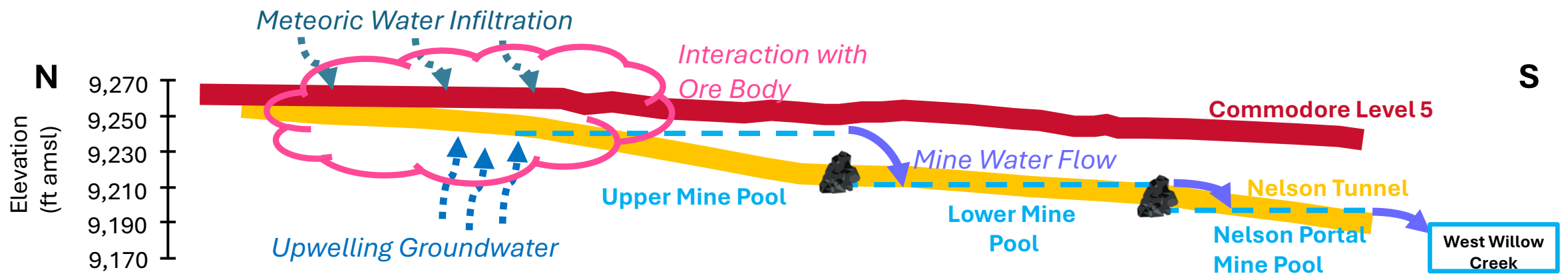
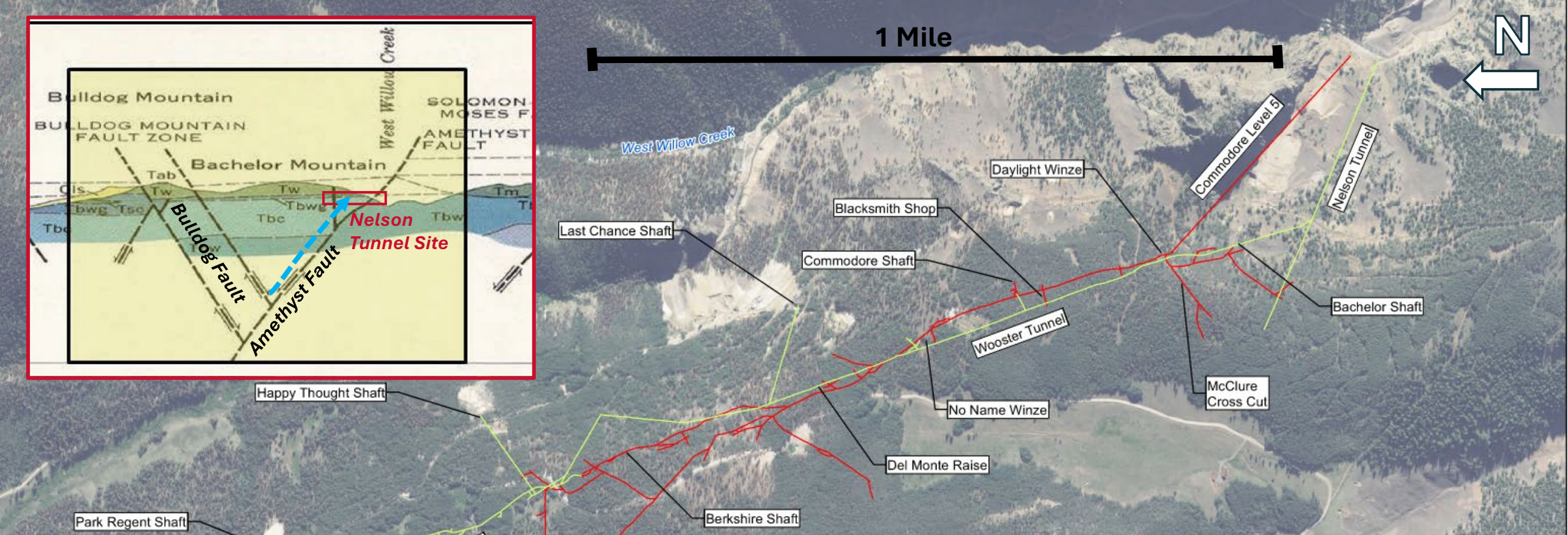
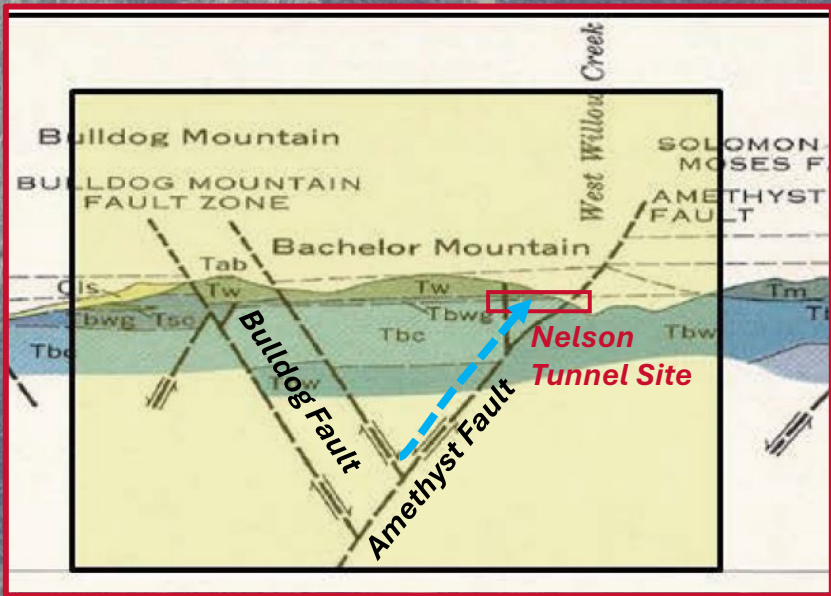
Bachelor Loop
County Road 504

West Willow Creek

The background image shows a rugged mountain landscape. In the foreground, there is a large, complex wooden structure, possibly a mill or a bridge under construction, built on a steep slope. A large pile of logs is visible in the lower left. The middle ground is filled with dense evergreen forests. In the background, a mountain peak is partially obscured by mist or low clouds. The overall scene is in a natural, somewhat desolate setting.

02

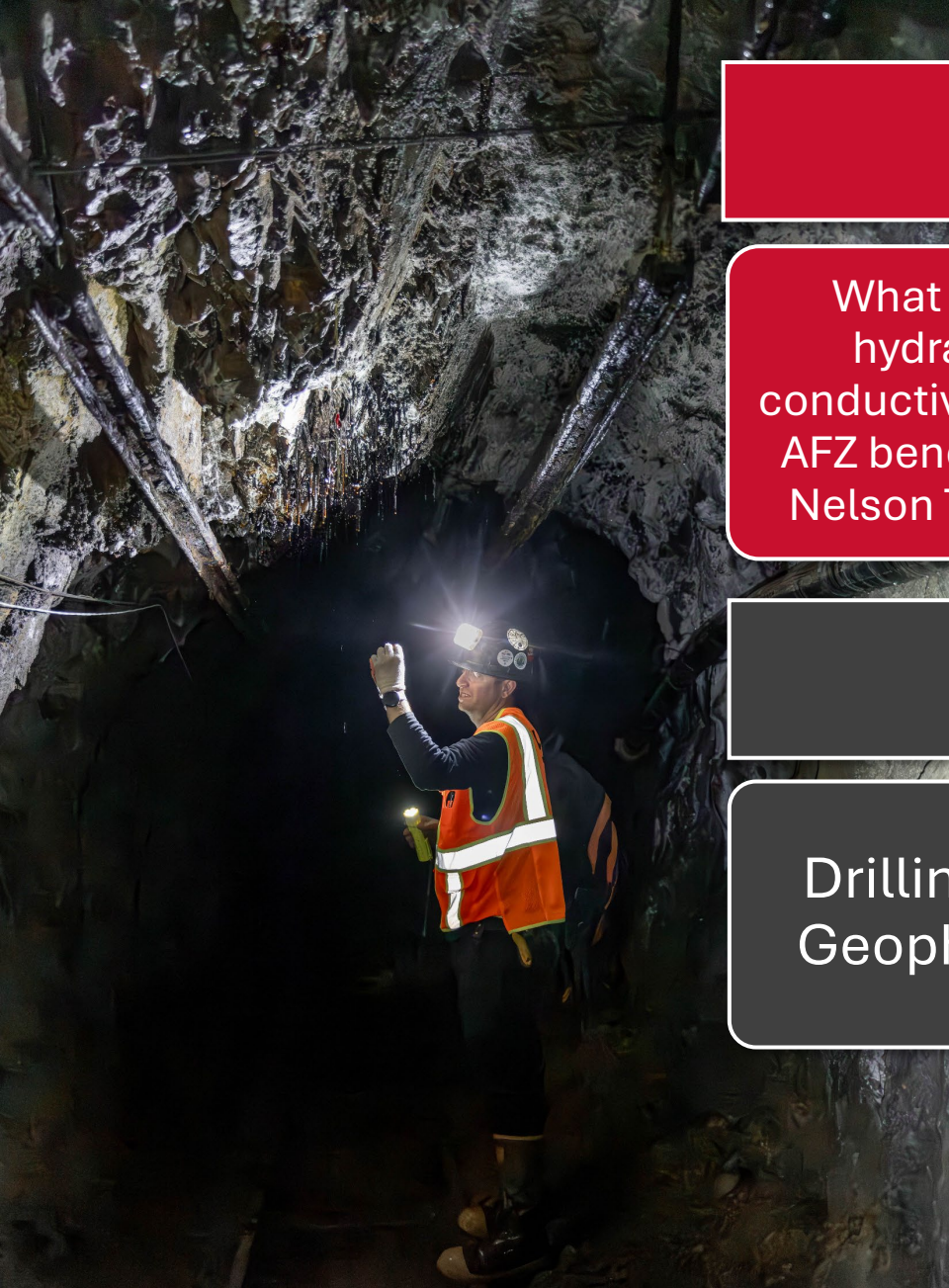
Conceptual Site Model





03

Feasibility Study Purpose and Design



PRINCIPAL STUDY QUESTIONS

What is the hydraulic conductivity of the AFZ beneath the Nelson Tunnel?



What is the quality of the groundwater within the AFZ?



What is the water flow path in the AFZ below the Nelson Tunnel mine pools?

PLAN

Drilling and Geophysics



Aquifer Testing and Water Sampling



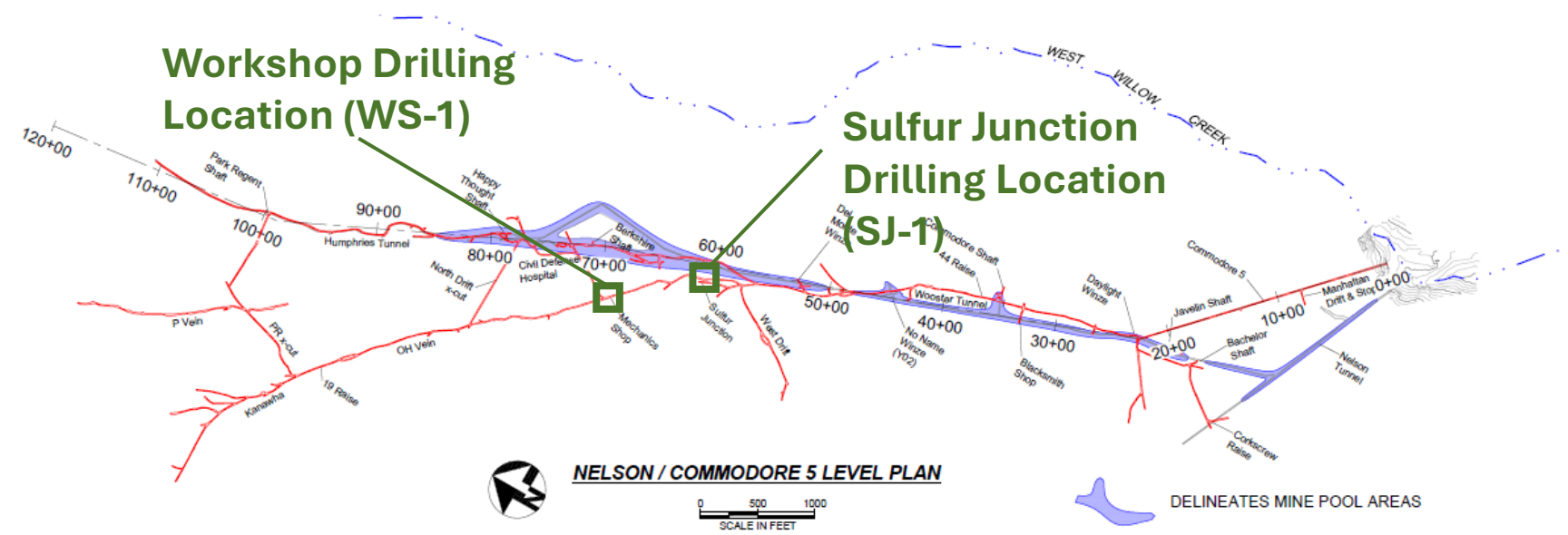
Tracer Study

*What is the source of water feeding the Nelson Tunnel pools?
Can we divert it/discharge it without costly treatment?*

04

Implementation and Results

Underground Drilling



Boring	Location	Approx. Heading (deg.)	Approx. Tilt (deg.)	Total NQ Length (ft)	Total HQ Length (ft)
WS-1	Workshop	88	25	423	395
SJ-1	Sulfur Junction	58	25	282	282





WS-1 Borehole

0+00 1+00 2+00 3+00 4+00 5+00

58° FROM NORTH

DRILL HOLE

DEEP EXPLORATORY DRIFTS
EXTEND SOUTH 624' FROM
BERKSHIRE PER ASARCO 1919
AND CONNECT TO 'KING DRIFT'

TO ANETHYST SHAFT

0 20 40
SCALE IN FEET



Aquifer Testing and Groundwater Sampling

Air Lift Test

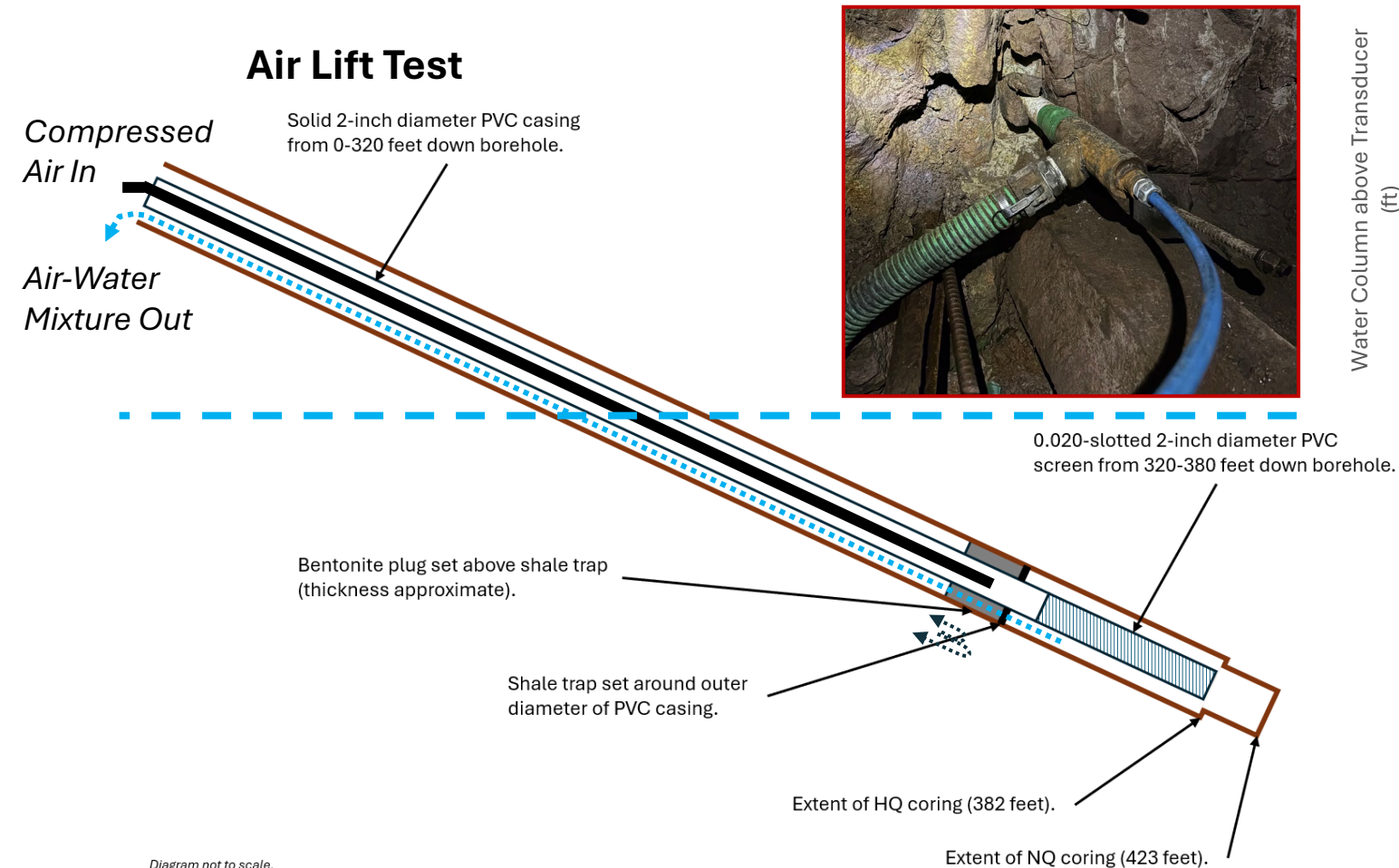
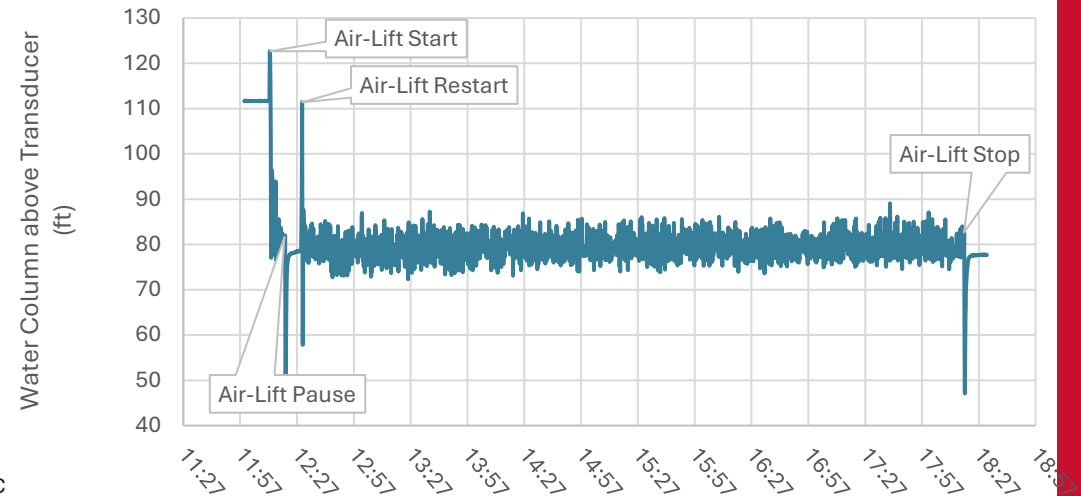


Diagram not to scale.
Vertical dimension is exaggerated.

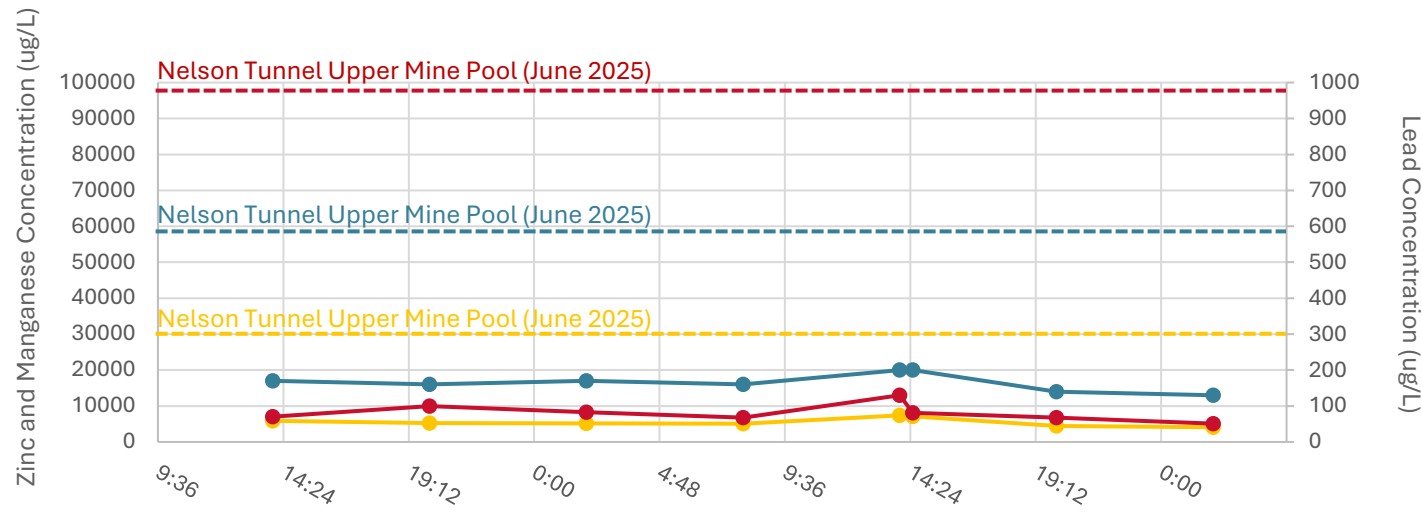


Pumping rate (Q) = 22 gpm
Drawdown (s) = 30.58 feet
Transmissivity (T) = 144.25 feet²/day

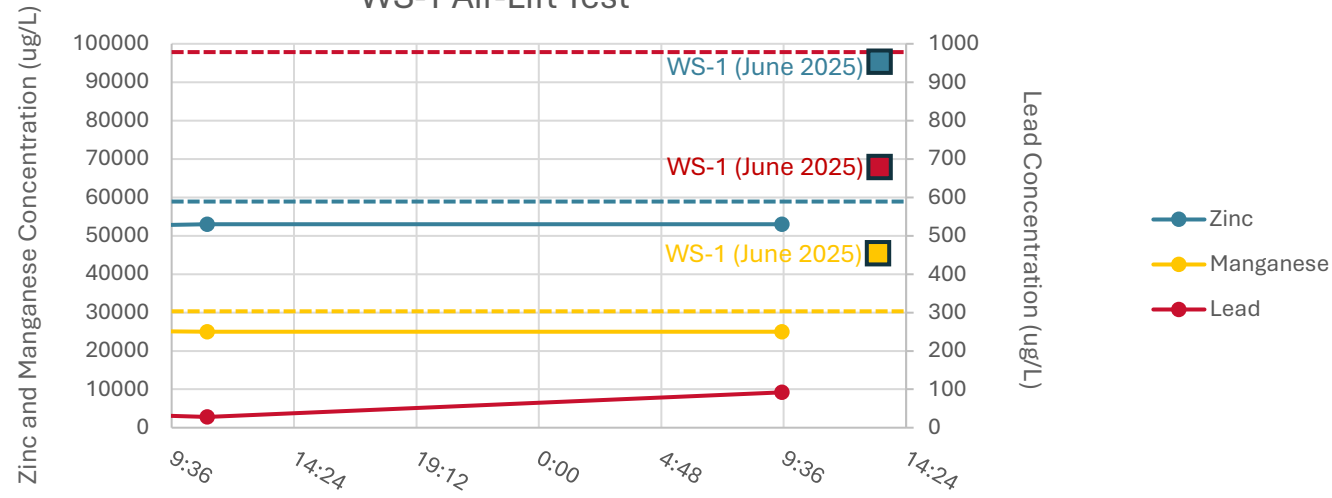
Hydraulic conductivity (K) = 1.5 – 2.4 feet/day.

Water Sampling Results

WS-1 Low-Flow Pump Test



WS-1 Air-Lift Test

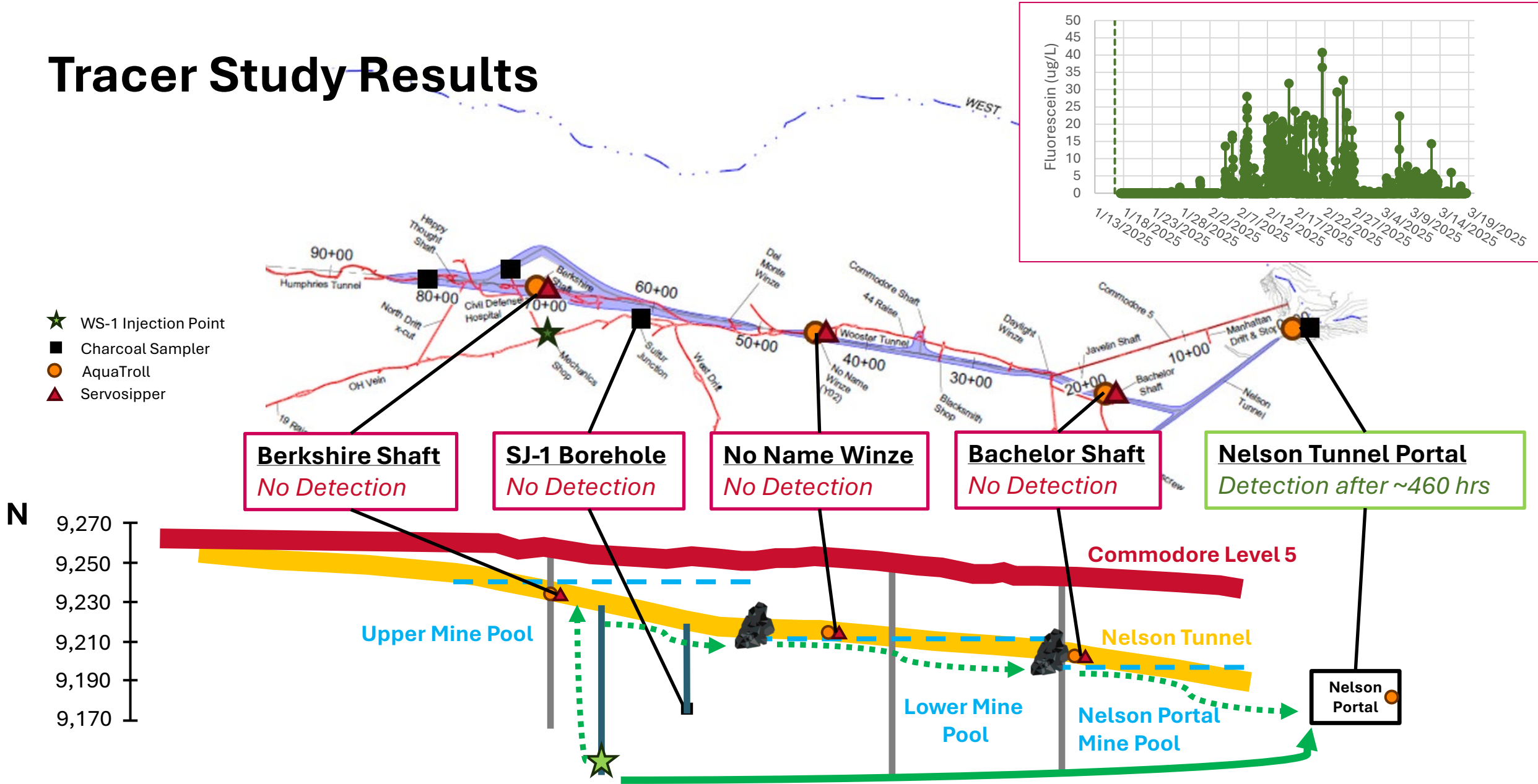


Tracer Study

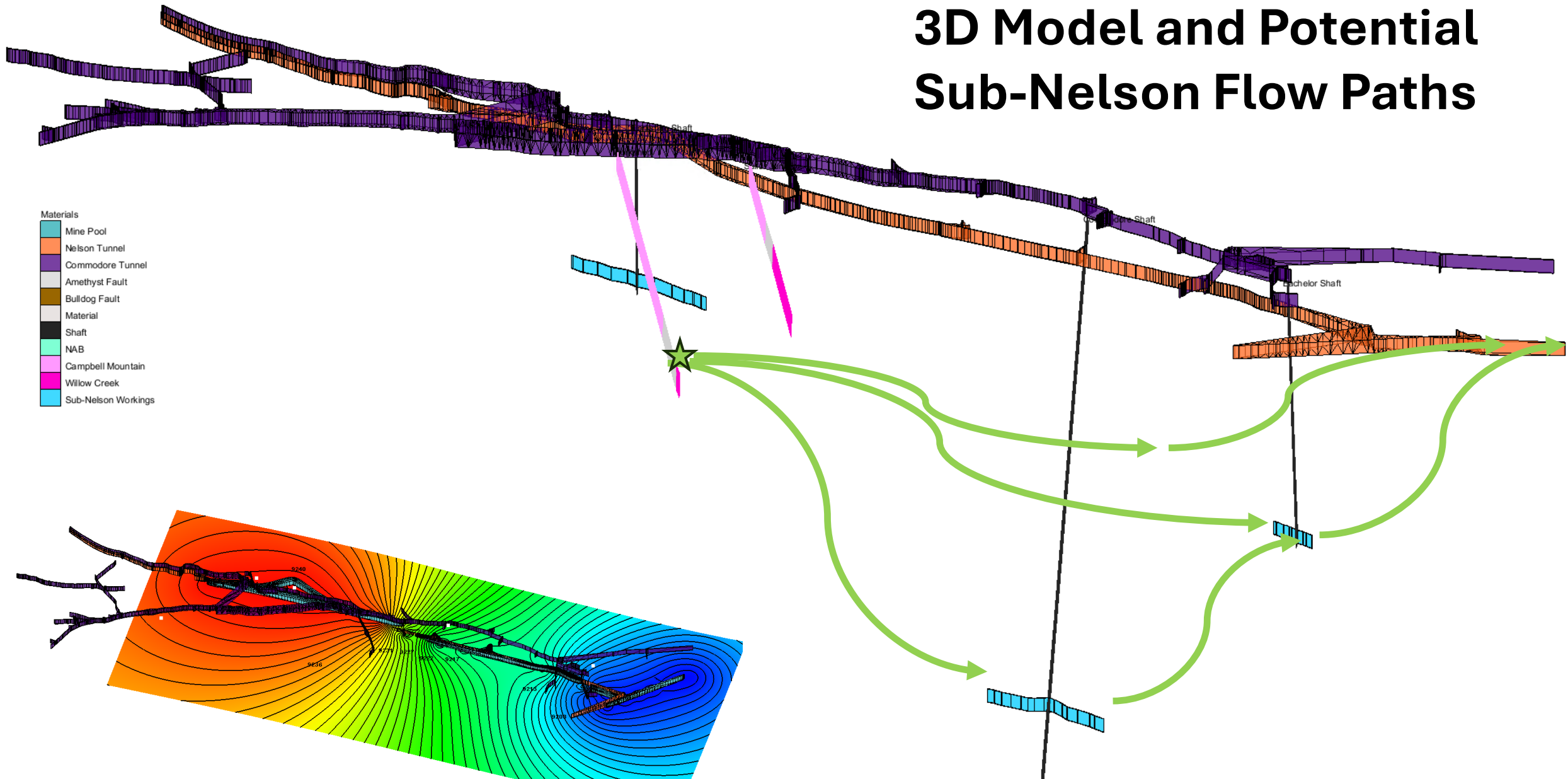
- Injection of fluorescein dye and lithium chloride tracers into WS-1
- Monitoring and sampling (sondes, charcoal samplers, and servosippers)



Tracer Study Results



3D Model and Potential Sub-Nelson Flow Paths





05

Findings and Lessons Learned

Principal Study Questions

What is the hydraulic conductivity of the AFZ?

1.5 – 2.4 feet/day though it likely varies along the length of the AFZ.

Potential area with higher hydraulic conductivity and groundwater flow?

What is the quality of the groundwater within the AFZ?

Preliminary results indicate water is impacted before it enters the pool system.

Results may have been affected by airlifting process.

Additional data is being collected.

What is the flow path of water below the mine pools?

Sub-Nelson AFZ and Upper Mine Pool are likely hydraulically connected.

Exact flow path(s) are still not entirely understood.

Potentially significant, deeper, lateral flow paths may exist.

Is an underdrain a viable final remedy for the site?

- Possibly...
- Additional work needed

Thank you to our partners and collaborators.

