Future ML/ARD Mitigation Approaches and Closure Planning for Nyrstar Myra Falls

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nyrstar

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Overview

- Introduction
- ‘Base Case’ Closure Scenario
- Water Quality Predictions
- Initial Assessment of Lynx SIS Performance
- Path Forward

‘Base Case’ Closure Scenario

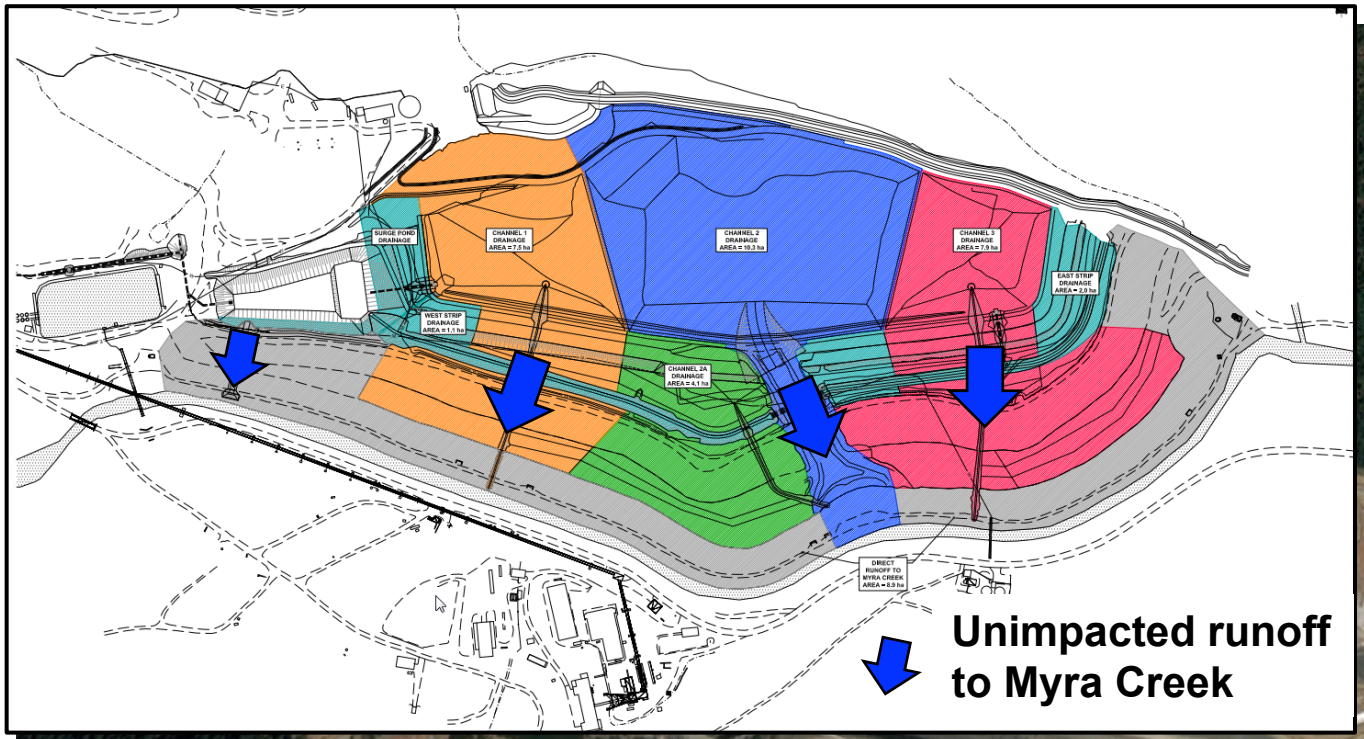
- **Closure objective: Achieve water quality objectives for Myra Creek**
  - Provincial WQGs: screening-level benchmarks
  - Science-Based Environmental Benchmarks (SBEBs) by 2020

- **ML/ARD Prevention and Mitigation Approach:**
  1. Operate the NOD and Lynx SIS
  2. Flood PAG rock and tailings underground
  3. Cover the WRDs and TDFs

- **Amec Foster Wheeler: <u>Closure engineering</u>**
  - Closure cover design and physical stability assessments
  - Surface water diversions, e.g. LLDD
  - Precipitation runoff management, e.g. decants, spillways, etc.

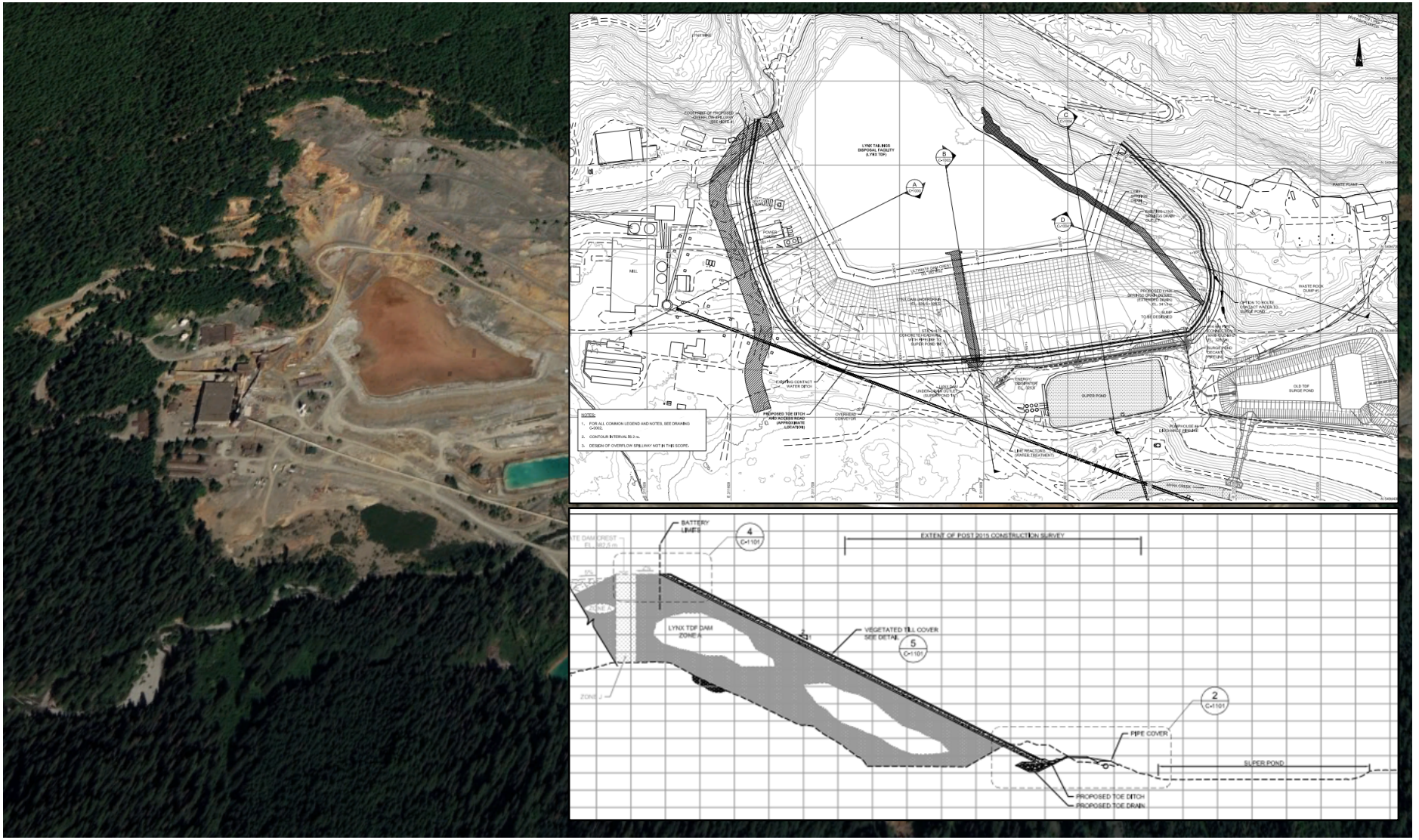
- **RGC: <u>SIS designs and load balance assessment</u>**
  - Assess NOD performance and conceptual Lynx SIS design
  - Predict future conditions (Zn loads and concentrations)

‘Base Case’ Closure Scenario for Old TDF



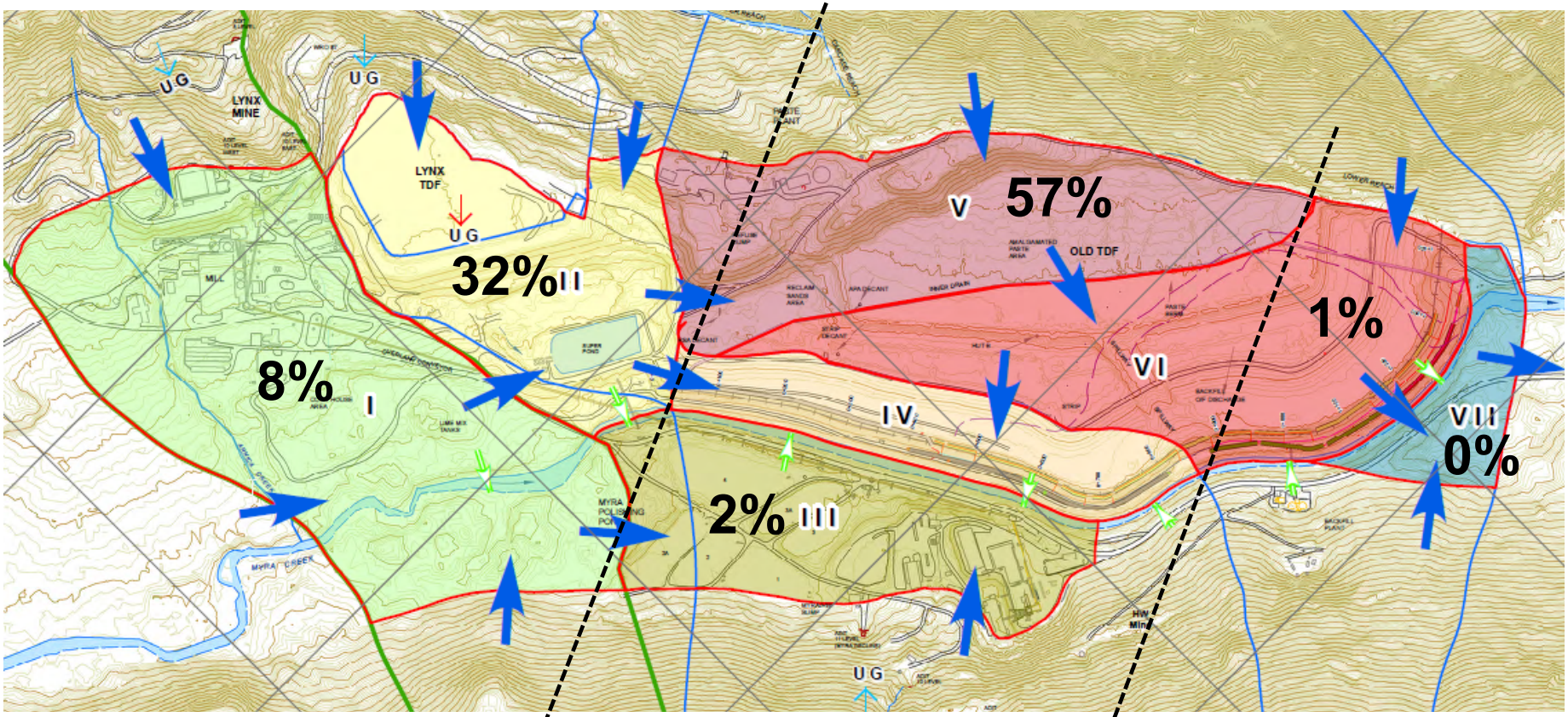
From Amec Foster Wheeler (2016)

‘Base Case’ Closure Scenario for Lynx TDF Berm



From Amec Foster Wheeler (2016)

Major Site Reaches and Model Zones (I to VII)



Water and Contaminant Load Balance Model (GoldSim)

Zn Load Balance
- **Source terms**
- **Observed Zn**

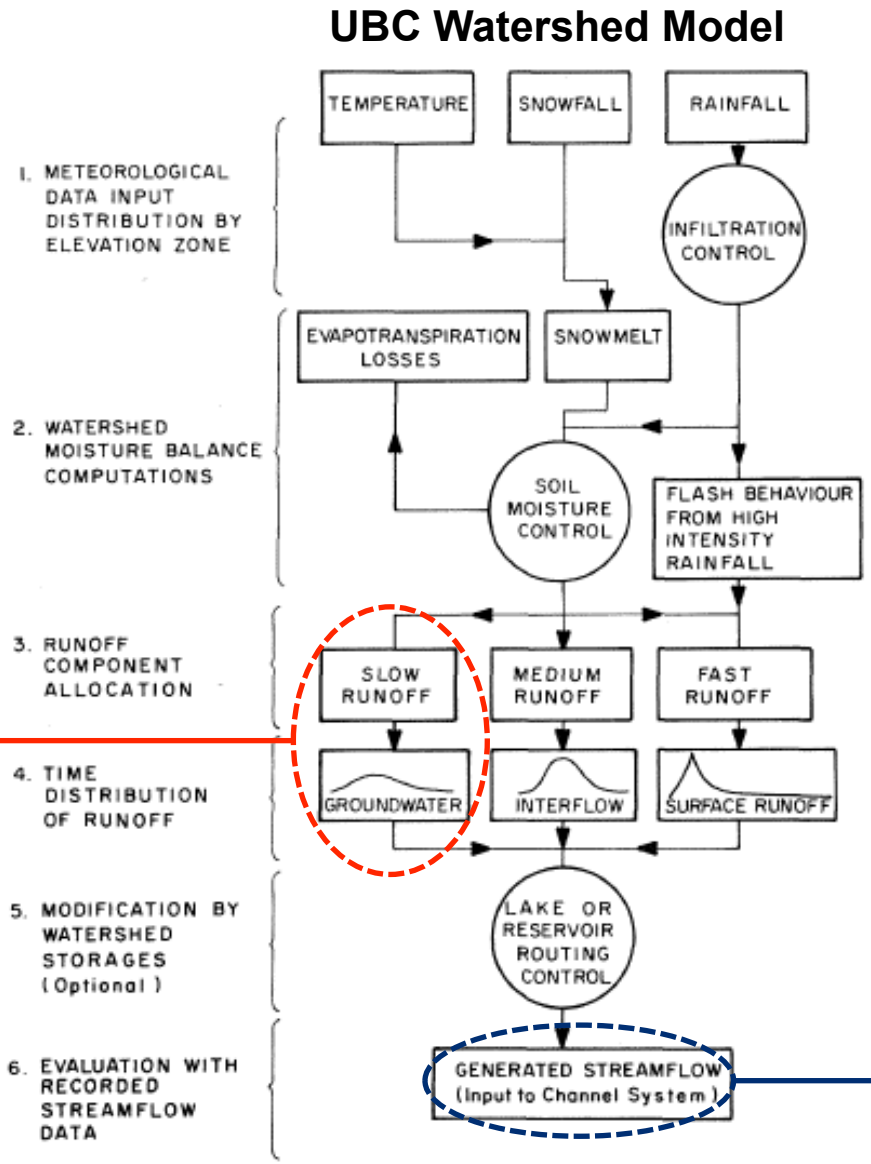
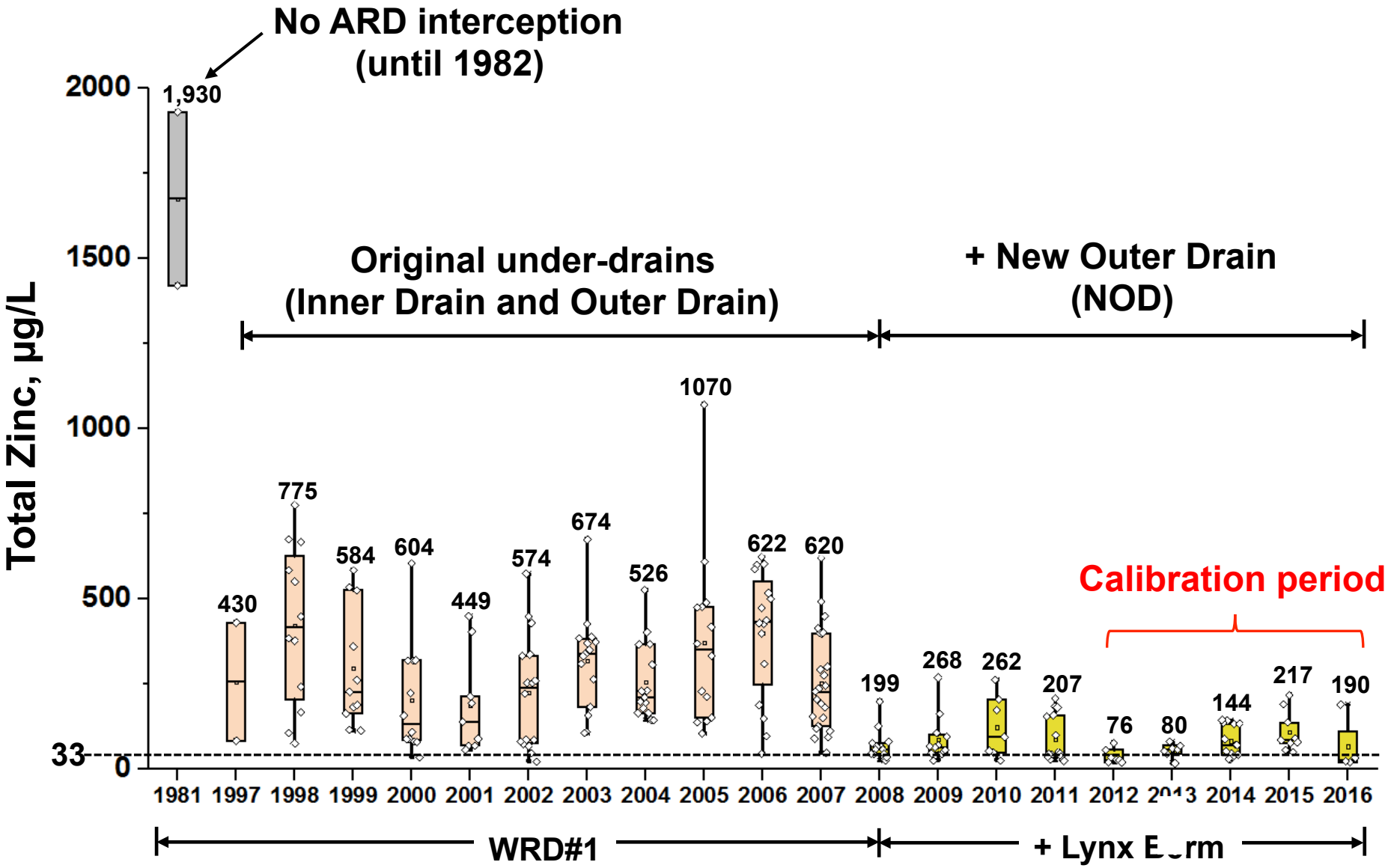


Fig. 1 – U.B.C. Watershed Model generalized flow chart.

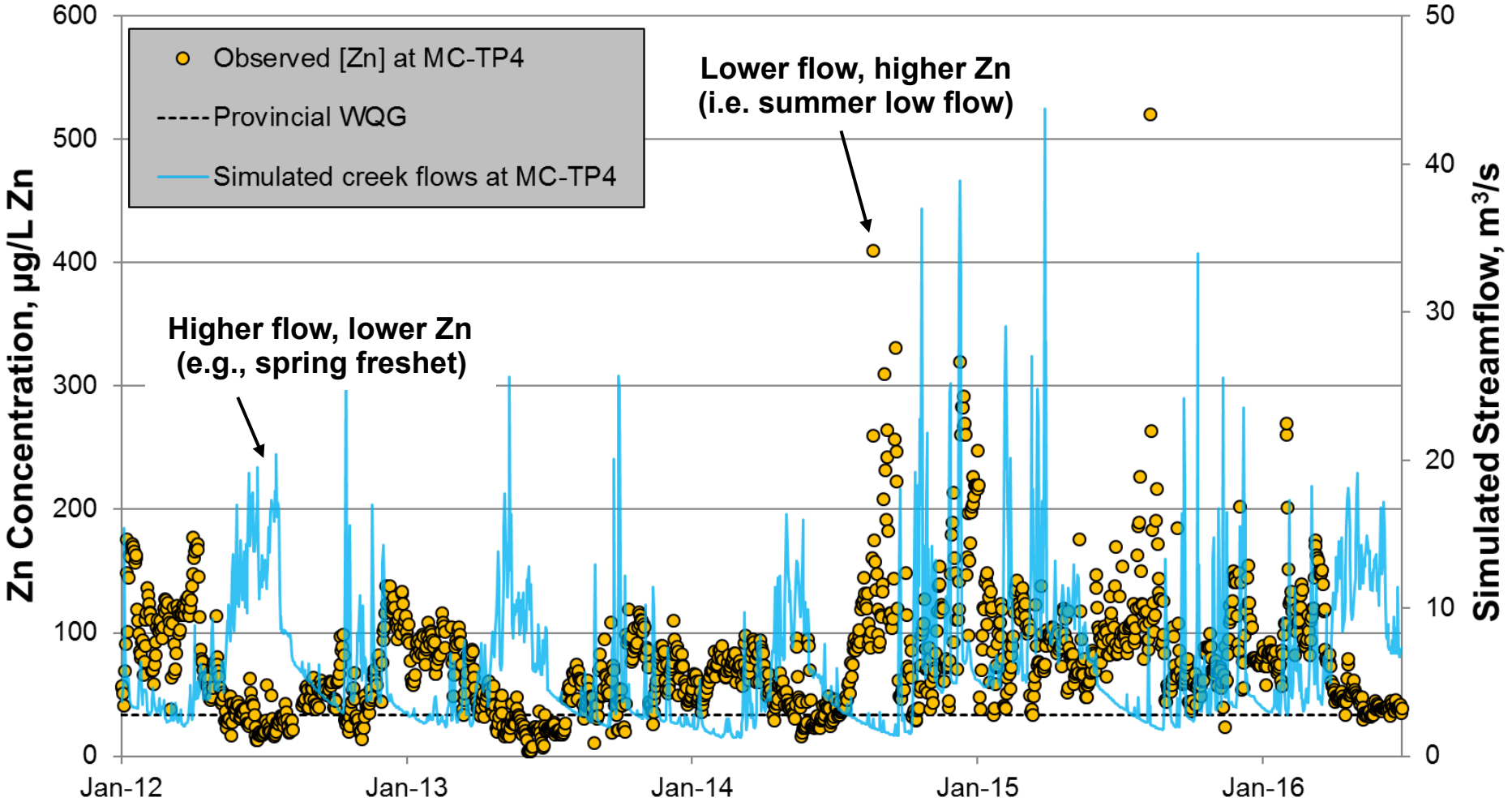
Simulated flows in Myra Creek

Figure from Quick and Pipes (1977)

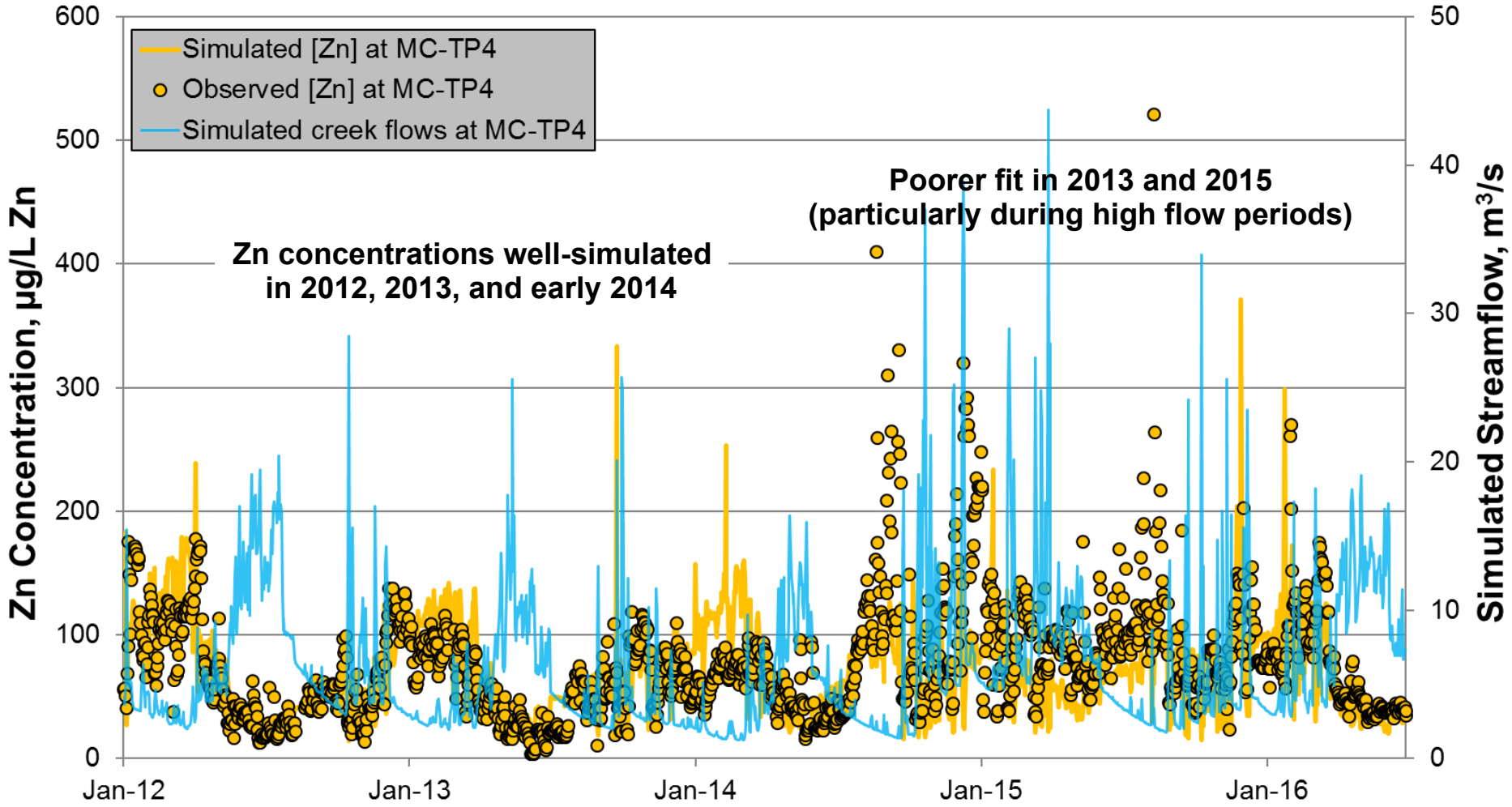
Zn Concentrations in Myra Creek at TP4, 1981 to 2017



Observed Zn Concentrations in Myra Creek, 2012 to mid-2016



Simulated and Observed Zn in Myra Creek at MC-TP4



Modeling Approach and Scenarios

- **GoldSim model run in "prediction mode"**

- **Modeled 'Scenarios':**
  - Lynx SIS in Zones I and II

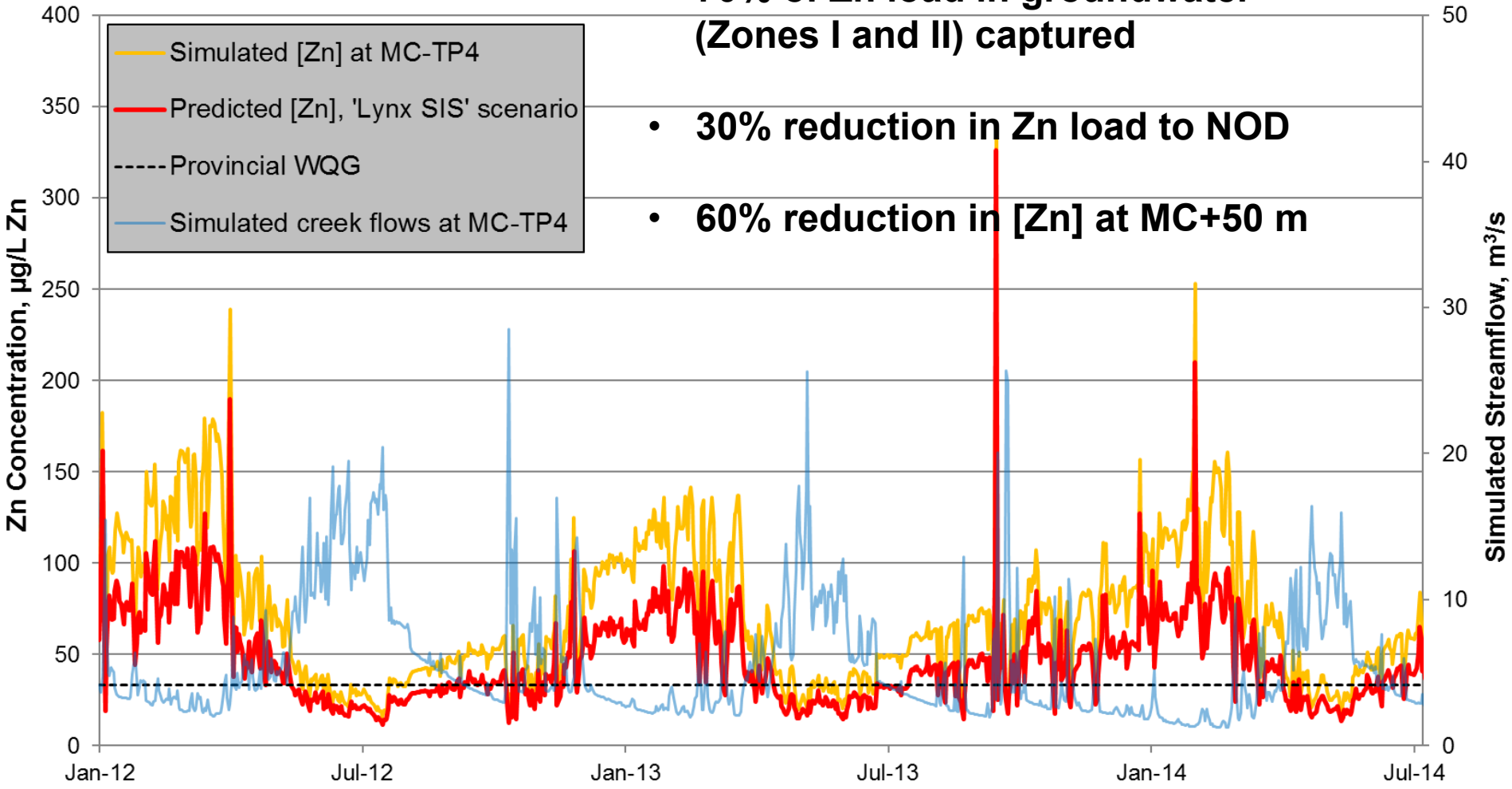
  - Old TDF Closure:
    - Re-grade and cover WRD#6 and
    - Cover tailing surface to reduce contact water

  - Final Lynx TDF (at closure and covered)

  - Additional seepage recovery in Zone I and IV
    - Pump from disconnected NOD
    - Pumping wells in ETA/Cookhouse area

- **Closure strategies implemented sequentially, so the effect of each change is additive, i.e. [Zn] progressively decreases**

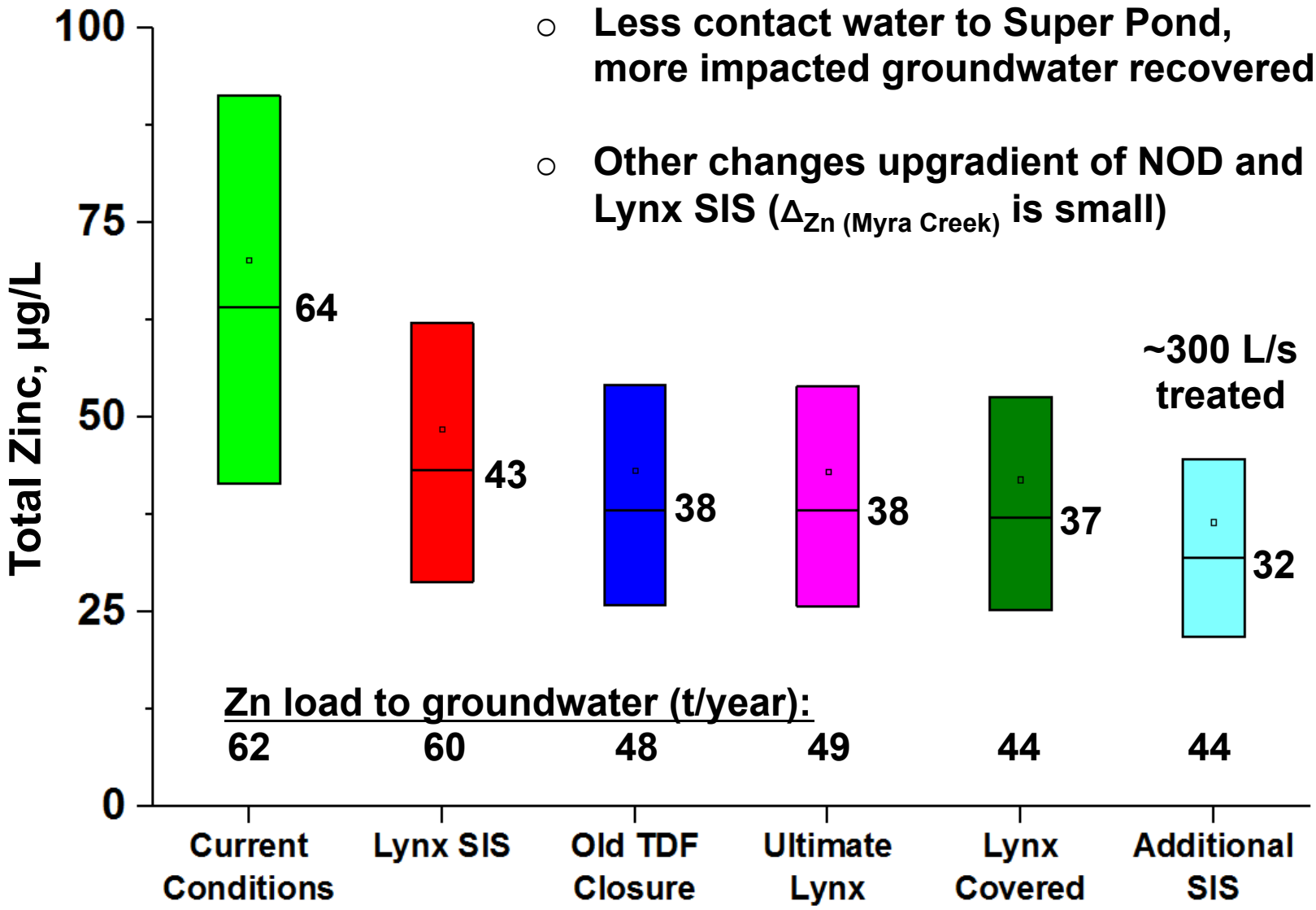
Predicted Conditions, Lynx SIS Scenario



Key Model Predictions:

- **70% of Zn load in groundwater (Zones I and II) captured**
- **30% reduction in Zn load to NOD**
- **60% reduction in [Zn] at MC+50 m**

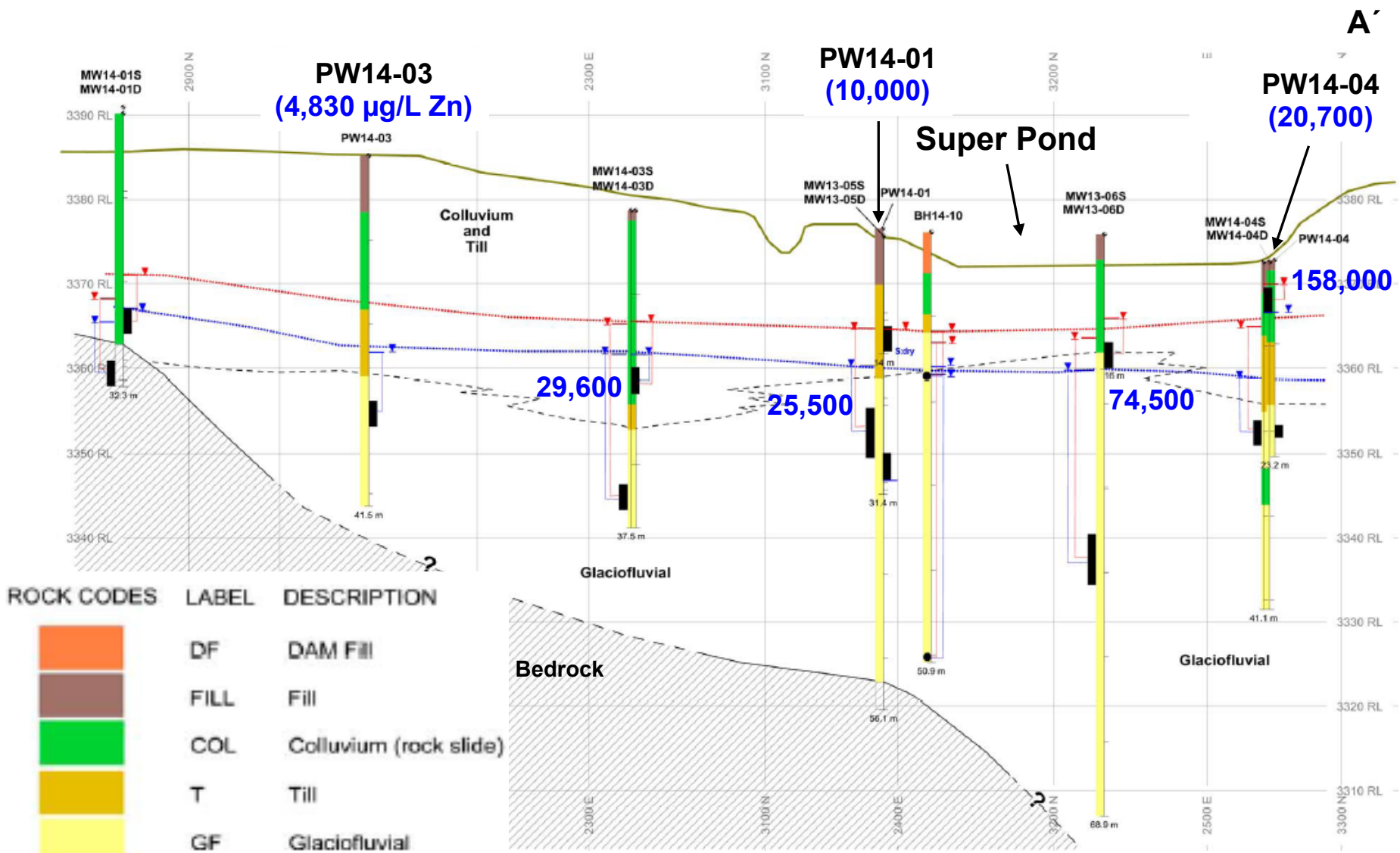
Predicted Zn Concentrations in Myra Creek



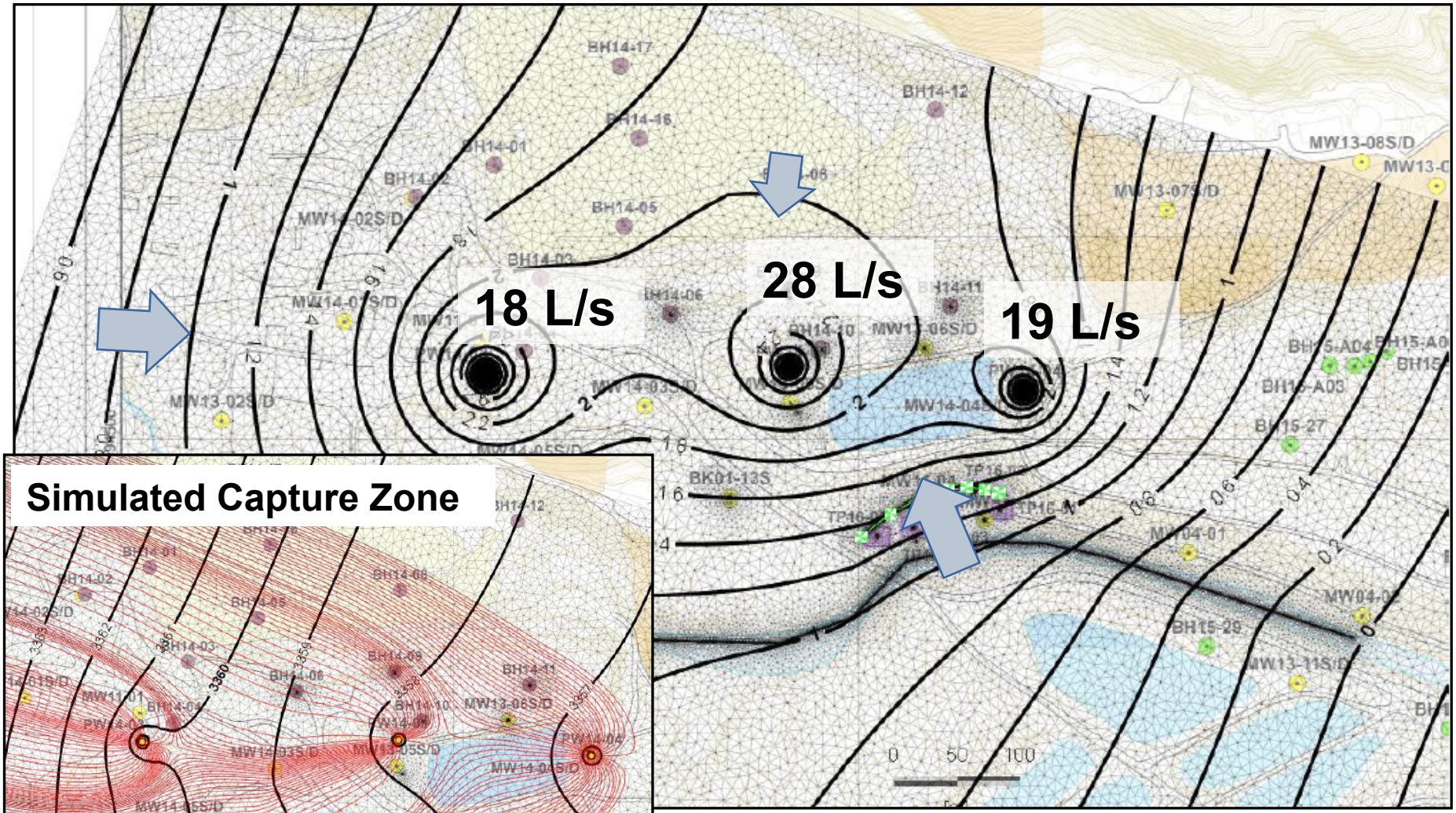
- Less contact water to Super Pond, more impacted groundwater recovered
- Other changes upgradient of NOD and Lynx SIS ($\Delta_{Zn\ (Myra\ Creek)}$ is small)

Lynx SIS Pumping Wells (Phase I SIS)

Cross-Section (Lynx SIS), East-to-West

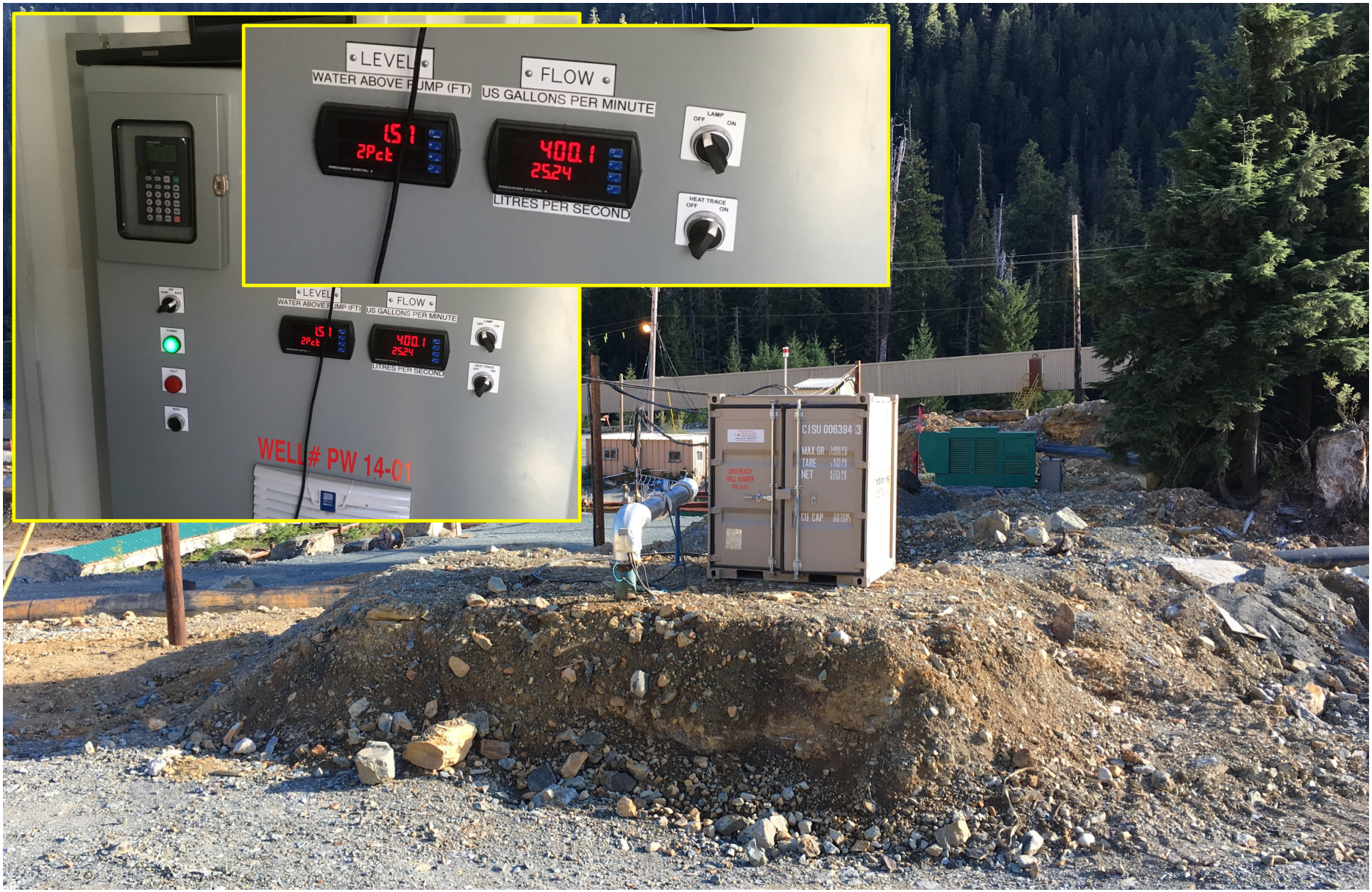


Simulated Drawdown (65 L/s) – Low Flow Conditions



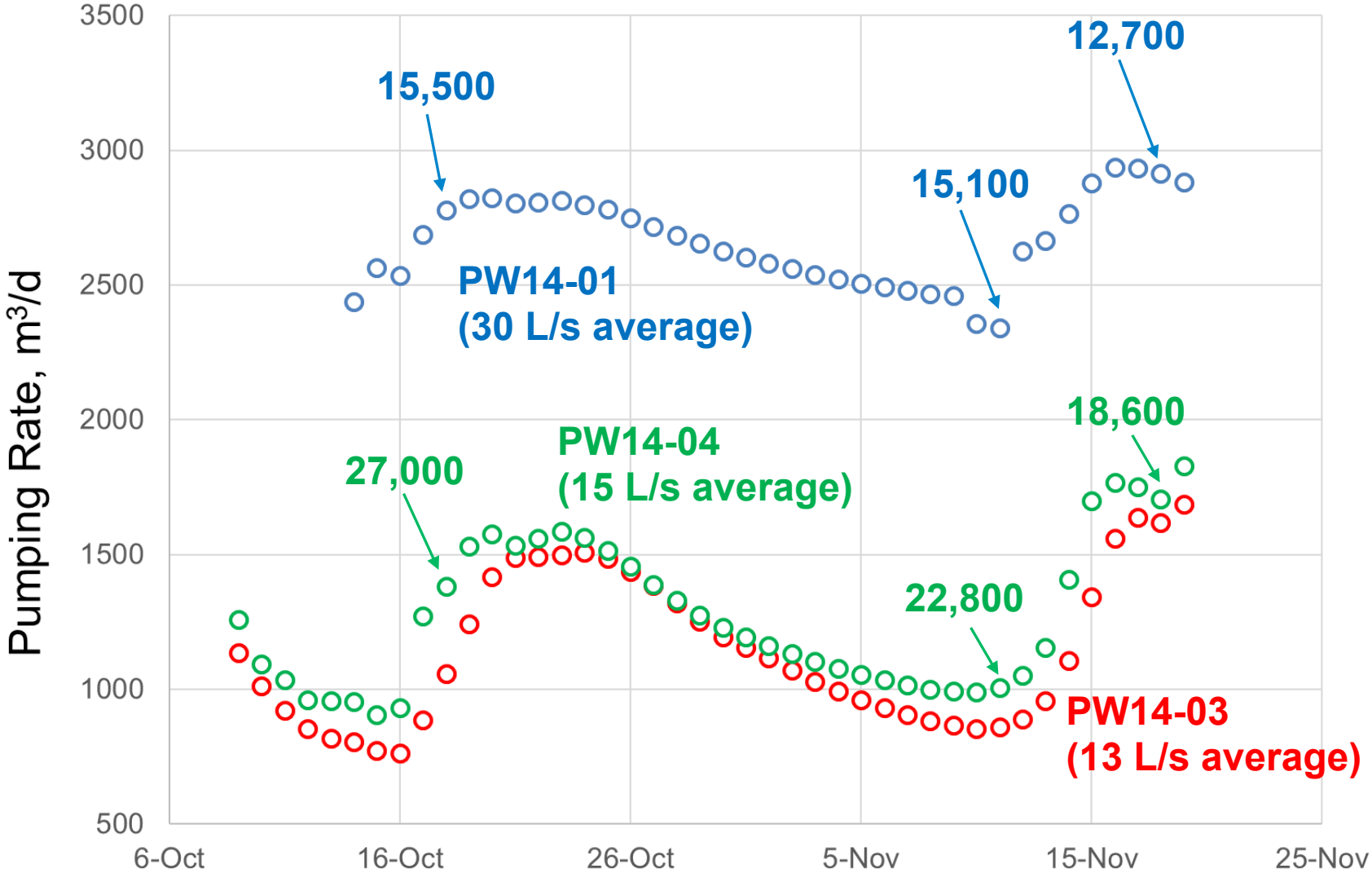
FEFLOW model (for Lynx Reach)

Lynx SIS – Constant Level Pumping System

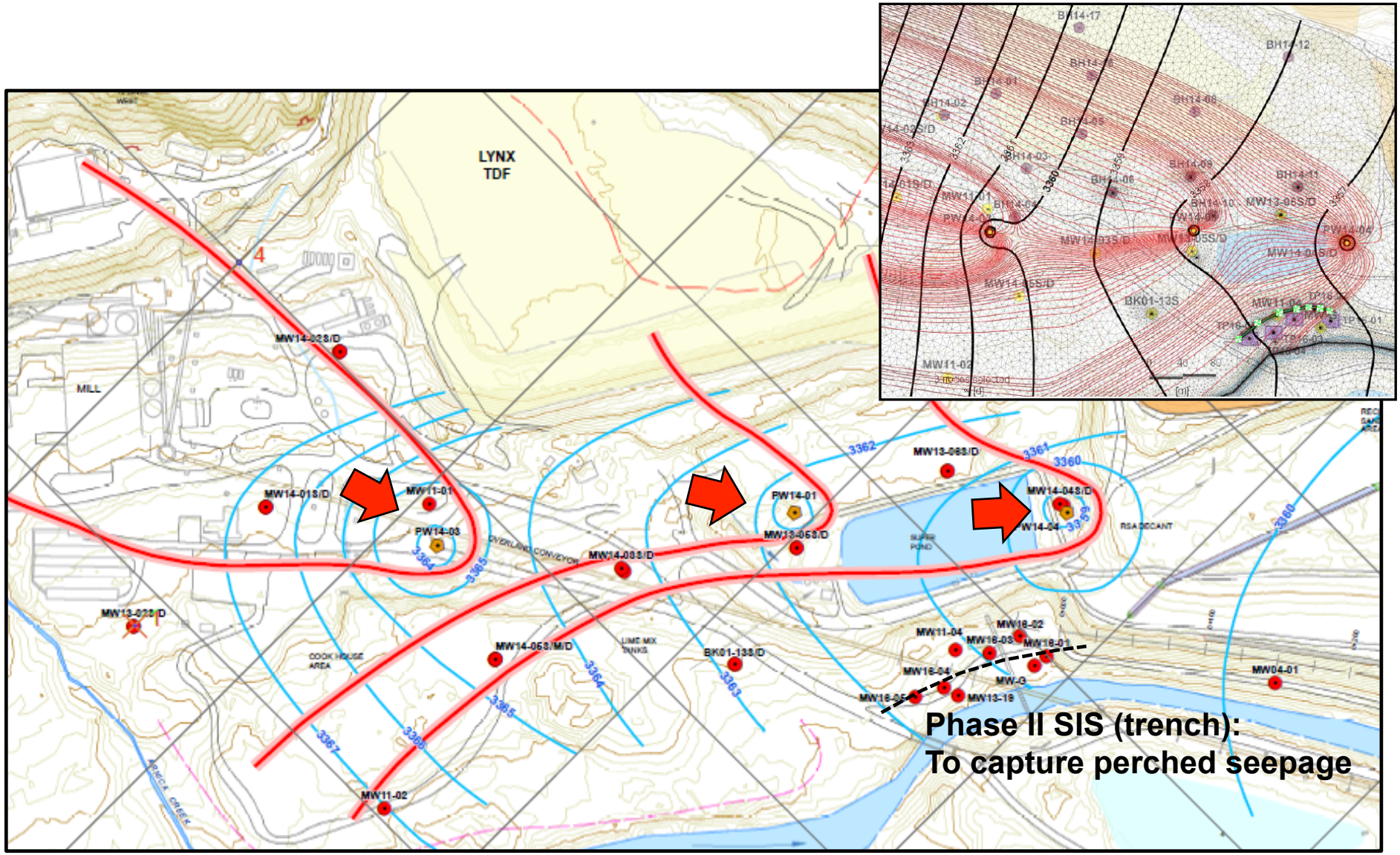


Pumping Rates and Zn Captured (since October 9th)

2.8 t Zn captured: ~50% of Zn to NOD

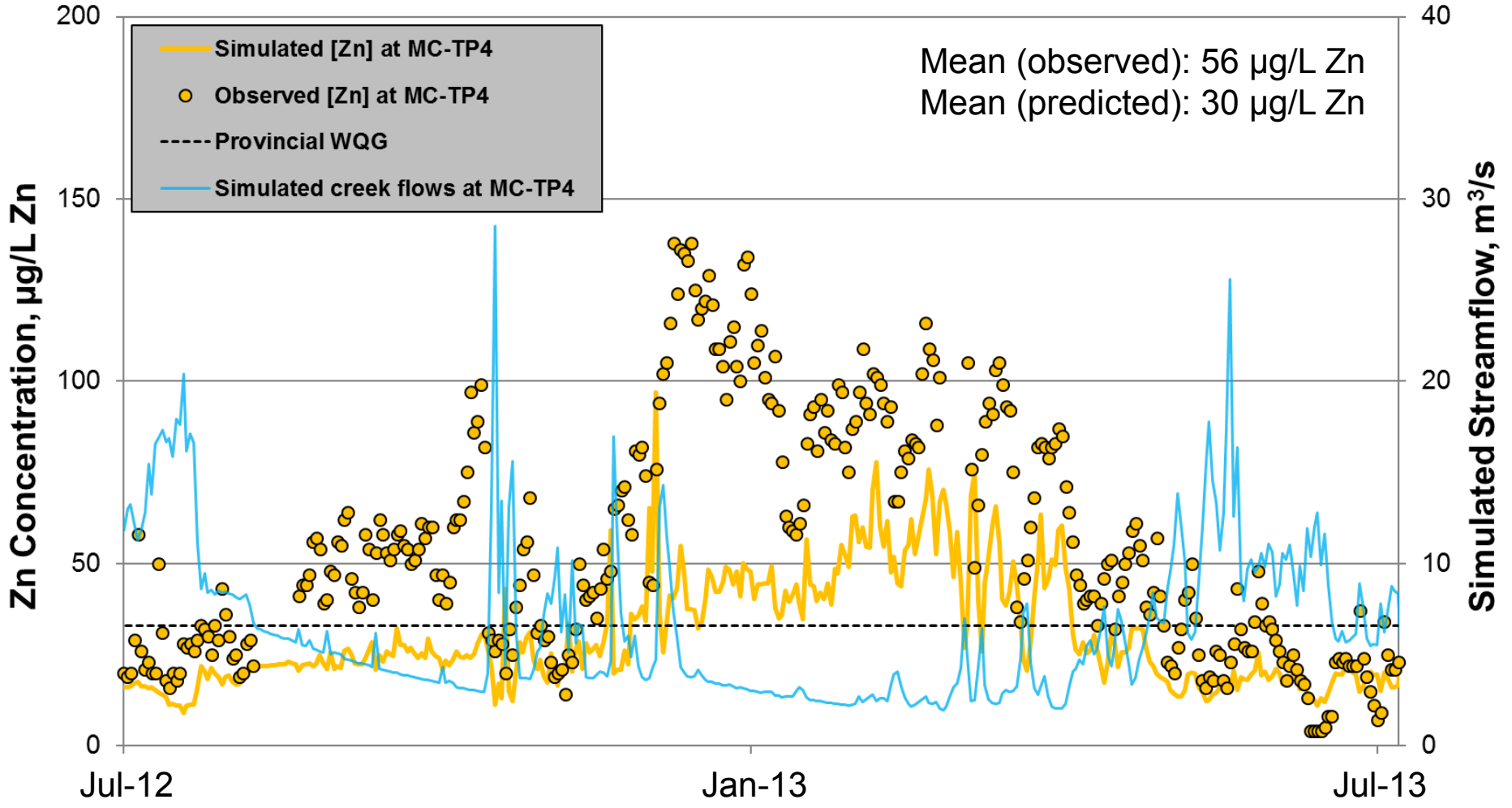


Inferred Capture Zone – High Flow (November 2017)

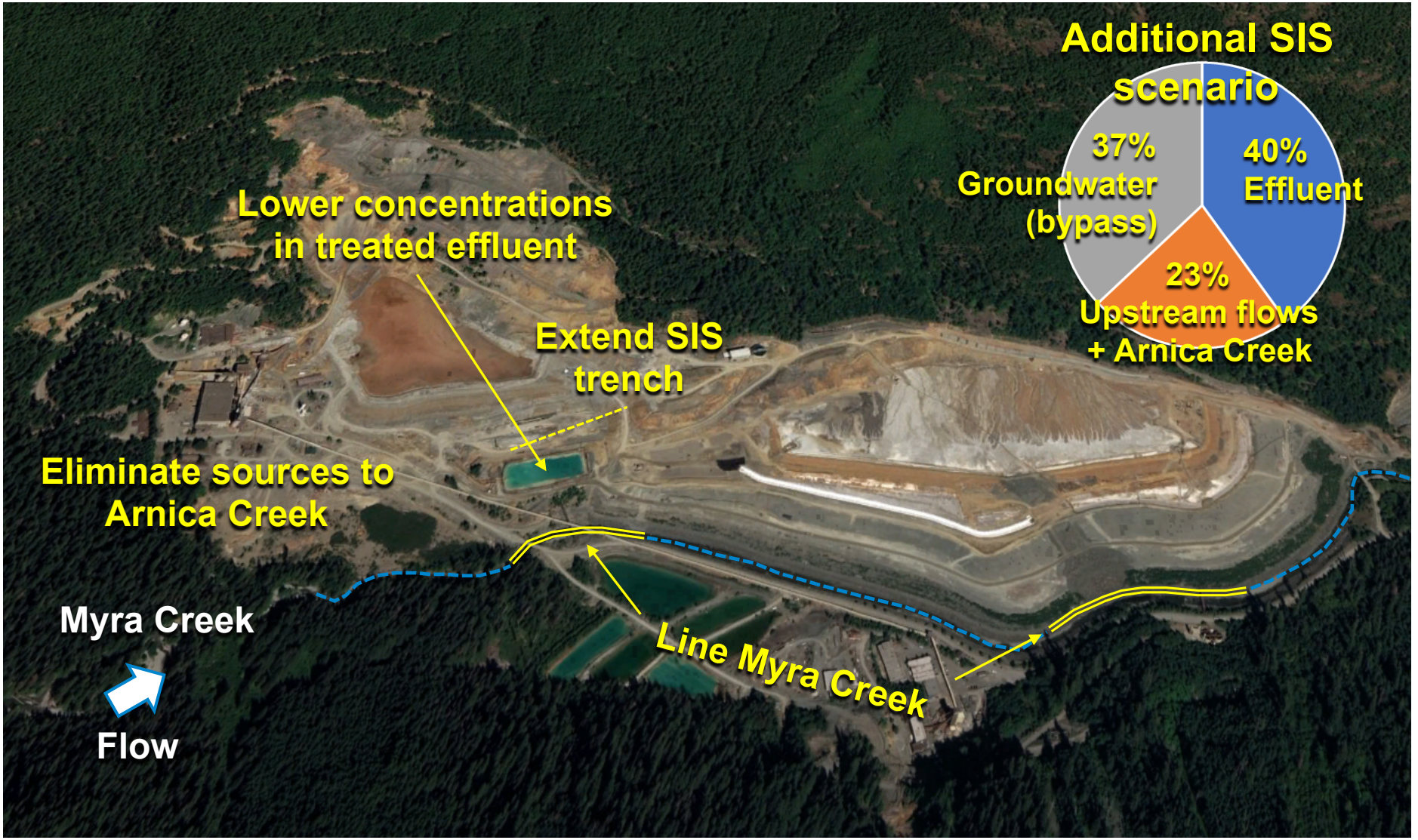


Simulated Zn (Additional SIS), 2012/2013 Water Year

Lynx SIS + Pumping from disconnected NOD + SIS in ETA/Cookhouse Area ('Best Case' Scenario)



Options to Further Reduce [Zn], 'Base Case' scenario



Summary and Path Forward

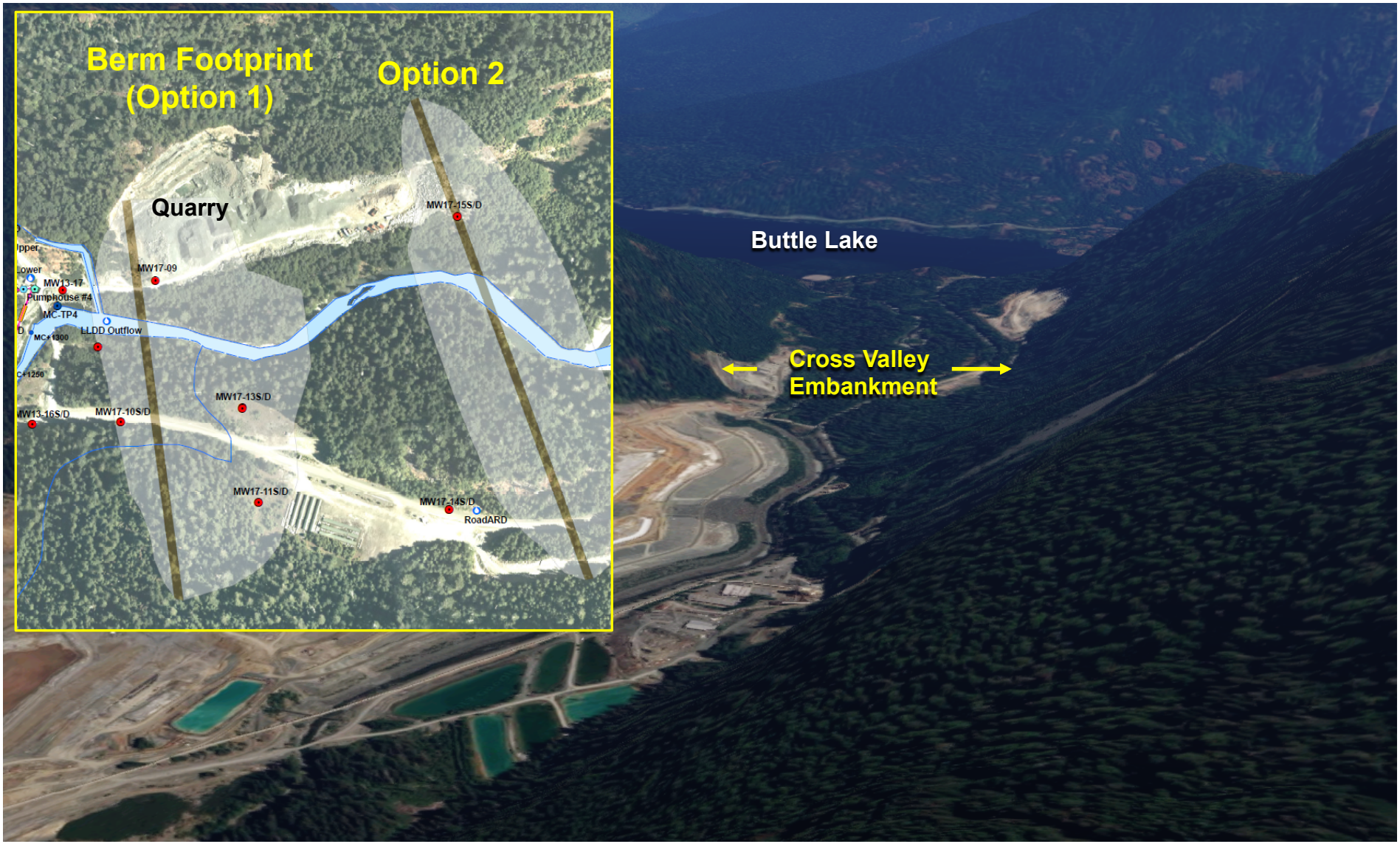
Summary

- **[Zn] in Myra Creek has been substantially reduced by the NOD**
- **Further reductions are predicted, as initial observations suggest:**
  - Phase I Lynx SIS is working as intended
  - Phase II (trench) could intercept perched seepage
- **SBEBs for Zn, Al, Cd and Cu (by 2020) will clarify post-closure water quality objectives for Myra Creek**

Path Forward

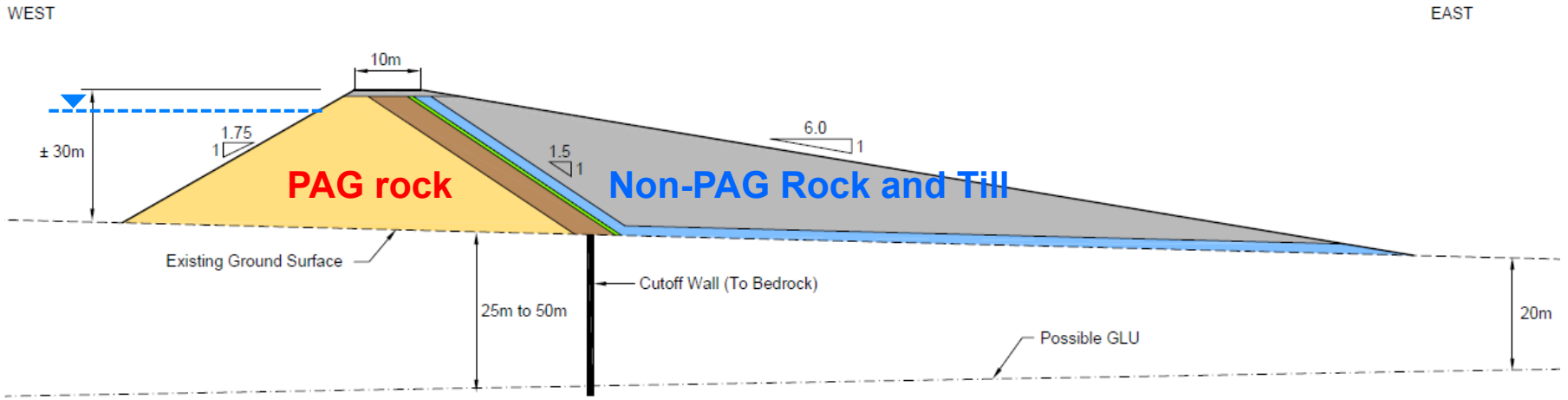
- **Refine the 'Base Case' closure scenario**
  - Cover designs
  - Lynx SIS performance assessment
  - Post-closure water treatment requirements
- **Evaluate an alternative closure scenario that emphasizes ML/ARD prevention**
- **Consult stakeholders (MEM, MOE, SPPAC, First Nations)**

Path Forward (2018) – Cross Valley Embankment



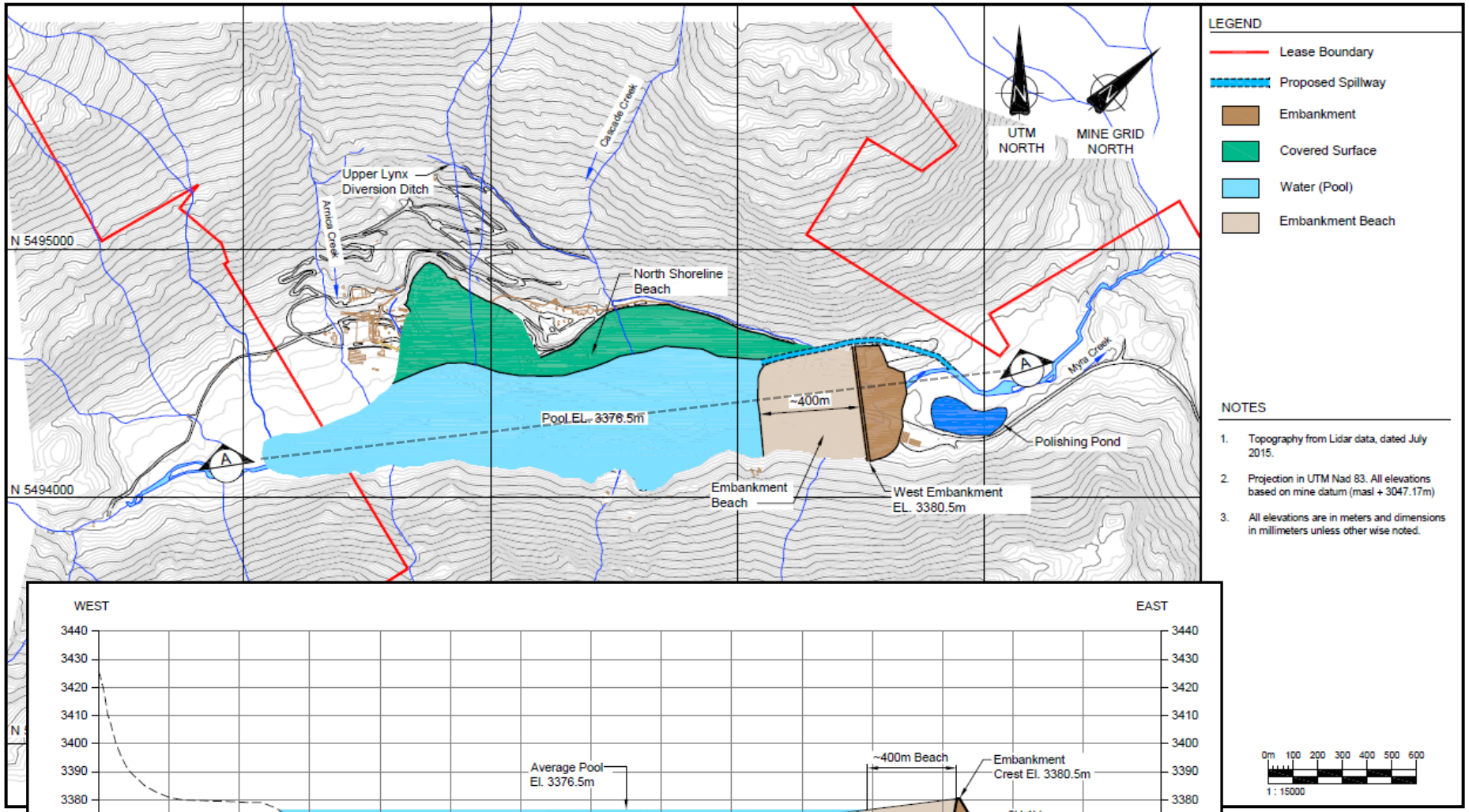
Alternative Closure Scenario ('Myra Wetland')

Conceptual Cross-Section of Cross Valley Embankment
(98% of PAG mine waste submerged)



Dam Crest Height, m	Dam Crest Elevation, m	Reservoir Volume, m^3	Upstream Shell (PAG), m^3	Downstream Shell (Non-PAG), m^3
31	3380.5	7,200,000	300,000	1,000,000

Conceptual Plan View ('Pool Option')



Collaborators and Contributors

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- Tara Raketti

Additional Acknowledgements

- Bill Price

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