

Overcoming Weak Foundation Challenges

Silver Standard - Seabee Gold Operations

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Discussion Topics

- 1. Description of Site
- 2. Project Background
- 3. Test Section Construction and Monitoring
- 4. Incorporation of Monitoring Data into Back Analysis
- 5. Back Analysis Results
- 6. Final Design
- 7. Operations Plan
- 8. Stage 1 Operations in 2016

General Arrangements & Background



Preliminary Design

- Continuous Waste Rock Dike (founded on tailings)
 - 900 m in length
 - 6 to 8 m high
 - U/S Slope 2.5H:1V and D/S 3.0H:1V



Field Investigation

- 16 Cone Penetration Tests (CPT)
 - Poor foundation conditions in Zone 2
 - Dike alignment shifted



Test Section Construction

Rational

Constructed in Zone 2

- Field Verification
- Minimize Risk

- 0.5 m lifts
- Elevation 460 m



Test Section Construction - Timeline

- Commenced in October 2012
- Competed Late April 2013 (7 months)



Test Section Monitoring

- Field Surveys
- 47 fixed survey monuments
- Data collection (April to August 2013 5 months)







Test Section Monitoring



LEGEND





— – 459.0 m Pond Level

Approved for Construction Test Section

Back Analysis – 1D Consolidation

- Determine maximum settlement •
- Assess staged construction



Predicted Settlements

(0.3 to 2.1 m)

undation

Back Analysis – 2D Finite Element Model

Section Locations



Back Analysis – 2D Finite Element Model

- Setup & Calibration
 - PLAXIS 2D
 - Calibrate model results to measured settlement values
- Adjustments to Tailings Properties
 - Void Ratio
 - Compression/Recompression Index
 - Friction Angle



Back Analysis – 2D Finite Element Model

- Settlement
 - Critical settlement period \rightarrow first 4 months
 - Primary consolidation \rightarrow 7 to 12 months
 - Differential settlement expected
- Stability
 - Safety factors determined by Shear Strength Reduction Models
 - Without staged construction SF > 1.4
 - With staged construction $SF \ge 1.6$

Back Analysis Conclusions

- Consistent with Design
- Adequate performance will require:
 - Staged Construction
 - Tailings Deposition and Water Management Plan
 - Dike Monitoring (during and post construction)



Construction (2015 to 2016)



Operations Plan – Water Management



Operations Plan – Tailings Management



Operations Plan Tailings and Water Management







Triangle Lake TMF

Operations Plan Inspection Components

| Inspection | Instructions/notes | Action |
|---------------------|--|---|
| Pond Levels | Pond level managed as low as practicable Pond volume < max storage capacity in Back Pond Staff Gauges for visual monitoring Pressure Transducers | If rise in pond level, inspect for seepage Monitor/manage seepage pumpback locations and Back Pond below elevation 459.5 m. |
| Tailings Deposition | Check production rate Monitor tailings beach generation along dike Record beach slope Critical Observations: Inspect for depressions or sinkholes on tailings beach. | Move to next spigot location Move spigot location to generate continuous beach slope along dike For critical observations: Document and notify Engineer of Record. |

Operations Plan Inspection Components

| Inspection | Instructions/notes | Action |
|-----------------|--|---|
| | Inspect downstream toe of dike for seepage. | Mark seepage areas and record seepage rate. |
| Seepage | Critical Observations: | For critical observations: |
| | • Some seepage expected (22 L/s), if greater deemed critical | Document and notify Engineer of Record. |
| | Critical Observations: | For critical observations: |
| Dike | Cracks, slumping or slope instability. | • Document and notify Engineer of |
| | Settlement and particularly differential settlement. | Record. |
| | Erosion | |
| | Plot data from drive-point piezometers and settlement pins | |
| Instrumentation | Plot pond levels in TMF and Back Pond | |
| | Critical Observations: | |
| | • Erratic changes in the piezometric levels and settlement pins. | |

Operation Plan – Year 2016



- Minimum Dike Crest Elev. 462 m
- 2 Spigots at Elev. 461.5 m (0.5 m Freeboard)
- Maximum Pond Elev. 459.5 m
- Deposition plan and tailings surface based on an avg. production of 750 tpd
- Dike configurations for each deposition year can accommodate 1,100 tpd
- Average tailings beach slope of 1% for all years of deposition
- Raise Dike to Crest Elev. 463.0 m for 2017 operation



Conclusion

- We can Construct on Tailings
- Operations Plan is Essential



