



**BARRICK**

**Mine Dewatering and Water Management at Barrick  
Goldstrike Mine in the Carlin Trend, Nevada**

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Presented at U.S. EPA Hardrock Mining Conference 2012  
Denver, CO, USA, April 3-5, 2012

# Presentation Contents



1. Introduction to Barrick and Goldstrike
2. Goldstrike Dewatering System
3. Goldstrike Monitoring System
4. Impact Evaluation
5. Conclusions

# Unit Conversion



## Distance:

1 meter = 3.3 feet

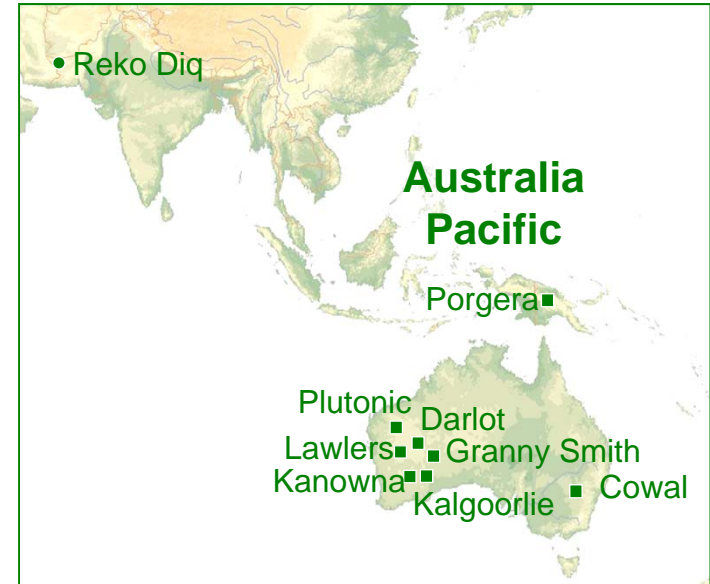
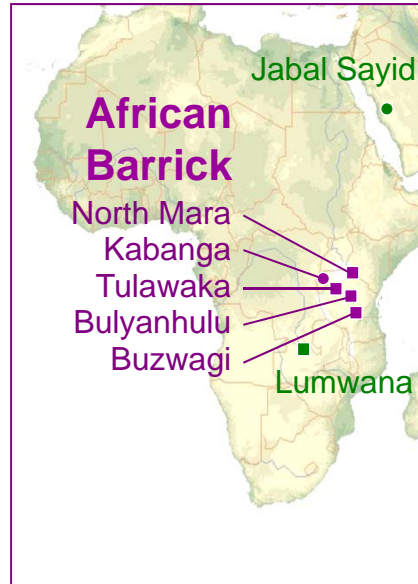
## Flow rate:

1 liters/second = 16 gallons/minute (gpm)

## Weight (Gold):

1 tonne = 32,000 troy ounces

# 1. Introduction – Barrick



■ Mine    ● Project

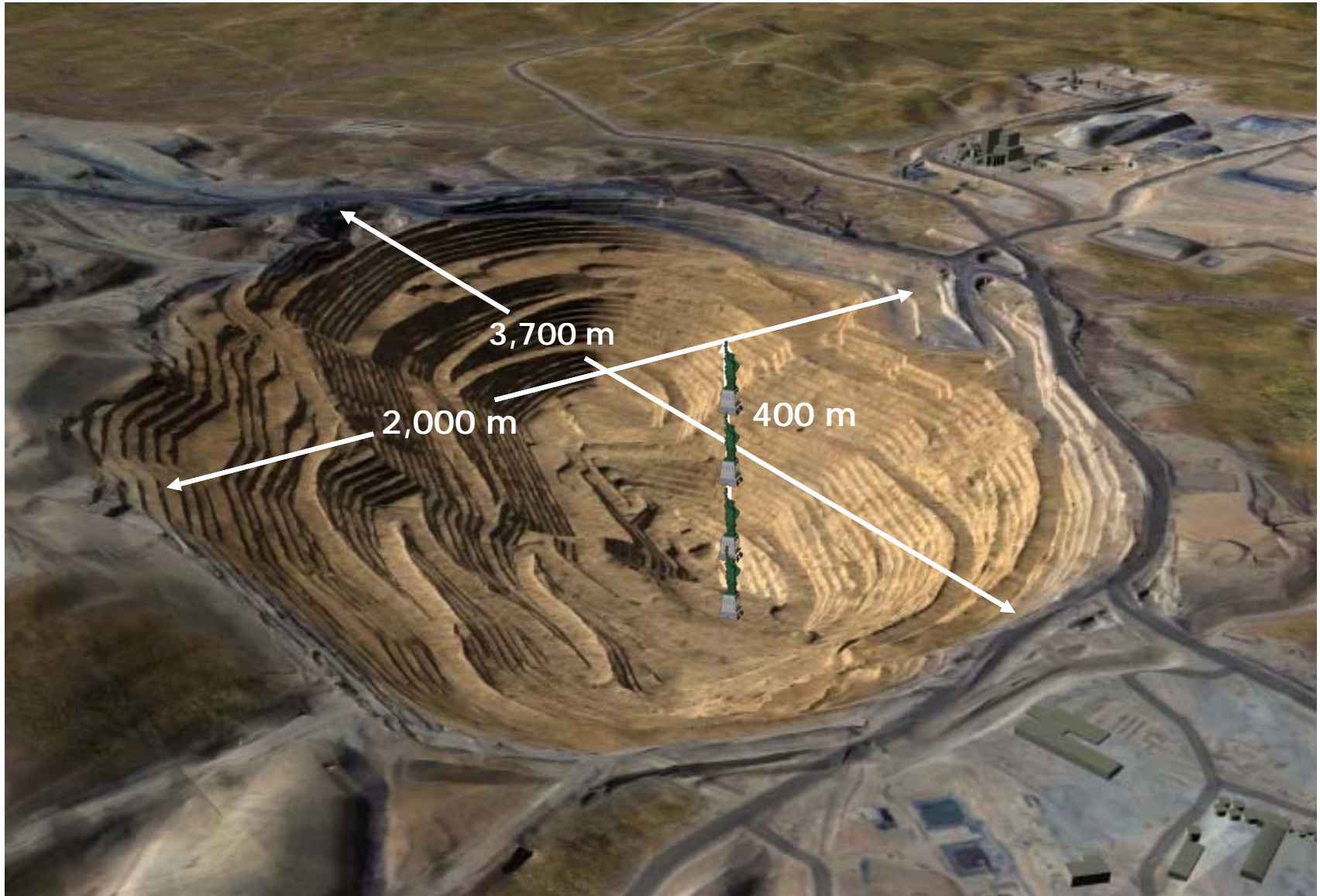
# Barrick Global Operations – Equinox Addition



# 1. Introduction – Goldstrike Mine



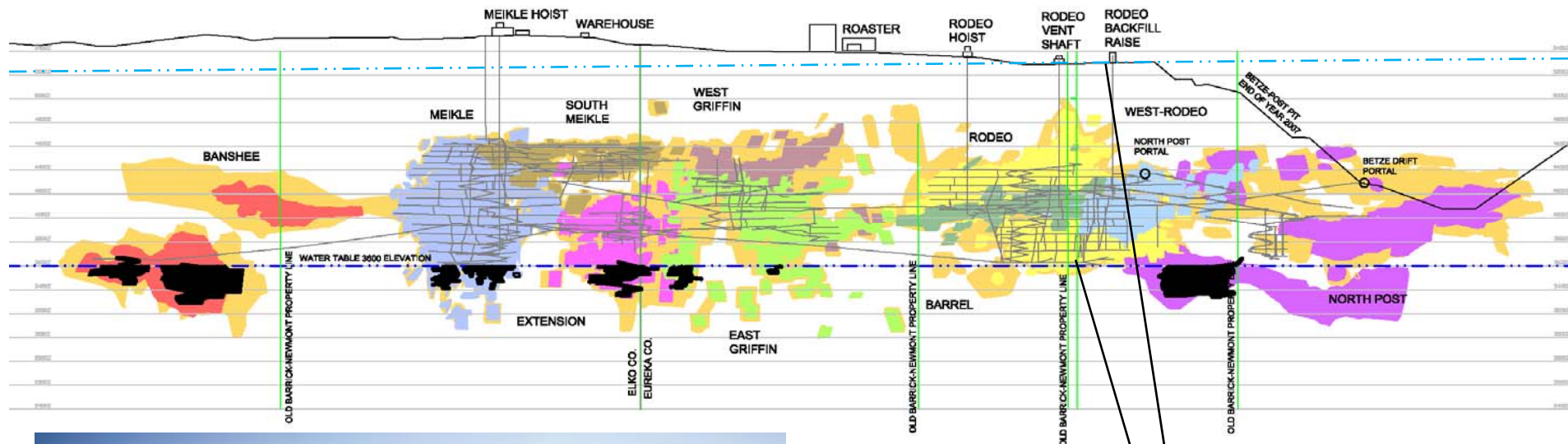
# Open Pit



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# Underground Mines

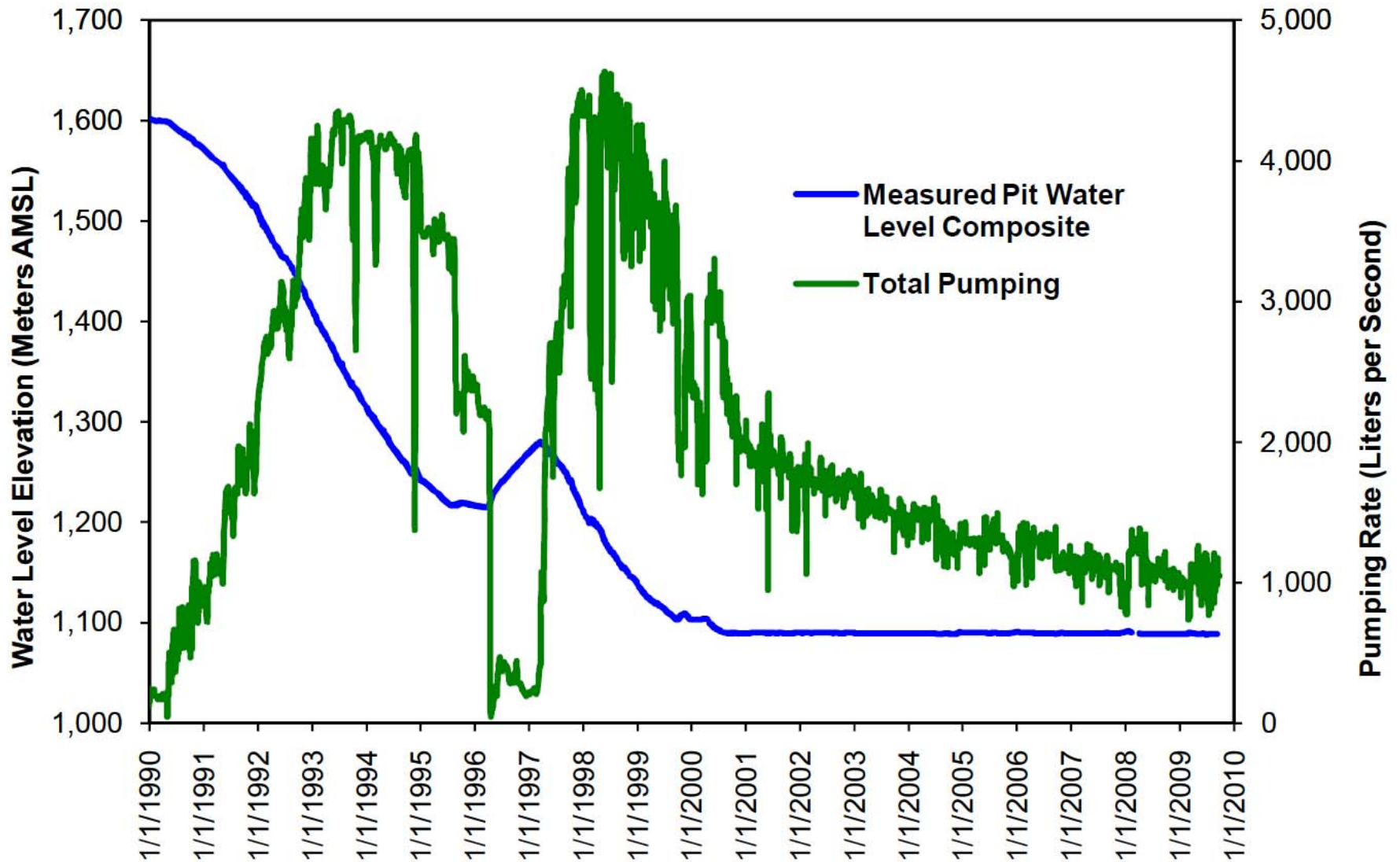


**Pre-mining water table  
1600 m amsl**

**Current water table  
1100 m amsl  
with a drawdown of 500 m**



## 2. Goldstrike Dewatering System

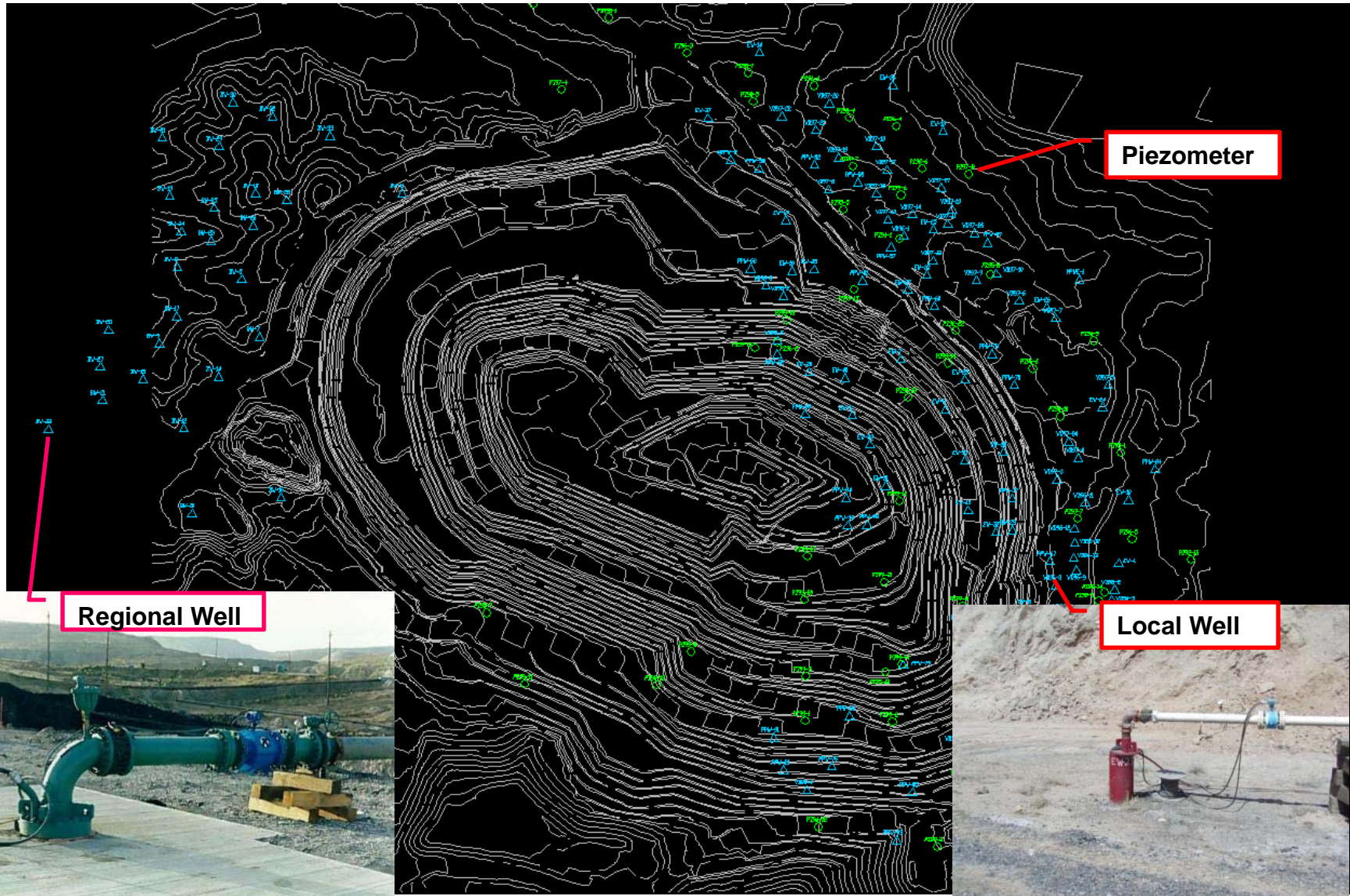


# Dewatering System - Active



**Pumping well -  
Depth: 1000 m  
Diameter: 50 cm  
Rate: 200 l/s (3,000 gpm)  
Power: 2,000 HP  
Cost: US\$3 Million/Each**

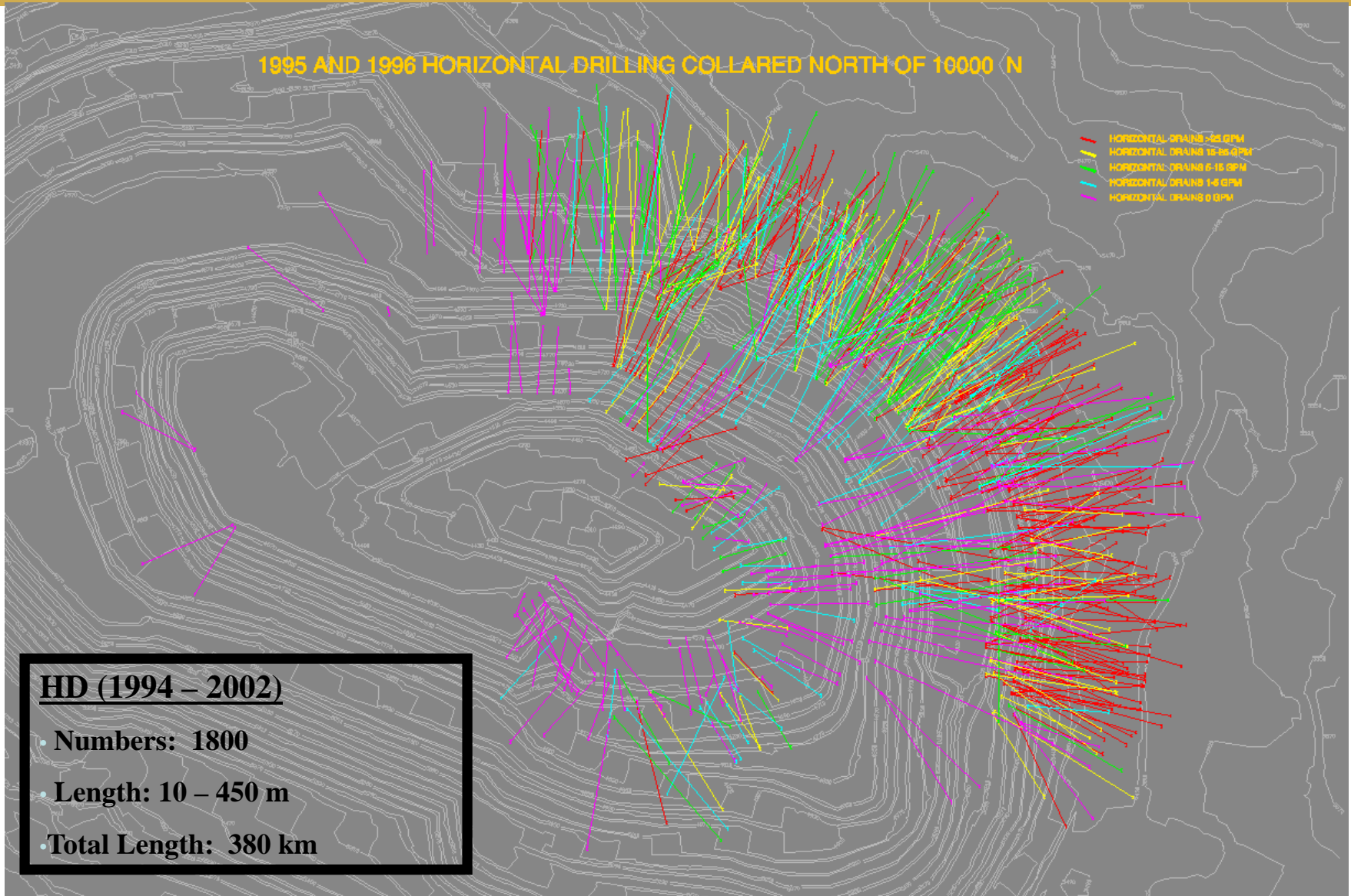
# Dewatering System - Active



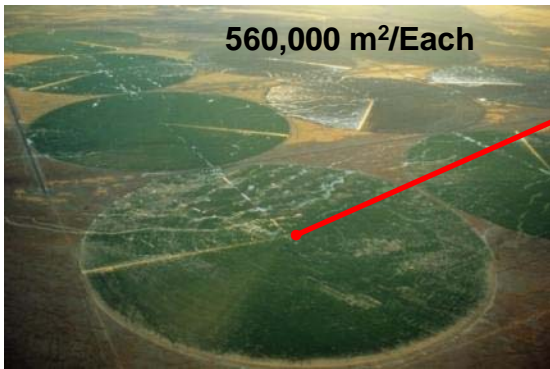
# Dewatering System - Passive



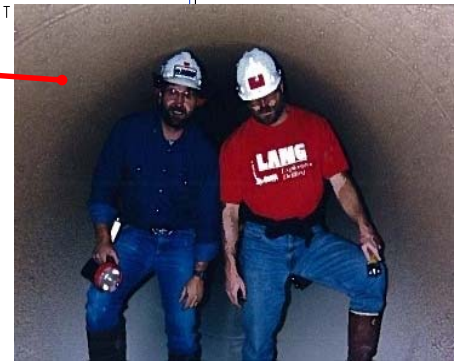
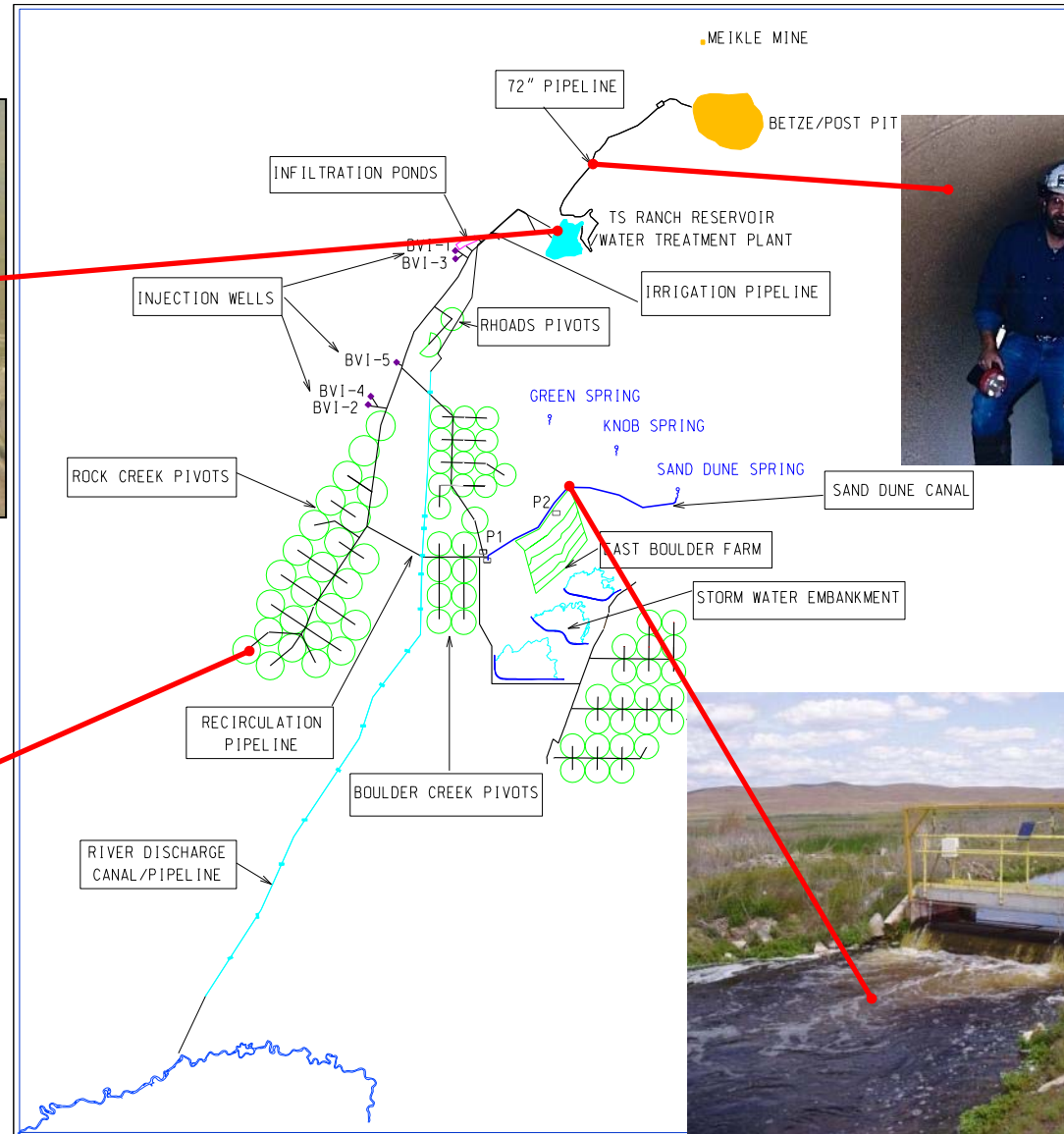
# Dewatering System - Passive



# Water Management System



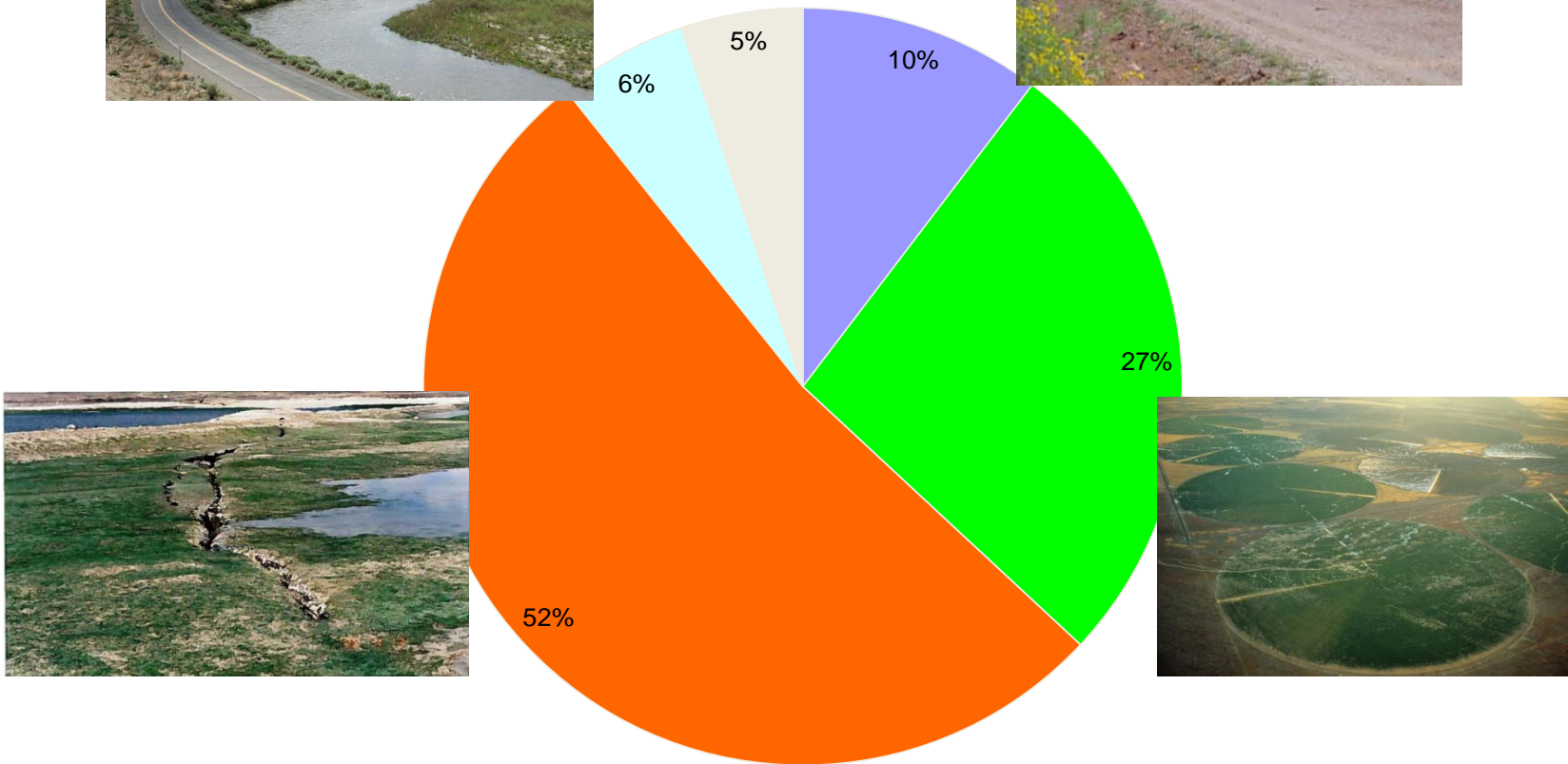
560,000 m<sup>2</sup>/Each



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# Cumulative Water Balance



■ Mine Use ■ Irrigation ■ Infiltration/Injection ■ Discharge to Humboldt River ■ Flood Irrigation and Evap

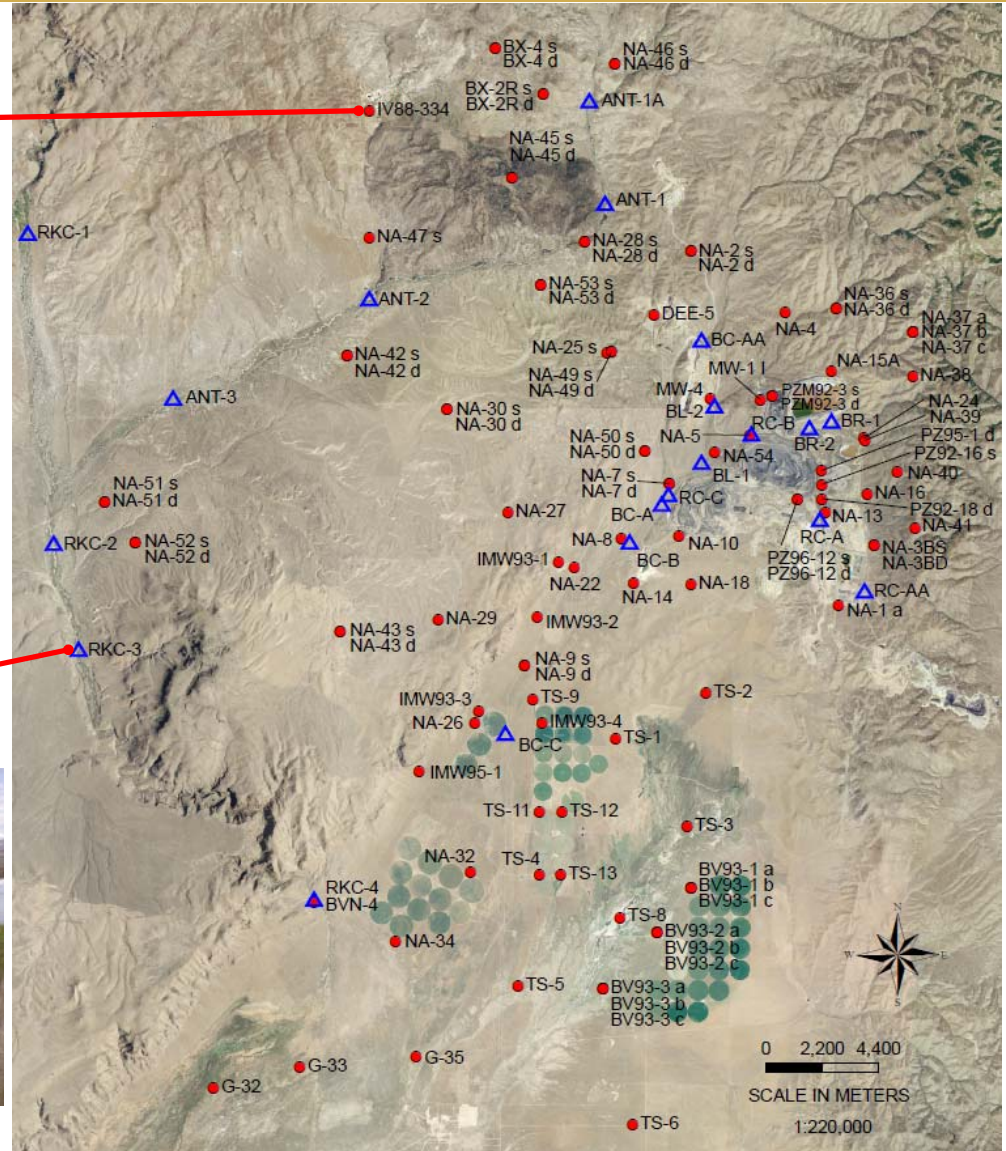
# 3. Goldstrike Monitoring System – 15,000 km<sup>2</sup>



**Manual/Automatic Groundwater Monitoring**

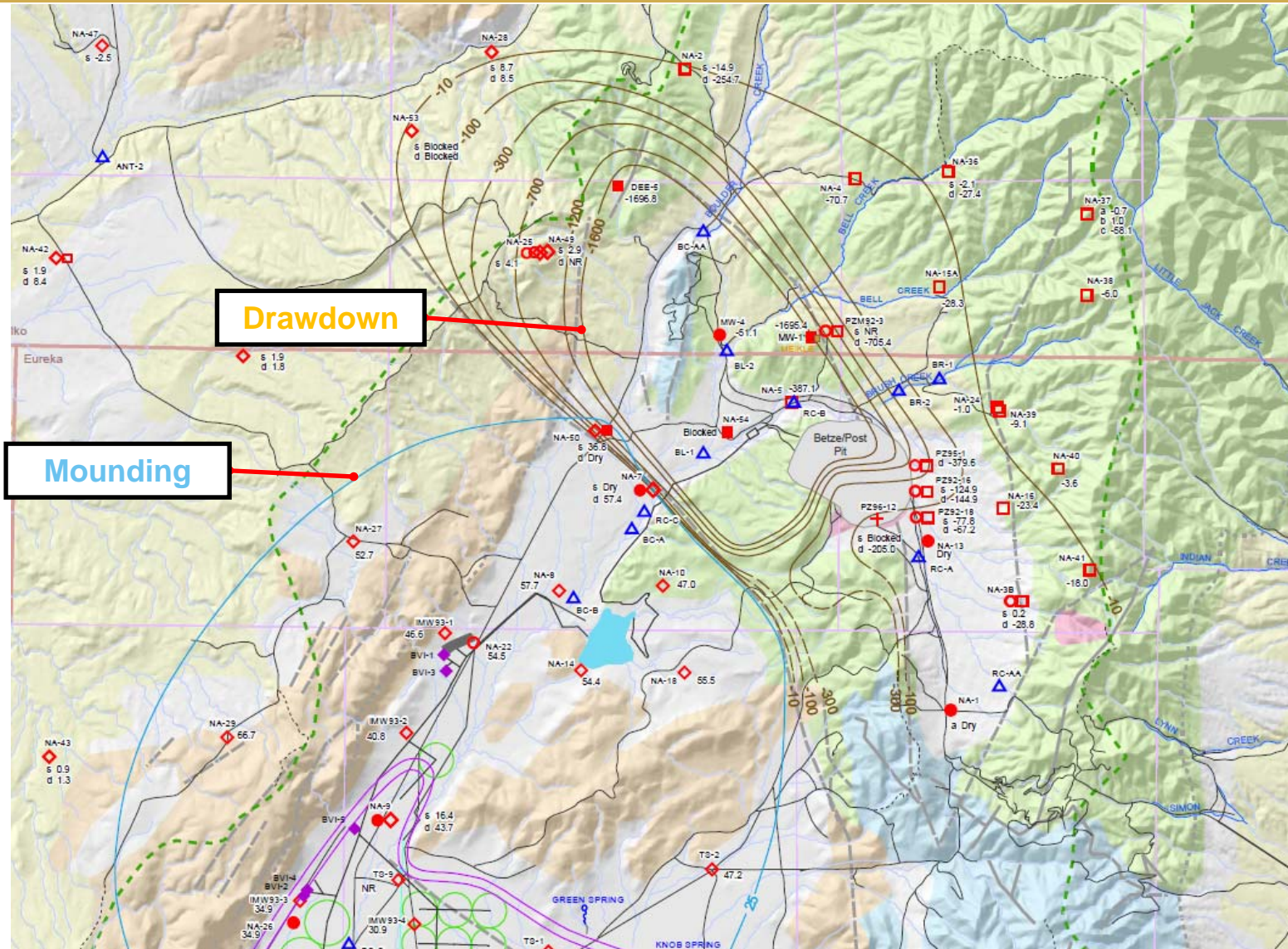


**Manual/Automatic Surface Water Monitoring**





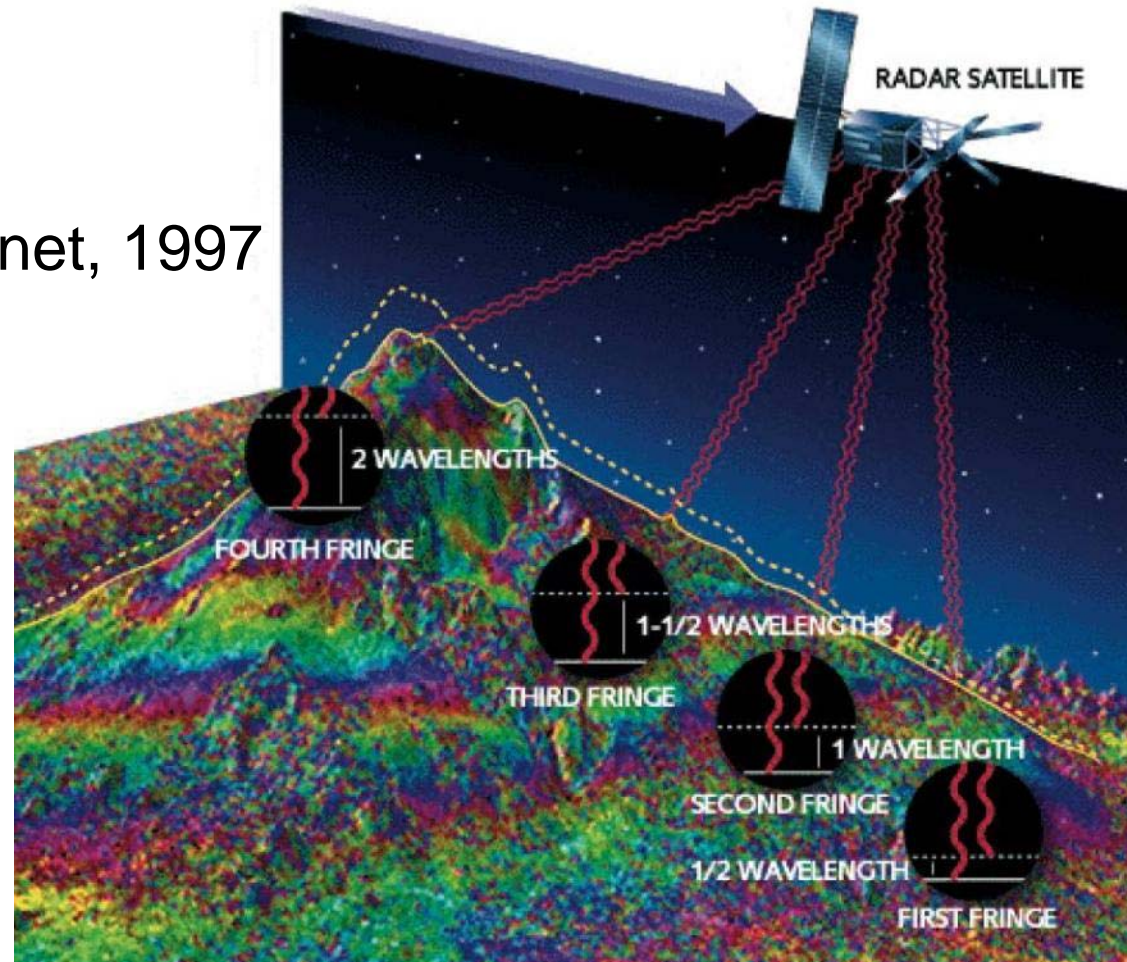
# Water Level Change To-Date



# New Tools – Ground Deformation

A New Assessment Tool - Interferometric Synthetic Aperture Radar (InSAR)  
Identified Subsidence/Uplift Associated with Mine Dewatering  
100km x 100km coverage at 5m pixel resolution

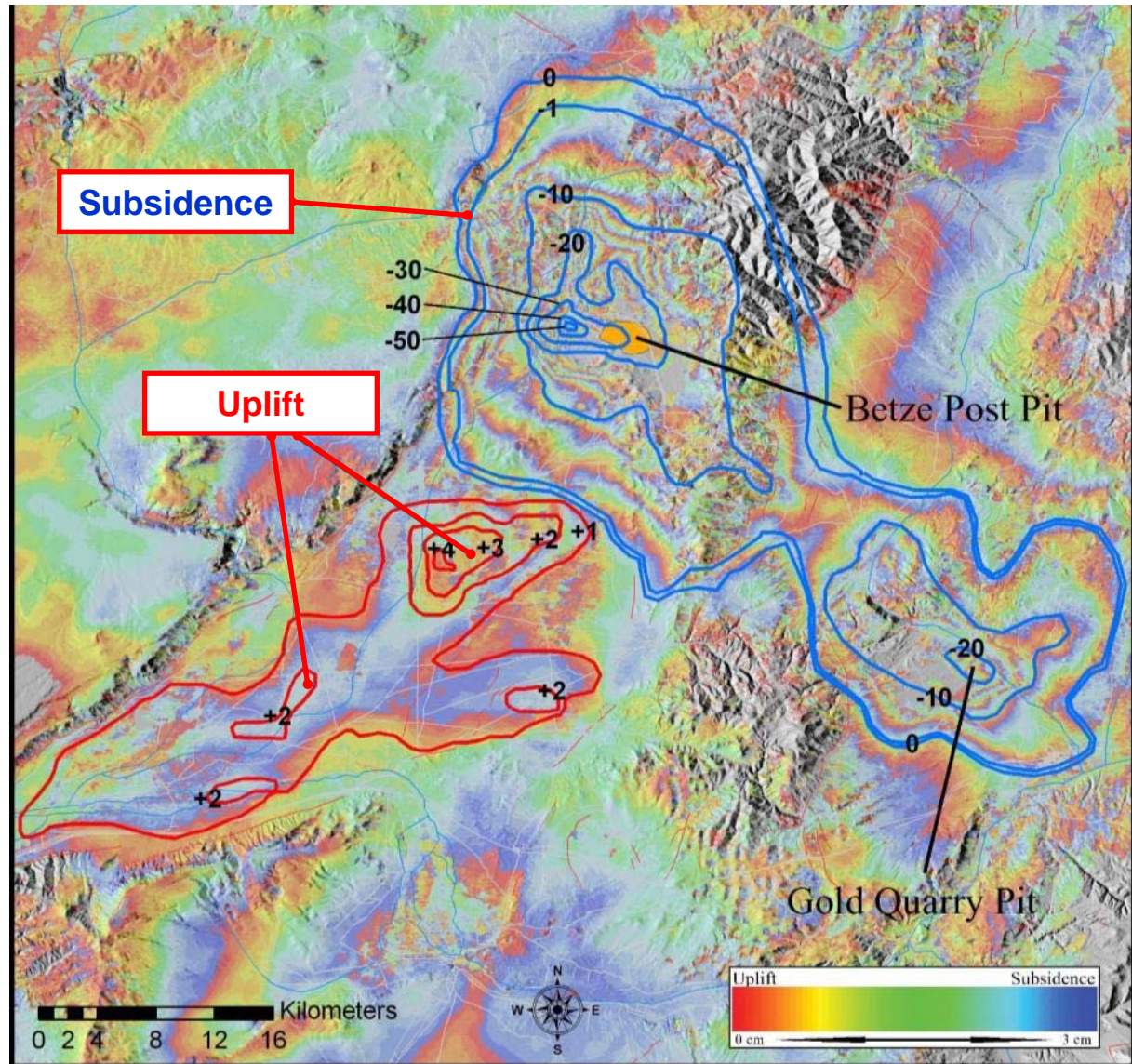
From Massonnet, 1997



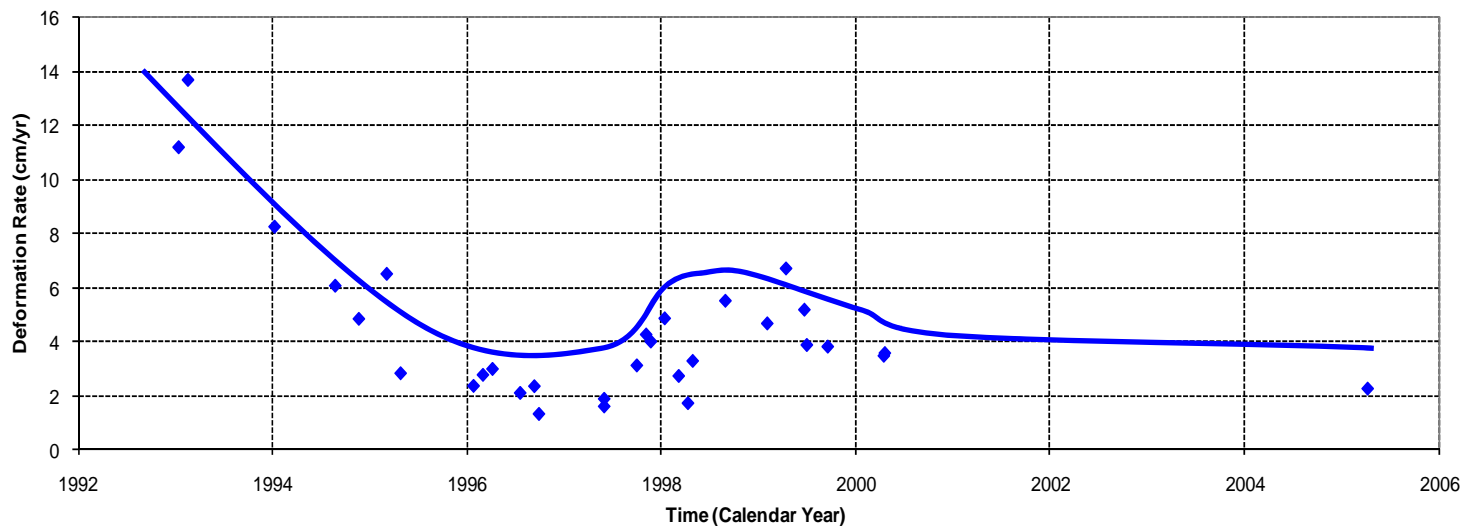
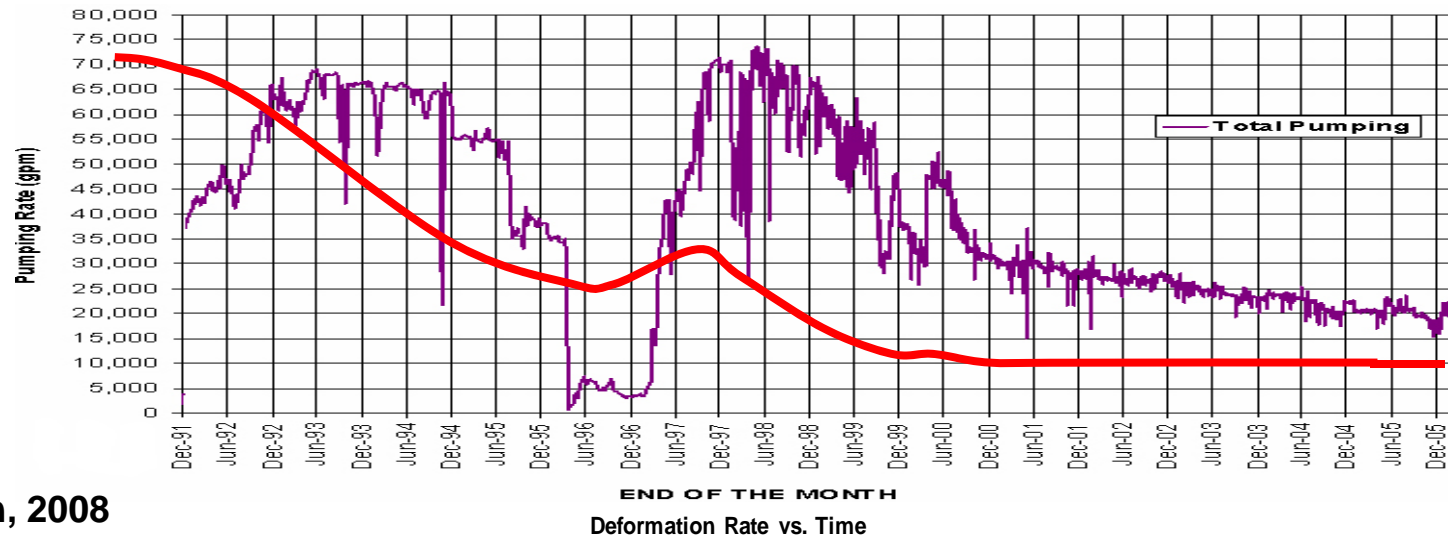
# Ground Deformation – InSAR Results

**Subsidence and Uplift**  
June 1, 1992 – Nov 26, 2000

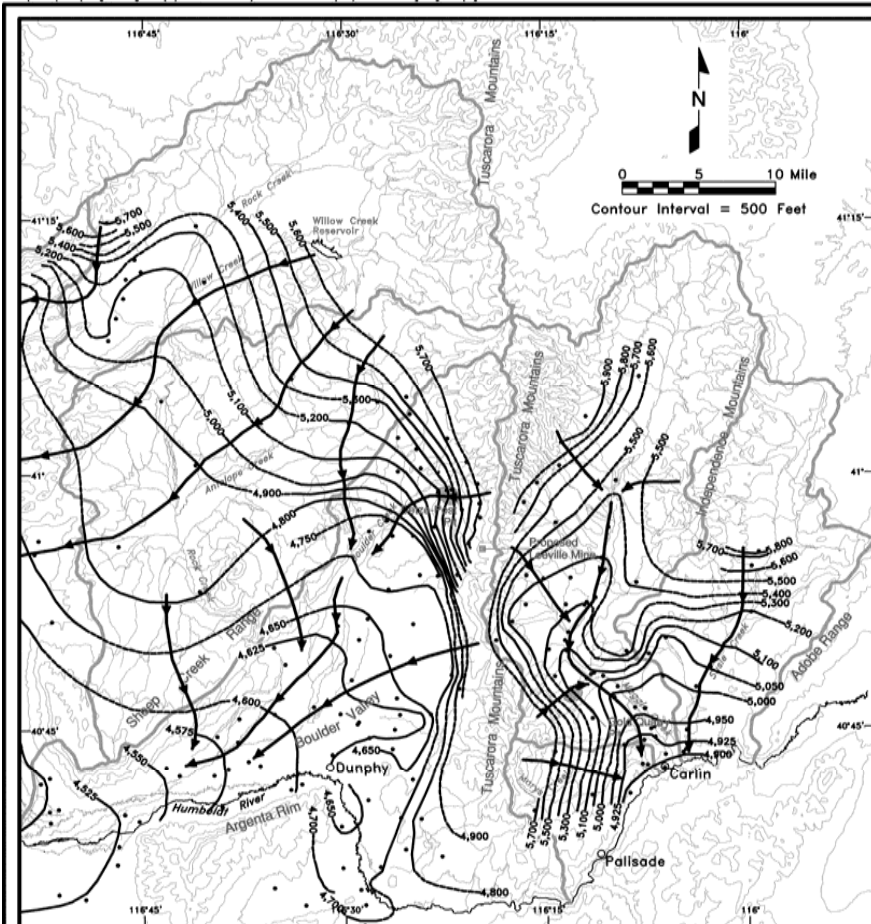
From Katzenstein, 2008



# Monitoring System – InSAR Results



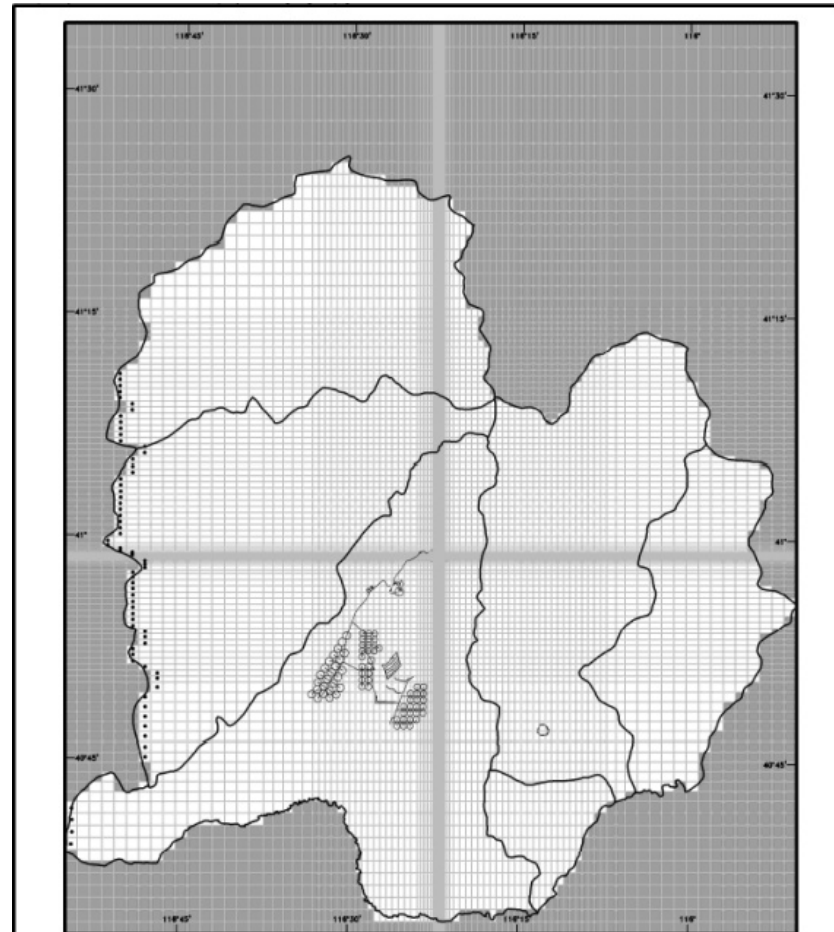
# 4. Impact Evaluation – Flow Model



- Legend**
- Ground Water Basin Boundary
  - Stream
  - - - Water-table contour, dashed where uncertain
  - General Direction of Ground Water Flow
  - Wells

From Maurer et al., 1996

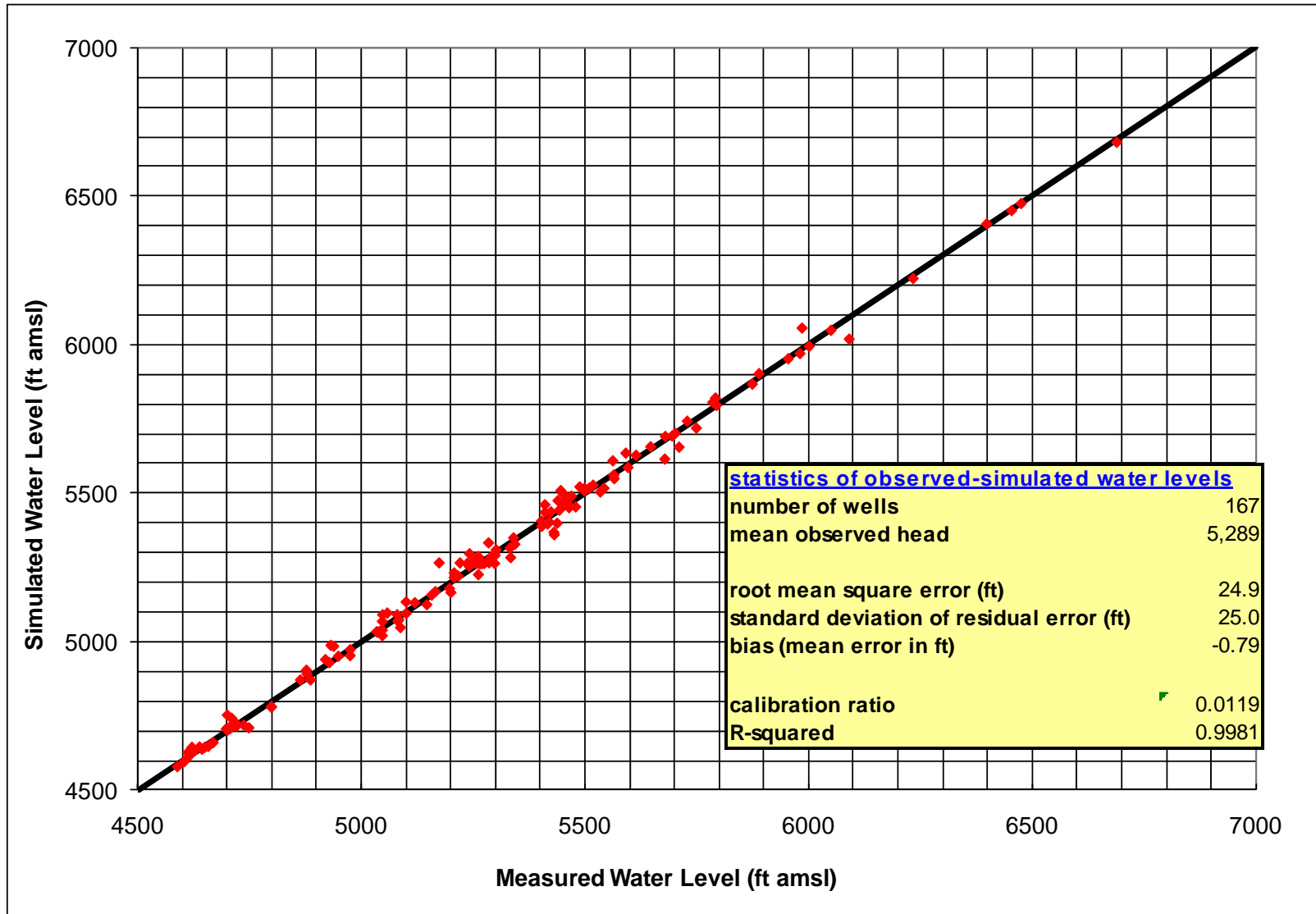
**Pre-Mining  
Water Level  
(1990-1991)**



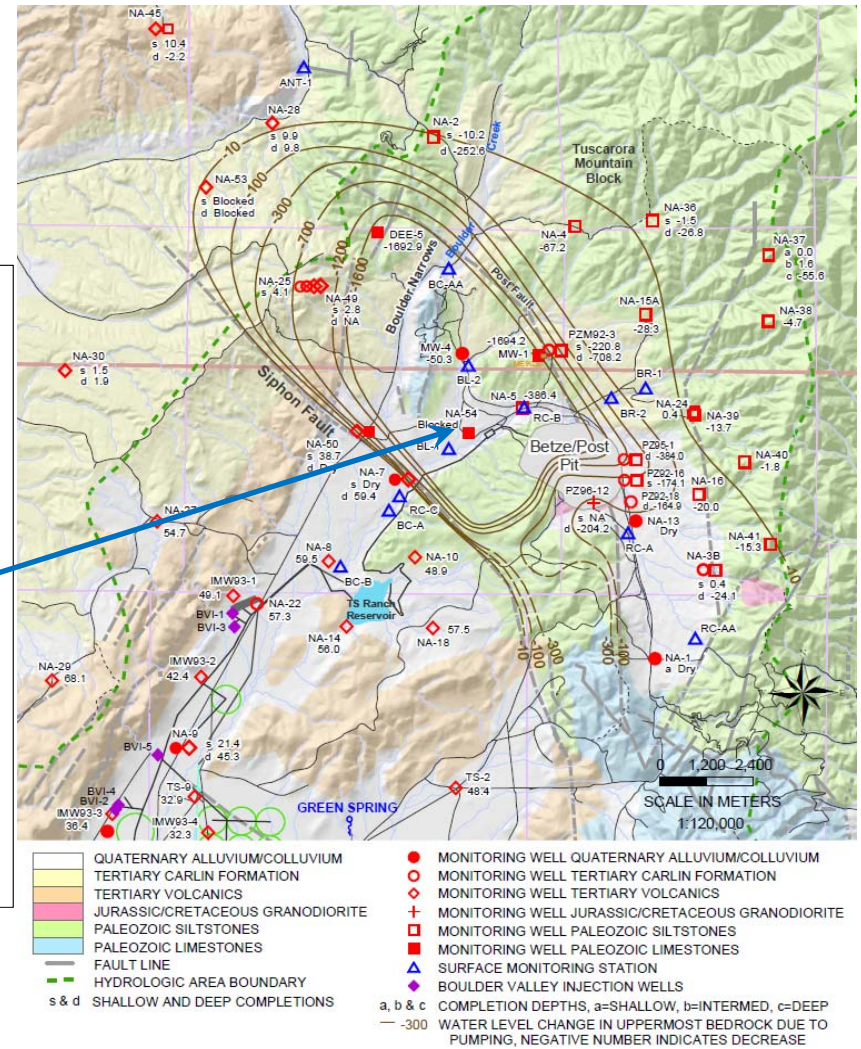
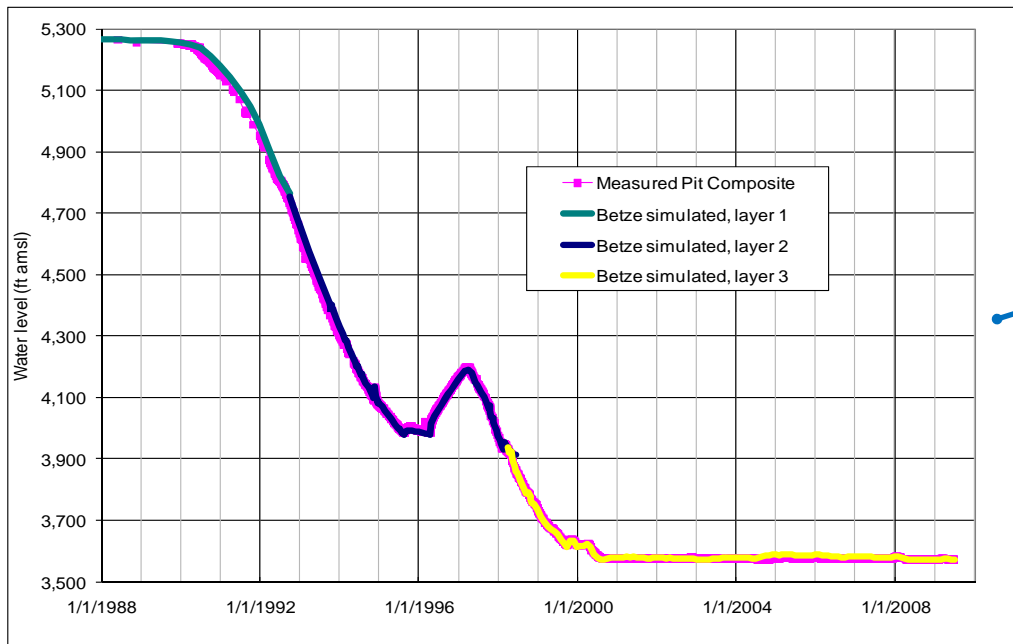
- Legend**
- Ground Water Basin Boundary
  - Active Model Cells
  - Inactive Model Cells
  - General Head Boundary
  - Center Pivot Irrigation

**MODFLOW  
Model Grids**

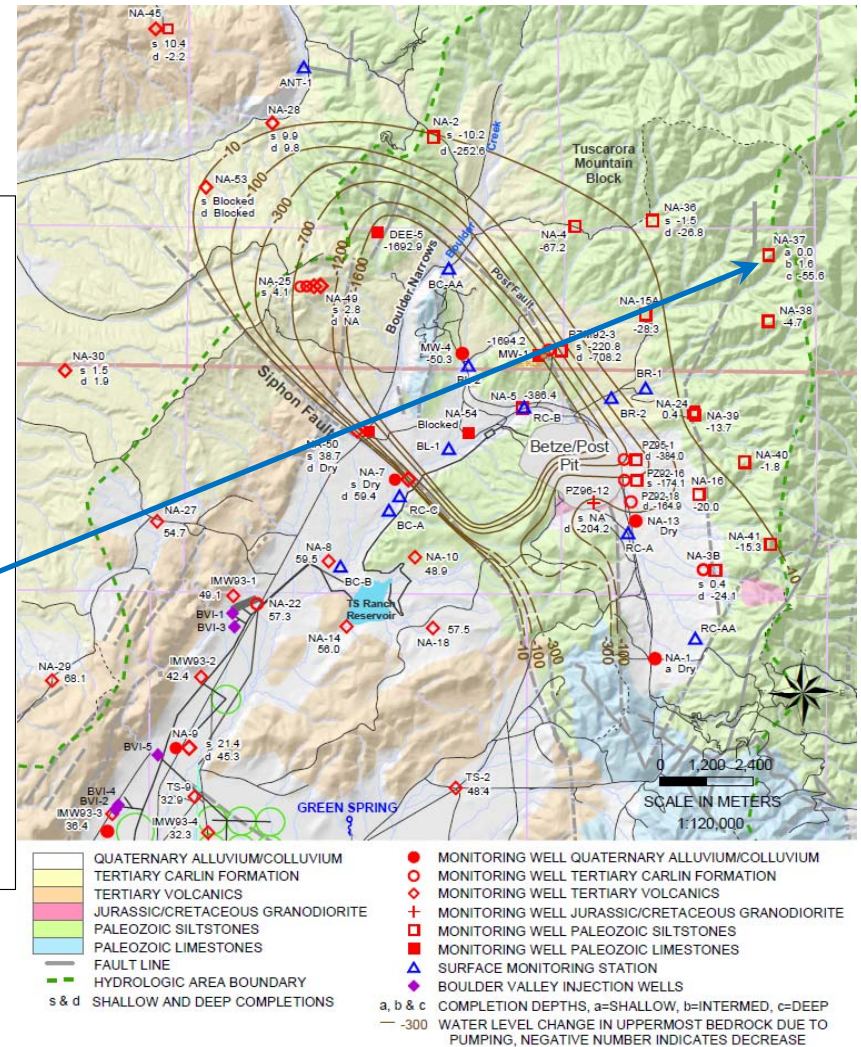
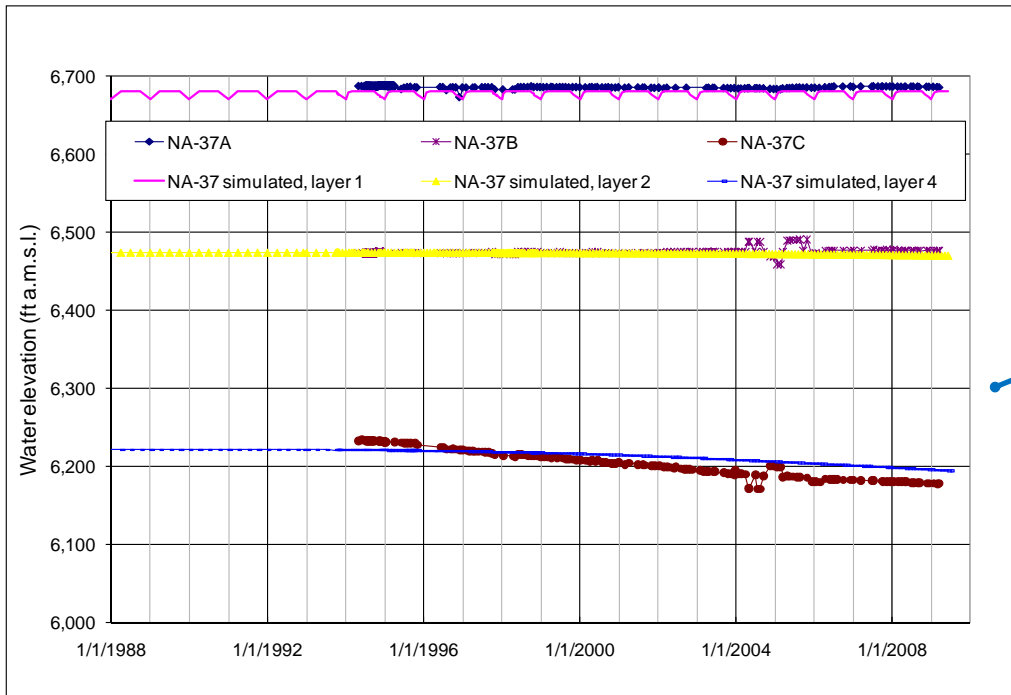
# Flow Model – Steady State (Pre-mining)



# Flow Model – Transient (Pit Area)

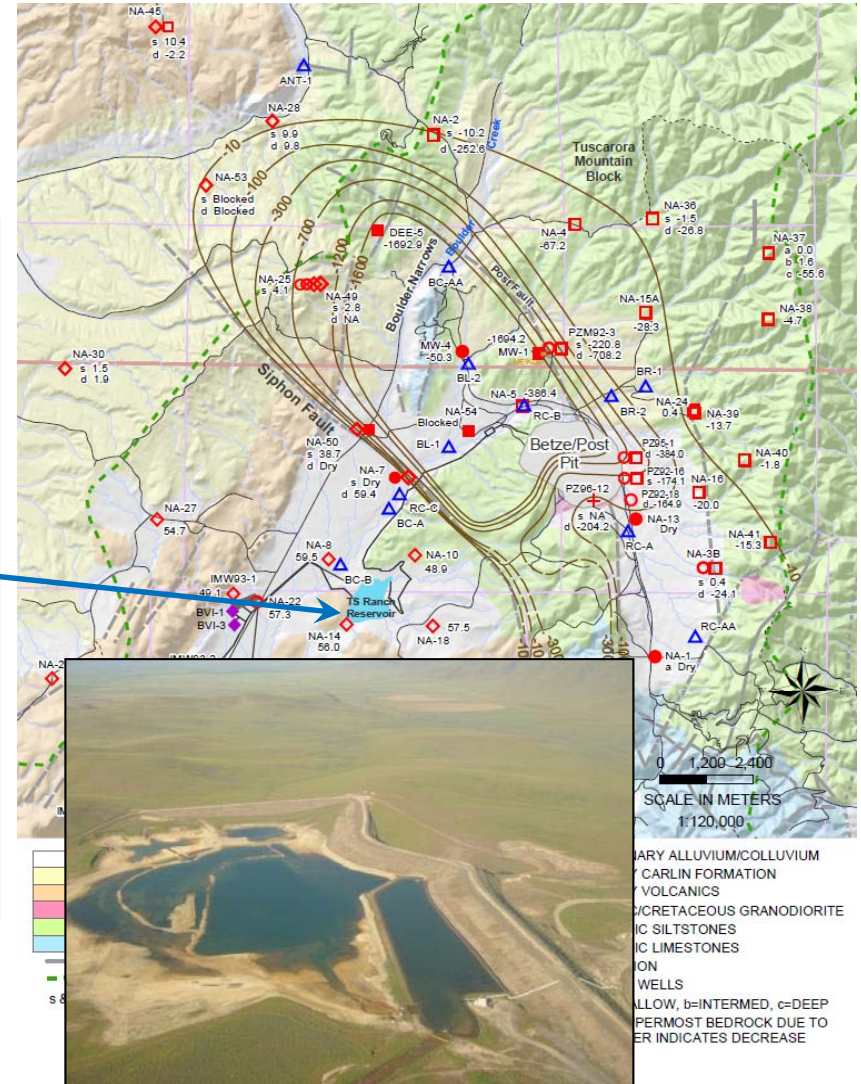
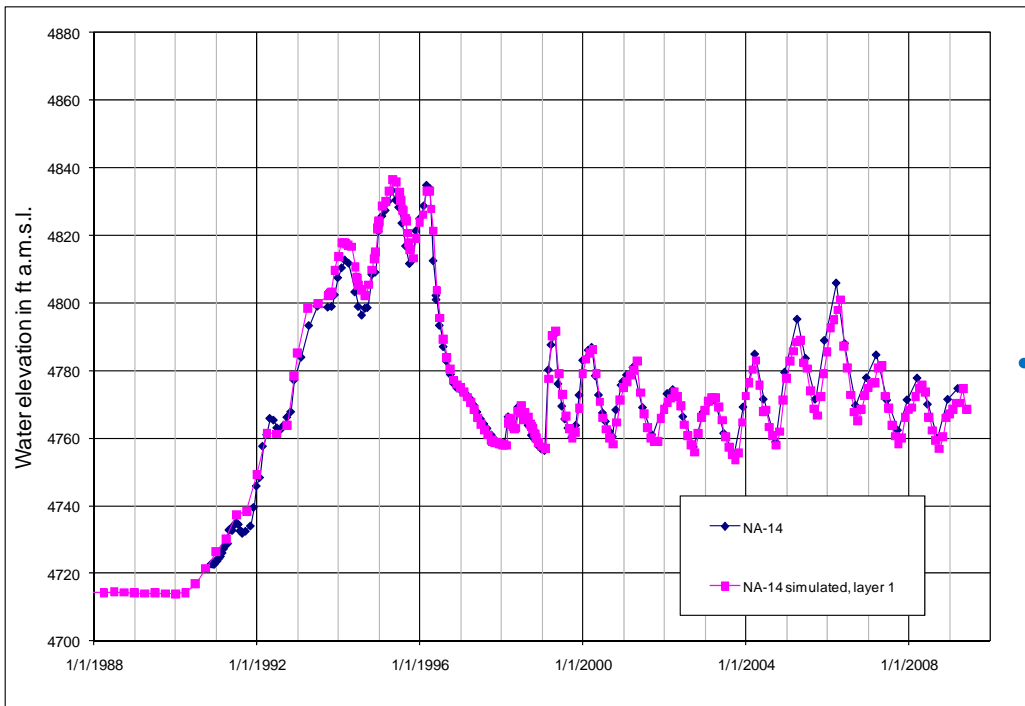


# Flow Model – Transient (Mountain Block)

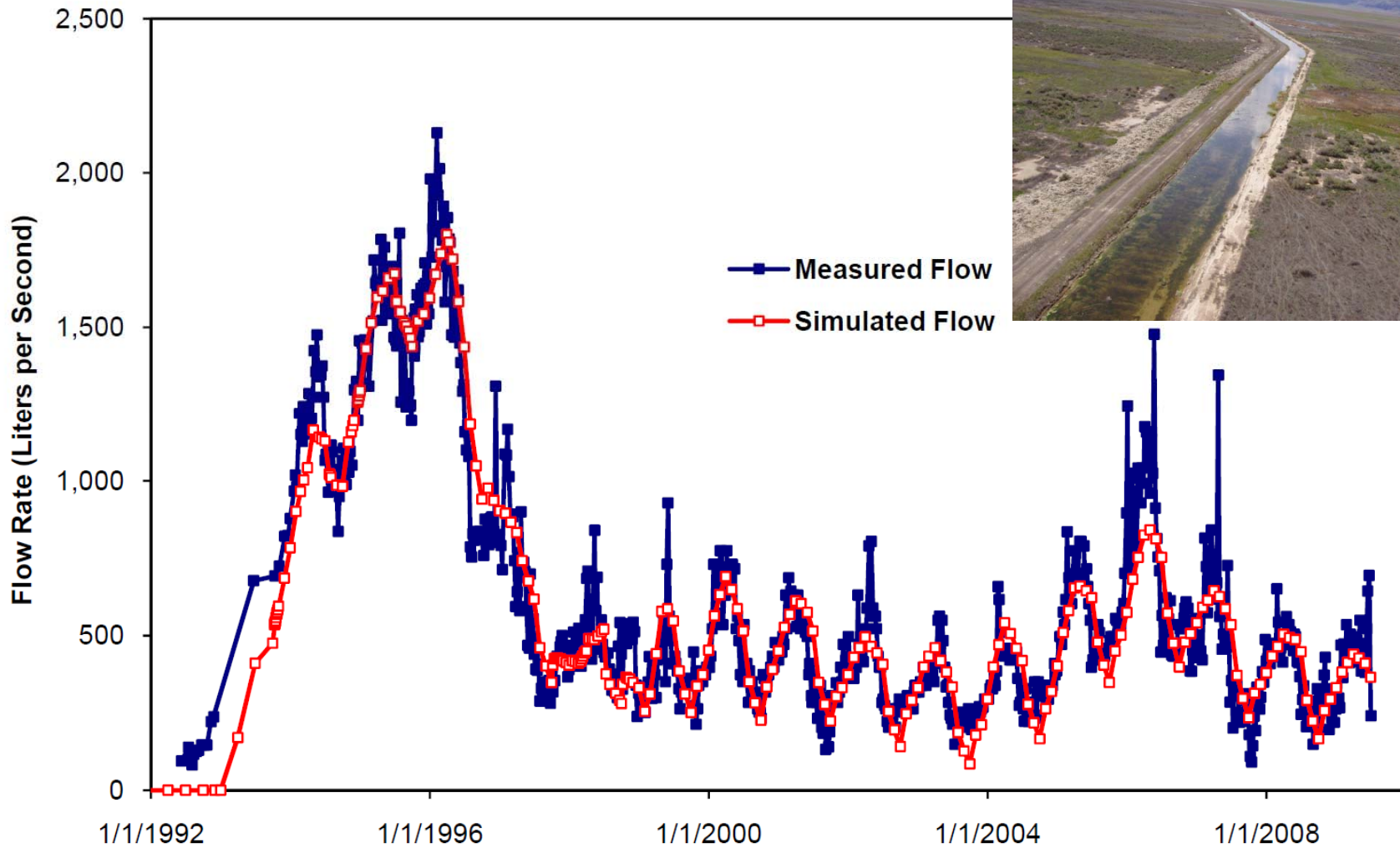




# Flow Model – Transient (Infiltration Basin)



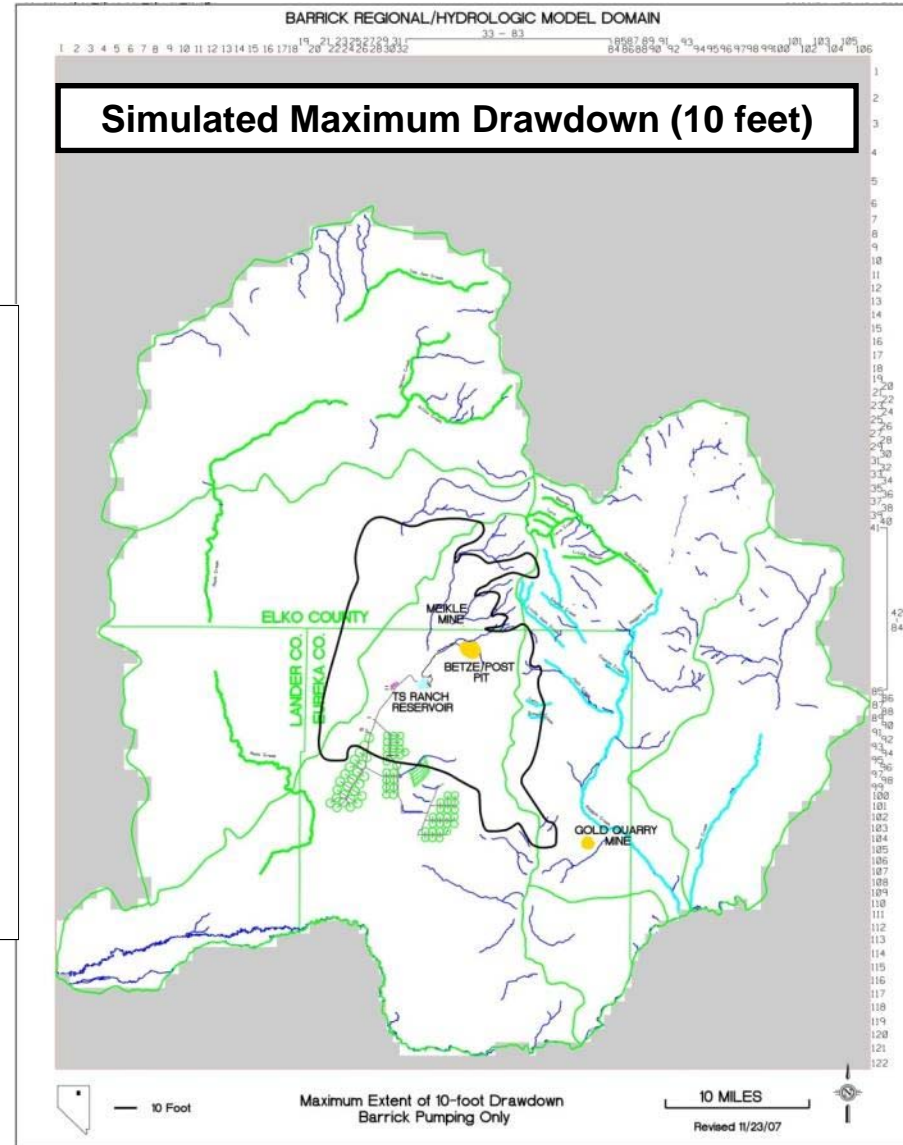
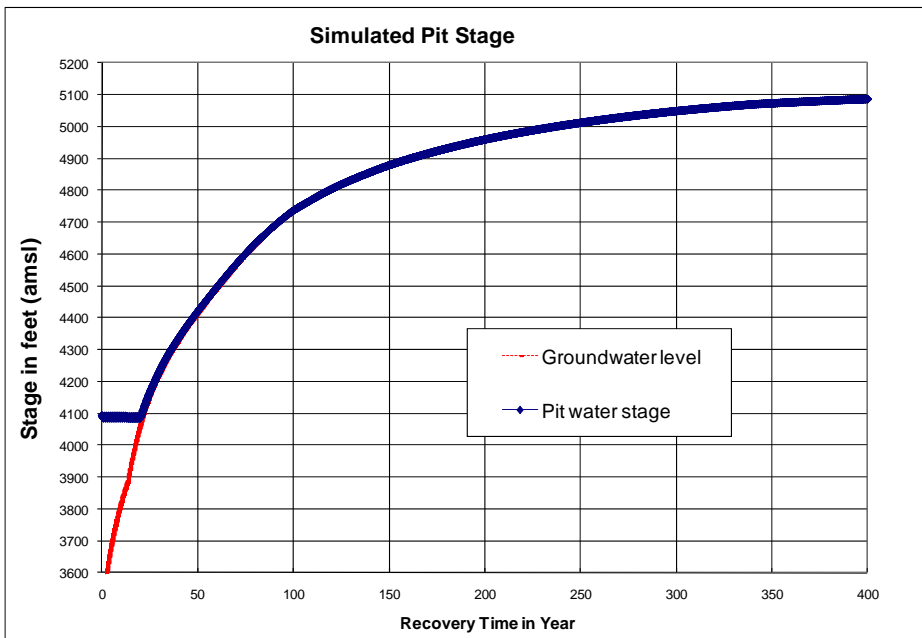
# Flow Model – Transient (Surface Water)



# Flow Model – Projection



## Post-Mining Pit Lake Recovery



## 5. Conclusions



- Groundwater pumping at Goldstrike has resulted in 520 m of drawdown around the mine site.
- Most of the water pumped at the mine has been returned to the same hydrologic basin.
- Extensive monitoring program, assisted by modern satellite technology and by robust modeling, has identified aquifer responses.
- Improvement of the water-management system, the monitoring network, the modeling and analysis continue at Goldstrike.

# Thank You for Your Attention!

