Groundwater Injury Assessment

Molycorp mine and tailings site

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Boulder, CO

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Groundwater Injury

- Tailings Impoundment Area
- Mine Site Area

Evaluate:

- Groundwater Volume
- Groundwater Flux

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Calculations

Volume = surface area of plume x depth x effective porosity

Flux = hydraulic conductivity x gradient x thickness x width of plume

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Tailings Area Groundwater Injury Quantification- Method

- Focus on sulfate
- Focus on upper alluvium (basal aquifer potentially contaminated but data insufficient to draw contours)
- Focus on groundwater downgradient of tailings impoundments only (not beneath)
- Determine spatial area where groundwater sulfate concentrations exceed 600 mg/L (using existing well data)

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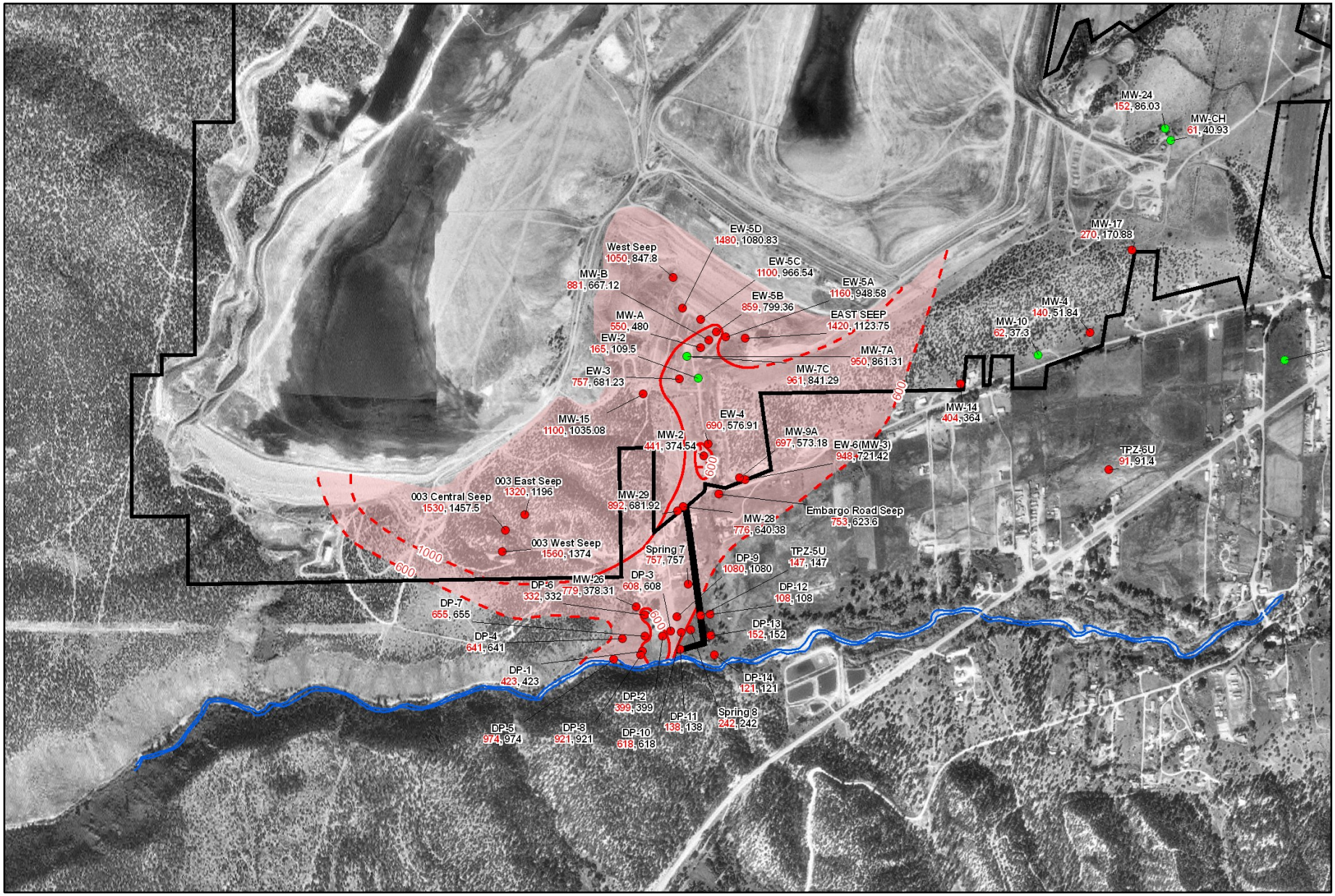

Alluvium with Groundwater Sulfate Concentrations Exceeding 600 mg/L

0 1,000 2,000 3,000 Feet

Streams
Mine boundary

Groundwater sample
Waterbody zone
Basal Alluvial Aquifer
Upper Alluvial Aquifer

Groundwater SO_4 concentrations (mg/L)
Estimated
Interpolated
Interpolated
Area of groundwater with SO_4 concentration > 600 mg/L

j:/projects/molycorp/amls_aprs/GWSulfateworking.mxd

Alluvium with Groundwater Sulfate Concentrations Exceeding 600 mg/L and Groundwater Elevations

0 1,000 2,000 3,000

Feet

- Town
- Mine boundary
- Average groundwater elevation (ft)
- Groundwater elevation (ft)

Groundwater SO_4 concentrations (mg/L)

- Estimated
- Interpolated
- Interpolated
- Area of groundwater with SO_4 concentration > 600 mg/L

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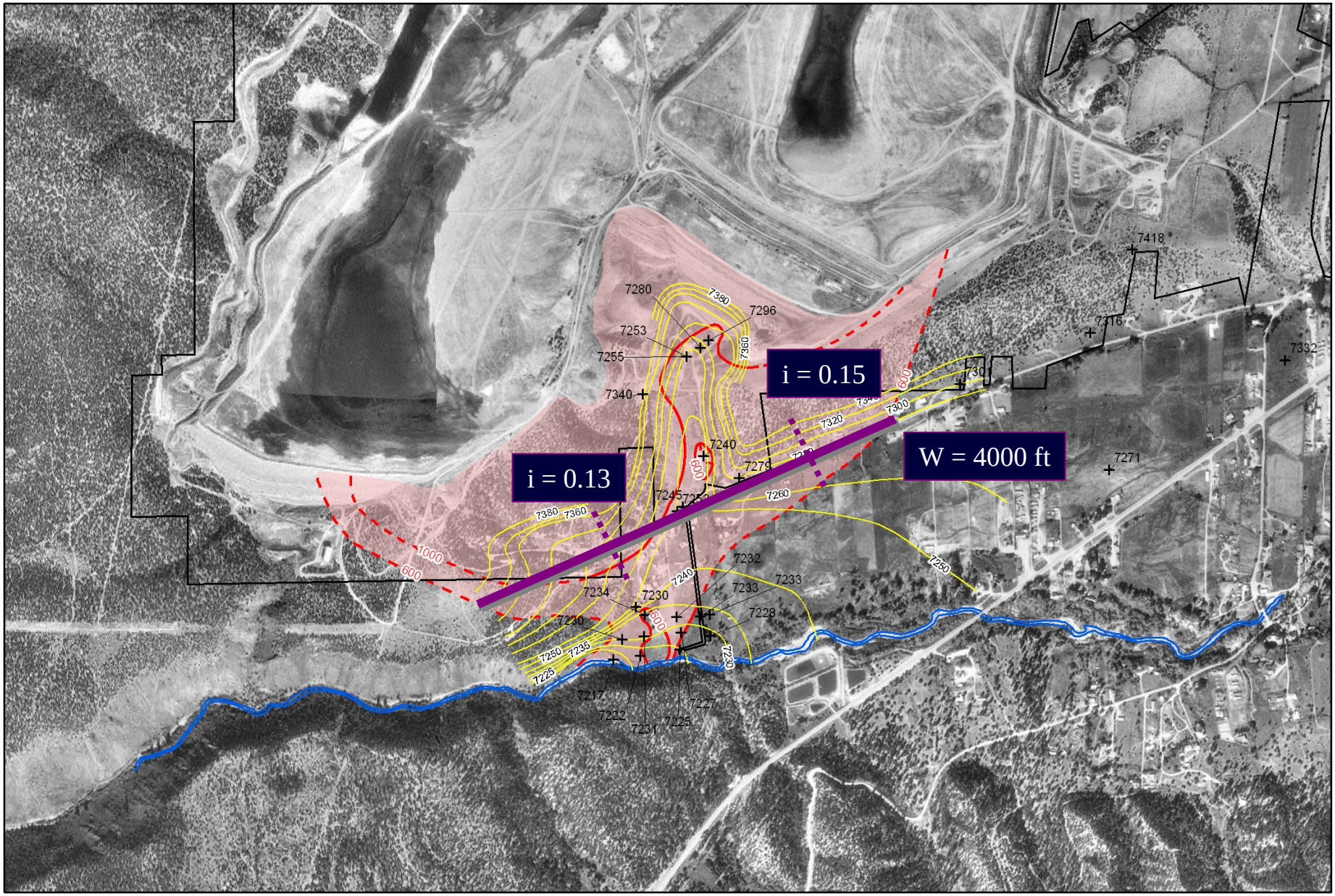

Alluvium with Groundwater Sulfate Concentrations Exceeding 600 mg/L and Groundwater Elevations

0 1,000 2,000 3,000

Feet

Town

Mine boundary

Average groundwater elevation (ft)

Groundwater elevation (ft)

Groundwater SO_4 concentrations (mg/L)

Estimated

Interpolated

Interpolated

Area of groundwater with SO_4 concentration > 600 mg/L

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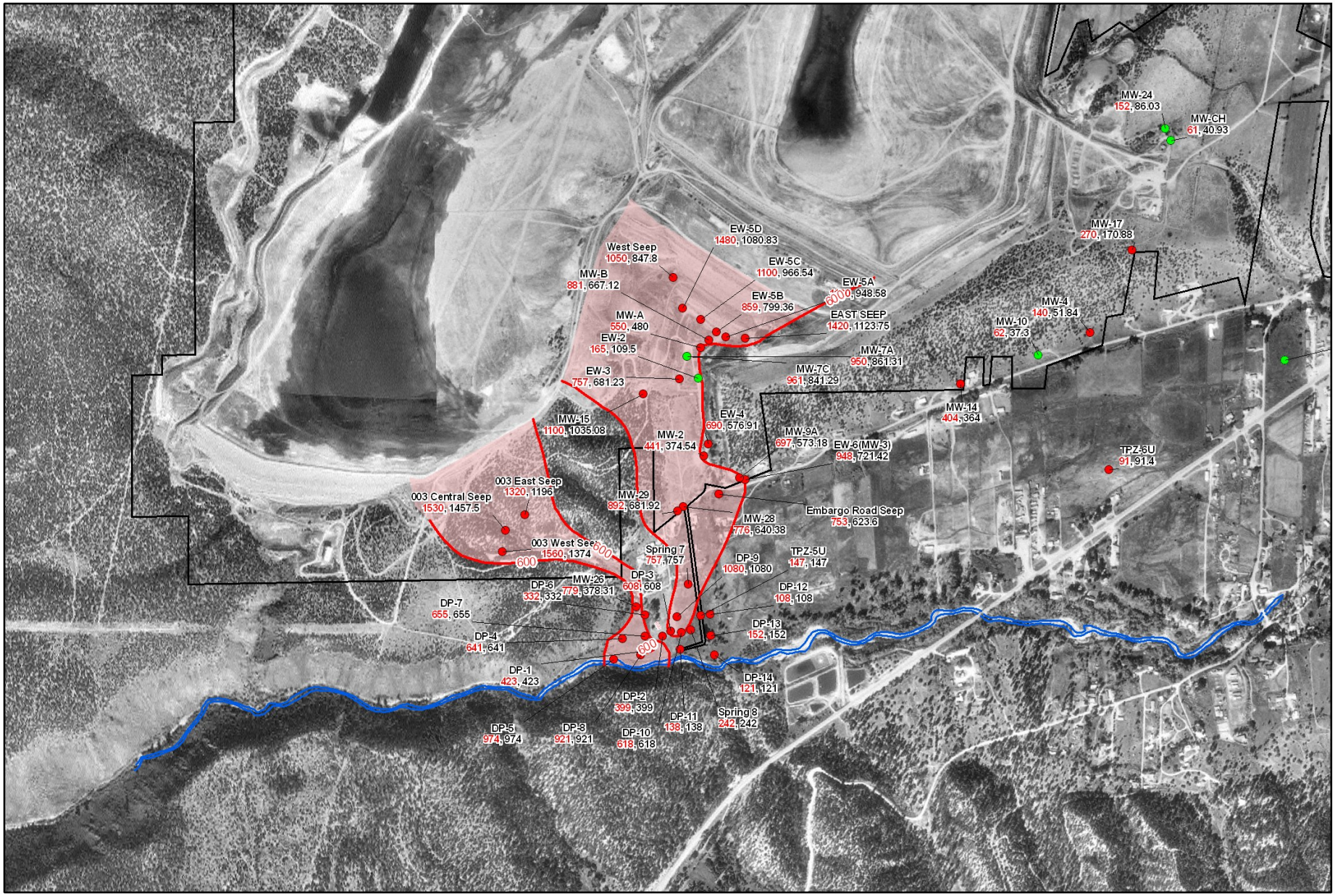

Alluvium with URS Groundwater Sulfate Concentrations Exceeding 600 mg/L

0 1,000 2,000 3,000 Feet

Streams

Mine boundary

Groundwater sample

Waterbody zone

Basal Alluvial Aquifer

Upper Alluvial Aquifer

URS Groundwater plume 600 mg/L contour

Area of groundwater with SO_4 concentration > 600 mg/L

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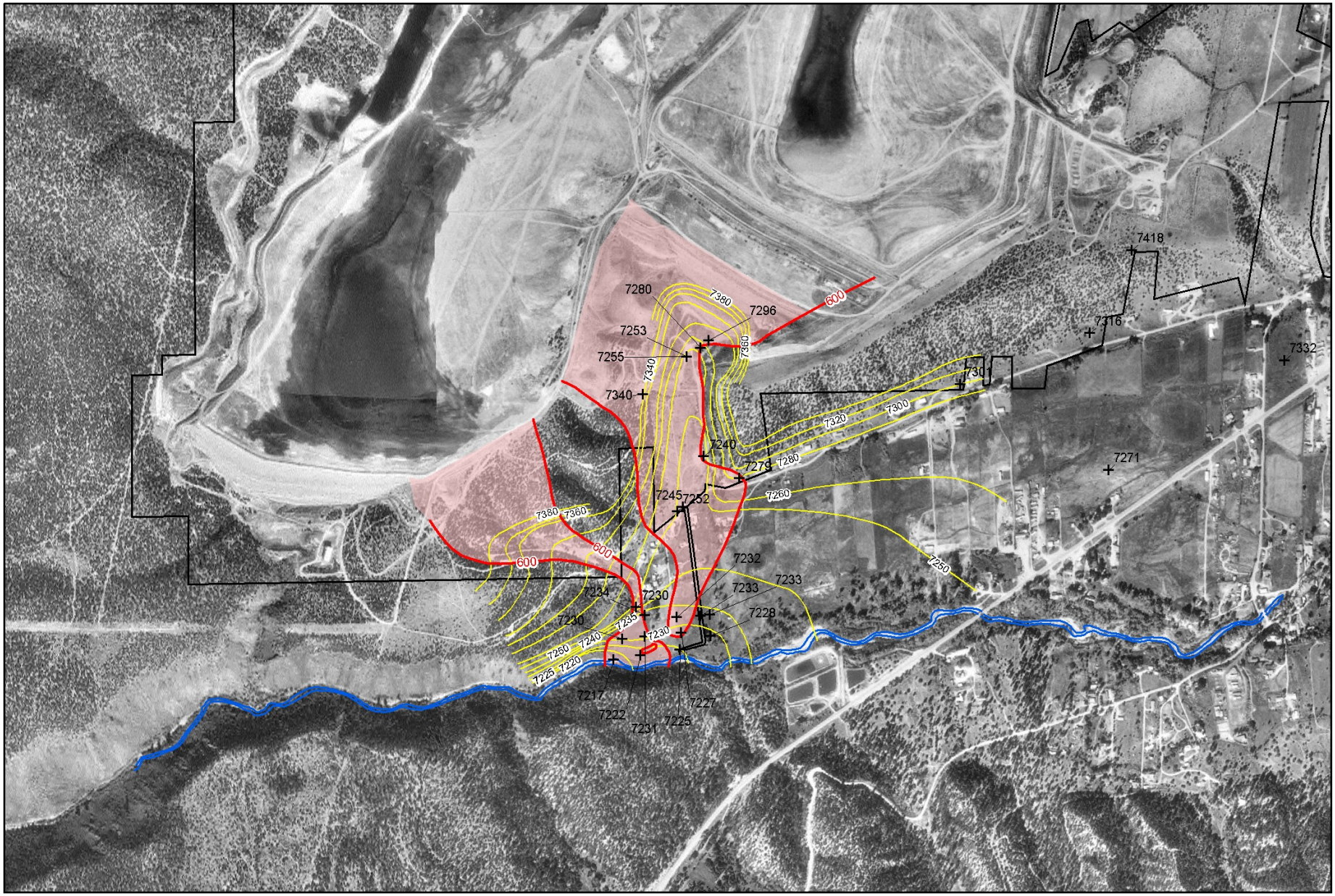

Alluvium with URS Groundwater Sulfate Concentrations Exceeding 600 mg/L and Groundwater Elevations

0 1,000 2,000 3,000

Feet

Streams

Mine boundary

Average groundwater elevation (ft)

Groundwater elevation (ft)

URS Groundwater plume 600 mg/L contour

Area of groundwater with SO_4 concentration > 600 mg/L

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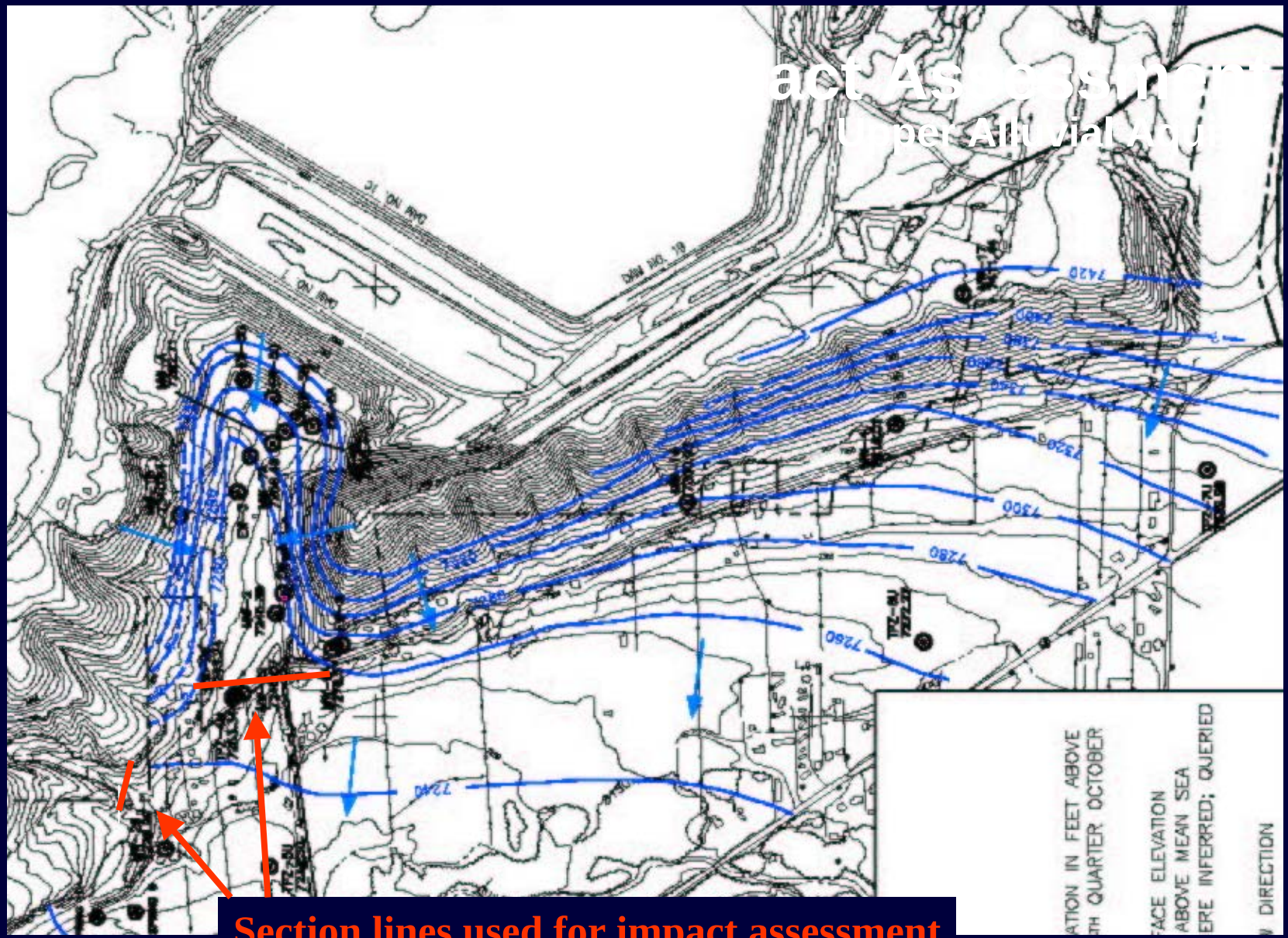

Cross Sections for Flux Calculations, Molycorp 4/11/05 Presentation

Tailings Impoundment Area Calculations - Volume

Volume = surface area of plume x depth x effective porosity

Volume = 236 acres x 60 ft x 0.25

Volume = 3,540 acre-ft

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Tailings Impoundment Area Calculations - Flux

Flux = hydraulic conductivity x gradient x thickness x width of plume

= 15.7 ft/day x 0.14 ft/ft x 60 ft x 4000 ft

= 6.1 ft^3/sec

= 4,420 acre-ft/yr

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Mine Site Groundwater Injury Quantification- Method

- Focus on sulfate
- Focus on Red River alluvium
  - Mine site bedrock analysis outstanding
    - Bedrock contamination pre/post pumping
- Determine spatial area where groundwater sulfate concentrations exceed 600 mg/L (using existing well data)
- Compare to reference area Red River Alluvium concentrations
- Evaluate effects of pumping

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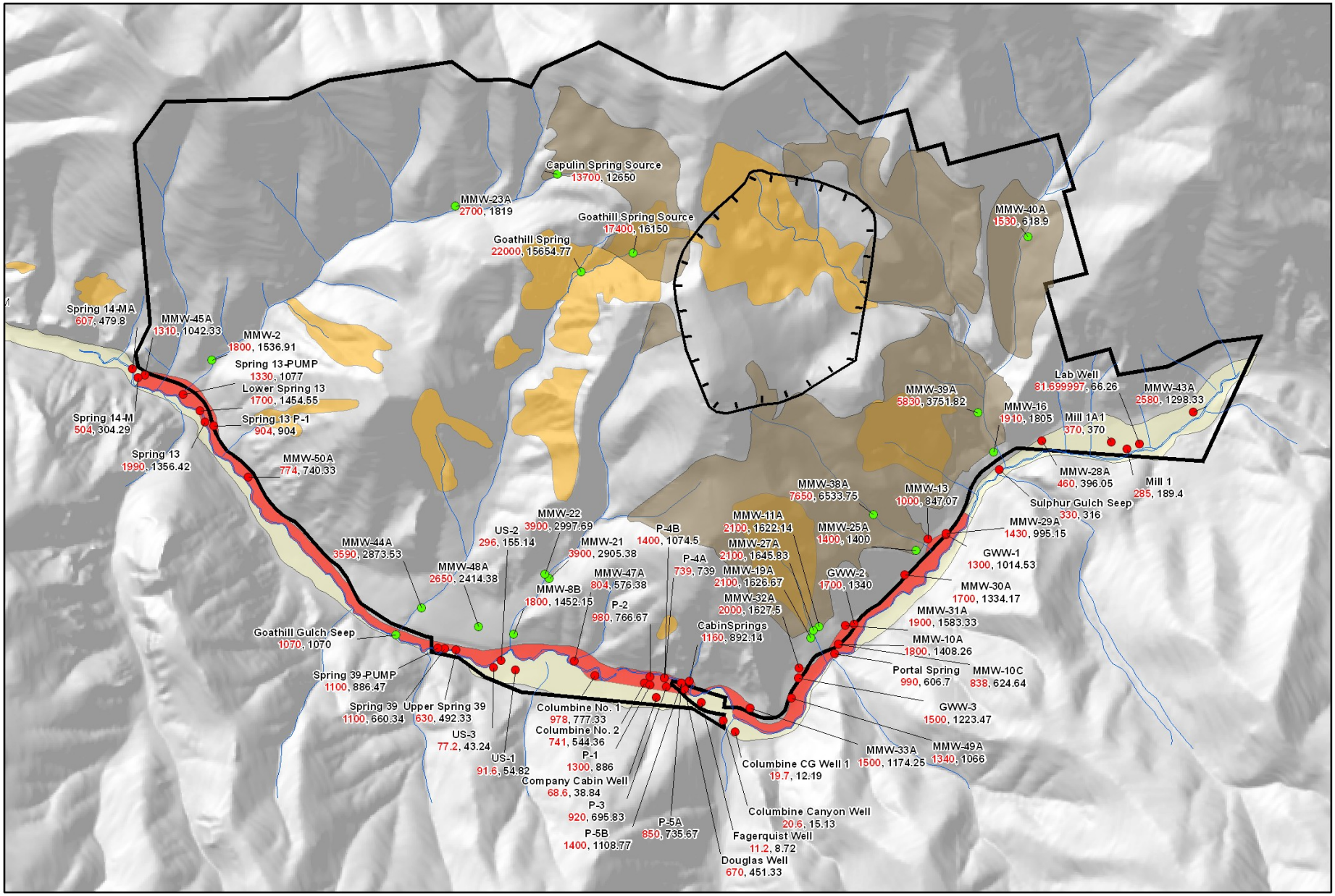

Alluvium with Groundwater Sulfate Concentrations Exceeding 600 mg/L

0 1,000 2,000 3,000

Feet

Groundwater sample

Waterbody zone

- Alluvial aquifer
- Colluvium

Streams

Pit boundary

Mine boundary

Hydro scars

Rockpile

Alluvium (April 2003)

Alluvium with SO_4 concentration > 600 mg/L

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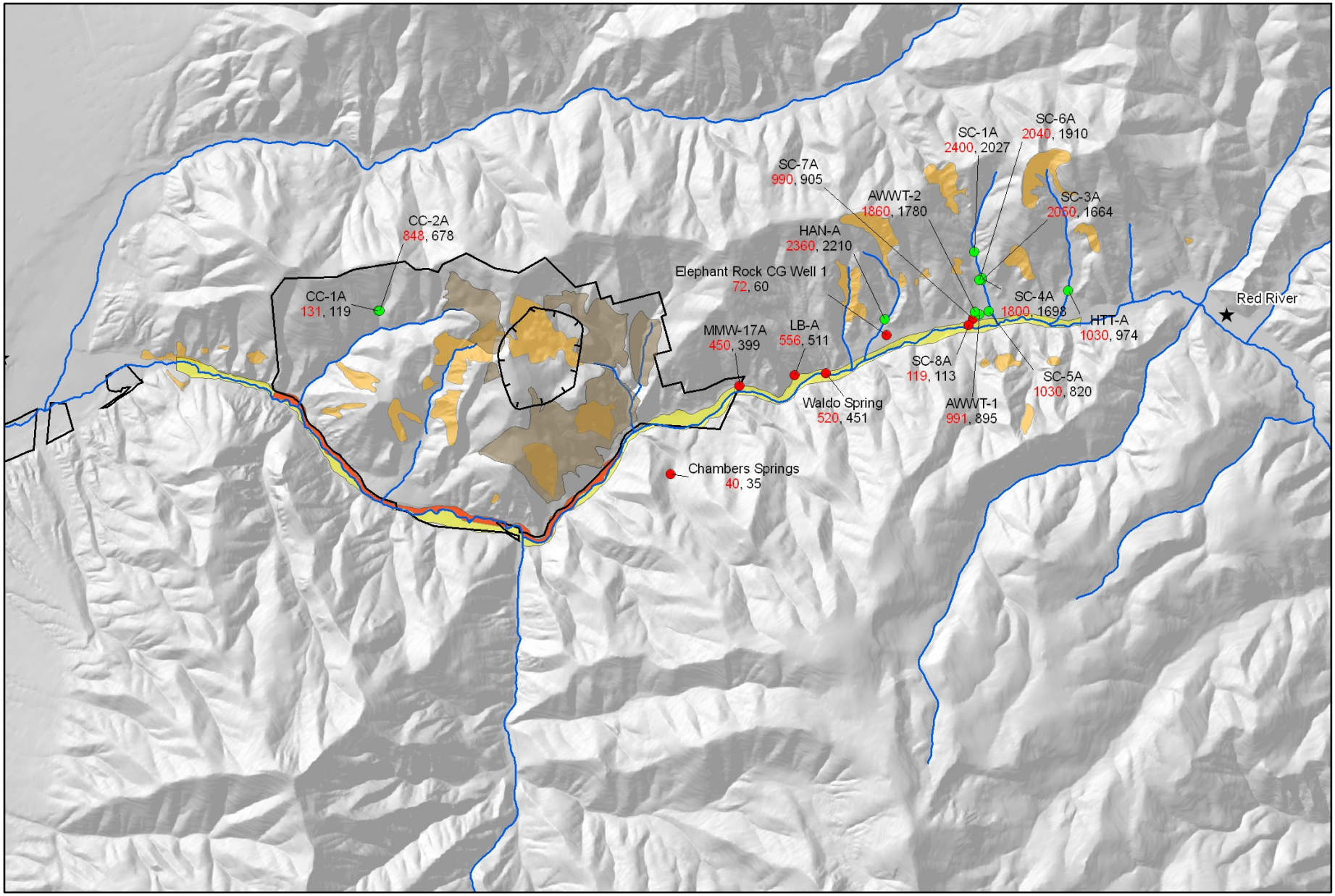

Alluvium with Groundwater Sulfate Concentrations
Exceeding 600 mg/L and Reference Site Concentrations

0 0.5 1 1.5
Miles

Town
Pit boundary

Mine reference sample sites
Aquifer type
Alluvial aquifer
Colluvium

Mine boundary
Hydro scars
Rockpile
Alluvium (April 2003)
Alluvium with SO_4 concentration > 600 mg/L

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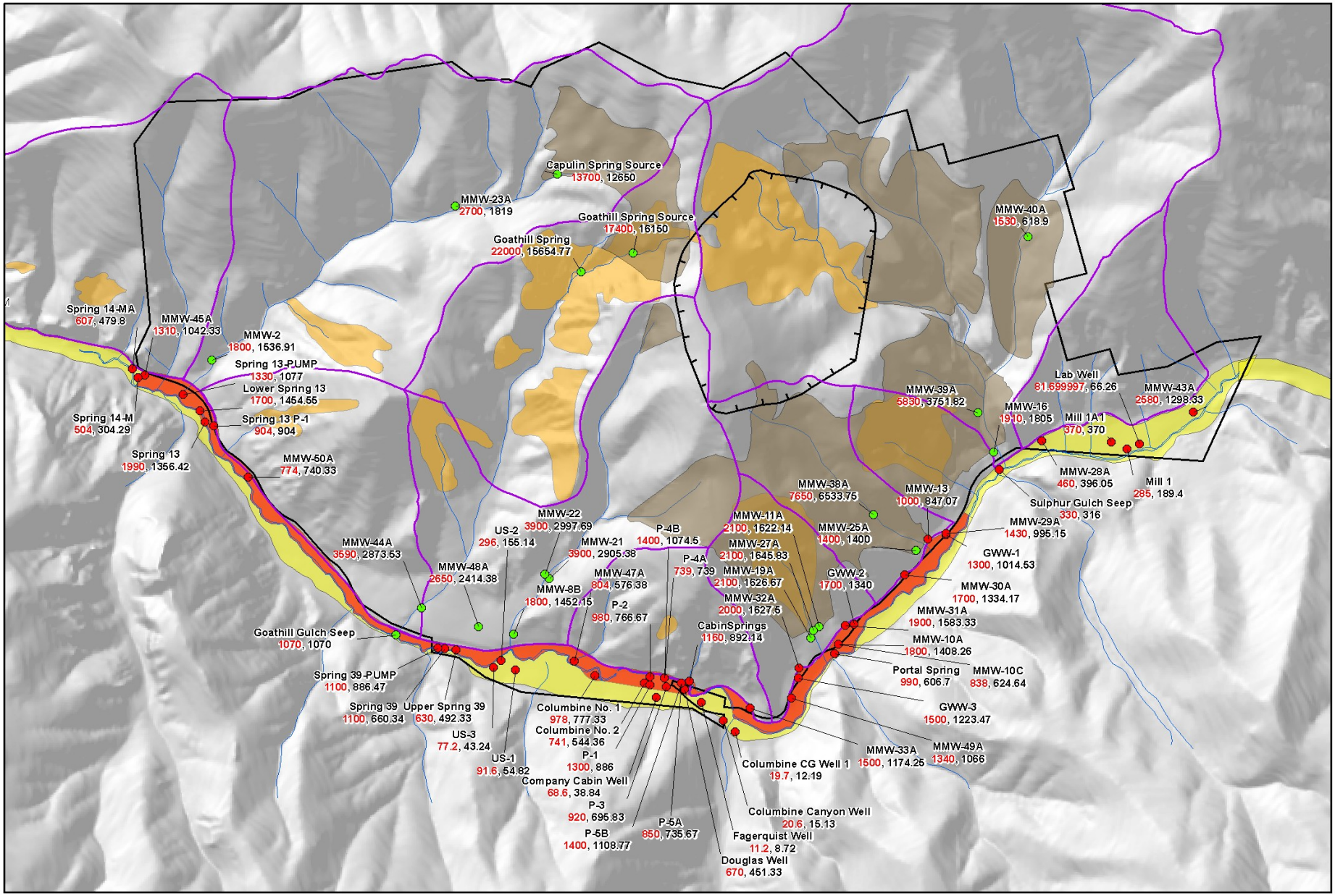

Alluvium with Groundwater Sulfate Concentrations Exceeding 600 mg/L

0 0.5 1 1.5 Miles

Groundwater sample

Waterbody zone

- Alluvial aquifer
- Colluvium

Streams
Pit boundary
Mine boundary
Subwatersheds

Hydro scars
Rockpile
Alluvium (April 2003)
Alluvium with SO_4 concentration > 600 mg/L

j:/projects/molycorp/amls_aprs/GWSulfateworking.mxd

Effect of Pumping – Minesite Alluvium

- Pumping data for Jan 2000 to September 2003
- Groundwater elevation data for June 2001 to August 2004 for mine site wells (Molycorp-URS database)
- Overlap period is June 2001 to September 2003

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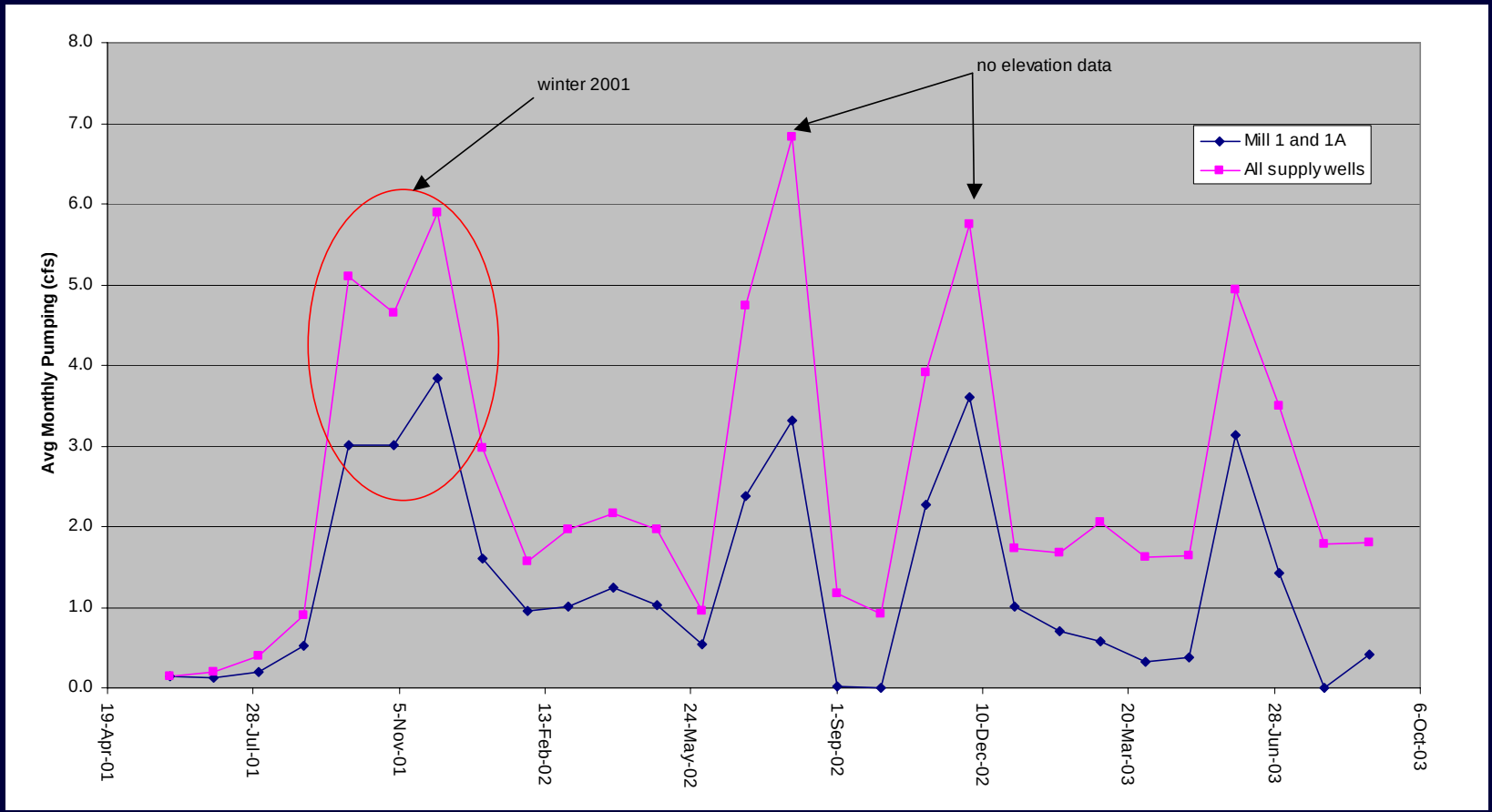
Mine Site Alluvium Pumping Rates



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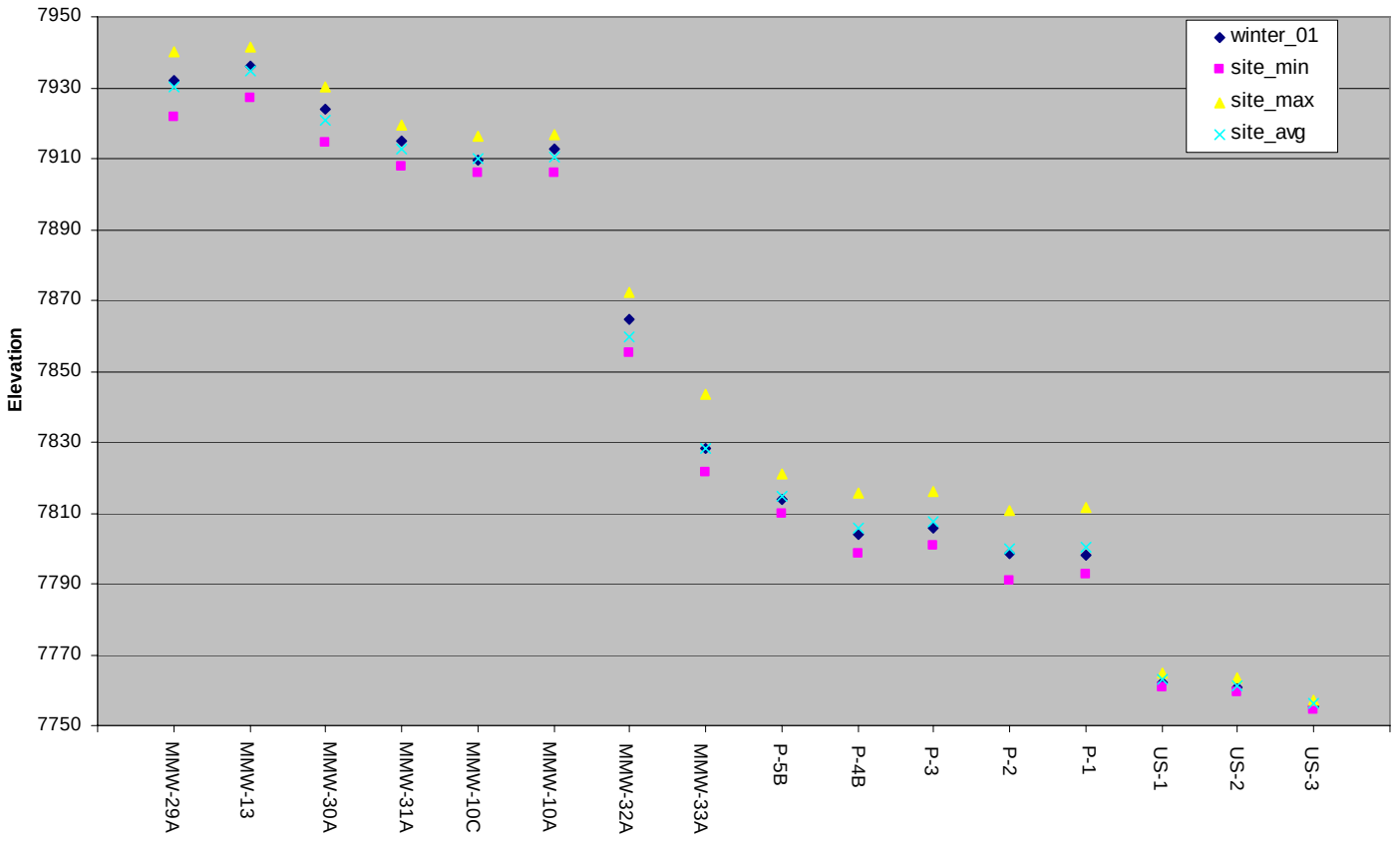
Minesite Alluvium – Groundwater Elevation



Mine Site Alluvium Calculations - Volume

Volume = surface area of plume x depth x effective porosity

Volume = 113 acres x 75 ft x 0.25

Volume = 2,100 acre-ft

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Mine Site Alluvium Calculations Flux

Flux = hydraulic conductivity x gradient x thickness x width of plume

= 800 ft/day x 0.02 ft/ft x 75 ft x 226 ft

= 271,200 ft3/day

= 3 ft^3/sec

= 2,300 acre-ft/yr

Consistent with Vail 2000 = 6-7 ft3/sec (4,300-5,000 acre-ft/yr) through entire alluvial section at Mill Area and Columbine Park

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Summary

- Tailings Alluvium
  - Volume = 3,540 af
  - Flux = 4,420 af/y
- Mine Site – Red River Alluvium
  - Volume = 2,100 af
  - Flux = 2,300 af/y
- Total - Alluvium
  - Volume = 5,640 af
  - Flux = 6,720 af/y
  - Mine site bedrock = TBD

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