McLaren Tailings Reclamation
Project Status
August 9, 2012

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Project Team

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- Joe McElroy, Marty Bennett and Doug Richmond, Pioneer Technical Services, Inc.
- Van Hildreth and Tom Lester, Knife River

2012 Major Project Elements

- Construction Dewatering
- Water Treatment
- Tailings Excavation
- Lime Stabilization of Tailings
- Placement and Compaction in Repository

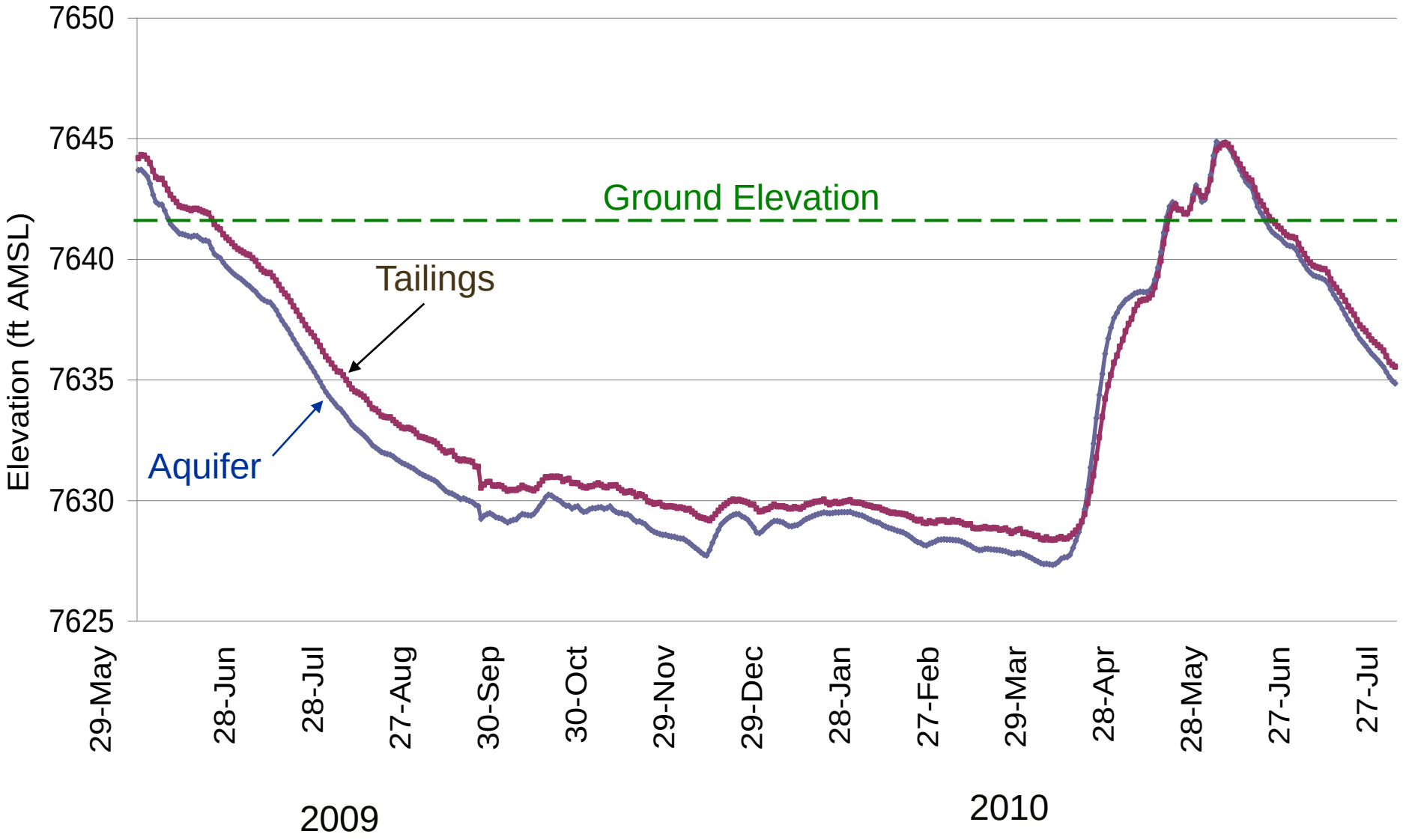
Water Management

Photo taken July 6, 2011

Reclamation Design Groundwater Investigation

Photo taken May 20, 2009

Fluid Levels Under Tailings Impoundment 2009 - 2010



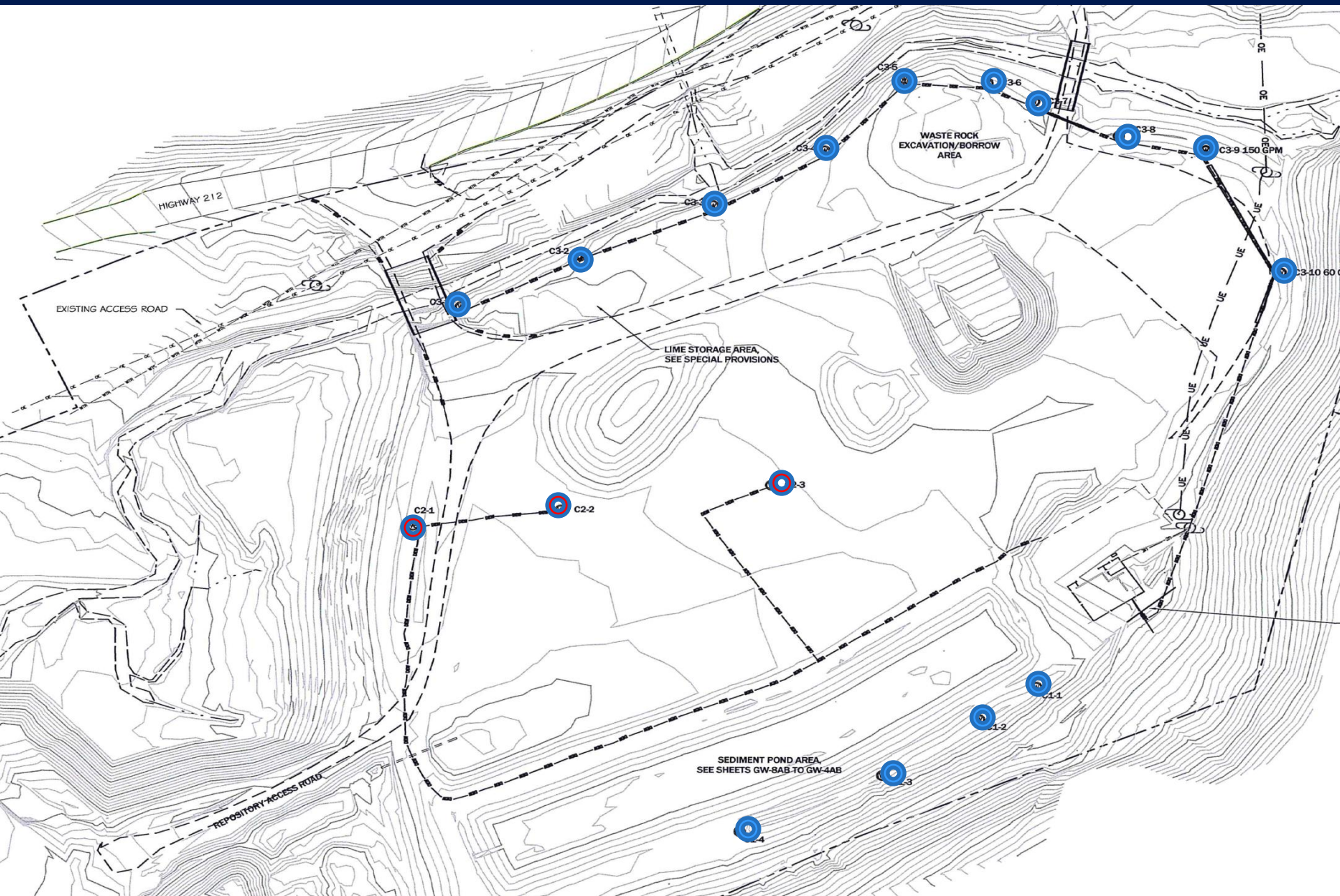
Artesian Conditions Below Tailings

Photo taken May 21, 2009

Construction Dewatering Overview

- Construct pumping wells screened in the alluvial aquifer beneath the bottom of the tailings
- 14 pumping wells along the perimeter of the tailings impoundment
- 3 pumping wells within the tailings impoundment footprint
- Active water treatment and lined sediment pond
- Winter and summer O&M and water sampling schedules

Construction Dewatering System

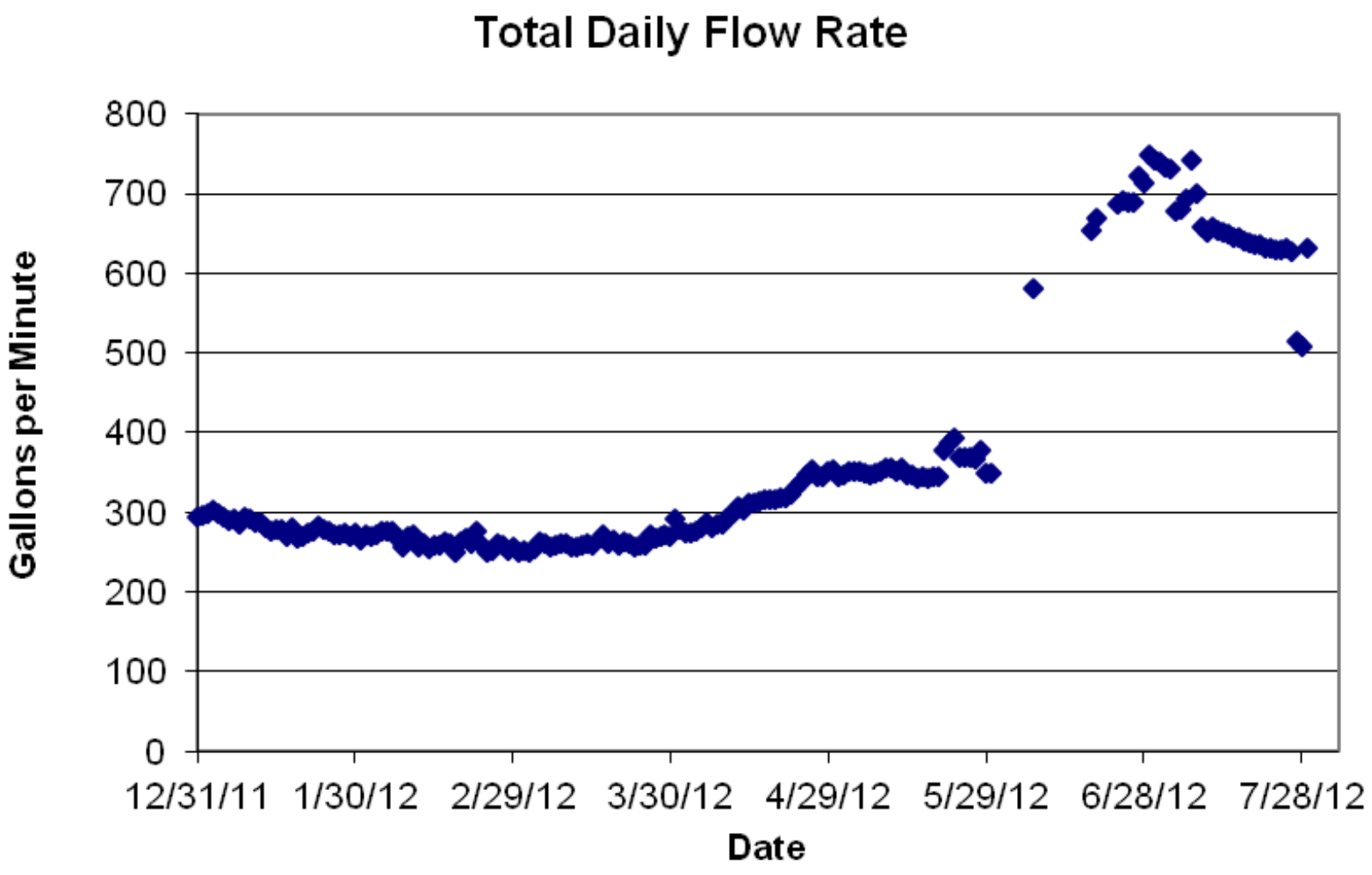


Winter Dewatering

- Selected perimeter wells pumped to maintain water flow through sediment pond: protect liner, avoid freeze up
- No chemical treatment
- Began pumping mid October 2011
- 10 sampling events: October 14, 2011 to May 25, 2012
- All sample results below DEQ-7 standards
- Maximums: iron 0.12 mg/L, manganese 0.004 mg/L, barium 0.07 mg/L
- No other metals detected (arsenic, aluminum, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc)

Summer Dewatering

- Three pumping wells under the tailings activated
- Comparison of 2010 and 2012 fluid levels indicates 25 – 30 feet of drawdown achieved in the three pumping wells
- Approximately 300 gallons per minute water piped to water treatment plant and treated
- Approximately 3 million gallons treated per week
- Perimeter water mixed with treated water prior to discharge to Soda Butte Creek


Total Daily Flow Rate
Gallons per Minute
800
700
600
500
400
300
200
100
0
12/31/11
1/30/12
2/29/12
3/30/12
4/29/12
5/29/12
6/28/12
7/28/12
Date

Construction Dewatering - Tailings Excavation

Photo taken July 11, 2012

Construction Dewatering - Tailings Excavation

Photo taken July 11, 2012

Construction Dewatering - Tailings Excavation

Photo taken July 19, 2012

Construction Dewatering - Tailings Excavation

Photo taken July 25, 2012

Construction Dewatering - Tailings Excavation

Photo taken August 9, 2012

Tailings Stabilization

- Mix quicklime (CaO) with tailings
- Dry wet tailings to promote compaction and structural stability in repository
- Reduce metal mobility

Metals Leaching From Tailings Pre and Post Lime Addition

Chemical	Target	Pre-lime	3 percent lime
Iron	0.3	24.5	<0.01
Manganese	0.05	4.29	<0.001
Aluminum	0.087	0.182	0.038
Copper	0.012	0.065	0.086
Cadmium	0.00033	0.091	<0.010
Zinc	0.15	0.23	<0.02

Target and Measured SPLP metals in mg/L

Target = DEQ-7 aquatic life or human health standards

Repository Construction

Photo taken July 25, 2012

Repository Construction

Photo taken July 25, 2012

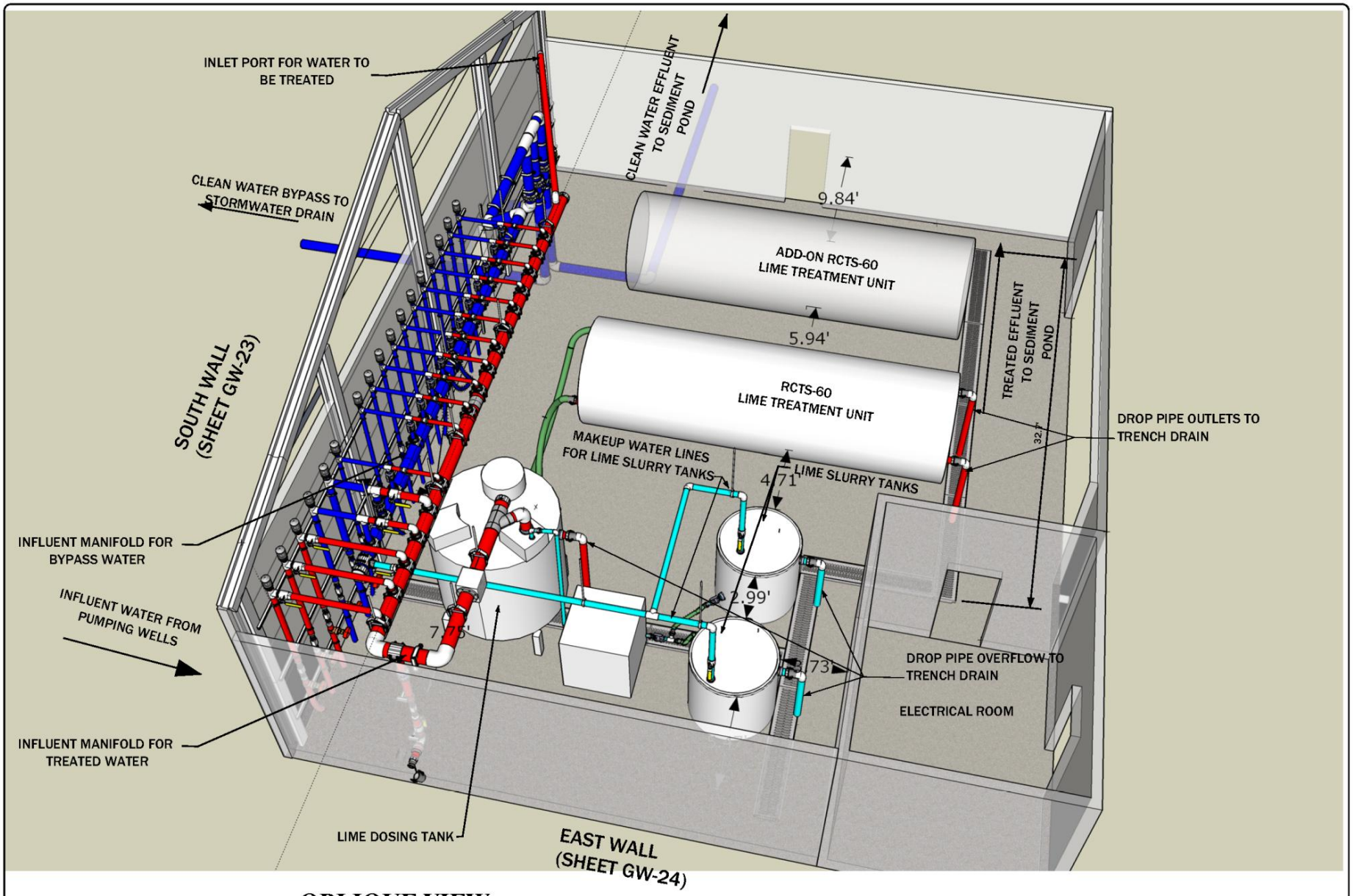
Repository Construction

Photo taken July 25, 2012

Water Treatment Design

- Pump groundwater from site margins and beneath tailings
- Apply hydrated lime and oxygen to precipitate metals
- Collect precipitated metals in a lined sediment basin equipped with filter curtains

Water Treatment System Layout



OBLIQUE VIEW

Rotating Cylinder Treatment System

Photo taken June 13, 2012

Sediment Pond with Filter Curtains

Photo taken July 11, 2012

Water Quality vs. DEQ Standards

Chemical	Target	Tailings	Influent
Iron	0.3	1490	21.7
Manganese	0.05	19.6	0.47
Aluminum	0.087	13.9	<0.03
Copper	0.012	1.86	0.1
Cadmium	0.00033	0.006	0.00011
Zinc	0.15	1.73	0.04

All concentrations in mg/L

Target = MT DEQ-7 aquatic life or human health standards

System Discharge vs. DEQ Standards

Chemical	Target	Maximum	Average
Iron	0.3	1.2	0.59
Manganese	0.05	0.096	0.042
Aluminum	0.087	<0.03	<0.03
Copper	0.012	<0.005	<0.005
Cadmium	0.00033	0.002	<0.00008
Zinc	0.15	<0.01	<0.01

All concentrations in mg/L
Eight weekly sampling events between June 13 and August 6
Aluminum, antimony, arsenic, chromium, copper, lead, mercury, nickel, silver, and zinc have not been not detected in Channel 5

Channel 5 outlet to Soda Butte Creek

Photo taken July 25, 2012

Reduced AMD Discharges

Photo taken July 25, 2012

Soda Butte Creek below AMD seeps 2008

Photo taken September 8, 2008

Soda Butte Creek below seeps: 2012

Photo taken July 25, 2012

2012 Project Status

- Approximately 120,000 bank cubic yards of tailings excavated and stabalized (71 percent)
- Stabilization and compaction of tailings in repository have been successful
- Project currently ahead of schedule

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

Questions

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