Zortman-Landusky: May 2011 Extreme Weather Event- Is it Time for Plans of Operations to Include an Ark?

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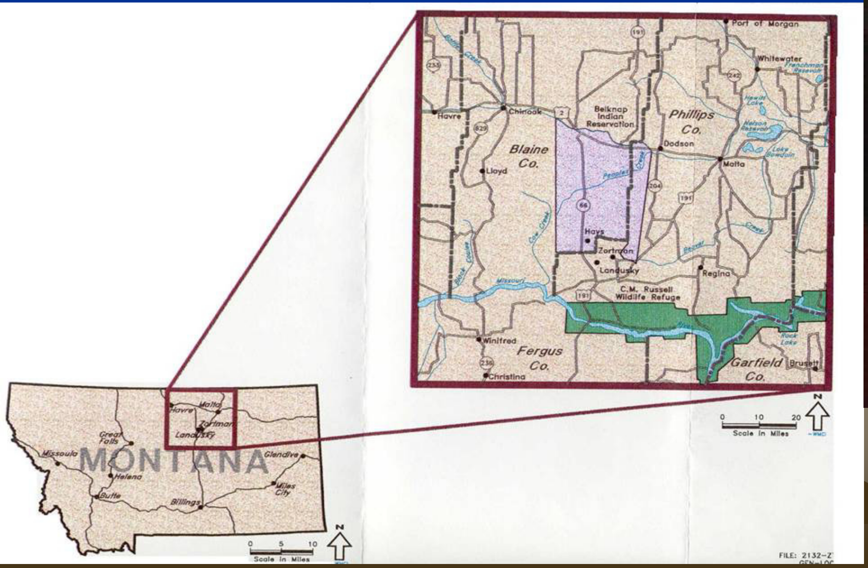
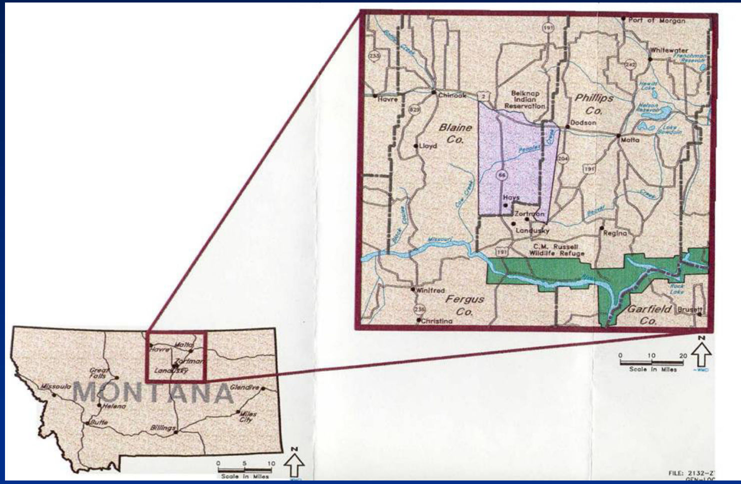



Oh, crap! Was that TODAY?
REGAN

Z-L Overview:



- Mining History
- Environmental Issues
- Bankruptcy
- Closure and Reclamation
- Water Treatment and $
- Swift Gulch Issues
- The Deluge: May 21-22, 2011
- After the Deluge

Geology and Mineralization

Montana's "Island Ranges"

- Post intrusive hydrothermal/tectonic activity formed mineralized brecciated veins and stockworks
- Higher grade zones localized in regional shears
- Lower grade zones adjacent to structural zones

History

- Historic Mining District Beginning in the 1880's
  - Underground Mining, Vat Leaching
- Part of the Mountains Purchased from Fort Belknap Reservation in 1895 for Mining (Grinnell Treaty)

More History

- "Modern" Open Pit Gold Heap Leach Operations Began in 1977
- State Operating Permits Issued in 1979 after completion of an EIS by the State
- BLM Plans of Operations Approved in 1981 under the 3809 Regulations
- Amendments/modifications were made to the Mine Plans from 1979 thru 1996 as mining continued
- Pegasus encounters difficulty developing the Mt Todd gold project in Australia

More History

1998: Pegasus Gold/ZMI File for Bankruptcy

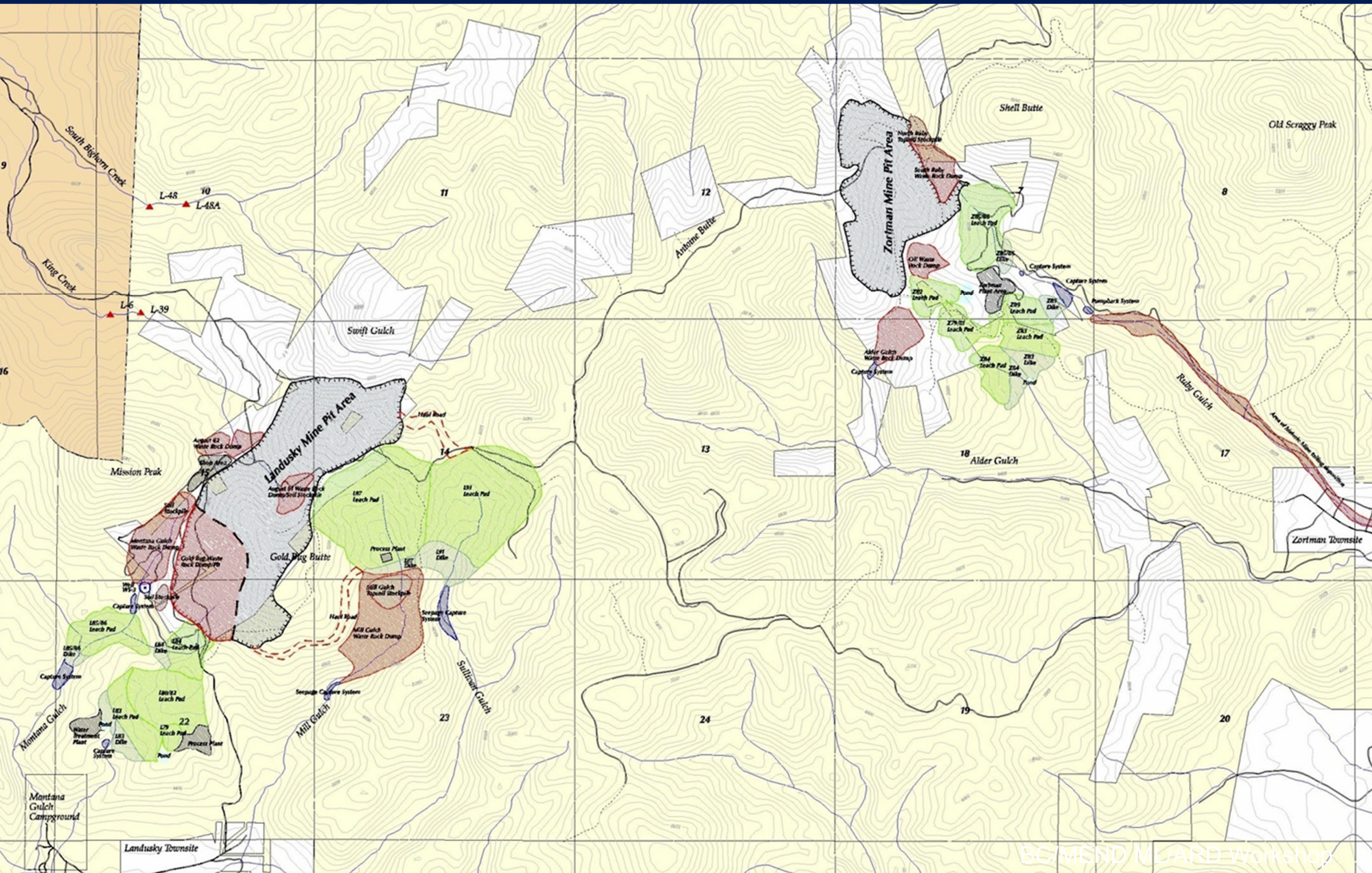
- Expansion Plans Cancelled by the Company
- $8.5 Million Reclamation Bond Shortage Claim Filed with Bankruptcy Court (Received $1 million)
- 2001-2005 Reclamation completed using bond and state and federal money (≈ $45 million)

- Ultimate mine disturbance is 485 hectares – About ½ on BLM-lands

Environmental Issues

- Water Management: ARD and Heap Leach Solutions (≈ 3,000 L/min)
- General Reclamation: Trying to do the best possible job of reclamation with a limited amount of money (annual shortfall ≈ $1million)

Zortman and Landusky Mines - Facilities & Land Status Map



Water Management

Hmm…might be “Mine influenced water”?

- ARD Seepage Capture Systems
- ARD Treatment Systems
- Leach Pad Solution Treatment
- Storm water Management

ARD Seepage Capture Systems

Seepage Capture Pond in Ruby Gulch Downstream of Zortman Mine

- Installed starting in 1993
- Routed seepage to heaps
- Upgraded in 1996

ARD Seepage Capture Systems

- 7 Capture Systems in 6 Drainages
- Routes seepage to WTPs
- Sized for 100-year, 24-hour event

ARD Treatment Systems

- **Two Water Treatment Plants (WTP)**
- Zortman Mine WTP, 1994
- Landusky Mine WTP, 1997

Inside the Landusky Mine Water Treatment Plant. Plant Runs 24/7 at about 1325 lpm.

ARD Treatment Systems

- Lime Precipitation for Metals & Acidity
- Treated ≈ 1.04 billion litres/year
- Average Cost $0.0009 per litre

Zortman Water Treatment Plant

Parameter	Influent	Treated Water	% Removal	Potential ARAR limit
pH	3.5	7.5	---	6.5 to 9
Arsenic	0.015 ppm	<0.003 ppm	>80%	0.018 ppm
Cadmium	0.2 ppm	0.004 ppm	98%	0.005 ppm
Iron	35 ppm	0.2 ppm	99.7%	1 ppm
Manganese	30 ppm	3.0 ppm	90%	---
Lead	0.005 ppm	<0.003 ppm	>50%	0.015 ppm
Sulfate	3000 ppm	2400 ppm	20%	---

Landusky Water Treatment Plant

Parameter	Influent	Treated Water	% Removal	Potential ARAR limit
pH	6.0	7.5	---	6.5 to 9
Arsenic	0.15 ppm	<0.025 ppm	>83%	0.018 ppm
Cadmium	0.010 ppm	0.001 ppm	90%	0.005 ppm
Iron	10 ppm	0.3 ppm	97%	1 ppm
Manganese	3.0 ppm	1.5 ppm	50%	---
Lead	0.004 ppm	<0.003 ppm	>50%	0.015 ppm
Sulfate	600 ppm	500 ppm	17%	---

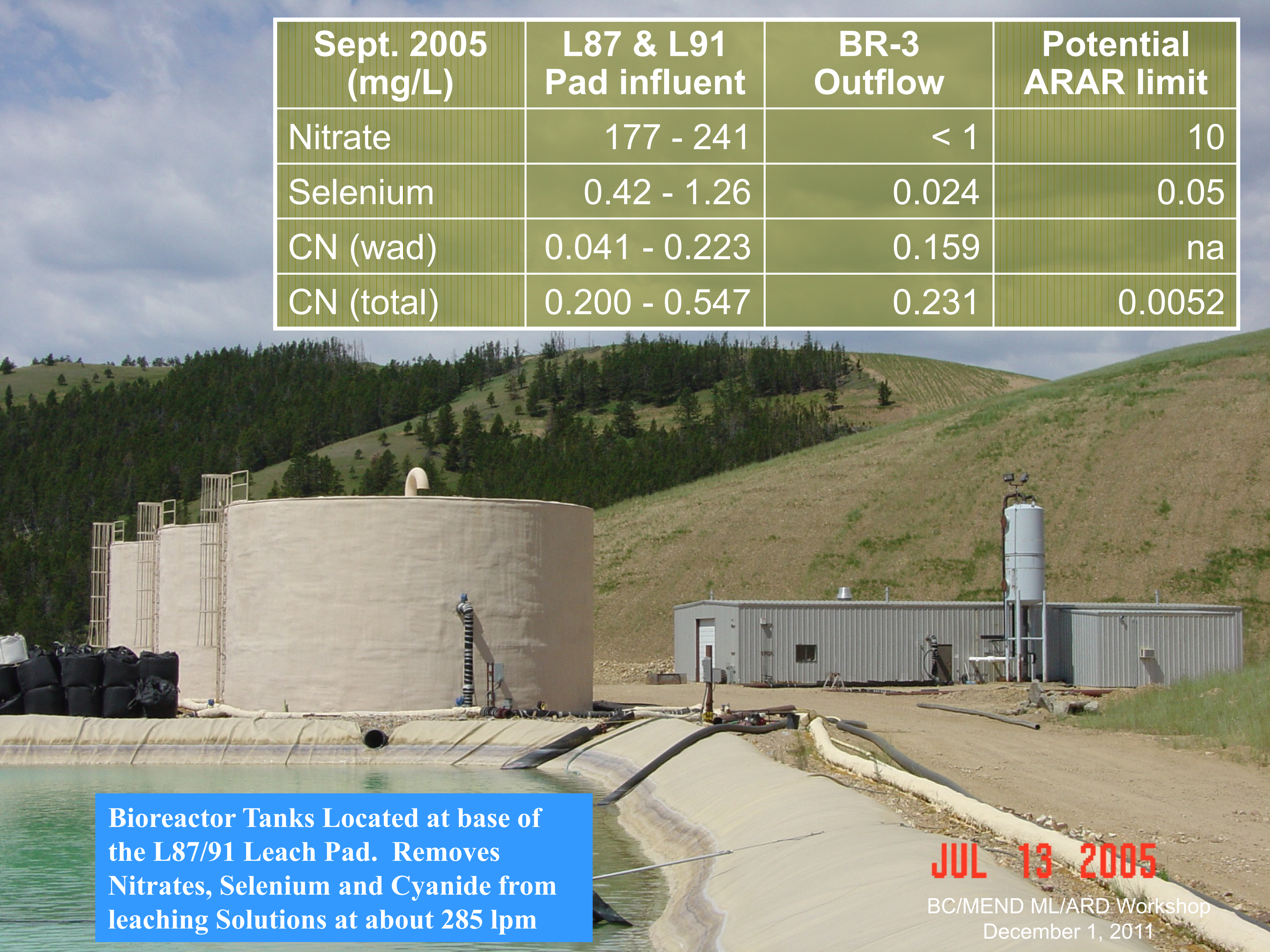
Sludge from the water treatment plants is placed in shallow ponds on top of the lined leach pads to solidify.

Backup Power Generators for the Capture Systems and Water Treatment Plants

Leach Pad Solution Treatment

- Heaps accumulate millions of litres precipitation per year
- Contains nitrates, selenium, & cyanide
- Some heap solutions are acidic

Sept. 2005 (mg/L)	L87 & L91 Pad influent	BR-3 Outflow	Potential ARAR limit
Nitrate	177 - 241	< 1	10
Selenium	0.42 - 1.26	0.024	0.05
CN (wad)	0.041 - 0.223	0.159	na
CN (total)	0.200 - 0.547	0.231	0.0052

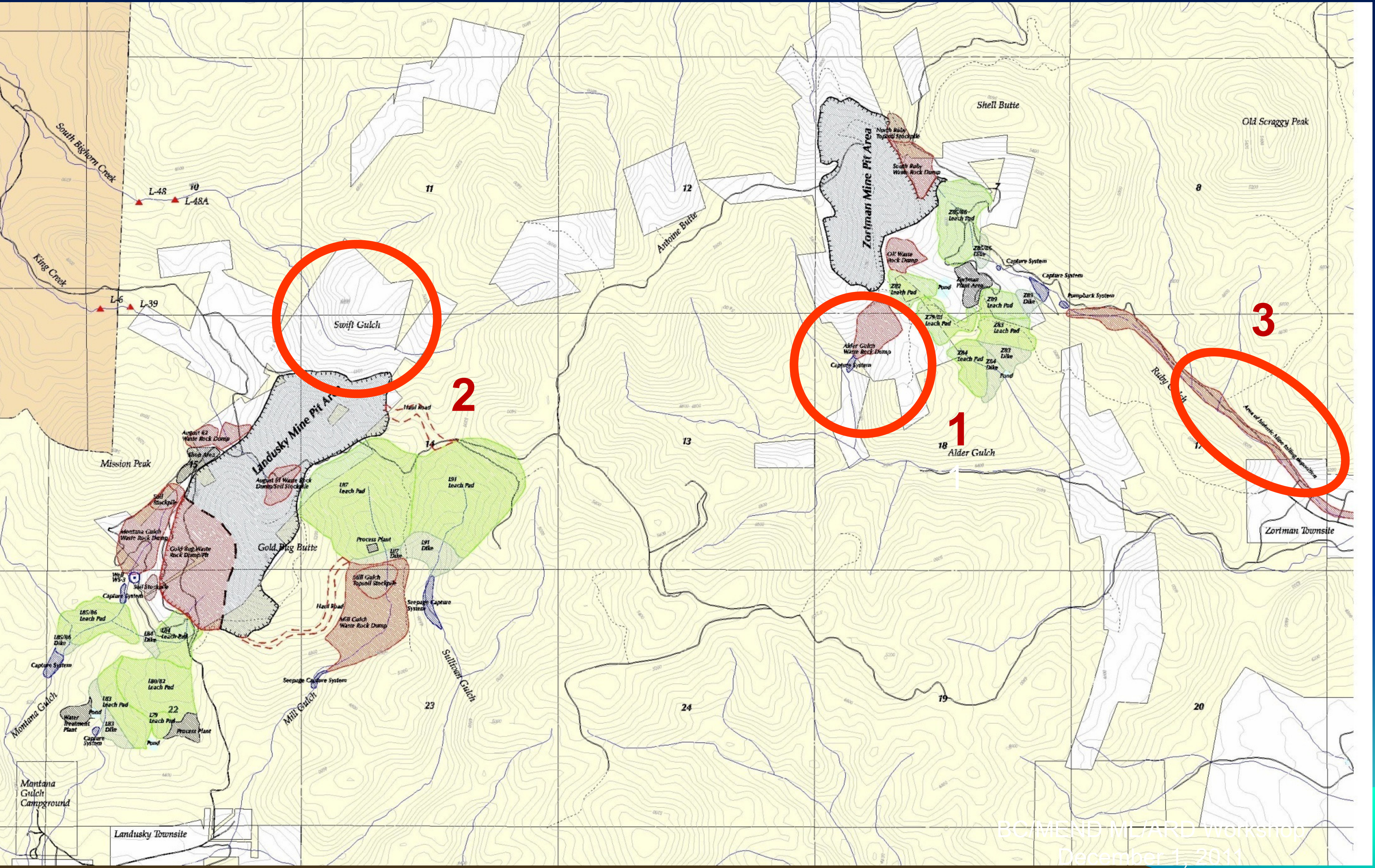


Bioreactor Tanks Located at base of the L87/91 Leach Pad. Removes Nitrates, Selenium and Cyanide from leaching Solutions at about 285 lpm

Goslin Flats Land Application of Treated Leach Pad Solution

The Deluge: May 21-22, 2011

After the Deluge…




Zortman Mine – June 1993
Alder/Carter Gulch Waste
Dump

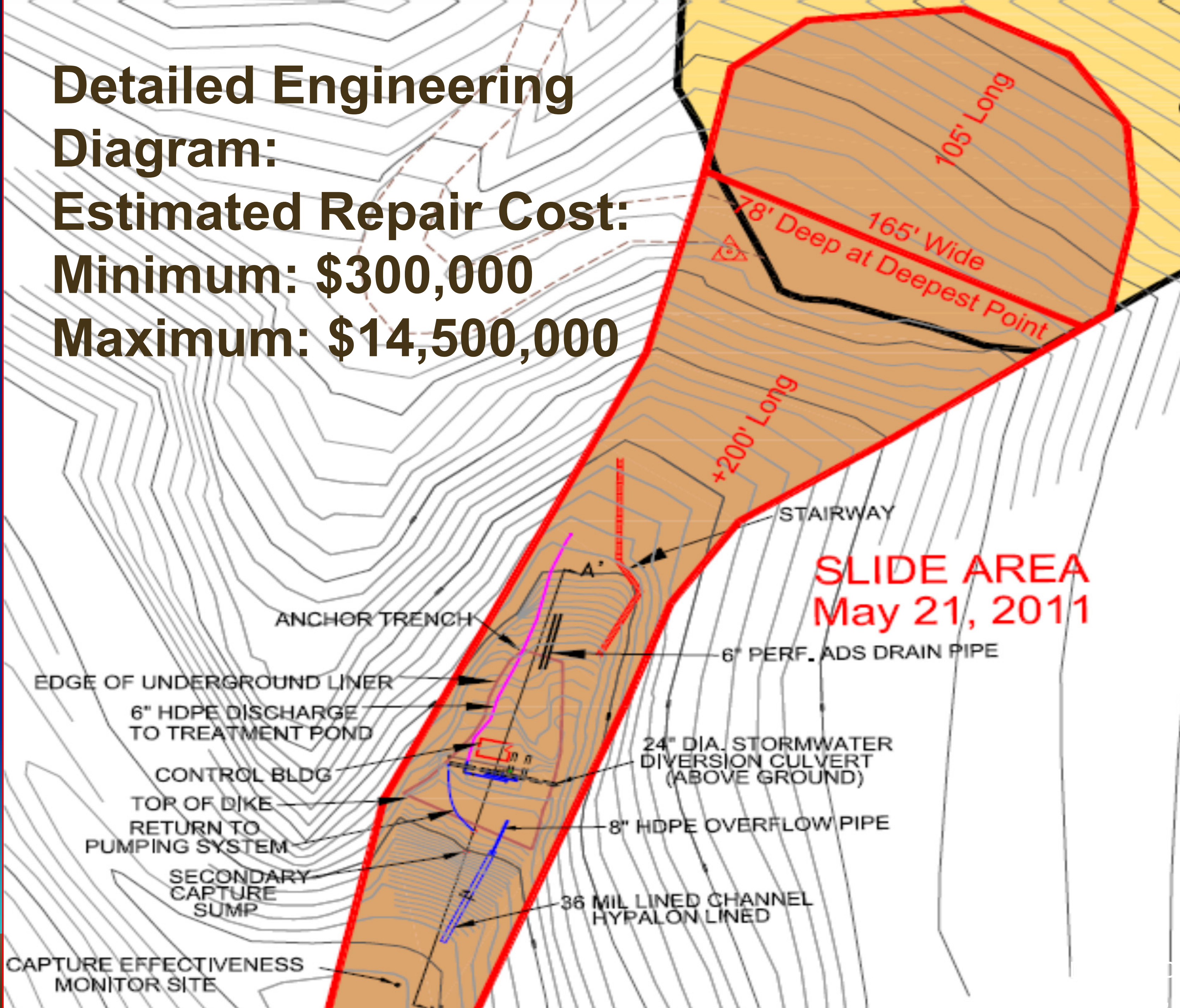
Zortman Mine – July 2005

Oops…

Carter/Alder Gulch Storm Damage

Approximately 43,000 cubic M

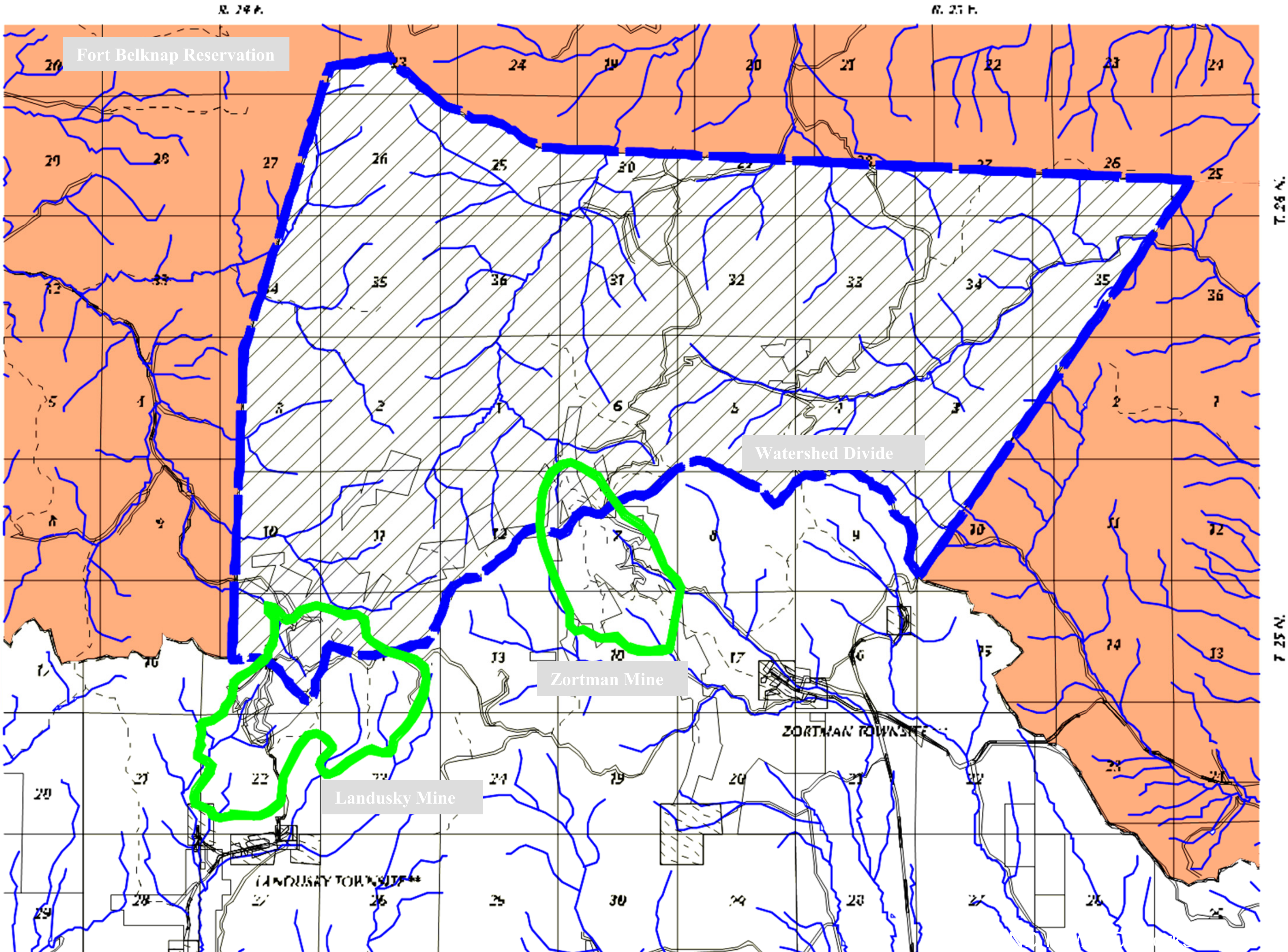
Detailed Engineering Diagram:
Estimated Repair Cost:
Minimum: $300,000
Maximum: $14,500,000



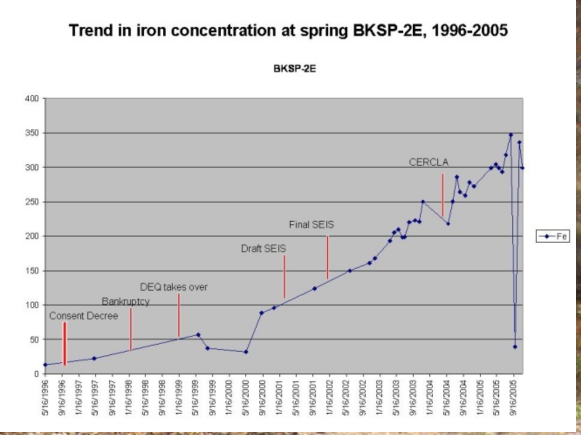

Landusky Mine, looking south
July 2000
L87 Leach
Pad
August
Pit
Suprise
Pit
Queen Rose Pit

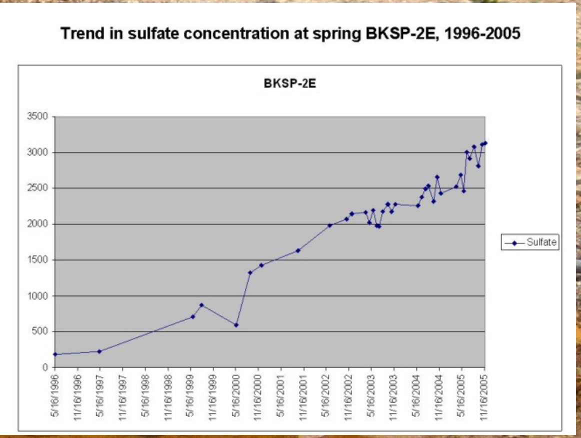
2005 Reclamation completed, Swift Gulch in the foreground

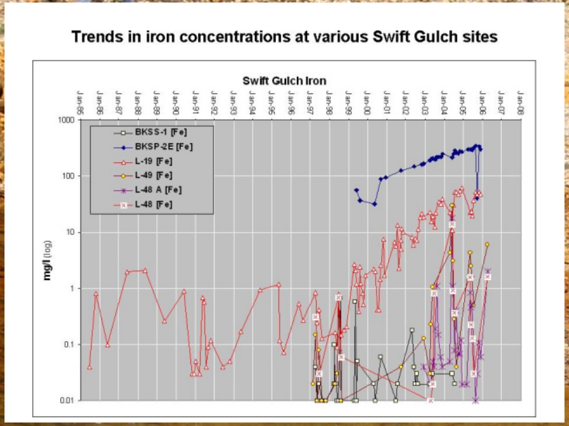
What's special about Swift Gulch??

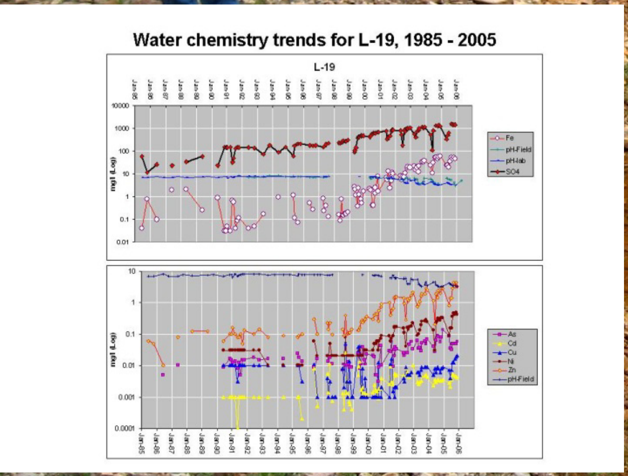

R. 24 E.
R. 25 E.
Fort Belknap Reservation
Watershed Divide
Zortman Mine
Landusky Mine
ZORTMAN TOWNSITE
T. 26 N.
T. 25 N.

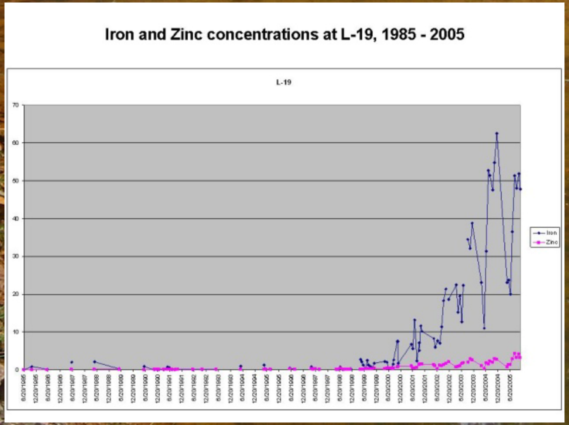
Swift Gulch Water Quality

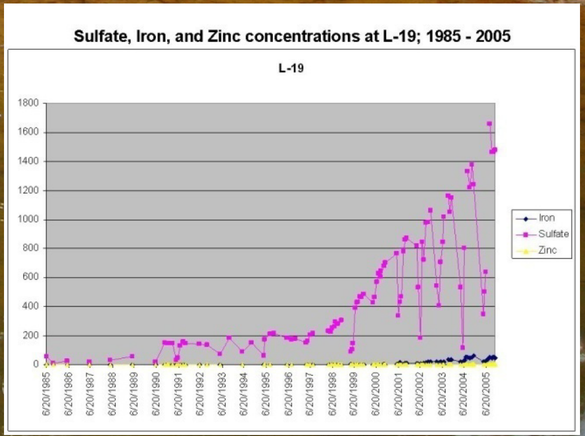












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Swift Gulch: Before the Deluge

Swift Gulch WTP design parameters:

Designed to treat up to 1900 L/min

May 2011: flow volume 9500L/min….before the deluge…


MADE IN U.S.A.
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Swift Gulch Water Treatment Plant Repair Cost Estimate: $ 252,000

Close Call: Ruby Gulch Seepage Capture Pond

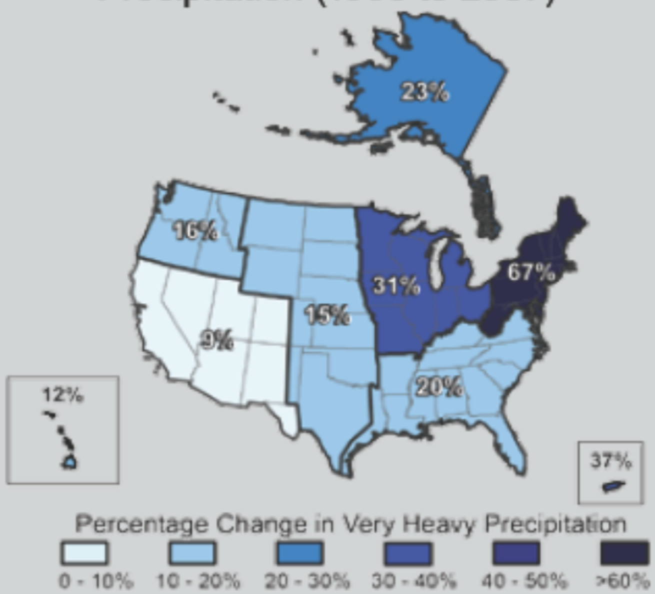
Representative Flow: Ruby Gulch

Various road/infrastructure damage

Site-wide Miscellaneous Repair Costs: ≈ $100,000

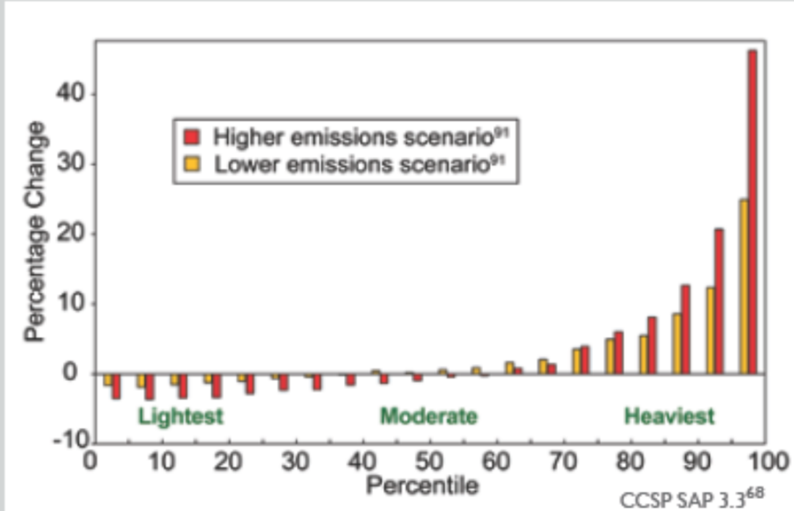
Q. Does this have anything to do with Climate Change?
A. Maybe.

Increases in Amounts of Very Heavy Precipitation (1958 to 2007)



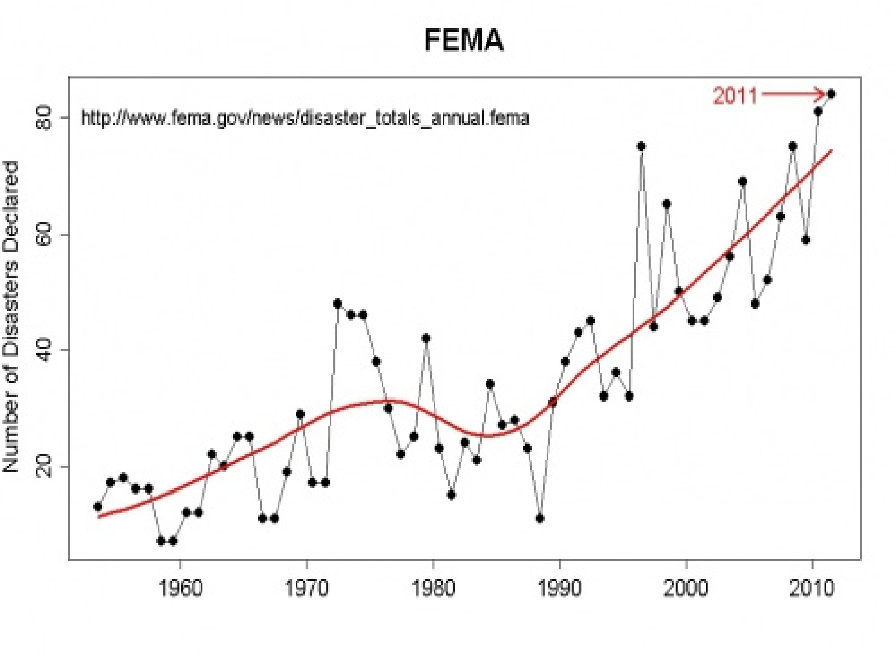
The map shows percent increases in the amount falling in very heavy precipitation events (defined as the heaviest 1 percent of all daily events) from 1958 to 2007 for each region. There are clear trends toward more very heavy precipitation for the nation as a whole, and particularly in the Northeast and Midwest.

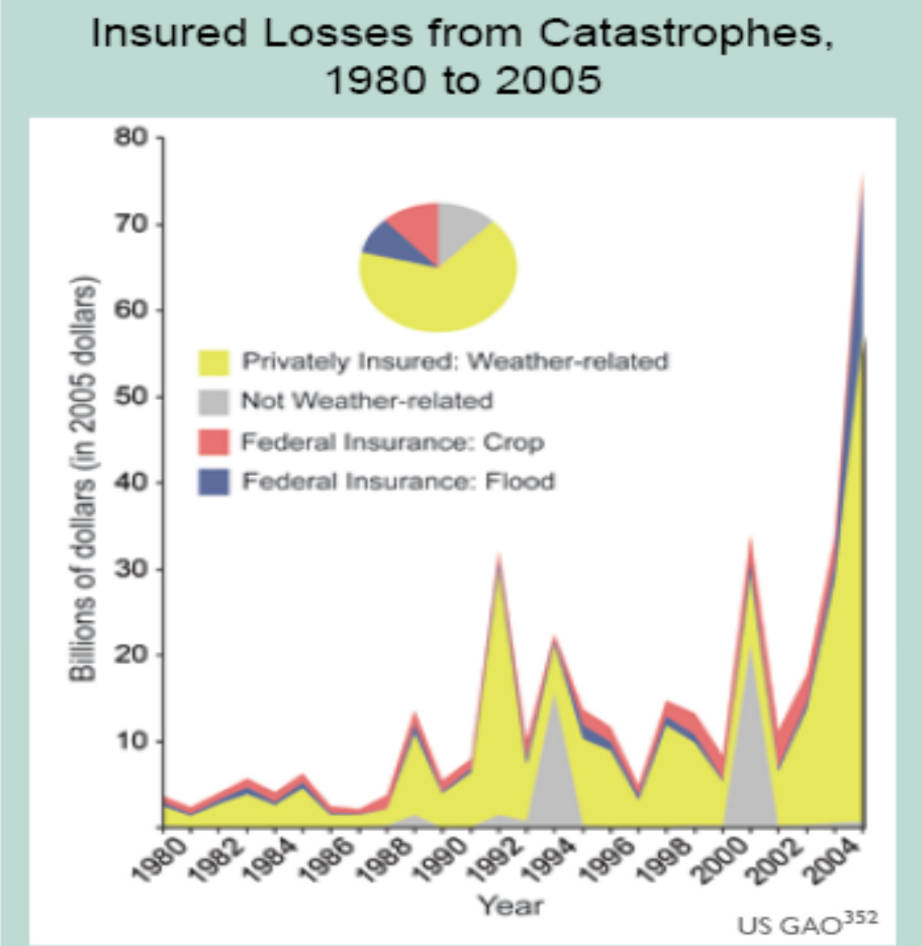
Projected Changes in Light, Moderate, and Heavy Precipitation (by 2090s)



The figure shows projected changes from the 1990s average to the 2090s average in the amount of precipitation falling in light, moderate, and heavy events in North America. Projected changes are displayed in 5 percent increments from the lightest drizzles to the heaviest downpours. As shown here, the lightest precipitation is projected to decrease, while the heaviest will increase, continuing the observed trend. The higher emission scenario[91] yields larger changes. Projections are based on the models used in the IPCC 2007 Four

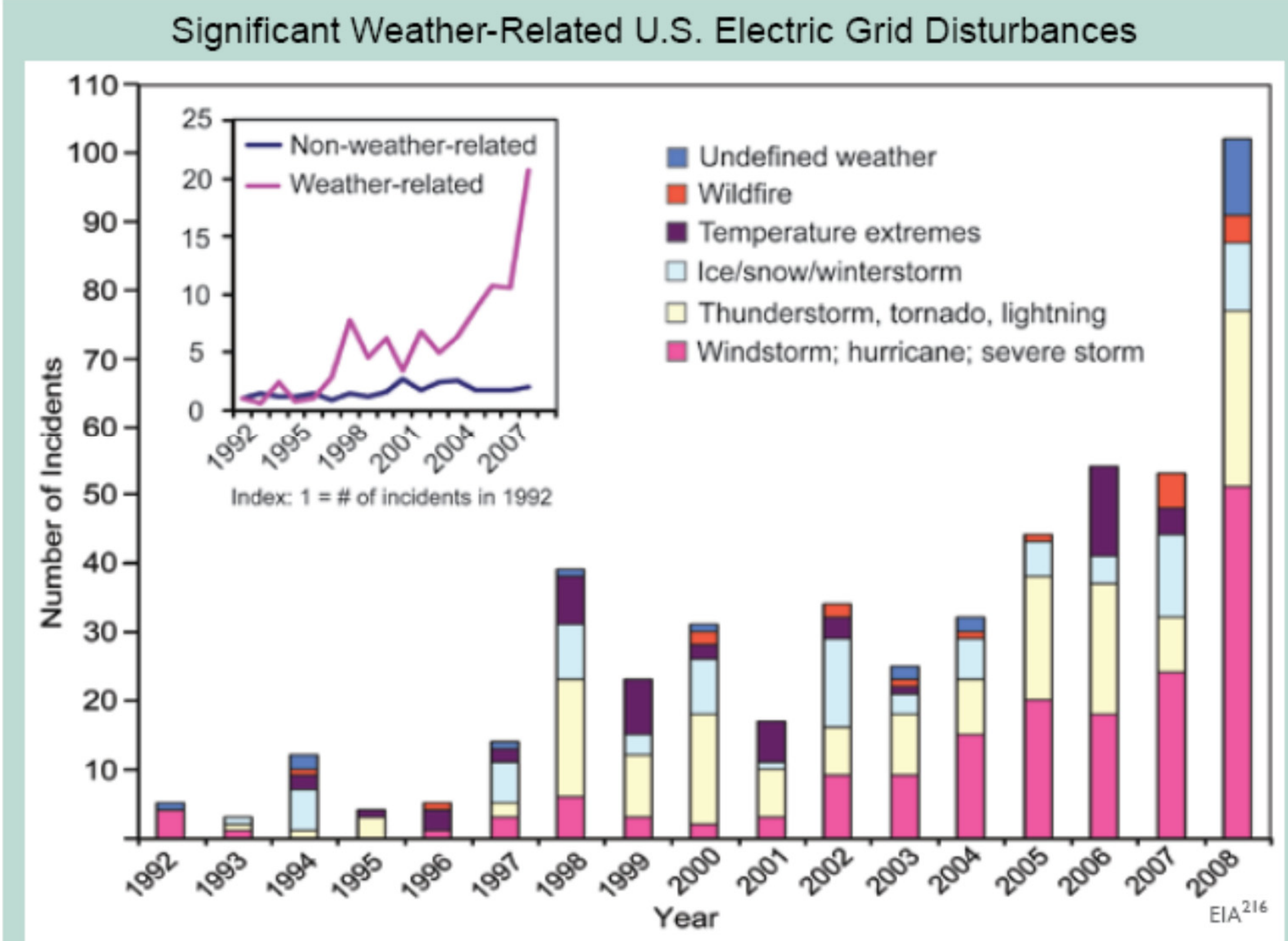
Other Indicators?





Weather-related insurance losses in the United States are increasing. Typical weather-related losses today are similar to those that resulted from the 9/11 attack (shown in gray at 2001 in the graph). About half of all economic losses are insured, so actual losses are roughly twice those shown on the graph. Data on smaller-scale losses (many of which are weather-related) are significant but are not included in this graph as they are not comprehensively reported by the U.S. insurance industry.

Collectively These all suggest extreme weather events will be more frequent in the future



The number of incidents caused by extreme weather has increased tenfold since 1992. The portion of all events that are caused by weather-related phenomena has more than tripled from about 20 percent in the early 1990s to about 65 percent in recent years. The weather-related events are more severe, with an average of about 180,000 customers affected per event compared to about 100,000 for non-weather-related events (and 50,000 excluding the massive blackout of August 2003).[201] The data shown include disturbances that occurred on the nation's large-scale "bulk" electric transmission systems. Most outages occur in local distribution networks and are not included in the graph. Although the figure does not demonstrate a cause-effect relationship between climate change and grid disruption, it does suggest that weather and climate extremes often have important effects on grid disruptions. We do know that more frequent weather and climate extremes are likely in the future,[68] which poses unknown new risks for the electric grid.

ARD Seepage Capture Systems

- 7 Capture Systems in 6 Drainages
- Routes seepage to WTP
- Sized for 100-year, 24-hour event


"..the reality is the industry is making closure, reclamation and drainage treatment predictions based on a historic climate that no longer exists."
We are in serious trouble….
Swift Gulch
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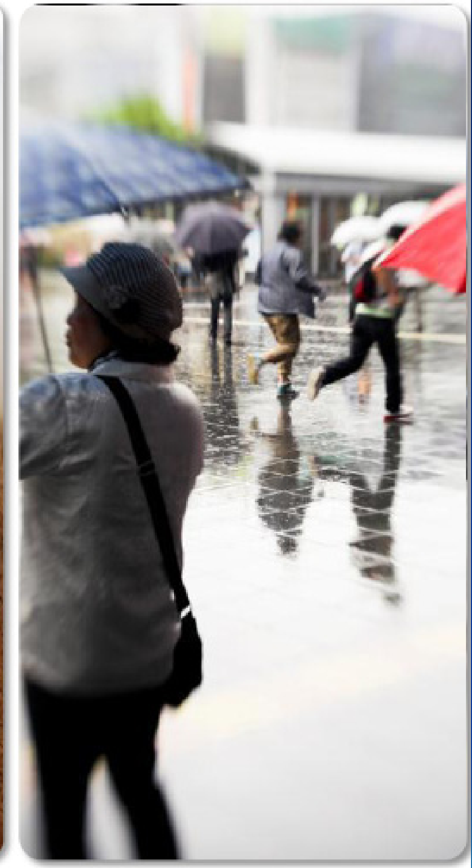
It will be important for mining companies to plan for extreme weather events as a contingency throughout the mine life and design their closure plans to survive them.

We are in serious trouble….

The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

ipcc
INTERGOVERNMENTAL PANEL ON climate change

A changing climate leads to changes in extreme weather and climate events




THE END
Questions??
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