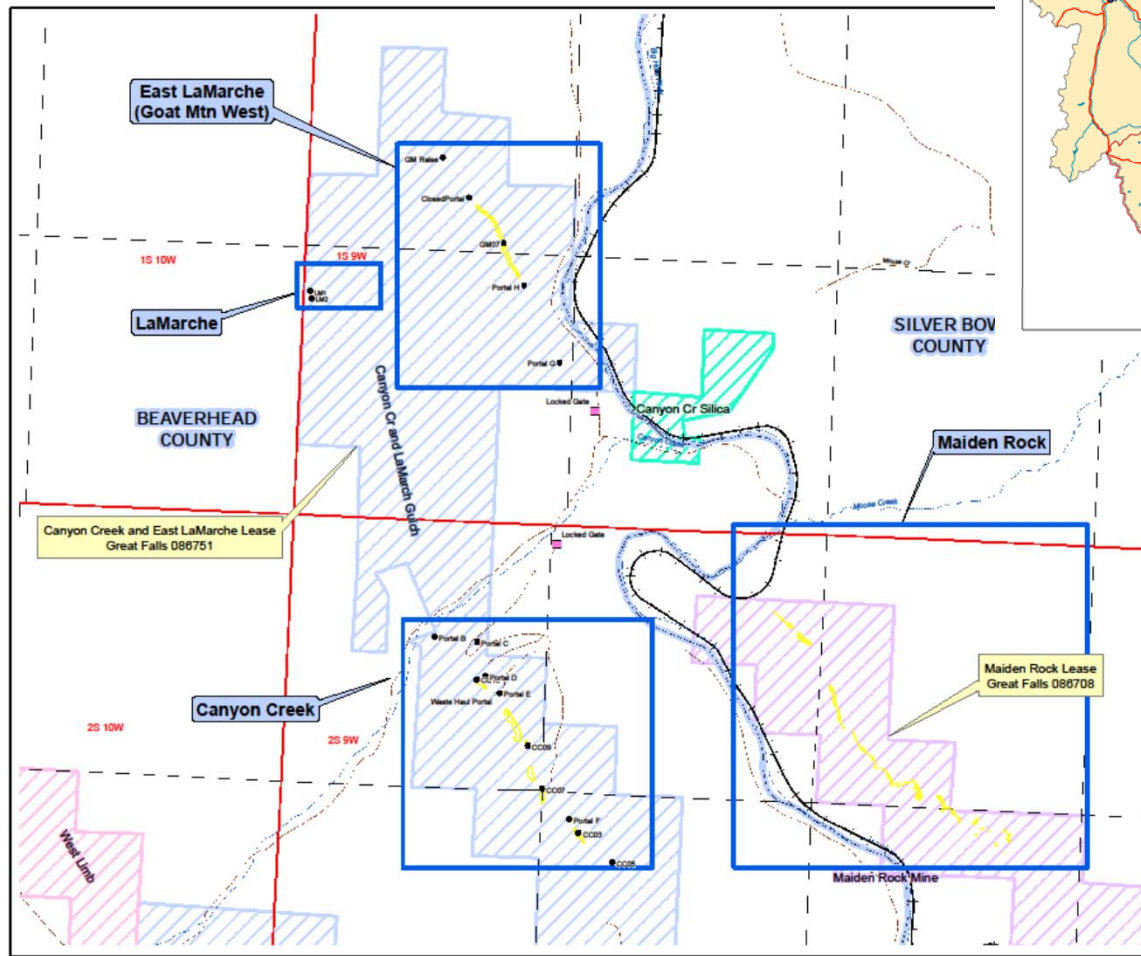


MAIDEN ROCK PHOSPHATE DISTRICT RECLAMATION



MAIDEN ROCK DISTRICT LOCATION



▨ Canyon Cr & LaMarche Gulch
▨ West Limb Mine

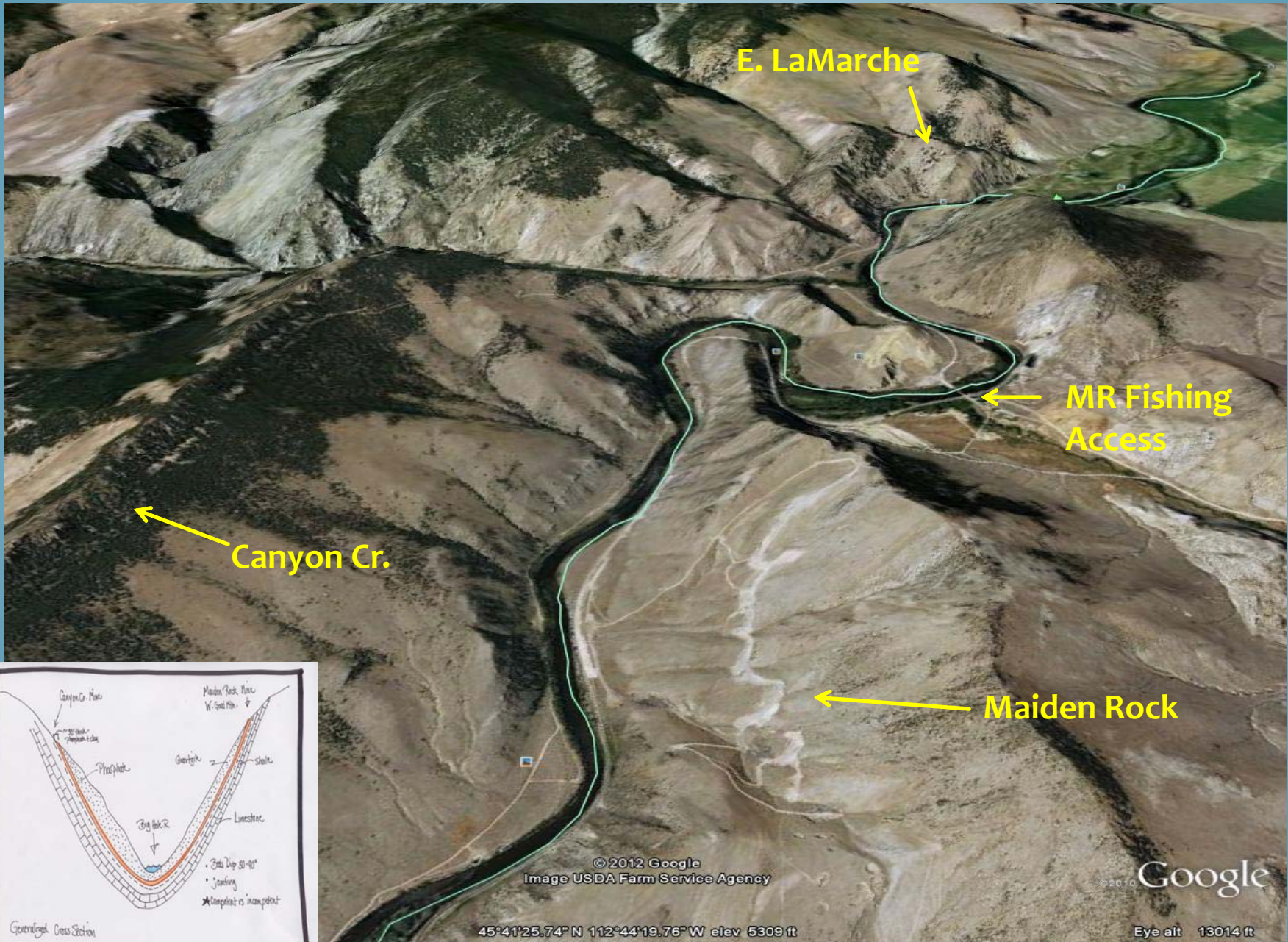
0 300 1500
 Feet
 Datum: NAD83 StatePlane Montana Feet

**CLOSED PHOSPHATE LEASES
 FOR
 MAIDEN ROCK AREA**

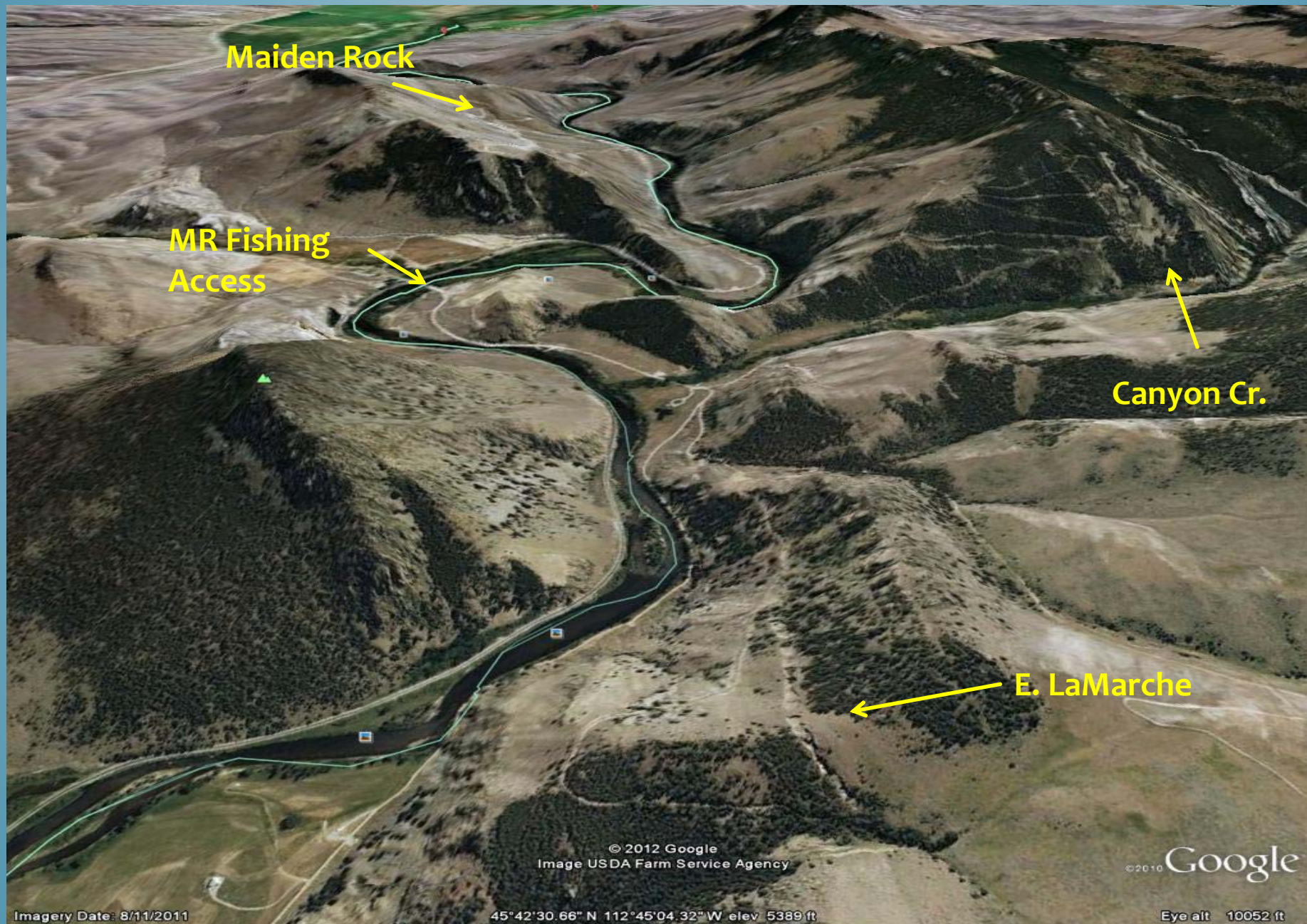
**MAIDEN ROCK PHOSPHATE
 DISTRICT PHASE II**
 Beaverhead County, Montana

SPECTRUM ENGINEERING Mining and Reclamation Specialists Billings, Montana	FILE: 609 Lease Map May 2019 Map 6 of 9
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GOOGLE EARTH VIEW LOOKING NORTH



GOOGLE EARTH VIEW LOOKING SOUTH



Maiden Rock

MR Fishing Access

Canyon Cr.

E. LaMarche

© 2012 Google
Image USDA Farm Service Agency

©2010 Google

Imagery Date: 8/11/2011

45°42'30.66" N 112°45'04.32" W elev 5389 ft

Eye alt 10052 ft

MAIDEN ROCK PHOSPHATE DISTRICT HISTORY

- Phosphate discovered ~1910, mined as early as 1921.
- Victor Chemical Company – purchased leases - 1947-48
- Mined from 1947 to 1963
- Ore shipped to Silver Bow for processing
- Stauffer Chemical Company
- Rhone-Poulenc – closed mine in 1963
 - reclaimed & relinquished leases 1990
- Rhodia Inc. - Presently responsible for clean up at Ramsey
- Production History:

• Canyon Cr & E. La Marche	3,303,211 tons
• Maiden Rock	2,169,624 tons
	5,472,835 tons



Slide 5

JLG1

Joan Gabelman, 4/24/2012

Rhone Poulenc, BLM & FS Reclamation Plan

- Rhone-Poulenc's reclamation plan
 - Close adits that pose safety threat
 - Dismantle/salvage structures
 - Scrap metal – haul to disposal site
 - Bury concrete slabs/foundations
 - Add water bars where required by BLM/FS
 - Gate access roads to abandoned mines
 - Sign all access points
 - Fence/sign specified areas
 - Remove power poles / wire to “various adits”
 - 3 year weed control program



WHY DID WE RELINQUISH THE BOND!

- Mining / Reclamation practices were different at that time (FLPMA _ 1979)
- Agencies and Mine concluded that the stopes were “similar” to the surrounding cliffs
- Mine did do a lot of reclamation
- Bond was \$12,000



Maiden Rock



E. LaMarche

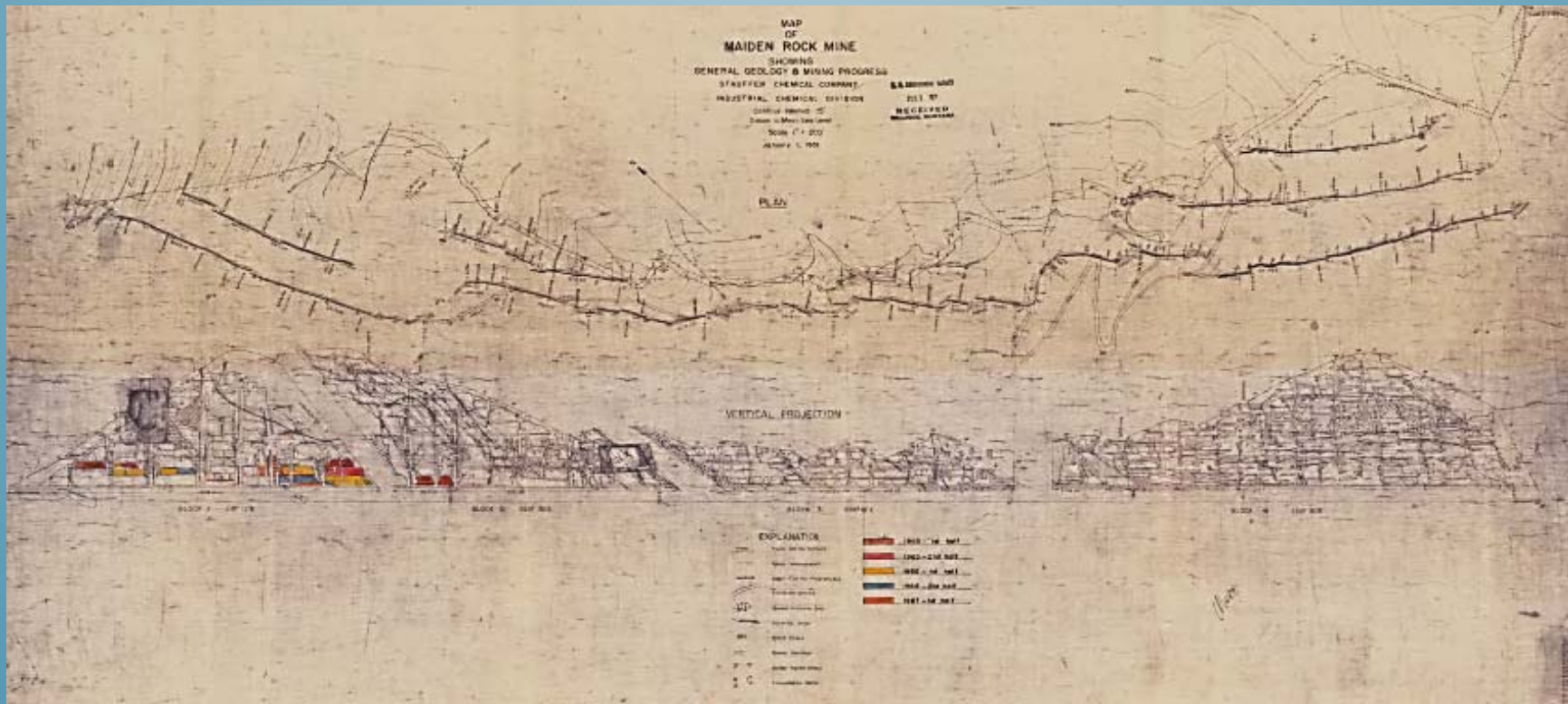
Why reclaim the mines today?

Why spend taxpayers money?

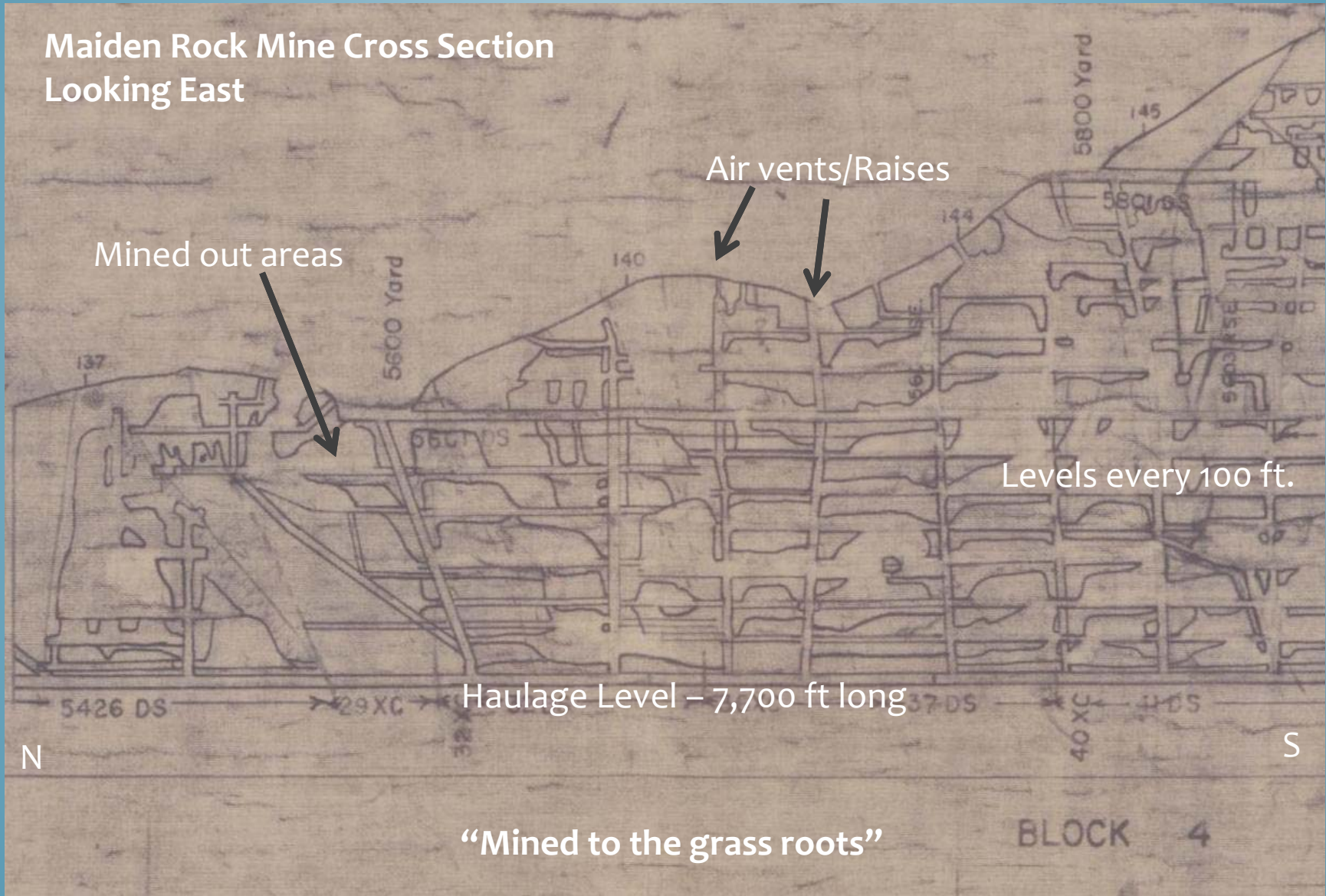
- INCREASE FOCUS ON PUBLIC SAFETY
- Awareness of abandoned mine dangers
 - BLM began AML program in mid 1990's
 - On going program
- Increased use of public lands - hunting, fishing, urban spread.
- Subsidence over the years has increased the danger of the surface features.
- Inspector General recently audited BLM Abandoned Mine Lands & Minerals programs

GEOLOGY STRONGLY INFLUENCES NATURE OF MINING AND RECLAMATION

- Phosphate occurs as soft rock between very hard layers.
- Steeply dipping
- Could easily mine the 10-30 foot wide ore zone with block cave methods.
- Mined up to surface
- Collapsed open to surface



Maiden Rock Mine Cross Section
Looking East



Mined out areas

Air vents/Raises

Levels every 100 ft.

Haulage Level - 7,700 ft long

N

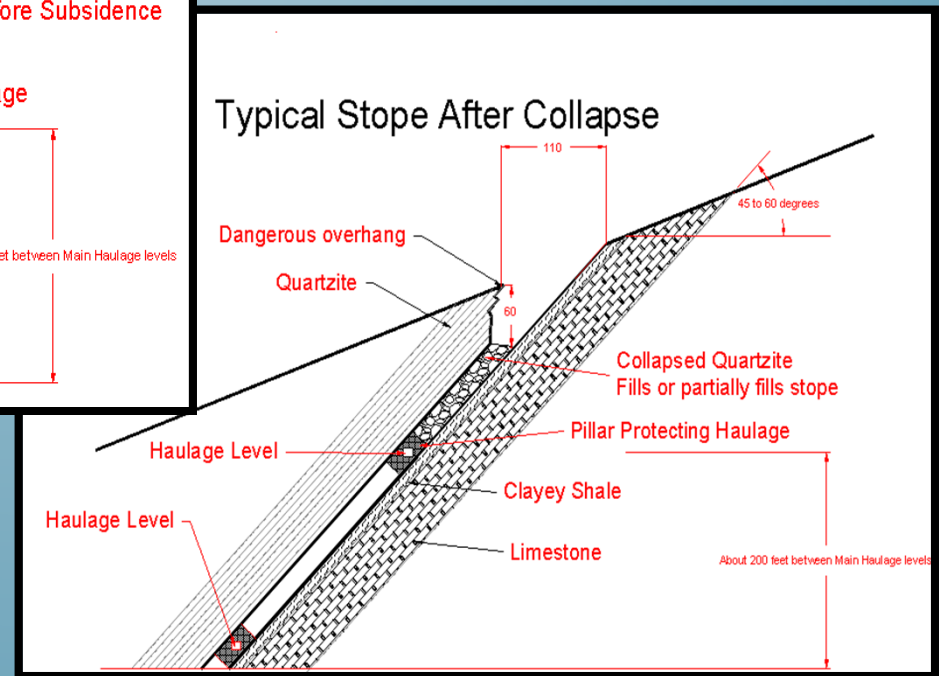
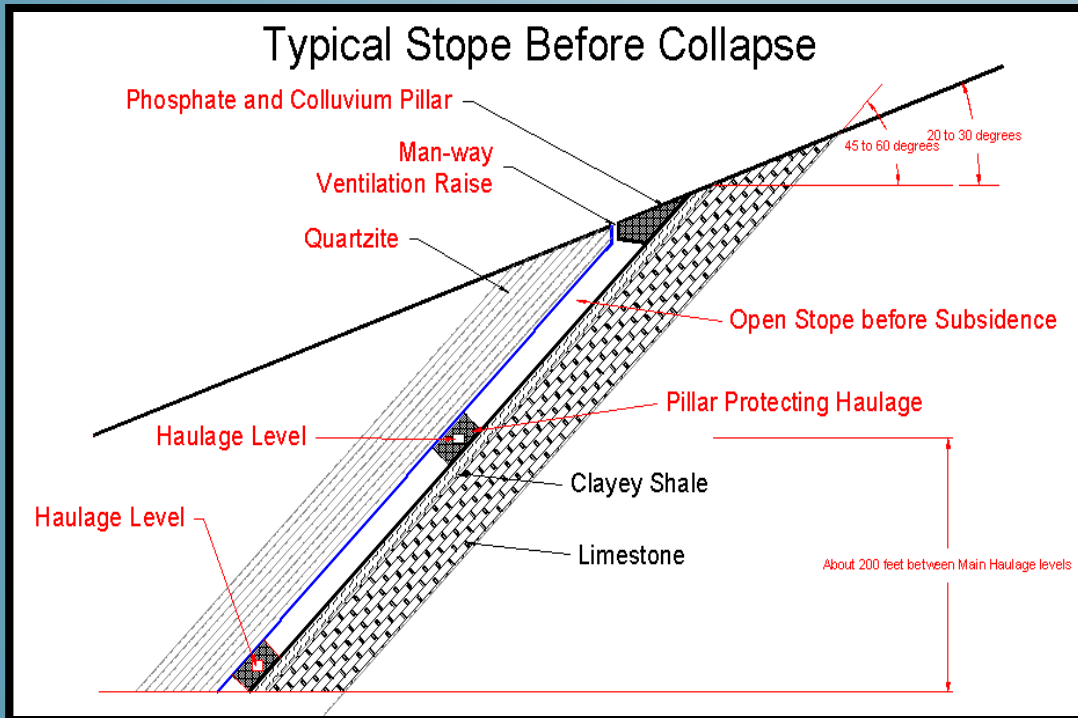
S

“Mined to the grass roots”

BLOCK 4

RESULTING SURFACE CONFIGURAITON

- Surface exposure of mines leaves tall highwalls with overhangs
- Extremely hard rock creates difficulty in drilling and blasting down highwalls



RESULTING SURFACE FEATURES



MAIDEN ROCK VENTILATION RAISES



PROJECT EVOLUTION

2008 - BLM review begins

5/2010 - Maiden Rock Phase I Inventory completed (Spectrum)

6/2009 - First USACE field visit

12/2009 ARRA funding received, Spectrum Phase II inventory

4/2010 - signed IGO – Authorized under Economy Act

6/2010 RFP – Cost-Plus-Fixed-Fee contract as a Task Order under the IGO

8(a) Set-Aside Security, Disaster & Infrastructure & Construction Contract MATOC (SDIC) Contract

(Rapid response division)

8/2010 - Bristol Contract awarded

9/2010 - IGO authority modified to FLMA

12/2010 – Single modification \$123,227 to \$2,021,038

10/2011 – Finalized field work

PROJECT CHALLENGES

Access

- *UPRR or over the hill*

Safety

Rock Quality

- *Hard quartzite, limestone*

Techniques - NEEDED TO BE FLEXIBLE – Trial and Error

- *Doze*
- *Pneumatic hammer*
- *Drill and blast*
- *Grate shafts*
- *PUF*

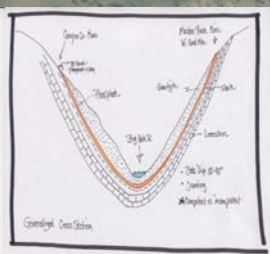
UPRR ROAD



- Legend**
- Drill Holes
 - ★ Mine Location Code
 - ✕ Mine Openings
 - ① Adit
 - ② Arch
 - ⊗ Closed Adit
 - ⊗ Collapsed Raise
 - ③ Open Stope
 - ⊗ Overhang
 - ⑤ Raise
 - ⊗ Subsidence
 - ▲ Survey
 - Road
 - Old Road
 - Trail
 - stream
 - ▭ Hazard Zone
 - ⊕⊕⊕⊕⊕ Subsidence Areas

ZONE 3 – fair probability of failure – low severity consequences

Steeply dipping bedding dip 60°
 Topographic slope 23°
 Sloughed material will run into stopes below
 Low amount of stoping
 Numerous pillars
 Thin ore zone 10'
 Many steep overhangs
 Most stopes choked off
 Few open stopes
 Less likely to have chimney failures



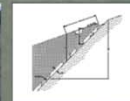
ZONE 4 - likely to fail – very severe consequences

Steeply dipping bedding 56°
 Topographic slope 27°
 Sloughed material will run into stopes below
 Very large amount of stoping
 Few pillars
 Thin ore zone 10'
 Almost continuous overhangs
 Several areas of open stopes
 Low likelihood of chimney failures



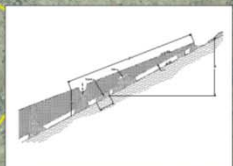
ZONE 2 - modest probability of failure – moderately severe consequences

Moderately dipping bedding – 45-50°
 Topographic slope 19°
 Sloughed material not run into stopes below
 Fair amount of stoping
 Few pillars
 Thin ore zone 10'
 Few overhangs
 Stopes choked off
 Less likely to have chimney failures



ZONE 1 – most likely to fail – minor severity

Gently dipping bedding - 28°
 Topographic slope 21°
 Sloughed material not run into stopes below
 Large amount of stoping
 Few pillars
 Thicker ore zone 17'
 Very few overhangs
 Stopes choked off
 Likely to have chimney failures



RECLAMATION ACTIVITIES

Zone 1

- Work mostly from uphill, and in trenches
- Backfill collapsed stopes with non-adjacent materials, and
- no blasting required

Zone 2

- Equipment work from uphill, and in trenches, and
- Little to no blasting required

Zone 3

- Equipment work from uphill, and in trenches,
- Significant careful blasting of overhangs required, and
- Possible fencing

Zone 4

- Equipment work from uphill only
- No blasting of almost continuous overhangs,
- Additional investigations required,
- Fencing required

Zone 5

- No excavation on steep slopes
- Fencing required

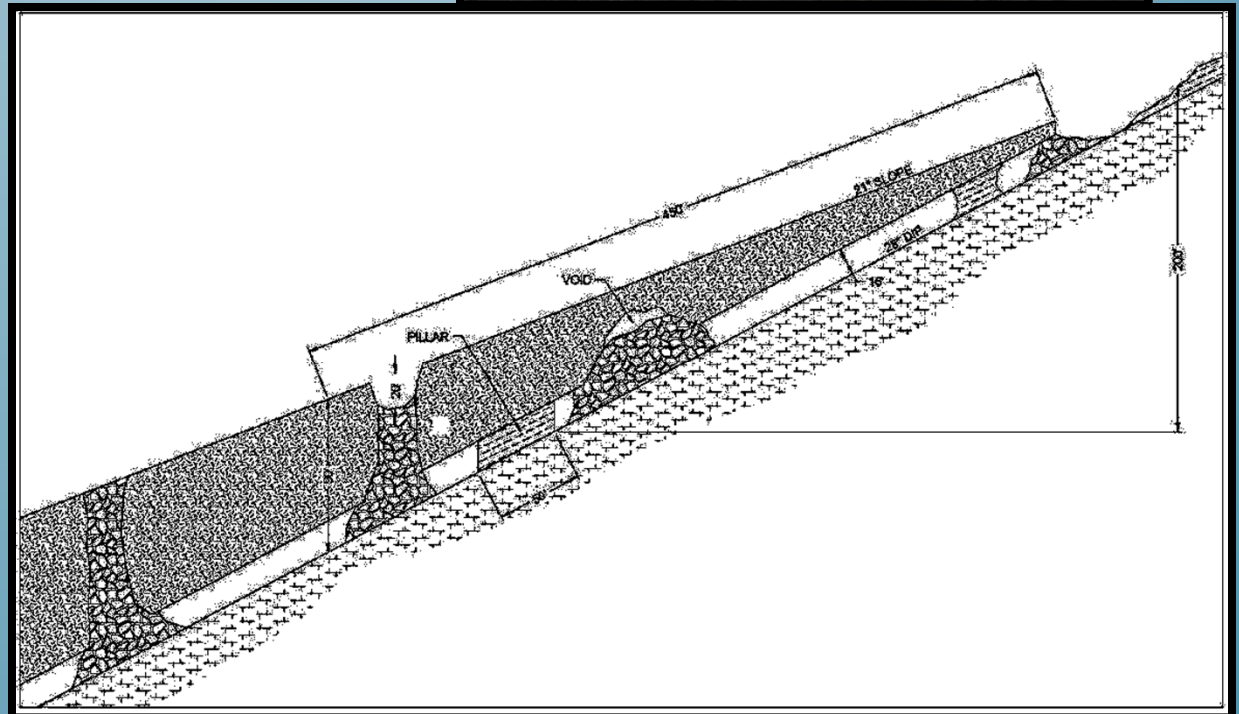


Reclamation & Safety Plan/ Developed Safety Zones

Reclamation Map
 Maiden Rock Mine Reclamation
 Silver-Bow County, Montana

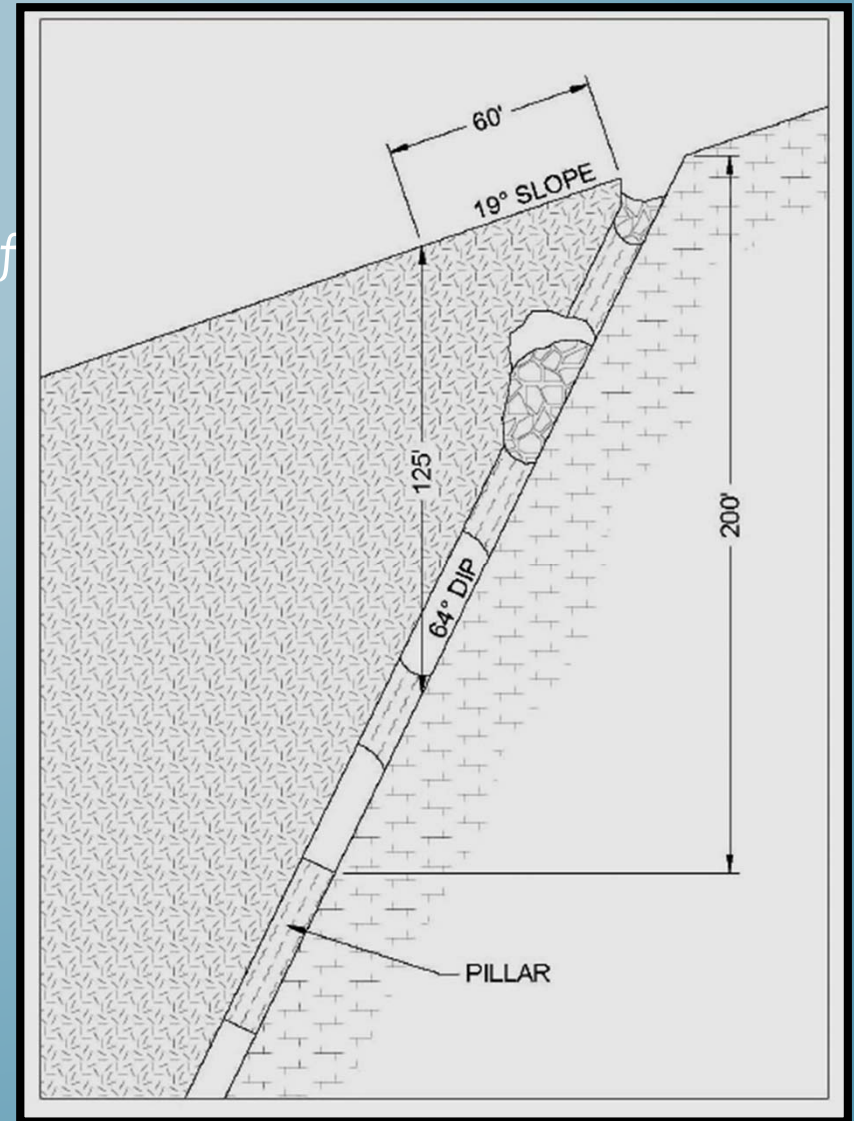
ZONE 1: MOST LIKELY TO FAIL – VERY LOW SEVERITY CONSEQUENCES FOR CONSTRUCTION EQUIPMENT

- Gently dipping bedding - 28°
- Topographic slope 21°
- Thick Ore (17 ft. / Thin beds)
- Sloughed material not run into stopes below
- Large amount of stoping
- Few pillars
- Thicker ore zone 17'
- Very few overhangs
- Stopes choked off
- Likely to have chimney failures



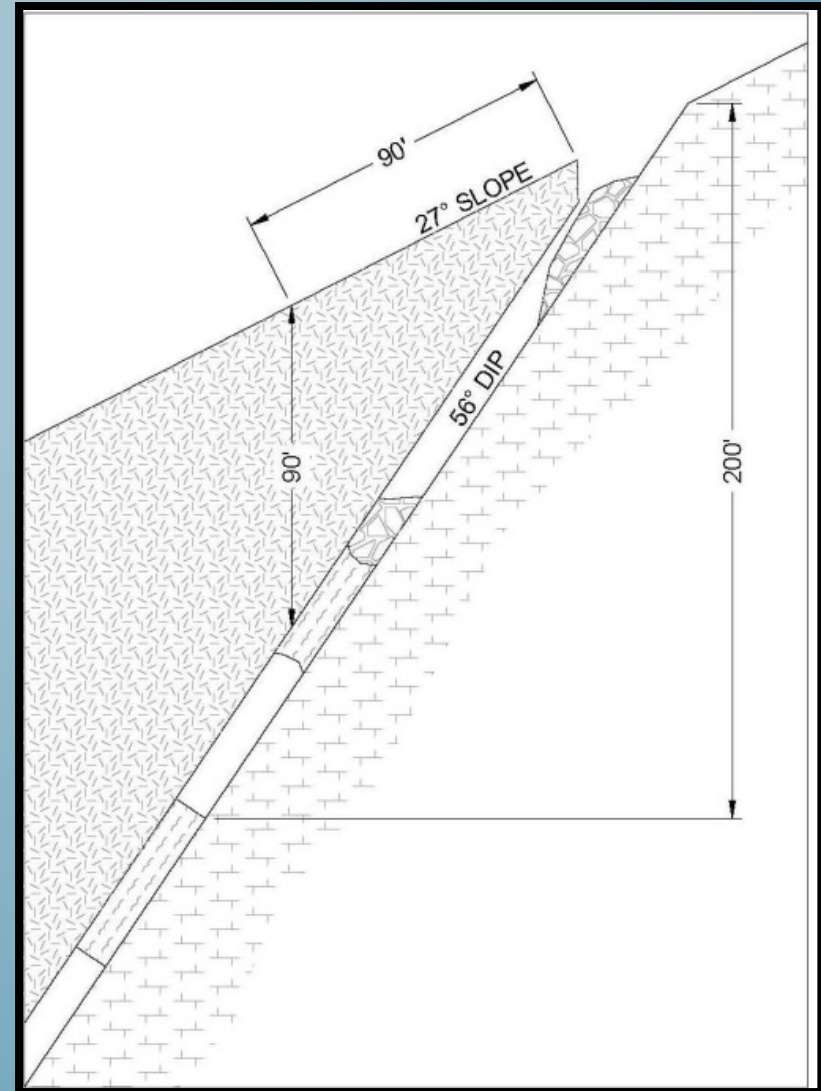
ZONE 3: FAIR PROBABILITY OF FAILURE - LOW SEVERITY OF CONSEQUENCES

- Steeply dipping beds @ 60°
- Topographic slope 23°
- Sloughed material will run into stopes
- Low density of chocking, mostly chocked off
- Numerous pillars



ZONE 4: LIKELY TO FAIL – VERY SEVERE CONSEQUENCES FOR CONSTRUCTION EQUIPMENT

- Steeply dipping bedding 56°
- Topographic slope 27°
- Sloughed material will run into stopes below
- Very large amount of stoping
- Few pillars
- Thin ore zone 10'
- Almost continuous overhangs
- Several areas of open stopes
- Low likelihood of chimney failures



BACKFILLING WORKED WELL



ZONE 4 CONSTRUCTION TECHNIQUES



CONSTRUCTION TECHNIQUES



Trench

Berm

CONSTRUCTION TECHNIQUES



CONSTRUCTION TECHNIQUES



CONSTRUCTION WORK



SOUTHERN EAST LAMARCHE BEFORE



EAST LA MARCHE BACKFILL & FENCE



AIR VENTS AND ESCAPE WAYS



GRATE INSTALLATION

M 153



Zone 1 – thin ground and no access

GRATE INSTALLATION – E. LAMARCHE



FENCING



BURNING SLASH



BLM & Split Estate Reclamation Summary (FS not included)

	Maiden Rx	E. LaMarche	Canyon Cr.
Documented Features	72	14	1
Backfilled	36	5	1
Grated	2	1	
Fenced	31	11	
NFA	2		
Total Features addressed = 85			

Cost Summary (not final)		
Total budget	\$2,540,000	
Access Road	\$228,616	Costs include UPRR flagmen
Grates + Helicopter Installation	\$92,195	
Fencing	\$142,190	
General	\$1,215,482	Backfilling, management, overhead, etc.
Total Reclamation	\$1,678,483	
USACE cost	\$301,517	11.8% awarded /15% total
Total spent	1,980,000	
Returned Funds	\$560,000	

SUPER TEAM MADE IT WORK

- *Spectrum – Phase 1 & 2 Inventories*
- *USACE - Project Manager*
- *Bristol – Primary Contractor*
- *Tetra Tech – Engineering Plan*
- *Noble Excavating*
- *Johnson Fencing*
- *Billings Flying Service*



AERIAL VIEW AFTER CLOSURE

