

Reliance, Wyoming Mine Subsidence Mitigation Project

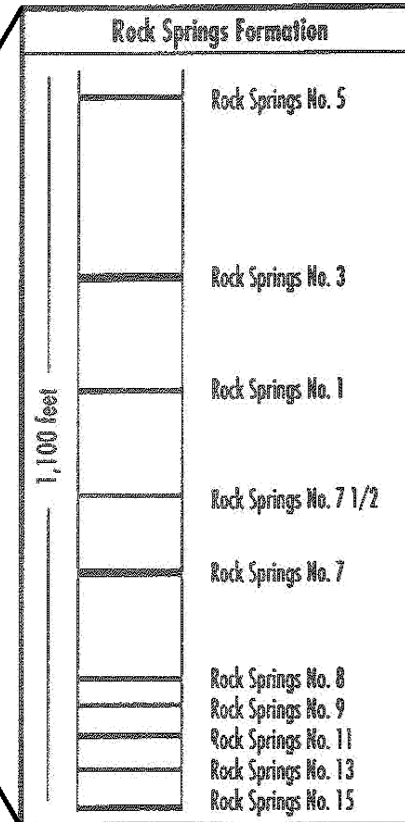
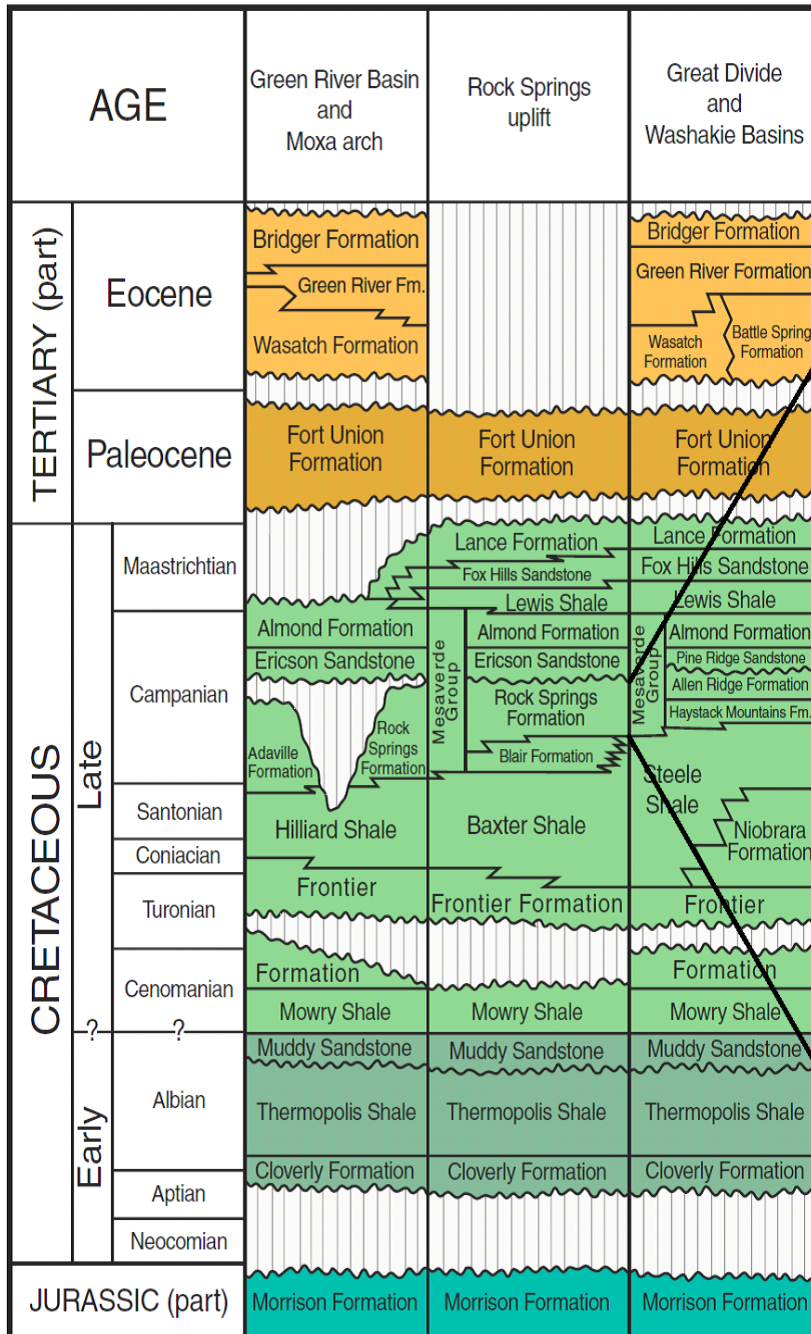


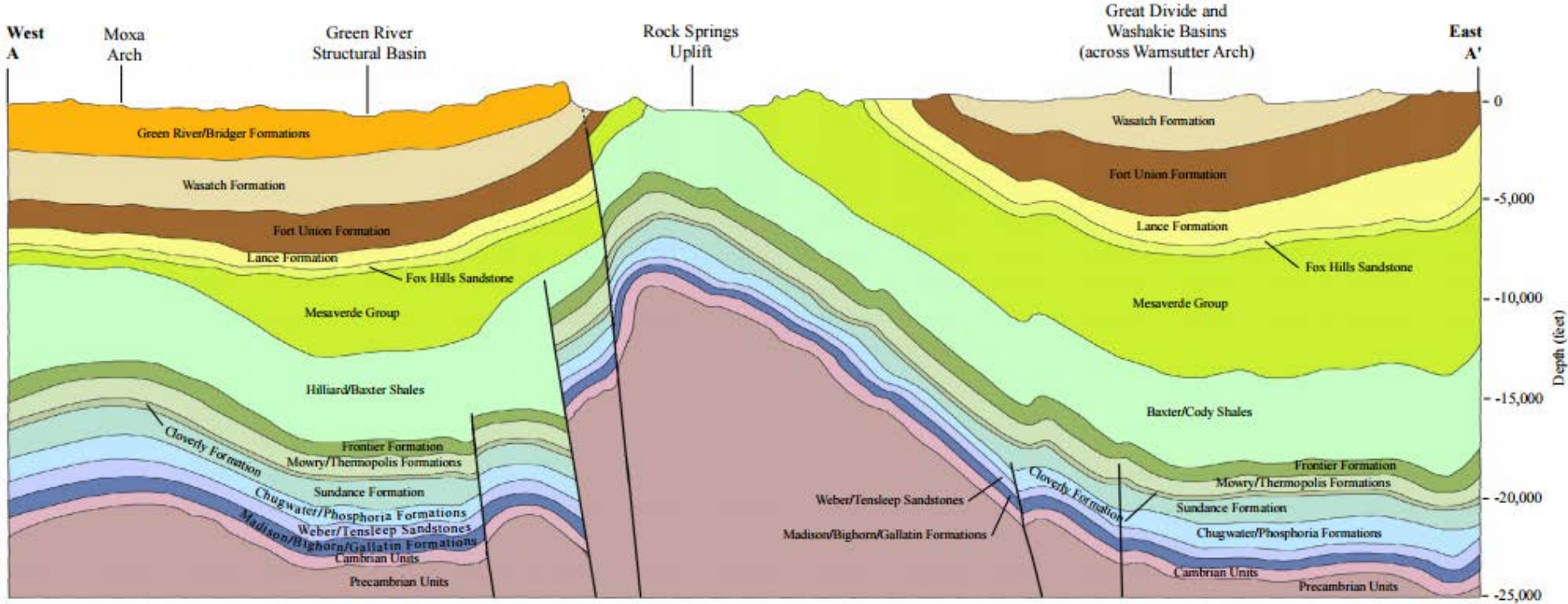
Reliance No. 1 Mine Portal



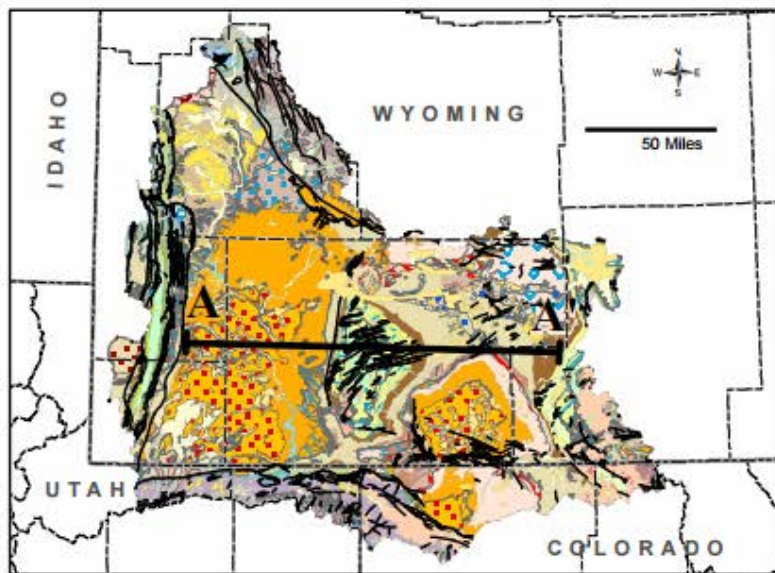
Reliance Project Timeline

- 1868 – Rock Springs No. 1 Mine opens to supply the Union Pacific rail road.
- 1910 – Reliance No. 1 Mine opens.
- 1911 – Town is established with 75 houses reported.
- 1926 – Mine fire begins in No. 1 mine causing temporary closure. No. 7.5 mine opens.
- 1933 – No. 1 Mine closed.
- 1936 – No. 7 Mine opens. Reliance tipple built.
- 1954 – All underground mines are closed.
- 1980 - Wyoming Abandoned Mine Land Program begins 1980
- 1980 through 1990's – Initial closure of largest and most accessible portals begins.
- 2000 – Wyoming AML performs initial statewide abandoned mine inventory.
- 2002 – AML Project 17H begins to address surficial mine features.
- 2003 through 2005 – Detailed statewide mine inventory completed
- 2005 – Sweetwater County Report of Investigation submitted
- 2007 – First 17H closure project initiated
- 2015 – AML Project 17.6B begins addressing mine subsidence in developed areas
- 2015 – Investigation drilling and grouting of east Reliance Road
- 2016 – Grouting of East Reliance residences is initiated (2 Projects)
- 2017 - Grouting of East Reliance residences 4th Phase
- 2018 – 5th Phase of Construction NTP June 4





10 Miles



Index Map and Line of Section

WSGS 2009

Projection: NAD 1983
UTM Zone 12N

Data Sources:

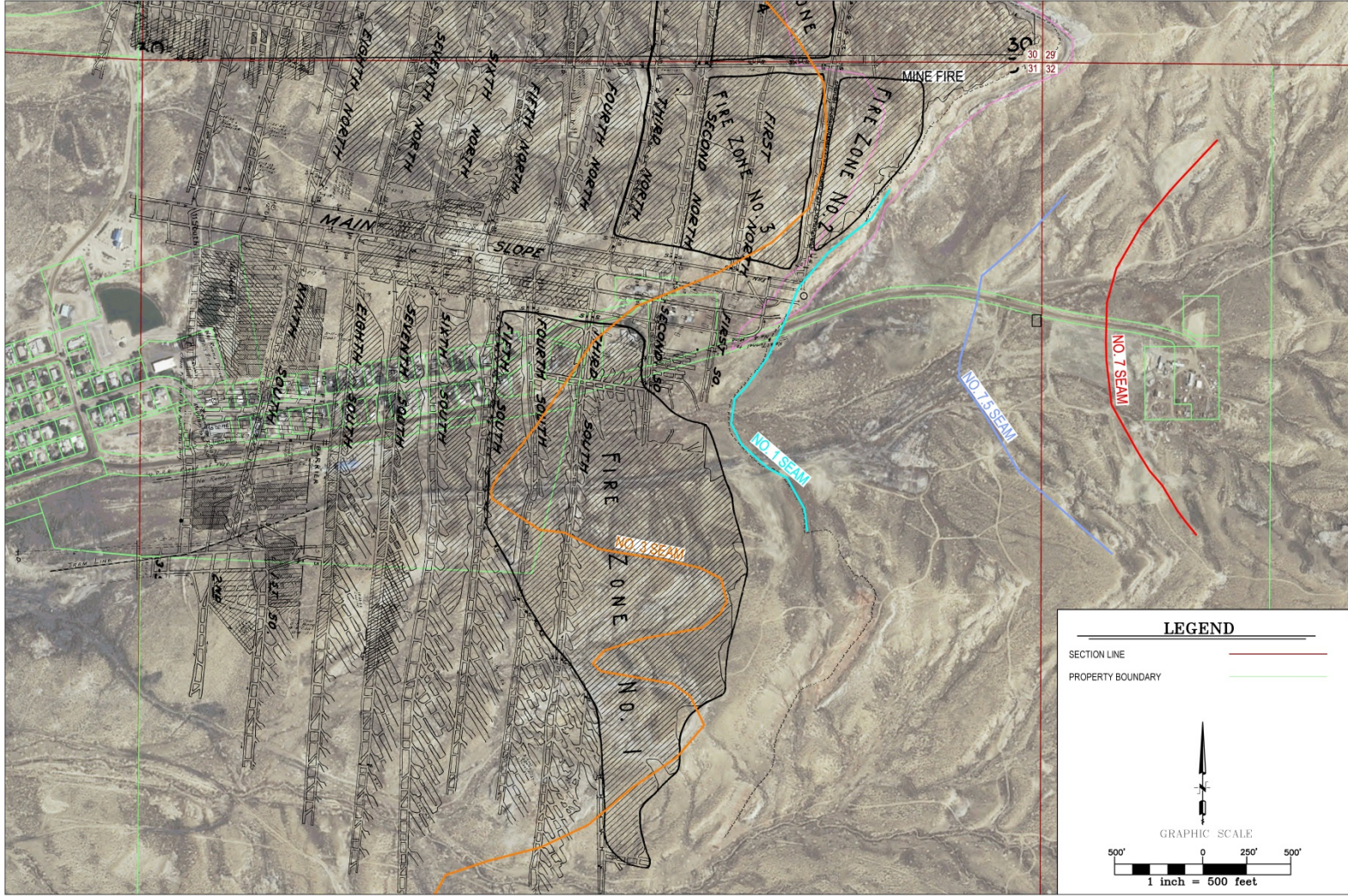
WSGS unpublished data

Hintze, et al. (2000)

Stoeser, et al. (2005)

Figure 2-5. West-east geologic cross section, Wyoming Greater Green River Basin. Cross section by Fred McLaughlin and Yuri Ganshin, WSGS.

Reliance No. 1 Seam Mine Map



LEGEND

SECTION LINE —

PROPERTY BOUNDARY —

GRAPHIC SCALE

500' 0 250' 500'

1 inch = 500 feet

RELIANCE 1 SEAM MINE MAPPING		SWEETWATER COUNTY GROUTING PROJECT		BRS	
DATE: 12/15/2011	SCALE: 1" = 500'	PROJECT NO: 17.08	PROJECT NAME: SWEETWATER COUNTY, WYOMING	DESIGNED BY: BRS	REVISION NO: 1
DRAWN BY: BRS	CHECKED BY: BRS	DATE: 12/15/2011	PROJECT NO: 17.08	LAST FILED DATE: 12/15/2011	DATE: 12/15/2011
PROJECT NO: 17.08	DATE: 12/15/2011	PROJECT NO: 17.08	PROJECT NAME: SWEETWATER COUNTY, WYOMING	DATE: 12/15/2011	DATE: 12/15/2011

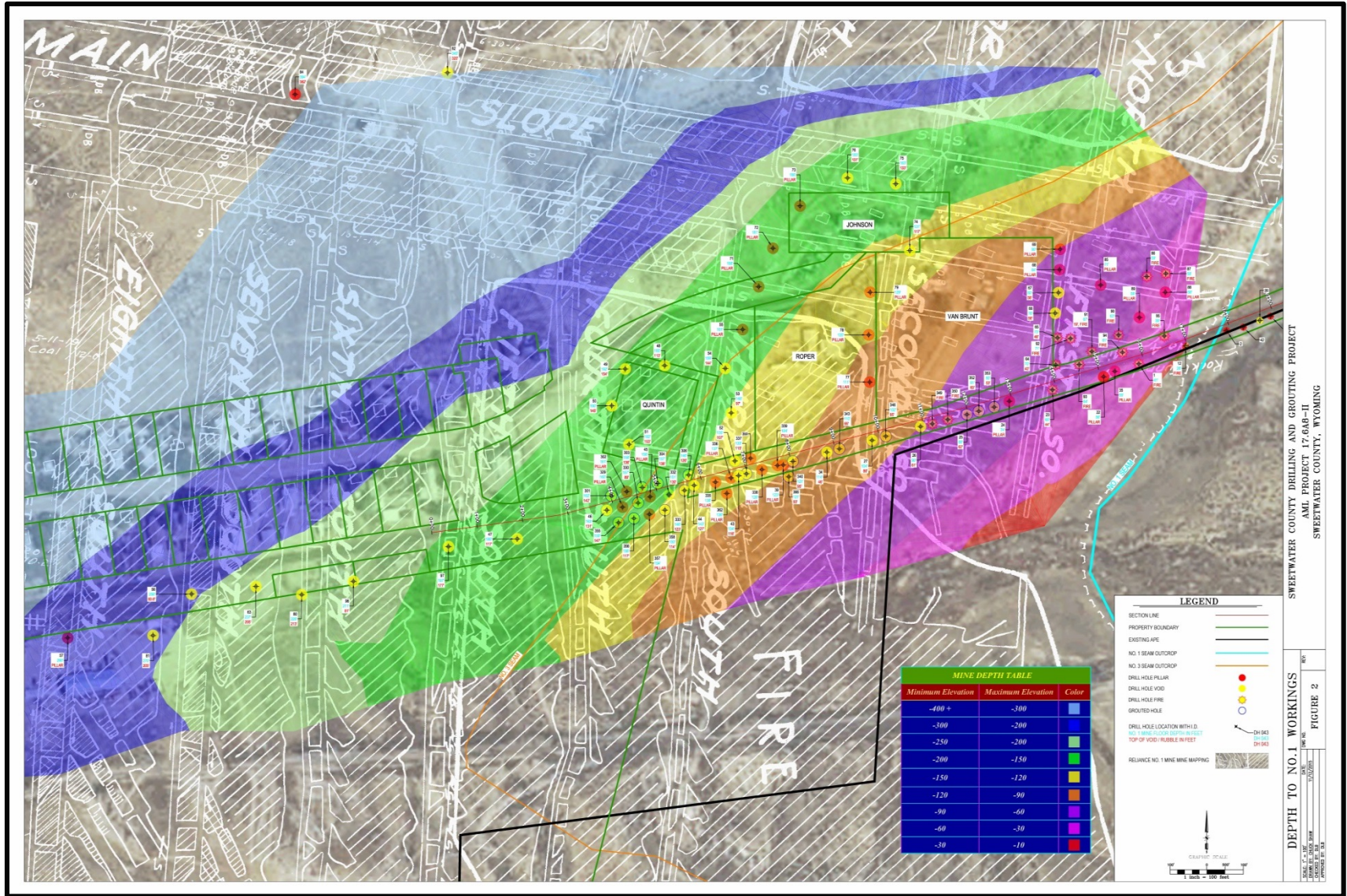
Ongoing Subsidence Projects Reliance No. 1 Mine 2015



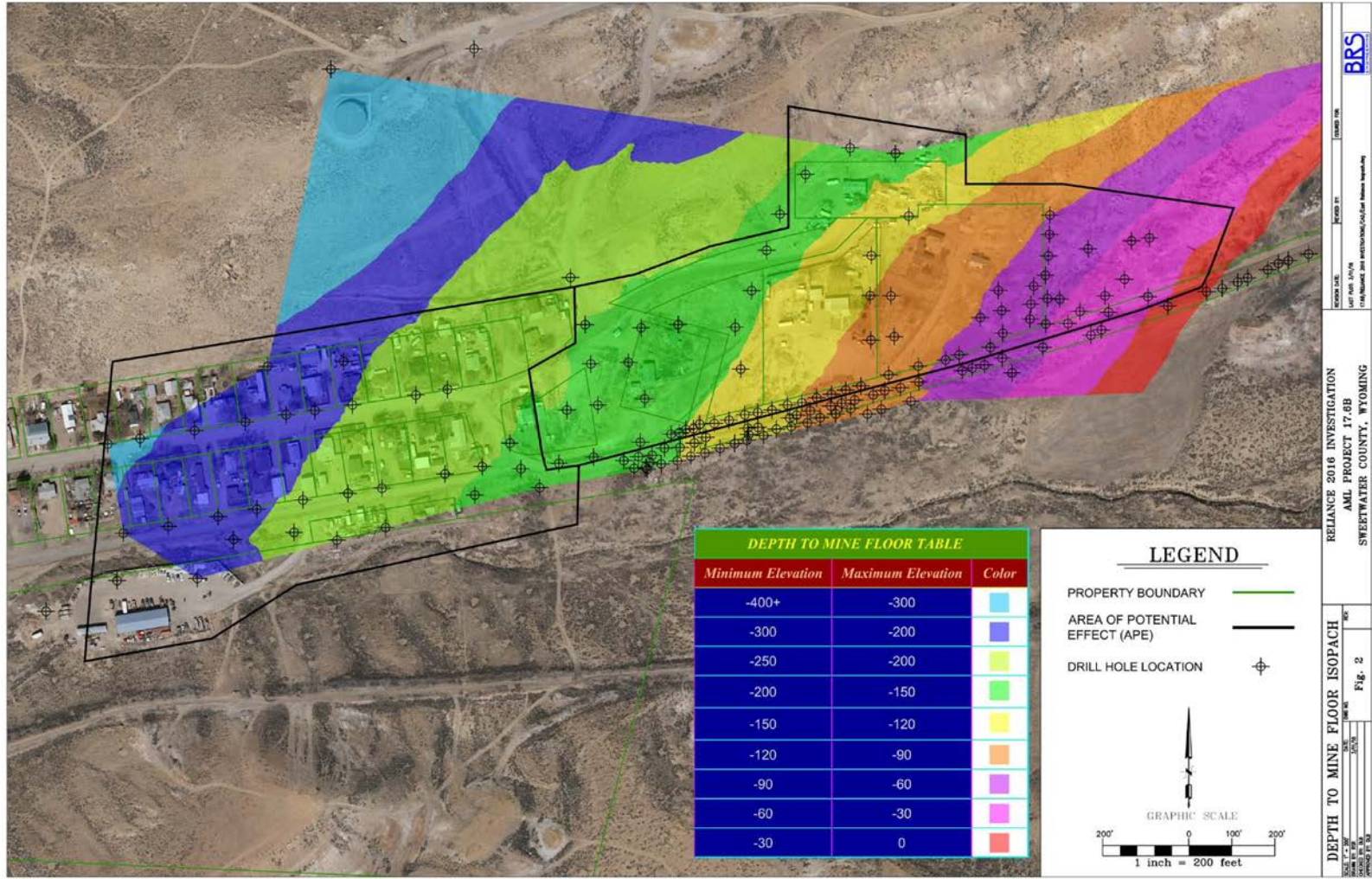
Ongoing Subsidence Projects Reliance No. 1 Mine 2015



Reliance Proposed Drilling and Estimated Depth to No. 1 Coal Seam



Actual Depth to Mine Floor Isopach Map



Reliance County Road Grouting



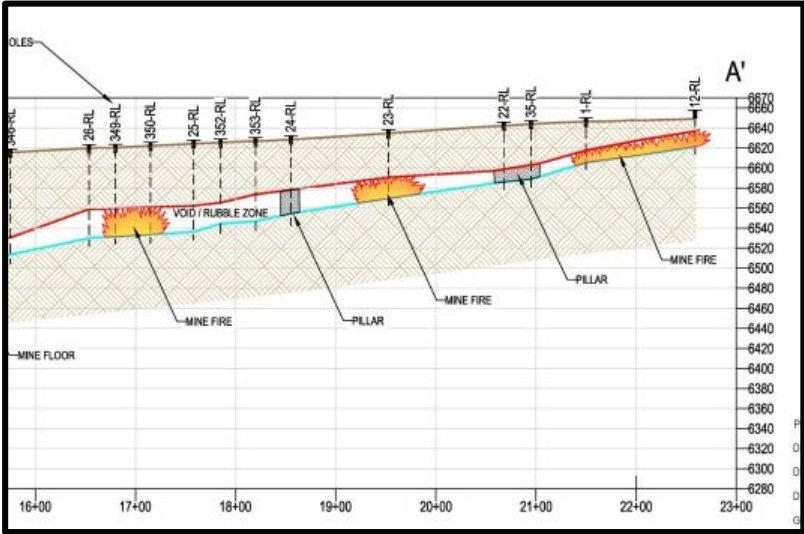
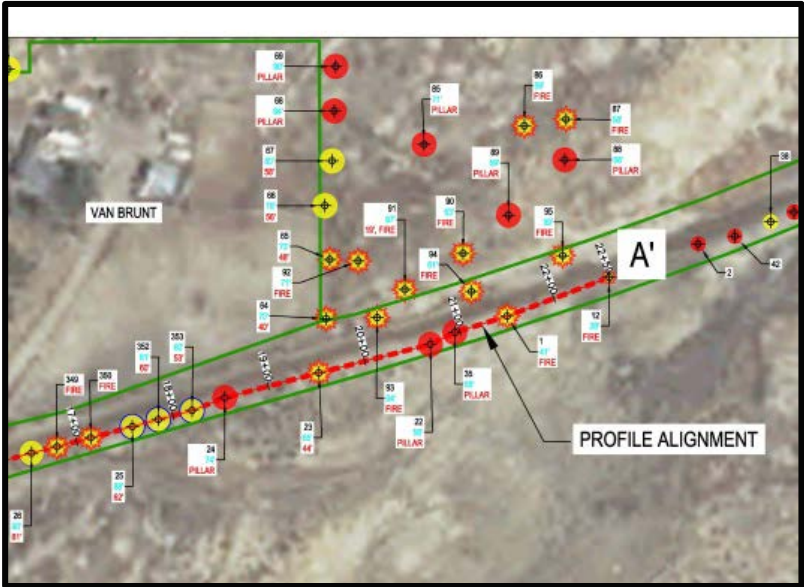
Fire Venting Through Drill Hole

Reliance County Road Grouting

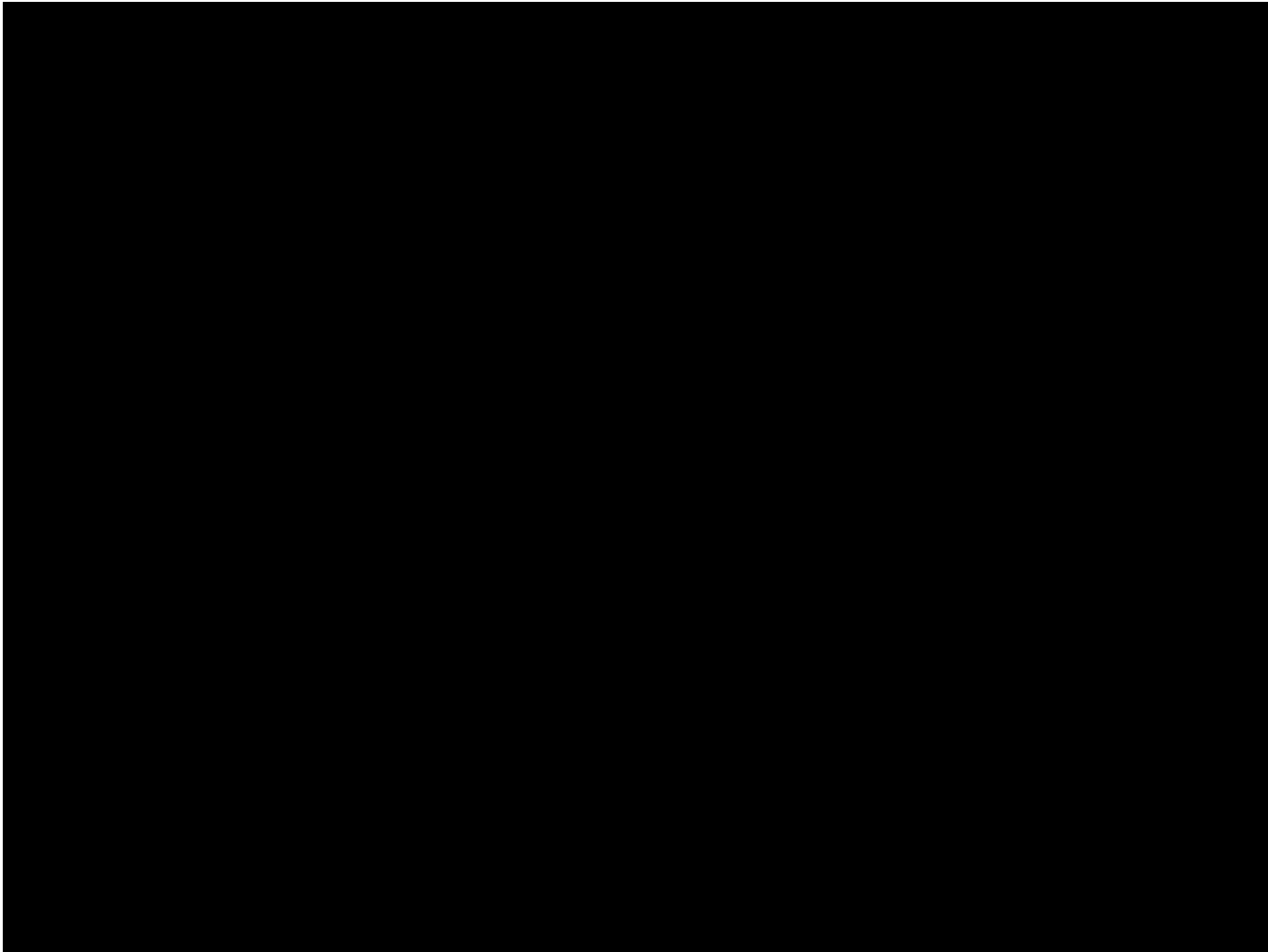


Elevated H₂S Gas Requiring Use of Self Contained Breathing Apparatus / Compressed Air Breathing Apparatus (SCBA/CABA)

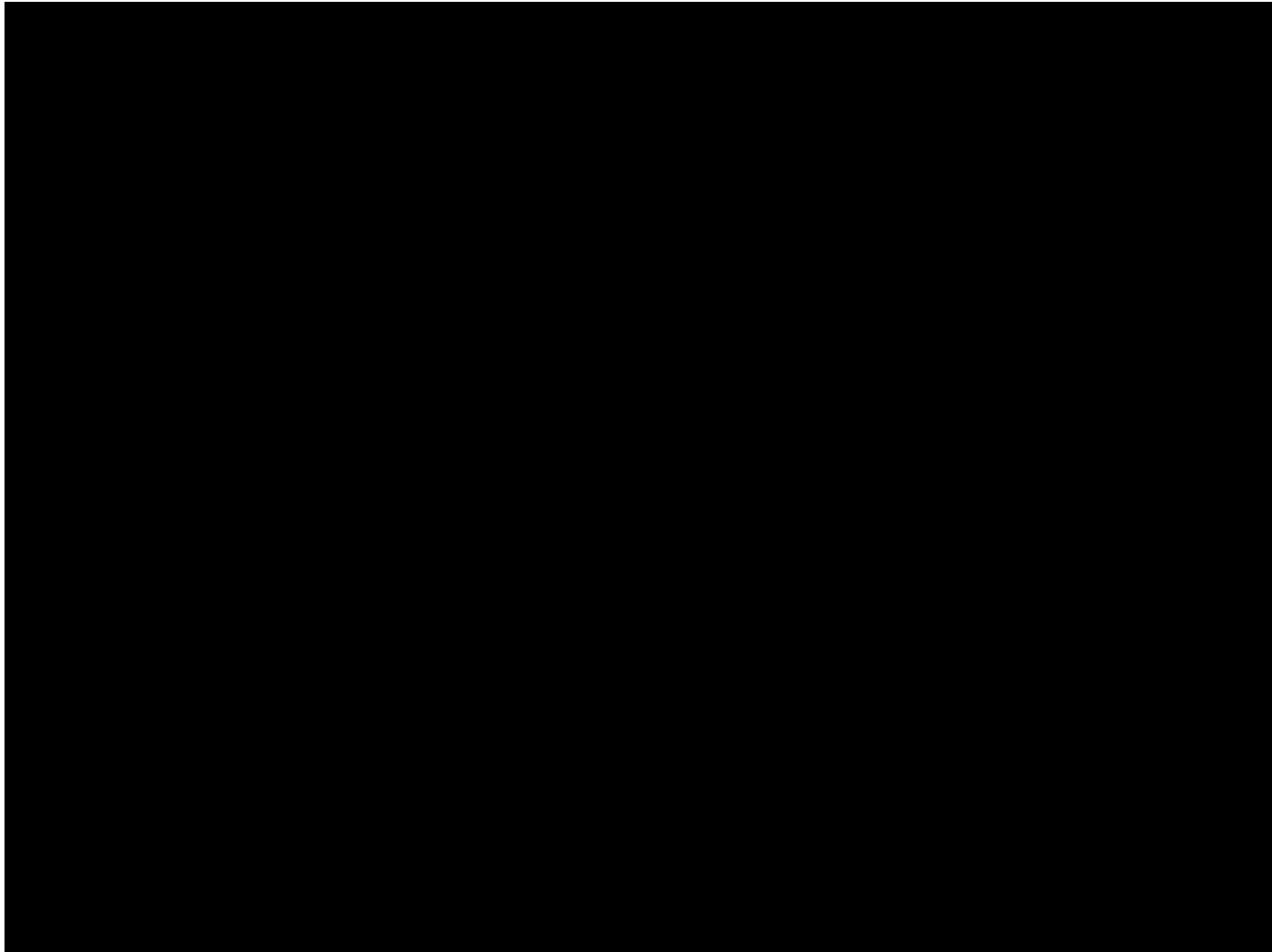
Reliance Drilling Results Cross Section



Drilling Results – Void Limited Support



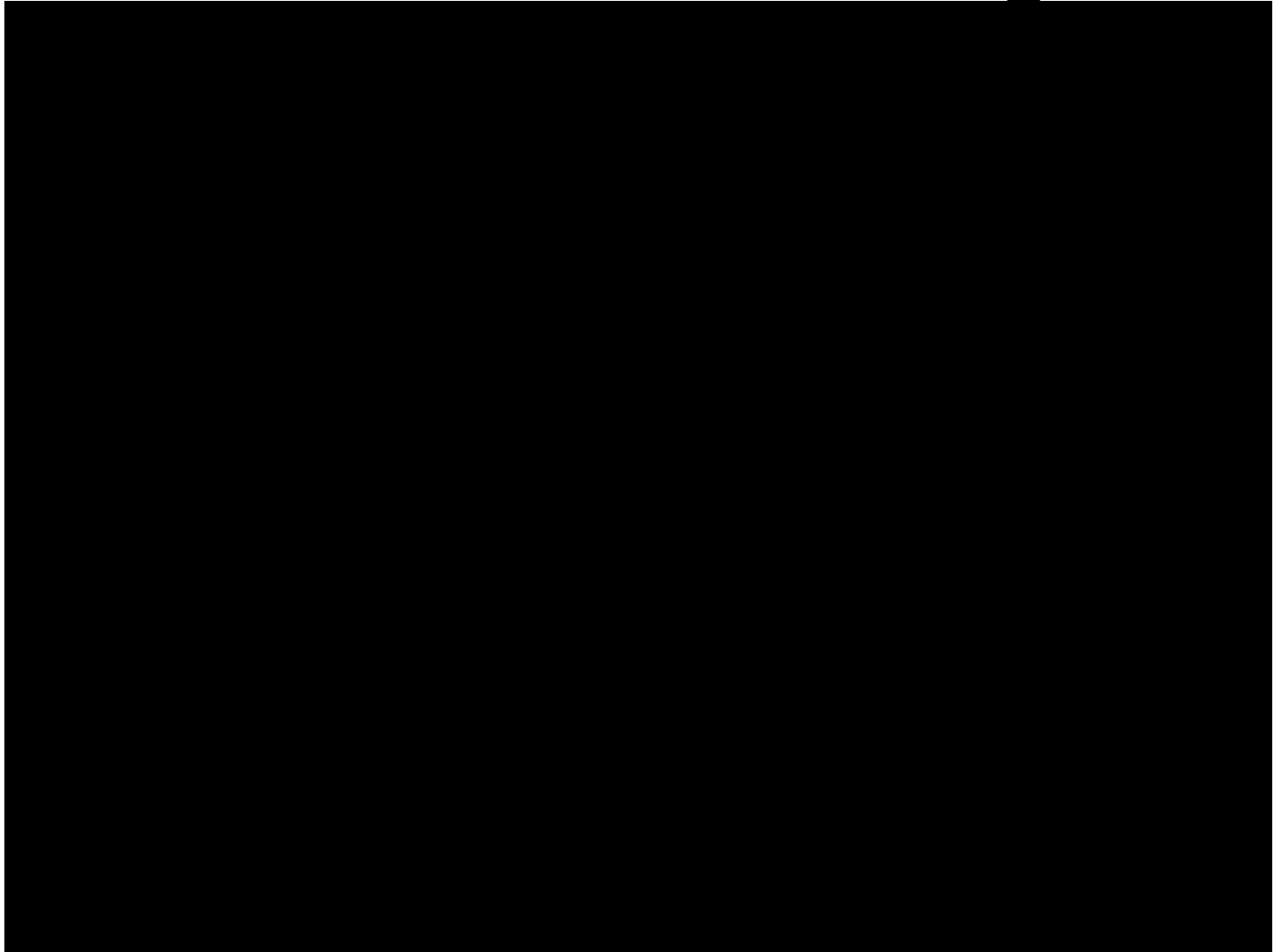
Drilling Results – Rubble Zone



REMEDIATION

- Goals – Mitigate Mine Subsidence and Control or Extinguish Mine Fire
- Method – Void Fill Pressure Grouting
- Approach –
 - Begin Grouting Down Dip from Mine Fire
 - Push Grout into the Fire Zone
 - Create “Fire Line” along Strike
 - Gradually Continue Up Dip to Outcrop

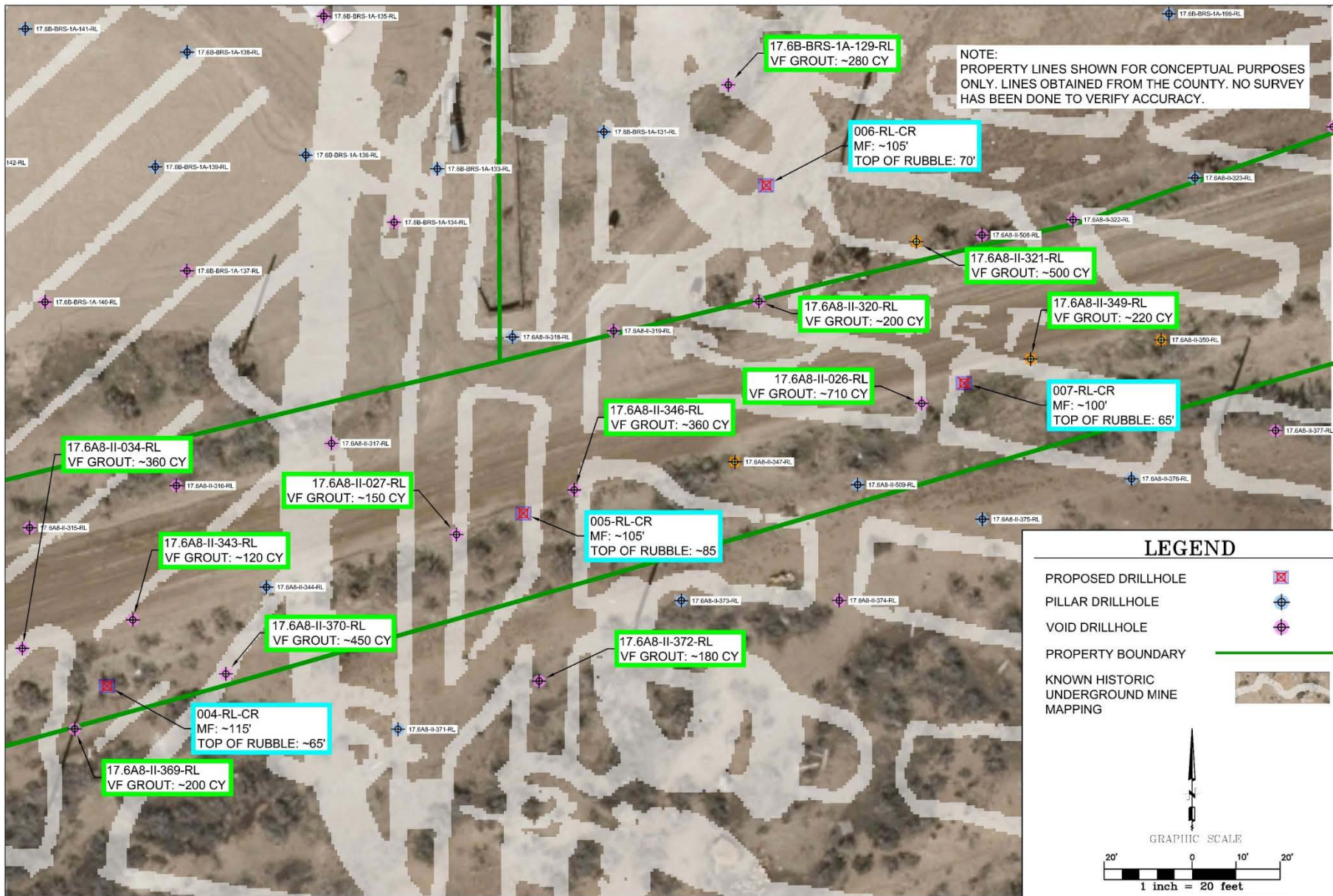
Pressure Grouting



RESULT

- Area Stabilized
- Mine Fire Extinguished
- No Safety Incidents
 - No Flash-Back
 - Eliminated Gasses
- Verification Drilling and Coring Completed
 - Grouting Placement and Strength Verified
 - No Fire or Mine Gasses

RELIANCE CORING 004 - 007



NOTE:
PROPERTY LINES SHOWN FOR CONCEPTUAL PURPOSES ONLY. LINES OBTAINED FROM THE COUNTY. NO SURVEY HAS BEEN DONE TO VERIFY ACCURACY.

LEGEND

- PROPOSED DRILLHOLE
- PILLAR DRILLHOLE
- VOID DRILLHOLE
- PROPERTY BOUNDARY
- KNOWN HISTORIC UNDERGROUND MINE MAPPING

GRAPHIC SCALE

005-RL-CR	MIN	MAX	AVG
ADJACENT HOLE GROUT STRENGTH (PSI)	780	1340	978



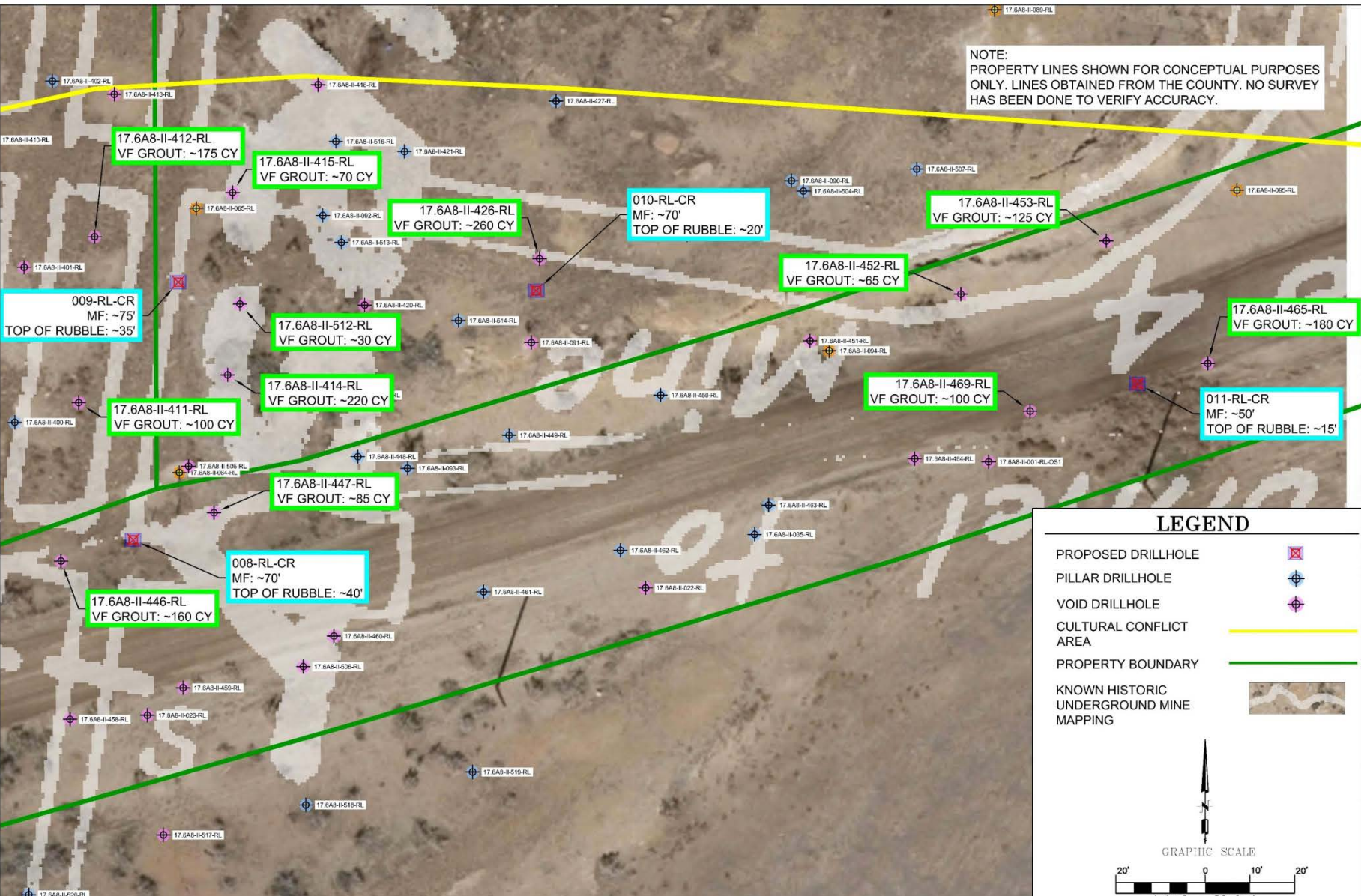
006-RL-CR	MIN	MAX	AVG
ADJACENT HOLE GROUT STRENGTH (PSI)	1090	1090	1090





RELIANCE CORING 008 - 011

NOTE:
PROPERTY LINES SHOWN FOR CONCEPTUAL PURPOSES ONLY. LINES OBTAINED FROM THE COUNTY. NO SURVEY HAS BEEN DONE TO VERIFY ACCURACY.



LEGEND

- PROPOSED DRILLHOLE
- PILLAR DRILLHOLE
- VOID DRILLHOLE
- CULTURAL CONFLICT AREA
- PROPERTY BOUNDARY
- KNOWN HISTORIC UNDERGROUND MINE MAPPING

GRAPHIC SCALE

1 inch = 20 feet

008-RL-CR	MIN	MAX	AVG
ADJACENT HOLE GROUT STRENGTH (PSI)	1070	1070	1070



009-RL-CR	MIN	MAX	AVG
ADJACENT HOLE GROUT			
STRENGTH (PSI)	1050	1200	1142.5

Reliance RD.
BOX NO. 3
64.9

COMPANY BRS/AML PROPERTY Reliance RD
 NC HOLE NO. 1768-BRS-K-009-RL-CR BOX NO. 4
 INTERVAL 64.9 TO 76.7



009-RL-CR-1
2500 PSI grout



009-RL-CR-2
5730 PSI grout

010-RL-CR	MIN	MAX	AVG
ADJACENT HOLE GROUT			
STRENGTH (PSI)	930	1240	1085

Reliance RD
R-B NO. 2

COMPANY BR/AML PROPERTY Reliance RD.
 NC HOLE NO. 1268-BRS-11-010-RL-CR BOX NO. 3
 INTERVAL 39.8 TO 55.0



010-RL-CR-1
3630 PSI sandstone



010-RL-CR-2
1770 PSI grout



011-RL-CR MIN MAX AVG
 ADJACENT HOLE GROUT
 STRENGTH (PSI) 1000 1590 1295

COMPANY *BR/AML* PROPERTY *Reliance RD*
 NC HOLE NO. *1768-BRS-1C-01-RL-CR* BOX NO. *2*
 INTERVAL *40.8* TO *50.0*

COMPANY *BR/AML* PROPERTY *Reliance RD*
 NC HOLE NO. *1768-BRS-K-01-RL-CR* BOX NO. *3*
 INTERVAL *50.0* TO *57.7*



Reliance West Main Grouting



Grout Pumping Near Homes