



BRIAN SANDOVAL
Governor

STATE OF NEVADA
COMMISSION ON MINERAL RESOURCES
DIVISION OF MINERALS
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RICHARD PERRY
Administrator

Las Vegas Office: 2030 E. Flamingo Rd. #220, Las Vegas, NV 89119
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COMMISSION ON MINERAL RESOURCES

Nevada Department of Agriculture
405 South 21st Street, Sparks NV 89431

Thursday, May 4, 2017

8:00 A.M.

AGENDA

CALL TO ORDER

The Agenda for this meeting of the Commission on Mineral Resources has been properly posted for this date and time in accordance with NRS requirement.

ROLL CALL

PLEDGE OF ALLEGIANCE

COMMENTS BY THE GENERAL PUBLIC

Pursuant to N.R.S. 241, this time is devoted to comments by the public, if any, and discussion of those comments. No action may be taken upon a matter raised under this item on the agenda until the matter itself has been specifically included on a successive agenda and identified as an item for possible action. All public comments will be limited to 5 minutes for each person. **ACTION WILL NOT BE TAKEN**

I. MINUTES

- A. Approval of the March 2, 2017 meeting minutes

FOR POSSIBLE ACTION

II. NEW BUSINESS

- A. Update on activities for the NDOM AML Program
Rob Ghiglieri
- B. NDOM OpenData Site-
Due to requests for GIS information, Staff has developed a web portal using ESRI's OpenData platform to allow the public to view and download this information. Lucia Patterson
- C. Review and analysis of LiDAR/InSAR/Remote Sensing techniques for possible use in NDOM Programs. Courtney Brailo
- D. Preliminary 2016 Nevada Mineral Production.
Mike Visher

FOR DISCUSSION ONLY

FOR DISCUSSION ONLY

FOR DISCUSSION ONLY

FOR DISCUSSION ONLY

III. OLD BUSINESS

- A. Oil, Gas and Geothermal Program annual update
Lowell Price

FOR DISCUSSION ONLY

- B. NDOM 2017-19 biennium budget update and current forecast
Rich Perry and Mike Visser

FOR DISCUSSION ONLY

- C. NBMG draft Scope of Work for FY 2018-2019.

FOR POSSIBLE ACTION

At the February meeting the CMR instructed the Division to prepare a draft agreement with a scope of work. The Division has prepared a draft scope of work with deliverables for each year to be presented for discussion, modification and possible approval. Every other year there is an opportunity for the Commission to fund studies or special reports, topics for which will be discussed for consideration. This agreement will require approval by the Board of Examiners. Rich Perry

IV. STAFF REPORTS

- 1) Mining/Reclamation Bond Pool – Mike Visser
- 2) Update on proposed Mineral Withdrawals and Lands Bills – Mike Visser
- 3) Legislative bill tracking including status of CMR bill AB 52 – Rich Perry

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COMMISSION BUSINESS

- A. Determination of time and place of next CMR meeting

ADJOURNMENT

NOTICE TO PERSONS WITH DISABILITIES

Members of the public who are disabled and require special accommodations or assistance at the meeting are requested to notify the Division of Minerals, 400 W. King Street, suite 106, Carson City, NV 89701 or contact Valerie Kneefel at (775) 684-7043 or Email Vkneefel@minerals.nv.gov

The Commission will tour the Tesla Gigafactory May 4th at 1:00 PM. A map and details will be handed out at the Commission meeting. We are limited to 20 people for the tour and must provide names a week in advance. Everyone must wear sturdy closed-toe shoes, (no ballet style flats or high heels) pants, and a shirt with sleeves (short sleeves ok). Tesla will provide eye protection. No photos or video is allowed in the factory.

Members of the public may attend but must provide their own transportation and safety equipment. Advanced notification is required. Please call Valerie Kneefel at (775) 684-7043.

I. MINUTES



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COMMISSION ON MINERAL RESOURCES

City of Henderson Council Chambers
240 S. Water St. Henderson, NV 89015

Thursday, March 2, 2017

1:00 P.M.

MINUTES

CALL TO ORDER

12:59 PM

ROLL CALL

Commissioners	Staff
Richard DeLong	Richard Perry
Dennis Bryan	Mike Visser
Fred Gibson	Robert Ghiglieri
Arthur Henderson	Garrett Wake
David Parker (by phone)	Bryan Stockton
John Snow	Valerie Kneefel
	Debbie Selig
**John Mudge is not in attendance	Public
	Jim Faulds
	Russ Fields
	Stephen Gibson
	Bill Durbin

PLEDGE OF ALLEGIANCE

Rich DeLong led the Pledge of Allegiance

COMMENTS BY THE GENERAL PUBLIC

No comments made by the public

I. MINUTES

- A. Approval of the November 1, 2016 meeting minutes

FOR POSSIBLE ACTION

Motion: Approved with minor editorial corrections by Rich DeLong

Made by: Dennis Bryan

Seconded by: John Snow

Unanimously Passes

II. NEW BUSINESS

A. Interstate Mining Compact Commission (IMCC)

FOR POSSIBLE ACTION

The NDEP and NDOM have discussed support to IMCC for services to the State including subscriptions to IMCC publications; IMCC special reports; IMCC memoranda and communiques; and work on the CERCLA 108b bonding issue. IMCC works on behalf of States on the Hard Rock-AML Good Samaritan legislation, mining-specific EPA issues, and MSHA metal non-metal mine rescue and training grants from OSM. NDOM recommends partnering with NDEP-BMRR for \$2,500 each (total \$5,000/yr) for services rendered for these activities that benefit the State and Mining Industry in Nevada. This is not a request to re-join IMCC as an associate member. This expenditure was budgeted in the current biennium budget.

Rich Perry explained about IMCC and the history of NDOM's involvement. Looking to do a cost sharing with NDEP instead of a full membership.

Richard DeLong: What is the full membership price?

Rich Perry: The maximum would be around \$50,000 per year.

Dave Parker: Is this a lobbying group? Can Bryan Stockton Comment?

Bryan Stockton: Rich had indicated this is more for publications and access to information. I don't think this would be lobbying. Unless our money is directly involved we don't have an obligation.

John Snow: As a NVMA member, I've been sensitized to the potential impacts of the CERCLA 108b rule and see that what IMCC does in informing its members is very important and I think we should support IMCC.

Richard DeLong: CERCLA 108b is a big issue and IMCC follows other issues in the State. It would be worth the commission investing in this.

Motion: to approve the \$5,000 per year (\$2,500 from NDOM and \$2,500 from NDEP) for services rendered

Made by: Dennis Bryan

Seconded by: Arthur Henderson

Unanimously Passes

B. UNR-MSM annual \$2 claim fee approval consideration

FOR POSSIBLE ACTION

Under the current 5-year agreement with the University, the Division collected \$394,086 in claim fees to support activities at the Mackay School. This was budgeted in the current biennium budget (\$351,293) under Special Projects. The Division has sufficient reserve to cover this item and recommends approval.

Mike Visser: The numbers are based on filings not on claims. On page 2 is showing the claim revenue by month. Over 20,000 claims may have filed early. FY-17 total filings 162,634 with total revenue of \$1,626,054.50

Richard DeLong: We should move forward with this. We should continue to make the payment.

Motion: Approve the sum amount that is available per Mike's presentation go specifically to Mackay.

Made by: John Snow

Seconded by: Dennis Bryan

Unanimously Passes

C. NBMG annual scope of work and funding

FOR POSSIBLE ACTION

The Division and Nevada Bureau of Mines and Geology (NBMG) have discussed developing a contract for specific deliverables by NBMG for the 2018 fiscal year, pending legislative approval of the NDOM budget. These deliverables are:

- 1) Completion of the Annual Mineral Industry Report by December 1 of the following year so it can be used at annual trade shows,
- 2) Completion of the annual exploration survey every other year in preparation for the legislative session (alternative study in odd years)
- 3) Scanning and updating of oil, gas and geothermal well logs onto an existing public-searchable database maintained by NBMG, and
- 4) Archiving of oil, gas and geothermal cuttings at the NBMG GBSSRL consistent with NAC 522.215

and NAC 534A.310. Staff is requesting approval to prepare a contract for \$85,000 per year for the two-year biennium 2018-19. This contract would require approval by the Board of Examiners. NBMG has prepared a budget quote for this work, which is included.

Rich Perry: This was put together during the budget. Does the commission want to give the Administrator the authority to move forward once it is passed? Another step in putting this in motion.

Art Henderson: The handout has different numbers than the packet.

Rich Perry: That is because \$10,000 is already budgeted for updating maps and printing the annual Major Mines report.

Jim Faulds: He went through the breakdown of costs between the information office, Cartography/GIS/ and 2 students.

Art Henderson: regarding the cuttings, how far behind are you?

Jim Faulds: This should get us caught up. Essentially, we are caught up now. We still do not have State funding for this part of our mission. This funding will help us get caught up and get current as well as produce the reports.

Richard DeLong: Is the amount we are talking about part of the biennium?

Rich Perry: we are contracting for both years. The amount is per year.

Jim Faulds: We will be digitizing the mining district reports in the alternate years.

Richard DeLong: would we revisit this every year? Or are you looking at 170,000 for the biennium?

Rich Perry: for today I'd like to have an approval to draft a contract for the next 2 years. We should put on the agenda this May meeting in Reno and discuss the topics.

Motion: 85,000 per year for the next 2 years and to proceed with developing a contract agreeable to both parties.

Made by: Dennis Bryan

Seconded by: Art Henderson

Unanimously Passes

D. Presentation of Intern Video and 2016 program review

FOR DISCUSSION ONLY

Garrett Wake: We have put together an intern video in order to help recruitment. In the future, we will be looking at more videos for instructional use such as "how to build a fence" etc.

Garrett showed the video to the commission and the audience.

Rob Ghiglieri: any questions? We did get bright orange NDOM shirts for the interns for the field.

Richard DeLong: well done and are you going to use this for recruiting?

Garrett Wake: yes, instead of explaining what we do, we can now show them.

Rob Ghiglieri: I think it was the best summer intern program so far. We wound up breaking a few records with just a phenomenal group of kids with no incidents.

Richard DeLong: does incidents include flat tires?

Rob Ghiglieri: no, but we did upgrade the tires this past year.

Rob Ghiglieri: He showed a map of the securing's. This will be the 3rd year in a row with no AML incidents.

E. NBMG Exploration Survey and update and approval of payment

FOR POSSIBLE ACTION

The Bureau recently completed an exploration survey in time for the 2017 legislative session. Director Faulds will present the survey and updates on other Bureau activities. The Division budgeted \$34,000 in the last biennium budget under an existing contract for services from the Bureau for curation of OGG materials and special reports. The Division has the reserves to pay in this fiscal year and recommends approval of the expenditure.

Jim Faulds: was able to secure funding of \$150,000 which will help with LiDAR acquisition for the Carson, Reno, Washoe general area.

See PowerPoint presentation from Mr. Faulds. He went through the online site and a count of all the "hits" on the website. He presented a breakdown of exactly what part of the site people were interested in and where they were

from. He also showed a survey report that Mike Ressel assisted with; the Nevada Mineral and Energy Resource Exploration Survey for years 2015 and 2016. The survey includes exploration expenditures by commodity class and by exploration type, the impact of global metals, direct exploration employment, and Nevada exploration impact factors. Went through the Mineral Industry Report for 2015 spearheaded by John Muntean. Nevada is 4th in the world for gold production and leads the United States with 83%. Nevada led the nation in barite and lithium production.

Art Henderson: We are the only state producing lithium. Are there other states with reserves?

Jim Faulds: Utah probably has reserves of lithium brines. But, Nevada is the only one producing.

Art Henderson: can you read the lithium exploration, baseline value?

Dennis Bryan: A point of clarification, there are no other lithium reserves, but there are other resources.

Rich Perry: That would be located on page 11 in the exploration survey.

Dennis Bryan: The lithium price is somewhat misleading. Above \$20,000 per ton. That's a spot price per China. There is no commodity index for lithium out there. \$10 to 12,000 per ton is more accurate. But still higher than it was and will probably still go up. On your survey, you have Lithium under metals and not under industrial mineral?

Jim Faulds: It really should be under industrial mineral.

Richard DeLong: Can you tell us what State leads in production of diatomaceous earth?

Jim Faulds: California

Jim Faulds: He went through a few Geothermal Energy slides.

Dennis Bryan: Navy wants to withdraw 600,000 acres of public lands from mineral entry and geothermal development. Do you have any influence with the Navy?

Jim Faulds: This is a delicate subject. Our interactions are at lower levels.

Richard DeLong: I support the collaboration with NBMG to put together something like we did on the Sagebrush Focal Area mineral withdrawal analysis.

Motion: approval of \$34,000 for exploration survey.

Made by: Dennis Bryan

Seconded by: Dave Parker

Unanimously Passes

III. OLD BUSINESS

A. Dissolved Mineral Resource bill update

FOR DISCUSSION ONLY

Division staff drafted language for a bill to include the regulation of dissolved mineral resources in the geothermal resources chapter, NAC 534A. The BDR pre-filed as Assembly bill 52. The Division began meeting with stakeholders regarding their concerns and drafted a proposed amendment to the original bill.

Rich Perry: Summary of BDR pre-filed as AB52. He said he started meeting with industry people about the pre-filed bill. After, we found there were a few things we needed to change. We then drafted an amendment outside the geothermal chapter. There is more clarification that needs to be done. It was not submitted to the commission today because it is not public yet. Rich showed a map to the commission that indicates active geothermal sites. If we don't get this bill through, then the BLM will and I don't think anyone will be happy about that.

John Snow: Planning ahead, if the division is cast with joint rules are we preparing for that work load?

Rich Perry: yes. That workload will not be as extensive as hydraulic fracturing. The NAC would just be a few pages.

Richard DeLong: Wyoming and Texas would be good resources to start.

STAFF REPORTS

1) Mining/Reclamation Bond Pool – Mike Visser

Mike Visser: activity has increased. New bonds have increased. Bond pool is healthy 126% funded.

2) Update on Arden Mine AML Closure efforts - Garrett Wake

Garrett Wake: Currently has SNPLMA funding for trailhead but not trail in front of openings or their closure. We are still working with the County on trying to close these in a timely manner.

3) Update on proposed Mineral Withdrawals and Lands Bills – Mike Visher

Mike Visher: this has recently passed through Pershing County Commission. Heller and Amodei are trying to push this through again. NMEC is taking the lead on educating stakeholders and congressional staff on this. 19% of the mining districts are being impacted by current withdrawals and another 8% by proposed withdrawals. Pershing County lands bill will be the template for Washoe Co.

Dennis Bryan: where is the data coming from on the mining districts impacted by withdrawals?

Mike Visher: NBMG

Jim Faulds: Some of the boundaries may need to be revised but the data should be complete.

Mike Visher: Provided update on the Fallon Range and Training Complex Modernization EIS process. The draft EIS will be out next year. It will be a congressional decision.

4) Legislative bill tracking – Rich Perry

Rich Perry: AB-159 a couple of commissioners were at LCB to testify against the bill. Faulds filed a letter yesterday as the State Geologist. There is not a work session date set yet. AB-169 has to do with recording fees. This would mean that mining fees would go from \$10 to \$36 for new filings.

COMMENTS BY THE GENERAL PUBLIC

No public came forward for comment.

COMMISSION BUSINESS

A. Determination of time and place of next CMR meeting.

Reno or Carson City- May 4th meeting and tour.

Art Henderson suggested that we try the Tesla plant for a tour this time.

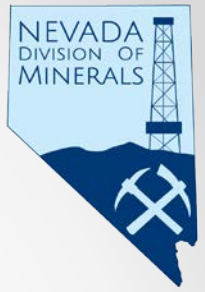
Russ Fields: May 5th is the Mackay awards banquet.

ADJOURNMENT

3:20 PM

II. NEW BUSINESS

II. A. Update on activities for the NDOM AML Program



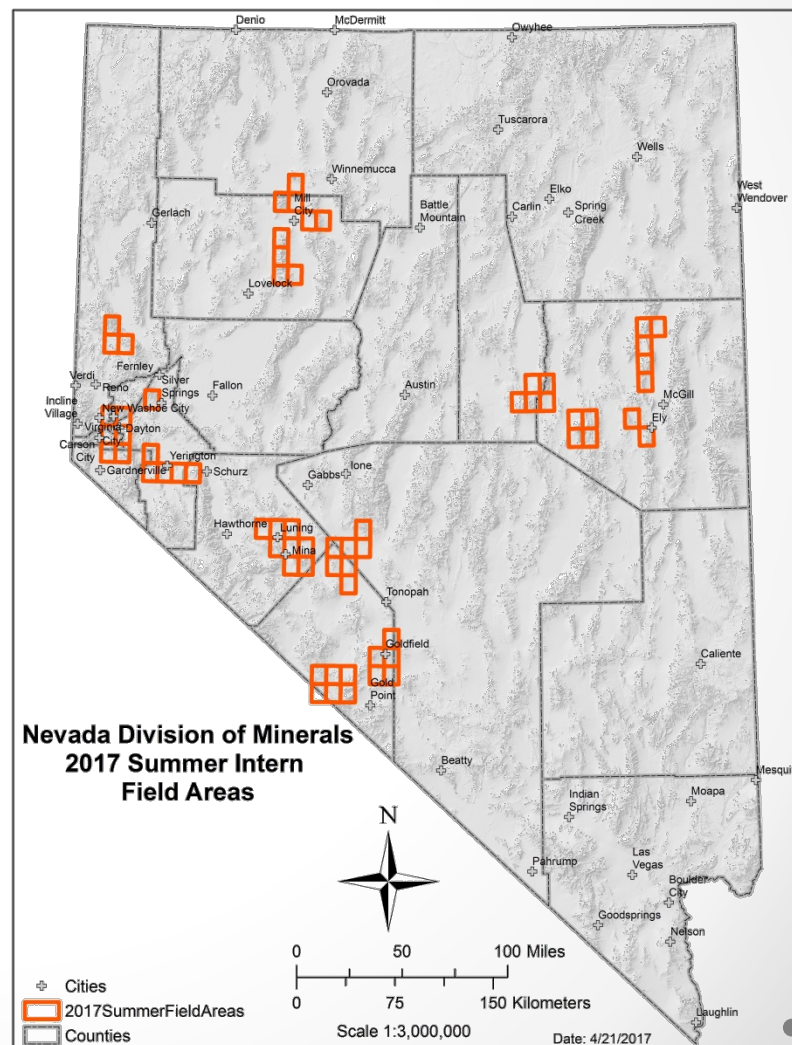
Commission on Mineral Resources 2017 AML Program Update

Rob Ghiglieri

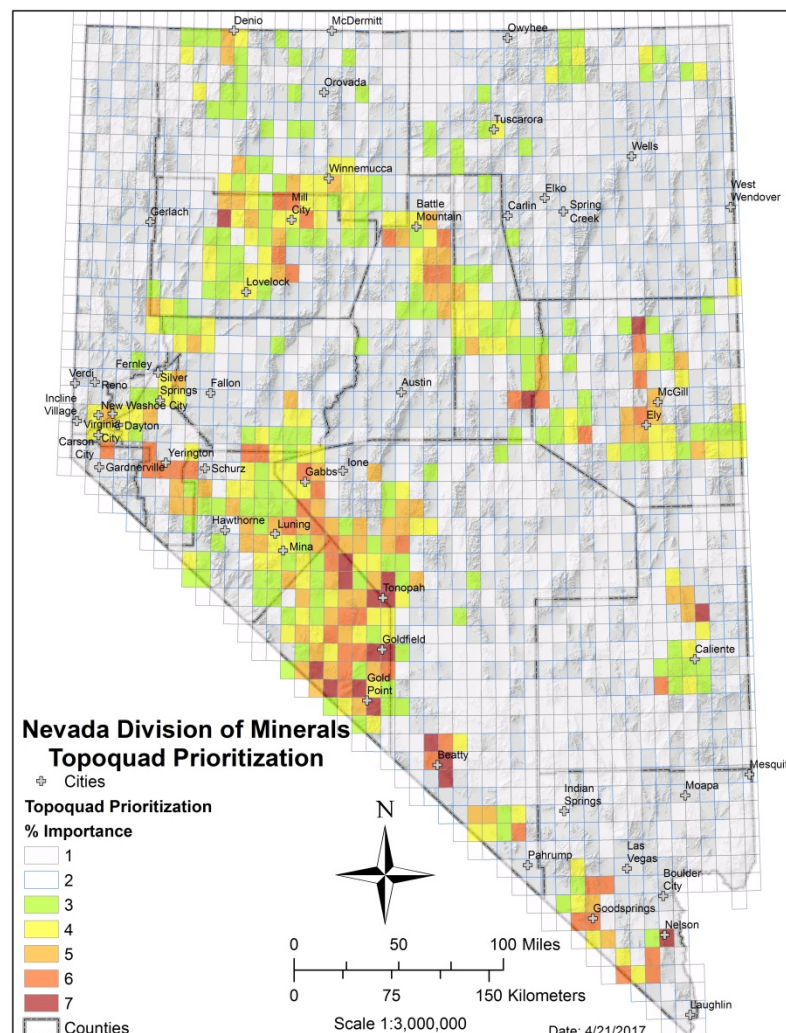
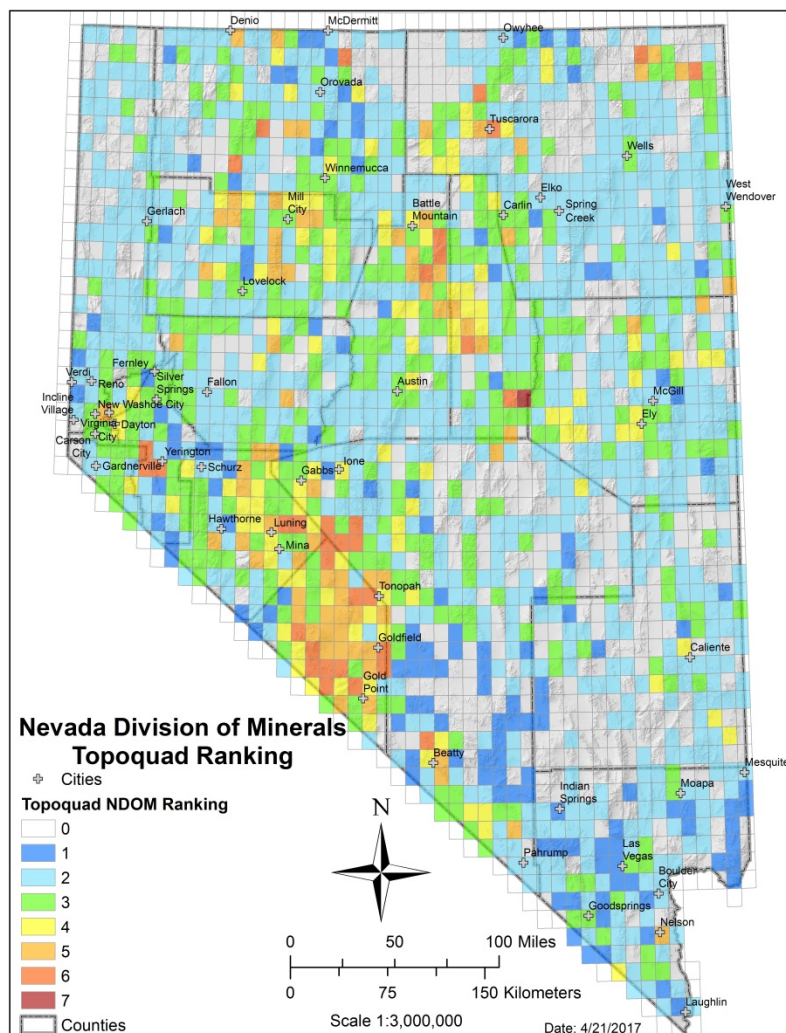
May 3, 2017

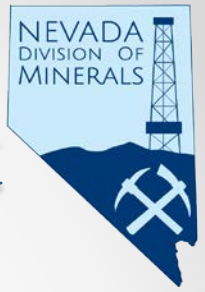
2017 Summer Interns

- 8 Interns
 - All 8 from Mackay
 - 2 girls 6 guys
 - 13 weeks total
 - First full digital field season
 - All 4 NDOM AML staff will spend time in the field with the interns



2017 Topo Quad Ranking





Expected 2017 Contractor Work

- Hard Closure Projects
 - North Tonopah Closure Project
 - 67 hard closures on BLM land surrounding Tonopah
 - Tungsten Mountain Closure Project
 - Some BCC's completed in April by NDOW, the 11 remaining sites to be completed in fall
 - Carnation Mine, Nelson area (14 sites total)
 - Monte Cristo stope collapse, (ST-0198)
 - Possible fall (BLM approval)
 - Ely area round 1 (56 total hazards), funded by NDOM, NDOW, and BLM
 - Nevada Eagle (43 hazards)
 - Sand Mountain (58 hazards)
 - Broken Hills (39 hazards)
- Inventory and Fencings projects
 - Gold Point, 64 fencings in the area after 2016 summer intern loggings
 - Shoshone, Inventory and Fencing
 - White Pine, Fencing
 - Red Butte, Inventory and Fencing

Water Born AML Hazards



Tonopah Historic Mining Park



- Build a demonstration BCC at the mining park with a Kiosk for public information
- BLM donating steel for the grate
- EPS donating time to build the gate
- NDOM funding the Kiosk
- Done during the same time as the North Tonopah project to save on mobilization costs

You are standing at the entrance to an important piece of Nevada History and a bat-friendly habitat!

Abandoned Mine Lands (AML) of Nevada

In front of you sits an abandoned mine! Nevada has a rich history of mining within its borders. In 1849 gold was found in Dayton, NV, not far from Carson City, which remains the state capital to this day. This began a rush of gold mining throughout the state. The early mines were not regulated as mines of today are in terms of environmental protection, safety and reclamation. Many of these mines were simply abandoned when they proved to be no longer advantageous to mineral prospecting. These mines vary in size from small surface disturbances to miles of precariously interwoven adits (horizontal openings) and shafts. Since the time of their inception these mines have fallen into a dangerous state of disrepair.

Today state legislation requires owners of land or minerals claims to barricade or fence these features that pose immediate threat to safety. State and federal offices also spend a great deal of time and effort securing known hazardous features within the state. The Nevada Division of Minerals works closely with the BLM and the Division of Wildlife to secure hazards, often by the construction of permanent structures, while at the same time protecting the habitat of the varied wildlife. Besides the 25+ species of bats there are also owls, birds and the endangered desert tortoise that call these features home.


Bats and Mines

Bats are nocturnal animals that hibernate during the winter. Finding adequate shelter for nesting is not an easy task for this small flying mammal. Bats are globally threatened due to human population growth and are also affected by disease. The high desert of Nevada is particularly prone to extreme weather and temperature swings that occur both seasonally and on a daily basis. During the summer months bats need shelter from extreme heat. In winter, when food (insect) supplies are low, bats need a long-term shelter in which to remain safe from snow, wind and predators.

It's no wonder that Bats find abandoned mines so appealing! Bats roost in abandoned mines year round. Abandoned mines, however, pose their own environmental and safety concerns for humans and other wildlife. In order to protect established bat colonies the Nevada Department of Wildlife and the Nevada Division of Minerals (AML Program) work together to develop a safe and environmentally friendly solution by installing bat-friendly closures for abandoned mines that have confirmed colonies residing inside. The closure you see here was constructed to protect bat habitats while keeping visitors safe!

Bat-Friendly Permanent AML Closures

Securings must fully cover opening of a shaft or adit while maintaining proper air-flow and space for bats enter and exit freely.



Gates – for adit entrances Gates – for shaft collars

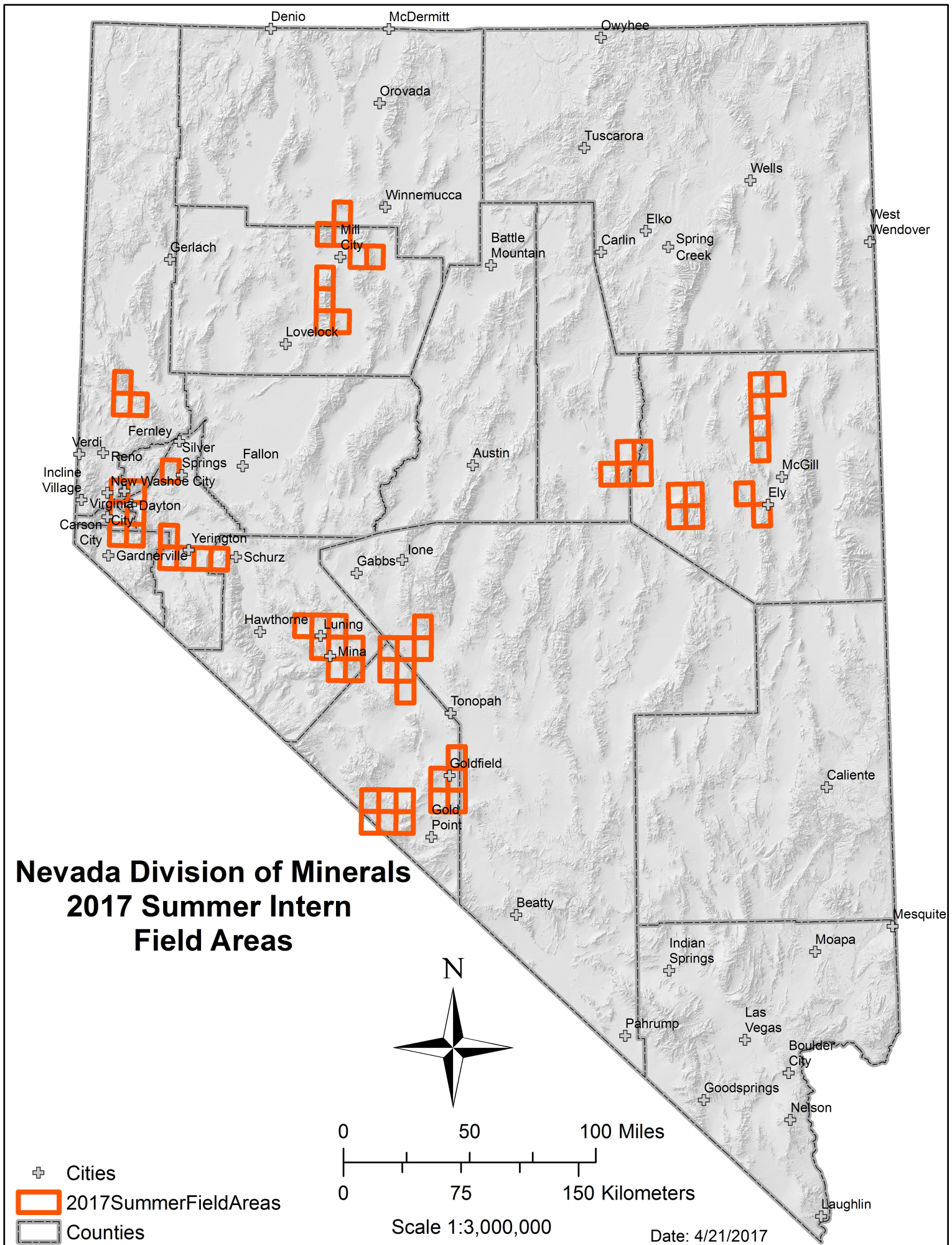
Cupolas – for large shaft collars

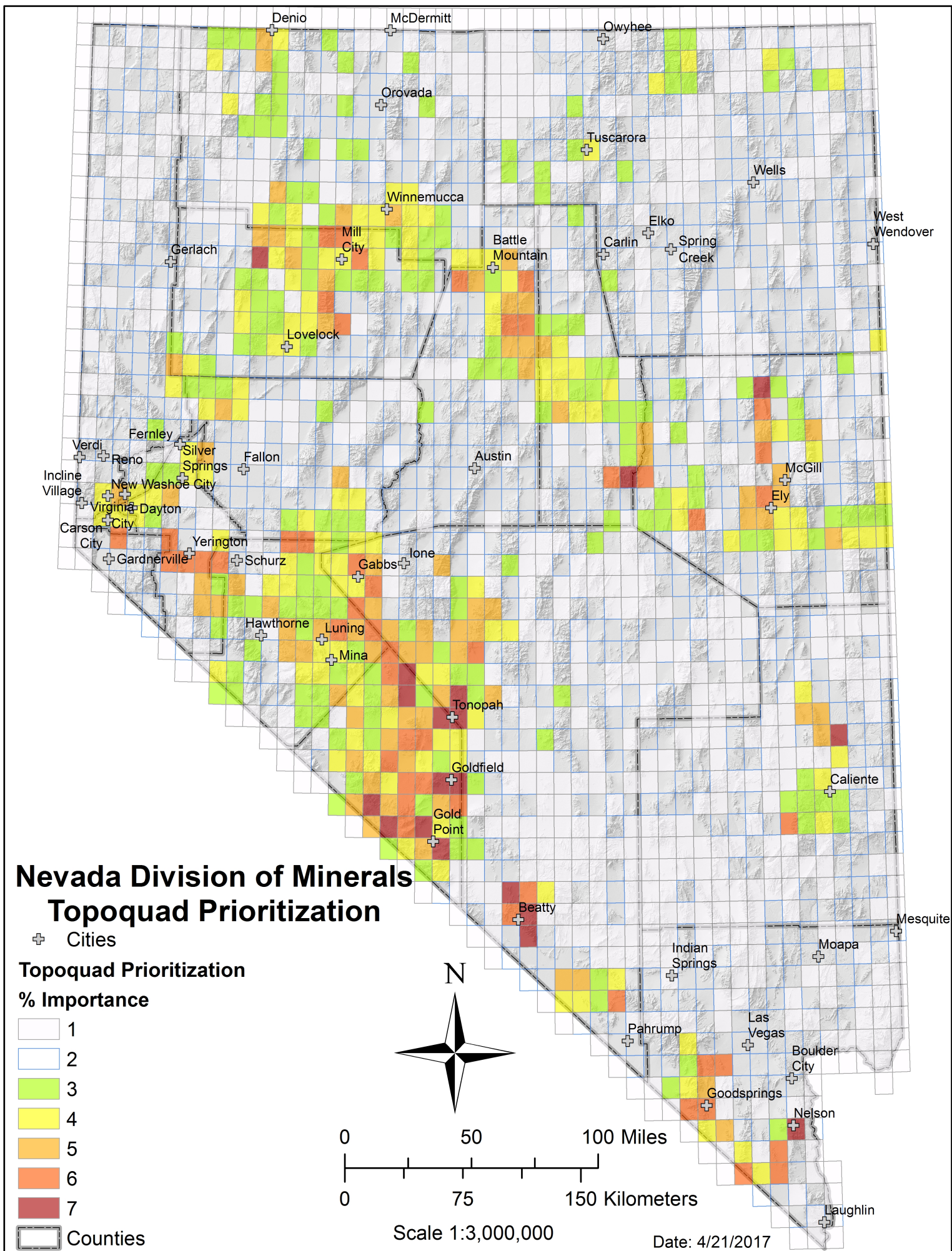
Mesh Netting – for large, unusual sized and/or unstable entrances Culverts – installed where sub-structure is unstable

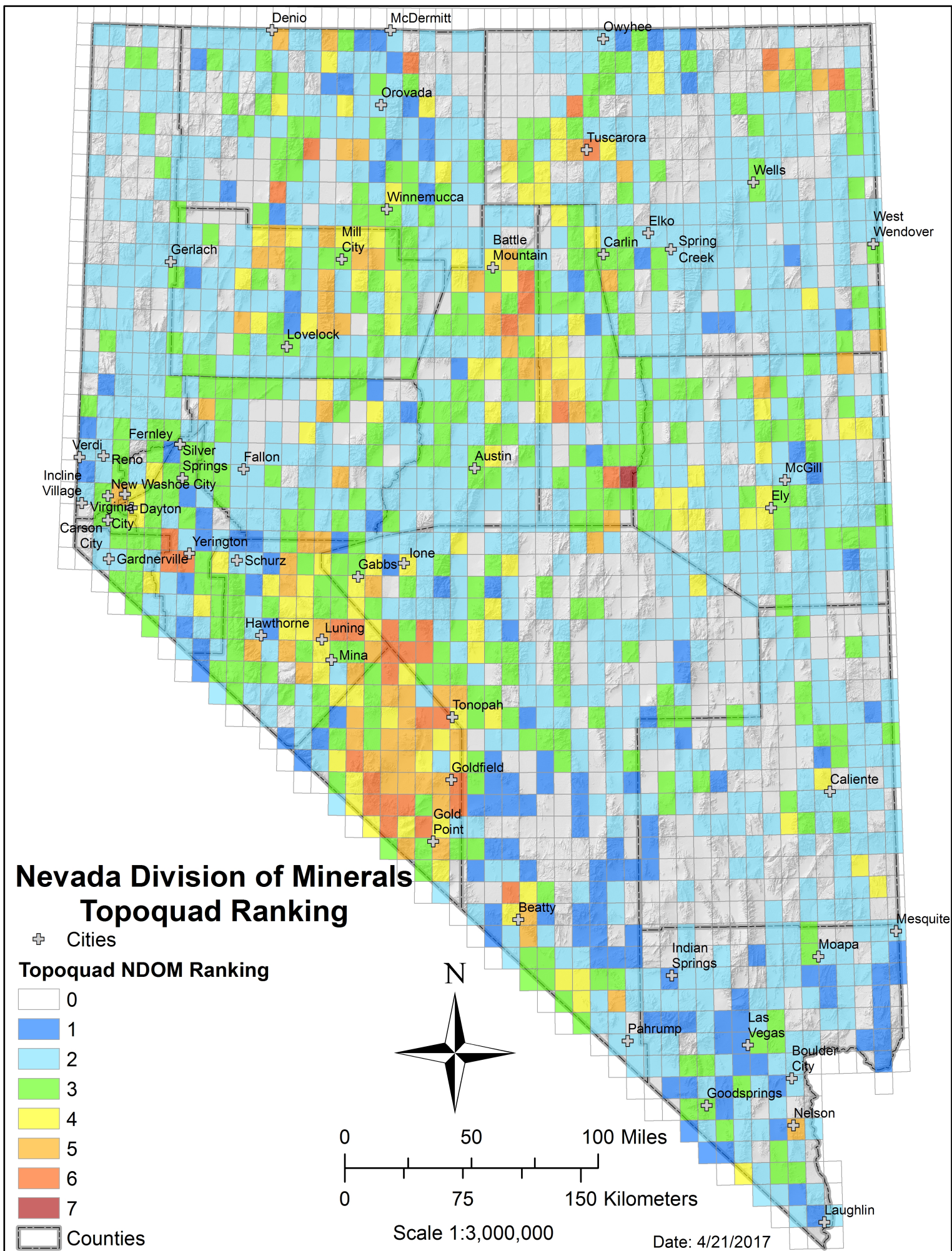
Additional AML Projects

- LIDAR
- Non-Hazard evaluations
- Arden Mine
- VC Grand Prix race route
- New AML hazard estimates
- SNPLMA Funding Opportunities
- New AML
NDOM/BLM/USFS
brochure









II. B NDOM OpenData Site

ArcGIS Open Data

What is ArcGIS Open Data?

Open Data allows organizations to use the ArcGIS platform to provide the public with open access to their authoritative data. Organizations configure a website with their own look and feel and specify Open Data groups to share specific items. The general public can use Open Data sites to search by topic or location, download data in multiple formats, and view data on an interactive map and in a table.



For Consumers

Interact with data through charts, tables, and maps to help you learn about your community. Discover, explore, and download data, or share a link to an interesting dataset.

[Show me how](#)

For Providers

Set up a customized website and select the authoritative data you want to share. Allow anyone to search, view, and download your data in multiple formats.

[Show me how](#)

Features

Create and share your own data using the workflows you already know to create an Open Data site.

- Enable Open Data on your organization and groups.
- Create customized sites for your data.
- Allow federated searching across organizations and groups.
- Provide support for spatial and non-spatial tables.
- Provide interactive filters to explore data.
- Share links to filtered views of datasets.

Data requirements

ArcGIS Open Data currently works with data from hosted feature layers, ArcGIS Server feature services, ArcGIS Server map services, ArcGIS Server image services, CSV files, hosted tables. ArcGIS Open Data offers limited support for external URLs, web maps, and other documents (such as Word documents and PDFs).

What's new

Open Data was updated in July 2015 with the following features and functionality:

- Gridded density visualizations for large datasets (GeoHash).
- Support for formal metadata from ArcGIS Online.
- Sign in with and sign up for ArcGIS Online accounts.
- User and administrator commenting on datasets.

Sneak peek

ArcGIS Open Data has just been released, and we're planning some exciting things in the road ahead:

- Statistical information on your data to track download counts and details on views.
- Greater administrative control over datasets and harvesting.
- Improved user experience for searching and filtering datasets.

Share your [ideas](#) for where ArcGIS Open Data will go!



Nevada Division of Minerals

Open Data Site

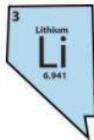
Mission: To encourage and assist in the responsible exploration for, and the production of, minerals, oil, gas, and geothermal energy which are economically beneficial to the state. This is the Nevada Division of Minerals' public platform for exploring and downloading our open data.

Disclaimer

The Nevada Division of Minerals (NDOM hereafter) assumes no responsibility for errors or omissions. No warranty is made by NDOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data; nor shall the act of distribution to contractors, partners, or beyond, constitute any such warranty for individual or aggregate data use with other data. In no event shall NDOM have any liability whatsoever for payment of any consequential, incidental, indirect, special, or tort damages of any kind, including, but not limited to, any loss of profits arising out of the use or reliance on this data.

Pages

Visit one of our pages to view interactive maps and download data.



Inferred Active Lithium Placer
Claims in Nevada



Active mining claims in Nevada



Nevada Public Lands Issues
Page Under Construction



[Visit our main Website](#)



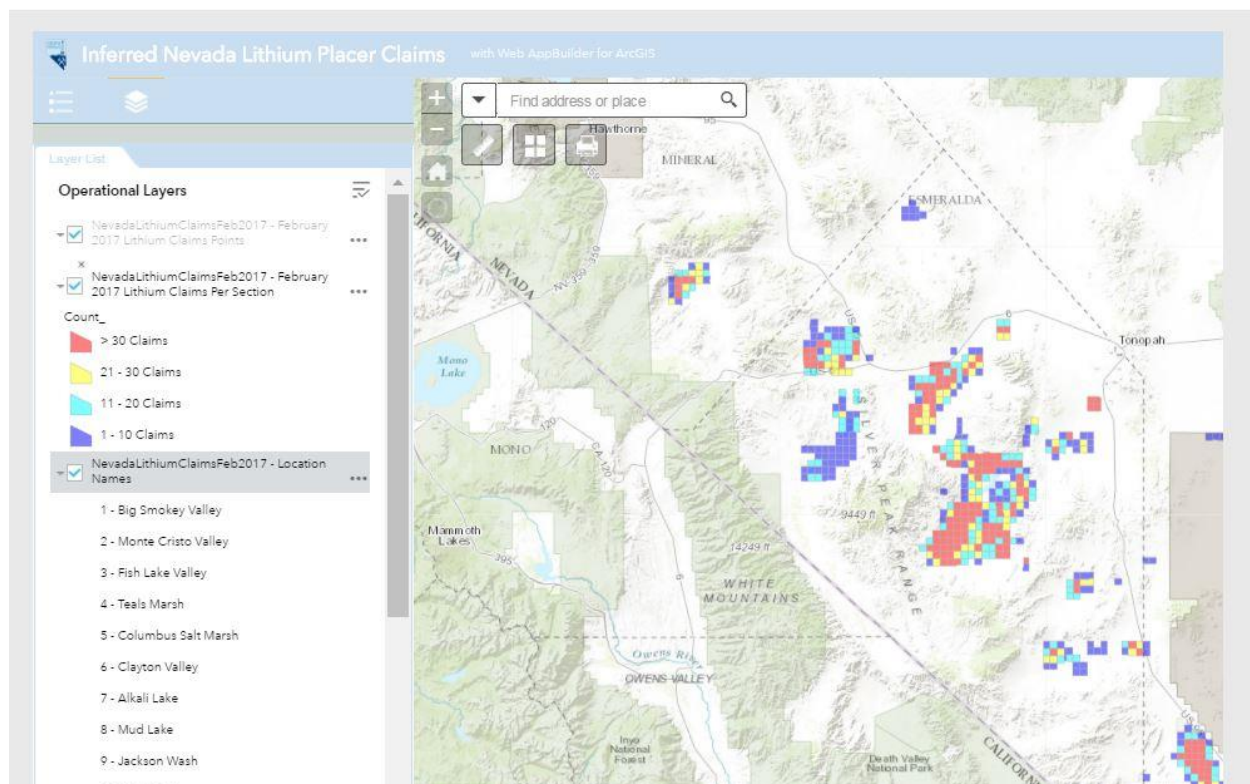
Lithium Exploration in Nevada:

Lithium exploration in Nevada has drastically increased in the past couple years. Nevada is home to the only operating lithium mine in the United States which is located in Clayton Valley, Esmeralda County. The mine has been in operation since 1967, employs 85 people, and produces lithium carbonate from evaporation ponds which concentrate the lithium.

The following summary statement on lithium brine deposits was taken from USGS Open-File Report 2013-1006:

Lithium brine deposits are accumulations of saline groundwater that are enriched (200-1,400 mg/l) in dissolved lithium. All producing lithium brine deposits share a number of first-order characteristics: (1) arid climate; (2) closed basin containing a playa or salar; (3) tectonically driving subsidence; (4) associated igneous or geothermal activity; (5) suitable lithium source-rocks; (6) one or more adequate aquifers. Economic brines have lithium concentrations in the range of 200 to 400 milligrams per liter."

As of February, 2017 more than 13,258 placer claims have been located in Nevada, presumably for lithium brine in 18 different hydrographic basins. Typical exploration is completed by drilling and sampling both sediment and brines using "dual wall reverse rotary" or "push-drill" techniques. The rock sample and the solution are assayed for lithium content. Some lithium exploration holes are 3,000 - 4,000 feet deep.



II. C Review and analysis of
LiDAR/InSAR/Remote Sensing techniques
for possible use in NDOM Programs.

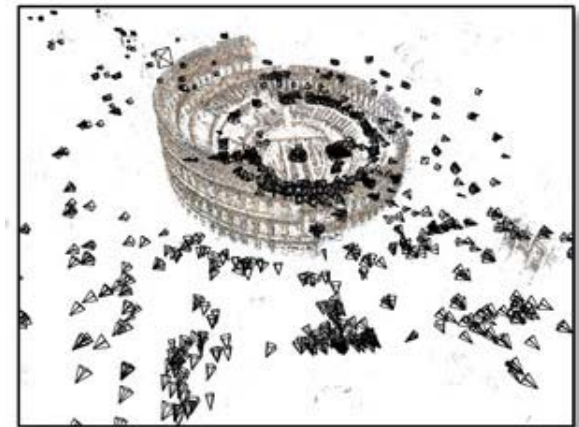
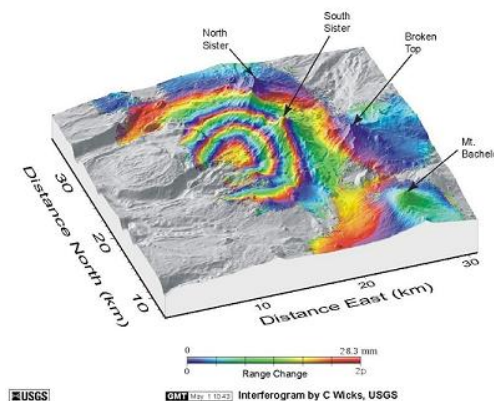
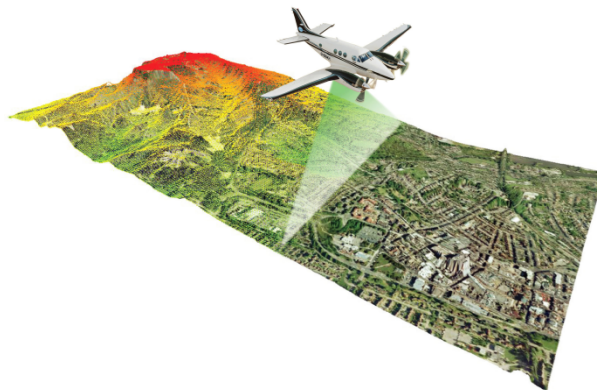
LiDAR, InSAR and SfM



Courtney Brailo - NDOM – March 2017

Geodetic Tools

- LiDAR – 3D Laser Scanner
- InSAR – Radar Scan Differencing
- SfM – Photo Compiler
- GPS – Spatial locator – high resolution / regional deformation (*trilateration + time delay*)

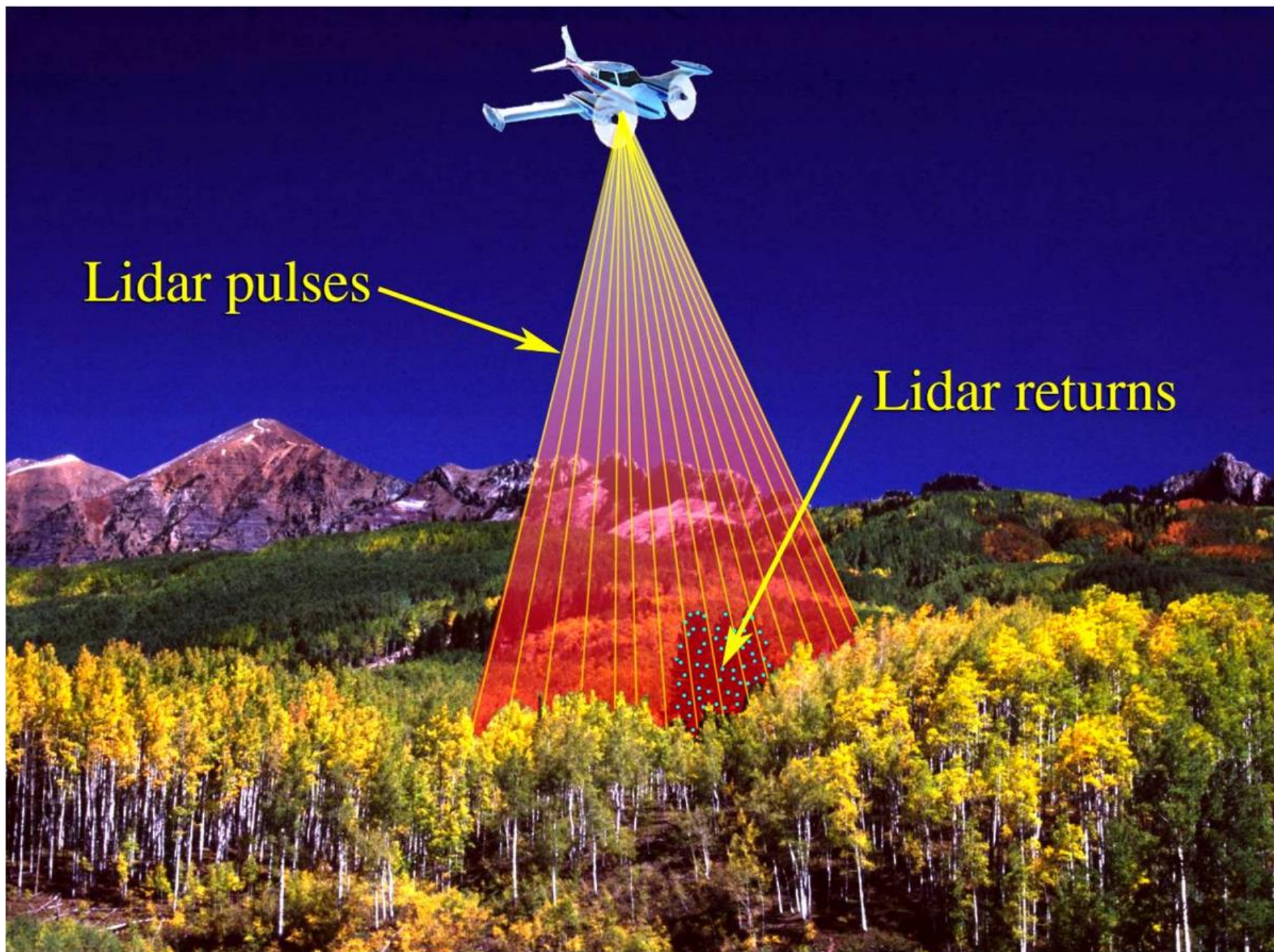


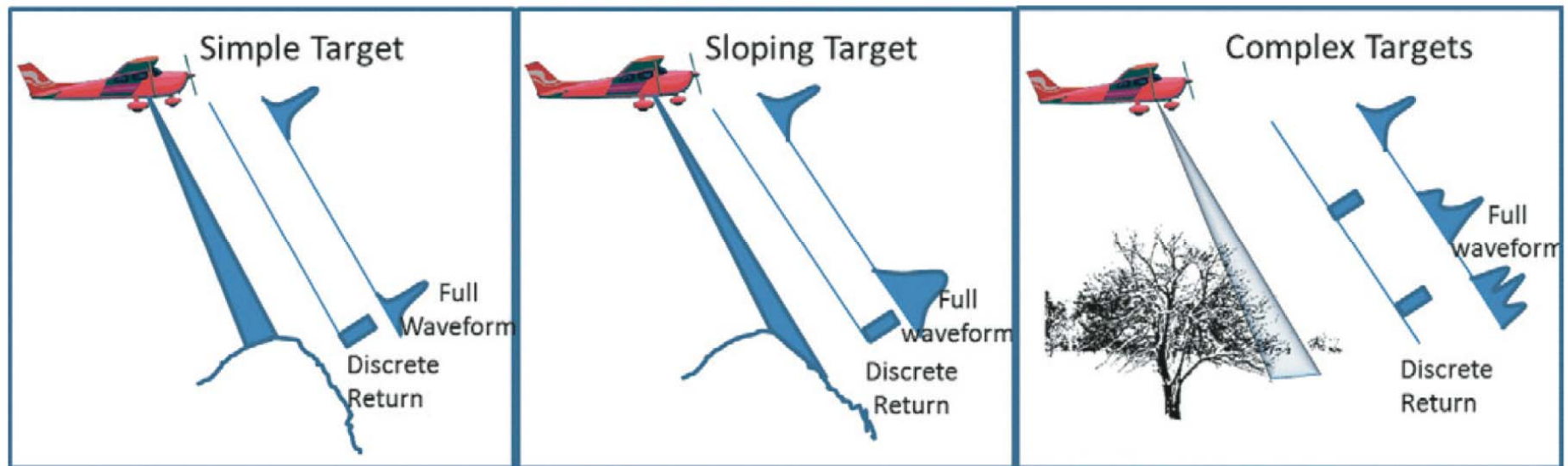
Presentation Format

- Introduction
 - Theory and Methods
- Practical Applications
- Limitations
- Cost of each – Time and Money
 - Training
 - Equipment
- Summary

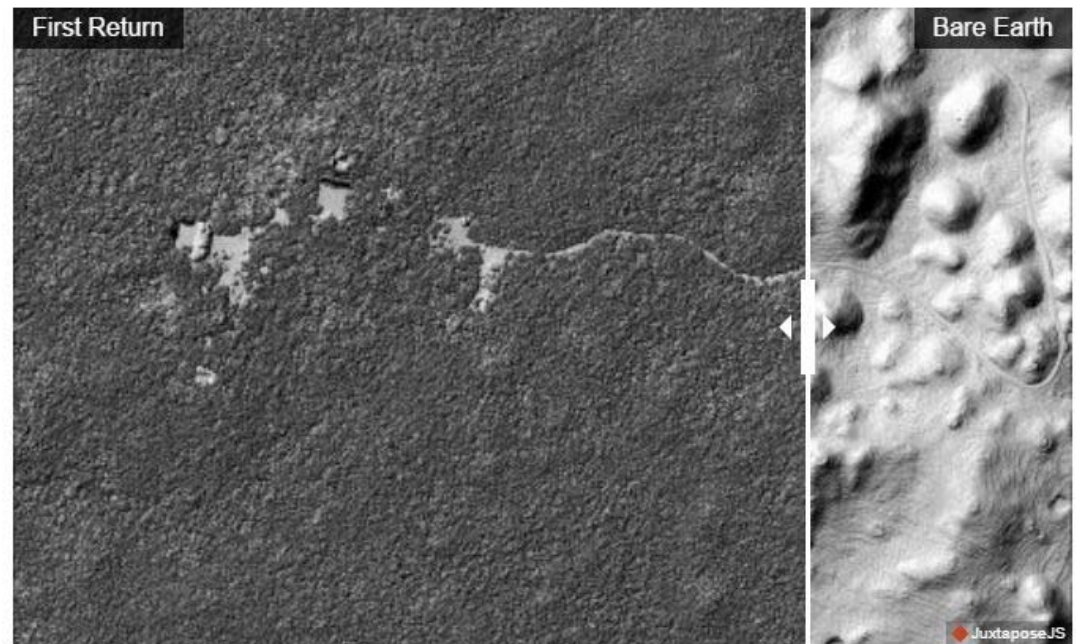
What is LiDAR?

- LiDAR – Light Detecting And Ranging imagery/ data
 - Laser array that produces high quality and resolution of area
 - Time travel of discrete laser beams – sent in pulses
 - *Bare earth returns assume last/latest return has made it through leaves, shrubs etc...*
 - Limitations in
 - Wet Areas
 - Vertical accuracy > horizontal accuracy (Opposite of GPS)
 - LiDAR data is a point cloud, XYZ point
 - Interpolation of these points to create a DEM





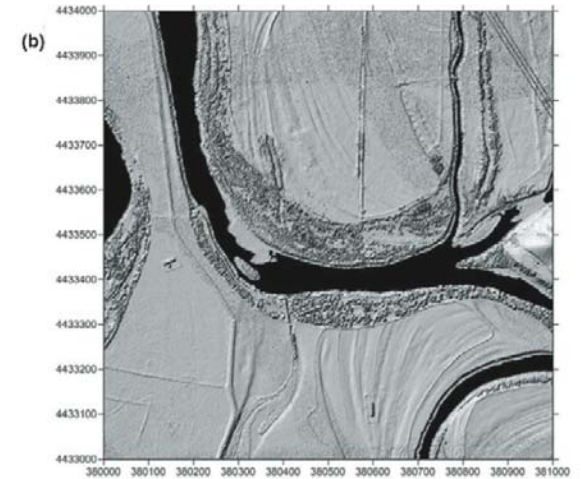
- Returning waveform from emitted laser shows how many surfaces pulse interacted with
- Can analyze these data to remove vegetation and create detailed maps



Traditional Resolution



Benefits of LiDAR

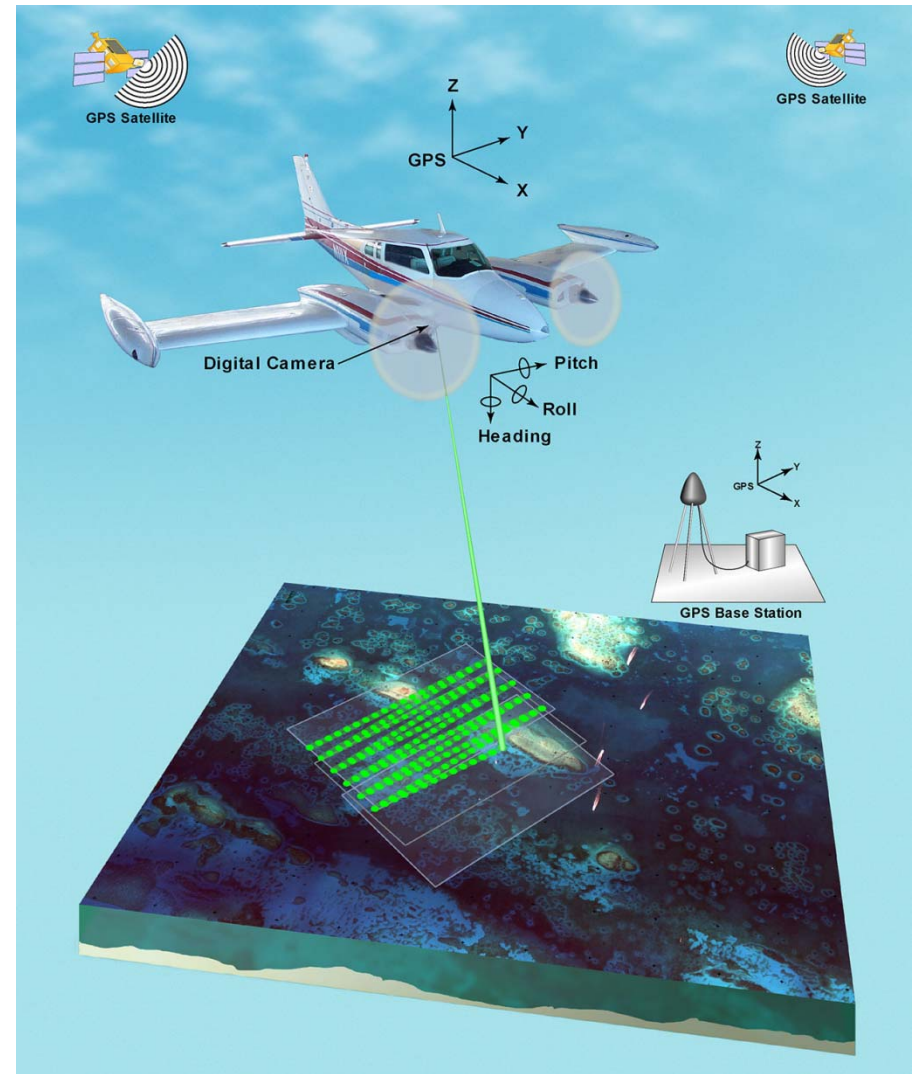
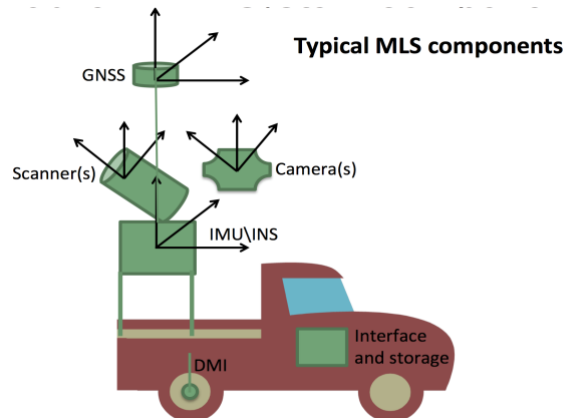


Glennie et al., 2013

- Ability to scan large areas
 - 100s km²/day
 - Rapid collection of 3D data
- High resolution of data
- Has immediate value for multi-disciplinary analysis and mapping
 - Also has future value for ongoing studies of change – differential LiDAR – but expense becomes an issue...
- **Abandoned Mine Lands (AML) applications**
 - Identification and logging of features

LiDAR Acquisition

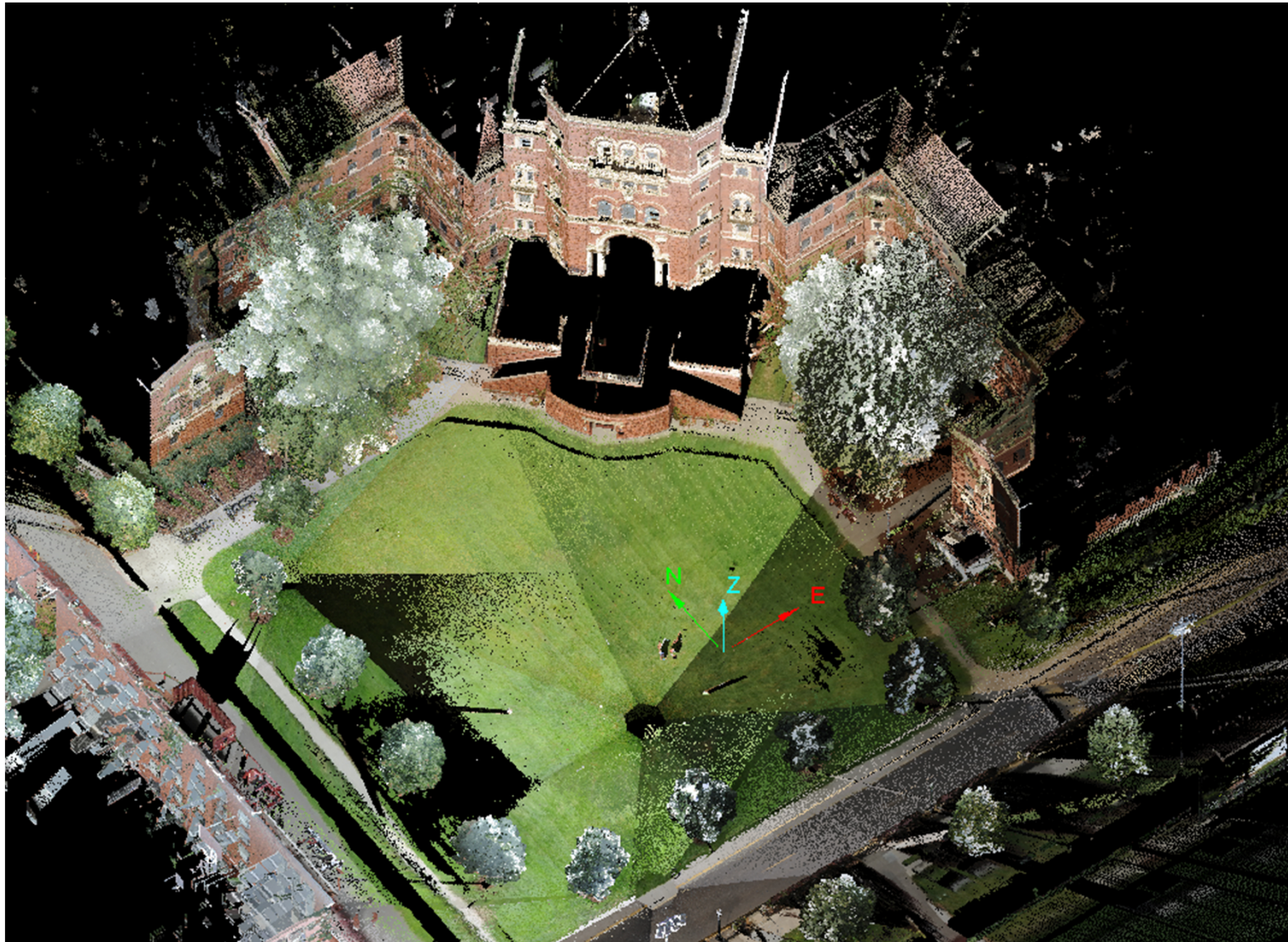
- Satellite LiDAR
- Aerial LiDAR
- Terrestrial LiDAR
 - Stationary Unit
 - Mobile Unit
- Green/red lasers
 - (water penetrating)



Terrestrial LiDAR Example



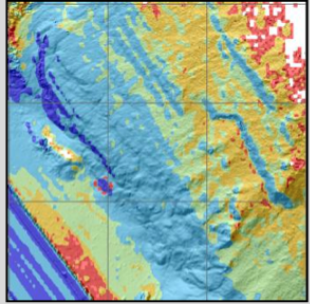
Terrestrial LiDAR Example



Terrestrial LiDAR Example

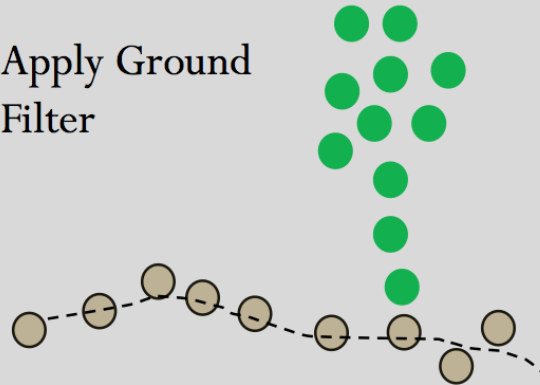


Point Density Map

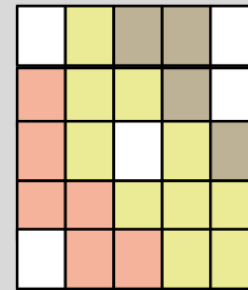


DEM Processing

Apply Ground Filter

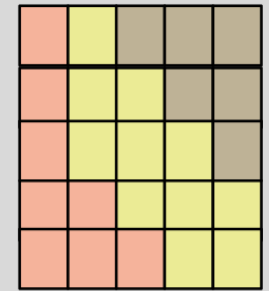


Create Initial DEM

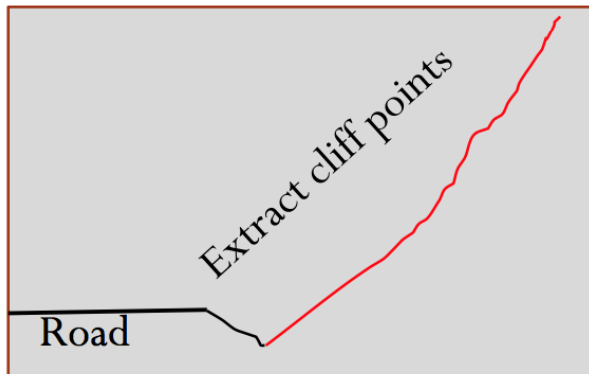


Fill Small Holes

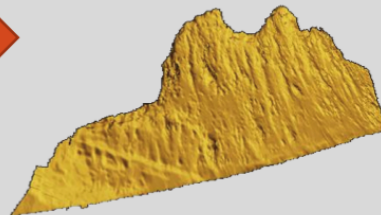
Final DEM



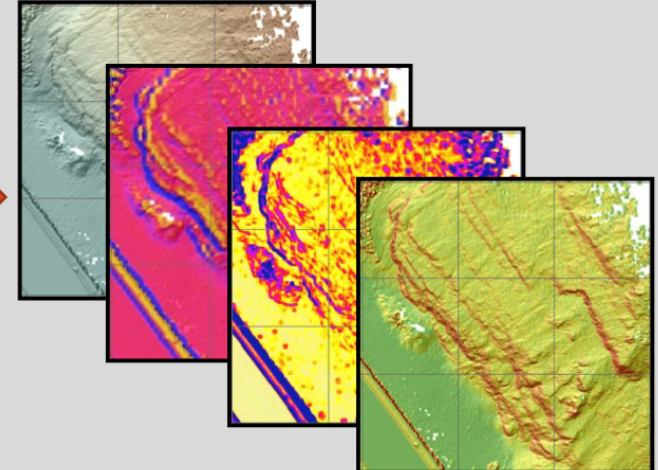
Cleaned Point Cloud



3D Triangulated surface model

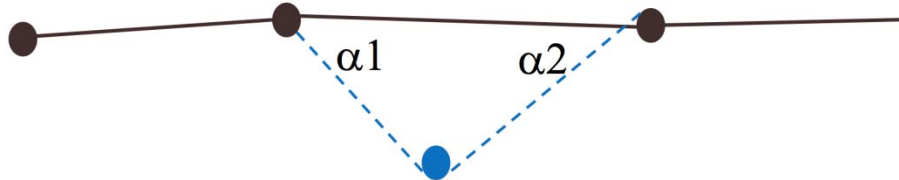


Derivative Products (Figure 3-X)



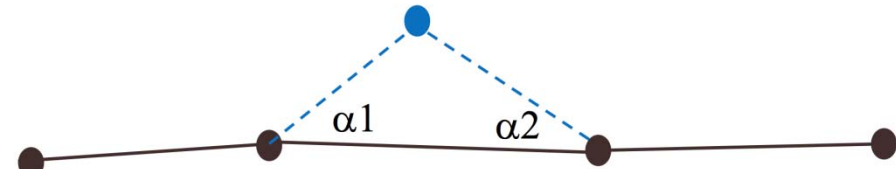
Common Approaches -1

- Bock Minimum
- Divide into grid cells and take minimum
- Error prone – sensitive to outliers
- Cannot remove system noise
- Neighbor comparison



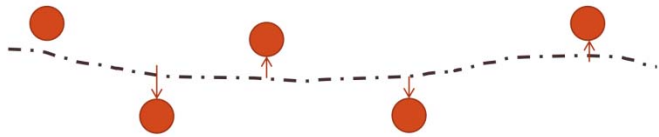
Common Approaches -3

- Adaptive Addition (Progressive Densification)
- Coarse mesh
- Add points if they meet angular criteria
- Iteratively Refine until minimal points are added



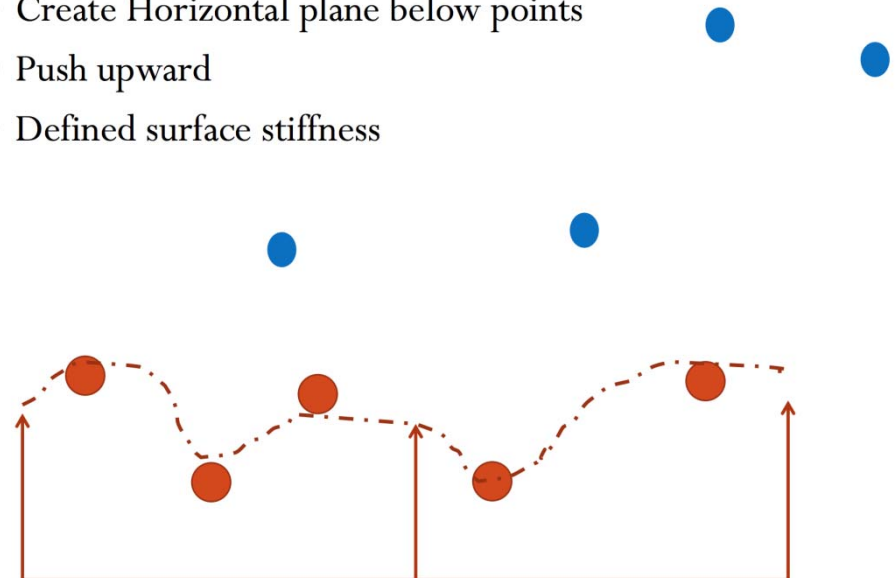
Common Approaches -4

- Surface based filtering
- A. Add all points w/ equal weights
- B. Calculate filter values (signed distance point to surface)
- C. Compute new weight based on filter value
- Iterate B&C

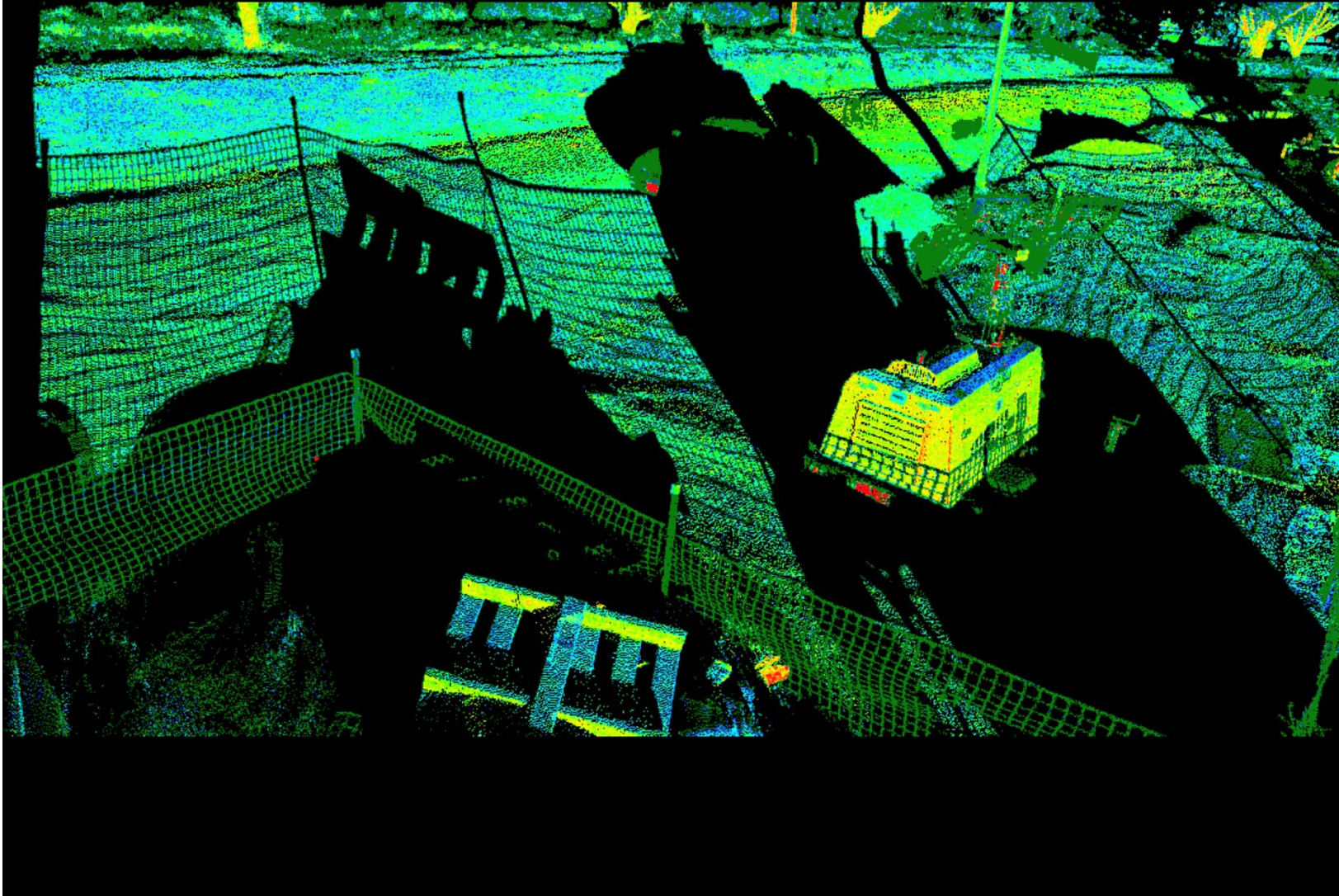


Common Approaches -5

- Create Horizontal plane below points
- Push upward
- Defined surface stiffness

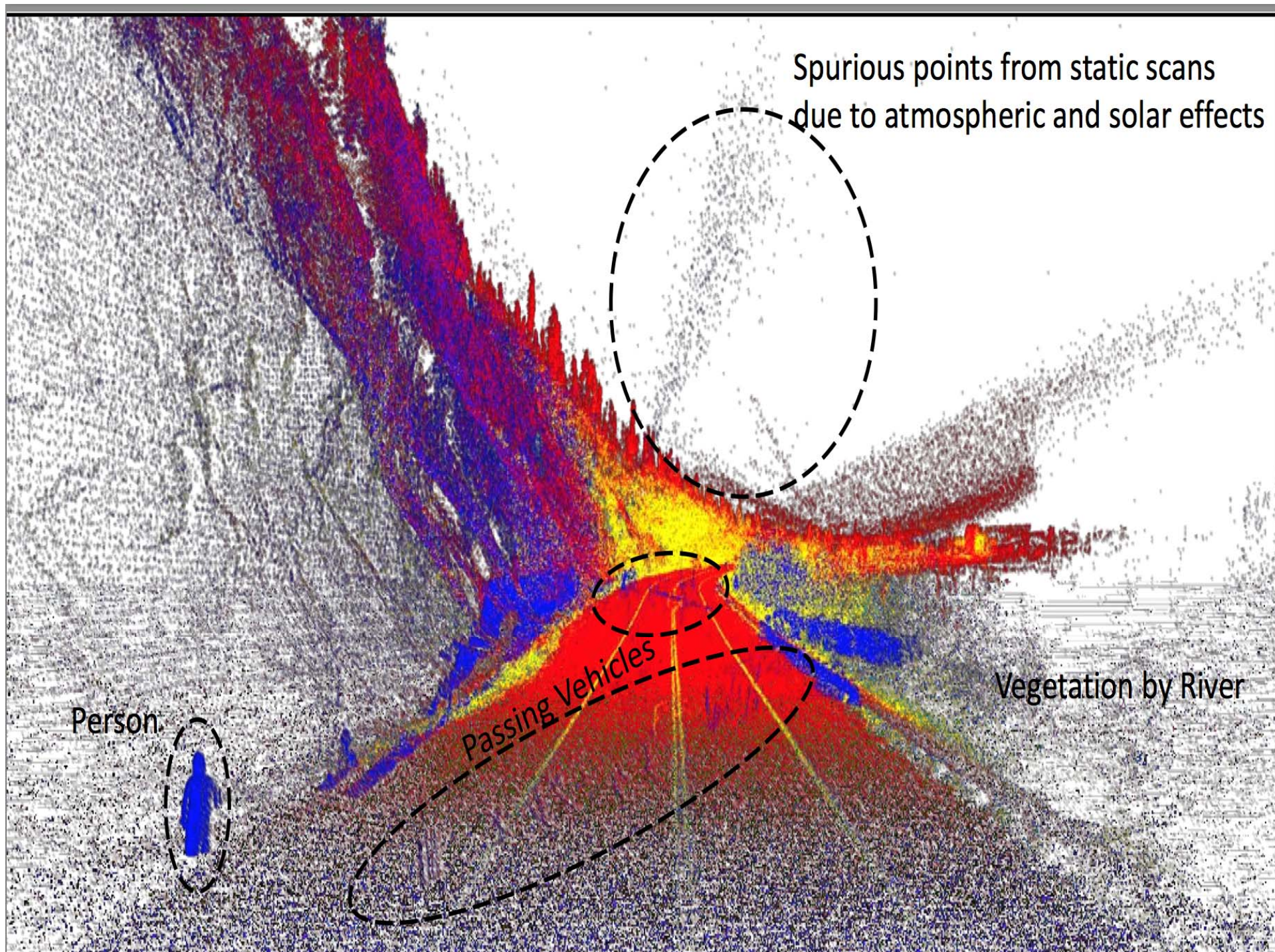


Artifacts

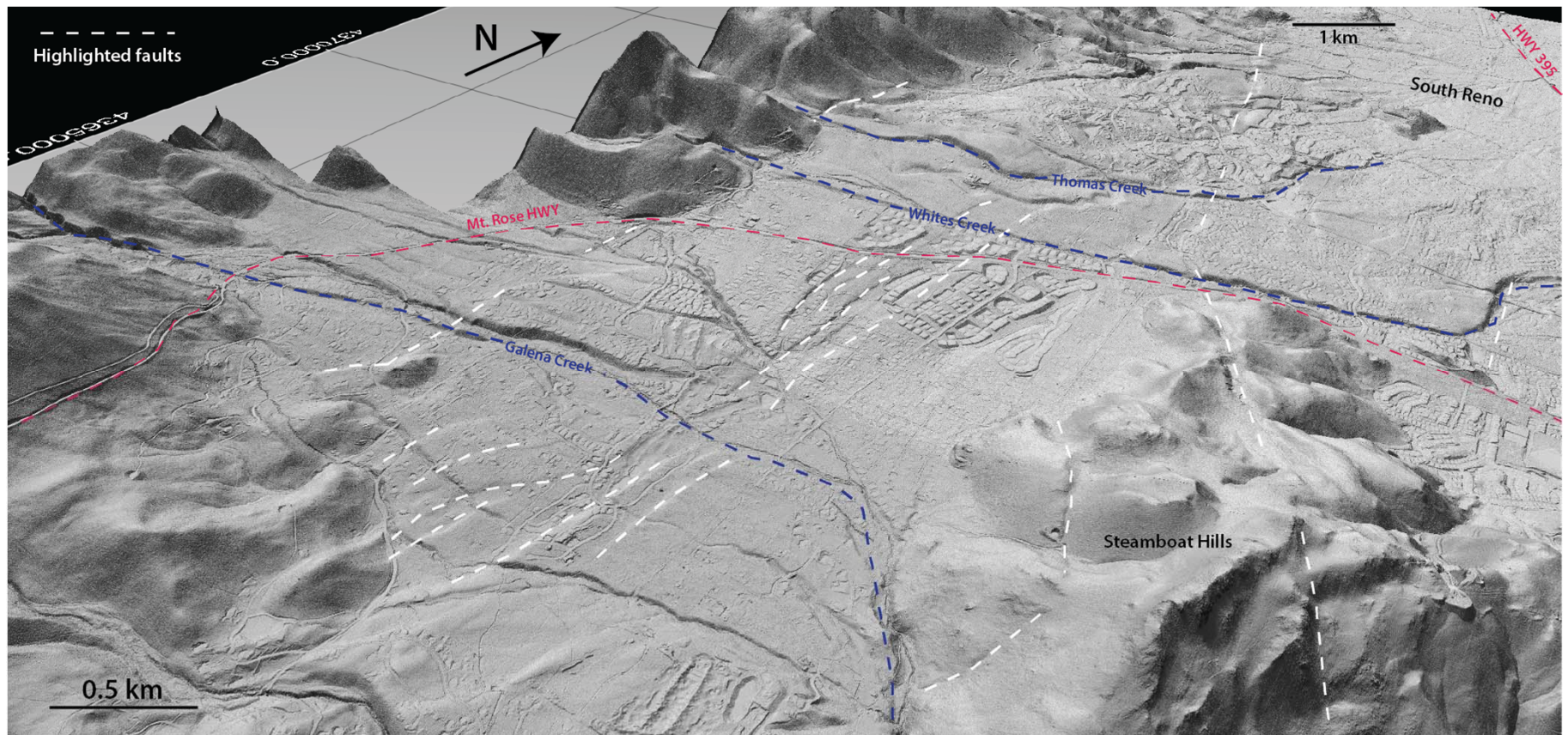


Some of our shafts are going to look like artifacts

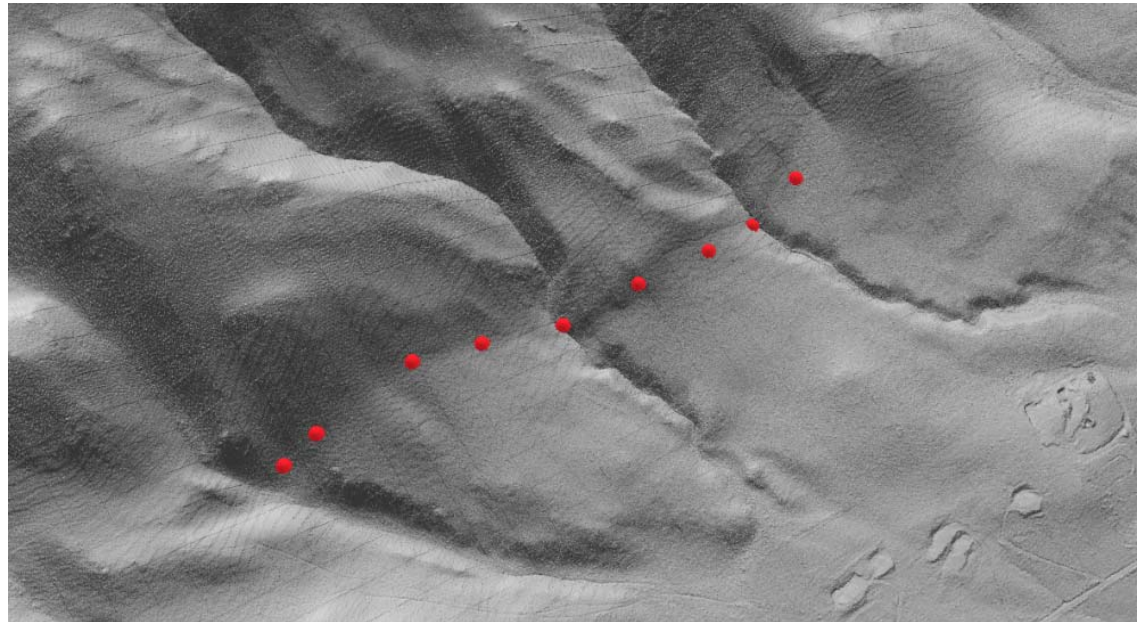
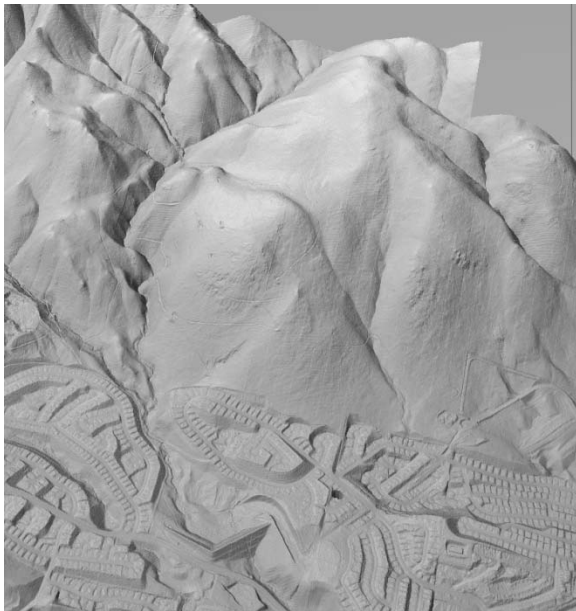
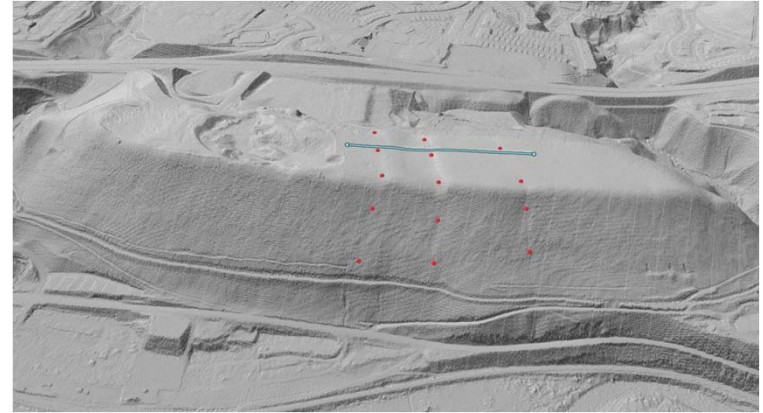
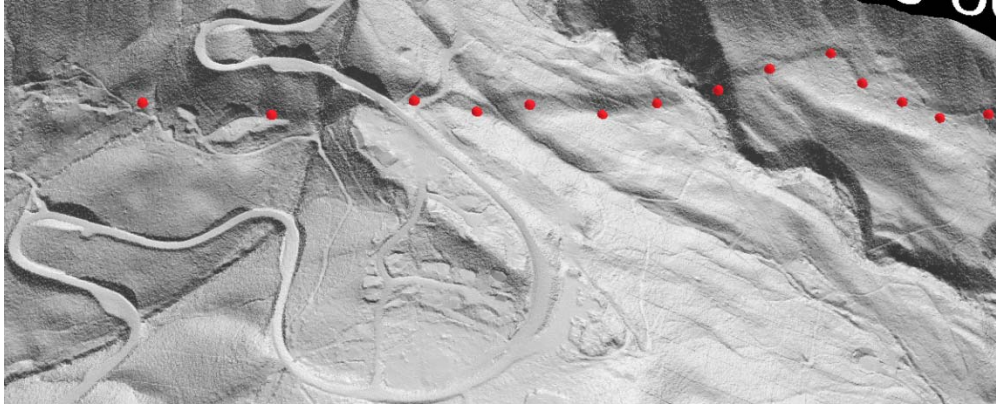
- We need to be careful not to filter/smooth them out – *we may not have control over this*
- Each return is 'real' need to be looking for the farther than ground returns



What the data will look like:



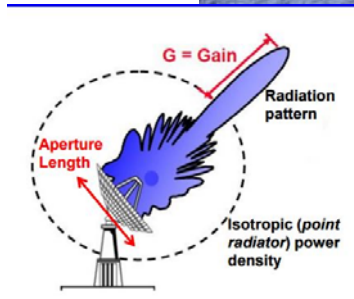
What the data will look like:



Limitations

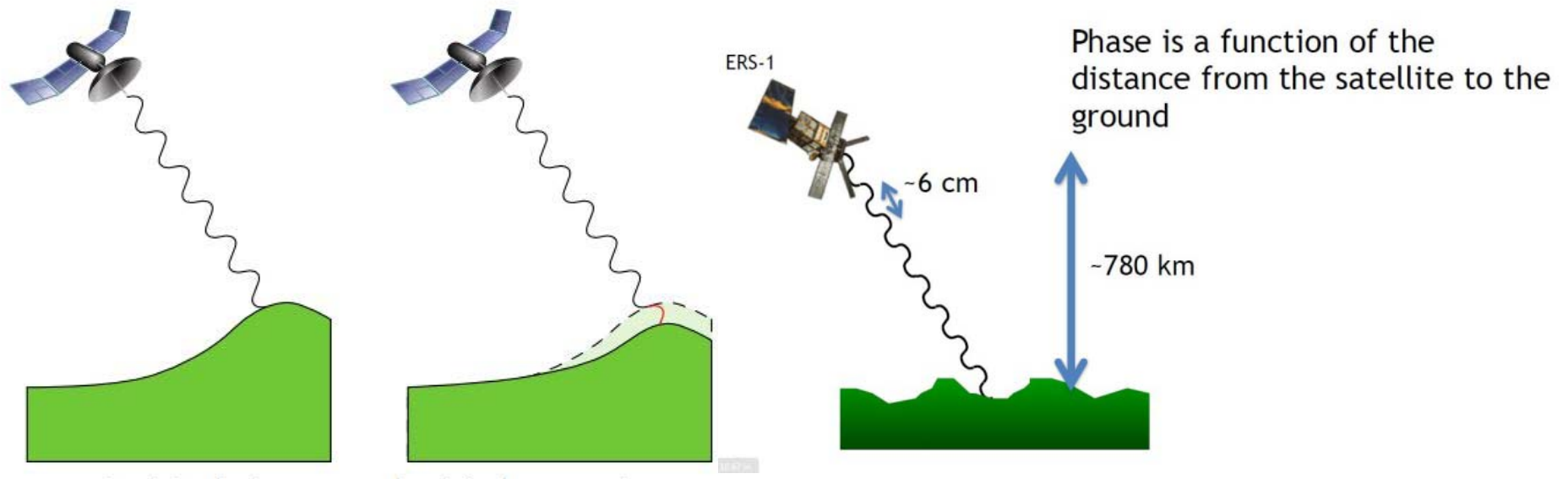
- Filtering and Clean up
 - We need to be careful of how our data are filtered so that our shafts are removed!
- Data Size & Resolution
 - Need proper overlap (\$\$) to get resolution we need (20-50%)
 - Very small features are still going to be hard to ID
 - *NEED A RETURN*
 - Computer storage & processing capabilities
 - *Will need spatial analysis toolbox – can try and process in ArcPro?*
- Cost
 - $\sim \$1000 / \text{mi}^2$ for $< 100 \text{ mi}^2 \rightarrow \sim \$500 / \text{mi}^2$ for $> 250 \text{ mi}^2$
 - **We'll likely have to wait for data to become available, might not have control over how it was collected**

InSAR



- **Interferometric Synthetic Aperture Radar**
- Interferometric - Uses wave interference
- Synthetic Aperture - Antenna
- Radar - Emits microwaves (*cms long*), measure echoes

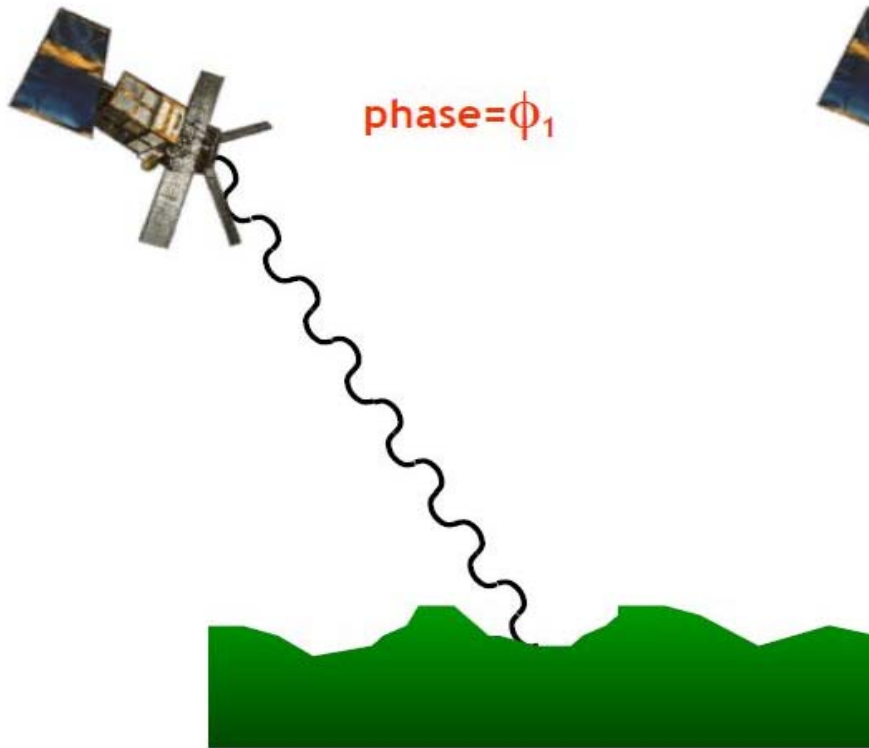
InSAR



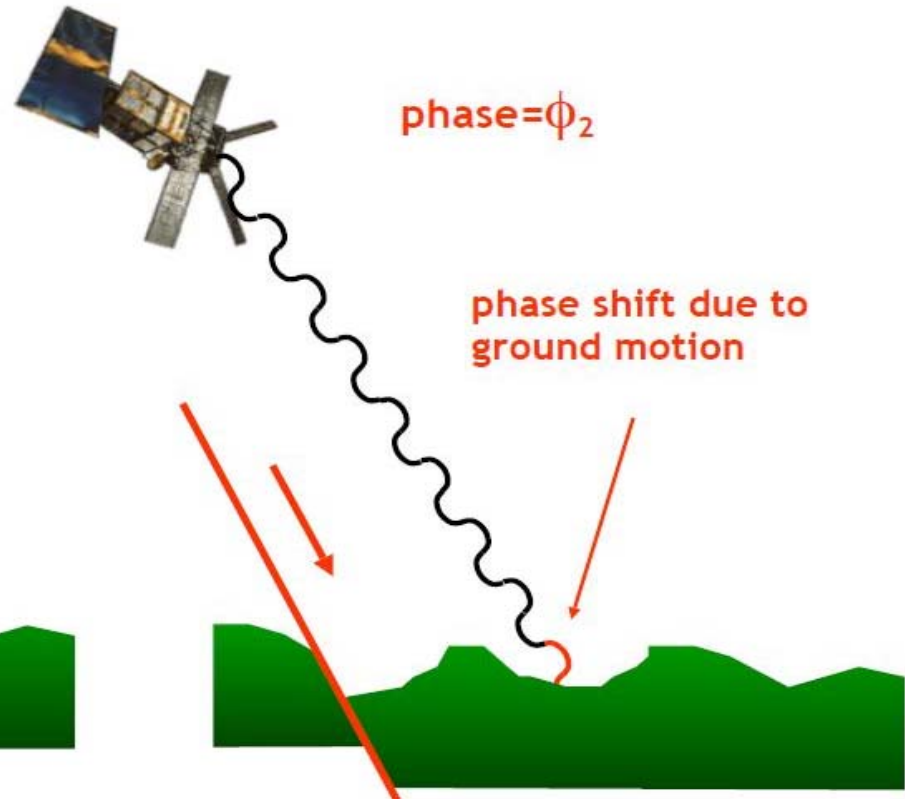
- Horizontal \approx Vertical Accuracy
- Typically used to measure changes in phase that occur during deformation
- So if a change is larger than one phase length it will be de-correlated...

Recording Deformation

Pass 1: pre-movement

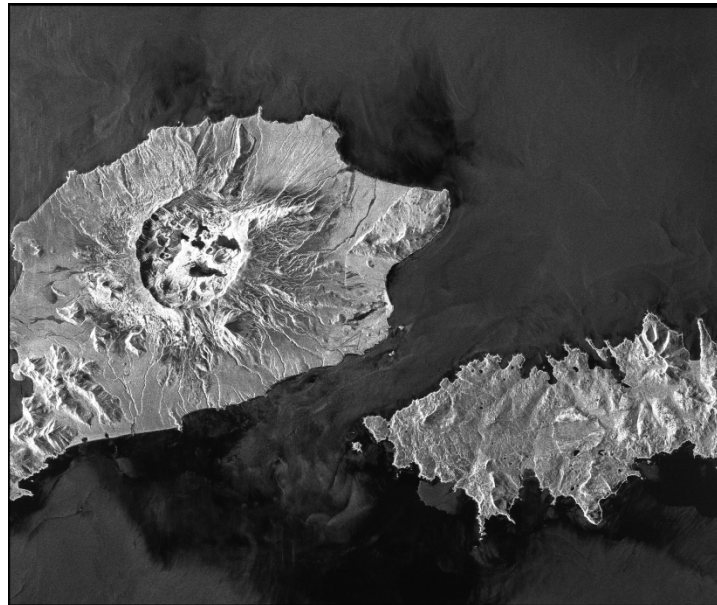
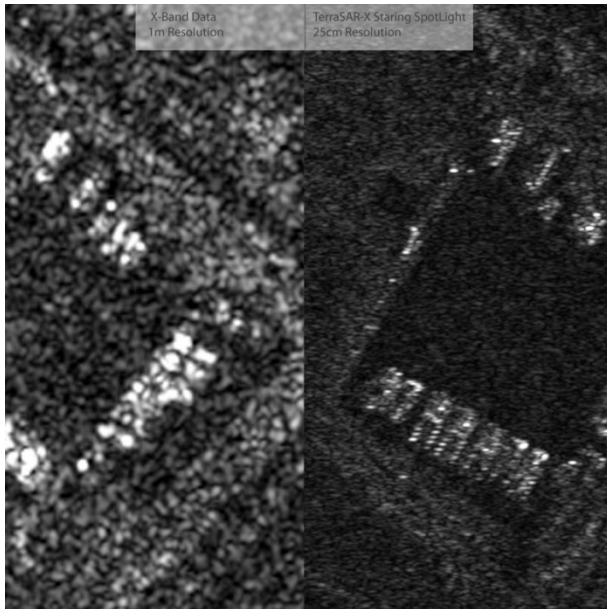


Pass 2: post-movement



SAR vs InSAR

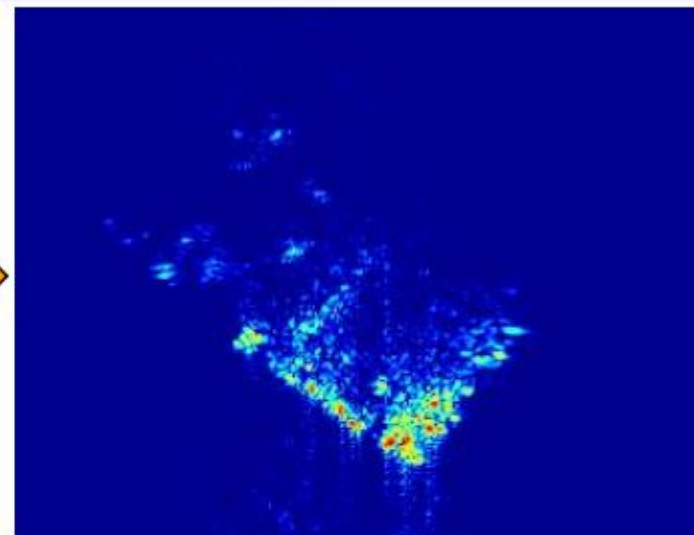
- Does not have the **interference** component
 - Still based on wave phase
 - Can be used for imagery – but not really what its good at...



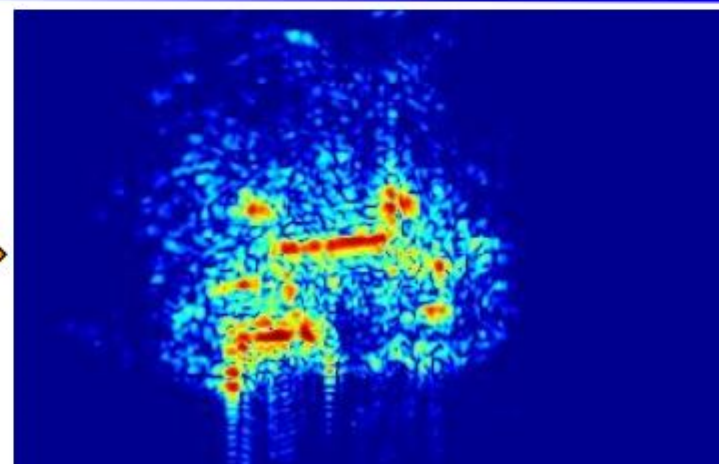


Backyard SAR Imagery

Phase is represented by color



5.0 Mustang on radar



Cannondale M300

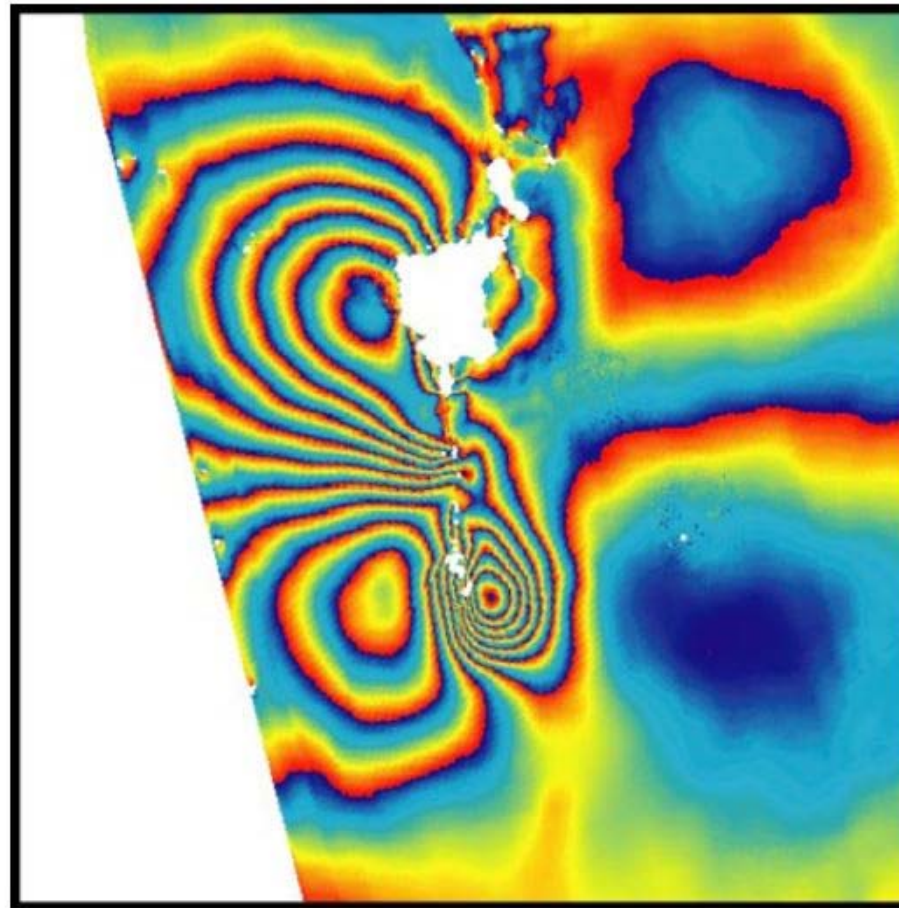
DEFORMATION *Count the Rings...*

2008 Wells,
Nevada

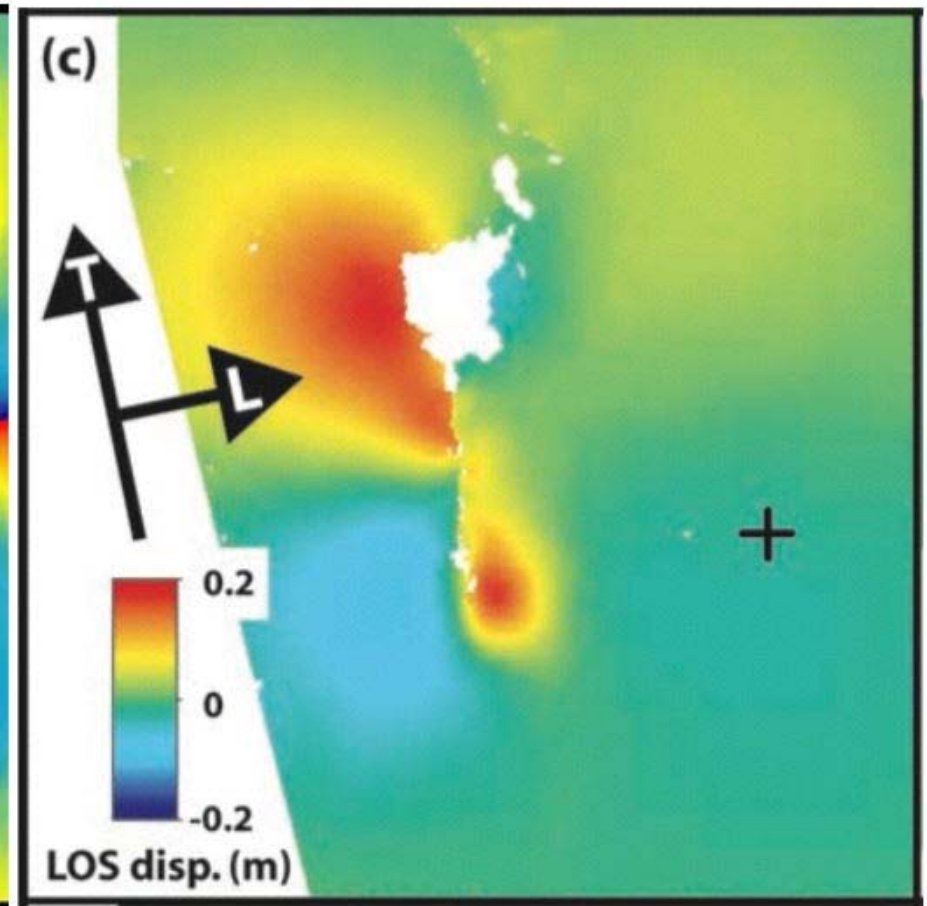
each cycle of
blue => yellow => red
= 28 mm of displacement
(half of the radar wavelength)
away from the satellite

10 km

‘wrapped’

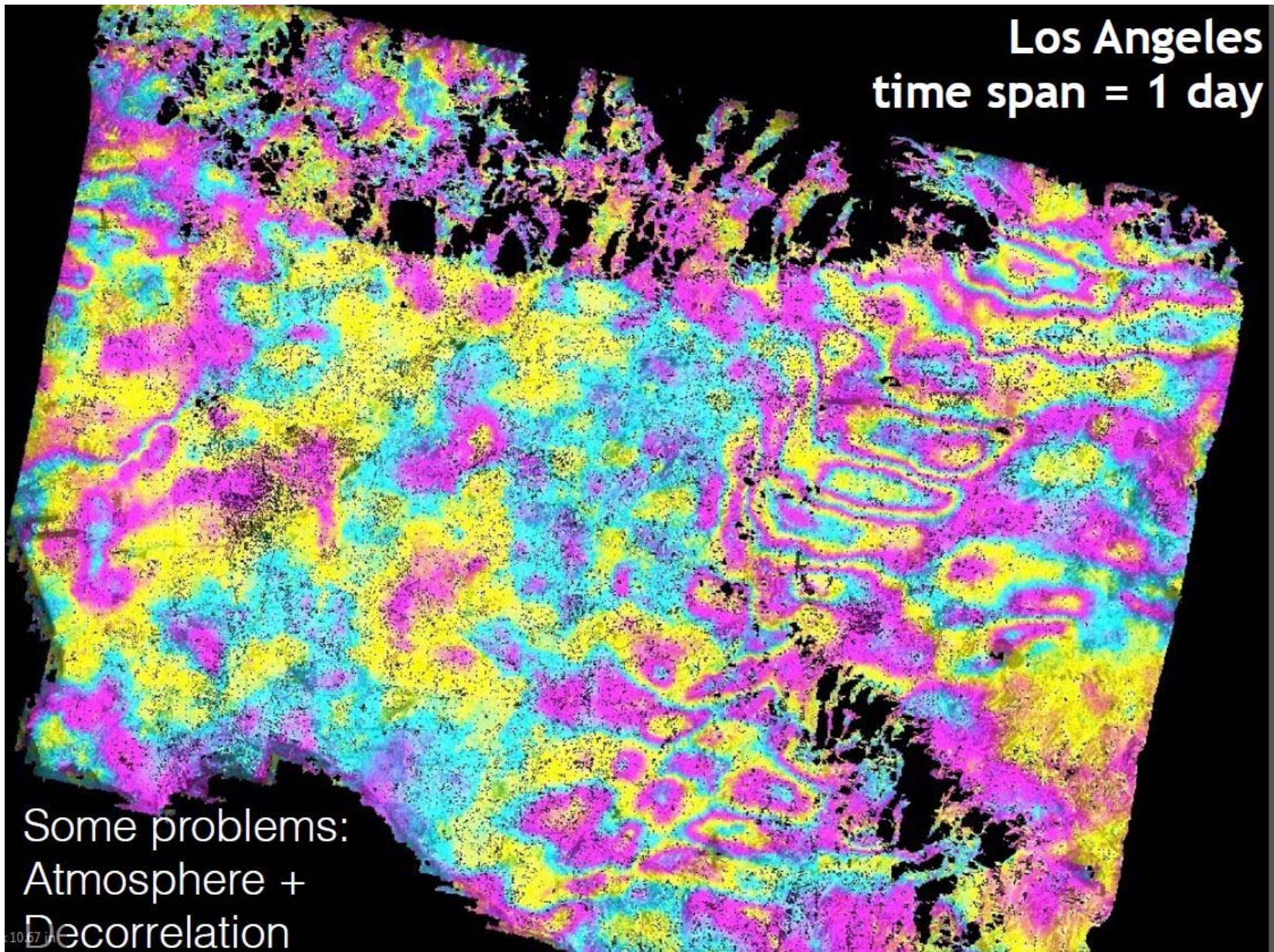


‘unwrapped’



which way is ~up?
which way ~down?
note order of fringe colors

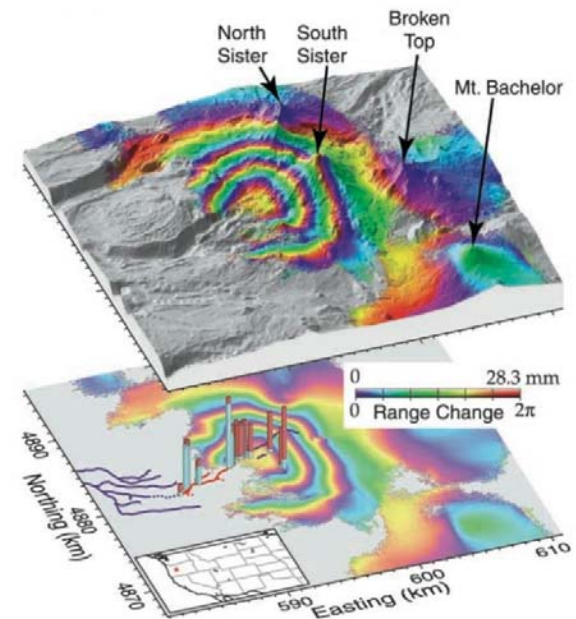
LOS stands for “line of sight”
only measures displacement
away and towards satellite
(the LOS direction)



If you have too much change topography – greater than a wavelength,
InSAR can not correlate those data (snow in this case)

Applications

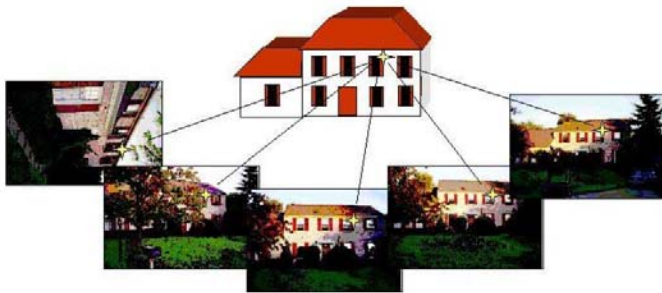
- Can measure deformation if greater than \sim size of an outdoor shed or detached garage
- Oil/Gas/Geothermal (OGG) well monitoring
 - Amount of pumping, timing and effects on surrounding areas



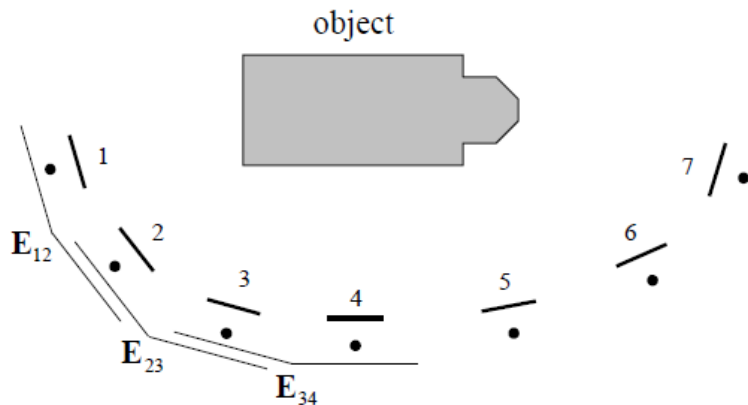
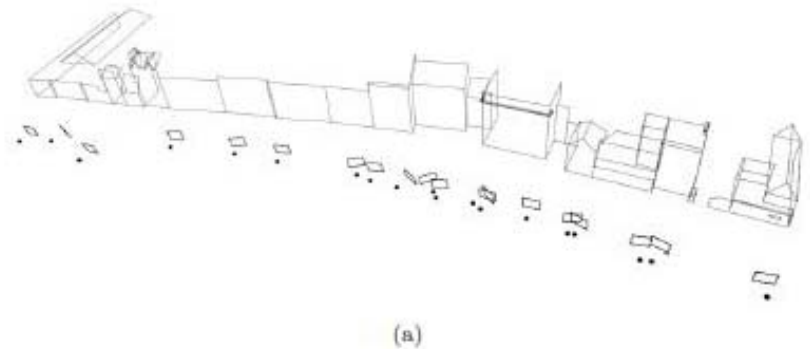
Limitations/ Costs

- Hard to acquire **detailed** *imagery*
- Time to learn how to use it, or need to pull in people to process data for us...
 - Class available next semester at UNR
 - Online trainings / webinars (*NASA*)
 - Workshops for learning how to process
- BENEFITS : Data is free! Software is free!

Alternate Geodetic Tools: Aerial Imagery & Structure from Motion (*SfM*)



<http://vision.jhu.edu/research.htm>



What is Structure from Motion?

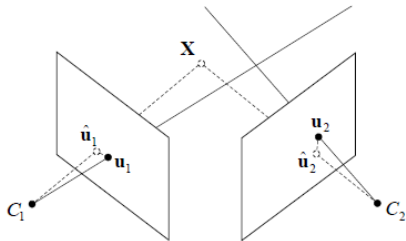
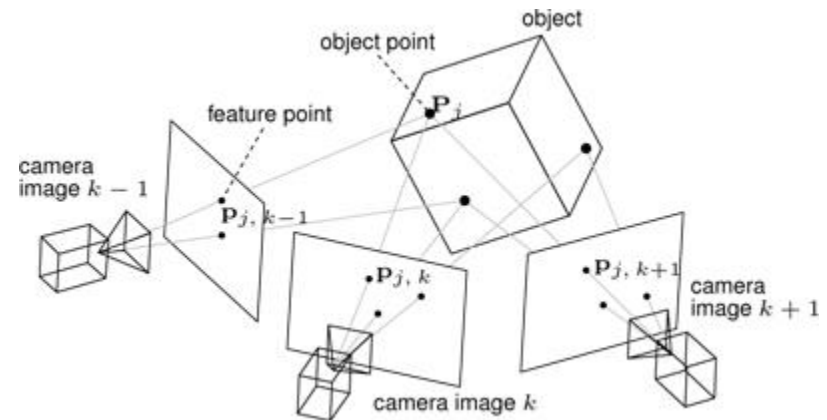
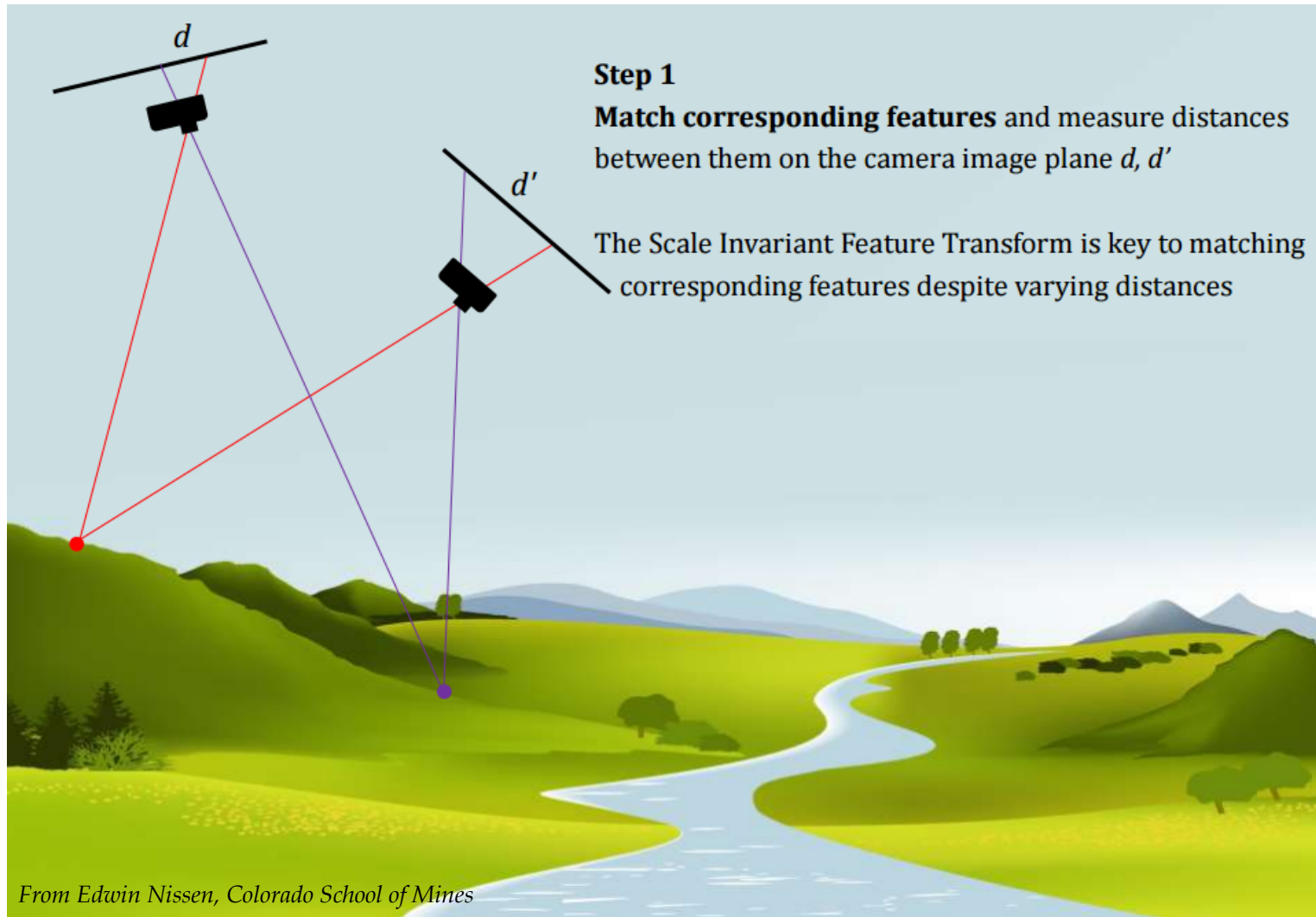


Figure 13.5: Triangulation illustration. Given projection matrices, a 3D point X can be computed from its measured pixel positions (u_1, u_2, \dots) in two or more views (C_1, C_2, \dots). Ideally, X should lie at the intersection of the back-projected rays (solid lines). However, because of measurement noise, these rays will not generally intersect. Hence X should be chosen so as to minimise the sum of squared errors between measured and predicted pixel positions (u_i and \hat{u}_i).



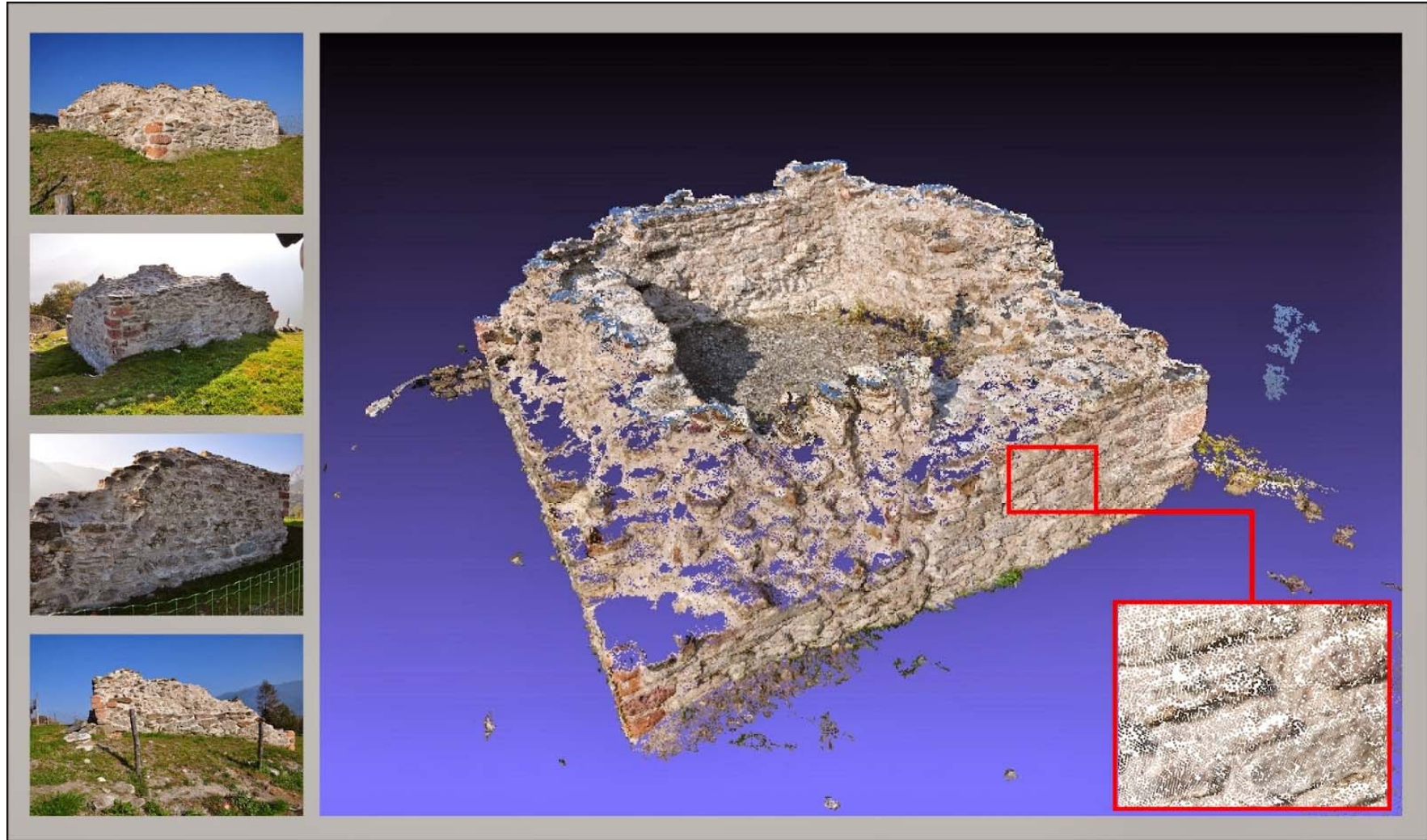
- A way to create 3D models (DEMs) from multiple photos using projection matrices & shape recognition
- Algorithms do this for us, processing on our end is SUPER easy!
- Called 'from motion' because its typically done from a moving camera, but it uses still shots...

Similar to a stereo pair



Stereoscopes rely on your eyes to visualize the image in 3D...

Software allows us to create true
3D digital image / model



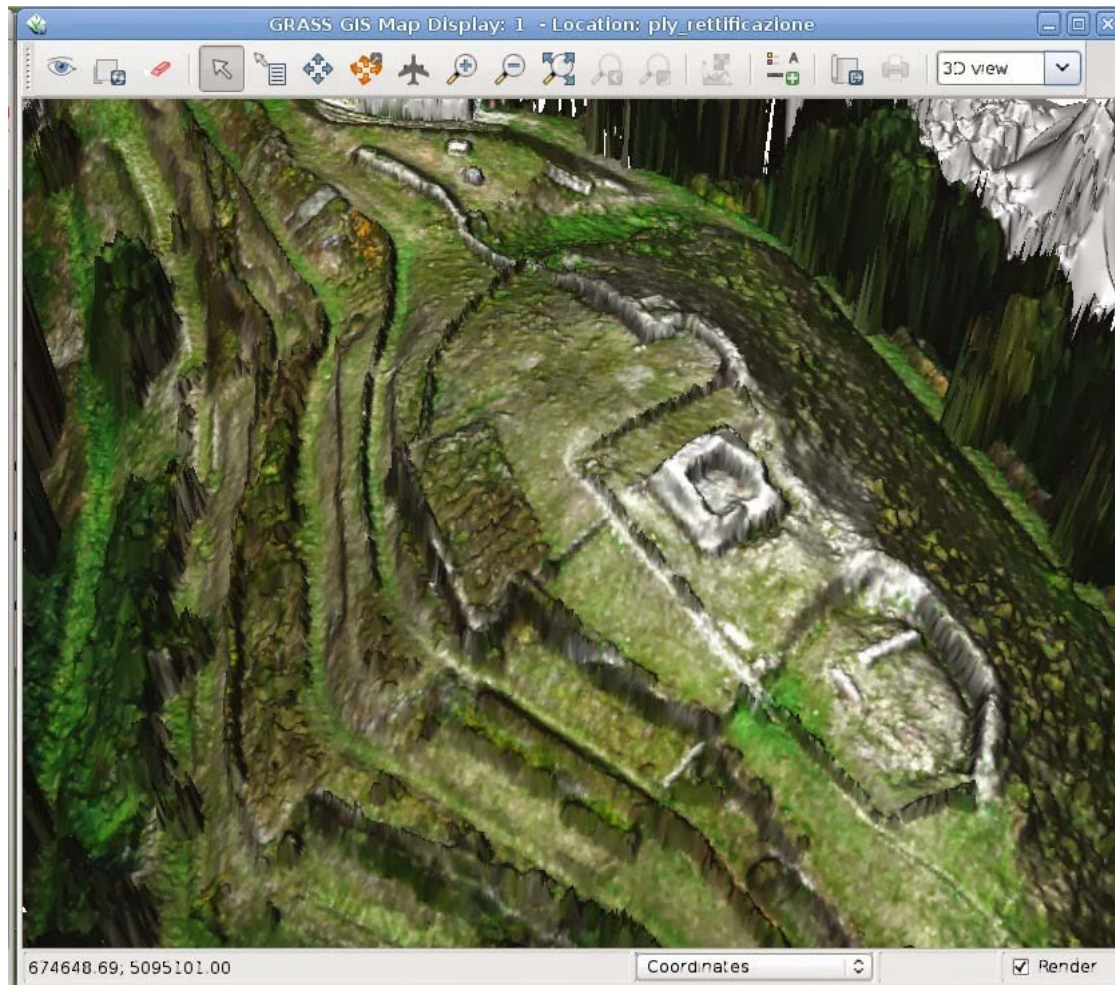


Process is very easy :

- Set up **camera** on a **quad-copter** that takes pictures every ~ 2 secs
- Photos tie in with markers that have arcuate **GPS** locations that camera can see from air
- *Also works on old aerial photos with enough overlap....*

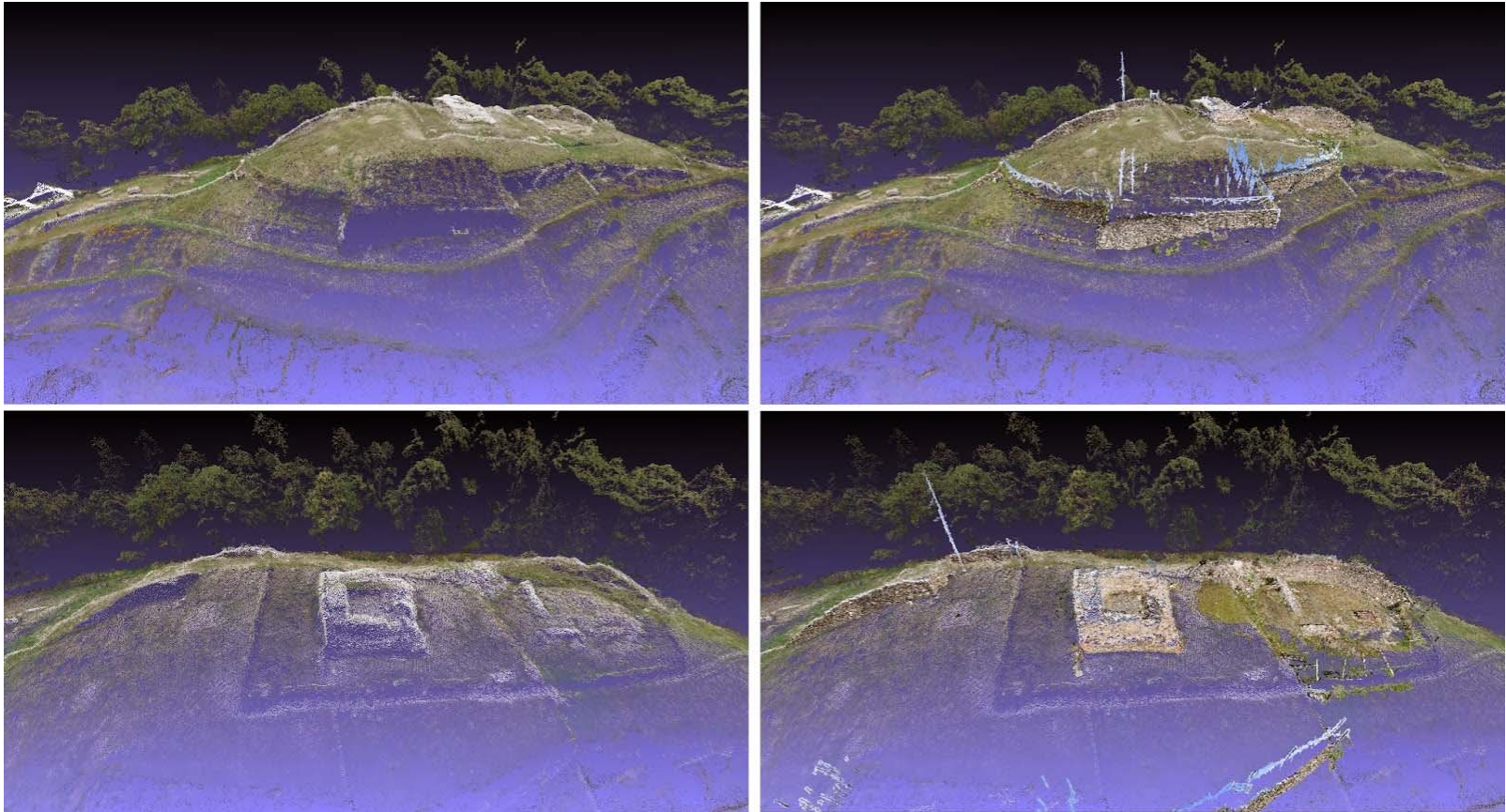


End Product:



- Full 3D dataset
- Provides the ability to see features (AML) in model
- Can be presented as:
 - interpolated surface
 - point cloud

End Product:



- *Generated point cloud is similar to LiDAR data*
 - *but based from imagery, **not distinct returns**.*
- *Cons: We need to buy equipment/software and go out and collect data...*

Other applications

- **AML – site specific logging /monitoring / continued documentation**
- Video Editing – AML , Teacher's Workshop Tours...
- Others?



- New drone features
 - Improved GPS Accuracy and waypoint ability
 - Improved camera and video capabilities
 - Preprogramed flight plans with real-time flight viewing
 - IMU redundancy – stable flights
 - Obstacle sensing (anti-crash)
 - Increased battery life (~30 mins)
- *Also could get an older one for less cost*

Maybe we don't even need the SfM model?

- With the same equipment:
 - CAMERA – DRONE – GPS
 - Maybe we don't need the SOFTWARE?
- Photo tiling – individual feature recognition & in-flight GPS

Cost & Limitations

- Phantom 4 Pro: \$1700 + \$300 for optional accessories
 - Has lots of new useful features!
 - *Phantom 3 Advanced* ~\$600
- New drones do not allow you to attach your own camera
 - comes included but takes 5 second shots (*fly slow!*)
- Software & Data (SfM)
 - **Model data are very large: *case-by-case use***
 - **Point Cloud is not a discrete return – modeled after photos**
 - *Agisoft PhotoScan: \$3500 Stand-Alone License*
 - *There are **free** options*
- BENEFIT: Everything is a one time buy!

Summary

- LiDAR – AML applications
 - Great Imagery / 3D data
 - Need to test dataset for proper filtering or have a say in how data are collected and processed
 - Need a sub-ground classification
- InSAR – OGG applications
 - Poor Imagery, good at deformation monitoring
 - Data & software are free
 - Need time to learn how to process
- SfM/Aerial Photography – AML, Outreach/marketing, others?
 - One time buy
 - Multiple use/applications
 - Easy processing

II. D Preliminary 2016 Nevada Mineral Production

2016 Metallic Mine Production for Nevada - DRAFT (4/18/2017)									
Nevada Division of Minerals Annual Status and Production Reports									
Operator	Mine	Gold 2015 (ounces)	Gold 2016 (ounces)	Silver 2015 (ounces)	Silver 2016 (ounces)	Copper 2015 (pounds)	Copper 2016 (pounds)	Molybdenite 2015 (pounds)	Molybdenite 2016 (pounds)
A.U. Mines Inc.	Manhattan Gulch	0	21	0	8				
Atna Resources (stopped mining in 2015)	Pinson	16,898	0	NR	0				
Barrick Cortez	Cortez Hills OP/Pipeline	520,060	850,312	17,602	22,565				
Barrick Cortez	Cortez Hills UG	478,940	338,275	16,210	6,294				
Barrick Gold	Turquoise Ridge JV	289,421	354,560	NR	NR				
Barrick Goldstrike Mines	Arturo	0	223,145	0	NR				
Barrick Goldstrike Mines	Betze Post	642,493	544,736	67,223	134,283				
Barrick Goldstrike Mines	Meikle	411,003	417,438	17,749	37,615				
Bernell Lloyd	BBD Placer	NR	4	NR	0				
Borealis Mining	Borealis	7,998	618	29,321	1,511				
Coeur Rochester	Rochester	52,588	50,750	4,630,739	4,564,139				
Comstock Mining	Lucerne	15,451	4,086	221,723	75,657				
Dun Glen Mining	Dun Glen Placer		43		NR				
Florida Canyon Mining	Florida Canyon	21,716	10,873	67,687	21,898				
Geo-Nevada	Spring Valley	NR	24	NR	18				
GRP Pan	Pan	21,316	8,714	680	NR				
Hycroft Mining	Hycroft	107,998	32,265	621,788	235,934				
Jerritt Canyon Gold LLC	Jerritt Canyon	167,683	140,990	4,000	NR				
KGHM International	Robinson	60,360	49,217	NR	NR	131,307,031	118,411,099	905,061	823,659
Kinross Gold	Bald Mountain	191,088	129,282	26,164	864				
Kinross Gold	Round Mountain	385,159	371,484	775,025	721,465				
Klondex	Fire Creek	77,055	101,284	92,114	80,593				
Klondex	Midas	28,838	29,577	1,513,112	1,345,990				
Mineral Ridge Gold	Mineral Ridge	39,690	36,879	19,742	16,950				
Newmont Mining	Carlin Trend Operations	885,242	943,823	92,173	101,475				
Newmont Mining	Lone Tree Complex	21,349	31,884	0	0				
Newmont Mining	Long Canyon	0	22,500	NR	NR				
Newmont Mining	Phoenix	183,371	176,756	966,159	1,175,126	46,330,821	41,806,950		
Newmont Mining	Twin Creeks	470,759	367,528	143,631	227,814				
Rawhide Mining	Denton-Rawhide	23,334	17,972	147,316	105,413				
Ruby Hill Mining	Ruby Hill	10,673	6,472	24,842	7,791				
Silver Standard Resources	Marigold Mine	207,005	205,116	2,841	2,349				
Sterling Gold Mining	Sterling Mine	1,700	350	NR	NR				
Sunrise Minerals	Sunrise Placer	471	668	210	121				
Totals		5,339,659	5,467,646	9,498,051	8,885,873	177,637,852	160,218,049	905,061	823,659
			2.4%		-6%		-10%		-9%
			YOY Change		YOY Change		YOY Change		YOY Change

2016 NEVADA METAL PRODUCTION, BY PRODUCER - DRAFT				
Operator	Gold (ozs)	Silver (ozs)	Copper (lbs)	Moly (lbs)
Barrick	2,639,826	200,757		
Newmont	1,631,131	1,504,415	41,806,950	
Kinross	500,766	722,329		
Silver Standard Resources	205,116	2,349		
Jerritt Canyon	140,990	NR		
Klondex	130,861	1,426,583		
Coeur Rochester	50,750	4,564,139		
KGHM International	49,217	NR	118,411,099	823,659
Mineral Ridge Gold	36,879	16,950		
Hycroft	32,265	235,934		
Rawhide Mining	17,972	105,413		
Florida Canyon Mining	10,873	21,898		
GRP Pan	8,714	NR		
Ruby Hill Mining	6,472	7,791		
Comstock Mining	4,086	75,657		
Sunrise Minerals	668	121		
Borealis Mining	618	1,511		
Sterling Gold Mining	350	NR		
Dun Glen Mining	43	NR		
Geo-Nevada	24	18		
A.U. Mines	21	8		
Bernell Lloyd	4	NR		
Totals	5,467,646	8,885,873	160,218,049	823,659

III. OLD BUSINESS

III. A. Oil, Gas and Geothermal Program annual update

OIL, GAS, AND GEOTHERMAL ACTIVITY

2017 Permitting and Drilling Activity (Through April 20, 2017)

Permit Type	Issued 2014	Drilled 2014	Issued 2015	Drilled 2015	Issued 2016	Drilled 2016	Issued 2017	Drilled 2017
Geothermal - Ind Production	5	5	10	7	9	10	---	---
Geothermal - Ind Inj	2	2	1	2	3	1	1	2
Geothermal - Observation	10	3	1	1	2	4	---	---
Geothermal - TG	---	---	5	5	---	---	---	---
Geothermal - Com	---	---	---	---	---	---	---	---
Geothermal - Dom	8 ¹	4	8 ²	5	---	4	2	2
Geothermal - Project Area	1	---	1	---	---	---	---	---
Geothermal - Total	27	15	26	20	14	19	3	4
Oil & Gas	16	5	4	2	3	1	0	0

¹Includes 4 wells previously drilled and completed; ²Includes 2 wells previously drilled.

Activity from January 1, 2017 to April 20, 2017	Geothermal	Ormat Nevada	During 1 st quarter 2017 Ormat Nevada completed the drilling of the Tungsten Mountain 75B-22 production and 24(44)-22 injection wells, New York Canyon 68(72-11)-2 production well, McGinness Hills 57C-22 injection well, and Dixie Meadows 75(53)-4 injection well. The permitted Dixie Meadows 17(87-7)-8 injection well has yet to be drilled. Ormat Nevada has filed a NOI with the BLM for 6 TG wells in the Dixie Comstock area, located a few miles north of Dixie Meadows and south of Terra-Gen's Coyote Canyon area. Ormat Nevada will be performing a directional redrill of an injection well at Wild Rose during April and May.
		US Geothermal	NDOM and the BLM approved sundries for the deepening of three observation wells at US Geothermal's San Emidio Field. The wells are located in a southwestern extension of the field. US Geothermal plans on deepening the 3 wells in late spring to early summer. This new extension of the field is expected to add ~47MW generation capacity through a to be constructed San Emidio II Power Plant. The San Emidio I Power Plant is currently generating ~10 MW.
	Oil	Makoil	The Munson Ranch 12-23X and 13-34 permits were approved in 2015, but have not been drilled. The two permits expire on June 12, 2017. The permitted Murphy Gap 14-23, located in Coal Valley, has not been drilled. This permit expires in March 2018.
		Bright Sky Energy & Minerals	The BLM and NDOM have approved the White River Valley 1-35 re-entry and testing sundries in February 2017.

Summary of Geothermal and Oil Well Inspections for Fiscal Year 2017

FY 2017 Well Inspections	Total Wells	Wells Needed for FY17	Wells Inspected	% of Total Needed	Wells Remaining
Geothermal (25 Locations)	448	149.3	232	155.4%	
Oil (19 Locations)	128	43	117	274%	
Totals	576	192	349	182%	-157

Databases

Lucia and I are continuing to compile geothermal (pre 2009) and oil (pre 1999) production and injection data for the two databases. We are obtaining the older data from scanned pdf files on the NBMG web site. Once compiled, the data will be appended to the databases. Receipt of cuttings by the Sample Library at NBMG will also be included in the databases.

Sundry Notice Activity: January 1, 2017 to April 20, 2017

One oil sundry notice was approved during the 1st quarter of 2017. Eight geothermal sundry notices have been approved during the 1st quarter of 2017.

BLM Lease Sales

The BLM Oil & Gas Lease Sale for the Elko District was held on March 14, 2017. There were 67 parcels, 115,969.69 acres, offered for sale in the original sales notice. All 67 parcels were protested, but no parcels were removed from the sale. Ten bidders were involved in this first 'online' sale, and 20 parcels, 35,502.86 acres, were sold. Total receipts, including administrative fees, were \$131, 245.00. The highest bid per acre was \$4.00. No acreage involved in the sale was deferred due to sage grouse habitat. The next BLM Oil and Gas Lease Sale will be held June 17, 2017, for the Battle Mountain District. Currently, there are 106 proposed parcels, totaling approximately 195,372 acres.

FORGE Project, Fallon Area

I have invited Jim Faulds to showcase the FORGE Project in our booth at the upcoming Geothermal Resource Council (GRC) Conference. The conference will be held October 1st through 4th in Salt Lake City. The Department of Energy will decide whether the FORGE Project or the Roosevelt Project, located in Utah, goes forward in March 2018.

IOGCC Annual Well Inspectors Forum and TOPCORP

I will be attending the annual IOGCC Well Inspectors Forum in Oklahoma City on May 7th. I will also be attending the final TOPCORP course, Emerging Topics & Communications, in Austin, Texas, May 22nd to 26th. I have already attended the Petroleum Geology and Engineering, Petroleum Technology, and Environmental Management Technology courses offered by TOPCORP through IOGCC.

III. B. NDOM 2017-19 biennium budget update and current forecast

Nevada Legislative Counsel Bureau
Budget Closing Action Report
General Government Joint Subcommittee
W01 - GOVERNOR RECOMMENDS

Title: DIVISION OF MINERALS
Account: 101 - 4219

Budget Page: MINERALS-4, Volume I

Revenues	2015-16 Actual	2016-17 WP	% Chg	2017-18 GOV REC	% Chg	2018-19 GOV REC	% Chg
FEDERAL FUND	66,859	50,000	(25.22)	50,000		50,000	
OTHER FUND	1,957,238	1,823,849	(6.82)	1,844,322	1.12	1,757,742	(4.69)
INTERAGENCY TRANSFER	88,269	76,100	(13.79)	88,269	15.99	88,269	
BALANCE FORWARD	(204,530)	1,061,288	(618.89)	985,603	(7.13)	680,723	(30.93)
Total Revenues	1,907,836	3,011,237	57.84	2,968,194	(1.43)	2,576,734	(13.19)

Total FTE		11.00		11.00		11.00	
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Adjustments to Revenue

Dec Unit	Cat	GL	Description	2017-18 Gov Rec	2018-19 Gov Rec
Sub-total				0	0
Line Item Changes to Revenues				0	0

Adjustments to Expenditures

Dec Unit	Cat	GL	Description	2017-18 Gov Rec	2018-19 Gov Rec
Sub-total				0	0
Line Item Changes to Expenditures				0	0
Total				0	0
Grand Total General Fund Impact of Closing Changes				0	0

Overview

The Nevada Division of Minerals (NDOM), authorized under NRS Chapter 513, is governed by the Commission on Mineral Resources. The commission directs mineral-related policy for the division and advises the Governor and Legislature on matters relating to mineral resources. The NDOM encourages and assists in the responsible exploration for and the production of minerals, oil, gas, and geothermal energy, which are economically beneficial to the state. The agency administers the Mine Reclamation Bond Pool and the Abandoned Mine Lands program and is responsible for permitting, inspecting and monitoring all oil, gas and geothermal drilling activities on both public and private lands in Nevada. The division is funded primarily through the collection of fees imposed on the mining industry.

Major Closing Issues

1. Increase in Contract Costs for the Abandoned Mine Lands Program
2. Costs to Exhibit at Mining Trade Show

Discussion of Major Closing Issues

1. Increase in Contract Costs for the Abandoned Mine Lands Program (E-350, MINERALS-8): The Governor recommends reserve funds of \$70,000 each year to increase contract costs for securing dangerous abandoned mine hazards for the Abandoned Mine Lands (AML) program. The AML program was established in 1987 and includes the following: 1) statewide inventory of sites; 2) securing hazardous mine features; and 3) public awareness campaign. Combined with base contract expenditures of \$50,000 each year for AML inventorying and ranking of hazardous mine features, the recommendation would increase contracted AML funding to \$240,000 over the 2017-19 biennium, which augments existing staff and summer intern identification, and securing of

dangerous abandoned mine hazards. Securing may include fencing or hard closures, such as backfilling, polyurethane foam closures, or bat compatible gates. Abandoned mine hazard securing is prioritized based on mine features, density, and proximity to the public, trails, and recreation areas.

On June 28, 2016, the Legislative Commission approved regulations amending NAC 513.315 to increase the Dangerous Mine Fee from \$2.50 per mining claim to the statutory maximum amount of \$4.00 per claim. *Nevada Revised Statutes* 513.103 requires the NDOM to use all money received from mining claims for the abatement of dangerous conditions existing at abandoned mines sites and for educating the public concerning dangerous abandoned mines. The \$1.50 increase to the Dangerous Mine Fee is projected to increase annual revenue by \$265,572, for a total of \$629,692 in FY 2018, and by \$250,965 to \$595,060 in FY 2019. According to the agency, the decrease in FY 2019 is due to the projected annual 5.5 percent decline in mining claim filings over the 2017-19 biennium, which the agency attributes to decreasing investments in mineral exploration due to sage grouse concerns. Staff is unable to validate the agency's projection relative to "sage grouse concerns" but would note that historically, mining claim filings appear to fluctuate annually.

The table below shows contracted fieldwork accomplishments for the Abandoned Mine Lands program for FY 2009 through FY 2017.

Nevada Division of Minerals - Contracted Abandoned Mine Lands Fieldwork									
Activities	FY 2009 Actual	FY 2010 Actual	FY 2011 Actual	FY 2012 Actual	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual	FY 2016 Actual	FY 2017 YTD
Identification of Hazardous Mines	1	8	152	97	55	209	100	26	4
Revisits of Mines	80	616	160	351	123	232	1	14	62
Securing - Fencing	22	146	109	123	97	94	7	24	0
Securing - Hard Closures	3	6	17	31	49	17	34	28	31
Total	106	776	438	602	324	552	142	92	97

Source: Data provided by NDOM

During the NDOM budget hearing on March 9, 2017, the agency indicated that mining hazards previously secured with fencing are often vandalized and require hard closures for public safety, which occur as funding is available. The NDOM estimates there are approximately 50,000 abandoned mine hazards throughout the state. The agency reports that 20,076 have been identified and 16,047 of those have been secured. The agency also indicated that its priority over the last two years has been securing mining hazards rather than the identification of new mine hazards. Further, the NDOM stated that it takes increased time and additional resources to secure hazardous mine features in rural areas, which has led to a decrease in some of its performance measures.

The NDOM has identified 345 hazardous mine features requiring hard closure fieldwork that could be addressed over the 2017-19 biennium based on available funding. According to the NDOM, the amount of actual contracted hard closure fieldwork to be realized over the 2017-19 biennium would be based on the type of hard closure required and its related cost. For example, the mining hazard identified could include several hazards in a remote area requiring more than one hard closure method, increasing the overall cost compared to one hazard at one accessible site. The NDOM has advised that prioritizing hard closure fieldwork is determined through risk assessments of the hazardous mine features, which is conducted in coordination with the Bureau of Land Management. The NDOM projects that the funding in this decision unit, together with base AML Program funding, would assist the contracted fieldwork activities in securing some of the 345 hazardous mine features that have been identified in addition to other fieldwork for the AML program.

Does the Subcommittee wish to approve reserve funds of \$70,000 in each year of the 2017-19 biennium for additional contract costs to secure hazardous mine sites throughout the state?

2. Costs to Exhibit at Mining Trade Show (E-125, MINERALS-7): The Governor recommends reserve funds of \$25,336 in each year of the 2017-19 biennium for the NDOM to exhibit at the Prospectors and Developers Association of Canada annual convention in Toronto. The agency states that being an exhibitor at the convention would increase international awareness of business opportunities for mineral exploration and extraction in Nevada. The recommendation includes the costs of exhibit space fee, furniture rental, and various displays for four days each year. Travel expenses and registration fees for two NDOM staff are included in the base budget since the agency has historically attended the conference annually as an attendee.

The agency indicated that the purpose of exhibiting at the annual convention is to provide information and answer questions on exploration, development and production, including the regulations and permitting requirements in the State of Nevada.

Does the Subcommittee wish to approve reserve funds of \$25,336 in each year of the 2017-19 biennium for the Nevada Division of Minerals to exhibit at an annual mining trade show in Toronto, Canada?

Other Closing Items

1. Staff Training (E-225, MINERALS-7): The Governor recommends online training in geographic information system (GIS) software technology that will assist in abandoned mine inventory funded with reserve reductions of \$7,420 over the 2017-19 biennium. Training classes include the creation of a multi-user geodatabase, ArcGIS site configuration and administration, and Microsoft Access 2010 Programming with VBA. **This decision unit appears reasonable.**
2. Vehicle Replacement (E-226, MINERALS-7-8): The Governor recommends the replacement of one agency vehicle with a Fleet Services vehicle funded with reserve reductions of \$2,757 in FY 2019. The new vehicle would be modified with protective equipment to ensure the safety of NDOM staff. The agency indicates the current vehicle will have approximately 130,000 miles in FY 2019 when exceeded. **This decision unit appears reasonable.**
3. Replacement Equipment and Software
 - Computer Equipment (E-710, MINERALS-8): The Governor recommends the replacement of seven desktop computers, three desktop/CADD workstations, four laptop computers, two printers, two scanners and associated hardware and software funded with reserve reductions of \$33,072 over the 2017-19 biennium. **This decision unit appears reasonable.**
 - Computer Software (E-711, MINERALS-9): The Governor recommends the replacement of eight Adobe Acrobat Pro software programs and seven Adobe Photoshop Elements software programs funded with reserve reductions of \$1,498 over the 2017-19 biennium. **This decision unit appears reasonable.**
 - Replacement Equipment (E-712, MINERALS-9): The Governor recommends the replacement of four exhibit displays (two each for the Carson City and Las Vegas offices) for use at various public outreach and educational events funded with reserve reductions of \$18,900 over the 2017-19 biennium. The recommendation includes 24 interchangeable display banner graphic cartridges for use with the above exhibit displays and the replacement of one desk for the Las Vegas office. **This decision unit appears reasonable.**
4. Salary Increase for Unclassified Positions (E-815, MINERALS-9-10): The Governor recommends salary increases for the unclassified Chief of Dangerous Mines position and three unclassified Field Specialist positions funded with reserve reductions of \$90,671 over the 2017-19 biennium. The NDOM

indicates the three Field Specialist positions should have comparable salaries to positions with similar responsibilities in the Department of Conservation and Natural Resources (DCNR) as discussed below.

For the Chief of Dangerous Mines position, the Governor recommends a 10.9 percent increase, before any cost of living adjustment (COLA), from the currently approved salary of \$70,169, to a maximum salary of \$77,798, which would be equal to the NDOM unclassified Chief of Mine Regulation position. The agency indicates that both the Chief for Dangerous Mines and Chief of Mine Regulation manage the fieldwork associated with the AML program and use the ArcGIS mapping software to assist in identifying AML hazards. According to the NDOM administrator, both positions are tasked with staffing, training, and managing approximately six to eight summer interns for abandoned mine hazard identifying and securing fieldwork. Additionally, both positions coordinate with various governmental agencies, such as the U.S. Forest Service, Bureau of Land Management and the U.S. Army Corps of Engineers regarding the AML program, mining claim owners, property owners and AML fieldwork contractors, and provide the NDOM educational public outreach. Finally, each position requires similar educational requirements and industry experience.

Regarding the Field Specialist positions, the Governor recommends a 17.0 percent salary increase, before any COLA, for each of the three Field Specialist positions, from the currently approved salary of \$59,979, to a maximum salary of \$70,169. The Field Specialist positions perform fieldwork activities, communicate with governmental agencies, and provide outreach to K-12 students and teachers on mining safety and minerals education. The Field Specialist positions also use ArcGIS mapping software to fill mapping requests of the Executive Branch. The recommended salary increase for the unclassified Field Specialist positions was based on comparable duties of a classified Environmental Scientist position with DCNR; however, Fiscal staff was unable to find a direct comparison between the positions. During the NDOM budget hearing on March 9, 2017, the agency indicated that the comparisons of NDOM positions with DCNR positions is based on a responsibility equivalency rather than a comparison of the position duties.

The NDOM indicates the agency has experienced retention issues with the three Field Specialist positions in that one position has been vacant on three separate occasions since December 2013 for a total of 11 months; and one position has been vacant twice since January 2015 for a total of 15 months. The remaining Field Specialist position has been filled continuously since July 2010.

Decisions pertaining to unclassified salaries will be determined by the money committees when the Pay Bill is considered. Staff requests authority to make any adjustments subsequently required.

Staff recommends the Other Closing Items, excluding item 4, be approved as recommended by the Governor and seeks authority to make technical adjustments as needed, including adjustments related to the outcome of legislation pending before the 2017 Legislature.

Additional Information – No Action Required

1. Assembly Bill 52 was approved Amend Do Pass by the Assembly Committee on Natural Resources, Agriculture and Mining on April 13, 2017. The amended bill has not been made available as of April 15, 2017; however, as currently written, A.B. 52 would amend NRS 534 defining the term “dissolved mineral resources” and setting forth certain provisions relating to drilling and operation of a dissolved mineral well and the operation of a dissolved mineral resource project. The bill would require the Commission on Mineral Resources to impose a fee for the issuance of a permit to drill or operate a dissolved mineral well, and require the commission and the DCNR to adopt regulations to carry out a program for dissolved mineral resources. The agency estimates that 25 wells would be permitted

annually generating \$7,500 in fees each year, which would be used for operating costs for well inspections, and that no additional staff would be required for the inspection of dissolved mineral wells.

2. Assembly Bill 159 was approved Amend Do Pass by the Assembly Committee on Natural Resources, Agriculture and Mining on April 6, 2017. The bill, as currently amended, would prohibit hydraulic fracturing in Nevada, but allow any effective permit issued before the effective passage of the bill to remain valid for the period issued and would allow the NDOM to renew those permits for not more than five years from the original date of expiration. The NDOM indicates approximately 20 permits have been issued for hydraulic fracturing in Nevada and five wells drilled. *Nevada Revised Statutes* 522.050 requires a fee of \$5,000 for the issuance of a permit to drill and operate an oil or gas well that is intended to be hydraulically fractured. The fiscal note submitted by the NDOM on the bill as originally submitted estimates reduced revenues of \$8,620 to the NDOM over the 2017-19 biennium.

Fiscal Year Cumulative Mining Claim Revenue By Month

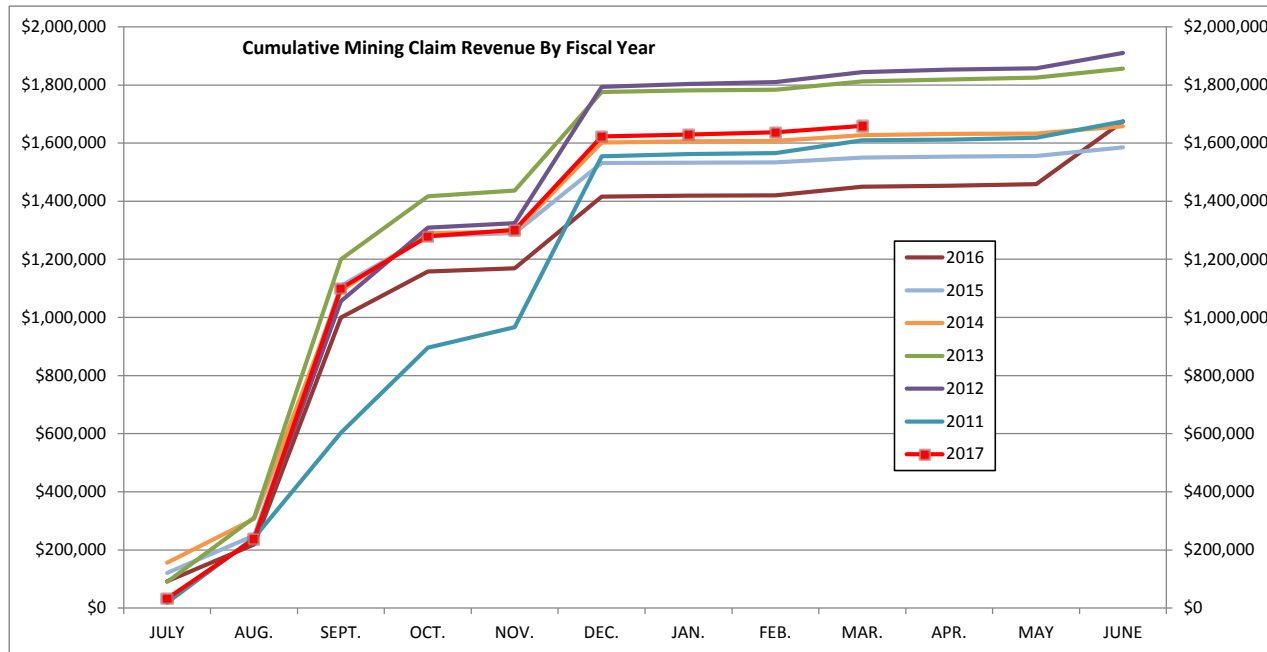
Fiscal Year	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	YOY	Total Claims
2017	\$32,650	\$236,939	\$1,099,584	\$1,278,775	\$1,301,335	\$1,622,635	\$1,629,225	\$1,636,885	\$1,659,635					165,963
2016	\$92,072	\$219,020	\$999,082	\$1,158,219	\$1,168,827	\$1,415,769	\$1,418,574	\$1,420,520	\$1,450,134	\$1,453,118	\$1,458,388	\$1,674,866	5.6%	197,043
2015	\$120,352	\$250,079	\$1,108,417	\$1,280,687	\$1,290,241	\$1,531,683	\$1,532,431	\$1,533,349	\$1,550,247	\$1,553,571	\$1,555,211	\$1,585,539	-4.4%	186,534
2014	\$155,703	\$306,646	\$1,090,754	\$1,290,496	\$1,294,661	\$1,602,233	\$1,606,177	\$1,607,656	\$1,627,283	\$1,631,235	\$1,632,417	\$1,657,789	-10.7%	195,034
2013	\$90,253	\$311,806	\$1,199,622	\$1,417,171	\$1,437,104	\$1,775,803	\$1,781,575	\$1,783,870	\$1,812,217	\$1,818,745	\$1,825,571	\$1,856,460	-2.8%	218,407
2012	\$26,248	\$239,904	\$1,055,539	\$1,309,017	\$1,324,445	\$1,793,687	\$1,802,901	\$1,810,432	\$1,843,795	\$1,852,541	\$1,857,012	\$1,910,562	14.1%	224,772
2011	\$18,504	\$241,374	\$602,803	\$895,475	\$966,603	\$1,554,871	\$1,562,053	\$1,565,649	\$1,609,424	\$1,612,118	\$1,618,145	\$1,674,304	3.8%	196,977
2010	\$34,315	\$252,520	\$866,626	\$1,120,355	\$1,151,704	\$1,527,997	\$1,532,639	\$1,537,911	\$1,566,170	\$1,569,088	\$1,574,207	\$1,613,142		189,781

*To date

*Skewed due to early payments

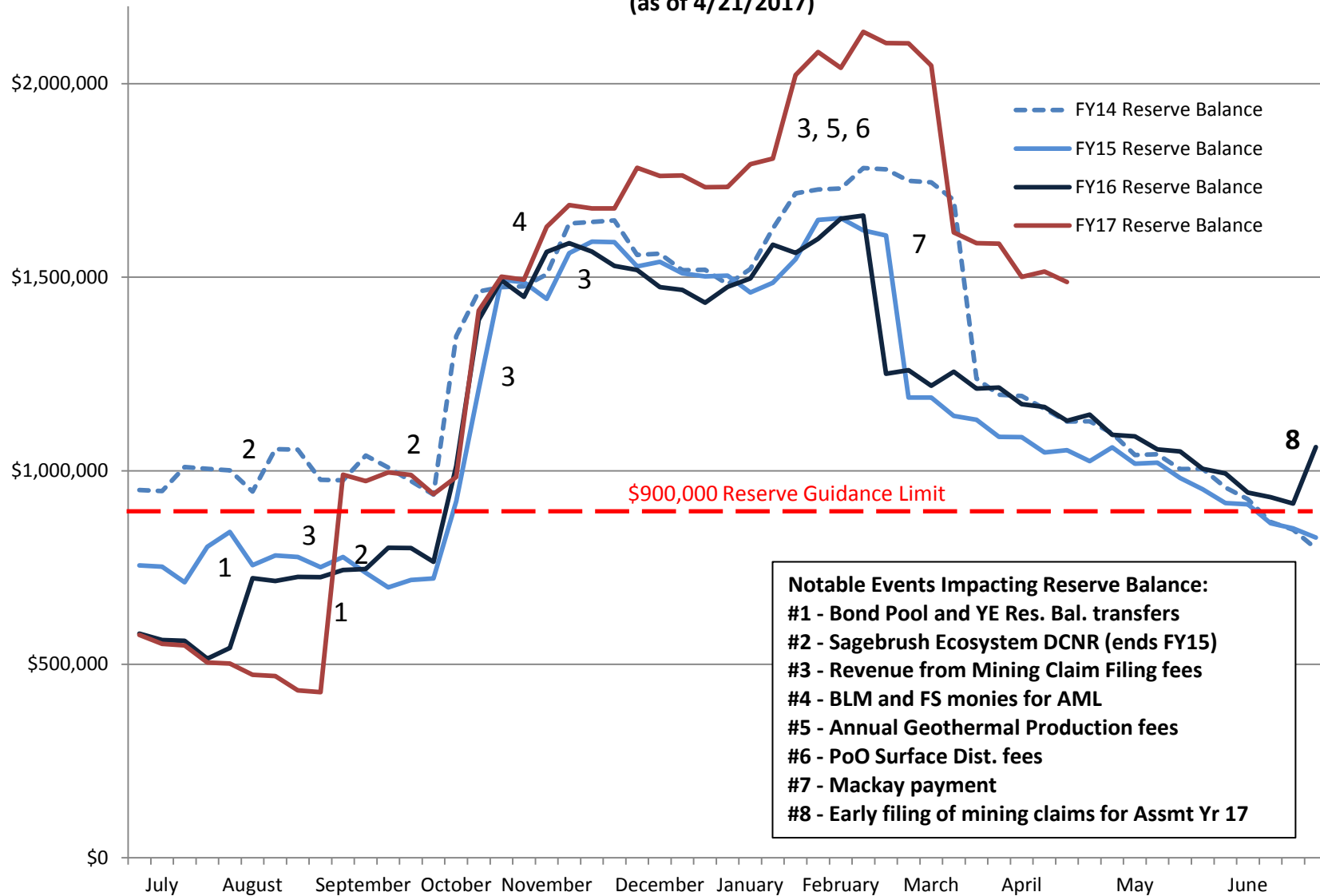
12 Counties pay quarterly: CC, CH, DO, ES, HU, LA, LI, LY, NY, PE, ST and WP

FY17 data as of 4/21/2017



NDOM Reserve Balance by Week for FY14 - FY17

(as of 4/21/2017)



DIVISION OF MINERALS - FORECAST OF REVENUE AND EXPENDITURES THROUGH FISCAL YEAR 2019

Division of Minerals - Forecast of Revenue and Expenditures Through Fiscal Year 2019 - as of 4/21/2017								
Revenue								
GL #	Description	FY 15 Actuals	FY16 Actuals	FY17 Current	FY17 Forecast	FY18 Forecast	FY19 Forecast	Remarks
2511	Balance Forward Previous Year	889,917	856,757	\$1,061,288	1,061,288	1,099,348	1,081,079	
3578	BLM Cooperative Agreement	110,000	49,000	43,590	50,000	50,000	50,000	Assumes we receive \$50k each year; current Mod1 total is \$150k (exp 2023)
3580	USFS Assistance Agreement	21,713	17,859	31,660	31,660	17,025	18,000	FS Cost Share Agreement \$35,025 ends 2/2022
3654	Oil Production Fee	38,640	39,769	29,436	35,250	33,488	31,813	Assumes \$0.15/bbl x 235k in FY17, 5% decline in '18 and '19
3717	Oil Permit Fees	2,000	4,100	500	600	6,000	6,000	Assumes 6 sundries in FY17, 2 conv.+1 unconv.+5 sundries in 18 and 19
3718 & 3727	Mining Claim Fees	1,585,539	1,674,866	1,659,615	1,700,000	1,839,657	1,802,864	1.5% projected increase in FY17, forecast 2% decline for FY18 and 19
3736	Geothermal Fees	107,525	163,900	161,700	164,000	167,280	170,626	Projecting 2% annual increases for FY18 - FY19
3770	Surface Disturbance Fee (AML)	106,320	45,220	76,200	76,200	50,000	50,000	
4011	Copy Machines - Sales to Public	104	0	0	0	0	0	
4027	Publication Sales (AML signs)	2,390	1,831	1,399	1,500	1,500	1,500	
4203	BOA Travel Card Refund	0	26	75	0	0	0	
4252	Excess Property Sales (truck)	0	21,604	0	0	0	0	Insurance payout and salvage of totaled truck
4311	Medallion Royalty Fee	616	98	115	115	100	100	
4326	Treasurer's Interest	3,947	5,824	4,477	5,970	6,000	6,000	
4620	Transfer from Recl. Bond Pool	86,498	88,269	0	83,000	78,000	73,000	Steady decline tied to exploration activity
	REVENUE TOTAL	\$2,955,209	\$2,969,123	\$3,070,053	\$3,209,583	\$3,348,398	\$3,290,981	
Expenditures								
CAT #	Description	FY15 Actuals	FY16 Actuals	FY17 Current	FY17 Forecast	FY18 Forecast	FY19 Forecast	Remarks
01	Personnel (Sal.,WC, PERS,OT)	1,009,184	1,095,422	727,501	1,004,724	1,156,210	1,155,414	Legislature approved #s (not yet final); back to 10.75 FTEs and 8 interns
02	Out-of-State Travel (Staff, CMR)	7,250	5,256	7,687	10,500	11,113	11,113	Legislature approved #s
03	In-State Travel (Non-AML)	13,218	16,865	11,776	17,370	16,865	16,865	Legislature approved #s
04	Carson Operating Expenses	100,628	103,609	107,197	116,647	138,868	140,481	Legislature approved #s + CC front desk PT
08	CMR Travel (In-State)	2,381	1,793	1,882	2,000	1,793	1,793	Legislature approved #s
09	Special Projects (Mackay, NBMG)	516,550	388,534	407,067	443,081	490,000	140,000	FY17 - \$394,086 (Mackay), \$11k (NvMA Ed), \$34k NBMG curation/reports and \$5k printing/other; FY18 - est. \$340,000 (Mackay), \$15k (NvMA Ed), \$25K (PDAC), \$85k (NBMG deliverables) \$10k printing/other, \$15k exhibit displays (2); FY19 - \$85k (NBMG deliverables), \$10k printing, \$25k (PDAC), \$15k (NVMA Ed), \$5k display updates
14	Las Vegas Operating Expenses	34,658	32,612	24,897	36,474	33,224	33,994	Legislature approved #s
17	Oil, Gas and Geothermal	8,943	9,535	10,775	14,500	12,333	13,033	Travel and equip. costs related to OGG; leg. approved #s
18	AML Support (per diem, trucks, fuel, AML supplies and travel, SOSA supplies)	134,759	133,240	89,158	174,000	148,320	152,320	Assumes 6.5 interns for FY17; each @ \$1,556/4 weeks; \$10k swag; 4 interns for 3 wks in winter (FY17-19); 8 interns FY18 and FY19; \$5k/yr increased vehicle repair costs; replacement truck in FY17 (\$35,000); 3% annual increase, \$4k Fleet Services in FY19
26	Computer and IT	6,984	18,725	8,106	32,453	22,770	25,467	FY17 Legislature approved budget, FY18 & FY19 leg. approved #s
39	AML Enhancements(contracts, equip.)	105,448	45,803	44,436	146,325	137,025	138,000	FY17 - FY19 - Assumes \$120k contracted annually + FS \$ (will need WP)
69	Sagebrush Ecosystem Transfer	131,572	0	0	0	0	0	FY15 transfer was last one
87 & 88 & 89	Cost Allocations (State, Purchasing, AG)	55,575	56,442	111,798	112,160	98,798	79,592	Actuals per Leg. approved budget
	EXPENDITURE TOTAL	\$2,127,150	\$1,907,835		\$2,110,234	\$2,267,319	\$1,908,072	
86	Reserve - Balance Forward to Next Year	\$828,059	\$1,061,288		\$1,099,348	\$1,081,079	\$1,382,909	

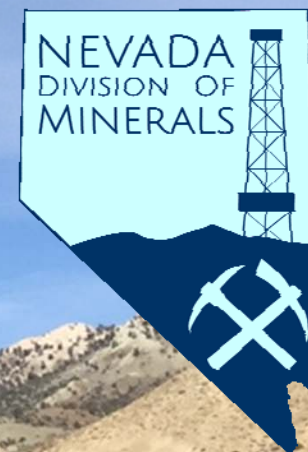
**III. C. NBMG draft Scope of Work for FY
2018-2019.**

Nevada Division of Minerals

NBMG Scope of Work for FY 2018 – 2019

**COMMISSION ON MINERAL
RESOURCES**

May 4, 2017





NBMG SCOPE OF WORK AND DELIVERABLES

- Database management and web availability of OGG well logs and scanned maps and mineral reports
 - F.Y. report to CMR on status of scanning and web availability of well logs, maps and reports, and backlog
- Curation of OGG cuttings and core
 - Quarterly report to Division and F.Y. report to CMR on status of cuttings and core inventory by well permit, and backlog



NBMG SCOPE OF WORK AND DELIVERABLES

- Publish annual Nevada Mineral Industry report (MI Report) by November 15 of each year for the following year
- Update Active Mines and Energy Producers maps by November 15 in odd F.Y. (OFR and E-series) ex: 11/15/16, 11/15/18
- Publish 2-year Mineral Exploration Survey and one-page summary sheet by January 31st of odd years. ex: 1/31/17, 1/31/19



- Other: Printing of Maps and Publications
 - NDOM has budgeted \$10,000 per year in CAT 09 for printing of maps and publications with NBMG. This would not be in the Inter-local agreement as it will vary by year and would include monies to pay for printing of:
 - Active Mines and Energy Producers Maps
 - Mineral Industry Survey
 - Exploration survey report and one-page summary
 - Other reports as needed

NBMG SCOPE OF WORK FOR INTER-LOCAL AGREEMENT		
<u>DELIVERABLE DESCRIPTION</u>	<u>ODD FISCAL YEARS</u>	<u>EVEN FISCAL YEARS</u>
	(ex: 7/1/16 to 6/30/17)	(ex: 7/1/17 to 6/30/18)
Database Mgmt and web availability of OGG well logs, scanned maps and mineral reports	Yes	Yes
Curation of OGG Cuttings and Core	Yes	Yes
Publish Annual M. I. Report by 11/15	Yes	Yes
Update Active Mines and Energy Producers maps by 11/15	Yes	No
Conduct and Publish Mineral Exploration Survey Report	Yes	No
Special Reports requested by CMR	No	Yes
Total Budgeted:	\$85,000	\$85,000

CHAPTER.....

AN ACT relating to minerals; changing the regulatory authority for natural resources; creating the commission on mineral resources and providing for its organization, powers and duties; abolishing the oil, gas and mining board; creating the department of minerals and providing for its organization, powers and duties; abolishing the division of mineral resources of the state department of conservation and natural resources; abolishing the department of energy; creating the office of community services; creating and increasing fees; and providing other matters properly relating thereto.

THE PEOPLE OF THE STATE OF NEVADA, REPRESENTED IN SENATE
AND ASSEMBLY, DO ENACT AS FOLLOWS:

Section 1. The legislature declares that the purpose of this act is to:

1. Benefit and promote the welfare of all the people of the State of Nevada.

2. Promote the efficient, orderly and economical conduct of the various activities for the encouragement, advancement and protection of mining and the production of geothermal energy, oil, gas and coal in this state.

3. Support, assist and encourage large and small mining interests, through the principles of private enterprise and individual initiative, in the discovery and development of the state's mineral resources.

4. Preserve an equitable and workable system of discovery and acquisition of mineral deposits and interests in and on the public lands, while retaining and defending the historic right of all citizens to free access to and across public lands for all lawful pursuits and purposes.

5. Achieve an equitable and reasonable balance between mineral and other legitimate interests in the realistic utilization of the public land and its surface and subsurface resources.

6. Study means and carry out programs to assist the operators of small mines in the acquisition of or access to milling and smelting facilities to process ores or concentrates into a marketable product.

Sec. 2. Chapter 513 of NRS is hereby amended by adding thereto the provisions set forth as sections 3 to 9.5, inclusive, of this act.

Sec. 3. 1. *The commission on mineral resources, composed of seven members appointed by the governor, is hereby created.*

2. The governor shall appoint:

(a) Two persons who are familiar with large-scale mining;

(b) One person who is familiar with the production of oil and gas;

(c) One person who is familiar with exploration for and development of minerals;

(d) One person who is familiar with the situations unique to small-scale mining and prospecting;

The Use of Thorium (Th-232) as a Suitable Replacement for Uranium (U-235) in the Production of Electrical Energy

Pros:

- Possibly 3-4x more crustal abundance, though skeptics argue U-238 is significantly abundant in seawater.
- No Enrichment
- Since Th-232 is fertile, a chain reaction could be stopped quickly (unlike traditional fissile U-235 reactions).
- Few Th-fueled reactors exist today, but the technology has been tested and is viable.
- The time could be near for a shift – nearly all U.S. reactors will be >60 years old by 2050 at the end of their 20 year license renewal.
- Countries like China and India are already building/have built Th-based reactors.
- Possibility of using spent-U/Pu waste in Th reactors, essentially reusing the waste over-and-over again, eliminating the need to store it.

Cons:

- Start-up costs will be high.
- It may be difficult to retrofit current U.S. reactors to accept Th (to be viable) – methods have been proposed.
- Many models require separation of U-233 from Th-232, which could be costly and hazardous to human health (robotics technology could eliminate health hazard).

Unknowns:

- Better/worse for proliferation?
 - U-233 just as weaponizable than Pu-239, possibly harder to separate.
- Radiotoxicity and storage?
 - Th byproducts typically non-transuranic, but produce more gamma radiation. Less safe to work with.
- Radioactive decay?
 - Th waste <500yr half-life (vs 10,000yr U-Pu) and there is 1,000 to 10,000x less waste.

Thorium is becoming a “buzzword” in the media and on the internet, and it does have merit. Th-232 has qualities that surpass U-235/238, but it has some pitfalls as well. Remember, the design of the reactor can make as much of a difference in safety and production as the fuel used.



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WHITE PAPER: BUSINESS STUDY FOR A NEVADA CONCENTRATE SMELTER
2-10-2015

The idea of attracting a private company to build a concentrate smelter in Nevada has been the conversation of several meetings between NDOM, University and Industry people for the past couple of months. Copper concentrates produced from Nevada mines are currently being shipped out of the country for smelting due to the lack of a base-metal smelter in Nevada and little spare capacity at existing smelters in Arizona and Utah. Smelting is a major cost of production to a base metal producer, and freight is significant. No single Nevada base metals producer has enough concentrate to consider a smelter, as they are a significant investment to build. Nevada has deposits of copper, molybdenum, vanadium, and other base metals that could benefit from a Nevada-based smelter. Sub-economic mineral deposits could become economically viable with the reduction in transportation for shipping concentrates. In addition, smelters often attract downstream businesses such as copper wire and specialty alloy manufacturers.

When we discuss what would be an economic development project that would create jobs and new industries in Nevada, this topic usually crops up. A Nevada concentrate smelter has little benefit to the State's precious metals producers, as they already ship a product they can sell. Precious metal mines have on-site refineries in Nevada and ship a marketable dore' product, with little transportation or downstream processing cost.

Engineering and construction contractors already know how to design and build a smelter. What we can do, however, is survey concentrate producers and collect cost data to produce a scoping-level study. We can also make some estimates of how much mineral resource (new mines or expansion of existing mines) in Nevada may become feasible to mine if a smelter were located here. Russ Fields, Director at the Mackay School at UNR and Jim Hendrix, Mackay Mining Department Chair put together a list of what a Nevada smelter scoping study would require:

1. Identify where the concentrates are or will be produced.
2. Determine where the concentrates are shipped today.
3. Determine the costs for transportation of concentrates to custom smelters outside of Nevada
4. Estimate the cost of locating a modern smelter for custom smelting in Nevada
5. Match the infrastructure needs of a modern smelter with what is available near existing rail, power, and natural gas distribution lines in Nevada
6. Evaluate the feasibility and cost of air and water permitting
7. Estimate how much more base metal production would occur if Nevada had a custom smelter
8. Estimate what downstream industries might locate near a smelter

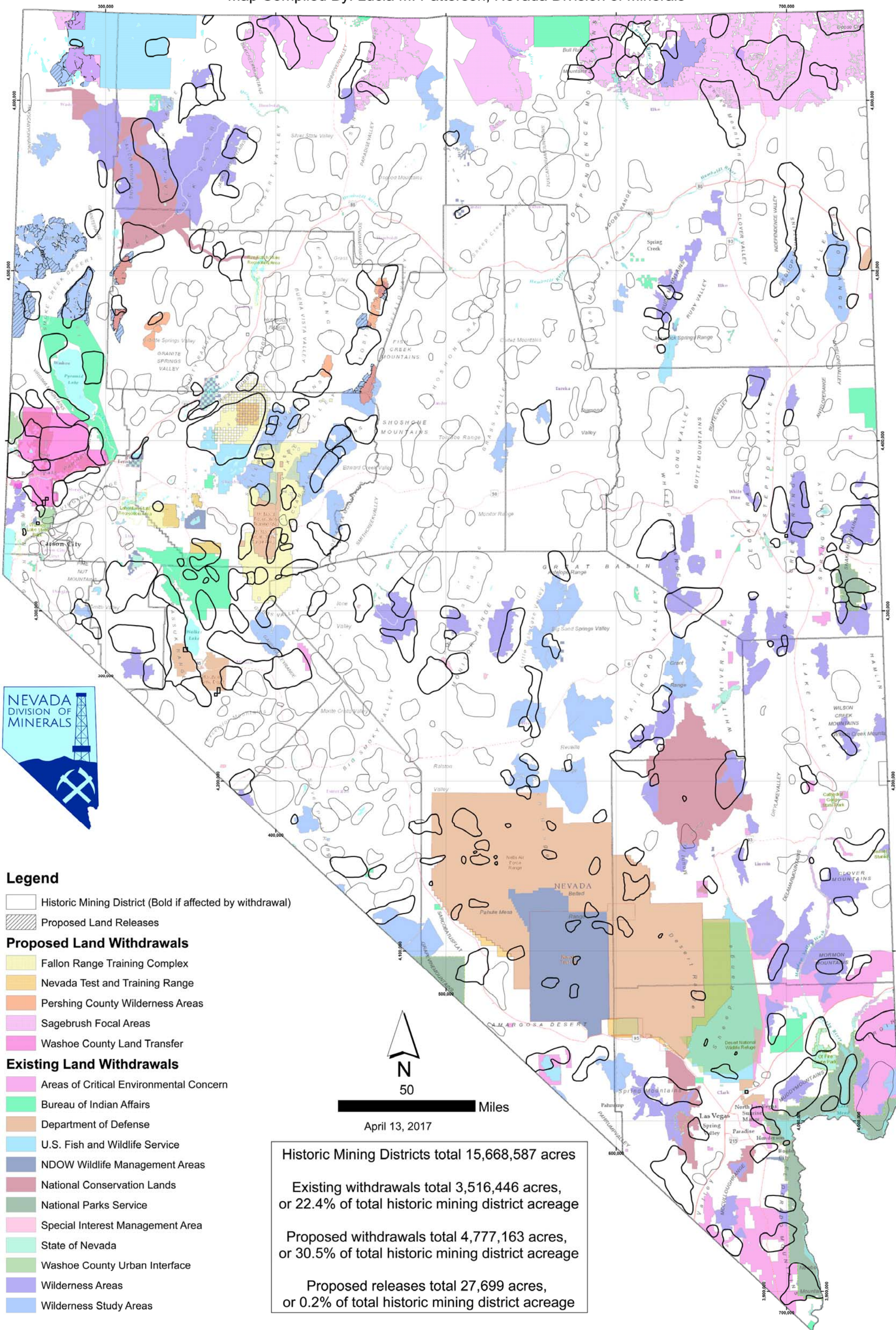
While the smelter survey would not have as many mining properties listed as the Annual Exploration Surveys conducted by the Nevada Bureau of Mines and Geology (NBMG), it would need to be more in-depth in its examination of markets for the metals. The companies that may be interested in this type of study are those that already operate smelters, or are producing concentrates in Nevada. ASARCO,

Freeport, Kennecott, Teck, and Sumitomo Metals operate smelters elsewhere. Two companies in Nevada ship concentrates, with another expected to go into production in the next two years. We estimate the cost of such a study to be inside of \$100,000, with involvement from NDOM, UNR-Mackay and the NBMG. The purpose of the study is to determine if there is a need. If the answer to that is yes, then the study could be used as a marketing document to begin a dialogue with industry.

IV. STAFF REPORTS

Map Compiled By: Lucia M. Patterson, Nevada Division of Minerals

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2010-2017

Carson City

8/17/2012-Tour in Yerington

12/11/2014

5/19/2016

11/1/2016

Virginia City

Elko

08/29/2014-Newmont LeeVile Mine

08/27/2015-Noble Energy's

Huntington

K1L Well & General Molly Mt. Hope

Reno

5/12/2010

10/19/2010

4/29/2011

7/27/2011 – Tour of Bat Cupola in VC

11/2/2011

5/03/2012- Virginia City

11/09/2012

5/03/2013- Hazen and Olinghouse

10/10/2013

05/09/2014- EP Minerals; Nevada
Cement Plant and Mine.

05/01/2015

11/05/2015-Bishop Manogue H.S.

05/04/2017-Tour of Tesla

Las Vegas

2/11/2010 – Tour of the McCaw

School of Mines - Henderson

2/07/2011 – Tour of Molycorp Mine

2/27/2012 – Searchlight Area

2/21/2013

2/14/2014- Tule Springs Park

2/24/2015

2/03/2016- Simplot Silica

3/02/2017

Battle Mountain

July 30, 2010 – Tour of Newmont Phoenix Mine

Tonopah

8/15/2013 - Solar Reserve Plant

8/16/2013 - Tonopah Mining Park

Wendover

8/25/2016- Graymont's Pilot Peak, Newmont Long Canyon Mine

