

# Anadarko



## *Willow Ridge 3-D*

### **Seismic Acquisition Program**

Uintah County and Grand County, UTAH

02/25/14



## Proposed Agenda

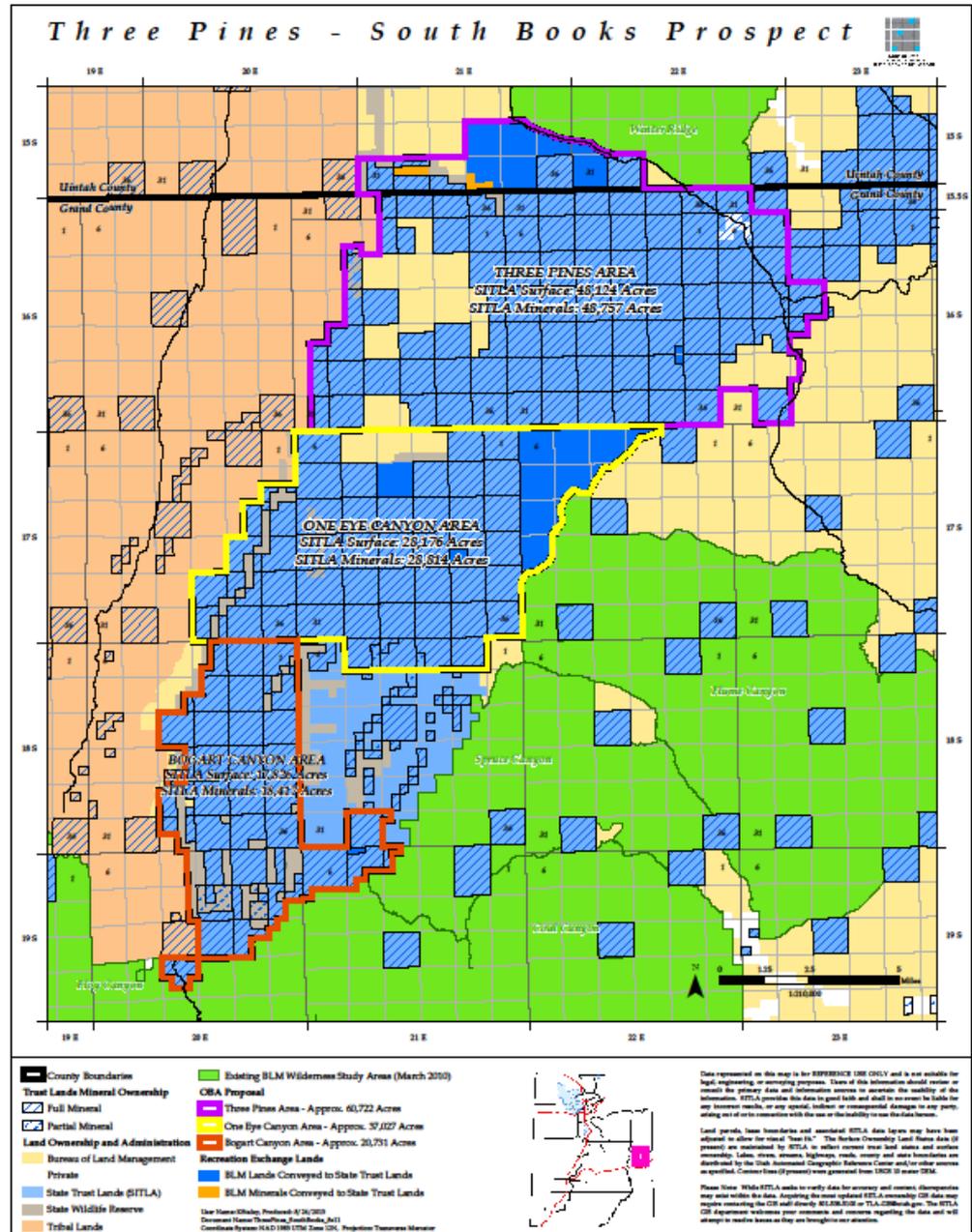
- **Three Year Work Plan**
  - Starting in One-Eye Canyon area
- **2015 Seismic Acquisition**
  - Cyclops 3-D
- **Timing**
  - Phases of Seismic Operation (survey, drilling and recording)
- **Sensitive Areas**
  - Wildlife, Hunting, Raptors, Road Access, etc...
- **Studies and Reports**
  - Bio, Arch, Paleontology, Consultations
- **Seismic Permit**
  - SITLA-issued Seismic Permit
- **Conclusions**
  - Questions and Discussion

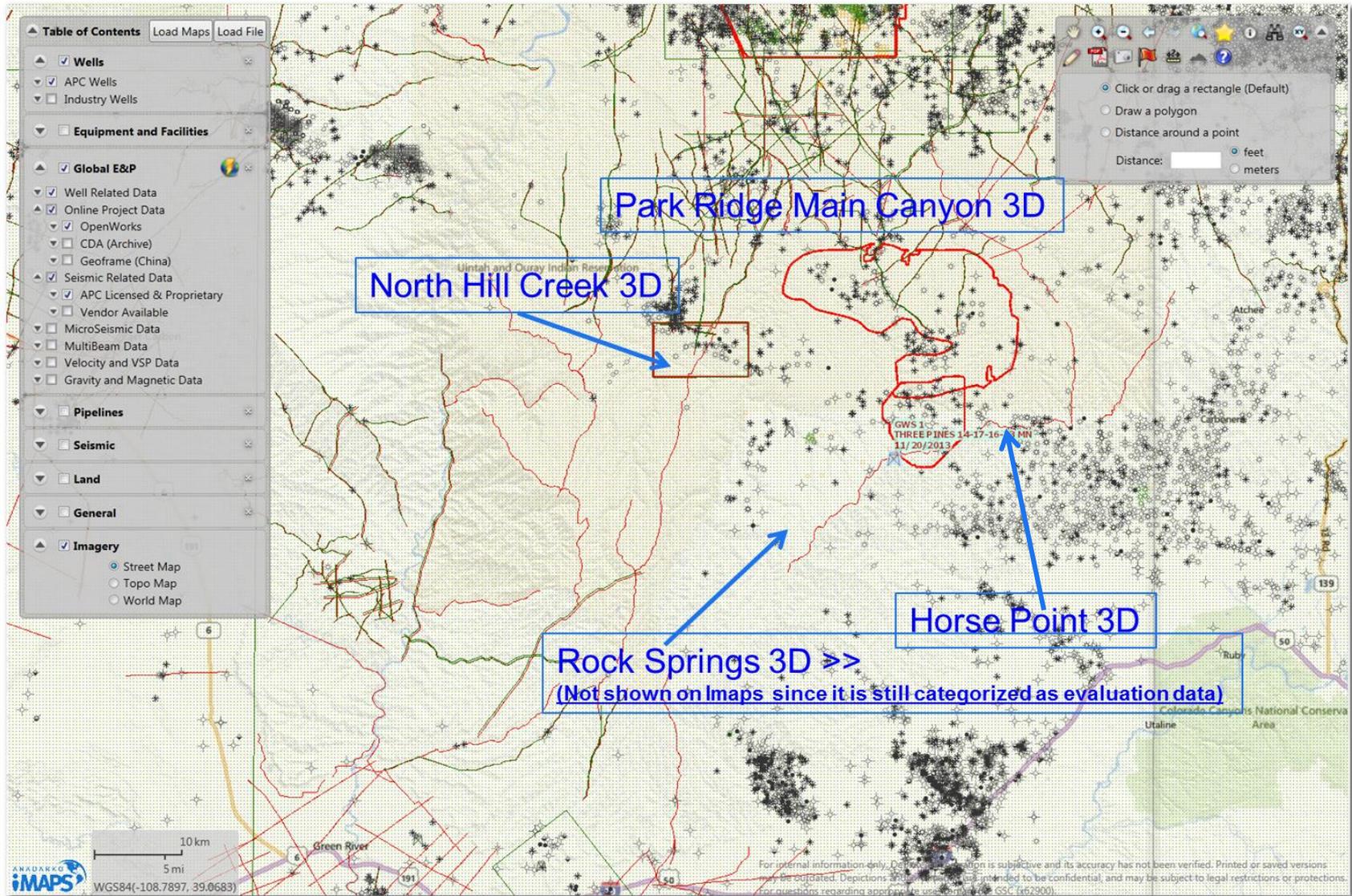


## ANADARKO Exploration

Three Pines  
One Eye Canyon  
Bogart Canyon

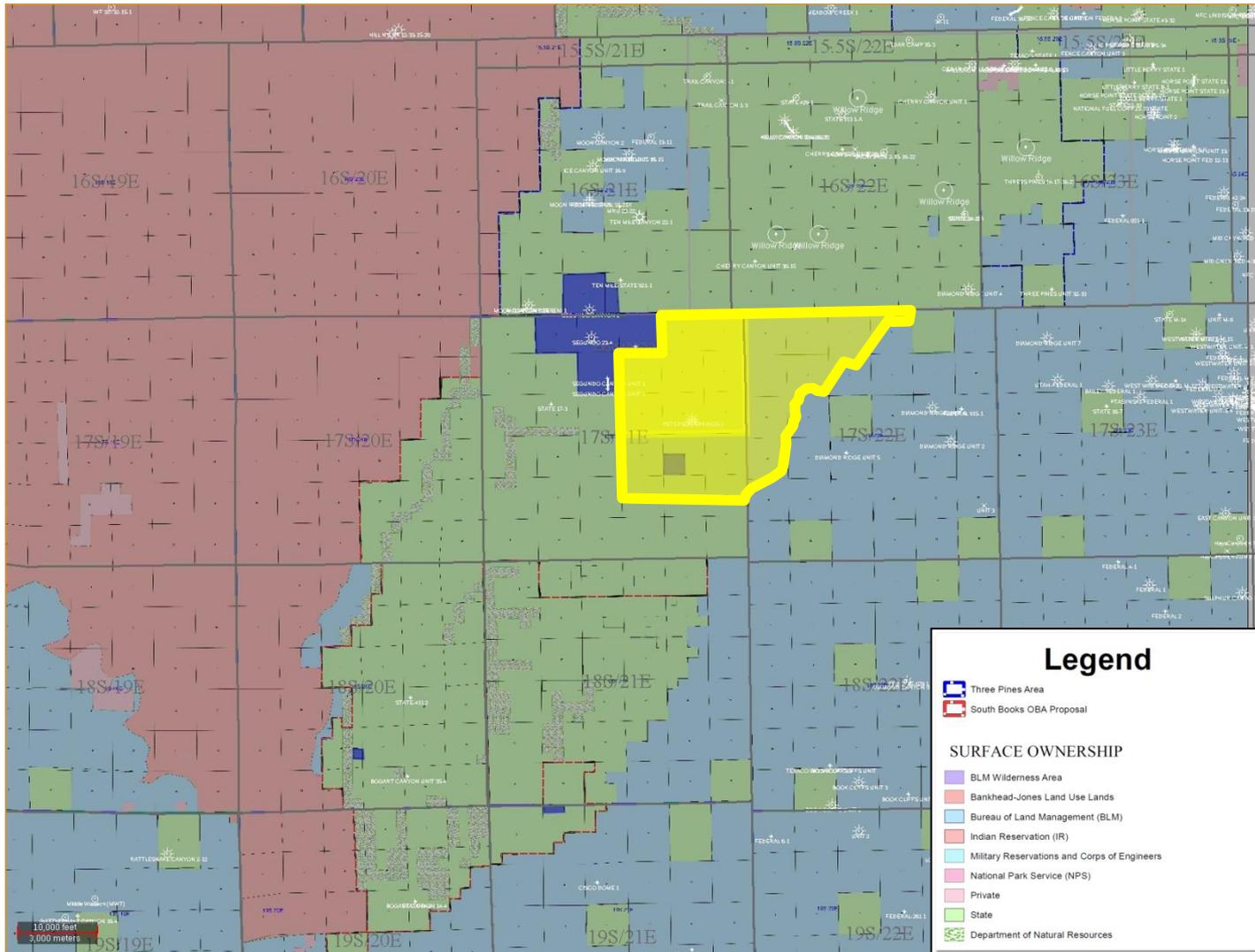
2014 – Test Drilling & Production  
2015 – 3-D Seismic, Drilling  
2016 – Additional 3-D and Drilling





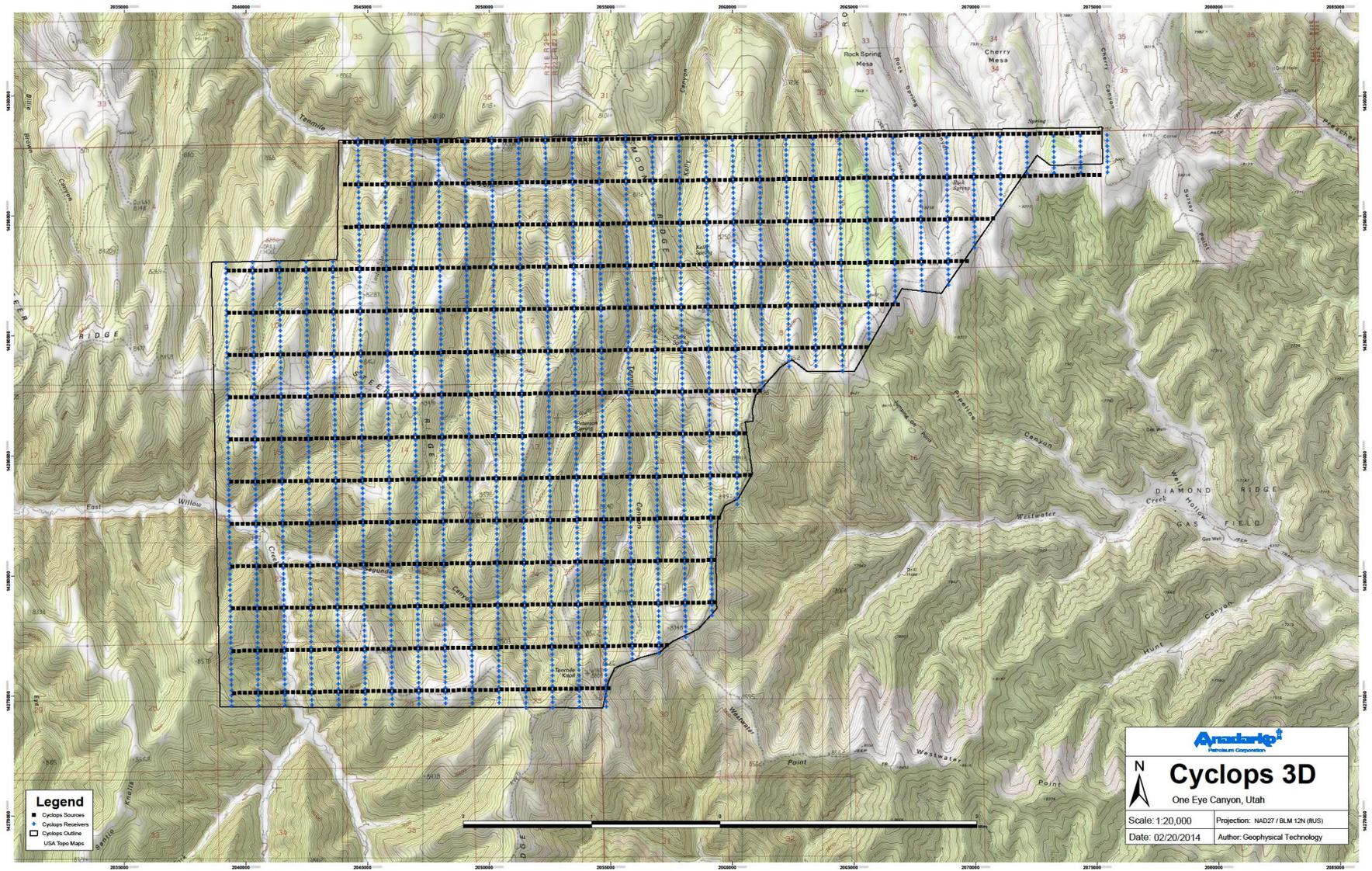
## ■ EXISTING SEISMIC

- Recorded 2000 - 2008. APC will incorporate new technology in both Acquisition and Data Processing.
- Higher Fold and Longer Offsets will improve resolution of geophysical targets.



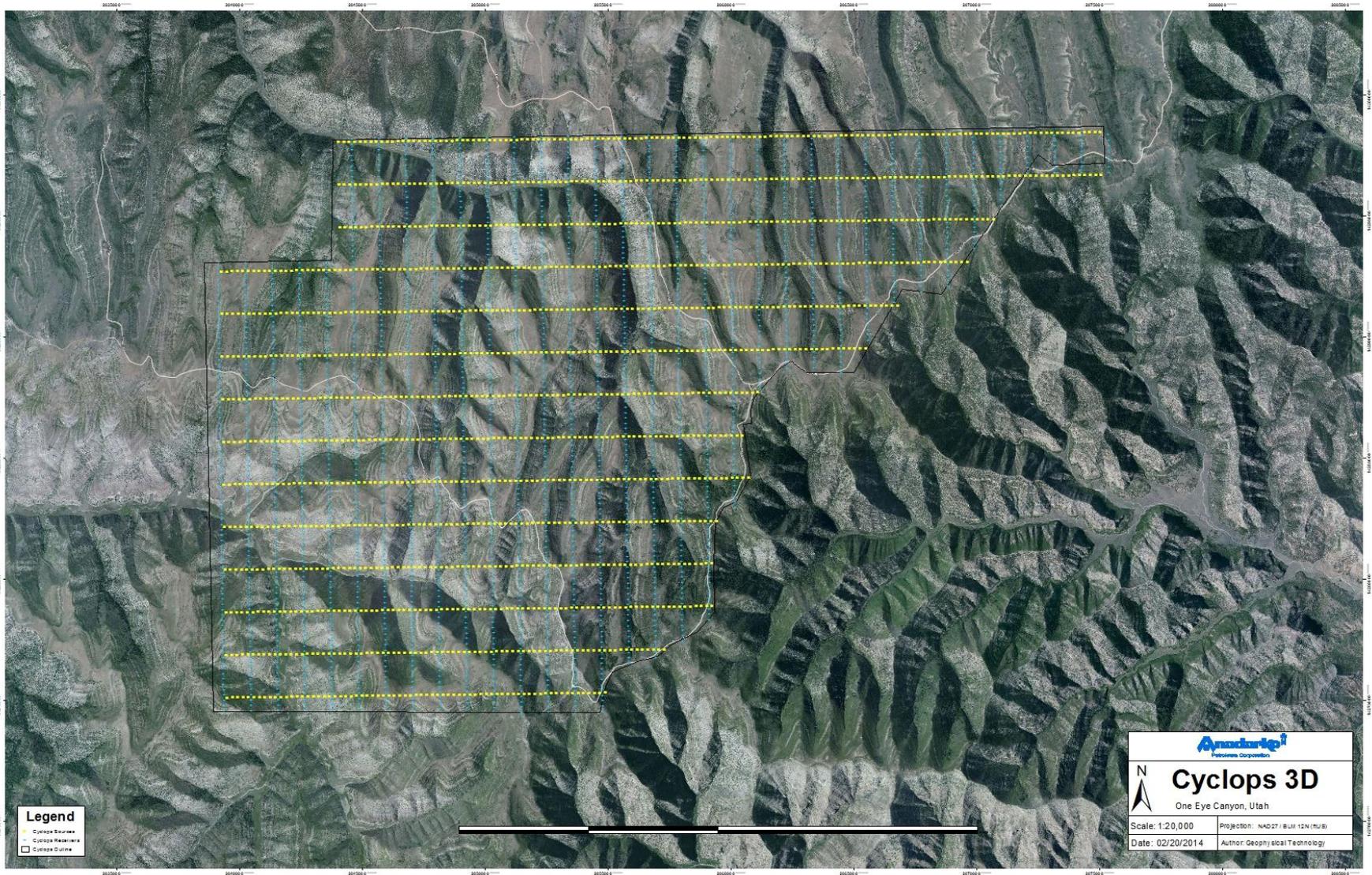
- **2015 Work Plan**

- **One-Eye Canyon** area. Seismic 3-D will be called **Cyclops 3-D** (20 squares).
- APC Work Program calls for 112 square miles 3-D over 3 years.



## CYCLOPS 3-D Topographic Map

Lighter Areas show Mesa area where vehicle access supports Buggy Drilling. Such access is needed to ensure completion in one full season.



## **CYCLOPS 3-D Satellite Photo**

1,350 shotholes and 2,344 receivers

Receiver Stations spaced 220 ft. on 1,100 ft. lines / Shotholes spaced 220 ft. on 1,760 ft. lines

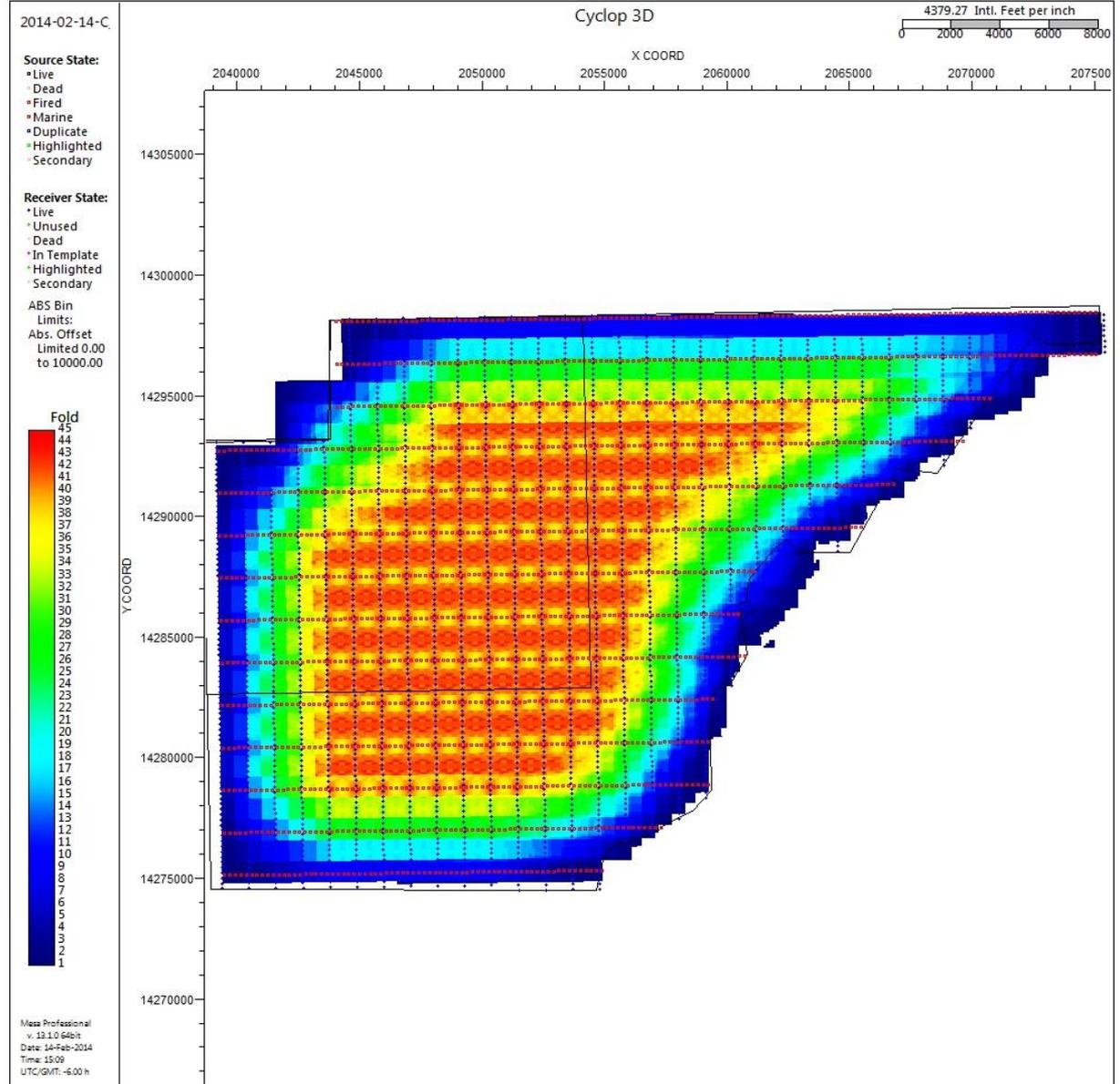


## CYCLOPS 3D

Fold at 10,000 ft

## CYCLOPS 3-D

TOTAL AREA is ~ 20 squares.  
IMAGE AREA is ~ 15 squares.





20 SQUARE MILES		<b><u>WILLOW RIDGE 3-D</u></b>												100% HELI-PORTABLE SHOTHOLE	
<b>ONE-EYE CANYON AREA</b>															
	DEC	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCT	NOV	DEC		
SEISMIC RECORDING ACTIVITY					SURVEYING		SURVEY SHOTHOLES		DRILLING	HELI-DRILL	RECORDING				
ARCHAEOLOGY PALEONTOLOGY, STUDIES					FIELD WORK REPORT	FIELD WORK REPORT									
DATA PROCESSING												FAST TRACK 3-D			
SAGE GROUSE LEK HABITAT (2 MI)															
ELK & DEER WINTER RANGE															
CRUCIAL ELK & DEER CALVING															
BULL ELK HUNTING SEASON															
BLACK BEARS IN THEIR DENS															
WHEN DOES SNOW MELT?????															

■ **Benefits of Recording Seismic in 2015**

- 3-D will be focused on 2016 drilling targets.
- This timing permits “Early Engagement” allowing time for pre-plan meetings, studies, permits.
- APC anxious to demonstrate expertise in an atmosphere of trust and understanding.

■ **Challenges of Recording Seismic in 2015**

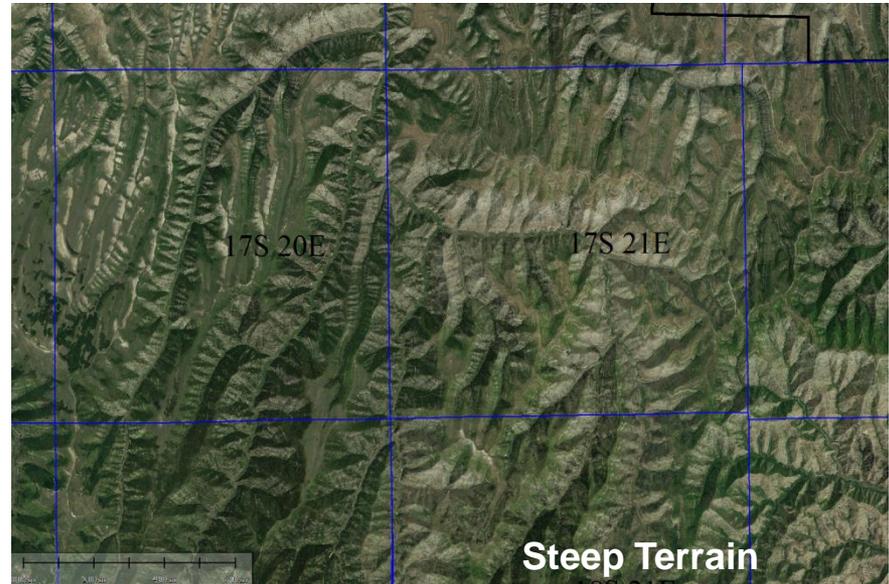
- Steep Terrain: Selection of high quality seismic contractor to carry out this 3-D will be vital.
- High elevations mean start of field studies must wait until after snow melt.
- Remoteness of location means either a seismic camp or long-distance bus transportation



# Advanced Recording Techniques



UNITE Recording Box



Steep Terrain

## ■ Issues and Answers to Recording Seismic in 2015

- Steep terrain, few roads make access difficult by vehicle.      Heli-portable      Low-Impact.
- New cable-less technology reduces recording equipment needs by 2/3's.
- “Lighter, Faster, Better” translates into significant impact mitigation.
- Traditional Cable Systems are cumbersome and dangerous.
  - *No longer necessary to connect receivers together.*
- Cable Recording was subject to devastating lightning strikes. No more.



## ■ Heli-Drilling & Recording Crew

- Heli-Operation costs >\$1,500/shothole.
- Buggy Drilling in Open Areas (“Mesa”)
- Possible Seismic Camp
- Challenge: All Ops in a single season.





## ■ Buggy Drilling

- Buggy SPs cost >\$800/shothole.
- Buggy Drilling in Open Areas (“Mesa”)
- ~33% Buggy Shotholes (450).
- ~67% Heli-Portable Shots (900).
- Advantage: More units drilling in summer..





## CONCLUSIONS

- 3-D Seismic increases chance of drilling success.
- Area's natural sensitivities must be protected.
- Anadarko has the experience to project manage this.

**Questions and Discussion**



**THANK YOU**