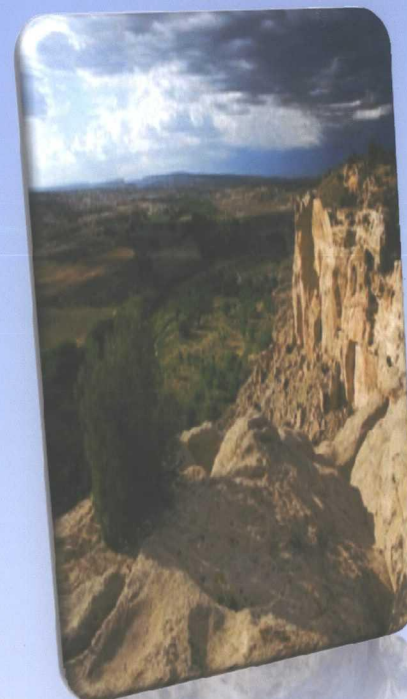
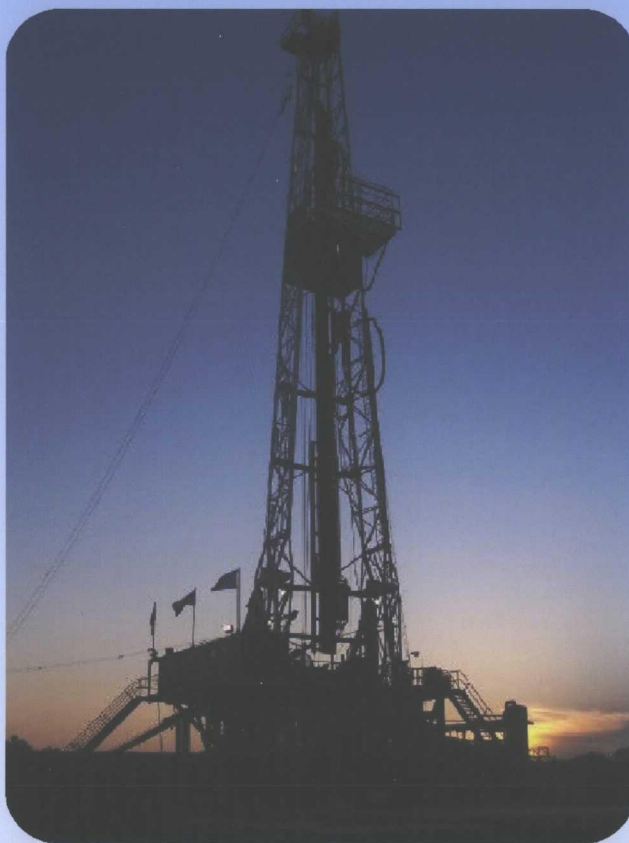


Chuza Northeast Hogback Unit Wells

State of New Mexico – Oil Conservation Division: Hearing, 07 June 2012



Chuza Oil Company: Northeast Hogback Unit Wells
Prepared by Signa Engineering Corp.

Chuza Northeast Hogback Unit Wells

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Overview

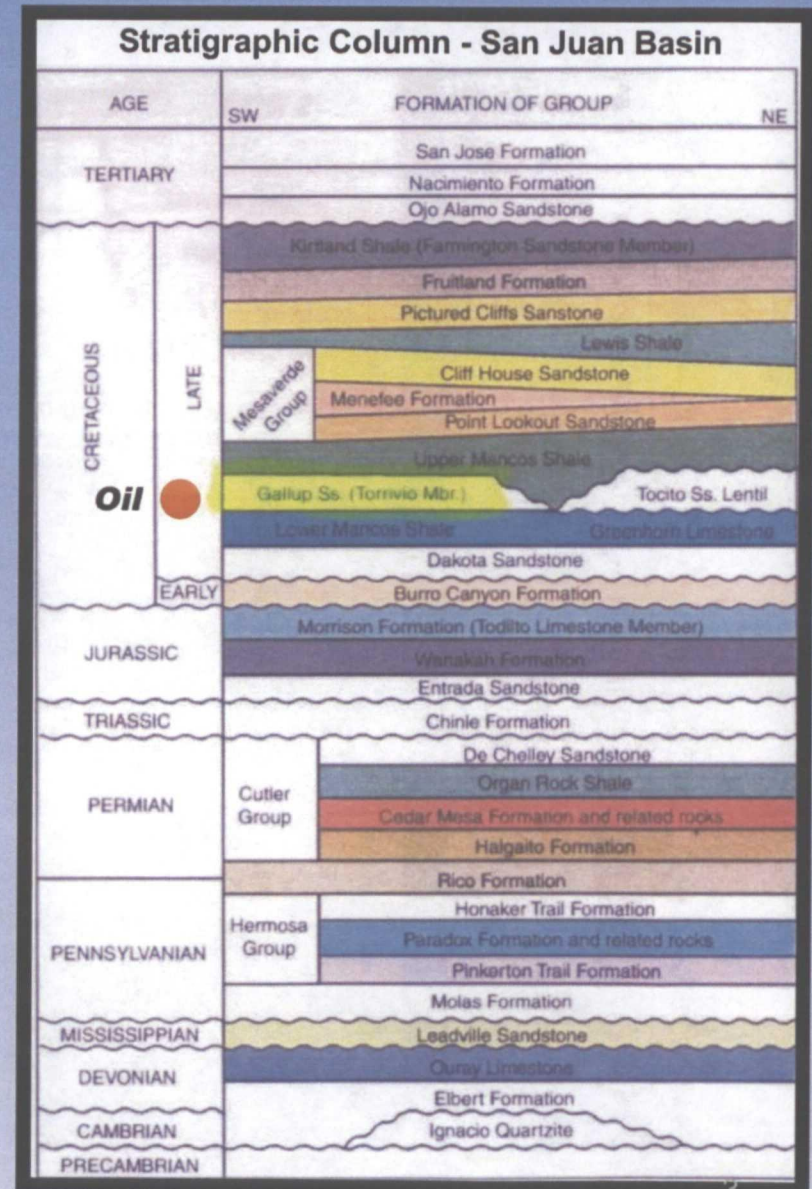
- Current Permit Details
- Project Status – Horizontal Well Plans
- Project Status – Drilling Technology
- Current Allowables
- Requested Allowables
- Conclusions

Chuza Northeast Hogback Unit Wells

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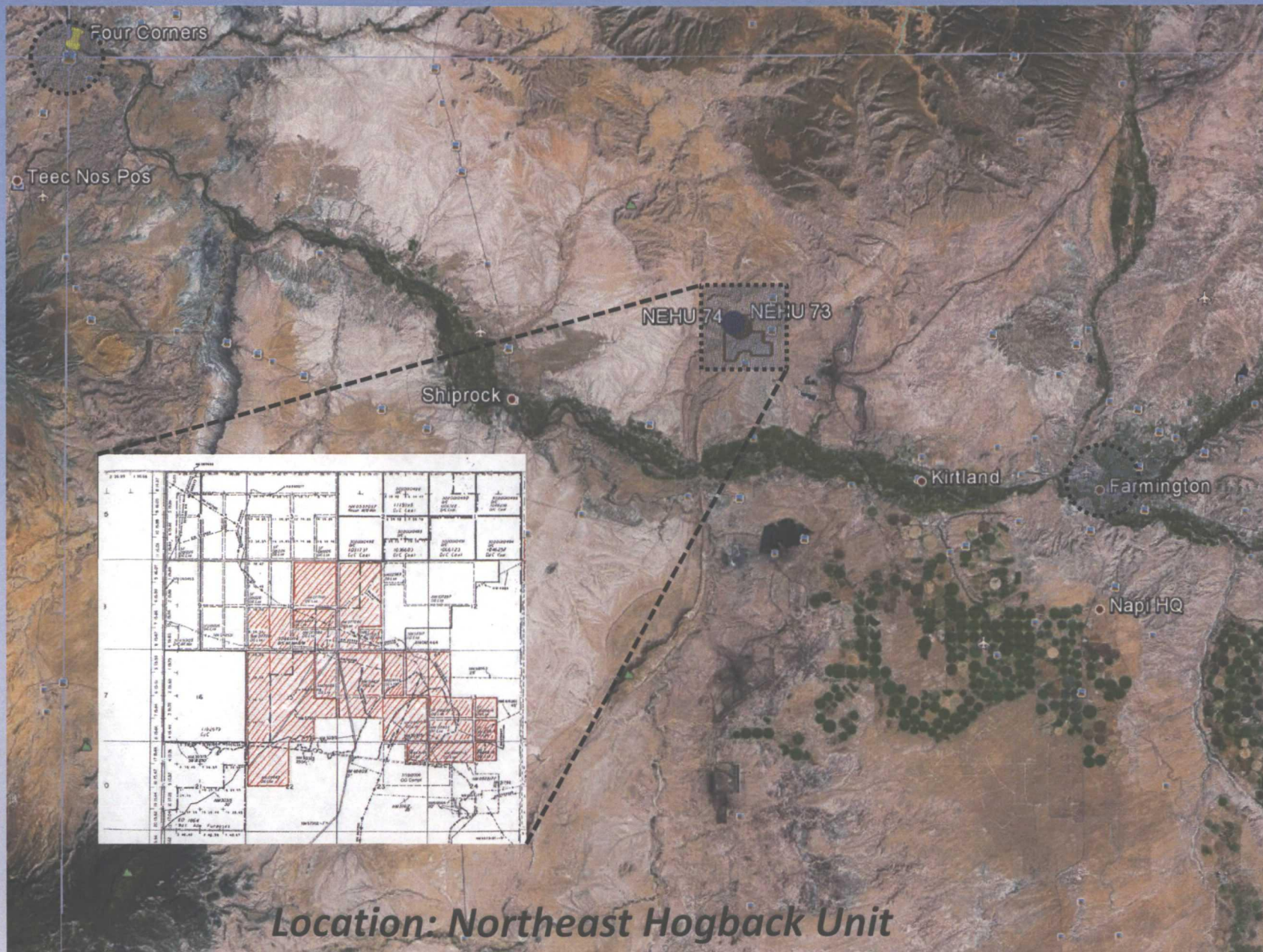
Current Permit Details

- Name of Operator: Chuza
- San Juan County, New Mexico
- Chuza has permits to drill two vertical wells in NE Hogback Unit (NEHU)
 - NEHU #73 (API #30-045-34754)
 - NEHU #74 (API #30-045-34755)
- Horseshoe Gallup Pool
- Target Formations
 - Upper Gallup Sandstone
 - Lower Gallup Sandstone



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Location: Northeast Hogback Unit

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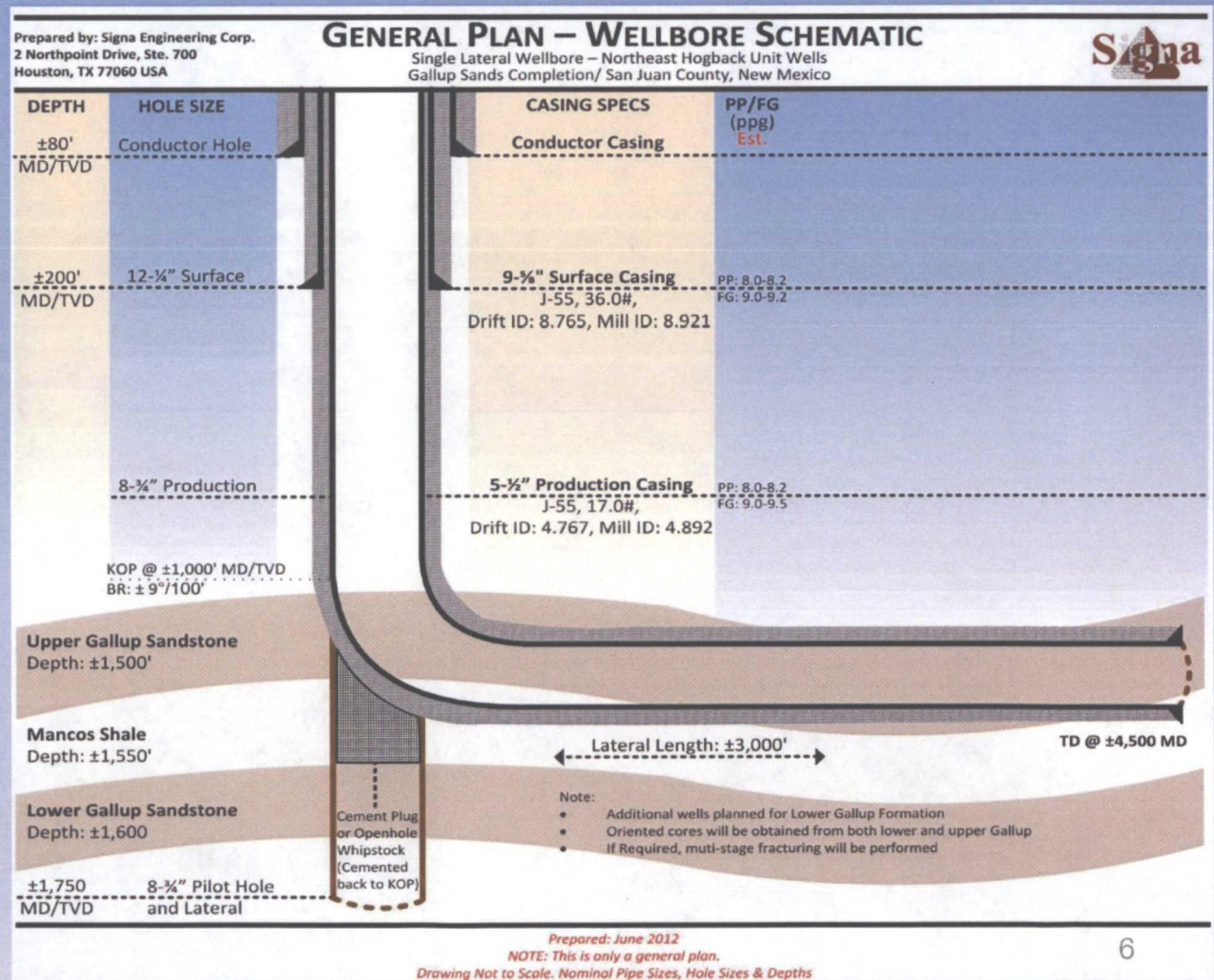
Chuza Northeast Hogback Unit Wells

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PROJECT STATUS: HORIZONTAL DRILLING WITH OPTIONAL MULTI-STAGE FRACTURING

To exploit all natural reserves in this pool, we plan to:

1. Drill multiple horizontal wells with $\approx 3,000'$ laterals
2. Drill separate wells into each of the Upper and Lower Gallup reservoirs
3. Stimulate each of these laterals with multi-stage fracturing to improve:
 - Drainage
 - Ultimate recovery
4. Drill laterals with potential for overlapping drainage



Chuza Northeast Hogback Unit Wells

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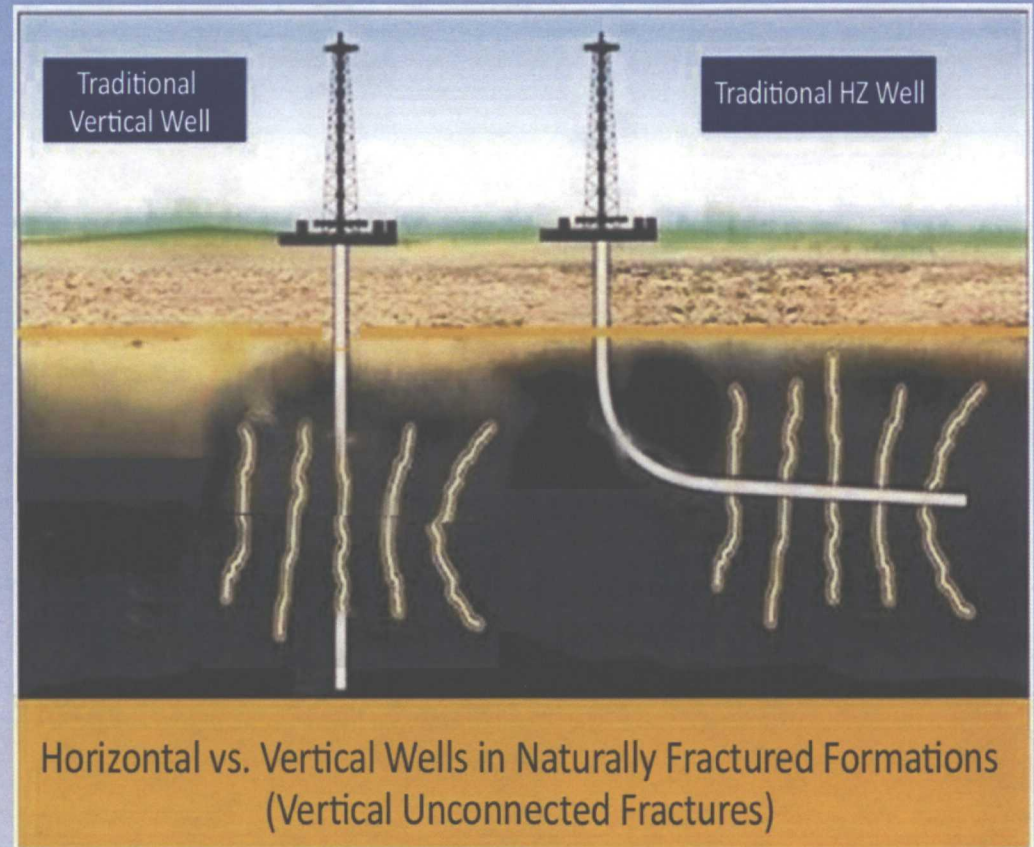
WHY HORIZONTAL DRILLING?

Vertical Drilling

- A typical vertical well can drain from one vertical fracture
- The amount of reserves recovered will depend on proximity of the wellbore in relation to the vertical fracture
- Naturally occurring fractures can be connected or isolated (Austin Chalk)
- Vertical wells do not efficiently drain unconnected fractures in tight formations

Horizontal Drilling

- A horizontal well (compared to a vertical well) can typically connect multiple unconnected fractures, resulting in:
 - Higher initial and total production
 - Higher ultimate reservoir recovery
 - Less reservoir/artificial energy requirement for an equivalent hydrocarbon production
 - Not exhausting reservoir energy needlessly
 - Makes drilling in marginal fields **ECONOMIC**



Chuza Northeast Hogback Unit Wells

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WHY MULTI-STAGE FRACTURING?

FRACTURE STIMULATION

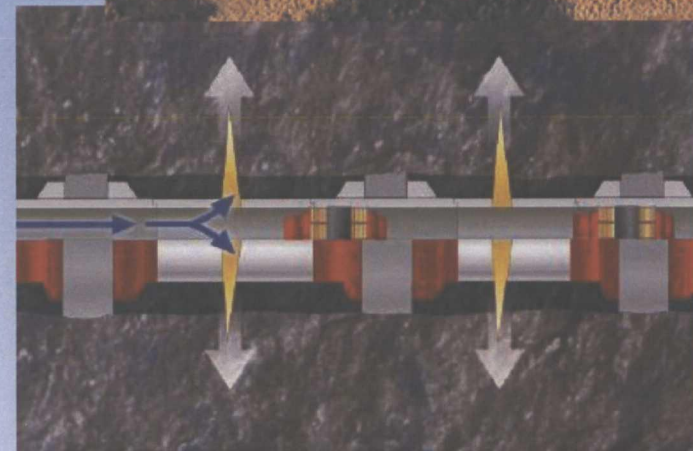
- Fracturing improves the permeability of the formation, effectively increasing the drainage radius
- Key fracture components: Length, width, height, and amount of proppant contained

MULTI-STAGE FRACTURING

- Helps to create a web of spaced isolated fractures only connected via the lateral
- Helps drain the reservoir more efficiently when properly spaced
- Increases ultimate hydrocarbon recovery
- Minimizes reservoir energy depletion

NEHU STIMULATION: MULTI-STAGE FRACTURING

- If needed, each horizontal well will be fracture-stimulated in an attempt to maximize the ultimate hydrocarbon recovery
- Adequate fracture spacing: $\approx 250'$ to $500'$ between the zones will be provided
- Each zone will be isolated with packers to help generate big web of isolated fractures only connected by the horizontal lateral



Chuza Northeast Hogback Unit Wells

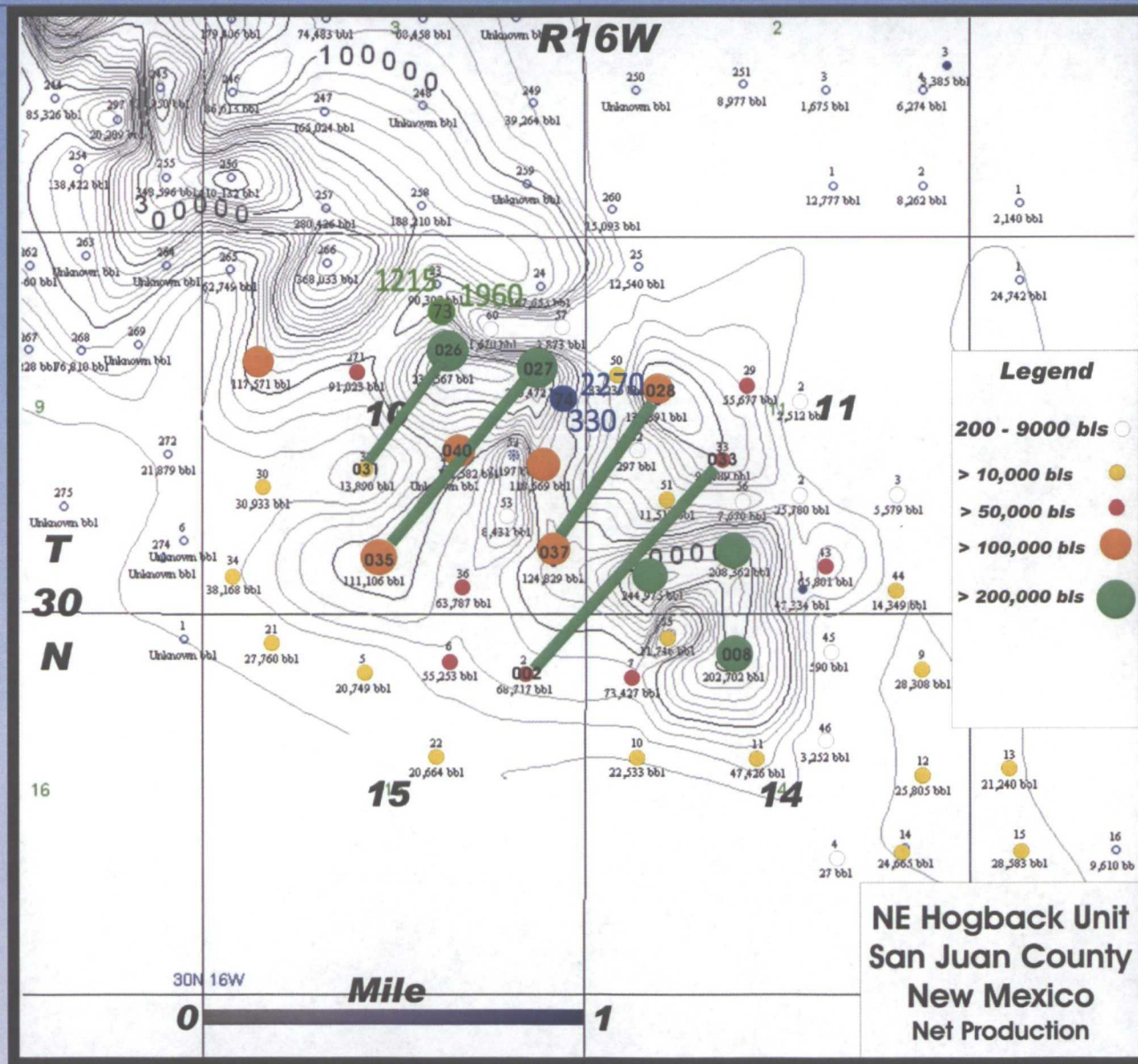
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Drilling Plan Overview

- **Logging:** Entire well will be logged using quad-combo log
- **Coring:** Oriented cores will be taken from the Mancos and the Gallup Formations in $\approx 50'$ sections from both upper and lower reservoirs
- **Drilling Fluid:** 8.4 ppg to 9.0 ppg drilling fluid will be used
- **Stimulation:** If needed, multi-stage fracture stimulation will be performed on each well to improve ultimate recovery
- **Tubulars:** Tubulars with sufficient safety factors will be used
- **Completions:** Open-hole completions with packers will be deployed

Chuza Northeast Hogback Unit Wells

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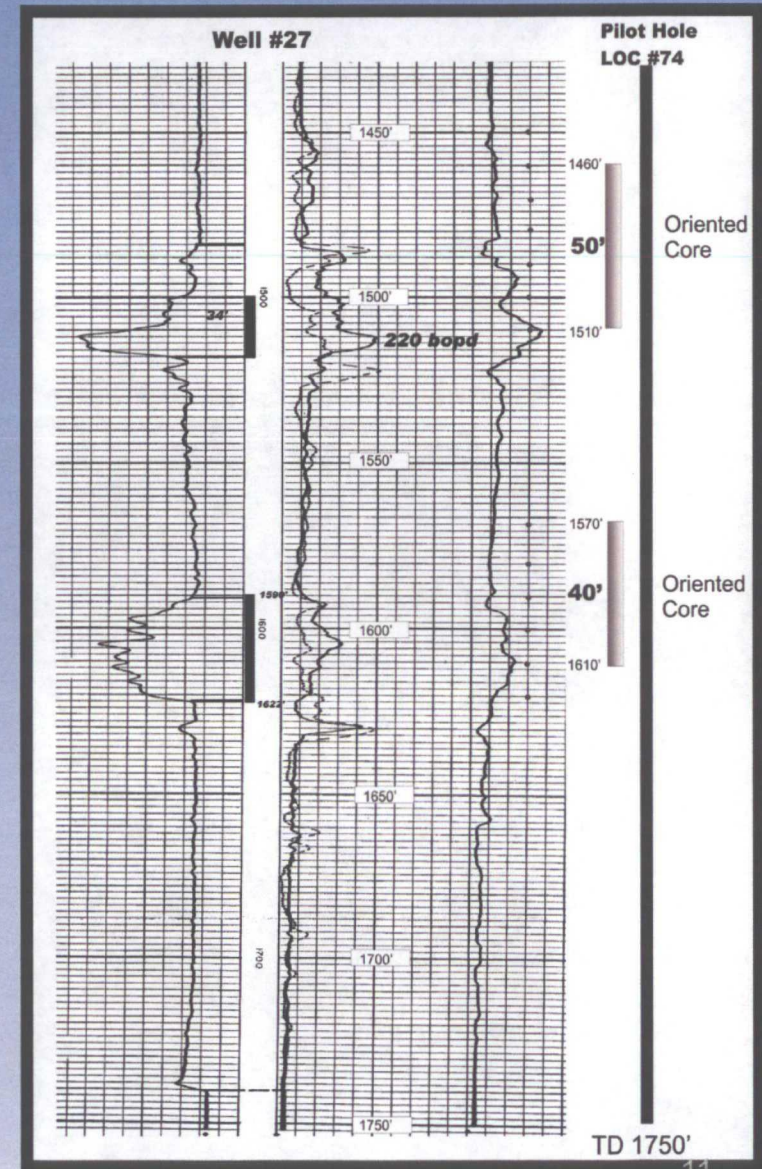
Well Location Map

Chuza Northeast Hogback Unit Wells

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Coring

- Two oriented cores $\approx 50'$ length will be obtained from Upper and Lower Gallup formations
- Coring will begin in the Mancos formation prior to the Upper Gallup formation
- The oriented core will be analyzed to determine:
 - The plane of least principal stress and maximum principal stress
 - If there is a sweet spot of high porosity that we need to hit
 - The makeup of the natural fractures (orientation, density, fracture type [macro or micro])
 - Water saturation, fluid compatibility, oil in place, permeability and compressive strength
 - If fracture stimulation is required



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Current Allowables

POOL DEPTH RANGE	DEPTH BRACKET ALLOWABLE		
	<u>40 Acres</u>	<u>80 Acres</u>	<u>160 Acres</u>
0 to 4999 feet	80	160	
5000 to 5999	107	187	347
6000 to 6999	142	222	382
7000 to 7999	187	267	427
8000 to 8999	230	310	470
9000 to 9999	275	355	515
10,000 to 10,999	320	400	560
11,000 to 11,999	365	445	605
12,000 to 12,999	410	490	650
13,000 to 13,999	455	535	695
14,000 to 14,999	500	580	740
15,000 to 15,999	545	625	785
16,000 to 16,999	590	670	830
17,000 and deeper	635	715	875

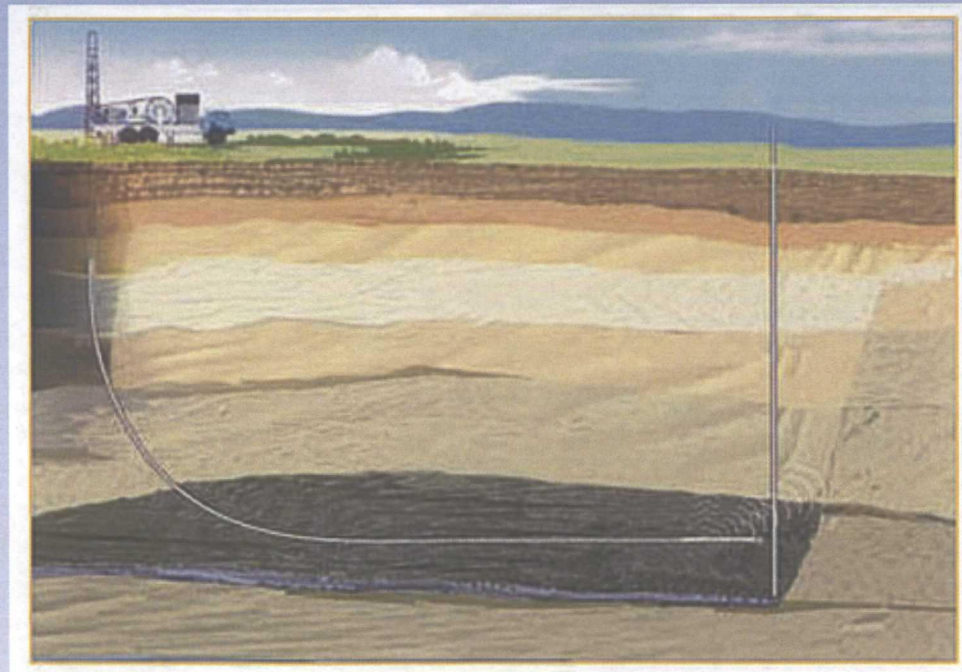
- *Currently 80 bbls/day based on 40-acre spacing*

Chuza Northeast Hogback Unit Wells

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Requested Allowables: Project Status

- **Increased Drainage Area:** Each horizontal lateral will cross additional acres compared to a vertical well
- **Connecting Virgin Fractures:** When virgin unconnected fractures are connected with a new horizontal well in a tight formation, the initial and total production will increase significantly
- **Coring:** When the cores from the Gallup formation are analyzed, significant information about the reservoirs will be known, including fracture stimulation requirements
- **Optional Fracture Stimulation:** If there is a need for well stimulation, multi-stage fracture treatment will be done on all required laterals



Chuza Northeast Hogback Unit Wells

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Additional Information

- There are no special pool rules for the Horseshoe Gallup Oil Pool (Statewide oil spacing and daily oil allowable rules apply)
- Chuza sent certified letters to all operators in this pool
- The terminus will not be closer than 330' from boundary of project area
- The majority of drilling services will be done by local personnel familiar with the Farmington, NM area
- If available, fracture mapping w/ micro seismic will allow more precise drilling and geo-steering

Chuza Northeast Hogback Unit Wells

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Conclusions: 1 – General

- Typical Horizontal Well (as opposed to vertical well)
 - Connects multiple fractures (connected and/or unconnected)
 - Makes drilling in marginal fields economic, and economic fields profitable
 - Requires less reservoir/artificial energy for an equivalent hydrocarbon production
 - Results in higher initial and total production, and higher ultimate reserves recovery
- Multi-Stage Fracturing
 - Improves the permeability of the formation, effectively increasing the drainage radius
 - Helps to create a web of spaced isolated fractures only connected via the lateral
 - Helps to drain the reservoir more efficiently
 - Increases ultimate hydrocarbon recovery
 - Minimizes reservoir energy depletion
- Science
 - Oriented Cores
 - Horizontal Drilling
 - Multi-Stage Fracturing

Chuza Northeast Hogback Unit Wells

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Conclusions: 2 – NEHU

- Horizontal Drilling with optional Multi-Stage fracturing has the potential:
 - To Efficiently produce the Northeast Hogback Unit reserves with high ultimate recovery
 - To Revitalize the NEHU field/pool charging up the old depleted fractures
 - To Increase initial production (IP) and total production significantly
 - Not To Needlessly deplete reservoir energy
 - Not To Leave behind reserves that cannot be economically recovered
- Local / Revenue
 - More revenue to the STATE
 - Increase (or revitalize) oilfield-related commerce in Farmington
 - Maximum utilization of local knowledge base. (Majority of services are being used from this area because of the local knowledge base. This will provide sustained employment to the locals.)
- With current allowable restriction, maximum daily production will not be possible – making this entire exercise (horizontals, science, and multi-stage fracturing) uneconomic
- Hence, “Special Project Permit Status” and “Increased Allowables” are keys for economic success in NEHU