# New Operational Techniques in $CO_2$ EOR

Chris Cordaro
Hess Corporation

Presented at the 19th Annual $CO_2$ Flooding Conference

December 11-13, 2013

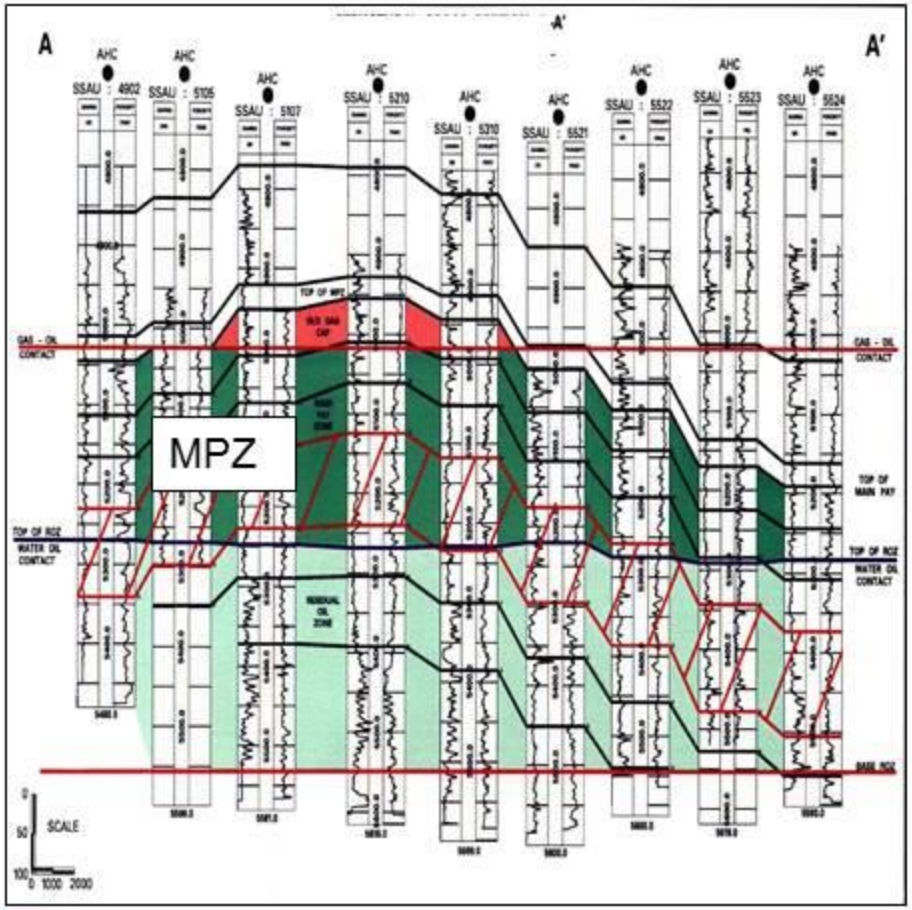
Midland, Texas

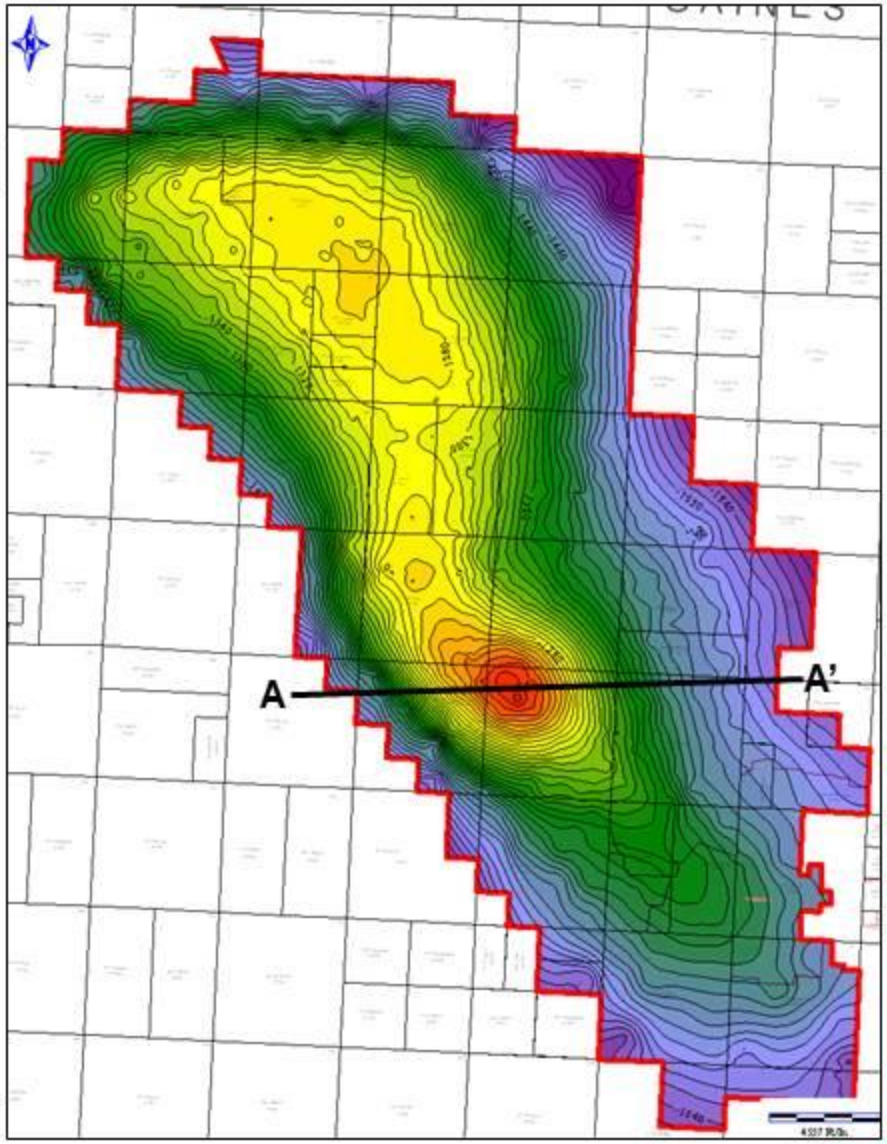
# CONVENTIONAL $CO_2$ DEVELOPMENT

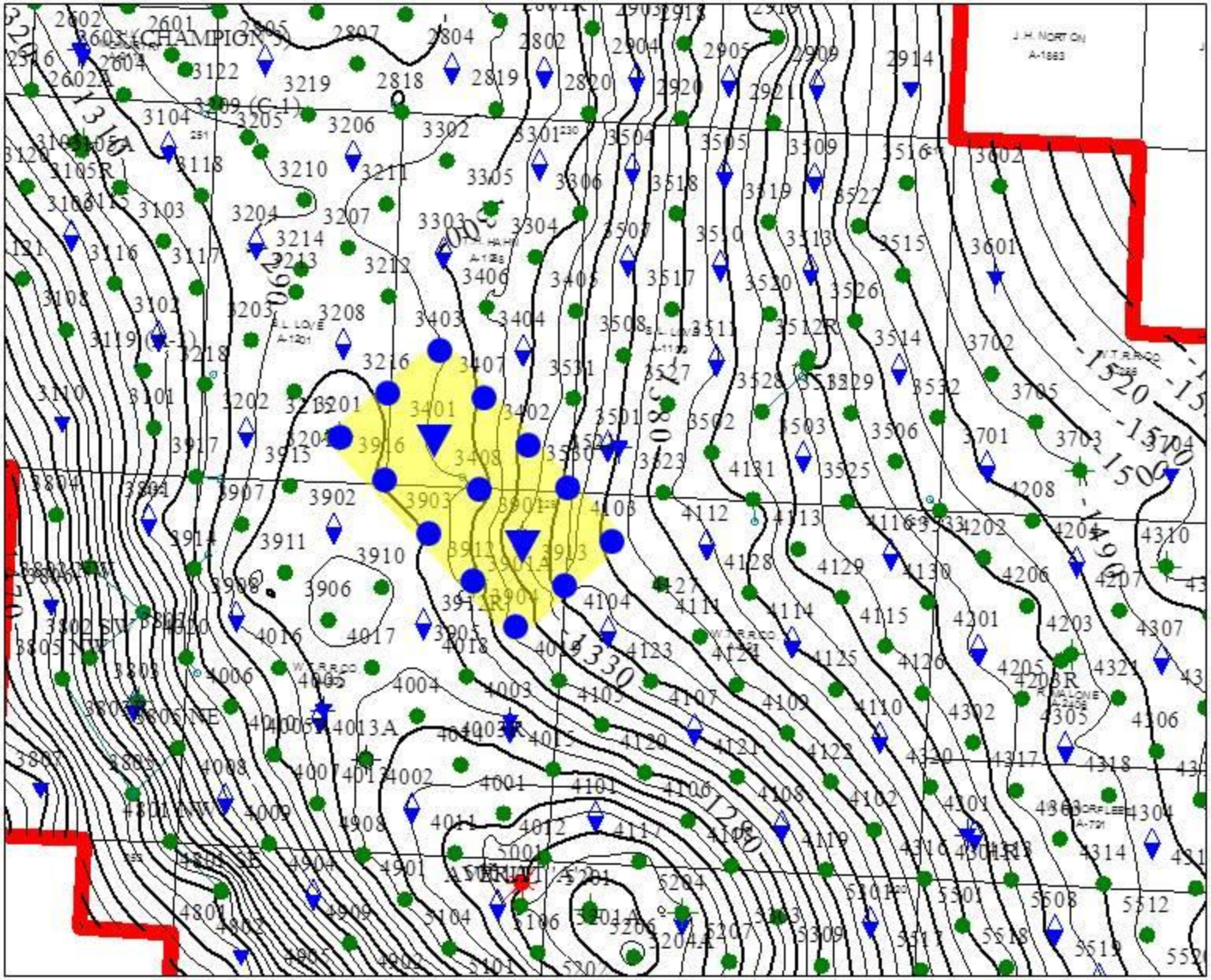
- Completions isolated to one zone
- Injection intervals correspond to producing intervals
- Established pattern configurations
- Pattern analysis is relatively straight-forward

# SSAU RESERVOIR

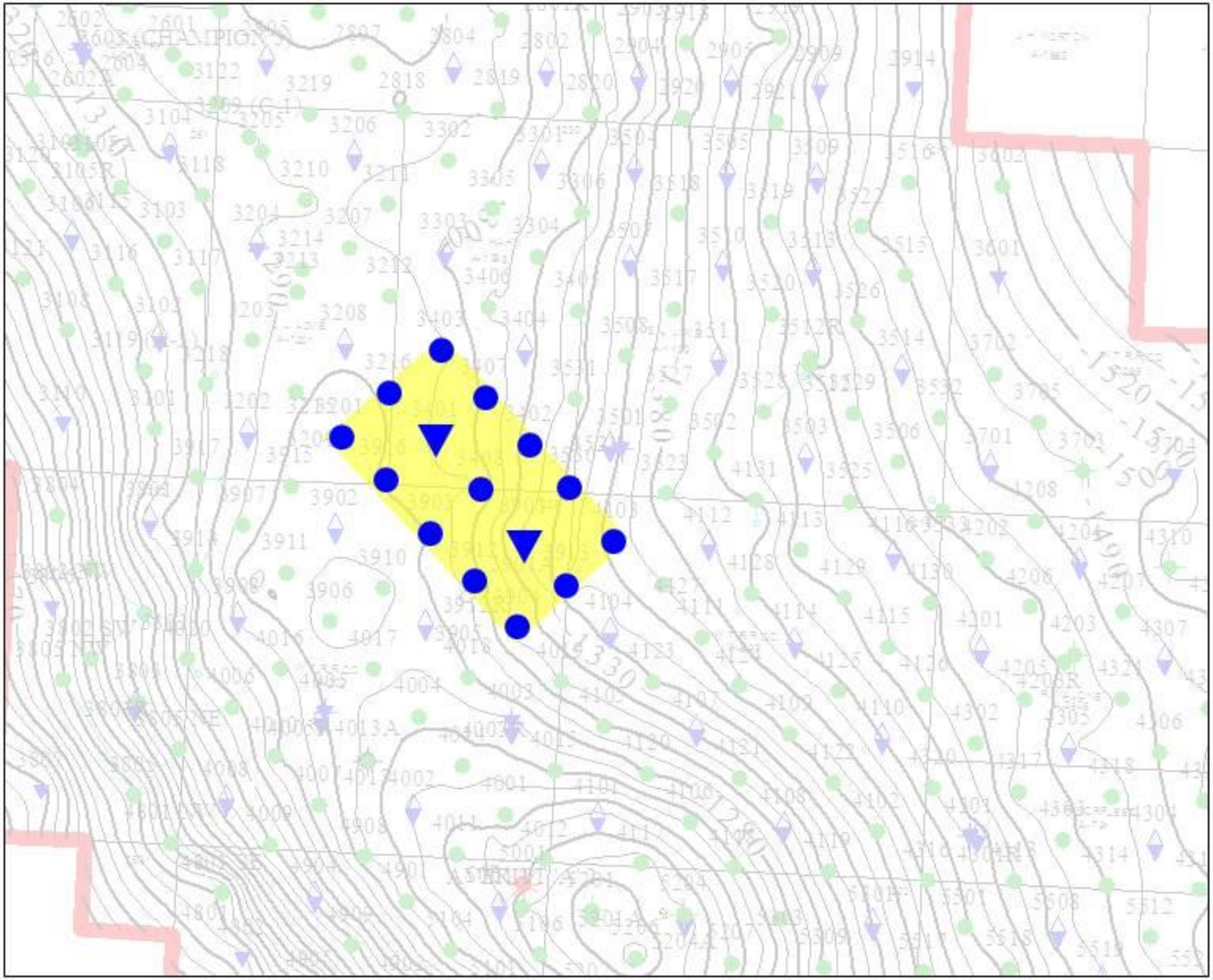
| | Net Thickness | Average Permeability |
|---|---|---|
| Main Pay Zone (MPZ): | 126' | 9 md |



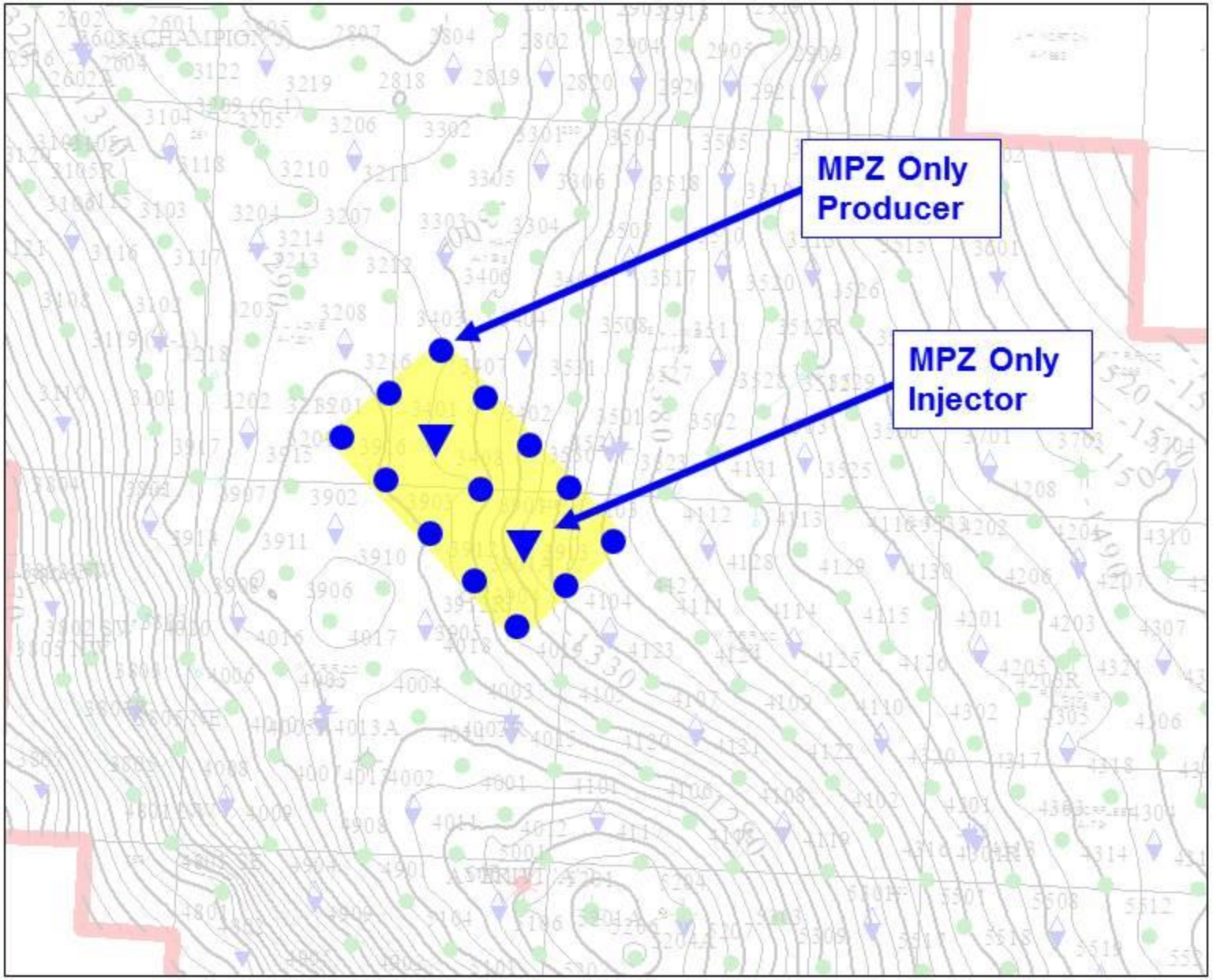




(CHAMPION)
J. H. NORTON
A-1883
-1520
-1500
-1490
-1330
-1280

# MPZ INVERTED 9-SPOT PATTERN

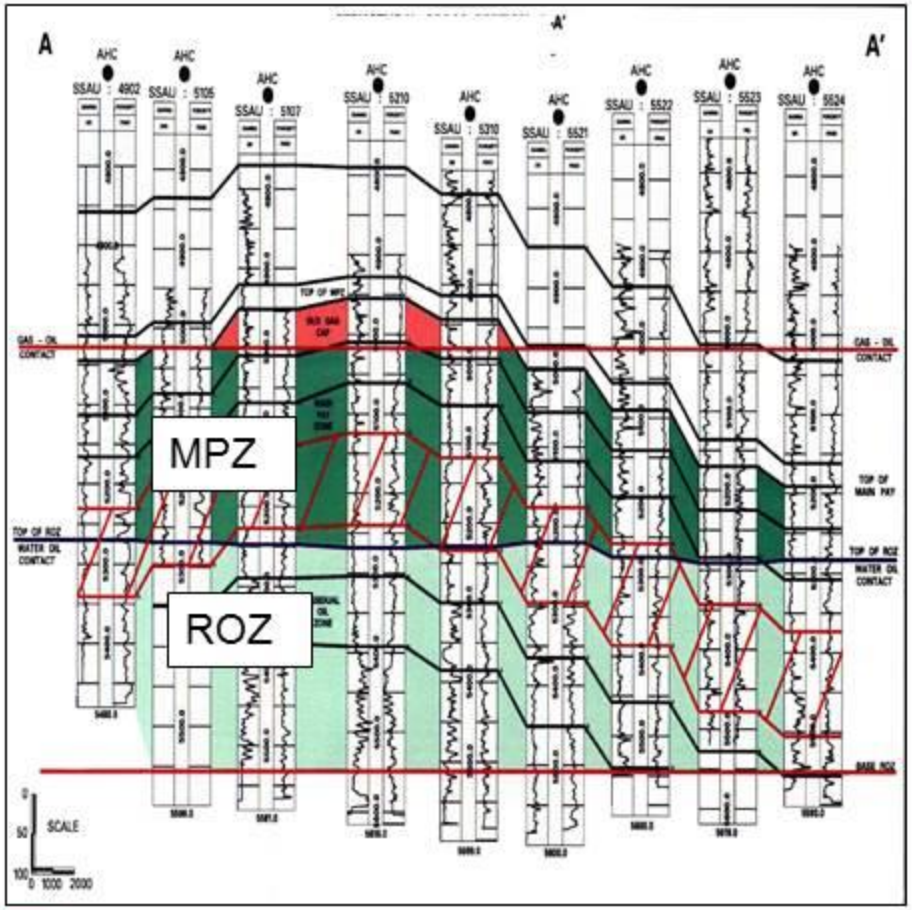


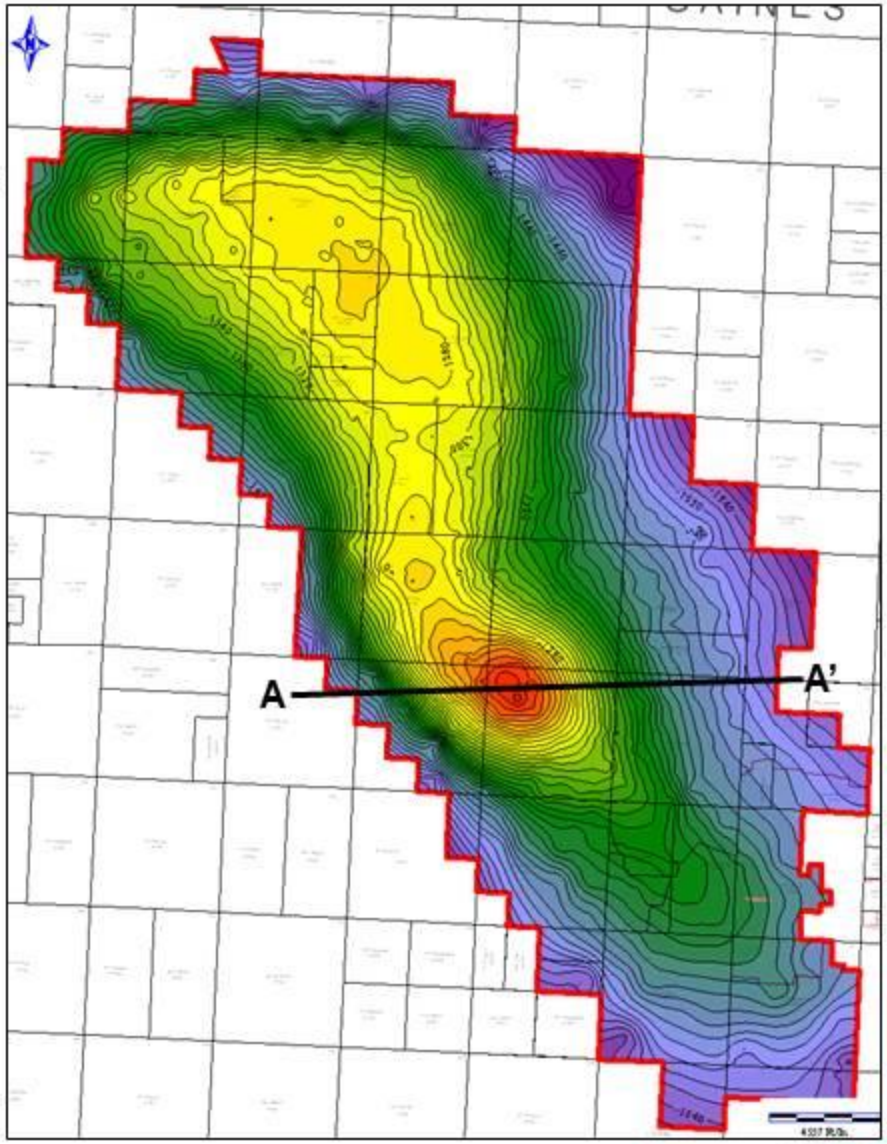
# MPZ INVERTED 9-SPOT PATTERN



# SSAU RESERVOIR

| | Net Thickness | Average Permeability |
|---|---|---|
| Main Pay Zone (MPZ): | 126' | 9 md |
| Residual Oil Zone (ROZ): | 213' | 12 md |




HESS

# WELLBORE AVAILABILITY

- Drill New Wellbore

  Pro's: Good cement and casing integrity

  Cased-hole completion

  Con's: $$$$

  Requires drilling rig

- Recomplete Existing Wellbores

  Pro's: More economical

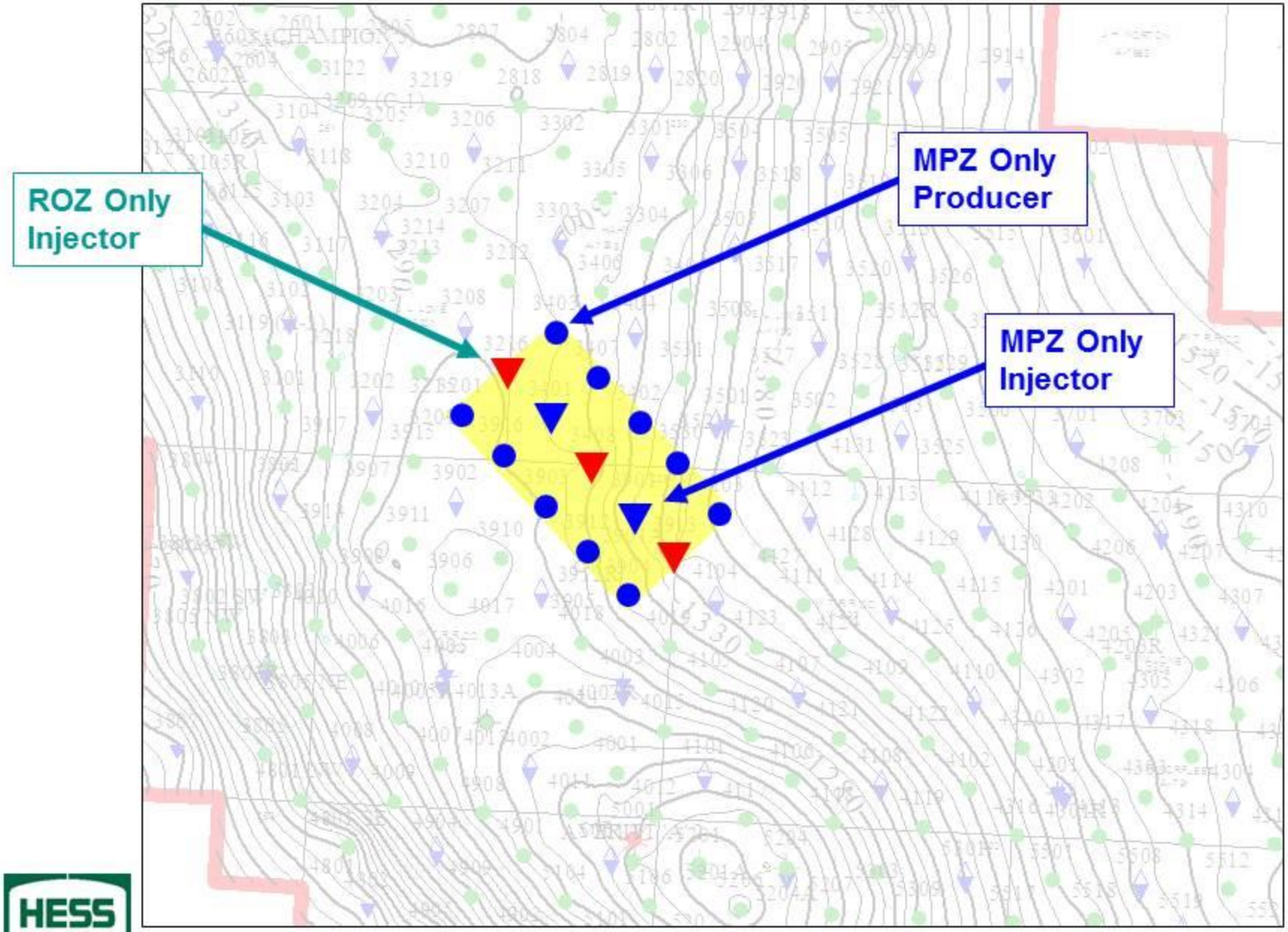
  Faster development

  Con's: Cement and casing integrity

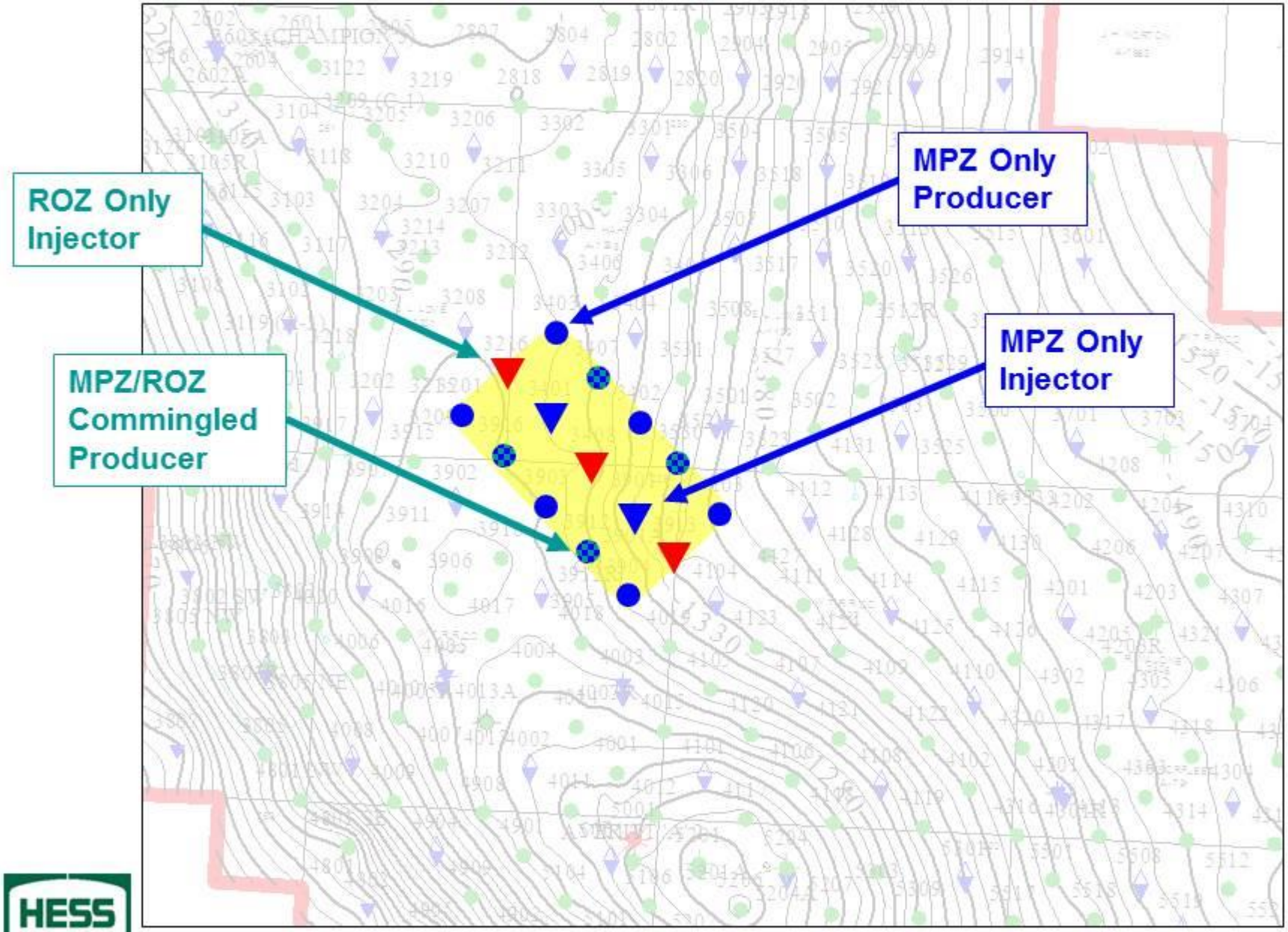
  Less control on completions

HESS

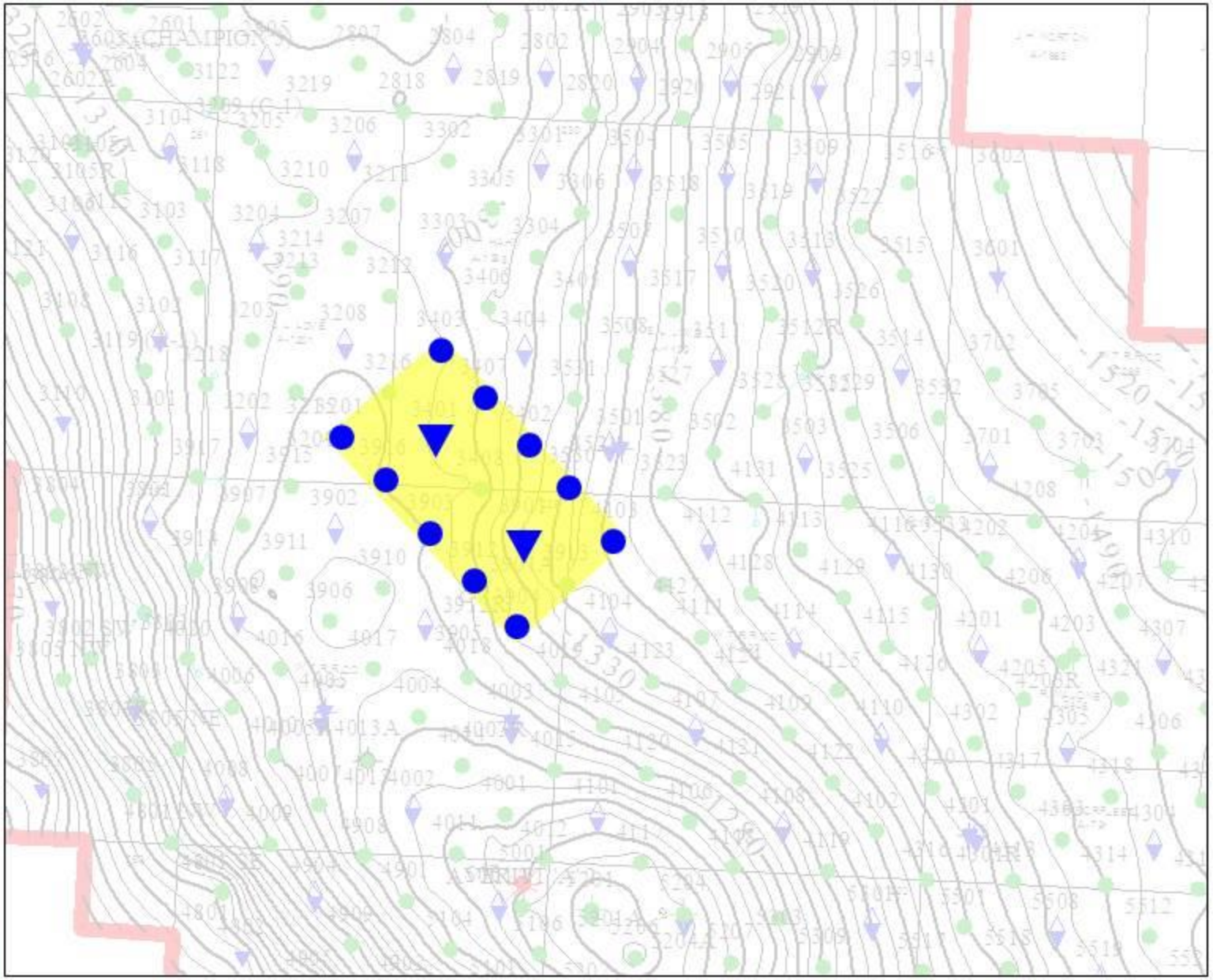
# ROZ CONVERSIONS FROM MPZ PRODUCER TO ROZ INJECTOR



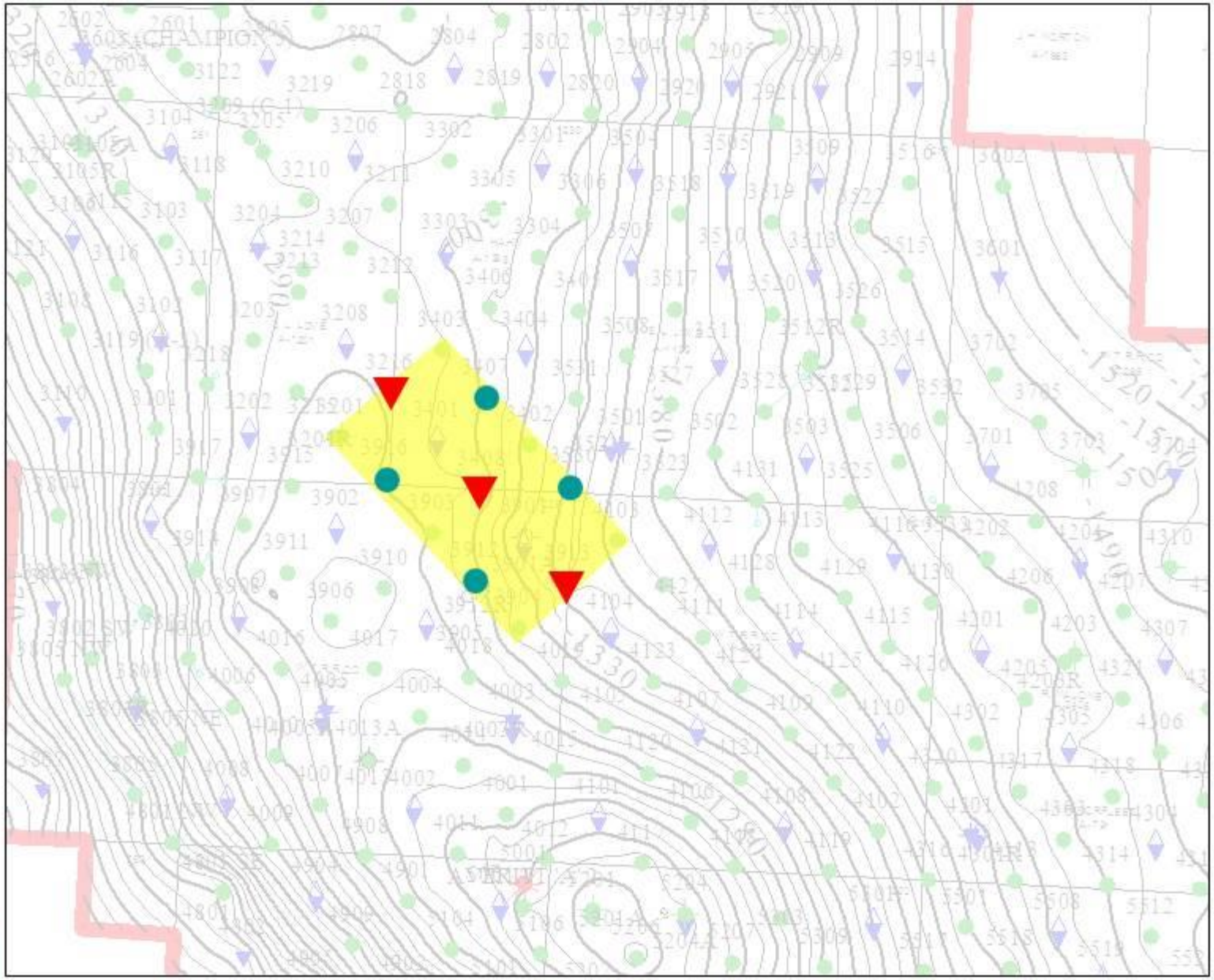
# MPZ/ROZ COMMINGLED PRODUCERS



# END RESULT MPZ - 2:1 SEMI-LINE DRIVE

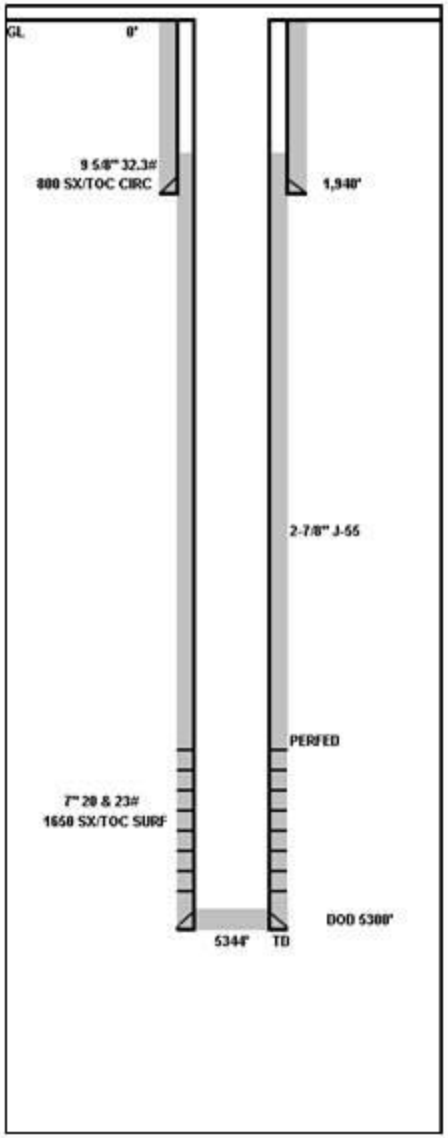


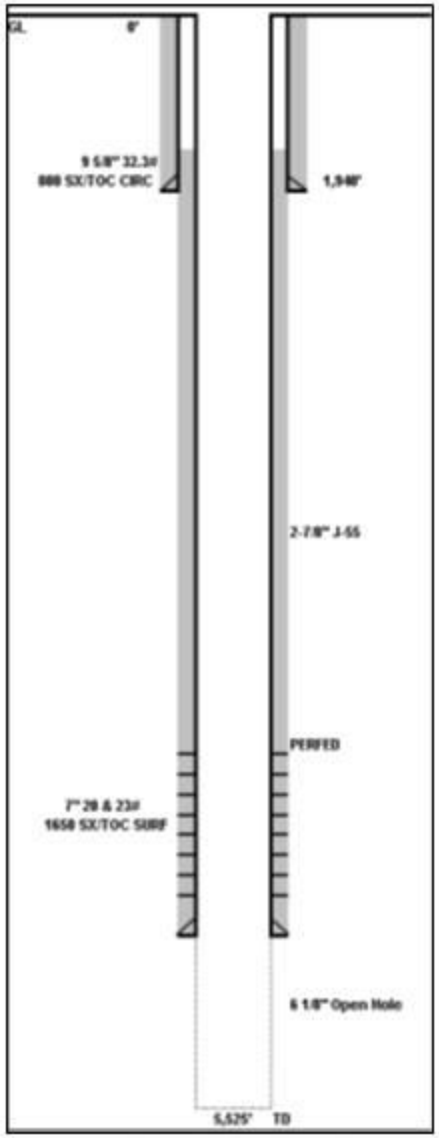
# END RESULT ROZ - 5-SPOT PATTERN



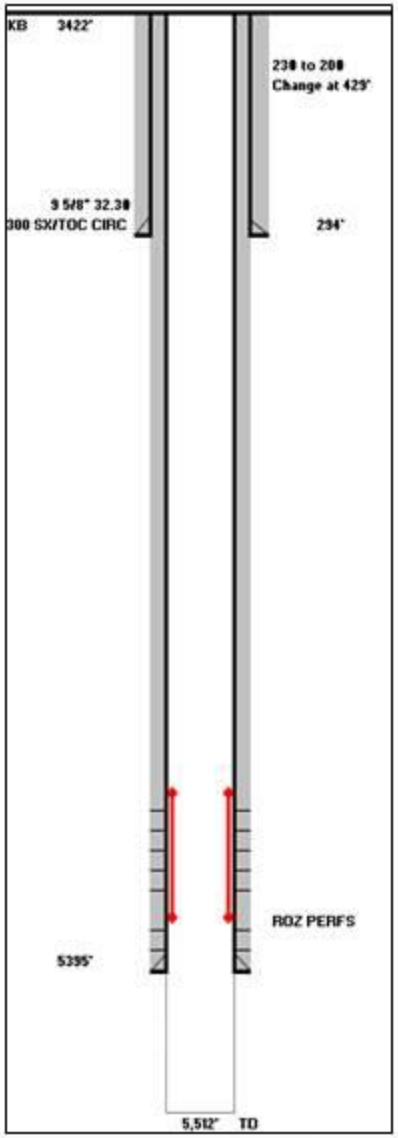

HESS

# RECOMPLETE EXISTING: MID CASING



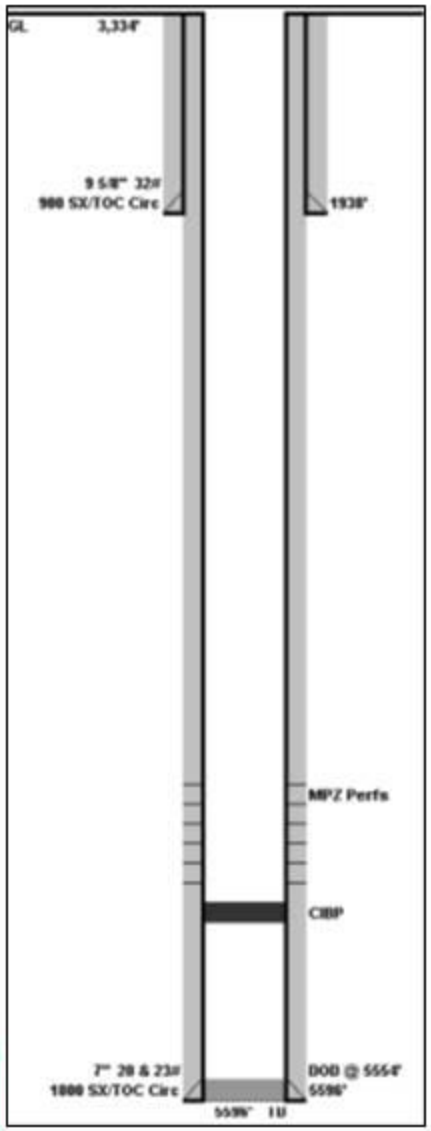



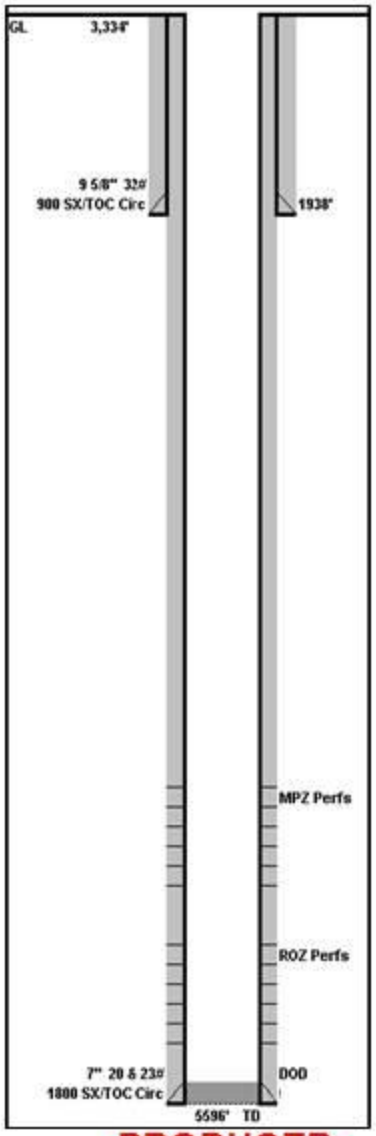

PRODUCER



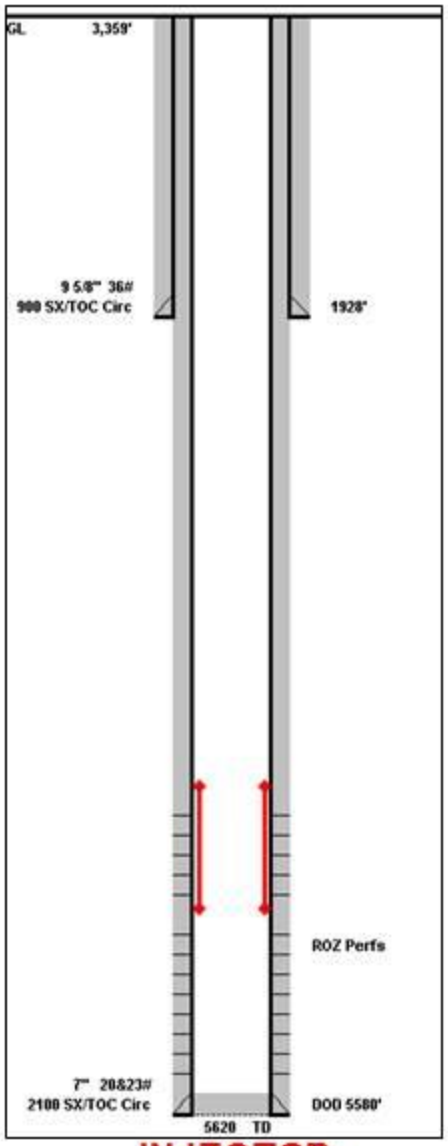

INJECTOR

# RECOMPLETE EXISTING:DEEP CASING




PRODUCER




INJECTOR

# OPERATIONAL CHALLENGES

- Isolating and Treating MPZ & ROZ
- Many MPZ only wells are produced using sucker rod systems
- When converting to MPZ/ROZ, fluid production increases 3-4X, necessitating use of ESP
- ESP's require additional power
- ESP's have a higher failure frequency

# OPERATIONAL CHALLENGES

- Increased presence of Scale & Asphaltenes
- Additional pay zones in the flood require additional CO2 supply
- Increased fluid rates may cause you to resize production flowlines and facilities
- Pattern analysis is complicated because you must look at both floods and patterns to determine pattern behavior

HESS

# THE END