

**COGCC Hearing  
Wattenberg Horizontal Rule  
Making**

**Aug. 8 & 9, 2011**

**Engineering**

# Engineering Outline

*Conclusion - Current well density is inadequate to drain resource*

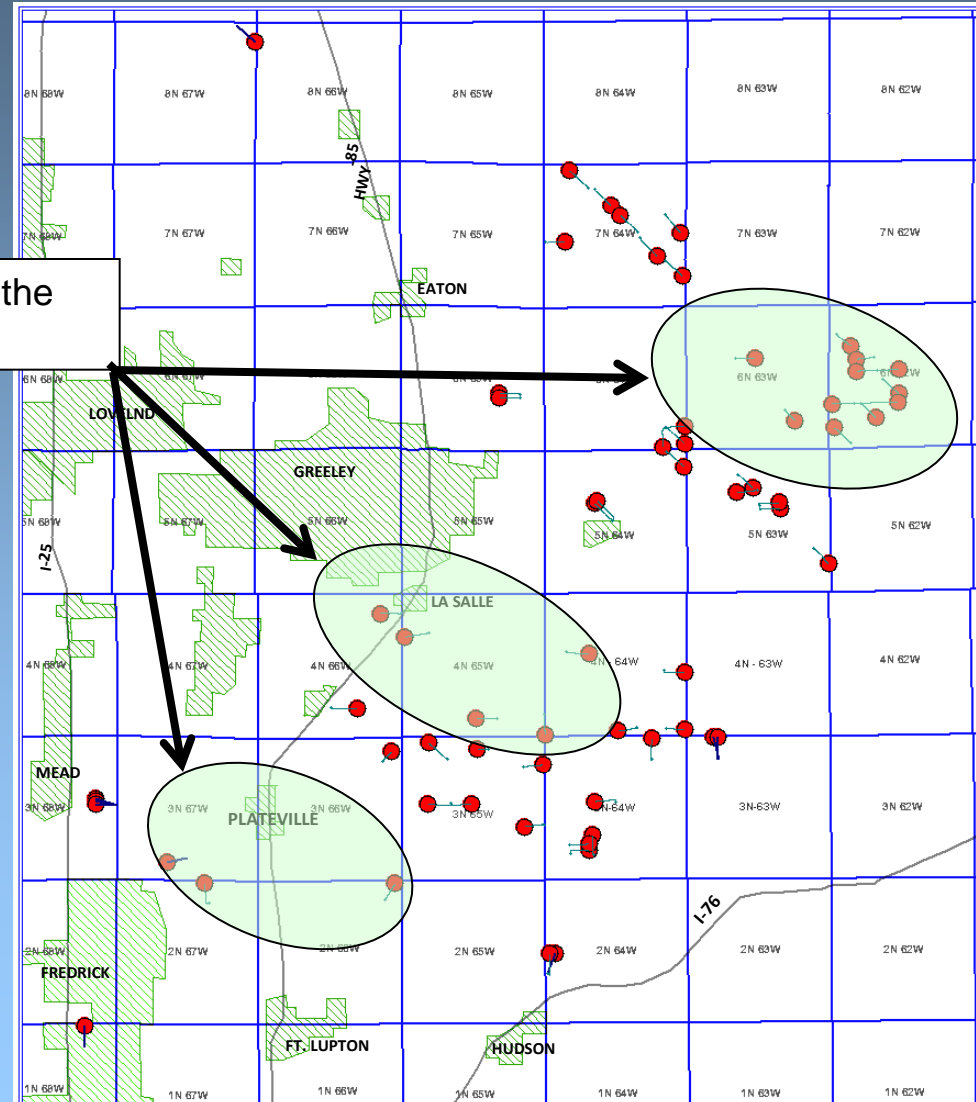
## Evidence:

- Production behavior
- Pressure comparison
- Hydrocarbon recovery

# Study/Review Area

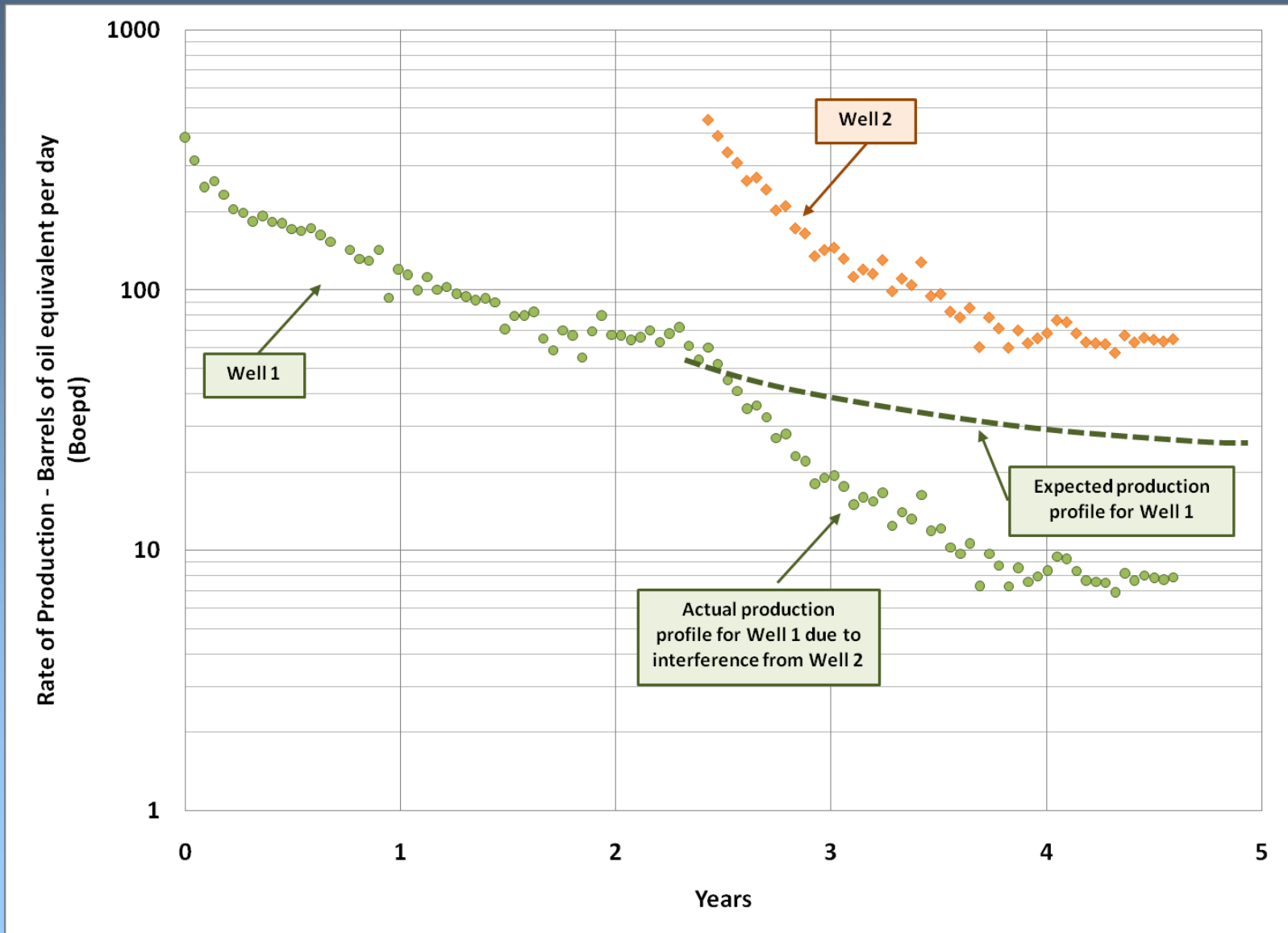
- Vertical and horizontal wells reviewed in the below area – Horizontal wells are shown

Detailed study of horizontal well performance and the effects on vertical wells



# Well Production Behavior

(Example of interference between wells)



# Example #1 -- Farmers 2-14 NBRR HZ

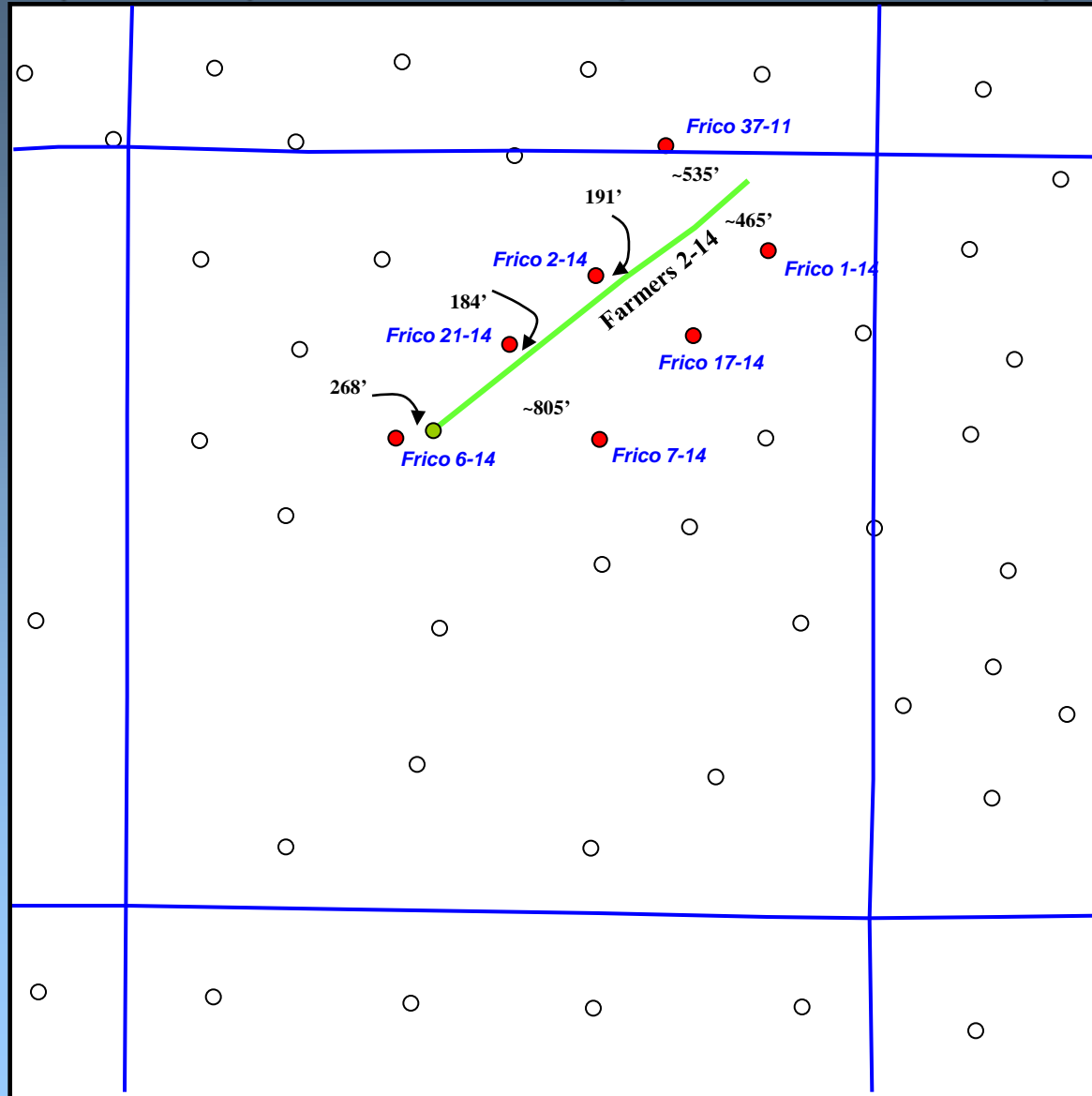
(Production Behavior)

- One of the older horizontal wells
- Horizontal well showing incremental production – simply means, we did not see a drop in vertical well production
- Additional vertical well drilling showed no interference and similar performance as original wells
- Vertical wells' performance not adversely affected
  - Even a vertical wells less than 200' away are still performing

# Production Behavior - Farmers 2-14 NBRR HZ

(Base Map – horizontal well path with vertical well)

Sec. 14-T3N-R65W

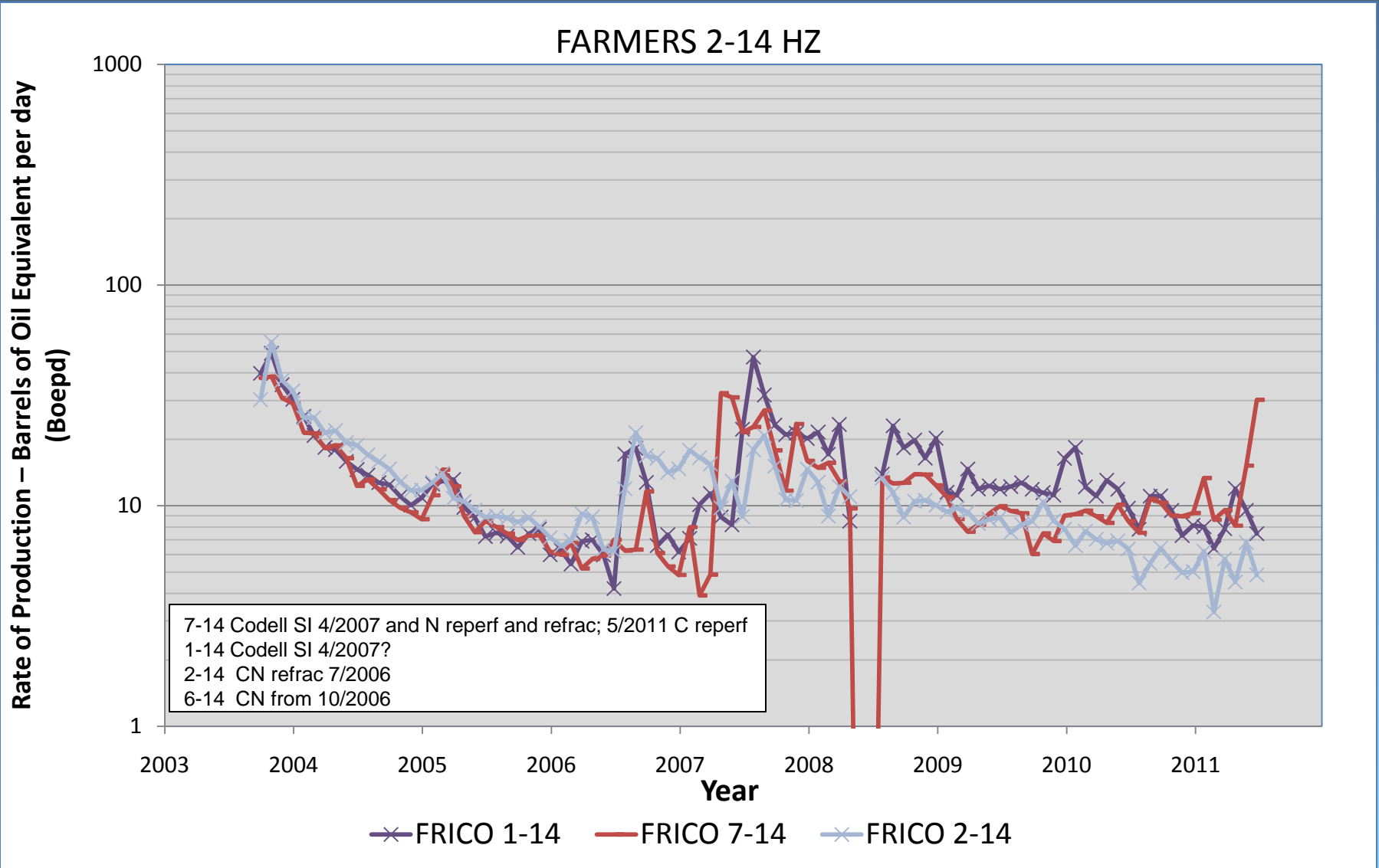


● Offset vert or BHL positions

● Farmers 2-14 trajectory & BHL

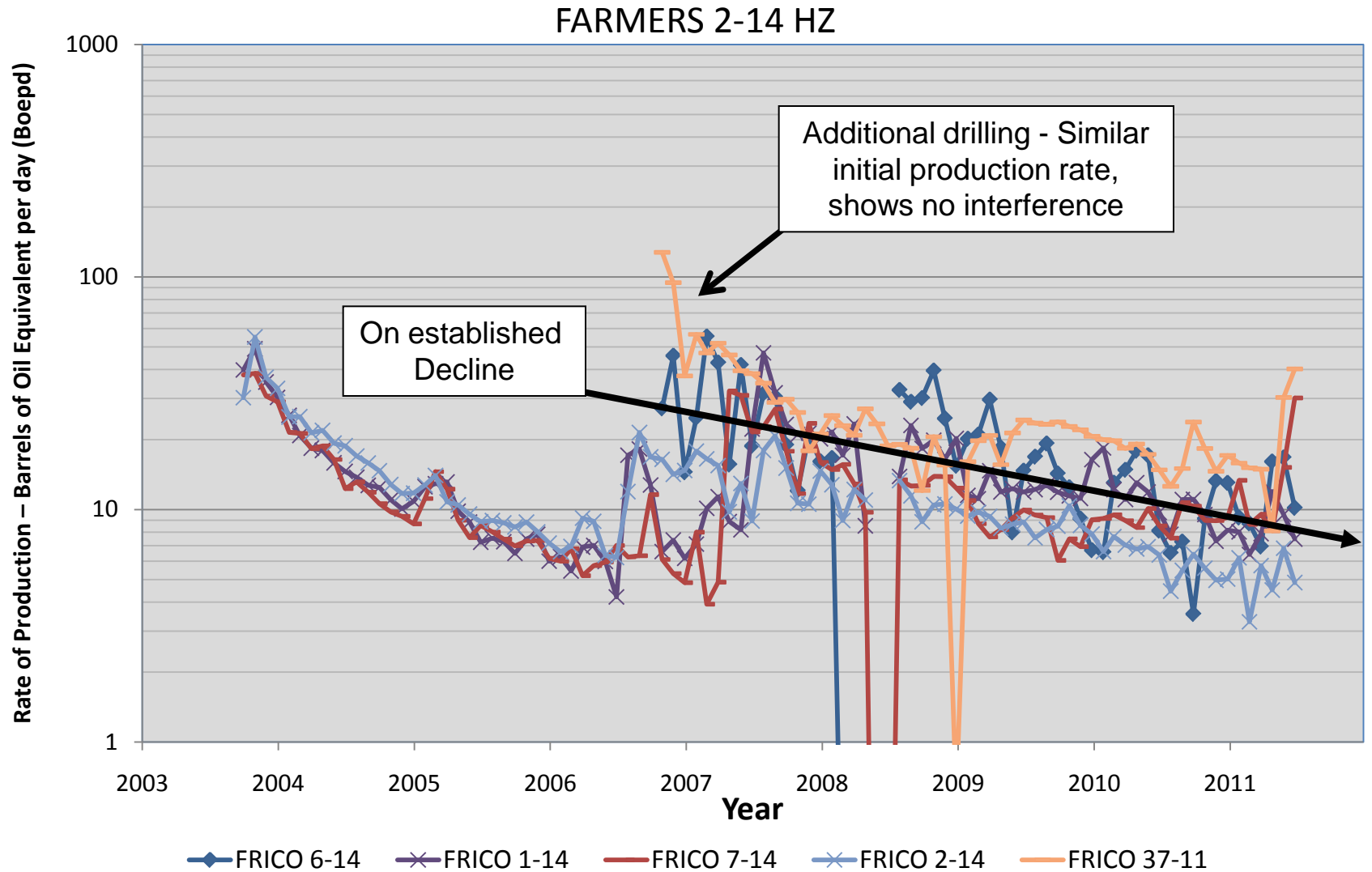
# Production Behavior

(Vertical wells only)



# Production Behavior

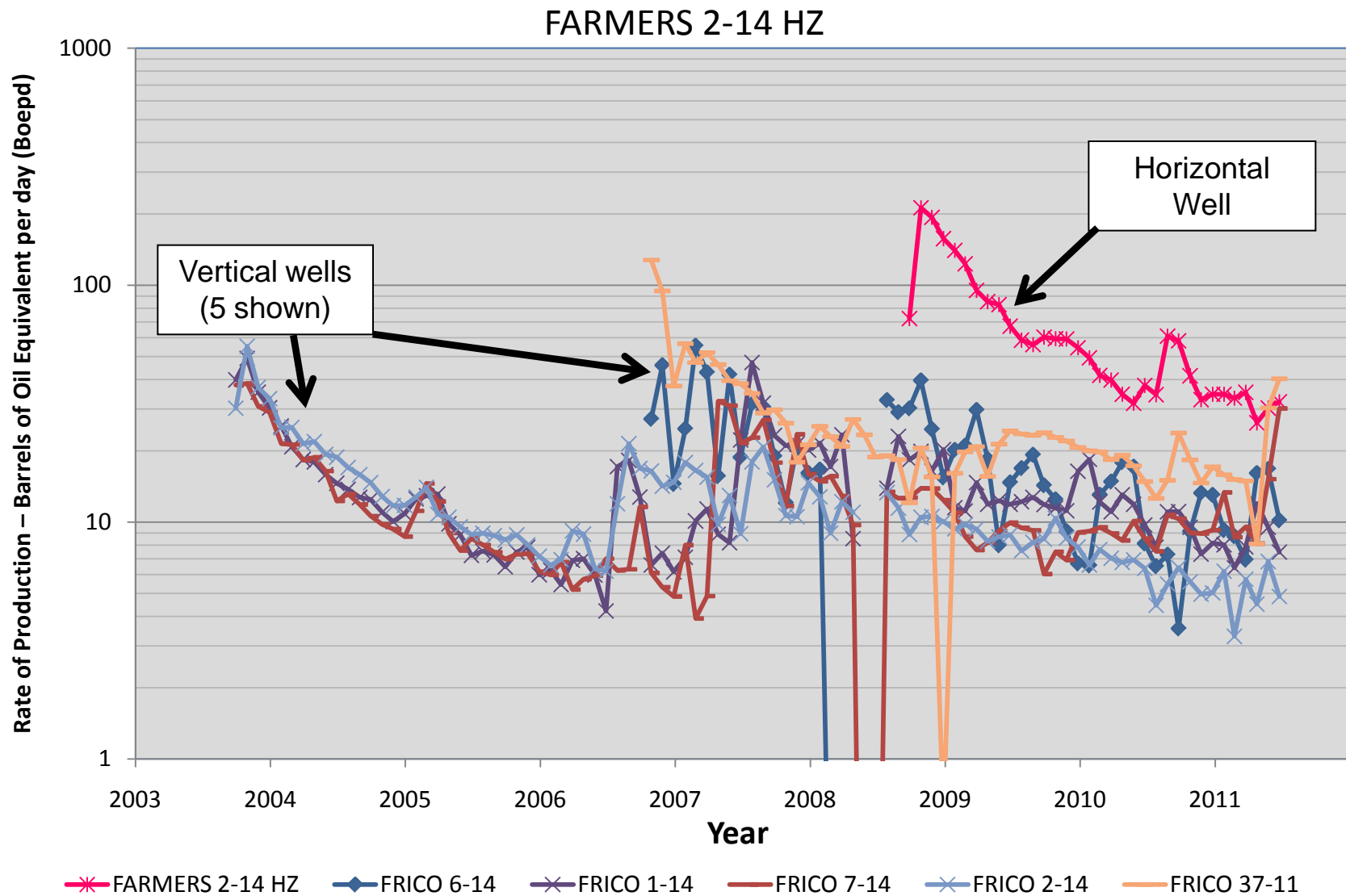
(Vertical wells only with additional drilling)





# Well Production Behavior

(Vertical and horizontal wells)



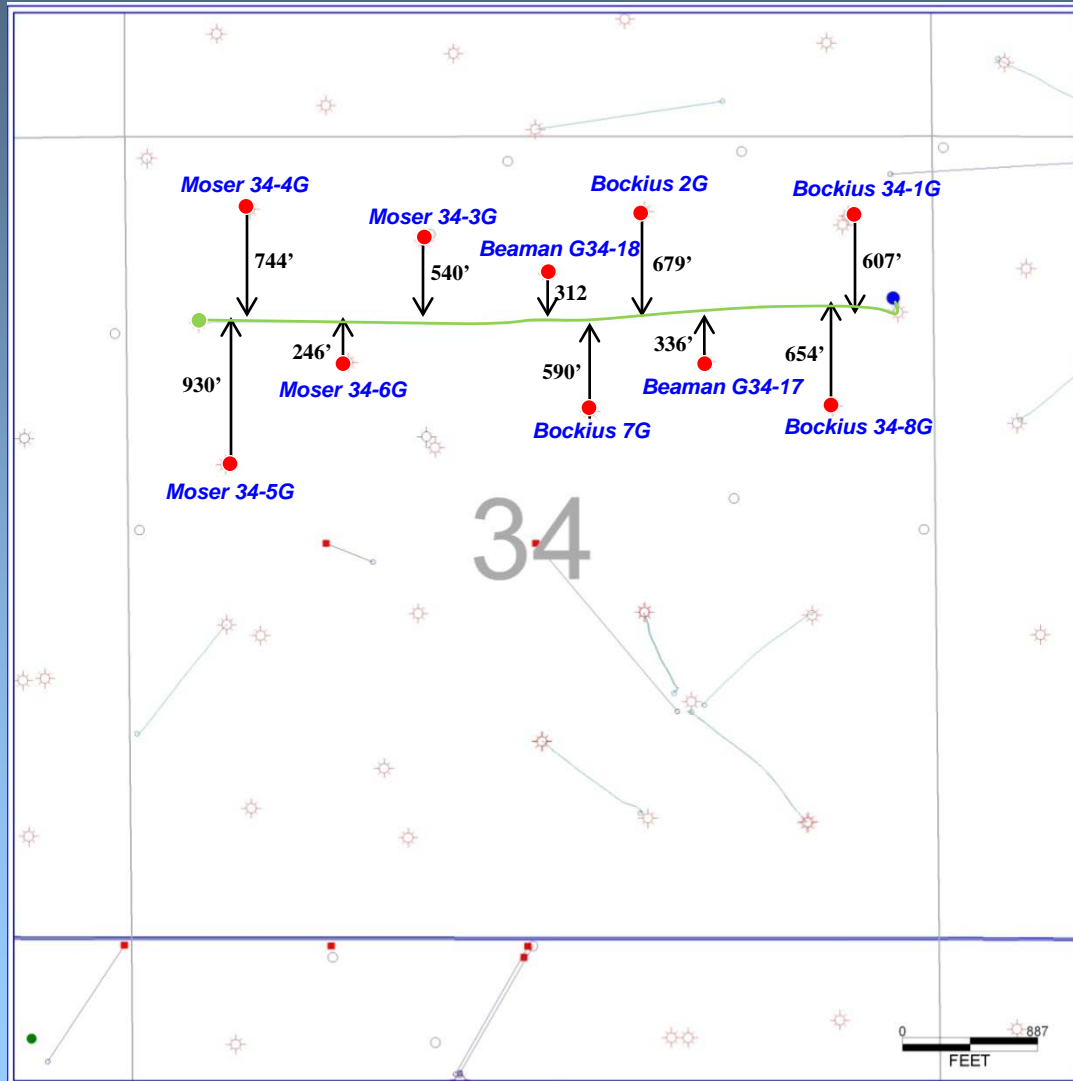
# Example #2 – Beaman G34-99HZ

(Production behavior and pressure comparison)

- Newer horizontal well
  - Optimized completion
- Horizontal well showed incremental production
- Established vertical offset producers not showing interference compared to recently drilled and completed horizontal producer
  - Even a vertical well 246' away is still performing
- Original reservoir pressure observed in horizontal well

# Production Behavior – Beaman G34-99HZ

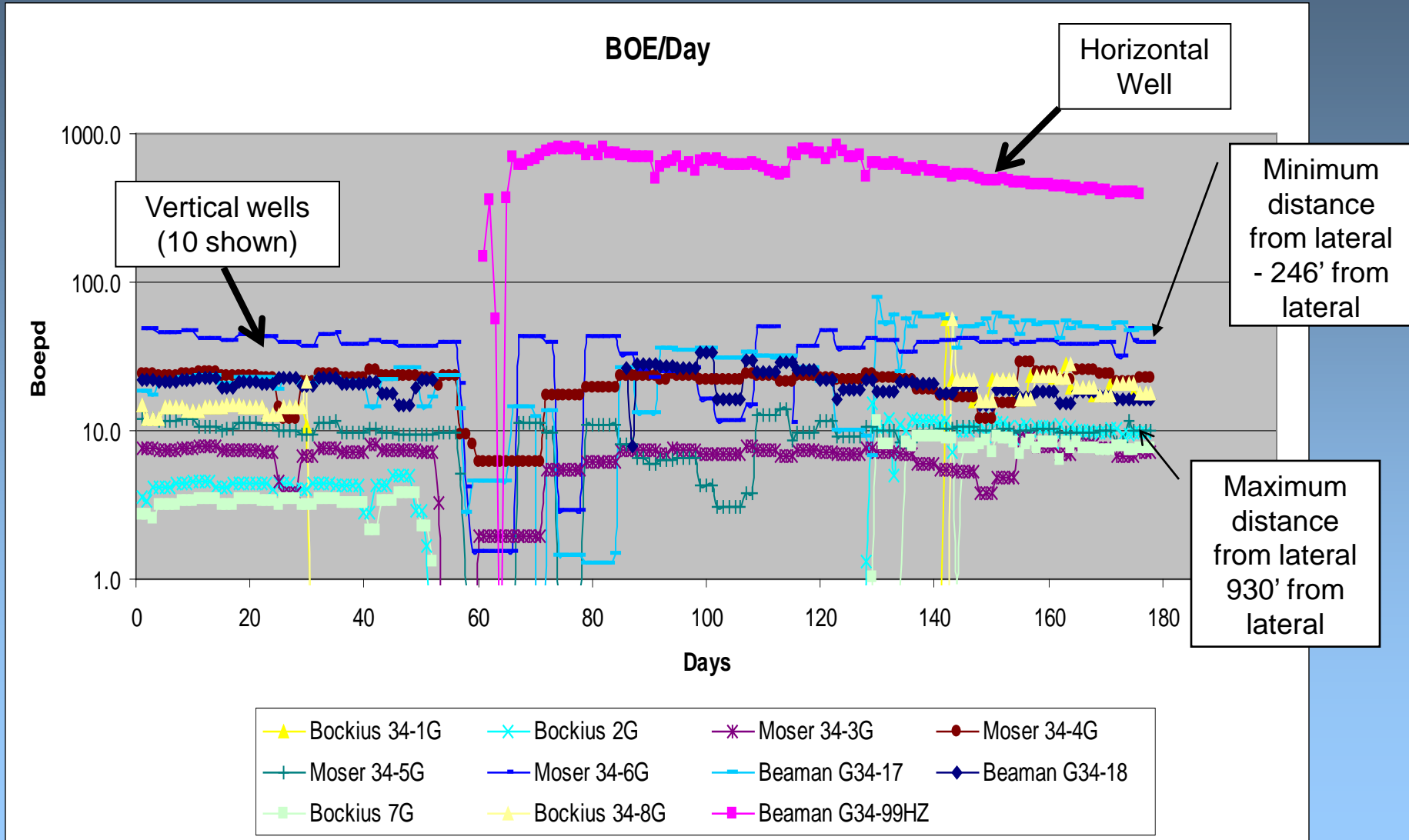
(Base Map with horizontal well path with vertical wells)



Sec. 34-T4N-R65W

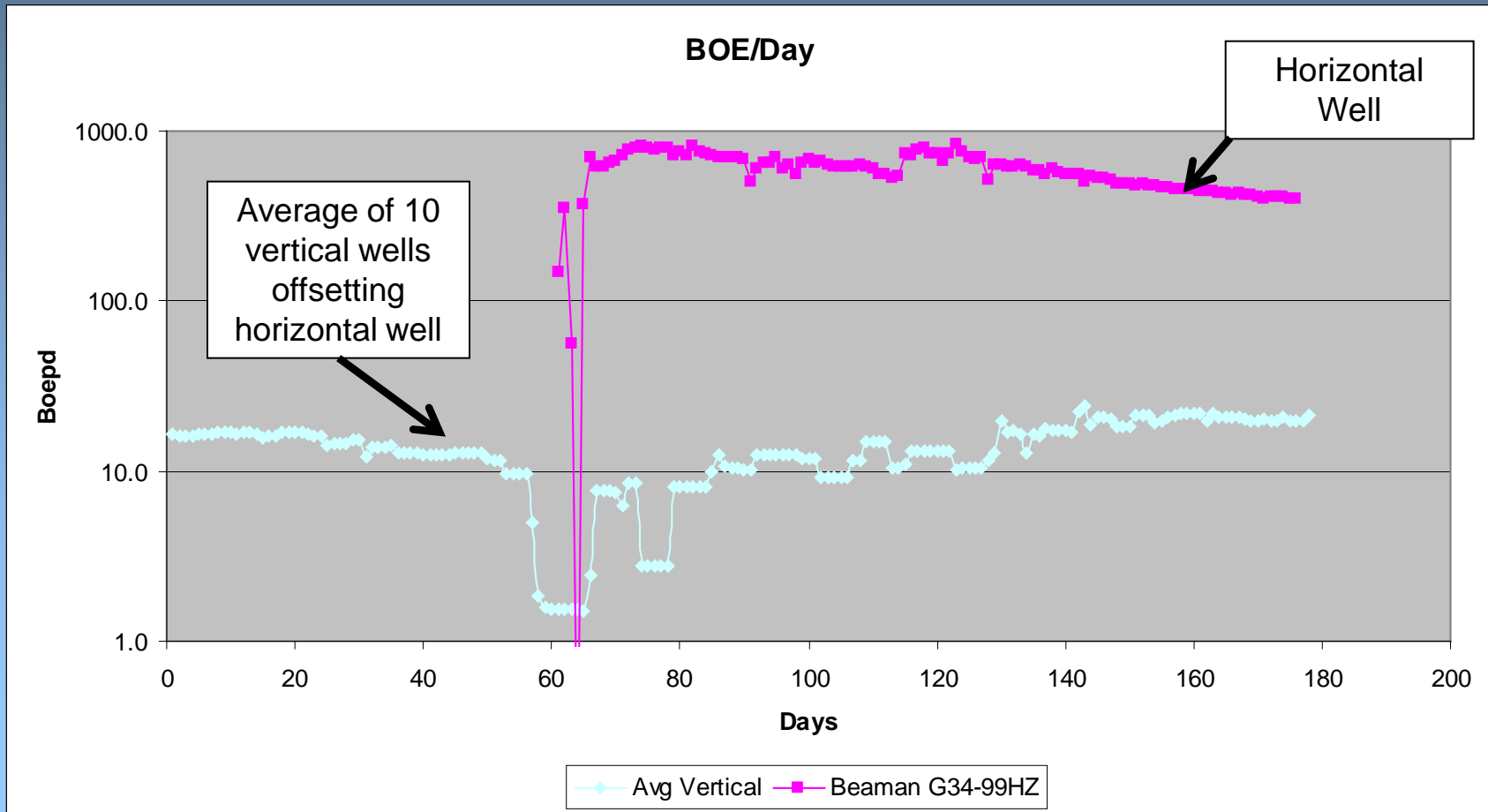
- Offset vertical or BHL positions
- Hz trajectory

# Production Behavior – Beaman G34-99HZ

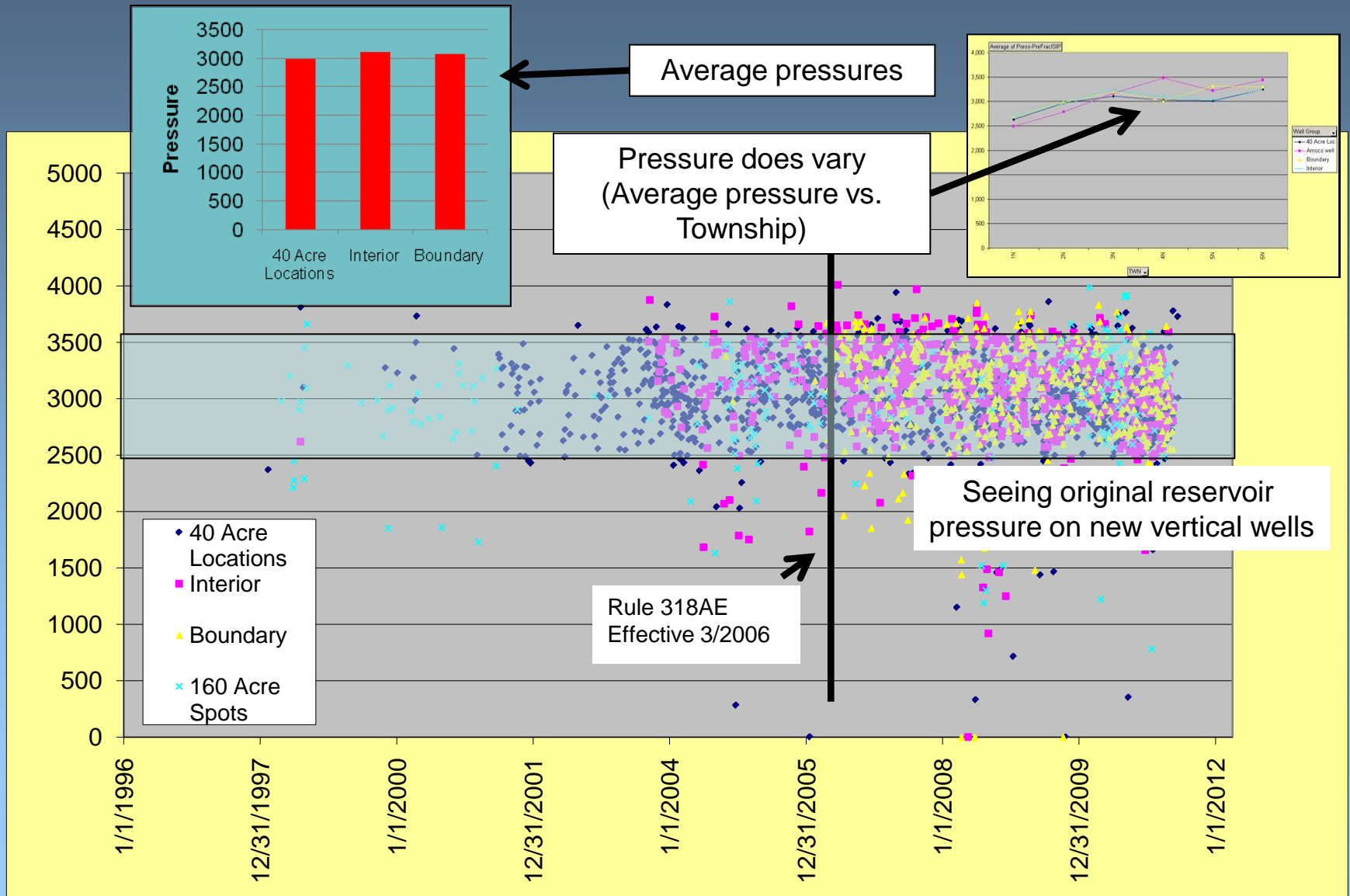


# Production Behavior – Beaman G34-99HZ

- Vertical offsets from previous slide averaged to show more clearly the effects (more recent horizontal example)



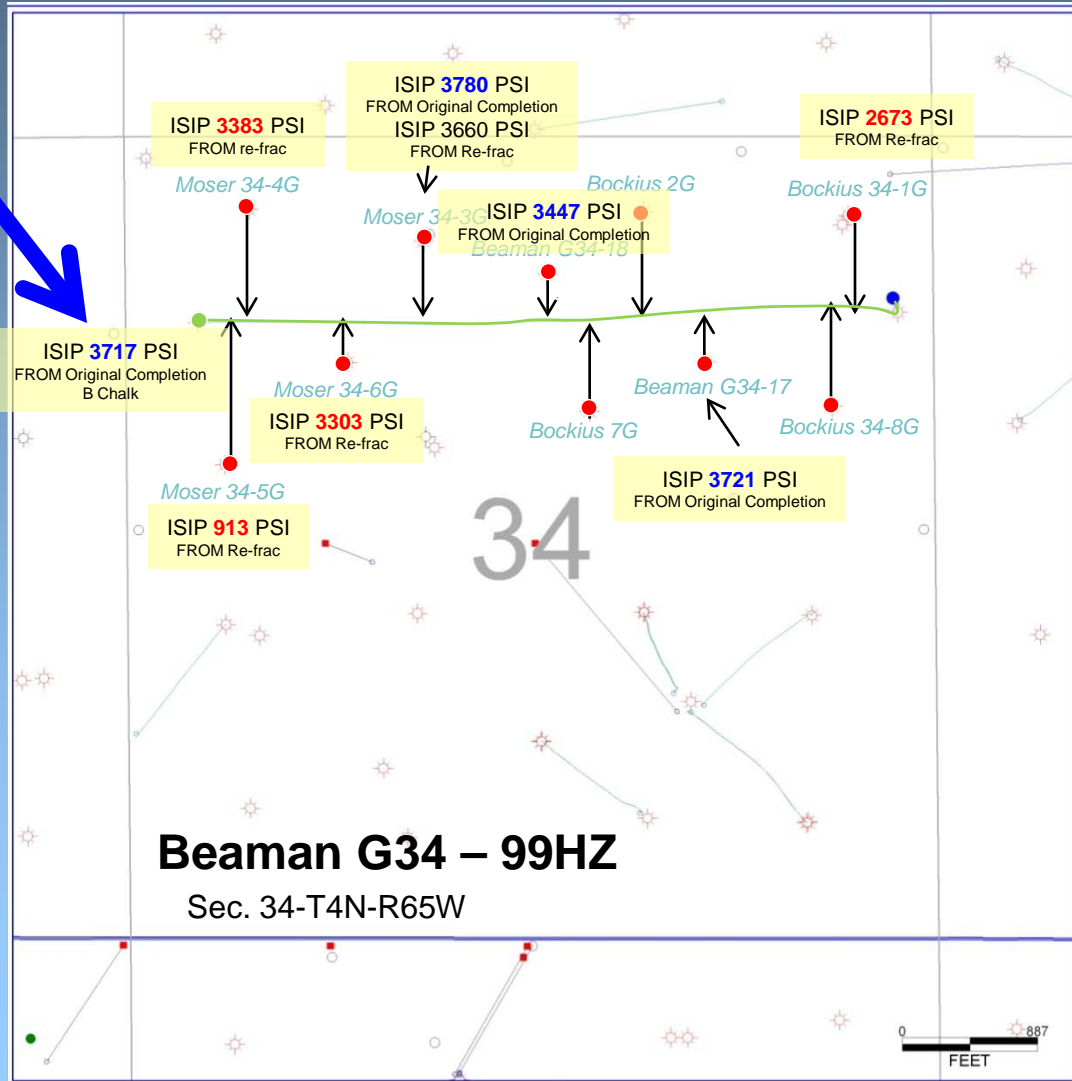
# Pressure Information – Field Wide



# Pressure Information

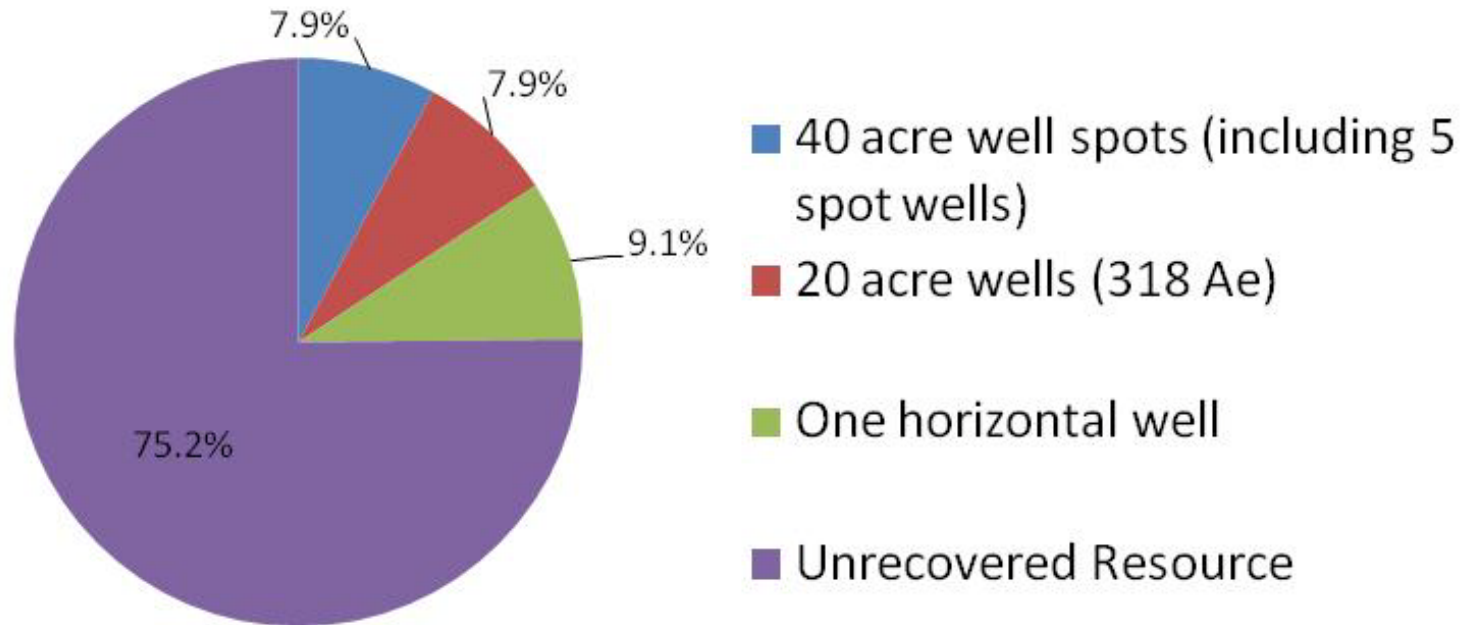
(Beaman horizontal well compared with vertical offset wells)

Horizontal well  
pressure –  
original pressure



# Example #3 - Hydrocarbon Recovery

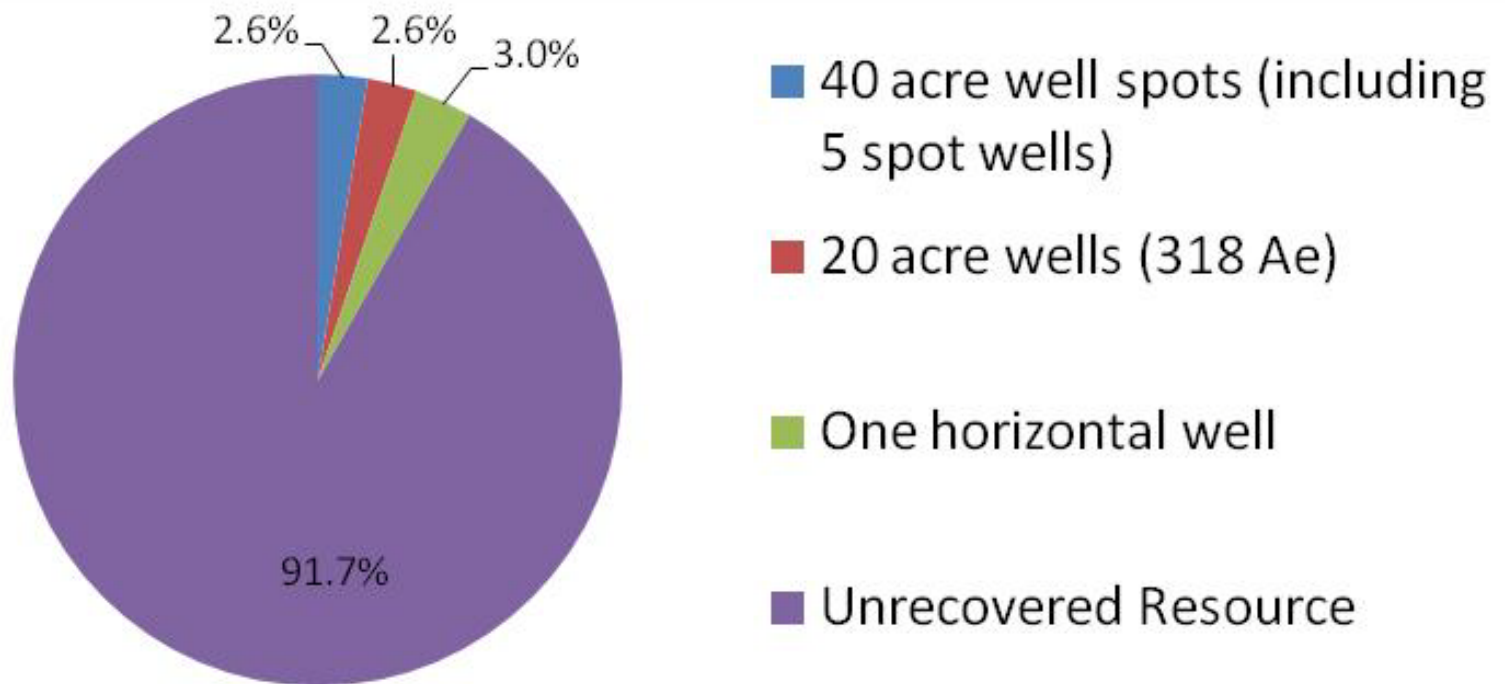
- Theoretical Example from 4N-64W, 320 acres (using 30' for net pay)





# Hydrocarbon Recovery

- Theoretical Example from 4N-64W, 320 acres (using 90' for net pay)



# Conclusions

- **Production information from close offset wells to horizontals shows that there are no long term effects from these horizontal completions.**
- **Pressure information shows that the infill wells drilled to date show approximately original pressure, indicating that no interference has taken place at these locations.**
- **Recovery factor calculations show that a low percentage of hydrocarbons will be recovered, even in areas with 20 acre vertical wells.**
- **The recovery factor can be increased with infill horizontal wells, benefitting all parties involved, and preventing waste of a very valuable resource.**

End of presentation