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NOV 17 2005

318A - Proposed Revision

No. 0508-RM-01

November 17, 2005

ENCANA
energy for people

KERR McGEE

noble energy

Overview/Land/
Surface Impacts

318A - Proposed Revision

Land Testimony & Exhibits

EnCana
energy for people

KERR McGEE

noble energy

318A - Proposed Revision

Kerr-McGee Rocky Mountain Corporation, EnCana Oil and Gas (USA), Inc. and Noble Energy Production, Inc. ("Applicants") have filed an amendment to Rule 318A to:

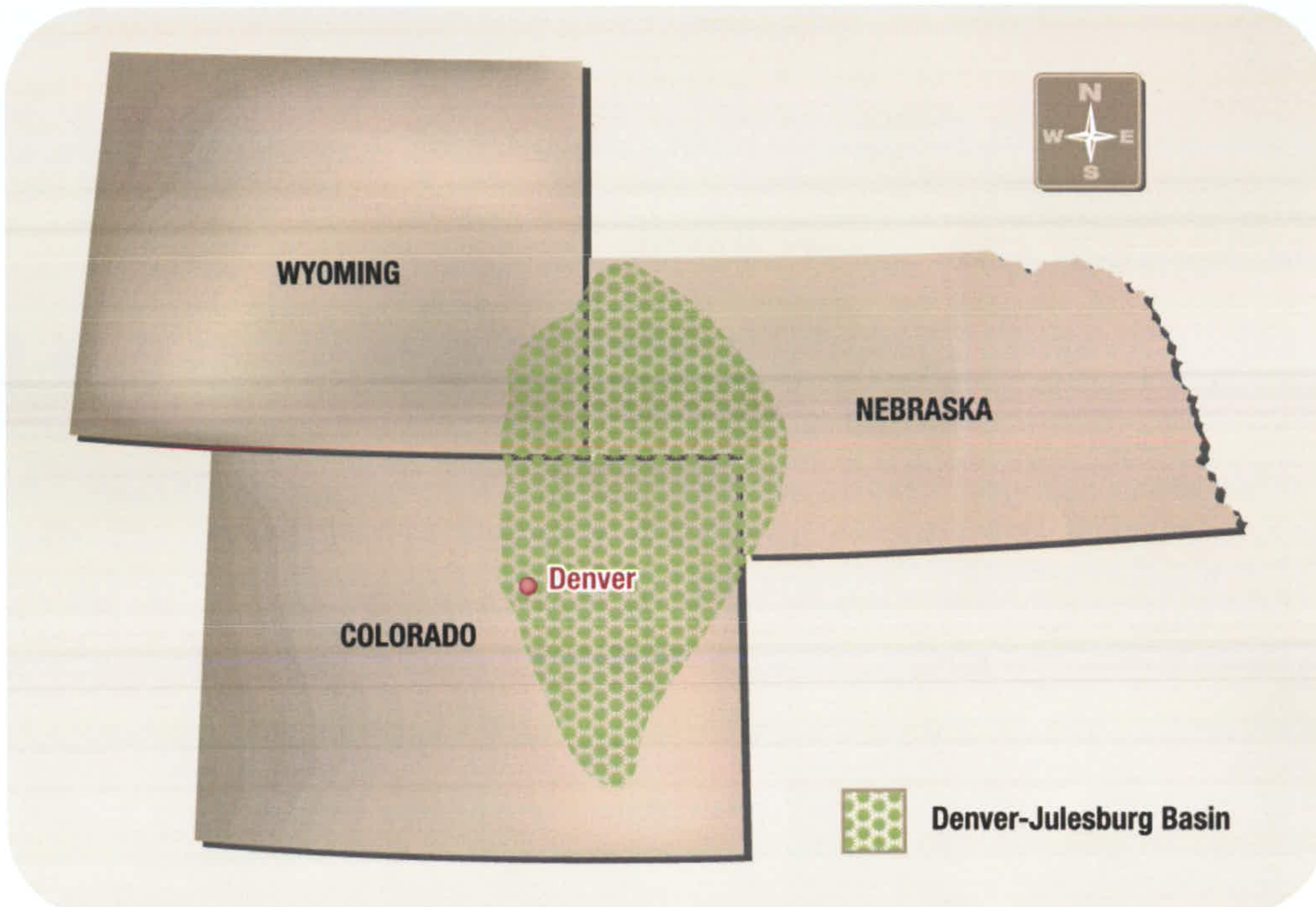
- Prevent waste
- Protect correlative rights
- Prevent the filing of multiple exception location applications
- Uniformly address future operations in the J-Sand and Codell/Niobrara formations
- Provide certainty for future well locations
- Recover currently untapped hydrocarbon reserves

318A - Proposed Revisions

Recent Changes to Proposed Rule:

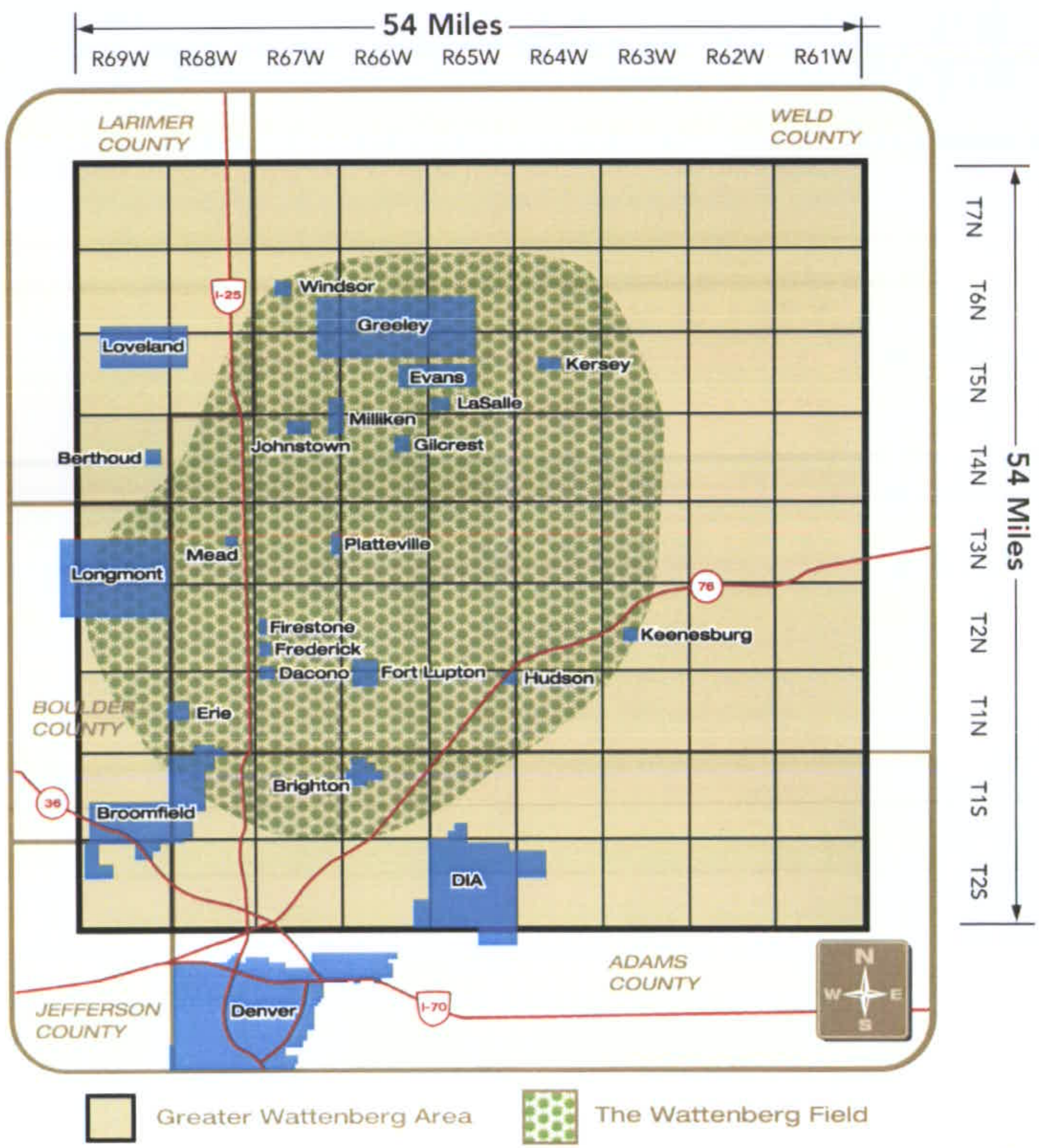
- The amendment is limited to the J-Sand and Codell/Niobrara formations.
- The size of the Greater Wattenberg Area will be reduced by more than 30% (25 townships).
- If the operator of a new well is the same as the existing well, the new well will be located within 50' of the existing well. If the existing well is operated by a third party, the new well will be located within 100' of the existing well.
- This effectively reduces the setback distance by two-thirds from the current Rule 318A and Policy.

Denver Julesburg Basin



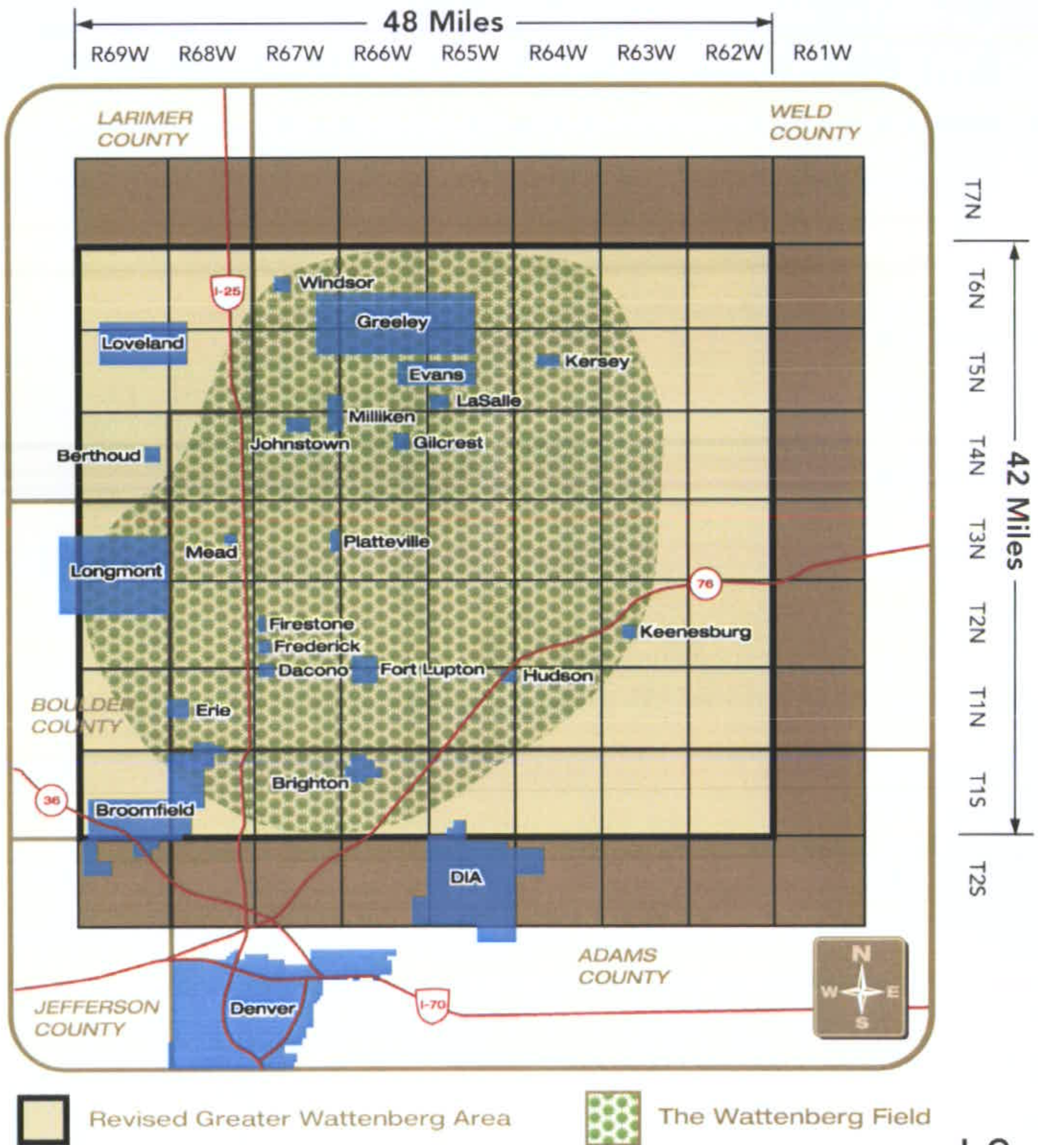
Greater Wattenberg Area - Current

- Covers parts of Adams, Boulder, Broomfield, Larimer and Weld counties
- Key producing formations include J-Sand and Codell/ Niobrara
- Major municipalities: Greeley, Loveland, Longmont, Broomfield and Denver
- 2,916 sq/mi



Greater Wattenberg Area - Revised
Limited to the J-Sand and Codell/Niobrara Formations

- 25 townships will be removed from the current GWA.
- Revised size will be 2,016 sq/mi.
- Represents more than a 30% reduction in the size of the GWA.
- Eliminates portions of the City and County of Broomfield and DIA from the GWA.



318A - Historical Background

Wattenberg Field/J-Sand Formation

- Wattenberg Field was originally developed in the 1970's with drilling to the J-Sand formation.
- Cause #232 was approved by the Commission in November of 1970.
- Provided for 320-acre spacing units for the J-Sand formation.
- Wells were to be located no closer than 990' to the boundaries of a quarter section.
- Subsequently amended in 1979 to allow a second J-Sand formation well in a 320-acre unit.

318A - Historical Background

Wattenberg Field - Codell/Niobrara Formation

- In the early 1980's, operators began to focus on the Codell formation.
- Cause #407 was approved by the Commission in December of 1983.
- Cause #407 established 80-acre spacing units for the Codell formation.
- Wells were to be located in the center of a quarter-quarter section with a tolerance of 200' in any direction.
- Allowed for a optional infill well on the undrilled 40-acre tract
- Subsequently amended to include the Niobrara formation.

318A - Historical Background

Rule 318A and Policy Provided for:

- The establishment of eight 400' x 400' and two 800' x 800' drilling windows in a 320-acre tract.
- New well locations must be in a drilling window.
- New well locations within 150' from an existing well location are administratively approved.
- The ability to produce any Cretaceous Age formation from the drilling windows.
- The ability to commingle all formations.
- An effective well density of one well per 32 acres.

318A - Typical Well Locations on Rural Lands

318A - Proposed Revision

Process Included:

- Initial discussions between the Applicants
- Informal meetings with Commission staff
- Pilot program with 50 wells drilled at half-section line locations
- Over 150 wells completed as the 5th well in a quarter section
- Notice of Rulemaking was provided to more than 12,000 working/mineral interest owners
- Notice of Rulemaking was published in 20 newspapers

Public Education Effort

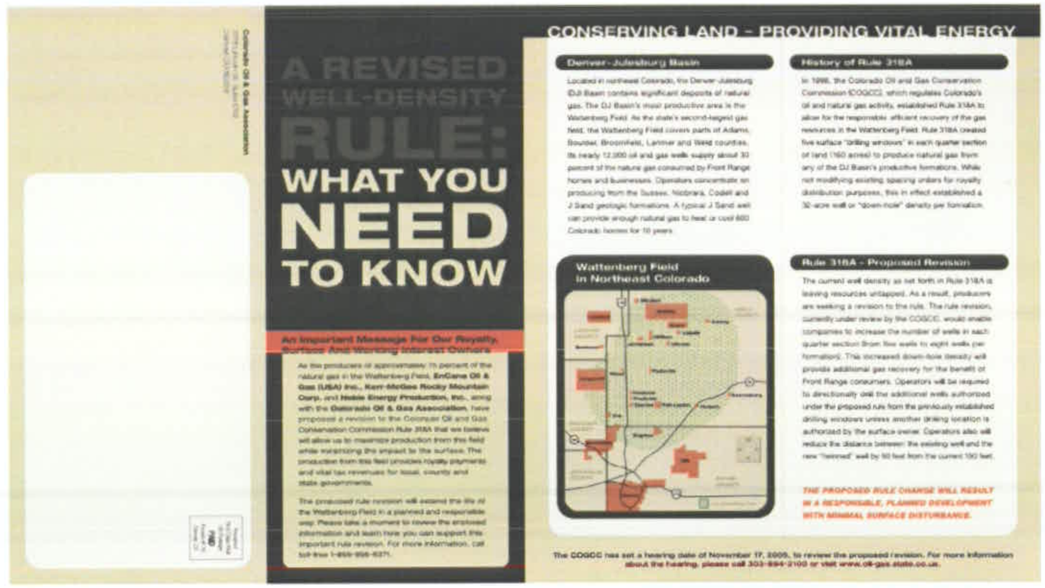
Process Included:

- Stakeholder Meetings
- Industry Meetings
- Field Tours
- Media Tours
- Individual meetings with interested parties

Public Education Effort

Direct Mail

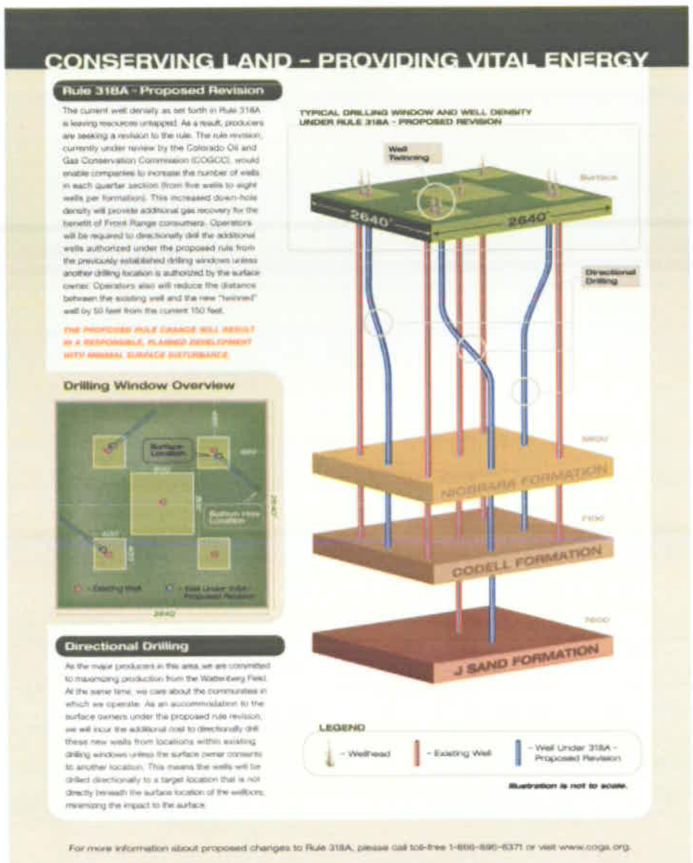
Mailed to approximately 12,000 working interest, mineral and surface owners.

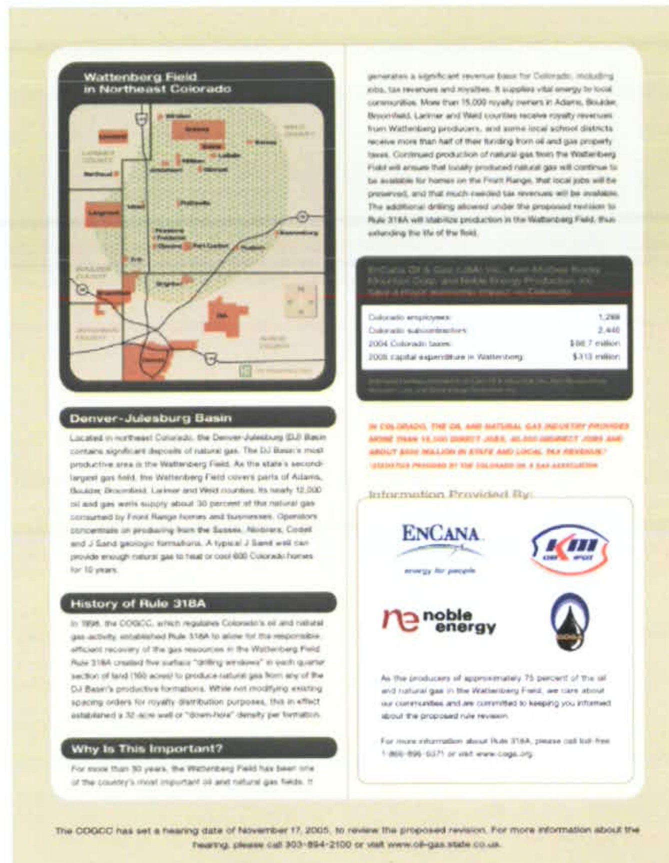


Public Education Effort

Informational Handout

Distributed approximately 2,000 fact sheets.

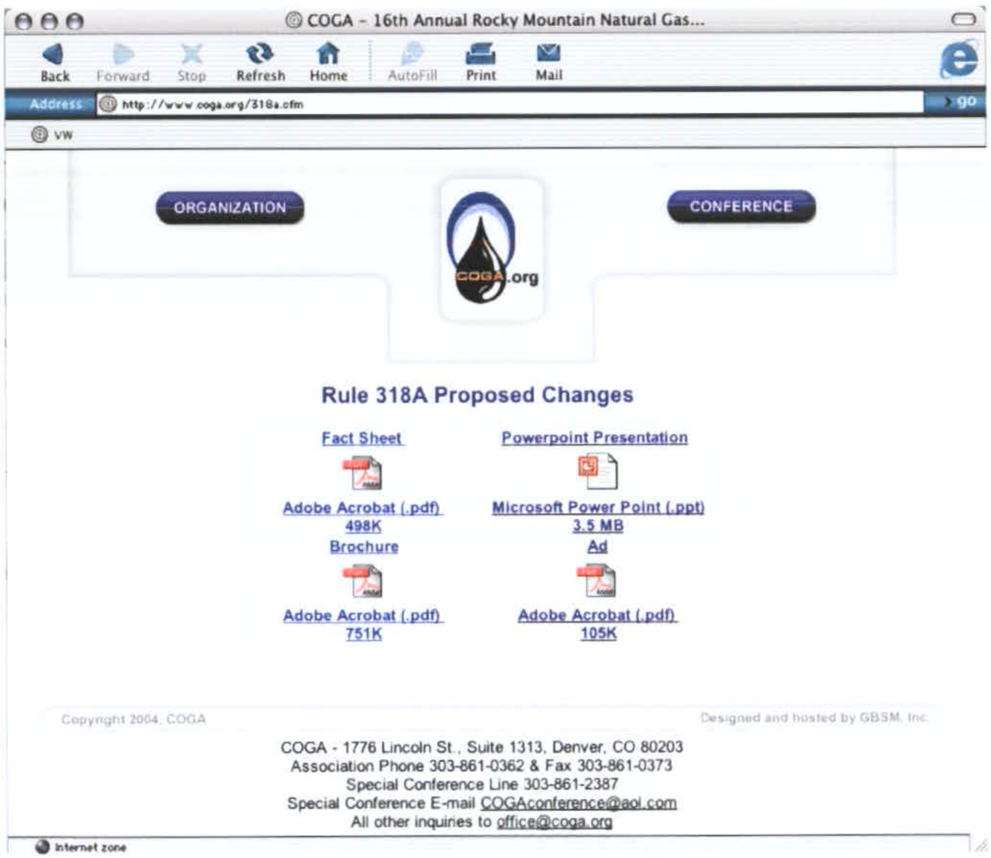




Public Education Effort

Website - Toll-Free Information Line

Posted information on the COGA website and a toll-free telephone number was utilized to answer questions and provide information.



Toll-Free Information Line

1-866-896-6371

Public Education Effort

Open Houses

Greeley

Thursday, Oct. 27, 4-8 p.m.

Fireside Lounge, University of Northern Colorado

Fort Lupton

Wednesday, Nov. 2, 4-8 p.m.

Aims Community College

Evans

Thursday, Nov. 3, 4-8 p.m.

Banquet Hall, Evans Community Complex

Longmont

Friday, Nov. 4, 4-7 p.m.

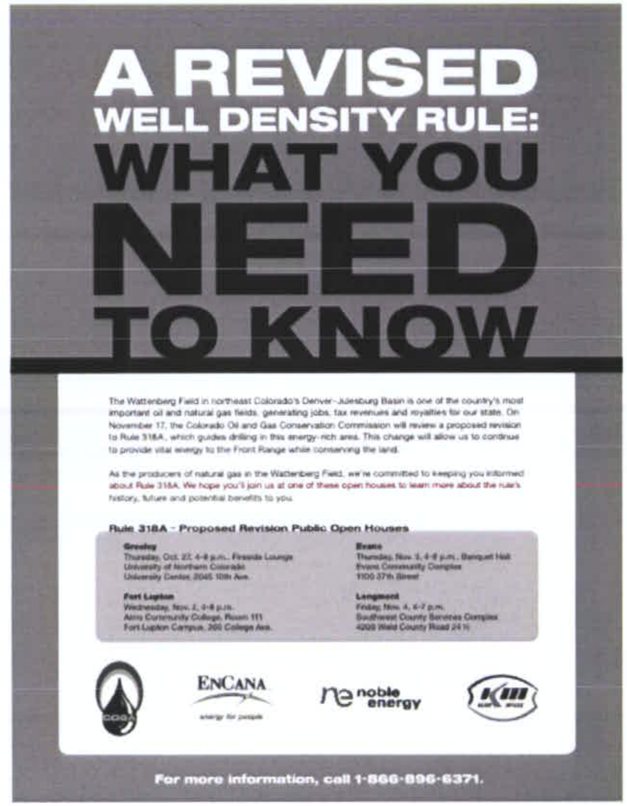
Southwest Weld County Services Complex

Public Education Effort

Ads

Ran 1/3 page ads in the following local newspapers:

Fort Lupton Press, Farmer & Miner, Brighton Standard Blade, Erie Review, Windsor Beacon, Johnstown Breeze, Greeley Tribune and Longmont Daily Times-Call



Flyers

Distributed and posted flyers in local communities.

Radio

KFKA-AM, KUNC-FM, KTRR-FM

Surface Locations vs. Bottomhole Locations

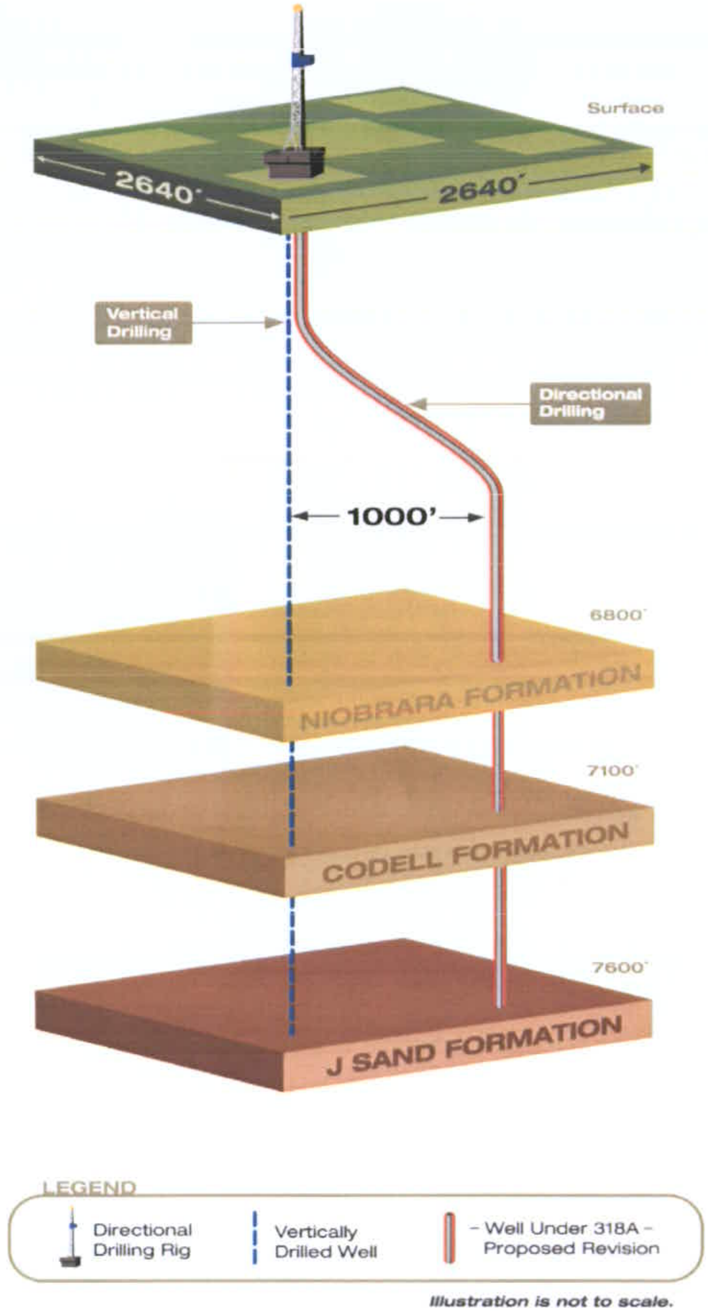
- Surface Location = well location at the surface
- Bottom Hole Location = wellbore location upon reaching the target formation
- The revised Rule provides that without the consent of the surface owner, all new well surface locations will be located within existing drilling windows and near existing wells.

Directional Drilling

- Bottom Hole locations will be reached from existing drilling windows using directional drilling techniques.
- The incremental directional drilling cost will be borne by the operator.

Directional Drilling

- Allows for multiple wells to be drilled from a central drilling pad.
- New wells drilled to target not directly beneath surface location of the wellbore.
- Directional drilling reduces the surface footprint and minimizes the need for new roads and pipeline.
- Allows for increased access to potential natural gas resources while conserving amount of impacted surface.



Wellsite Locations

- Current Rule 318A and Policy provides for administrative approval if a new well is less than 150' from existing well.
- Revised Rule 318A provides that absent safety, mechanical, topographical or surface constraints, new wells will be located within 50' of existing wells if the existing well is operated by the same operator.
- If the existing well is operated by a third party, the new well will be located within 100' of the existing well.

Building Setbacks

- Commission Rule 603 provides that in certain designated high density areas, new wells must be 350' from a occupied building unit.
- In all other areas, new wells must be 150' or one and one-half times the rig height, whichever is greater, from an occupied building unit.
- A building setback is the area around a well or production facility in which buildings cannot be located.
- Municipal building setbacks can range from 150' to 350'.
- The majority of communities impose a 150' building setback from a well.

Building Setbacks

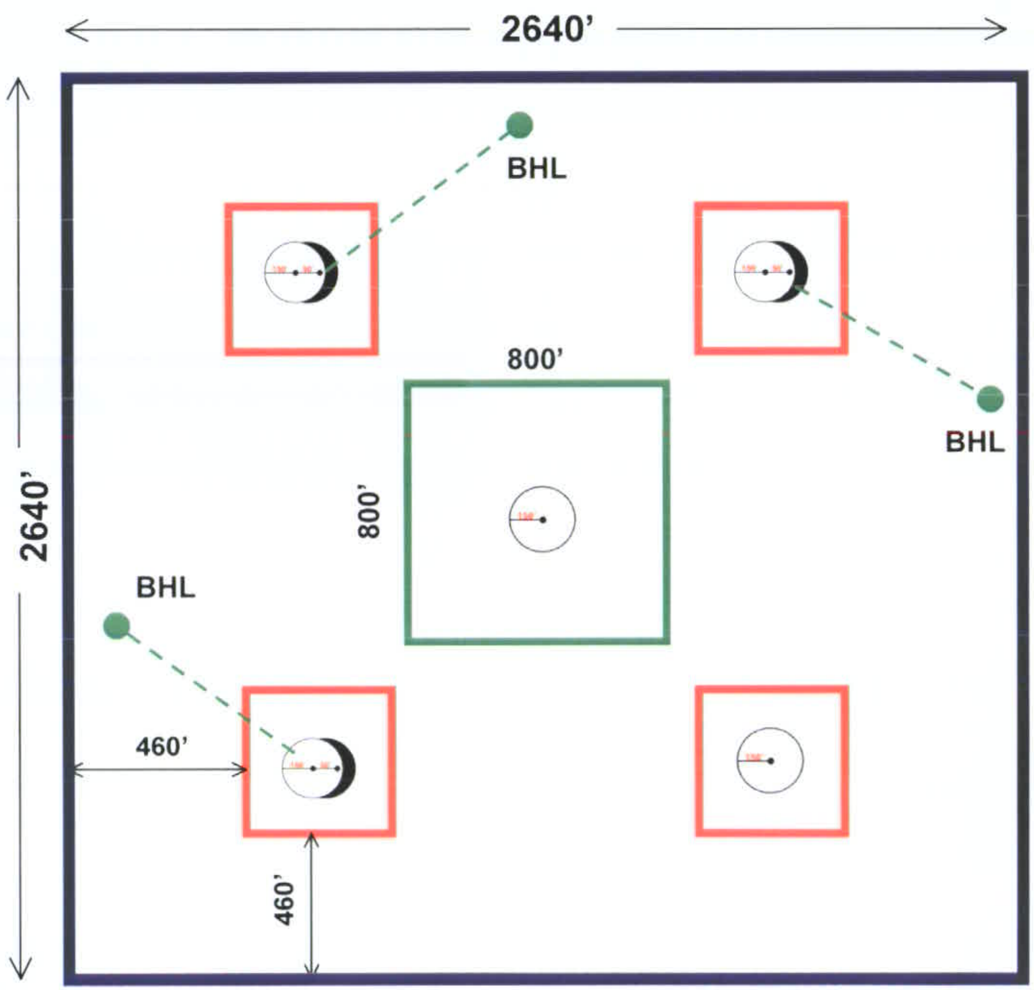
- 150' building setback around one well = a 1.62 acre No Build Zone.
- Two wells, 50' apart with 150' building setback = 1.97 acre No Build Zone
- Difference 1.97 - 1.62 = .35 acres

Setback Area

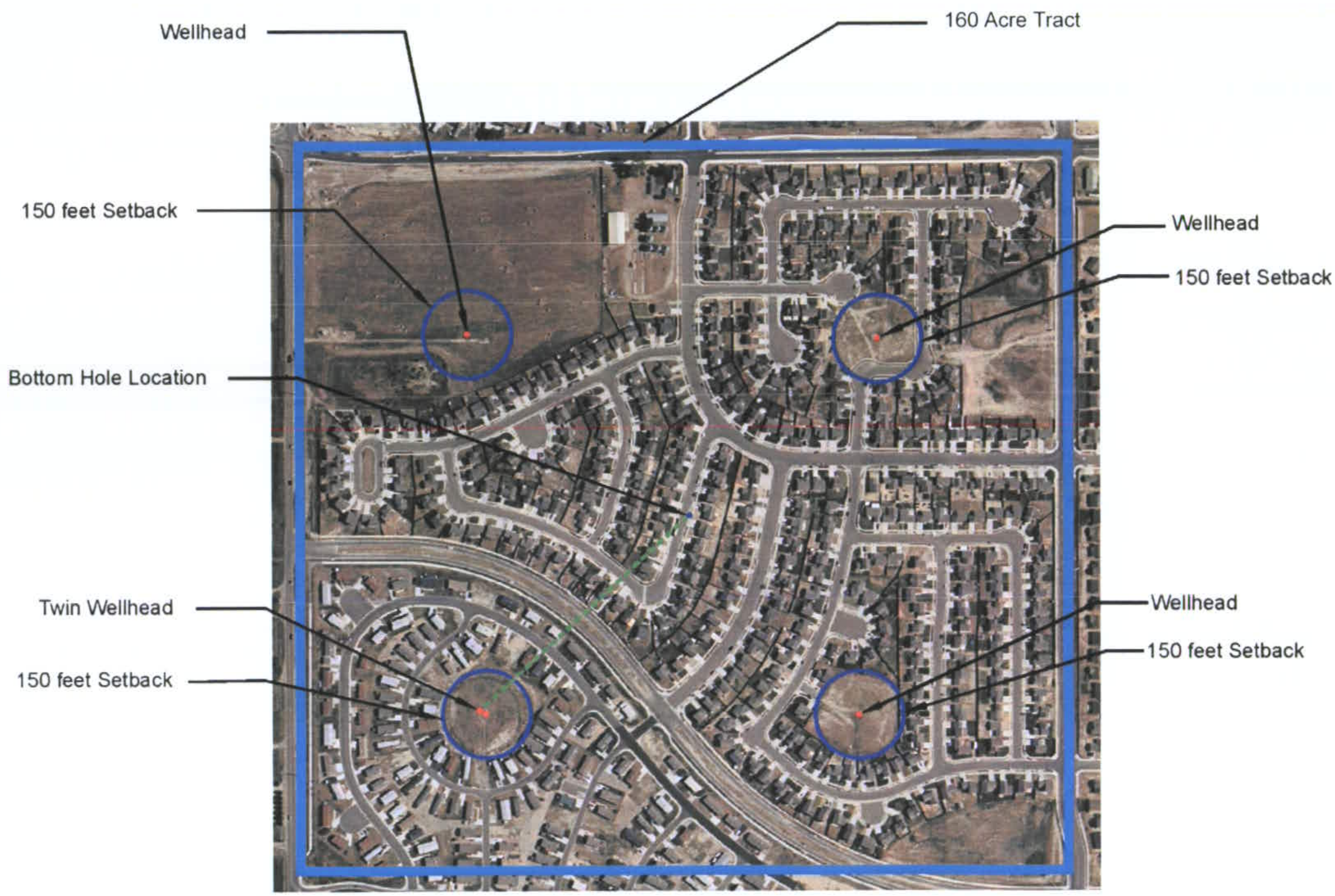
- 5 Well No Build Zone:
  1.62 acres x 5 wells = 8.10 acres
  % of 160 acres = 5%

- 8 Well No Build Zone:
  8.10 acres + (.35 acres x 3 new wells) = 9.15 acres
  % of 160 acres = 5.7%

- Increase in no build zone:
  1.05 acres or .7% of 160 acres



Five Wells in Subdivision
One Well Directionally Drilled



Interior Infill Wells

- Definition - A well whose bottom hole location is greater than 460’ from the boundary of an existing 320-acre spacing unit, except for a well located in the windows.
- If the bottom hole location for an Interior Infill Well is greater than 460’ from the boundary of an existing 80-acre or 320-acre spacing unit, the spacing unit for the Interior Infill Well will conform to the existing spacing.
- If the bottom hole location for an Interior Infill Well is less than 460’ from the boundary of an existing 80-acre or 320-acre spacing unit, a Wellbore Spacing Unit will be formed comprised of the four 40-acre governmental quarter-quarter sections nearest the bottom hole location.
- Wellbore Spacing Unit is formed to protect correlative rights.

Boundary Wells

- For any new well that has a bottom hole location that is less than 460' from the boundary of a 320-acre spacing unit, a Wellbore Spacing Unit shall be designated by the Operator.
- The Wellbore Spacing Unit shall be comprised the four 40-acre governmental quarter-quarter sections nearest the bottom hole location that comprise a 160-acre square around the bottom hole location, regardless of section or quarter section lines.

Bottom Hole Well Density Limits

- The revised Rule limits the formations that can be completed in a wellbore to the J-Sand and Codell/Niobrara formations.
- However, a maximum producing bottom hole wellbore density of one well per 20-acres is authorized in each existing drilling and spacing unit for the J-Sand and Codell/Niobrara formations.

Unspaced Areas

- If any new well is being completed in an unspaced formation and the well is greater than 460' from the boundary of the governmental quarter-quarter section in which it is located, the Operator will designate a drilling and spacing unit not smaller than a governmental quarter-quarter section.
- If any new well is completed in an unspaced formation and the well is less than 460' from the boundary of the governmental quarter-quarter section in which it is located, a Wellbore Spacing Unit shall be formed of the four 40-acre governmental quarter-quarter sections nearest to the wellbore.

Notice of Hearing Procedures

a. Notice will be given by certified mail by the Operator of the proposed 160-acre Wellbore Spacing Unit or Boundary Well to all working interest owners and unleased mineral interest owners in the proposed Wellbore Spacing Unit.

b. Each owner will have a 20-day period after receipt of the notice to object to the Boundary Well or Wellbore Spacing Unit. Absent receipt of an objection from an owner within such 20-day period, the Director may administratively approve the Boundary Well or Wellbore Spacing Unit. A location plat will be required to be submitted to the Director together with copies of any surface waivers along with a certification that no timely objections were received.

c. If an objection is received, the matter will be set on the docket at the next available Commission hearing.

Revised - 318A
What it does not change

The revised rule will not:

- Change the rights of Operators to voluntarily pool lands or to seek well location exceptions under Rule 318c.
- Alter the size or configuration of existing drilling and spacing units for previously authorized GWA wells.
- Prevent owners from filing an application with the Commission alleging abuse of their correlative rights.
- Change Rule 305 and 306 regarding notice and consultation with surface owners.
- Change the Commission Policy for Onsite Inspections

Health, Safety and Welfare

- The revised Rule will stabilize production in the GWA, extending the life of the Wattenberg field.
- Prevent waste by recovering reserves that would otherwise remain in place.
- Protects correlative rights through the formation of Wellbore Spacing Units.
- Current Commission Rules and Policies remain in effect and offset health, safety and welfare considerations.
- Locally produced natural gas will continue to be used to heat/cool approximately 30% of all Front Range homes.

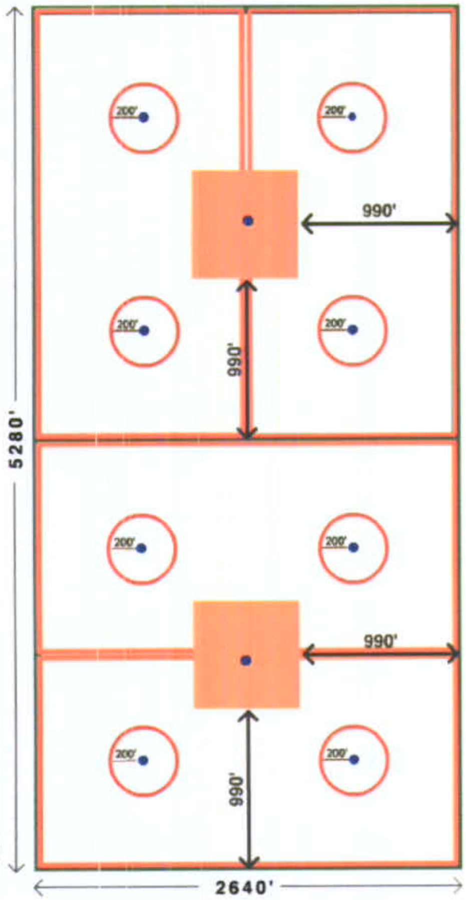
Health, Safety and Welfare

- Local jobs will be preserved and local economies will benefit.
- Oil & Gas tax revenues will increase in Colorado.
  - Property Taxes - $116 million in 2004
  - Severance Taxes - $58 million in 2004
- Helps keep the tax burden low in Weld County. Without tax revenues from oil & gas, county taxpayers would be paying 36% more in property taxes.
- These tax revenues support local government programs including school, fire and other specials districts.

Health, Safety and Welfare

- Royalty revenues will be maintained for 12,000 plus royalty owners in Adams, Boulder, Broomfield, Larimer and Weld counties.
- Will minimize surface use by utilizing directional drilling techniques and minimizing the distance between existing wells and new wells.

320 ACRE SPACING UNIT



LEGEND

RESET NEXT

Vertical Wells

80 Acre Spacing Units

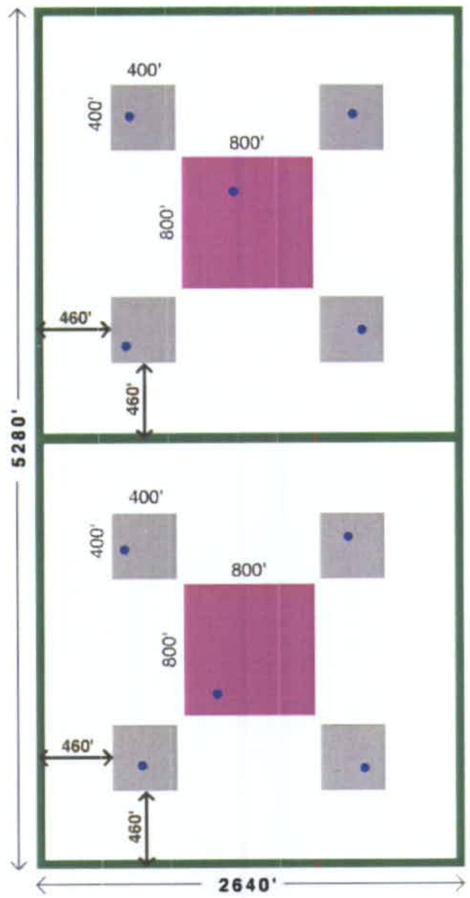
J-SAND Drilling Unit

80 Acre Spacing Units

Codell/Niobrara
Drilling Windows

320 ACRE SPACING UNIT

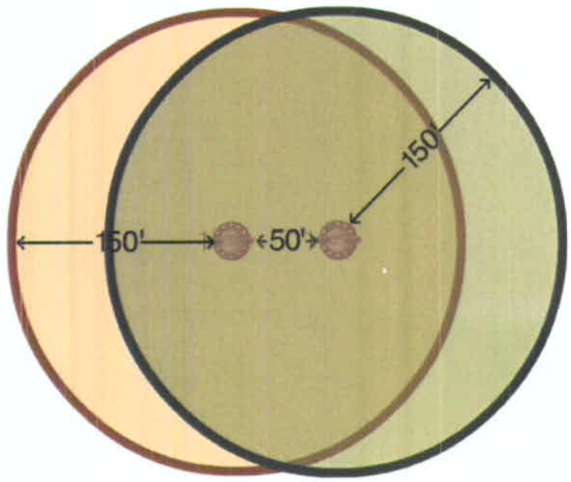
PREVIOUS | RESET | NEXT



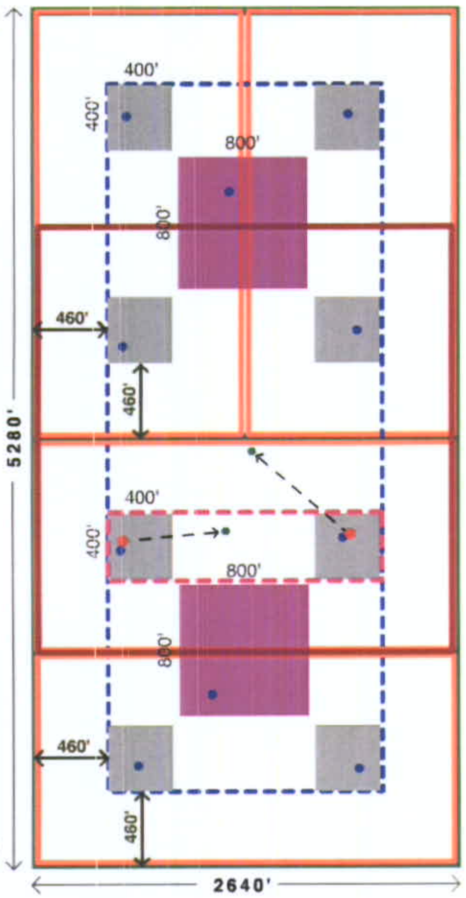
IMPROVED SURFACE UTILAZATION

LEGEND

PREVIOUS RESET NEXT



320 ACRE SPACING UNIT



LEGEND

PREVIOUS | RESET | NEXT

Vertical Wells

80 Acre Spacing Units

460' boundry (320)

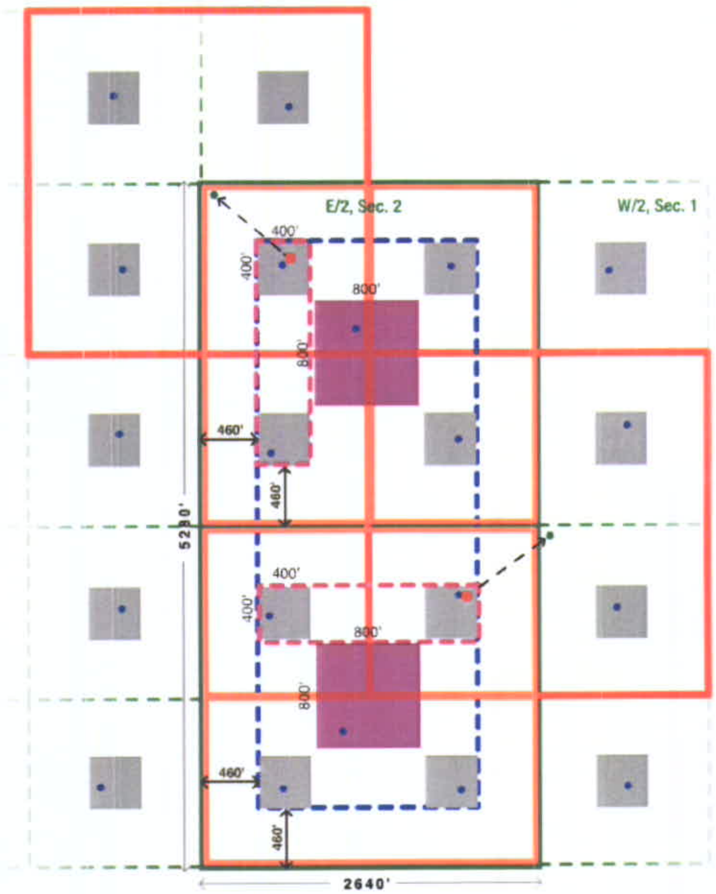
Directional Wells

80 Acre Spacing Units

160 Acre Wellbore Spacing Unit

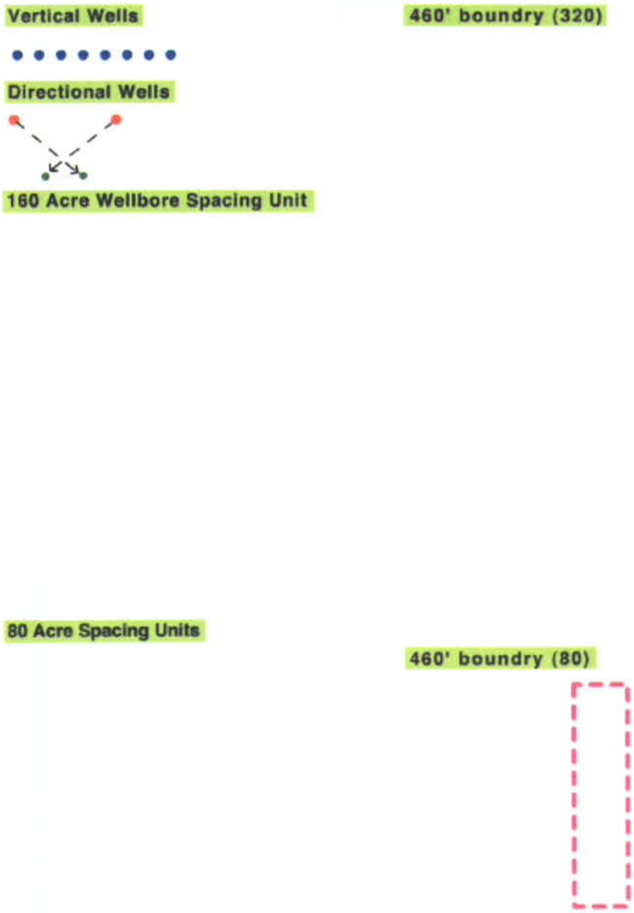
460' boundry (80)

320 ACRE SPACING UNIT



LEGEND

PREVIOUS RESET NEXT



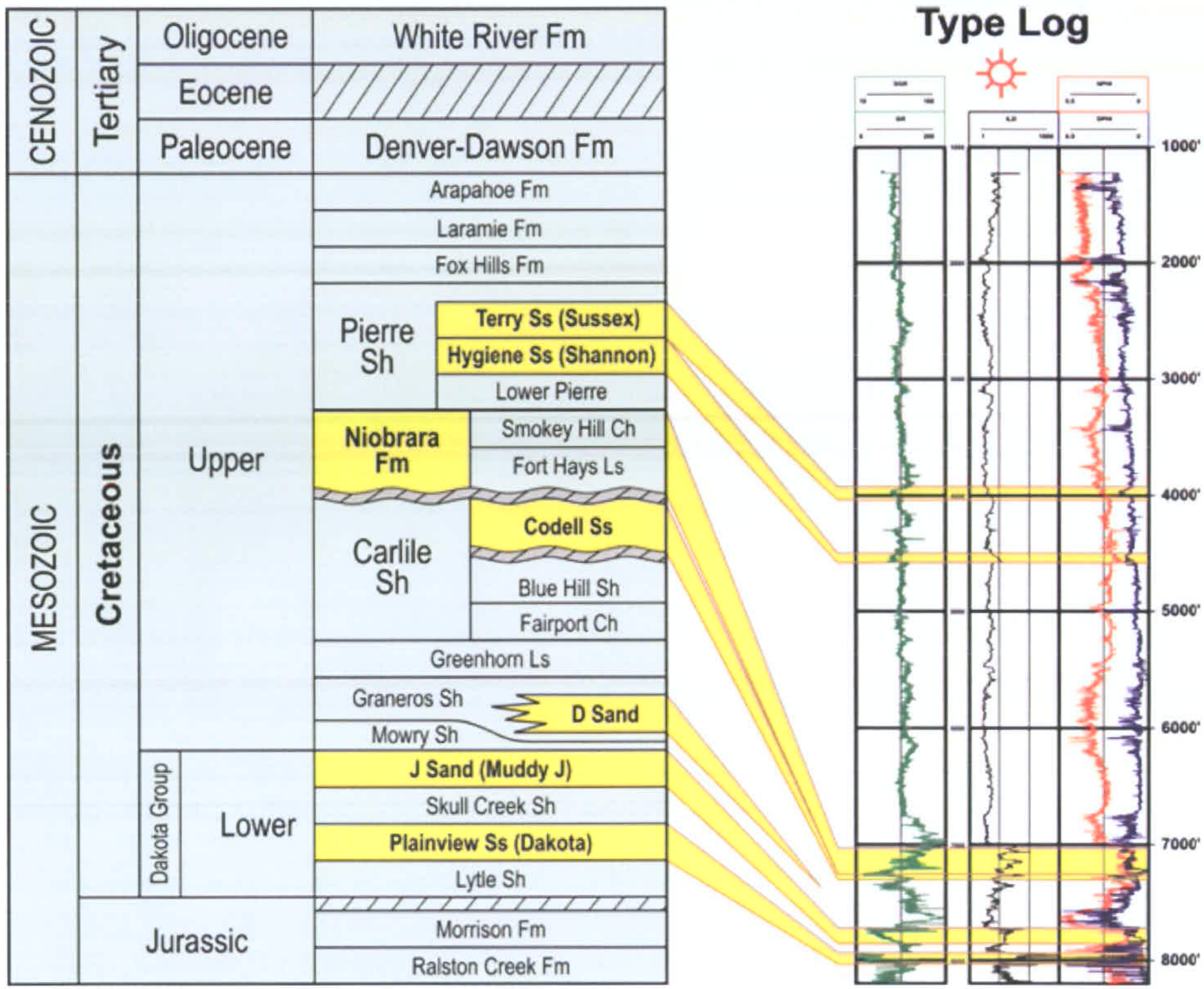
Geology

General Geology Discussion
Greater Wattenberg Area

by

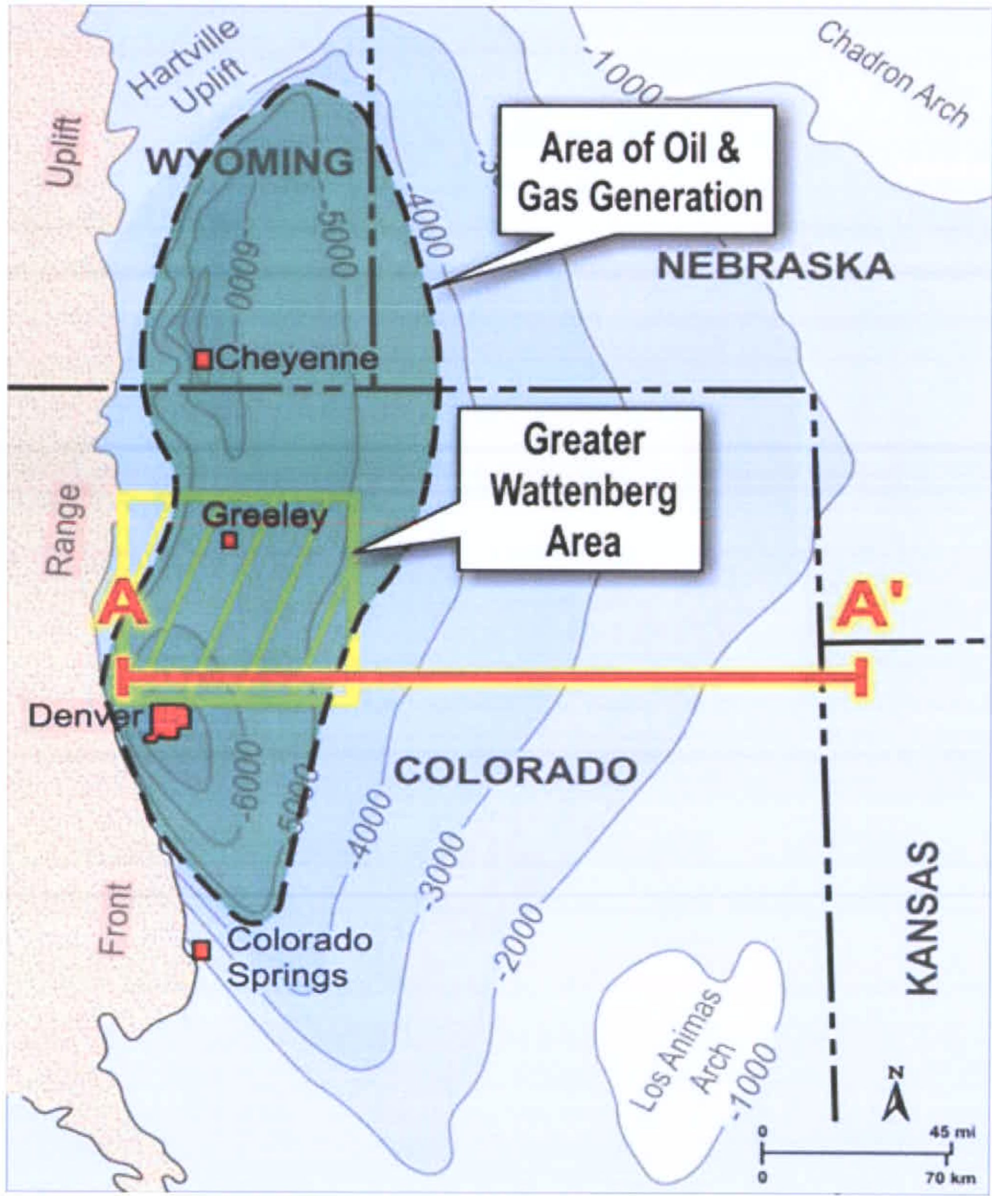
Dr. Robert J. Weimer

GWA Stratigraphic Column



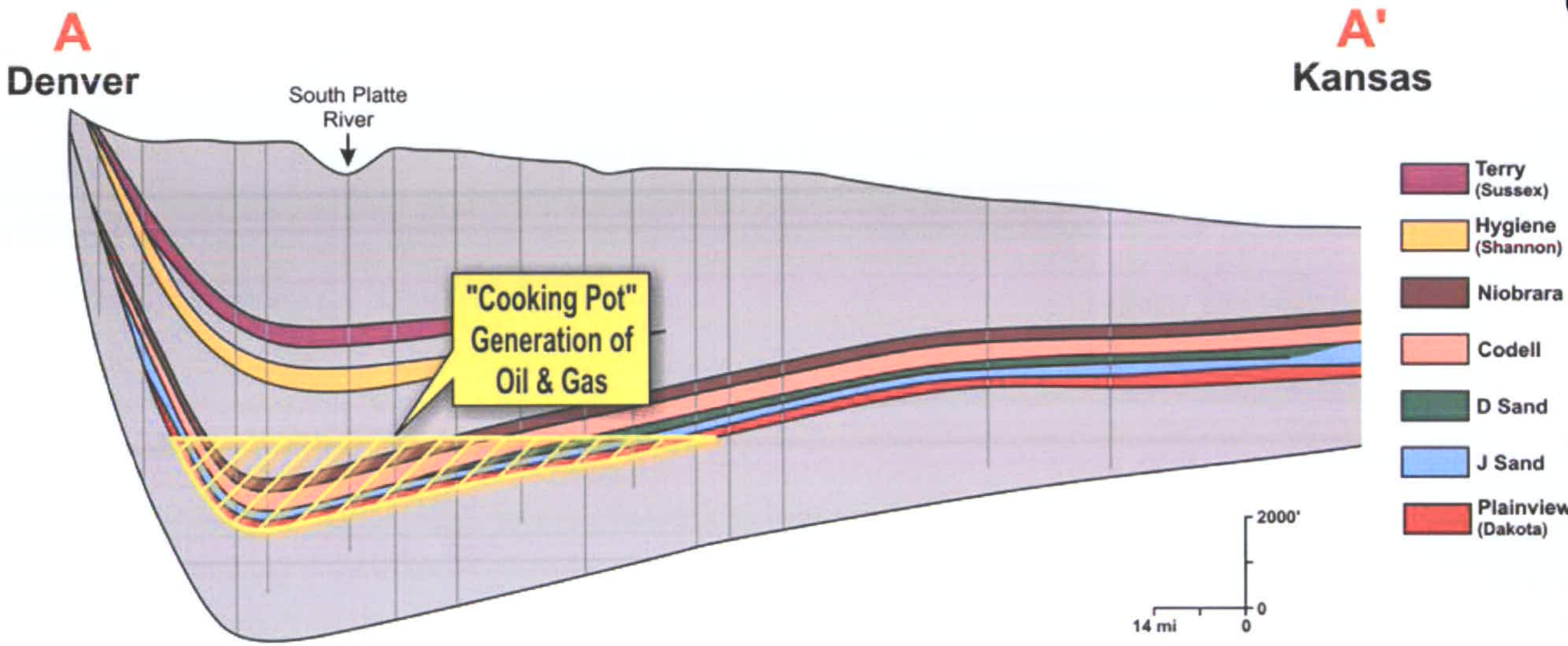
After Higley, et al, 2003

Deep Basin Petroleum Generation Structure Map (Top PC)



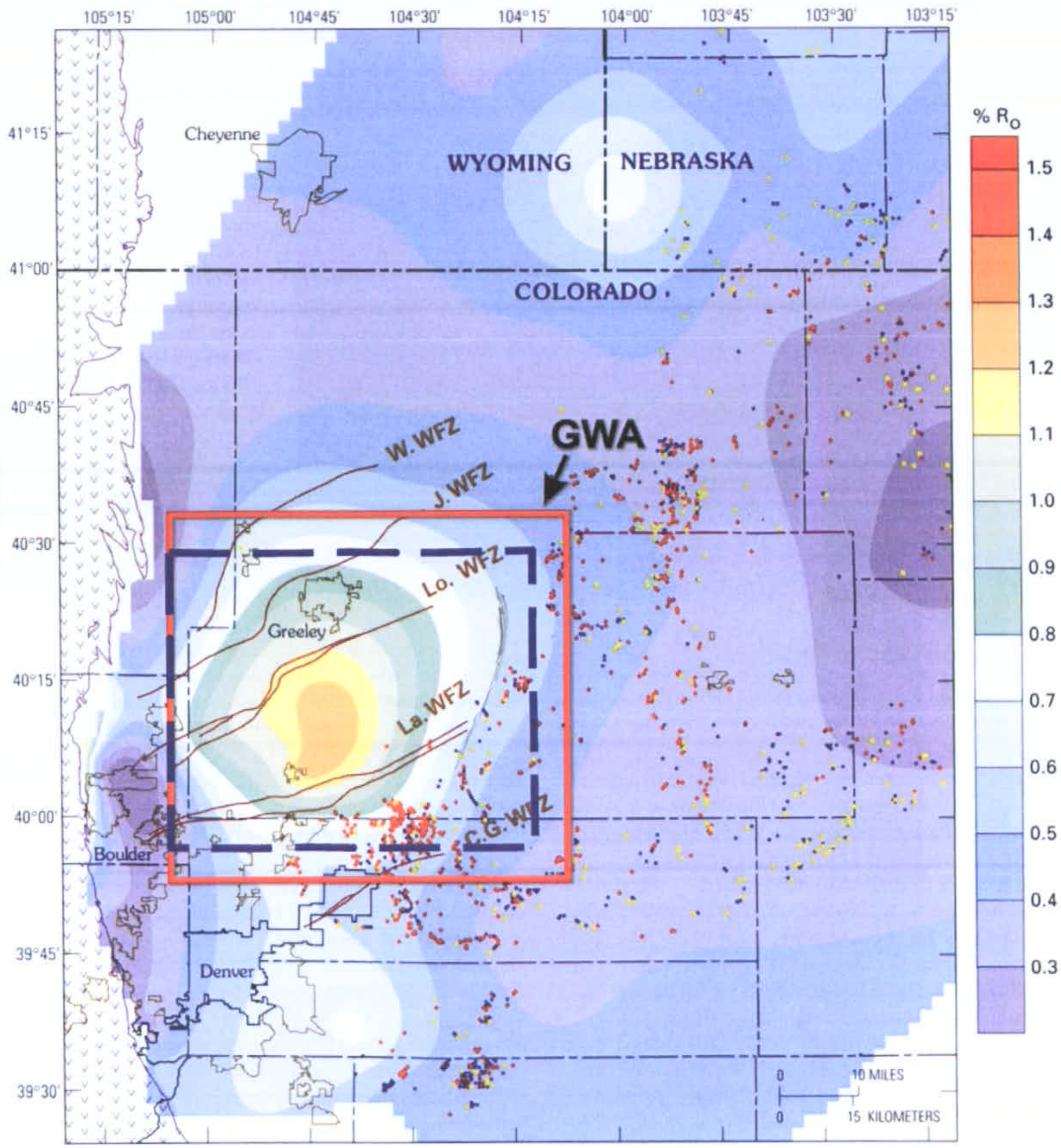
Weimer, 1996

Structural Cross Section of the Denver Basin



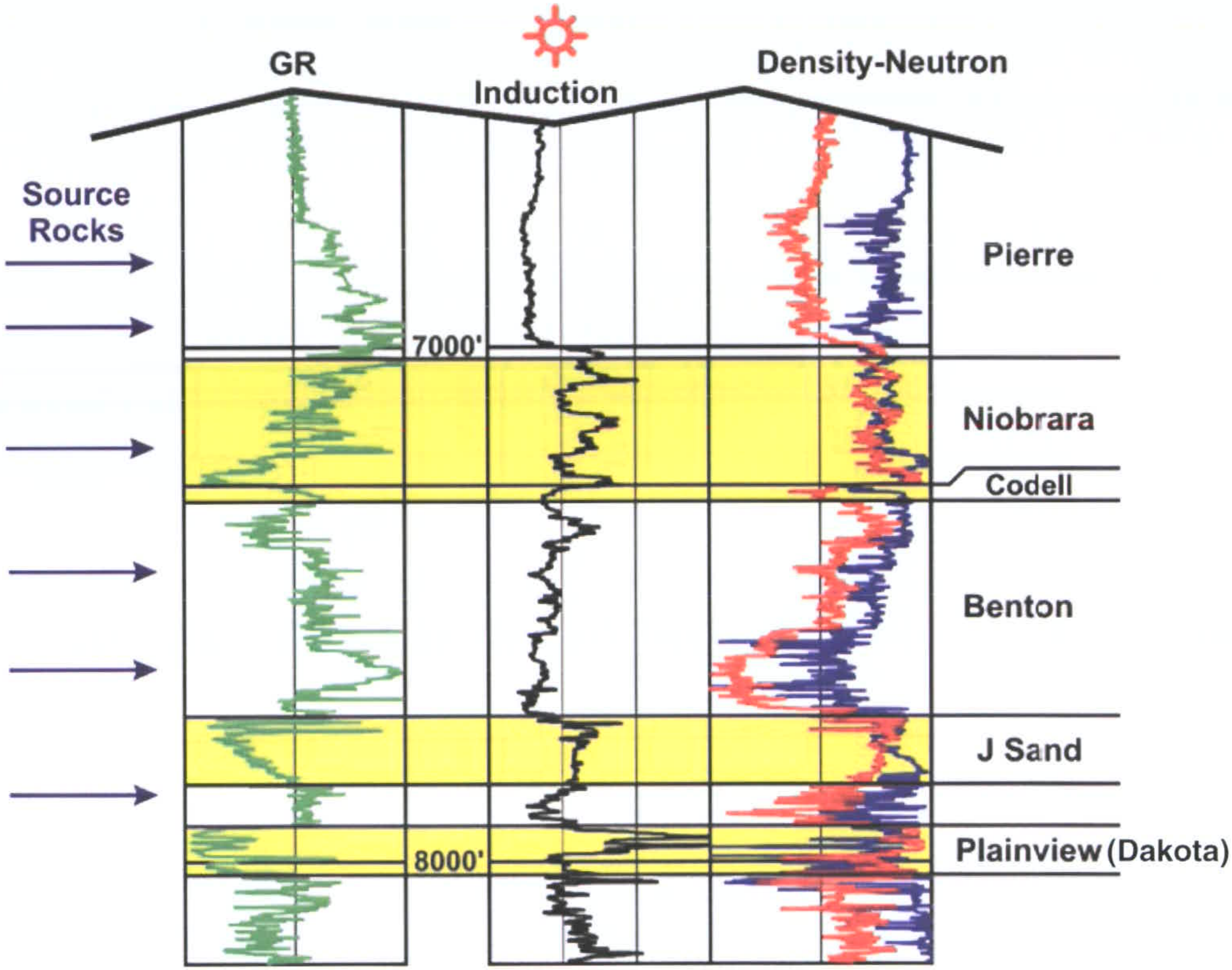
Weimer, 1996

Vitrinite Reflectance

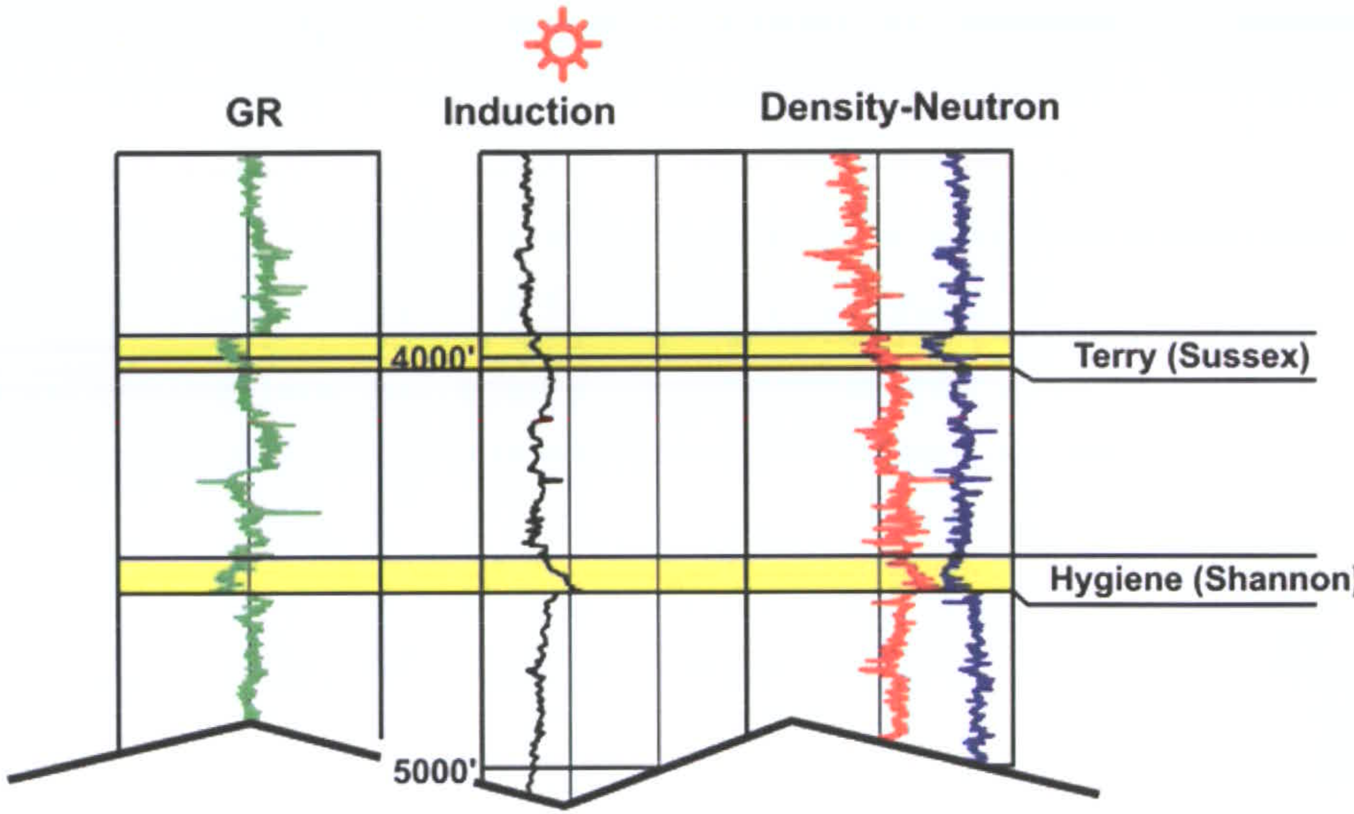


Higley & Cox, 2005

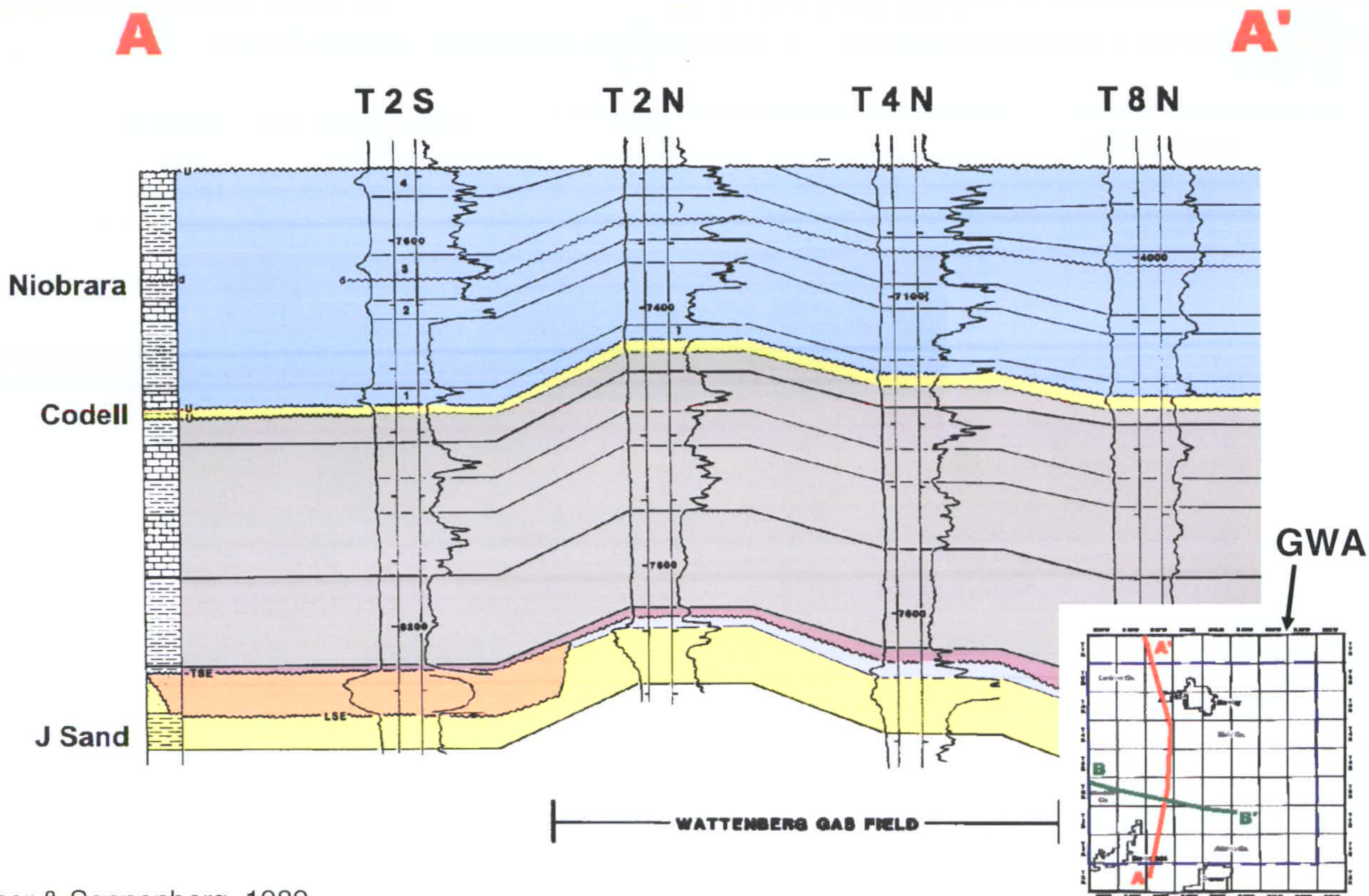
Type Log
Lower Producing Units



Type Log
Upper Producing Units

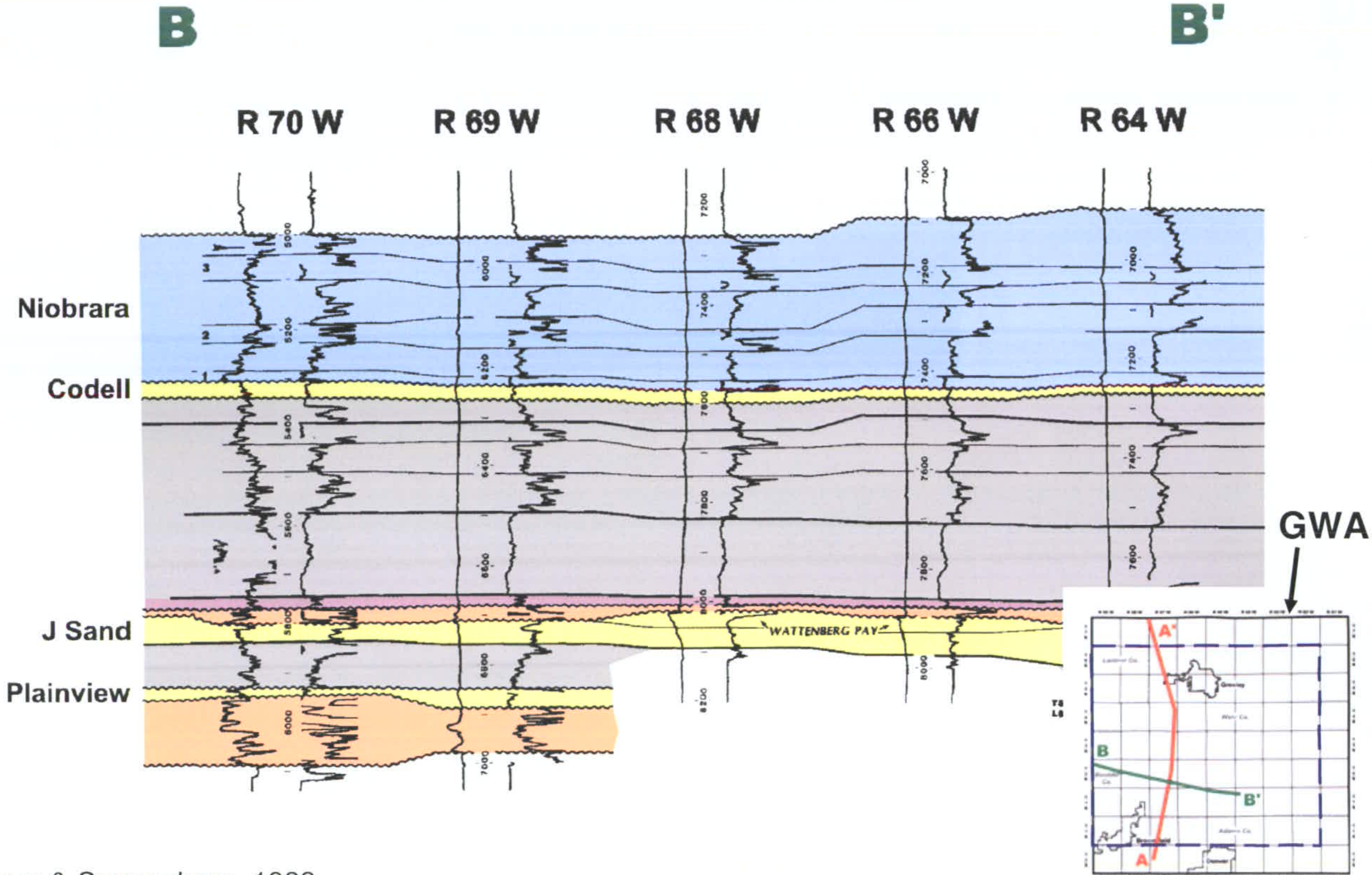


North-South Cross Section



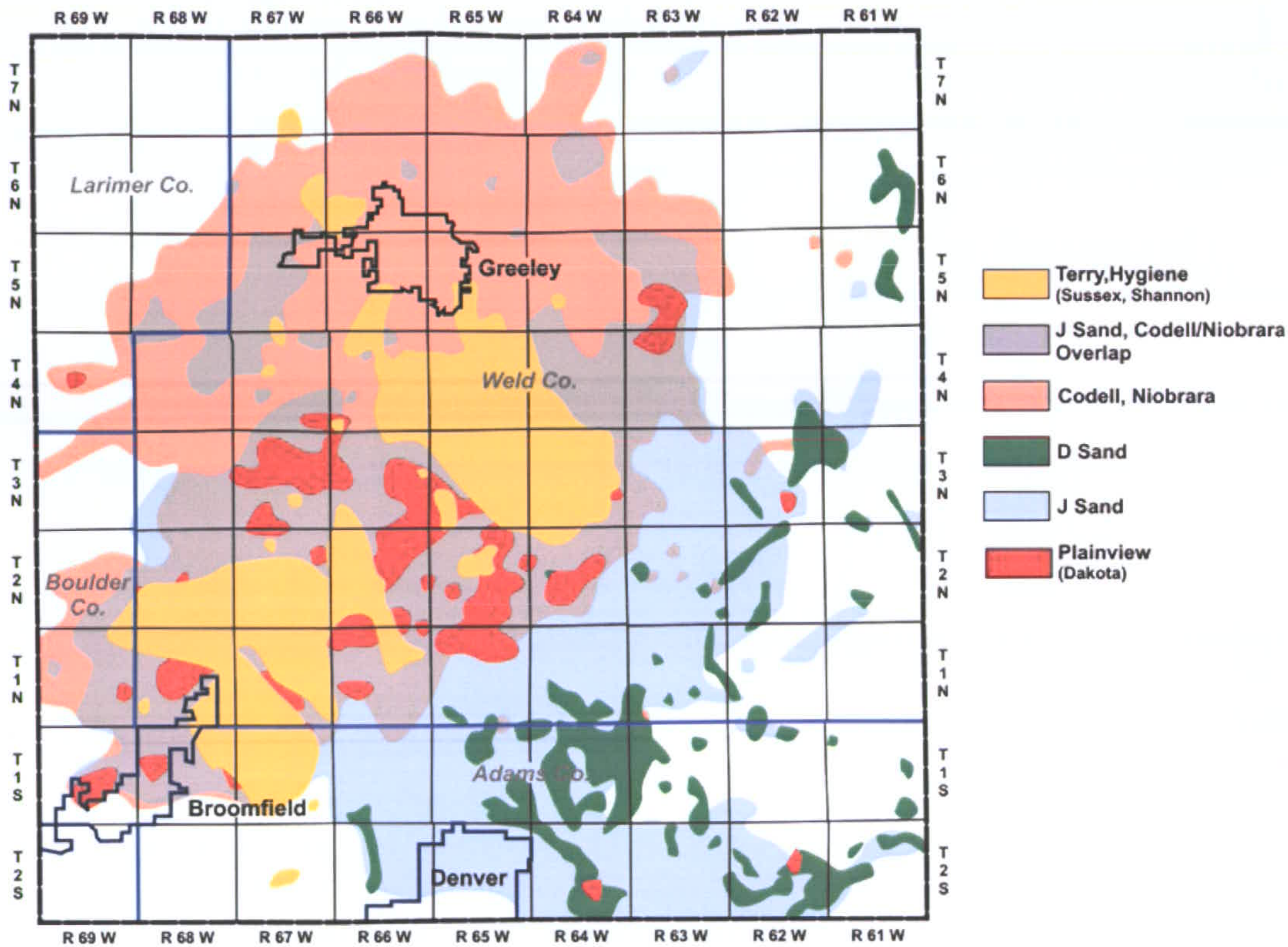
Weimer & Sonnenberg, 1989

East-West Cross Section



Weimer & Sonnenberg, 1989

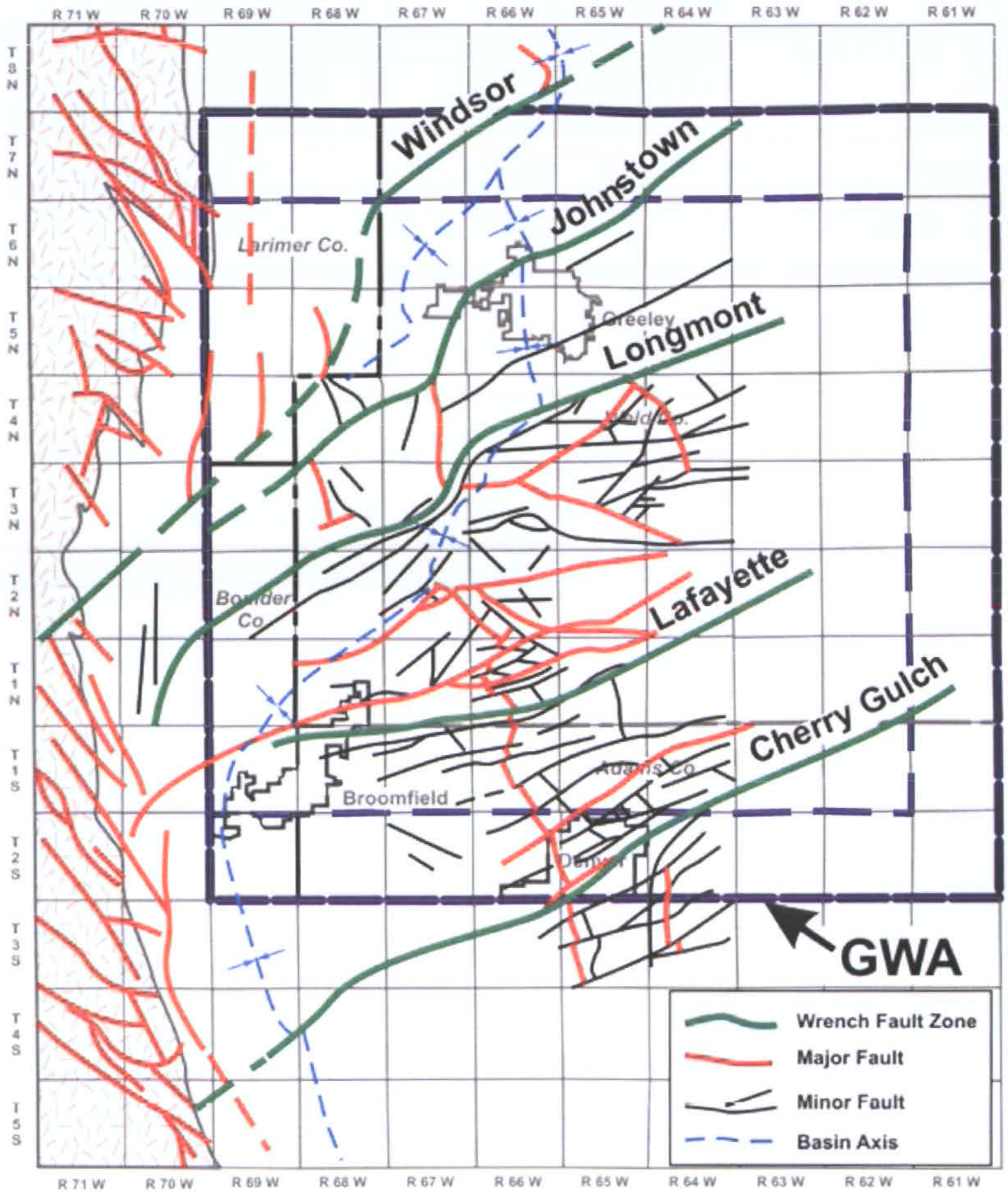
Currently Productive Areas-Wattenberg Field



Modified after Ladd, 2001

Fault Map with High Density Well Control

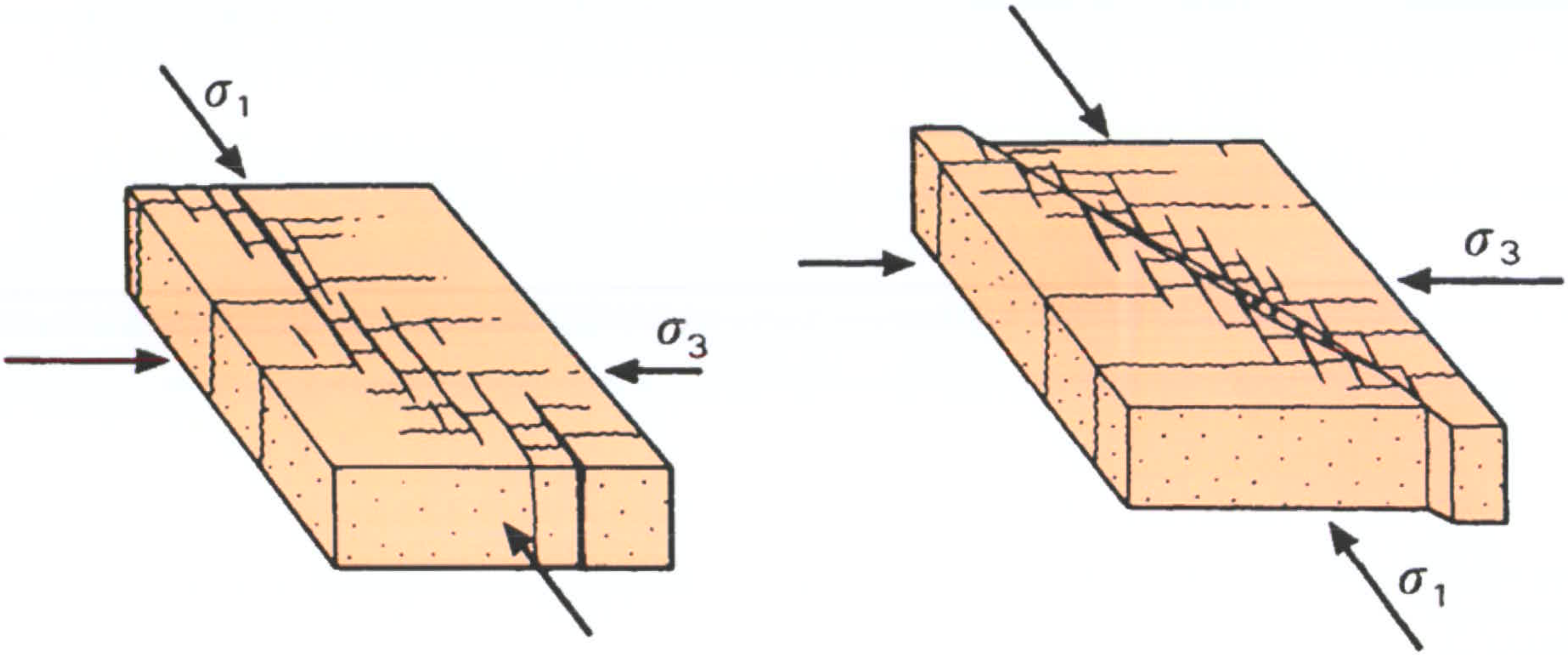
1996



Weimer, 1996

Model for Fracturing & Faulting

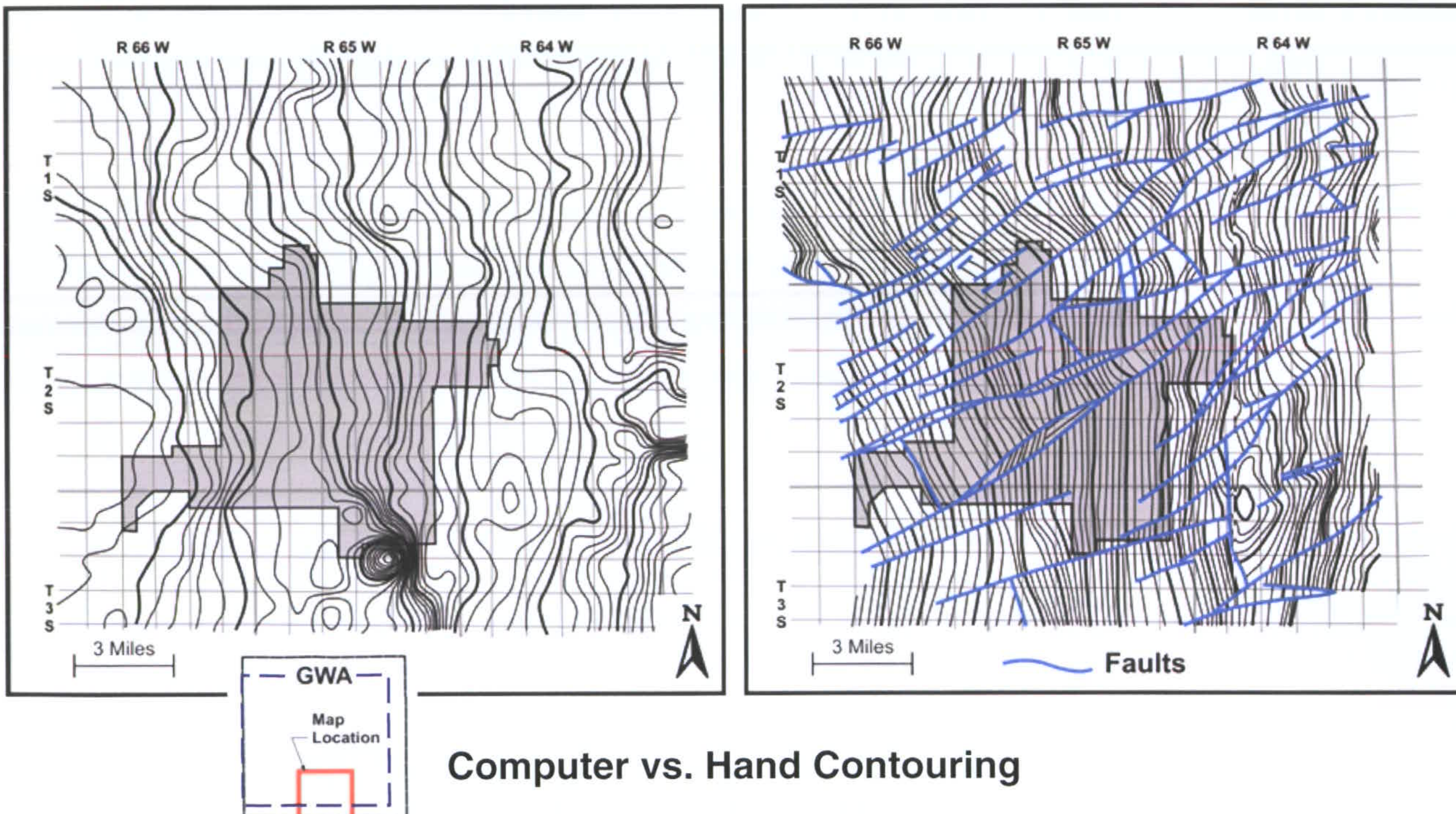
Wrench Faulting



Fracturing & Stress Fields

du Rochet, 1981

Structural Interpretation

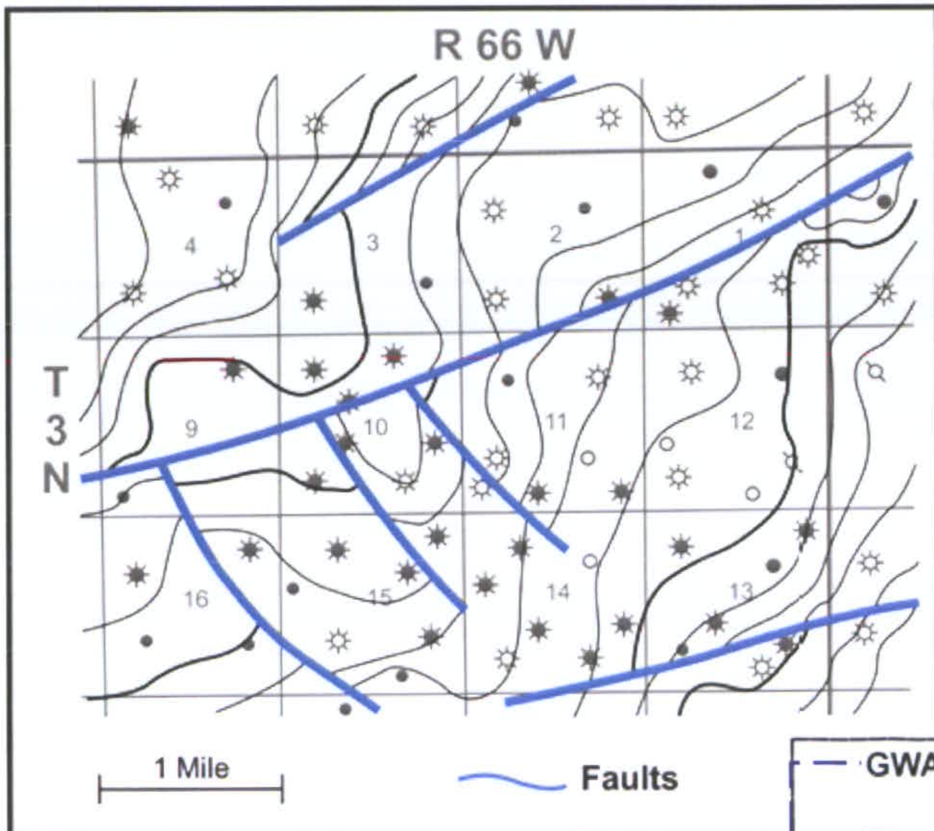


Computer vs. Hand Contouring

Weimer, et al, 1998

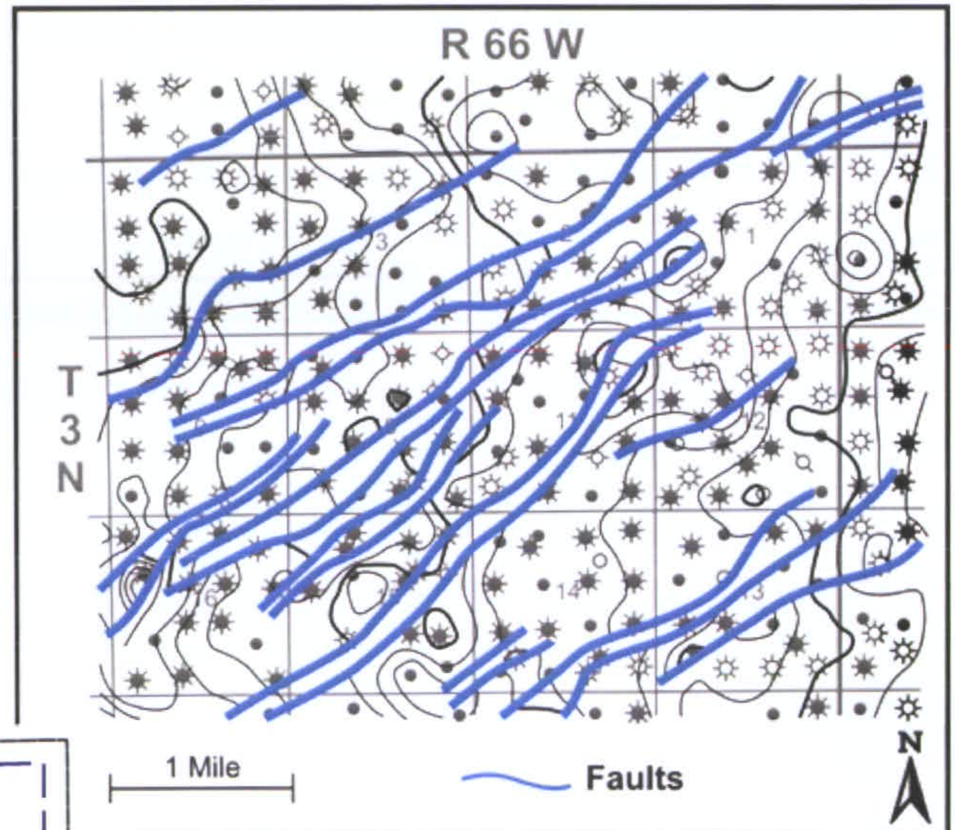
Codell Faulting Density is Greater than J Sand

J Sand Faulting



160 Acre Spacing

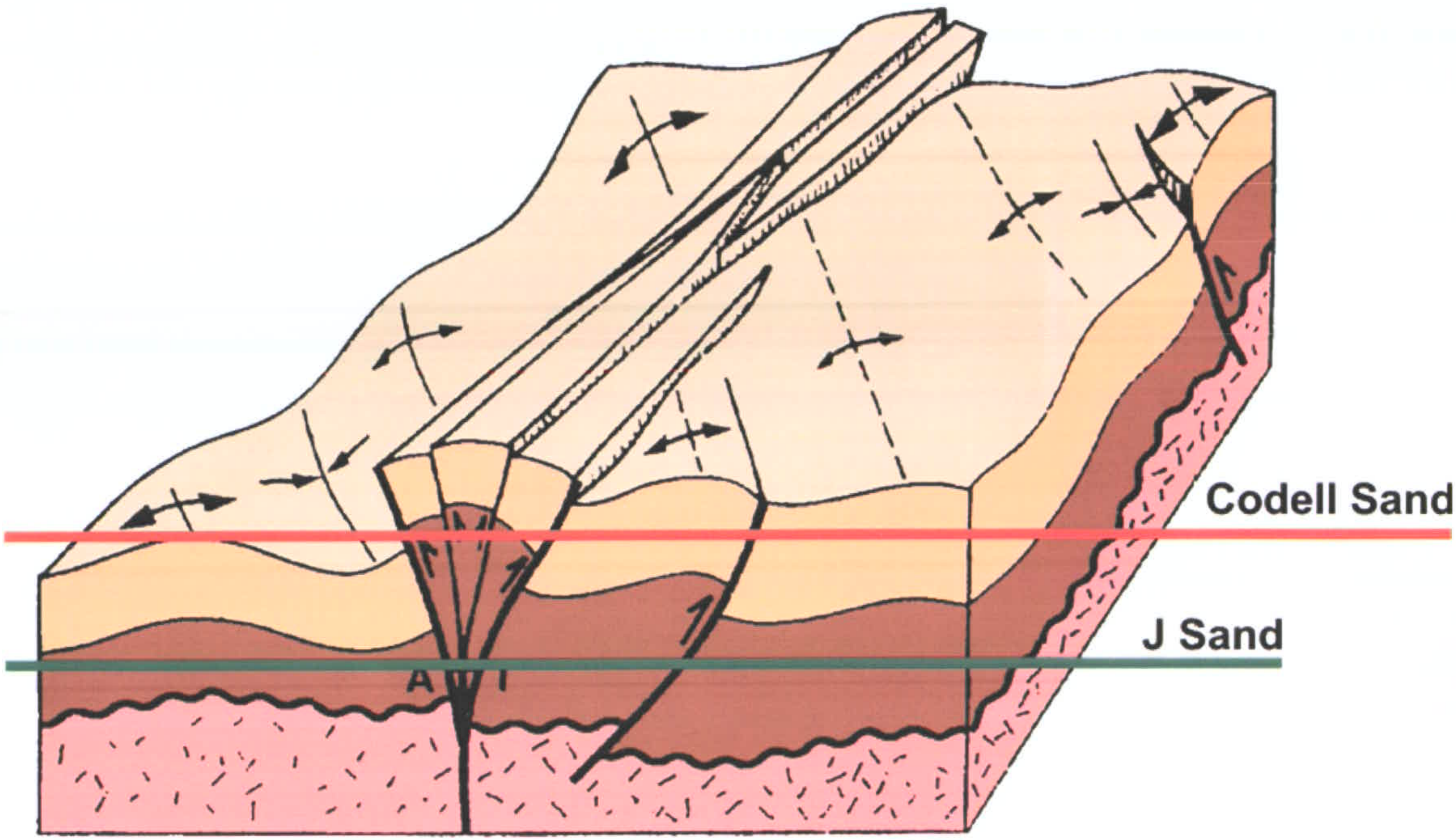
Codell Sand Faulting



40 Acre Spacing

Ladd, 2001

Convergent Wrench Fault Flower (Palm) Structure



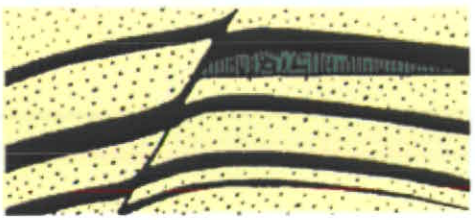
Adapted from Harding, 1990

Stratigraphy & Reservoir Compartmentalization

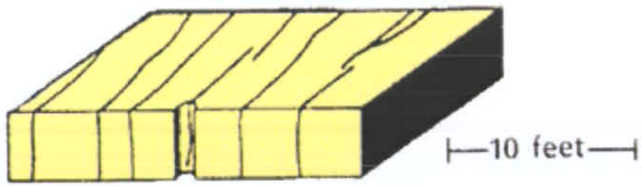
Types of Compartmentalization

Most Common Types

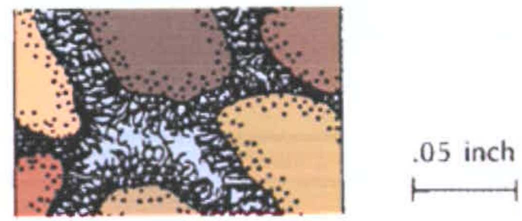
Sealing Fault
Semi-sealing Fault
Non-sealing Fault



Fracturing-Tight
-Open

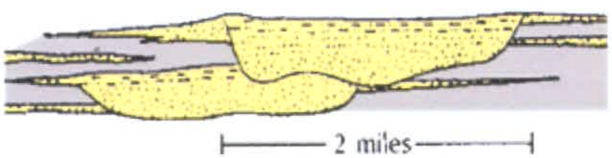


Microscopic Heterogeneity
Textural Types, Diagenesis

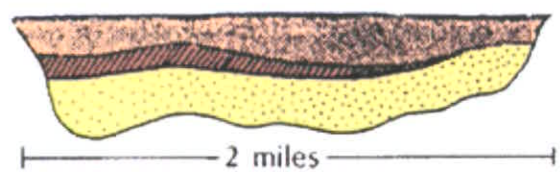


Less Common Types

Boundaries Genetic Units



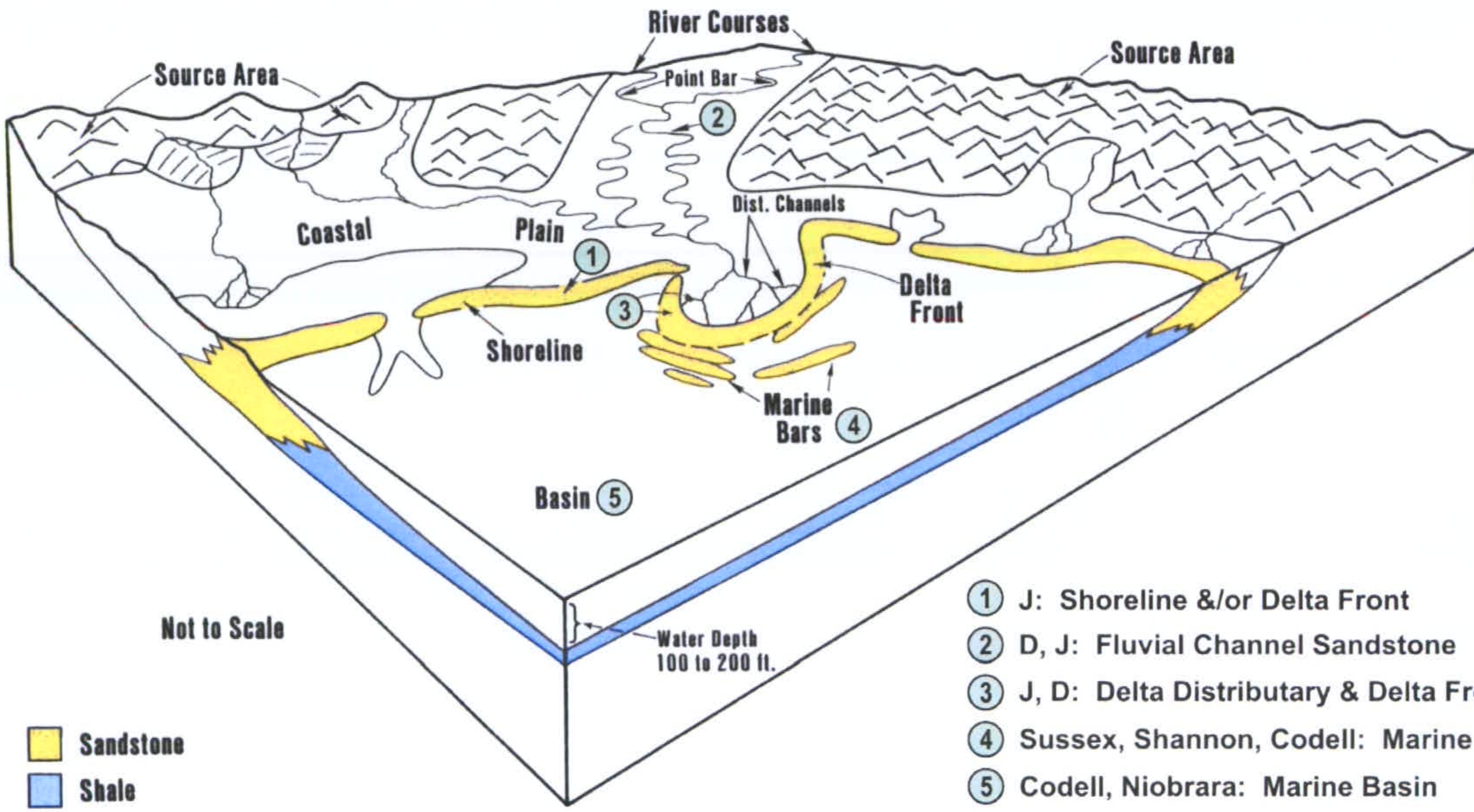
Permeability Zonation Within Genetic Units



After Weber, 1988

Environments of Deposition
Reservoir Compartments

(Mega-Scale)

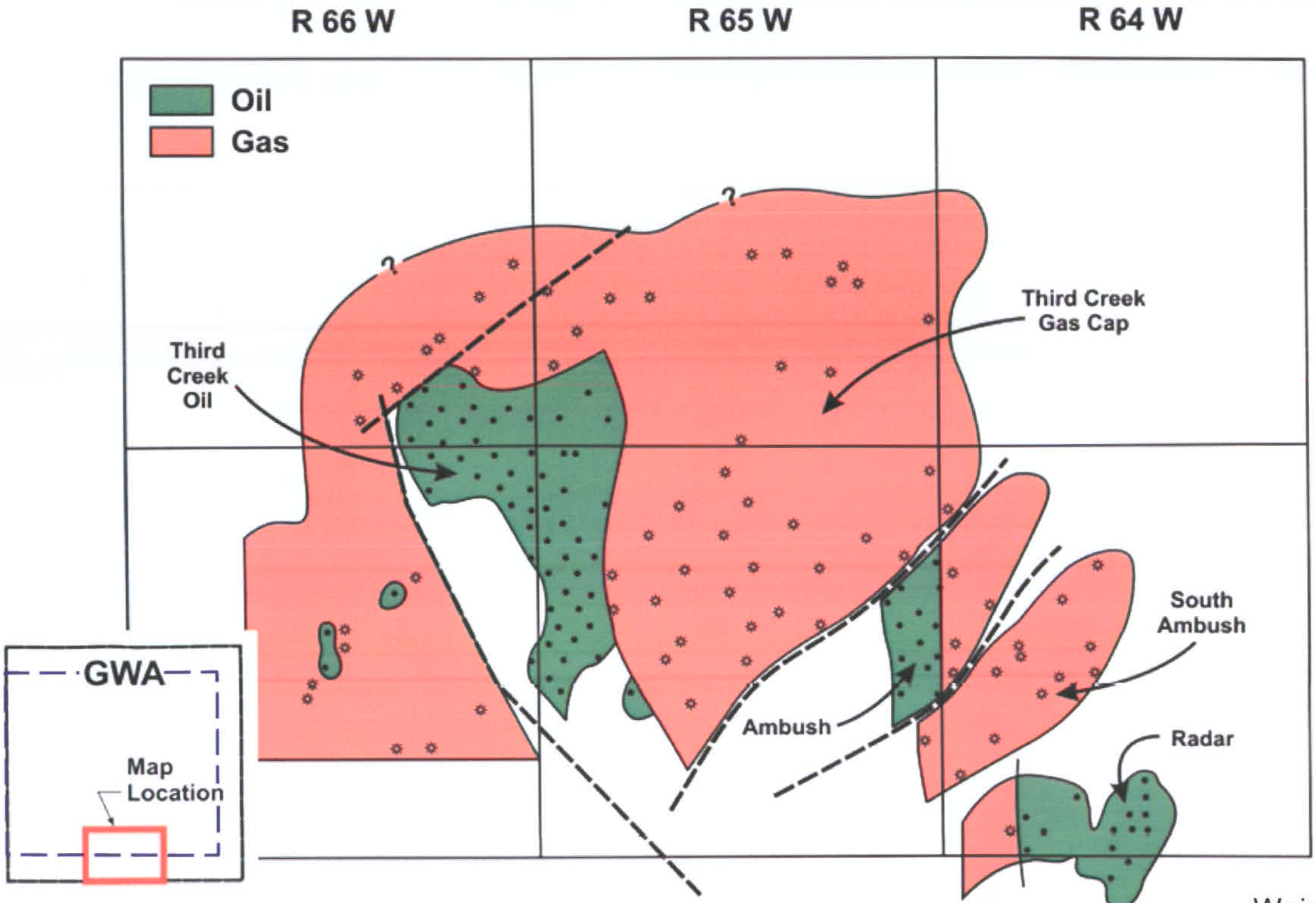


1. J: Shoreline &/or Delta Front
2. D, J: Fluvial Channel Sandstone
3. J, D: Delta Distributary & Delta Front
4. Sussex, Shannon, Codell: Marine Bars
5. Codell, Niobrara: Marine Basin

Weimer, Land, & Porter, 1985

Reservoir Compartments

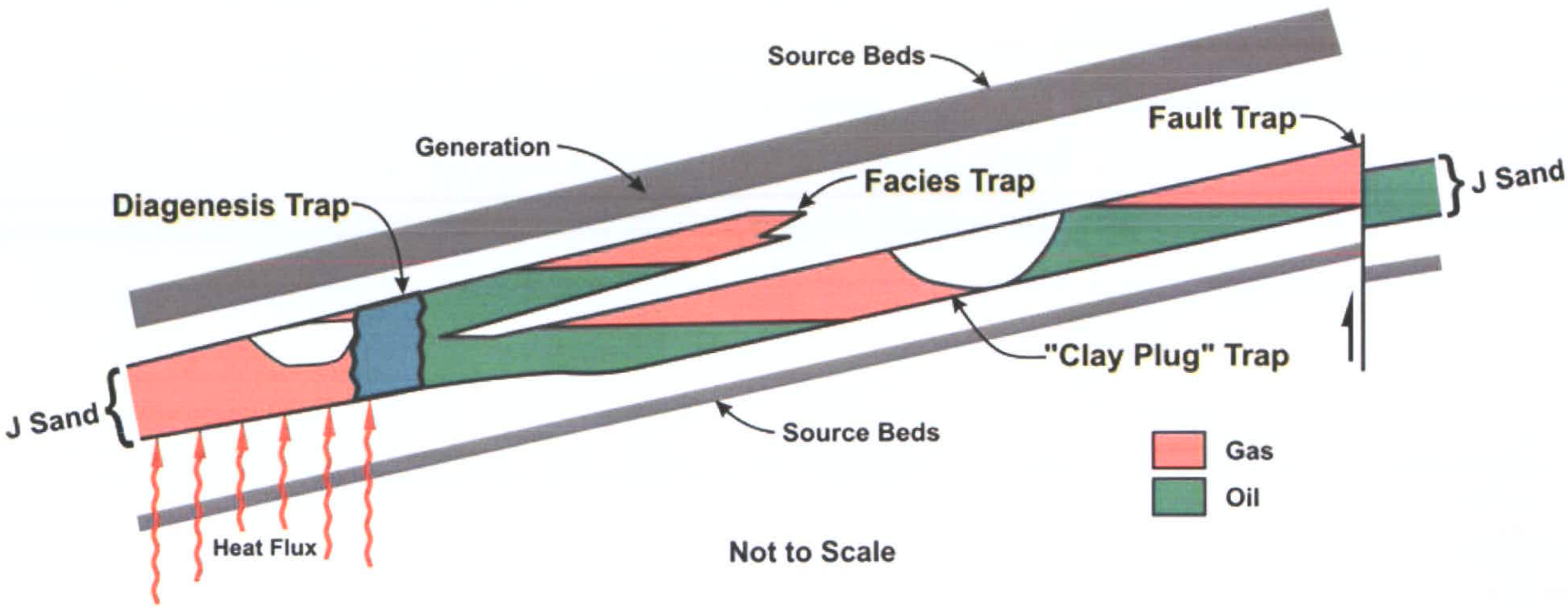
DIA Example (South GWA)



Weimer et al, 1998

Reservoir Compartments

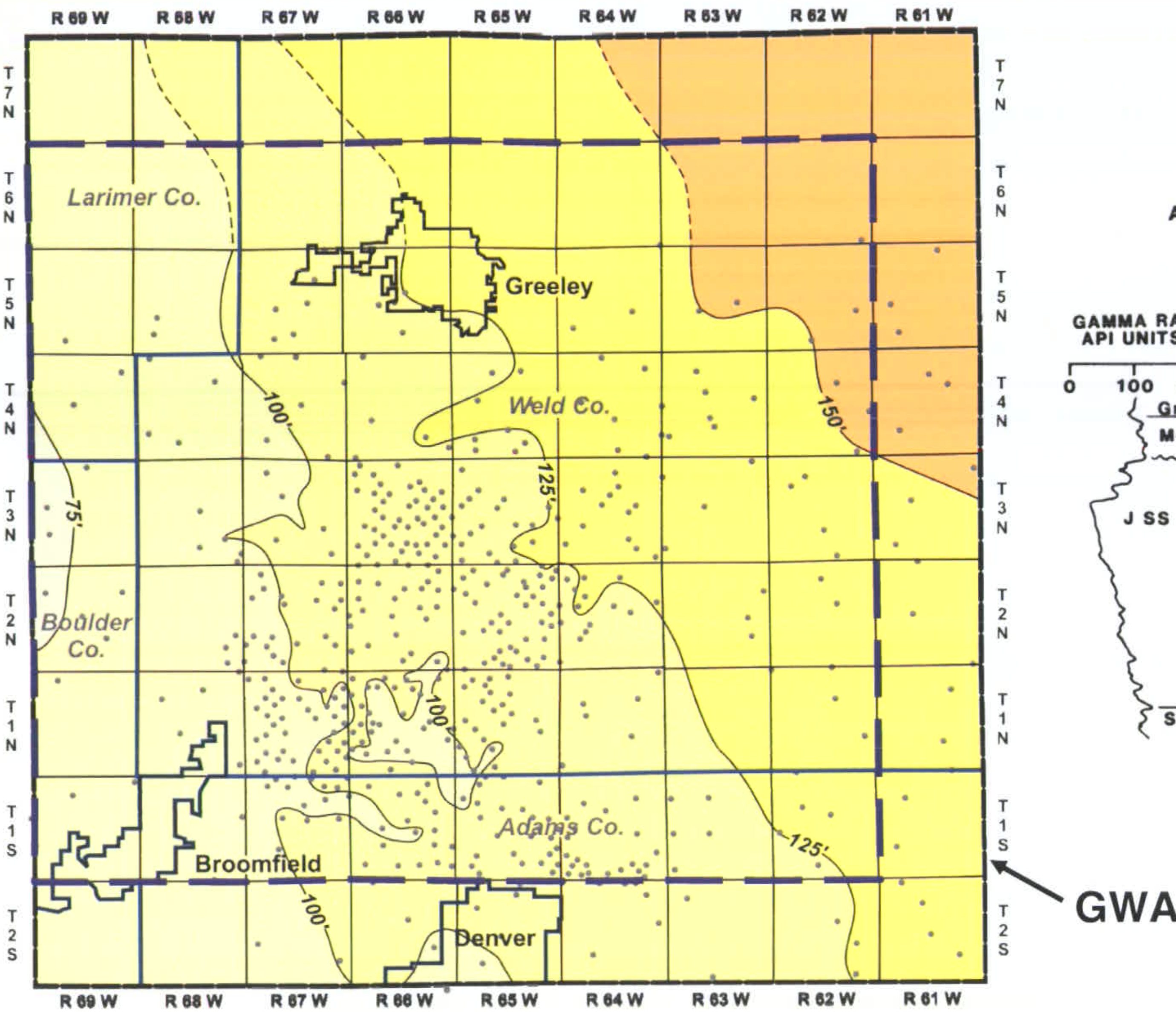
Diagramatic Cross Section

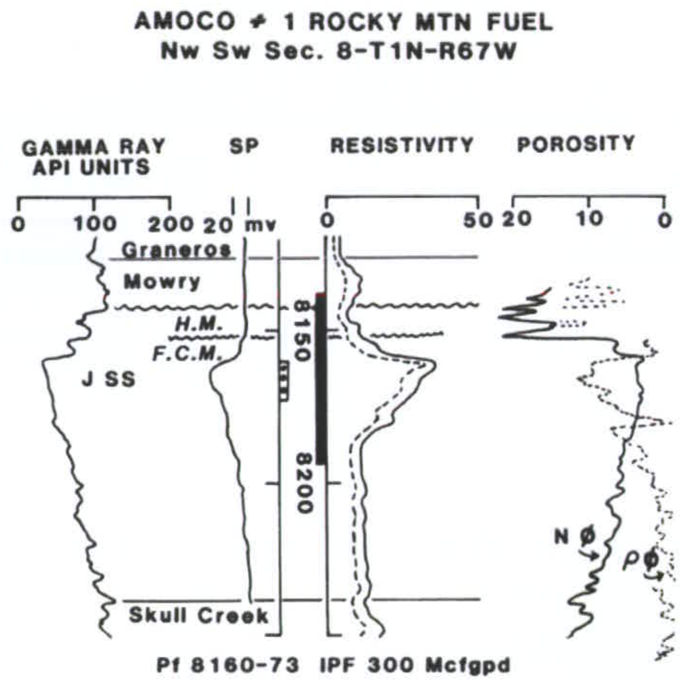


Weimer et al, 1998

Discussion of Major Pools in GWA

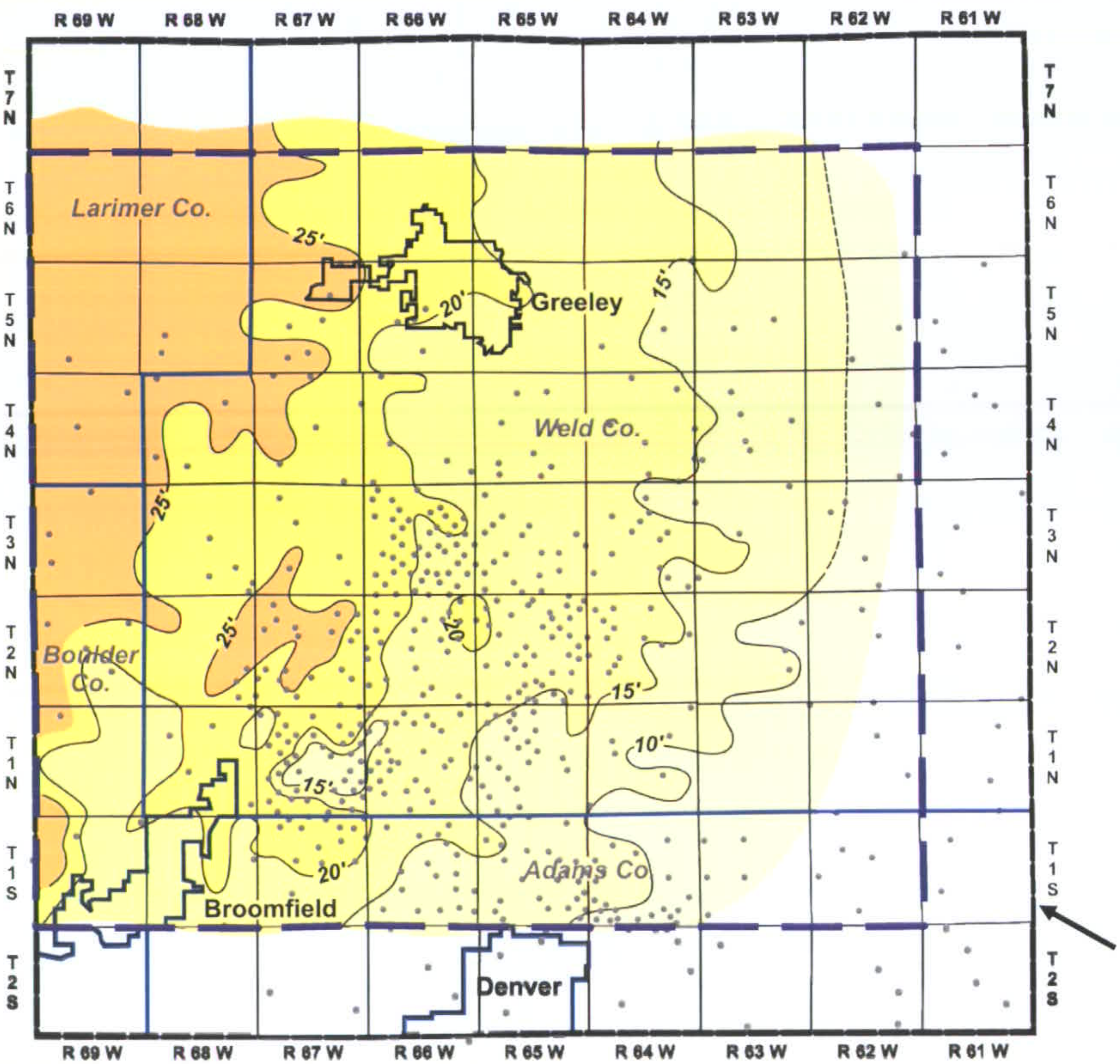
Isopach Map of J Sand





Weimer & Sonnenberg, 1989

Codell Sand



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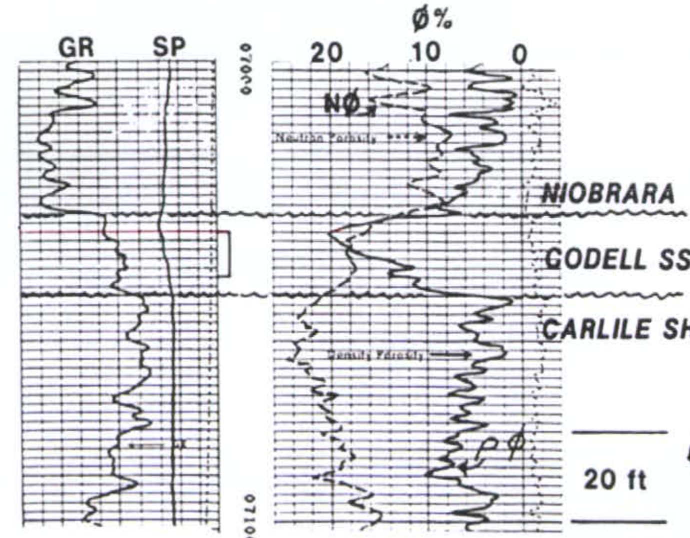

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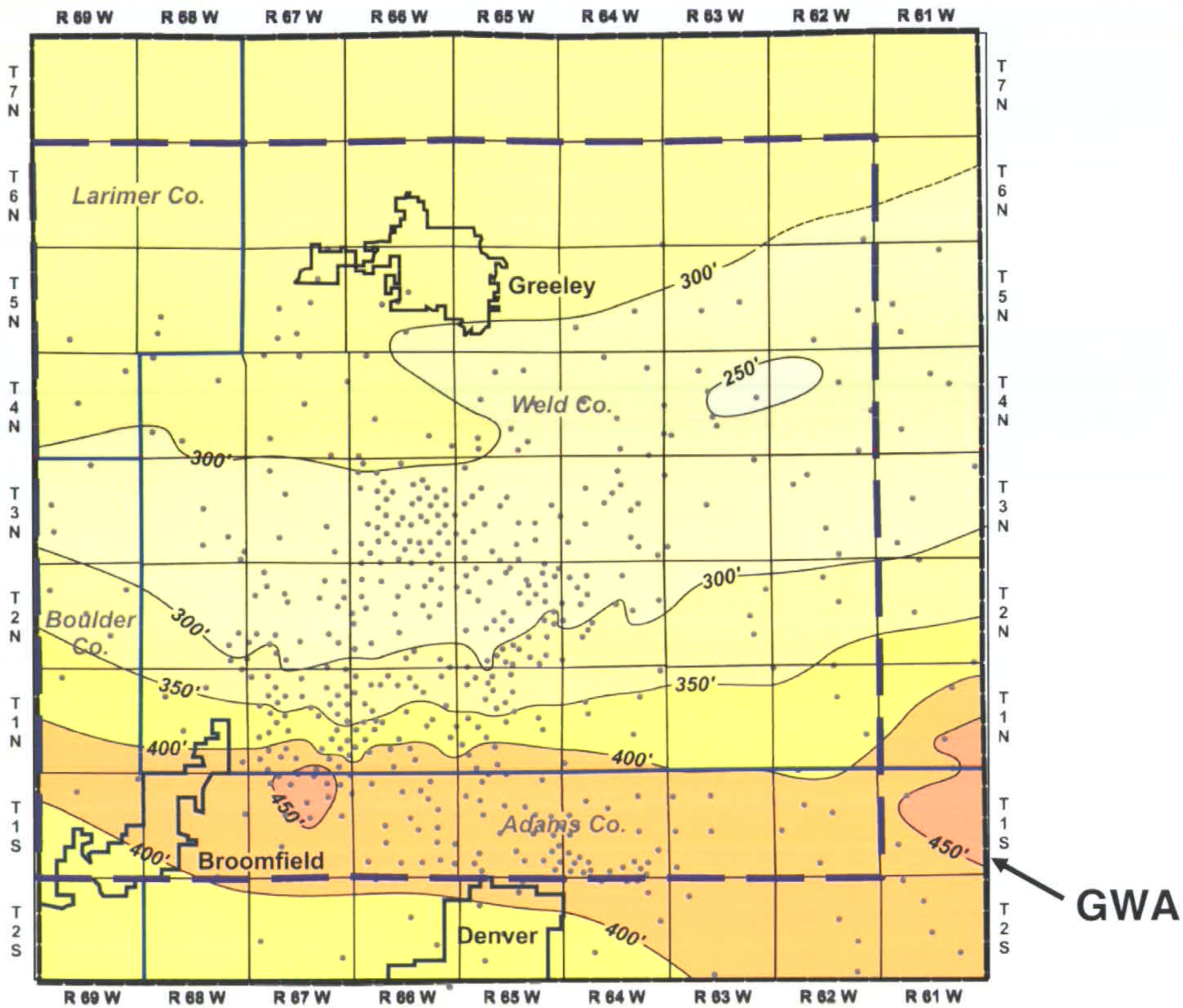
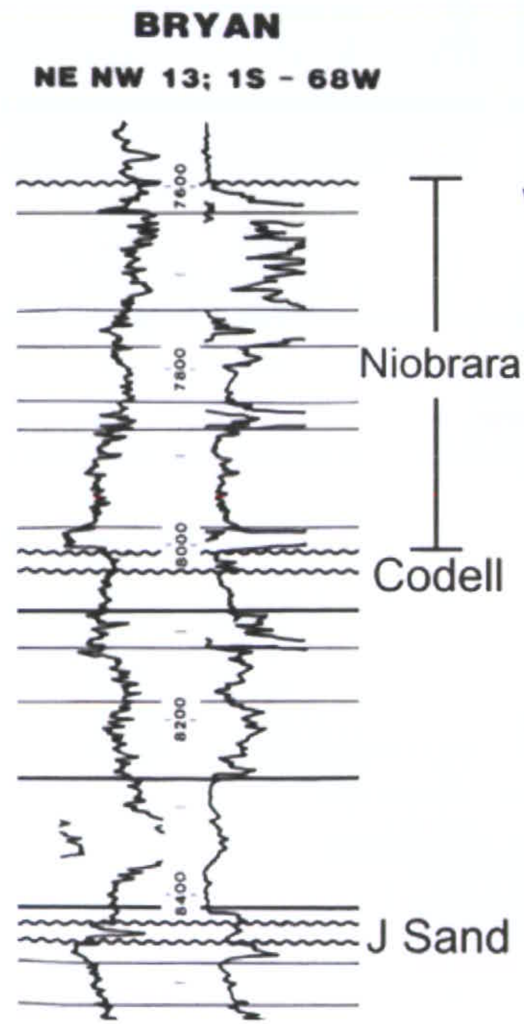
H. Panigoro, 1988

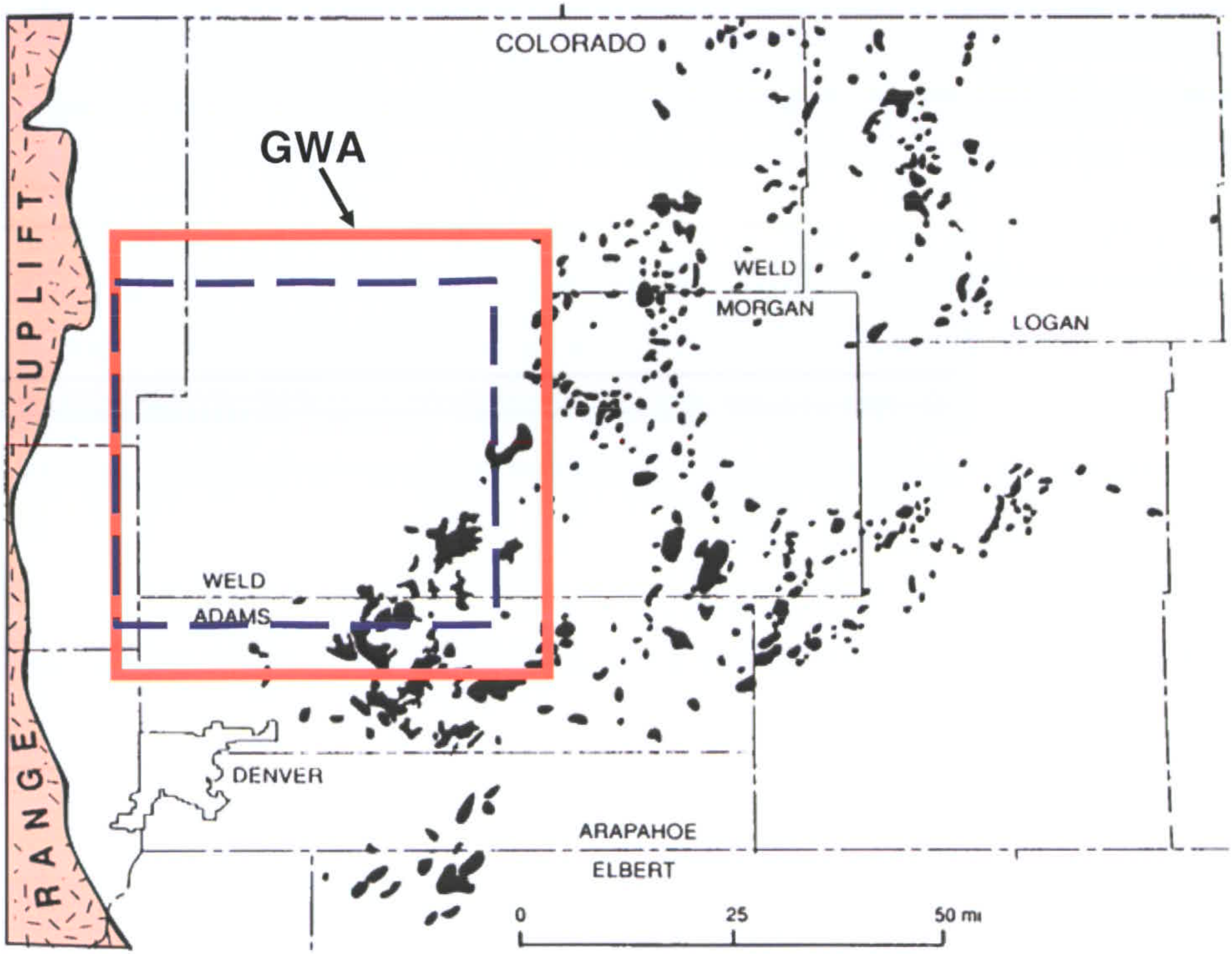
Niobrara Isopach Map





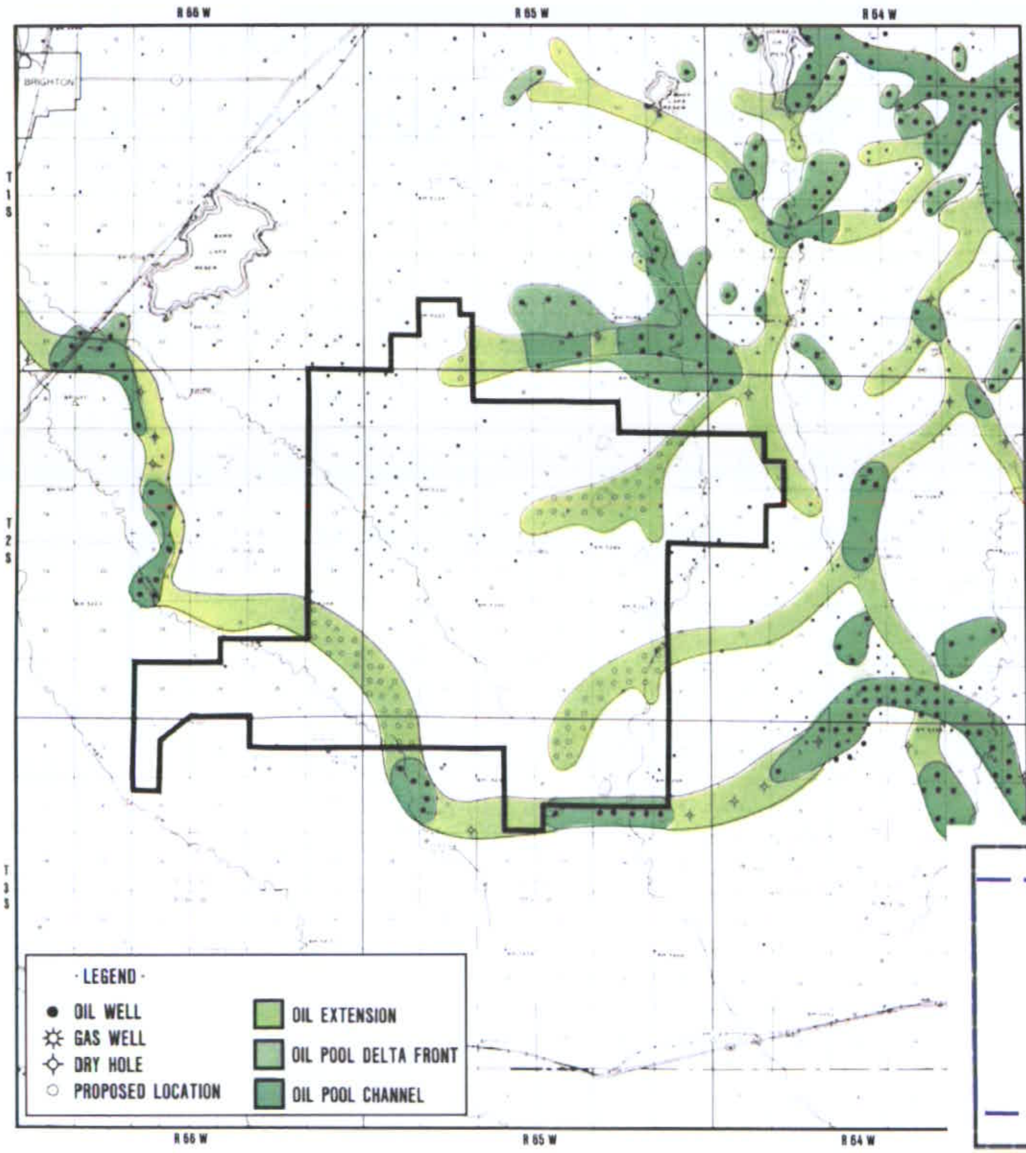
Weimer & Sonnenberg, 1989

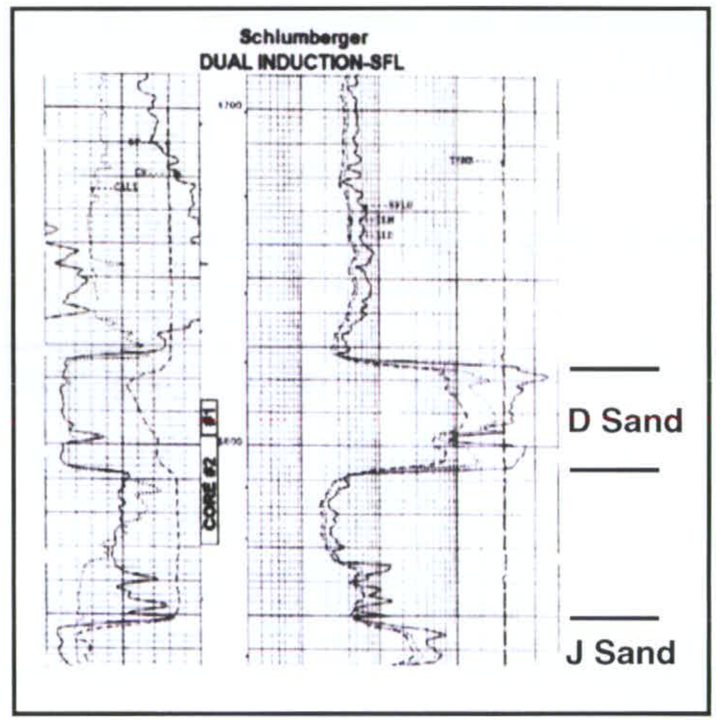
D Sand Field Distribution

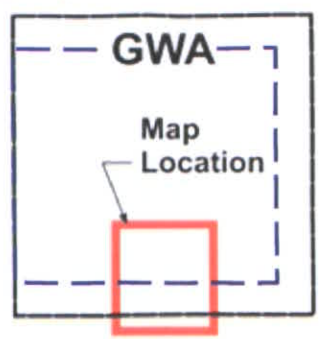


Gackle et al, 2001

D Sand Channel & Oil Fields
DIA Area







Weimer, et al, 1998

Summary

- Wattenberg is a multi-pool field (seven pools), with depths from 4,000 to 8,500 feet.
- One or more of the Codell, Niobrara, J are present throughout the revised GWA.
- The geology of each pool shows compartmentalization related to:
  - Original depositional environments
  - Later faulting
  - Reduction of porosity or permeability by diagenesis
  - Other post-depositional changes

Summary (con't)

- Size of compartments are on mega- and micro-scale.
- Closely spaced wells assure that most of the gas and oil in place can be produced to the benefit of mineral owners, lease owners, the counties and the state.

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NOTES ON SLIDES USED IN GEOLOGIC PRESENTATION FOR 318A HEARINGS BEFORE THE COGCC, NOVEMBER 17, 2005

By Robert J. Weimer, Consulting Geologist
Golden, CO 80401

Slide No.

1.--GENERAL GEOLOGY DISCUSSION

2.—Concept: Cretaceous sedimentary formations, 9000 feet thick in the GWA, contain seven thin oil and gas reservoirs.

A generalized table of formation names in GWA compiled from outcrops and well data with a typical log of oil and gas reservoirs.

3.—Concept: A basin center petroleum system in this producing basin has source rock, generation, migration, and trap, with accumulations that extend over least 700,000 acres (after Rice, 1984).

A structure contour map of Denver Basin shows the area of oil and gas generation in deeper part of basin, with an outline of the Greater Wattenberg Area and the line of cross section A-A' shown on next slide. The large productive area and estimated ultimate recovery (EUR) classifies Wattenberg as a "Giant Field".

4.—Concept: Oil and gas were generated where source rocks were subjected to increased temperatures at depth in the bottom of the basin.

A structural cross-section with Cretaceous strata shows the "cooking pot" where solid organic material, under high temperature, is converted to liquids and gas in the deep basin with the creation of a high pressure cell. Oil and gas migrated laterally or vertically to the seven producing horizons. Vertical migration from the "cooking pot" to the Shannon and Sussex pools was along near vertical faults and fractures.

5.--Concept: Higher than normal subsurface temperatures are found within the GWA and large volumes of oil and gas were generated over the large area.

This map shows temperature variation by use of vitrinite reflectance data (Ro values) with a contour interval of 0.1%. High temperatures caused a higher yield of oil and gas to migrate and charge reservoirs, and converted oil to thermogenic gas. The temperature anomaly has been related to an igneous intrusion in basement rocks along the trend of the Colorado Mineral Belt. Oil and gas may be generated in areas with a Ro value higher than 0.6%, which would give a potentially larger producing area than shown by the present outline of the Wattenberg Field. The hydrocarbon charge was large enough to displace water from the reservoir so that no free water leg is present in the field. The gas column has at least a 500-foot structural elevation for the J sand.

6.—Concept: The geologic formations are easily correlated in the GWA because of distinctive patterns on geophysical logs.

A type log shows the lower geologic formations productive in the GWA. Shale intervals with high organic content and high gamma ray readings, identified as source rocks for oil and gas, are labeled along with the producing reservoirs. Density and neutron logs are used for porosity analyses. In ascending order, these formations are the Plainview, J, D (not shown), Codell, and Niobrara. Producing depths vary from 7000 to 8500 feet; and, reservoir thicknesses vary from 10 to 50 feet.

7. –Concept: Same concept as above.

This is a reference log of Hygiene (Shannon) and Terry (Sussex) sand members of the Pierre Shale. Producing depths are 4000 to 5000 feet; reservoir thicknesses vary from 10 to 50 feet. Faulting provides the migration paths for charge to these reservoirs above the depth of oil and gas generation.

8.—Concept: If formations with reservoirs and rich source rocks are widespread, a large oil and gas field may accumulate.

A north-south cross section A-A' from T. 8 N. to T 2 S. of the lower producing formations illustrate the wide geographic distribution of the main producing formations—J, Codell and Niobrara. This cross section shows thinning and an unconformity in the upper Niobrara related to paleo-structural movement on a fault block called the "Wattenberg High".

9.-- An east-west cross section B-B' from R 64 W. to R 70 W.—same description as above.

10.—Concept: The Wattenberg Field has seven oil and gas pools related to one petroleum system.

This map of GWA shows areas of production (pools) for each of seven reservoirs ranging from 4000 to 8500 feet in depth. Areas of production overlap among pools are also indicated.

11.—Concept: Faulting and fracturing have segmented the producing reservoirs.

Major wrench fault zones are labeled on this GWA map, which are from north to south: Windsor (W-WFZ); Johnstown (J-WFZ); Longmont (Lo-WFZ); Lafayette (La-WFZ), and Cherry Gulch, (CG-WFZ). Secondary associated faults and the basin synclinal axis are also shown. Minor associated faulting, not shown on this scale map, may segregate the reservoirs into areas as small as 20 acres.

12.—When horizontal-directed stress was applied to rocks in the subsurface, faulting and fracturing occurred over large areas associated with the wrench fault systems.

These two block diagrams, summarizing laboratory studies, show a pattern of rock breakage with vertical fractures and faults when horizontal stress is applied. The diagram on the left shows little offset on the fractures, but under greater stress, the rock is offset along a through-going fault (right diagram). Fractures parallel to the principal stress direction (sigma 1) are open and may be open or closed in other directions. Thus, the faults may be seals for traps or conduits for migration. This and other modeling illustrates the complex influence of faulting and fracturing on oil and gas production.

13.—Concept: The methods used in structure contouring of formation tops, from variable well density, may result in widely different structural interpretations.

These two maps with structure contouring on top of the J sand are from the greater DIA area. The map on left is a computer-generated structure contour map (25 foot contour interval) with no faulting. The map on the right is a structure contour map drawn by hand contouring with northeast and northwest fault patterns that explain oil and gas segregation in the reservoirs (10 foot contour interval). Faults are more easily mapped where well control is denser. Areas of closely spaced contours on left map are uncorrected computer errors.

14.—Concept: Intensity of faulting may vary at different stratigraphic levels.

These two structure contour maps show more abundant faults at the Codell-Niobara level with wells drilled on 40 acre spacing than those mapped 500 feet deeper in the J sand (160 acre spacing). The density of well spacing shows more reservoir compartmentalization in the Codell-Niobrara with northeast fault trends, whereas J sand faulting shows northeast and northwest trends.

15.—Concept: A greater fault density may occur in shallower layers as a result of splaying of faults over deeper vertical wrench faults to give a "flower or palm tree" structure.

This block diagram, compiled from world wide wrench fault patterns, illustrates how the fewer number of faults cutting the J sand can be related to bifurcation and more closely spaced faults in the Codell sand. The faults may be open or closed, but if closed, may result in small reservoir compartments.

16.—STRATIGRAPHY AND RESERVOIR COMPARTMENTALIZATION

17.—Concept: Reservoirs may be compartmentalized because of primary or secondary stratigraphic changes, or by faulting and fracturing.

The types of reservoir compartmentalization occur on a mega-scale and micro-scale because of changes of porosity and permeability in strata. Most of the common types are compiled in these summary diagrams. The faulting and fracturing type was illustrated by earlier slides. Clay or silica infilling of pore space causes tight reservoirs over most of field area with average porosities of about 8 to10 %, and permeabilities of 0.1 md or less. Because of the tight sands, the drainage area for a well may be as small as 20 acres; wells on this spacing may be needed to efficiently drain the reserves. The less common types noted are stratigraphic changes on a megs-scale.

18.—Concept: The geometry of primary reservoirs compartments is related to facies (lateral changes) caused by processes in the original depositional environments.

This summary block diagram reconstructs the origin and trends of reservoirs in the seven pools of the GWA. The environments of deposition are determined by use of diagnostic features observed in cores, outcrops, and log suites of the J and other sands. With this type of modeling, production trends and compartmentalization can then be predicted.

19.—Concept: Mega-scale compartmentalization isolates individual pools of oil and gas; and, smaller compartments also occur within the pools.

An oil and gas field map of the DIA area in the south portion of the GWA shows segregation in the J sand on a mega-scale (.5 to 6 miles) on the westward regional dip of the strata. Faults, facies change and silica diagenesis causes an unusual distribution of oil and gas in contiguous fields. A greater density of drilling may show smaller scale compartments in addition to those present in T. 2 S., R. 66 W., where a few oil wells are surrounded by gas wells.

20.—Concept: In the DIA area, compartmentalization divides the J sand reservoir into four types of separate traps caused by facies change, clay plugs, diagenesis and faults.

This cross section summarizes traps for oil and gas on regional west-dipping strata, as illustrated in map view on the previous slide. Normal gas-oil gravity separation is disrupted by gas down dip from oil, or gas at the same structural elevation as oil. These anomalies are explained by reservoir compartments, and they may occur in the GWA on land tracts as small as 20 acres.

From source rocks and heat flux, oil and gas were generated and they migrated laterally, vertically or downward to charge reservoirs.

21.—DISCUSSION OF MAJOR POOLS IN GWA

22.—Concept: The J sand has a widespread distribution in the GWA because of deposition in the following ancient depositional environments: shoreline and delta front; fluvial channels (valley fill); and, marine shelf.

This isopach map of the J formation shows thickness variation from less than 75 to more than150 feet. The main reservoir thickness averages 25 feet and occurs in the upper part of the formation as shown on the geophysical log. The J sands have subnormal fluid pressures.

23.—Concept: The Codell is a marine shelf sand, that occurs over all of the GWA except for a small area in the southeast portion where it is absent.

This isopach map shows the Codell sand to vary from a wedge edge to 25 feet thick. The sand is regarded as a low-resistivity pay because of clay content. Abnormal high formation pressures in the north-central portion of GWA were created because the sand is sandwiched among hot mature source rocks. The geophysical log shows the Codell sand overlain by the Fort Hays Limestone Member of the Niobrara Formation, and where fractured the Codell and Fort Hays form a common reservoir.

24.—Concept: The Niobrara Formation is a deeper marine water deposit of chalk limestone and organic rich shales (source rocks), and is present throughout the GWA.

Individual layers within the Niobrara Formation have distinctive patterns as shown on the geophysical log and are easily correlated over all of eastern Colorado and beyond. The formation is generally 300 to 400 feet thick. Oil and gas have been produced from the fractured and faulted shale and limestone but, because of its wide distribution and faulting, the formation may be an important target for future production, especially as a shale gas target.

25.—Concept: The D sand was deposited in deltaic, shallow marine and valley fill environments and is present only in the southeast and eastern portion of the GWA.

Distributary channels of a bird foot delta have small isolated fields as shown on this map, as well as narrow but thick valley fill sands. Reservoir thickness varies from 10 to 60 feet. The source of the D sand is from the east and changes westward to marine shale where it is absent. D sand trends are present in the general area where the Codell sand is absent.

26.—Concept: Same as previous slide.

This map shows detailed mapping of D channel sands in the greater DIA area covering an area of nine townships. Fields (dark green) are found in channel sands deposited in fluvial and deltaic environments of deposition. Oil-productive sand bars vary from 0.25 to 0.75 miles in width and from 0.5 to 2 miles in length, and are developed on 40 acre or smaller spacing. The geophysical log shows a thick D sand deposited in a valley fill of a main trunk river.

27.—SUMMMARY

- Wattenberg is a giant multi- pool field (seven pools) with depths ranging from 4,000 to 8,500 feet.

- The three formations being considered for spacing in this hearing are present throughout the GWA.

- The geology of each pool shows compartmentalization related to:
  --Original depositional environments.
  --Later faulting.
  --Reduction of porosity and permeability by diagenesis to form tight sands.
  --Other post-depositional changes.

o The size of reservoirs compartments are on a mega-scale or micro-scale.

o Closely spaced wells assure that most or all of the oil and gas and oil in place can be produced to the benefit of mineral owners, lease owners, the counties, the state.

Engineering/
Economics

Engineering & Economic Discussion Greater Wattenberg Area

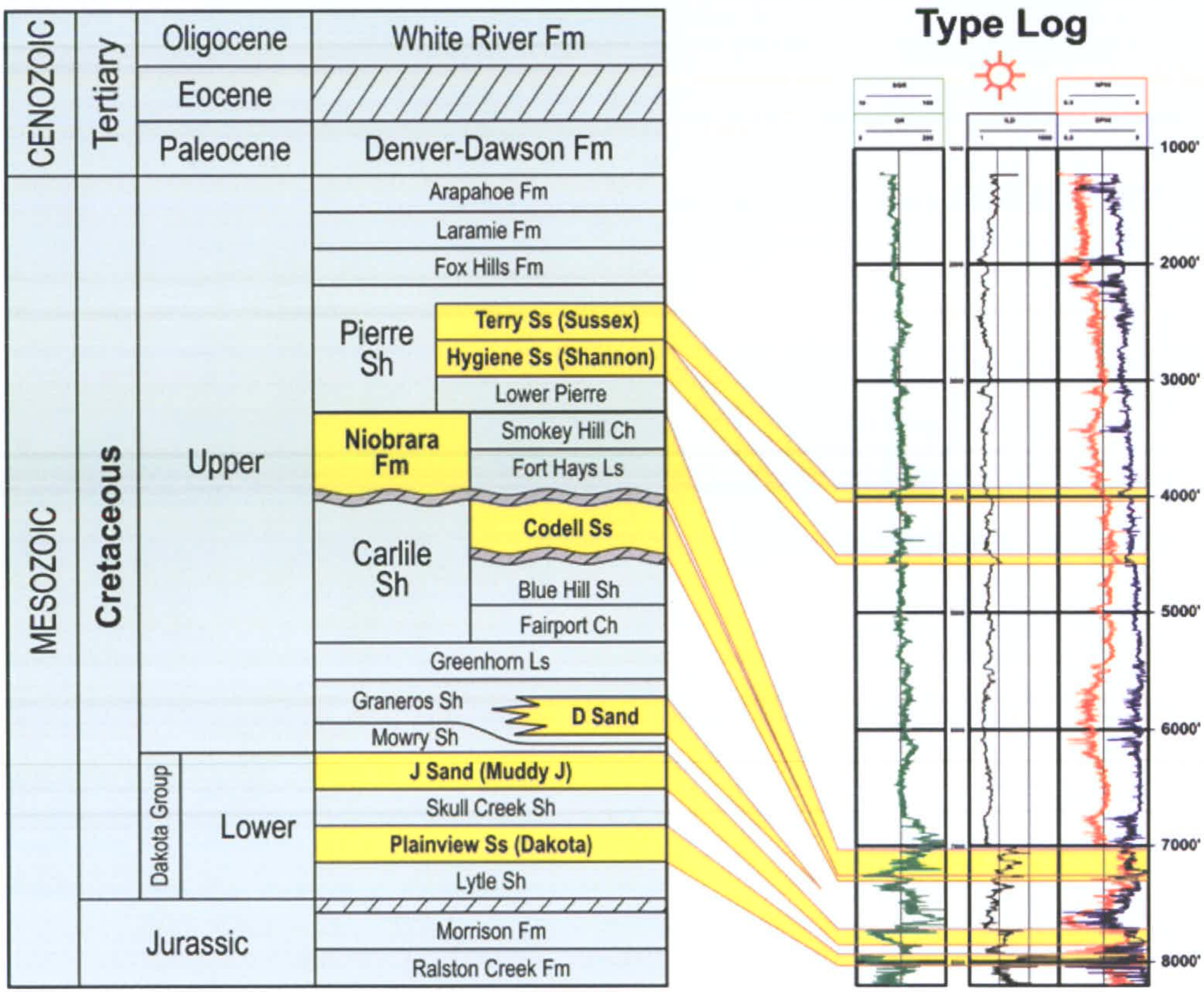
by

Dr. John D. Wright

Outline

- Overview of Greater Wattenberg Area (GWA)
  - Development history
  - Production to date
    - Codell/Niobrara
    - J Sand
- Pilot and 5th Spot Results
  - Pressures
  - Production rates
- Economics
  - Prediction for infill wells
  - Overall GWA

Stratigraphic Column

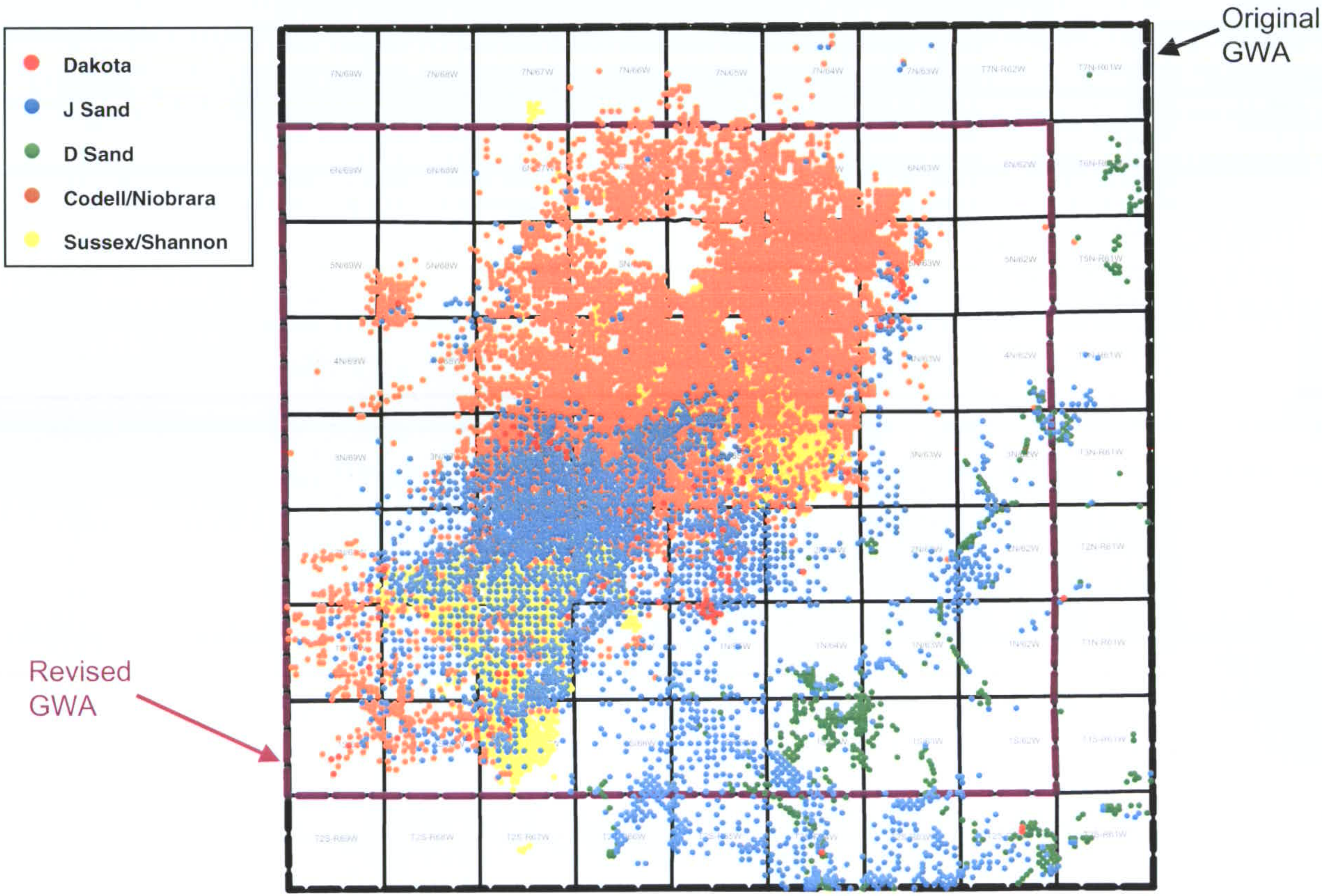


Development History of Wattenberg Area

- 1970: 320 acre units for drilling and spacing of J Sand
- 1972: Amoco/Panhandle Eastern JV
- 1979: Additional J Sand well allowed per 320 acre unit in Wattenberg
- 1980: Section 29 tax Credit; Tight Gas Sand Designation (expired in 2002)
- 1983: Codell spaced on 80 acre; Gas production curtailed due to lack of market.
- 1984,85: Niobrara added to Codell spacing order
- 1991: J Sand wells can be recompleted to C-N and commingling of all downhole zones allowed
- 1998: Rule 318A allows 5 wells per quarter section in GWA for all Cretaceous age formations

Major Producing Formations

E-5



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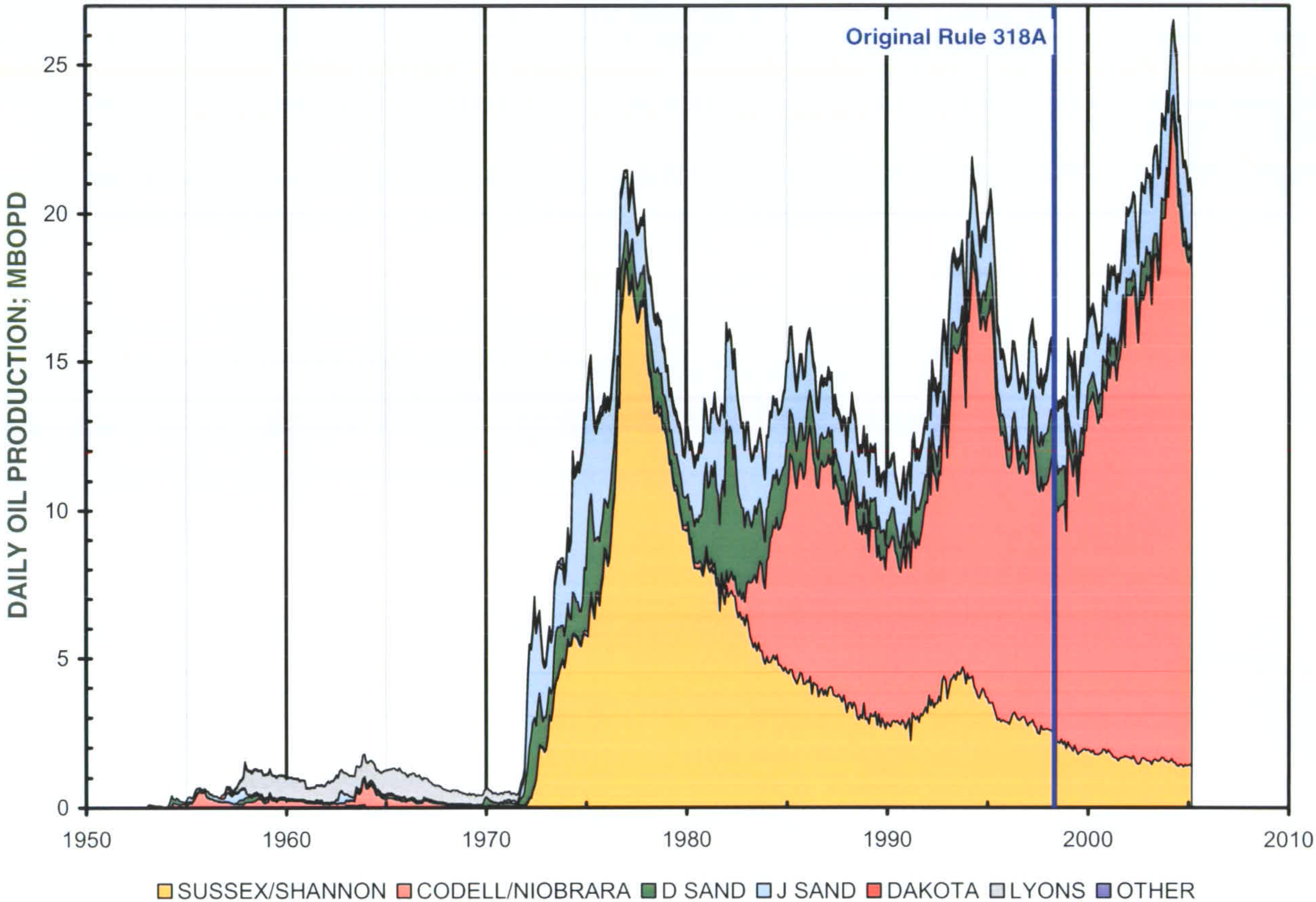
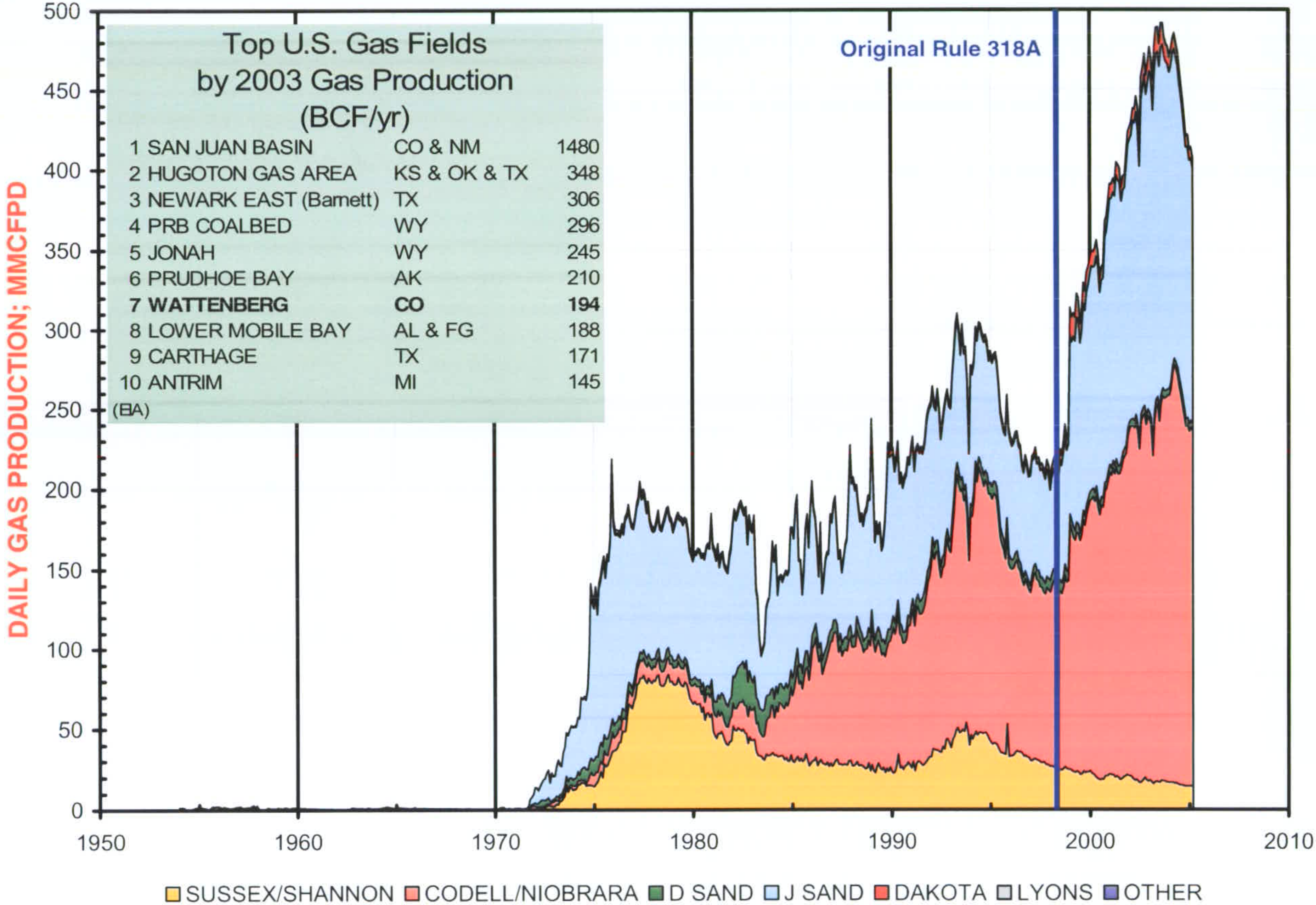
GWA Production History

GWA Oil Production Rates

E-7

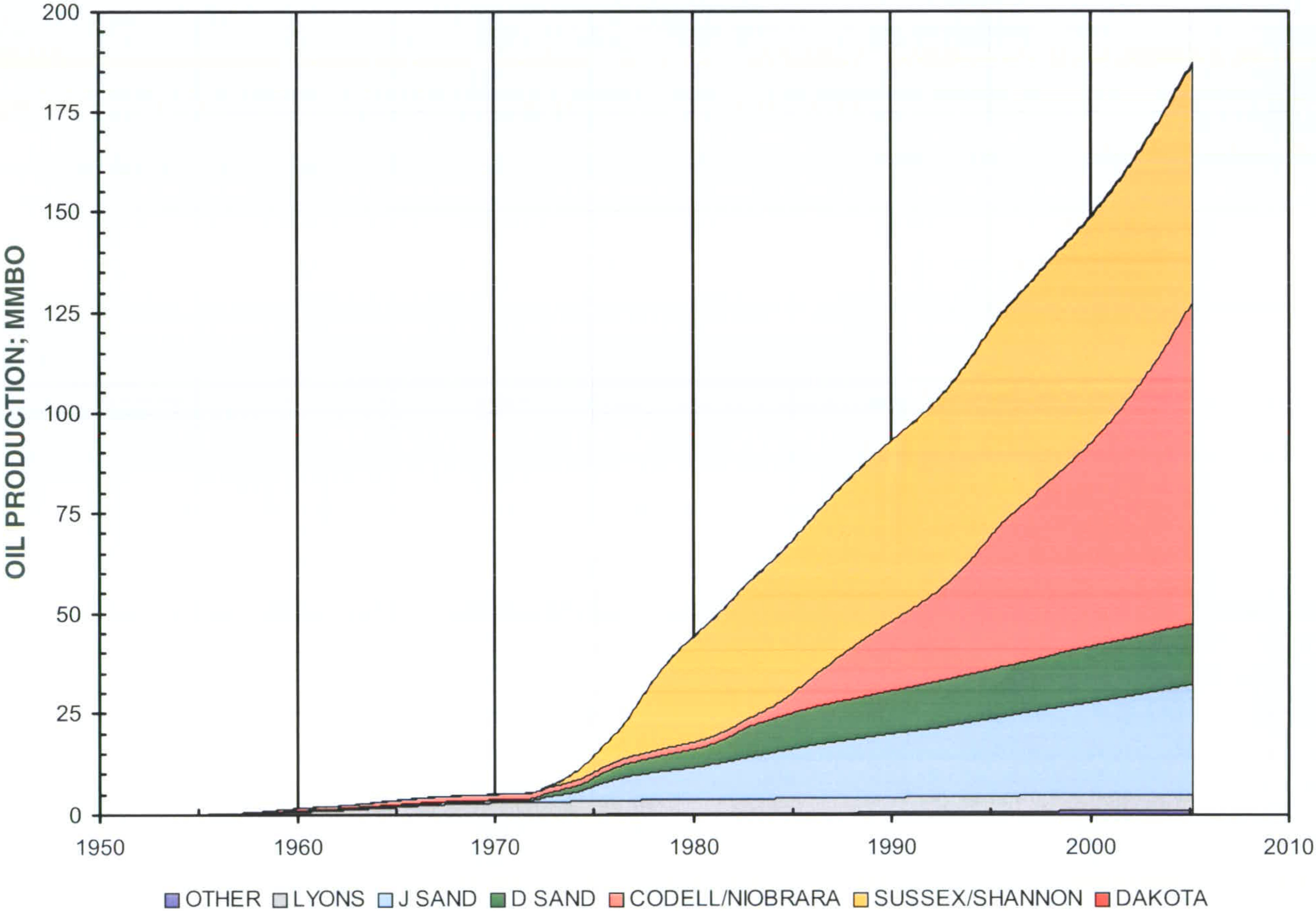


GWA Gas Production Rates



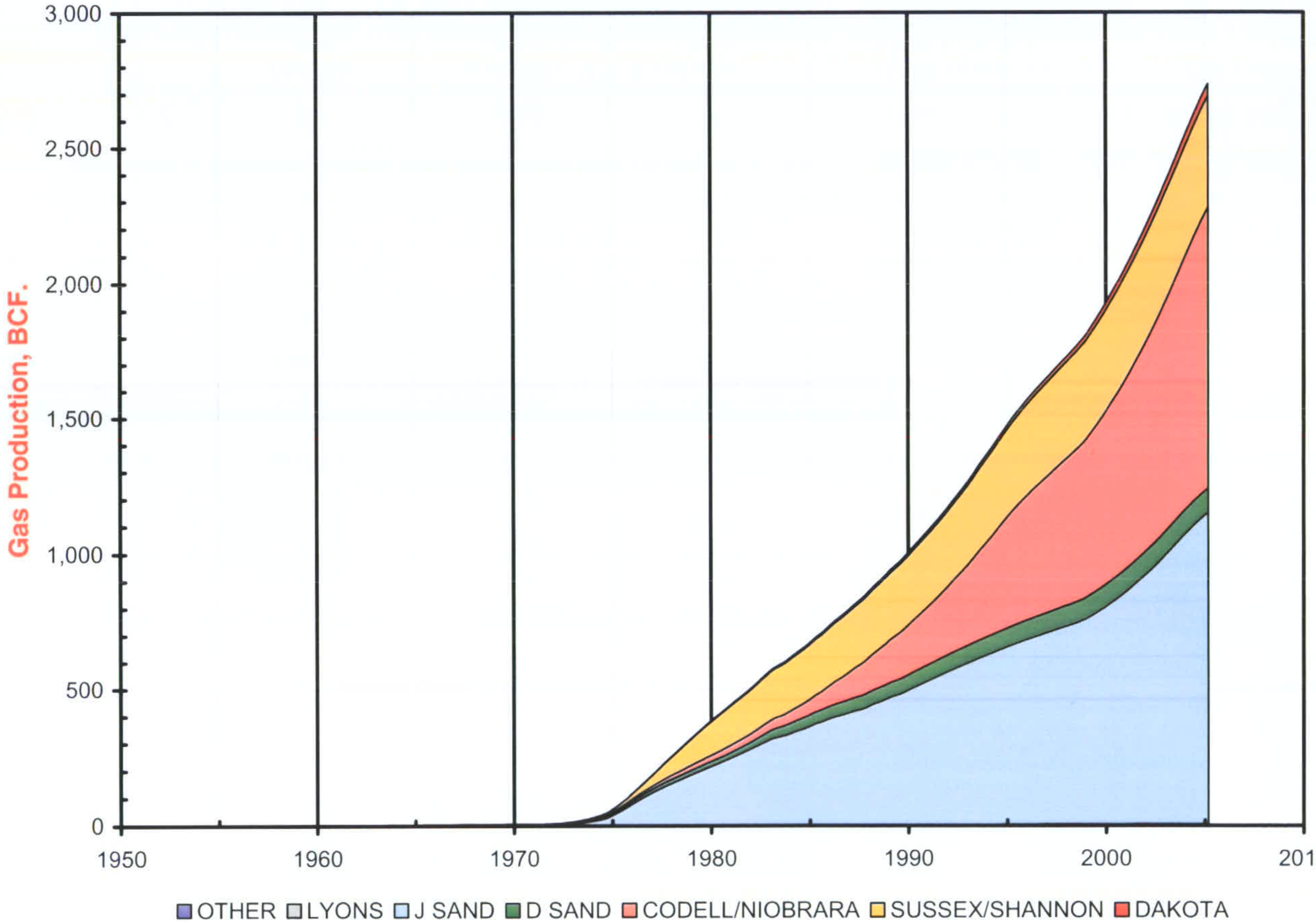
GWA Cumulative Oil Production

E-9



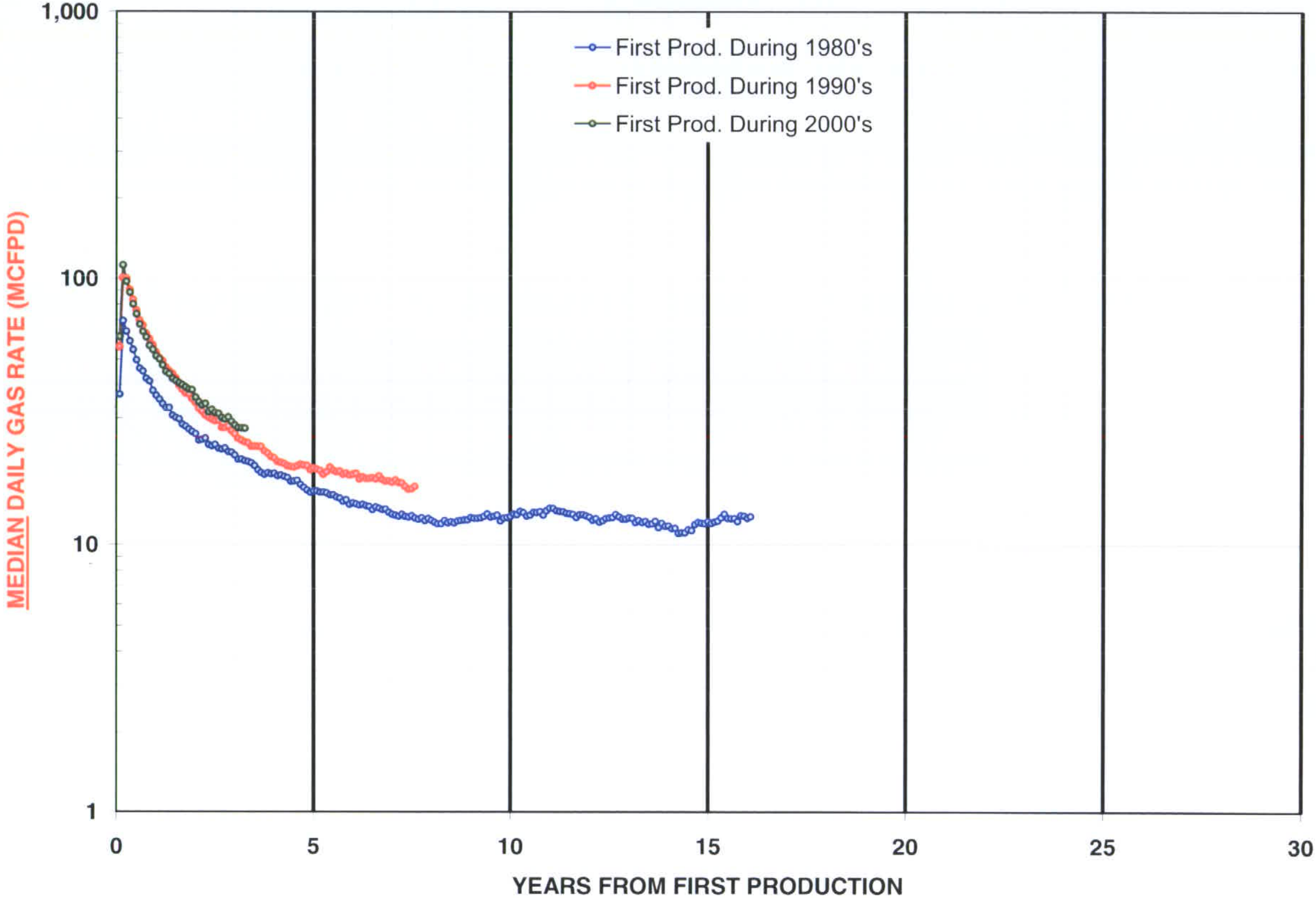
GWA Cumulative Gas Production

E-10

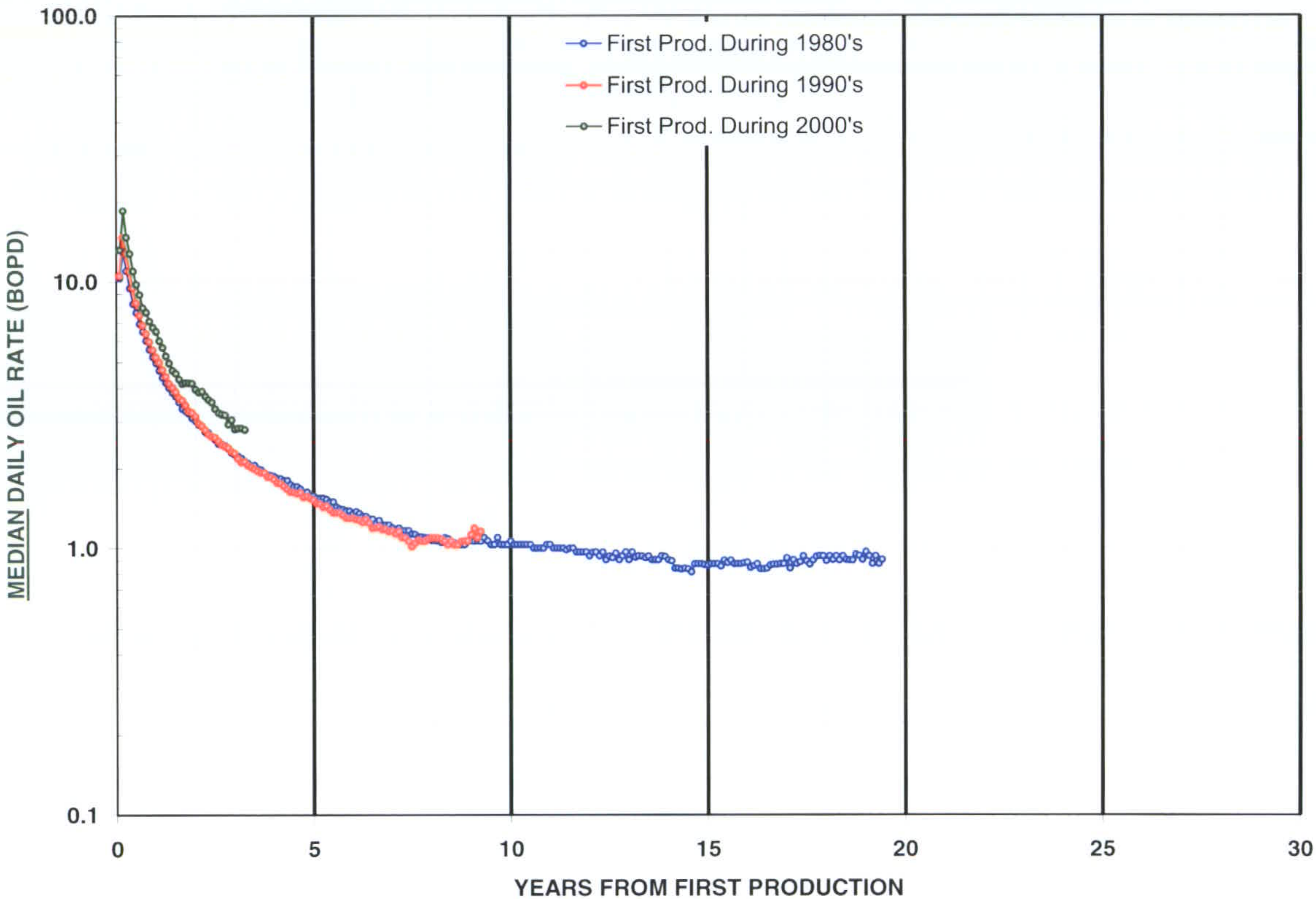


Individual Formation Production Characteristics

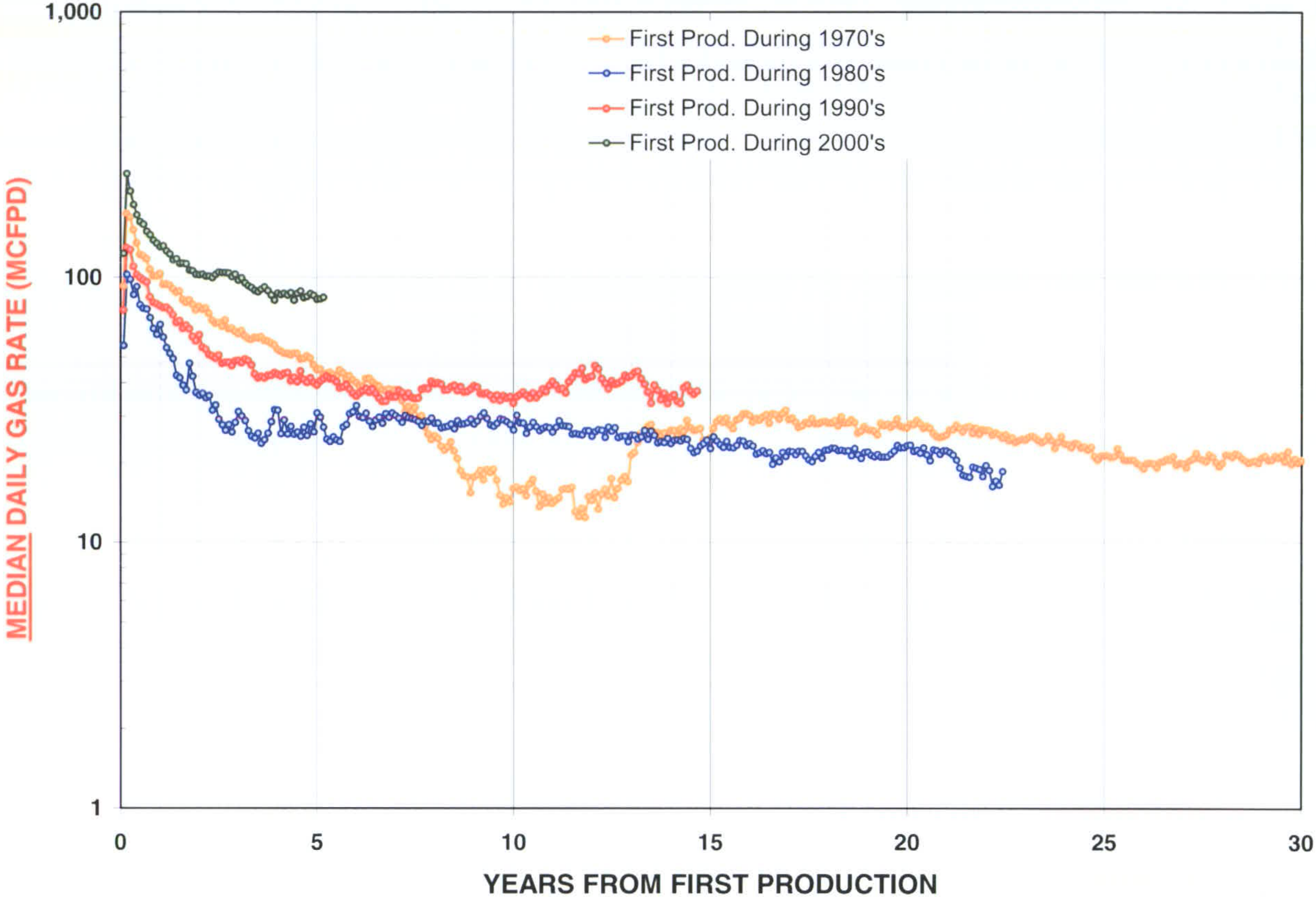
Typical Individual Well Performance
Normalized C/N Gas Production Rates



Typical Individual Well Performance
Normalized C/N Oil Production Rates



Typical Individual Well Performance
Normalized J Sand Gas Production Rates



Conclusions from Production Review

- Wattenberg is a “giant” gas field (> 3 TCF recoverable) and a large oil field.
- Wells drilled in the 2000’s have similar production characteristics to wells drilled earlier
- There is no evidence of total reservoir depletion in the Codell/Niobrara and J based on observed production rates

Pilot Well Program
and
5th Spot Well Program

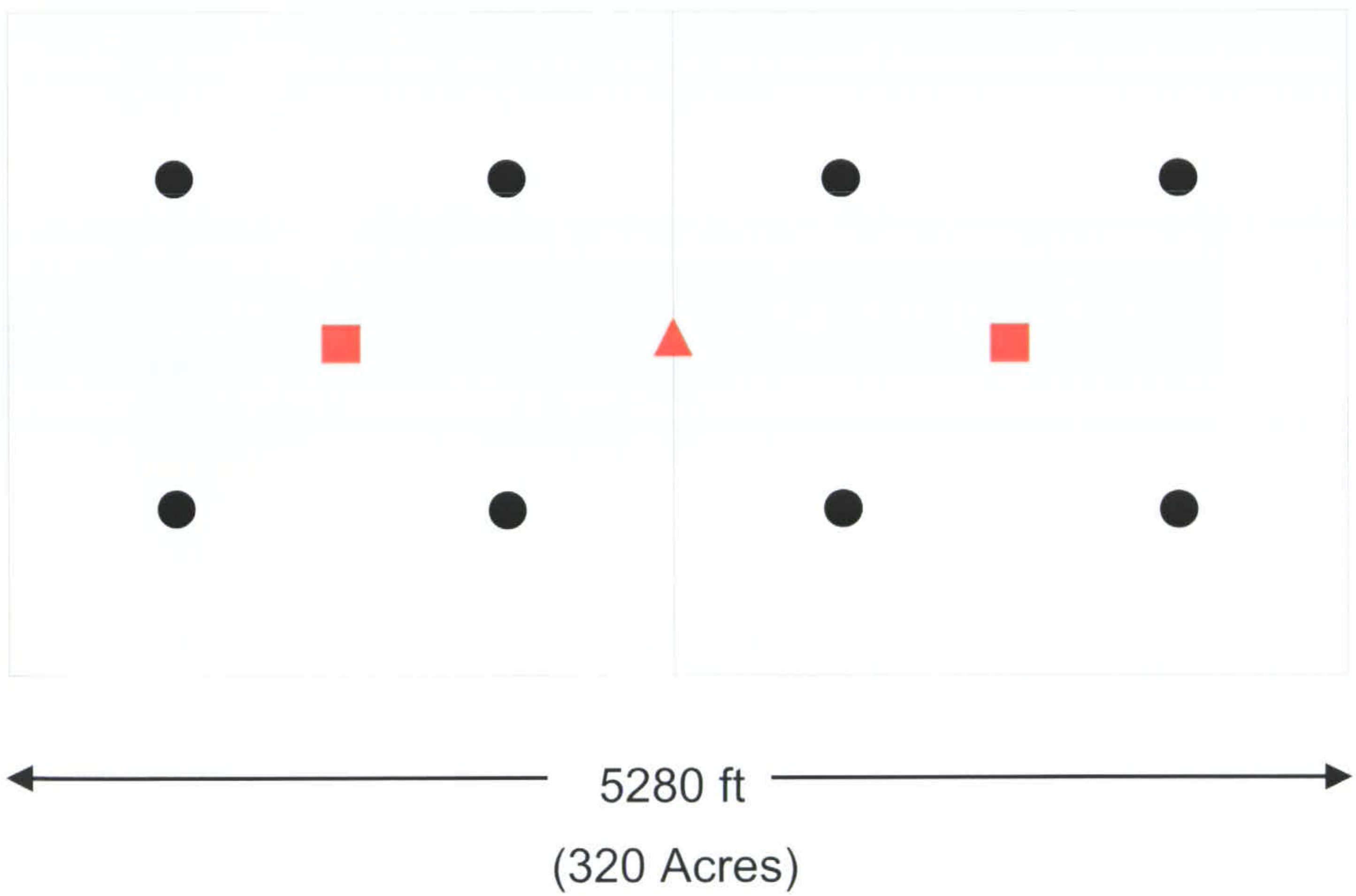
Codell and J Pilot Program

- Approved by Commission Staff Aug/2004
- 40 wells drilled and tested in Codell
- 10 wells drilled and tested in J
- Bottomhole locations are on boundaries of 160 acre tracts
- Selection Criteria
  - Operator owns 100% of 320
  - Areas with high well density
  - Areas with older wells
- Initial pressure measured from DFITs or buildup tests

C/N and J 5th Spot Wells

- 5th well in a 160 acre tract under Rule 318A
- Many C/N 5th spots were in areas where offsets have been refraced
- More than 159 drilled and tested to date
- Most wells had initial pressure measured from DFIT tests or buildup tests

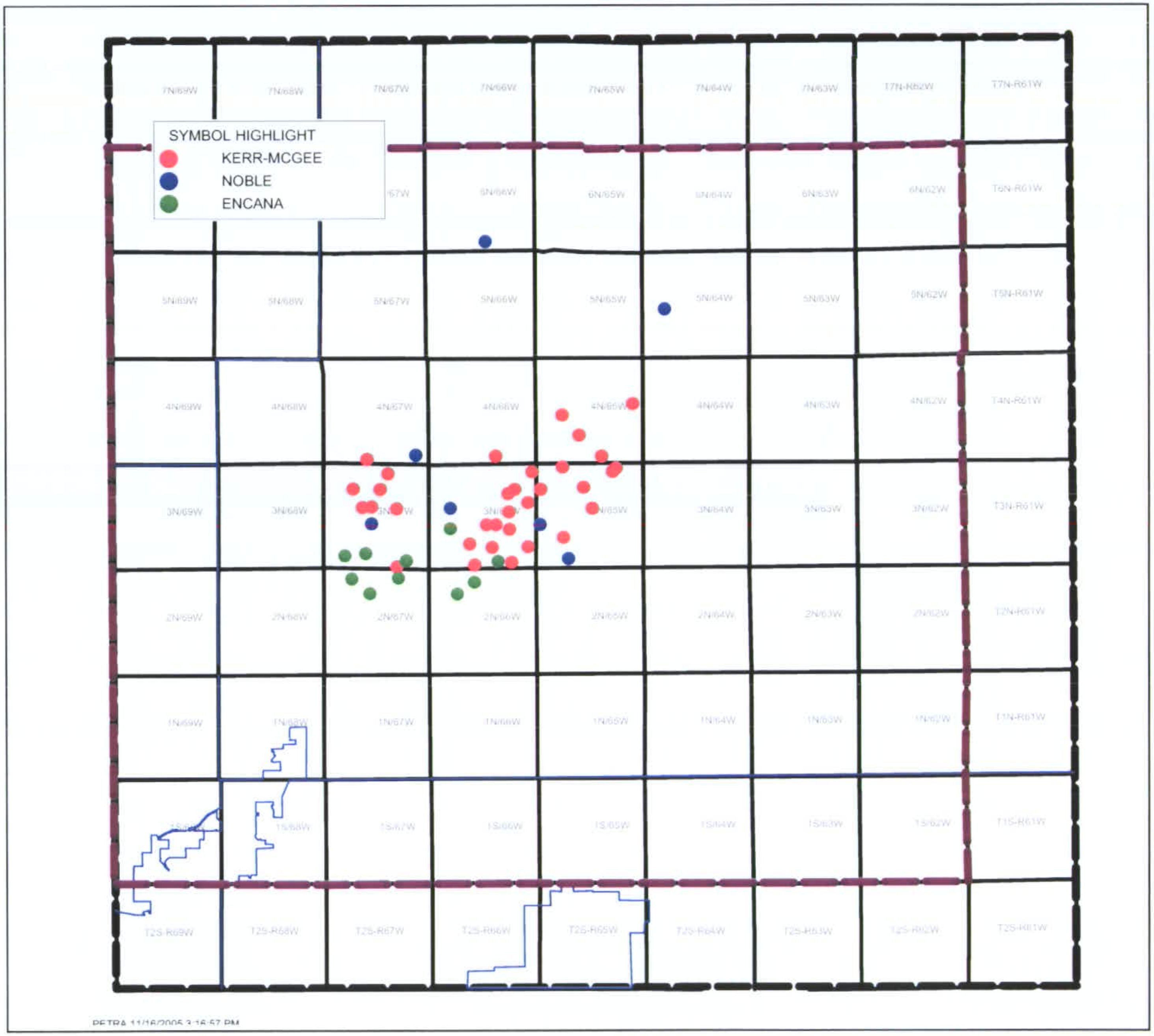
Pilot and 5th Spot Wells



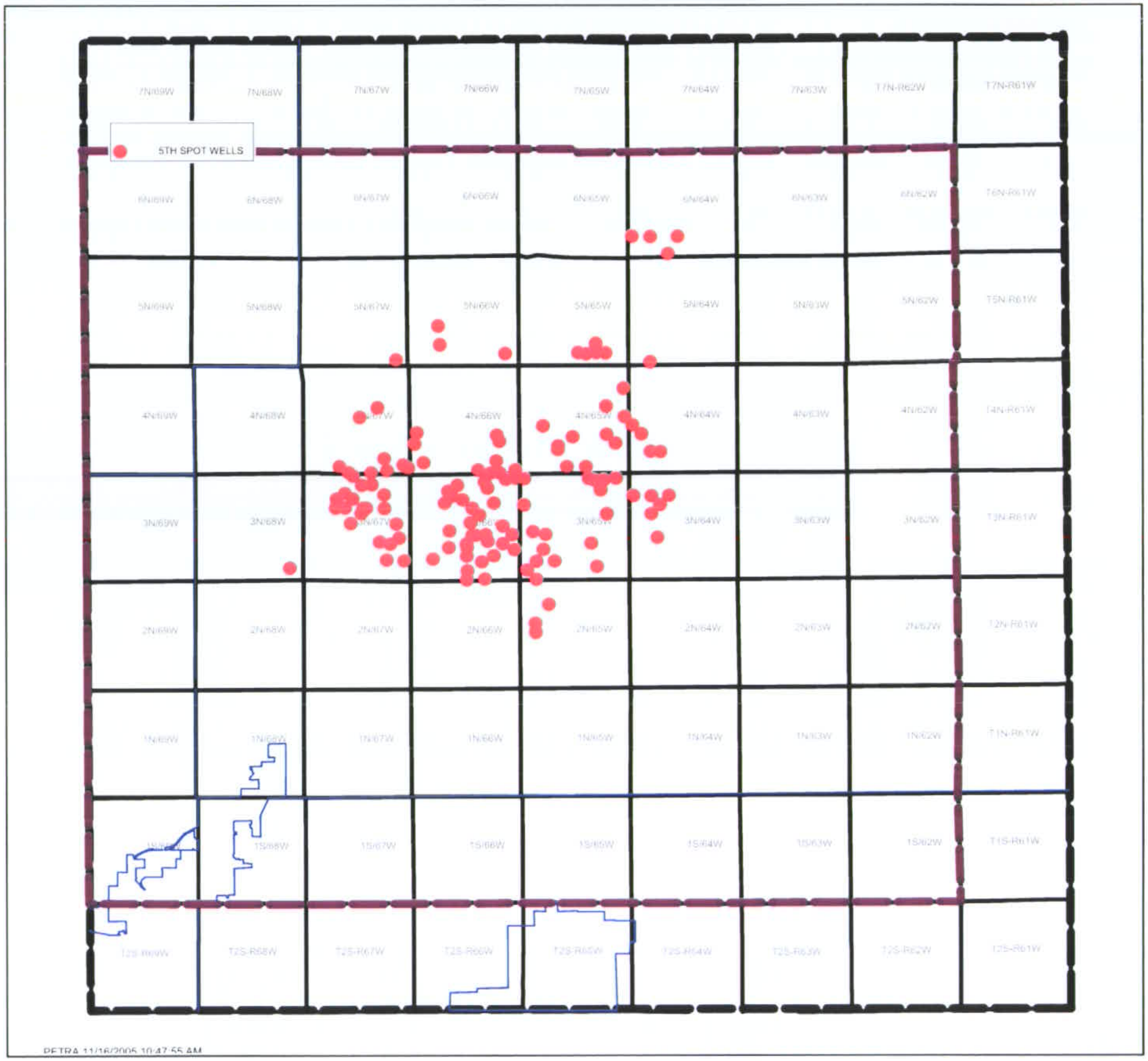
Approximate Bottom Hole Locations

- 40-Acre Wells
- Pilot Wells
- 5th Spot Wells

Pilot Well Locations



Codell/Niobrara 5th Spot Wells



Representative J-Sand Reservoir Simulation Model

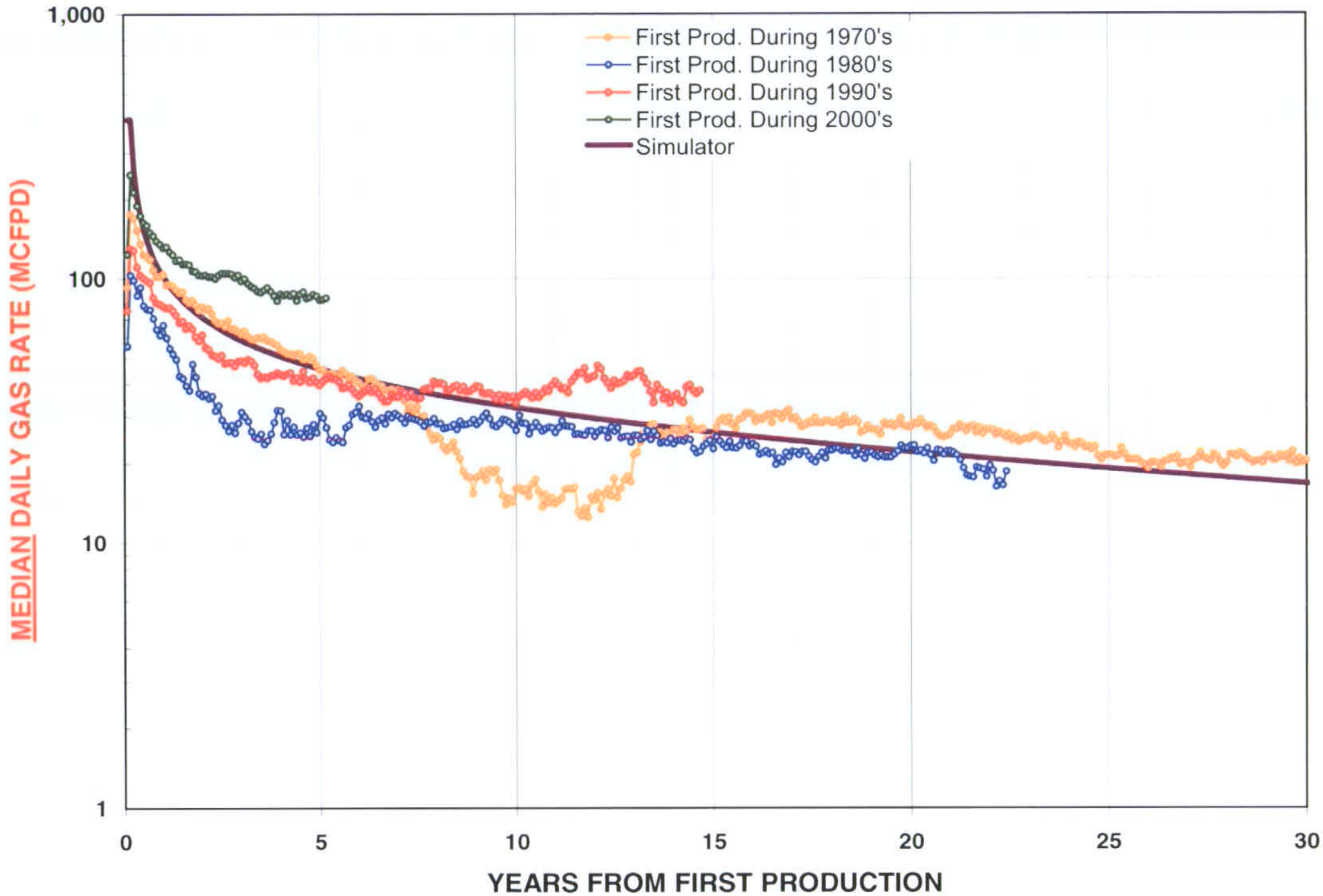
Is there pressure depletion with 5 wells per 160?

Representative J-Sand Reservoir Simulation Model

- Homogeneous Model
- Single Layer
- h = 33 feet (net pay)
- $\Phi = 0.10$
- k = 0.001 md
- x_f = 600 ft
- P_i = 2900 psi
- Model cells are 20 ft x 20 ft

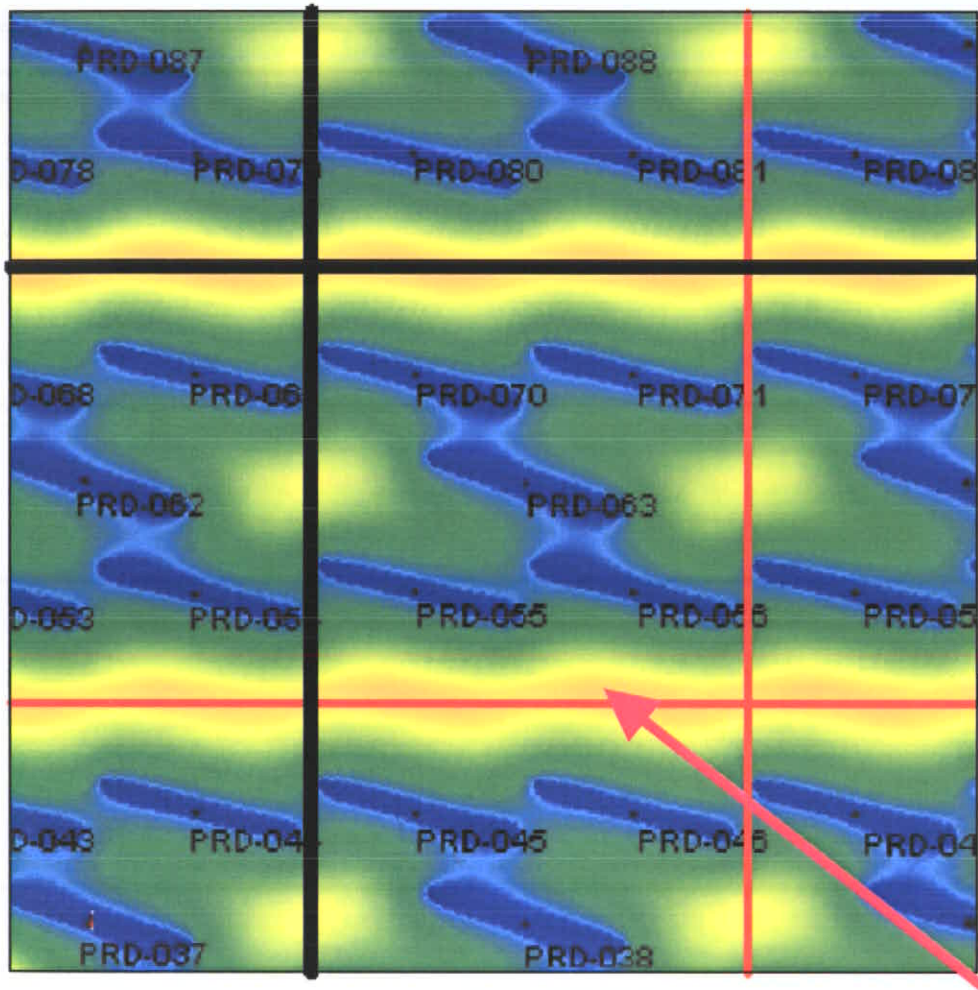
Results in acceptable history match of time normalized production rates

J-Sand "History" Match



Representative J Reservoir Model (5 wells/Qtr)

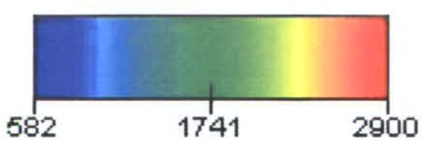
E-25

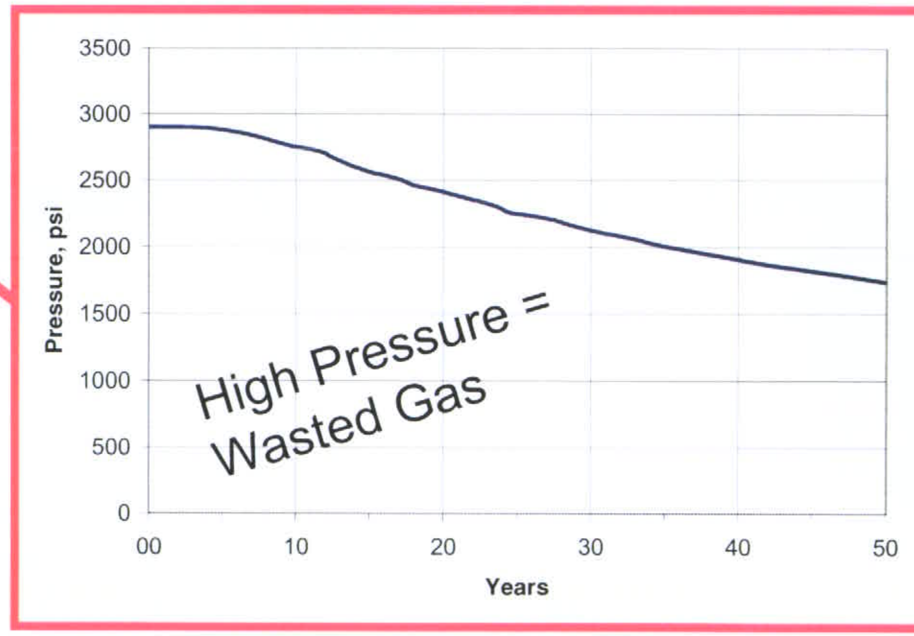


Section Line

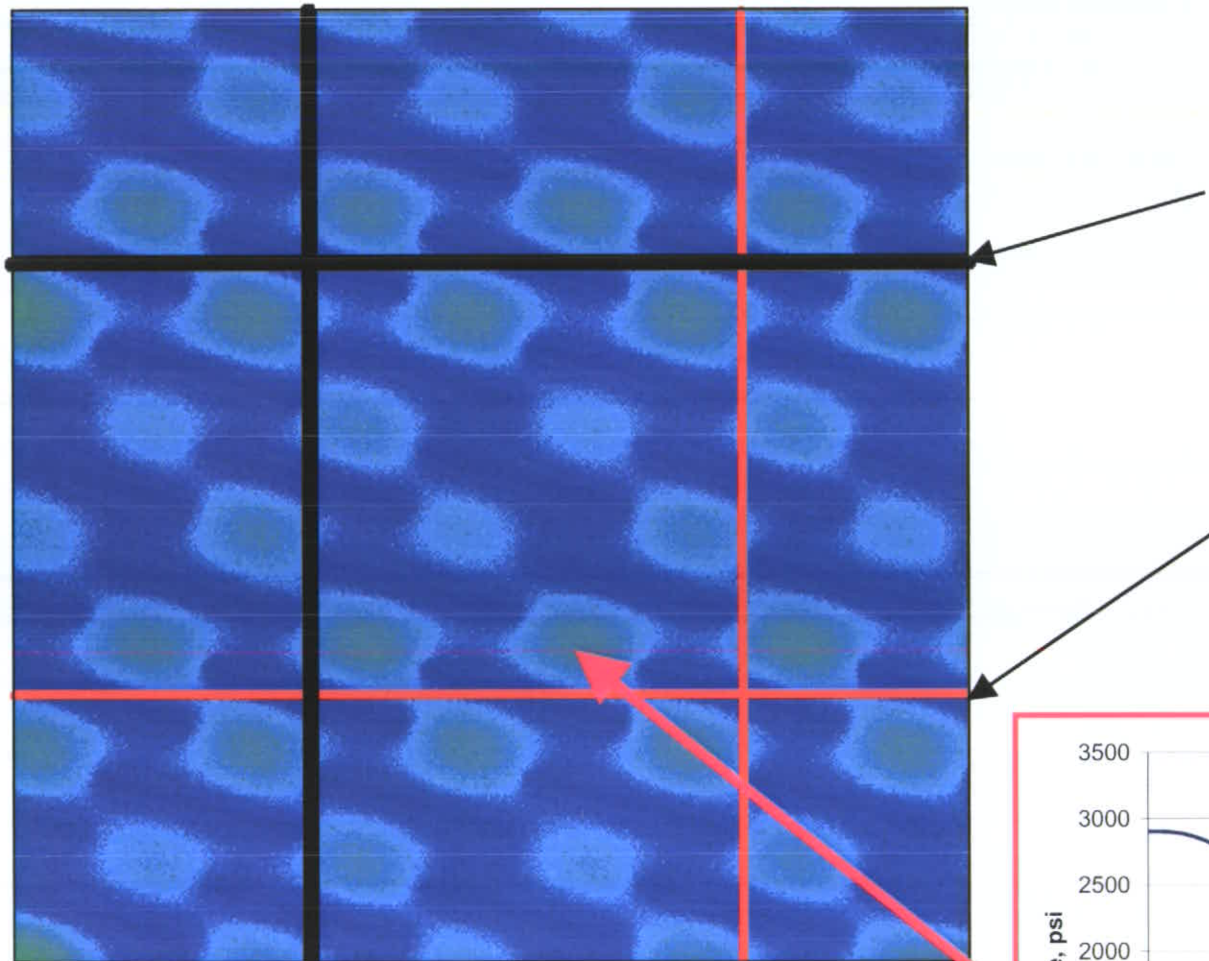
Quarter-Section Line

Pressures after 20 years of production

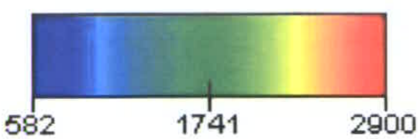




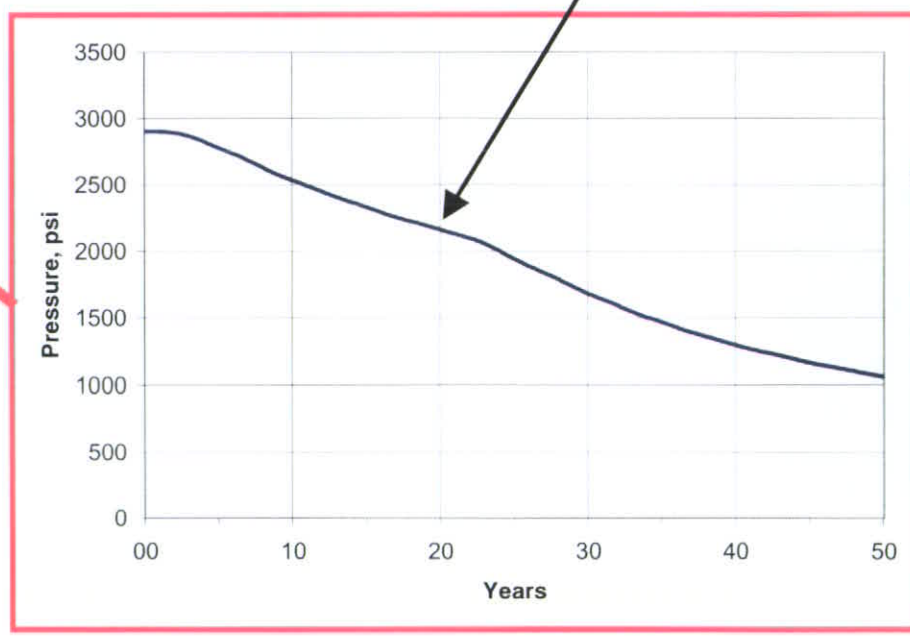
Representative J Reservoir Model (8 wells/Qtr)



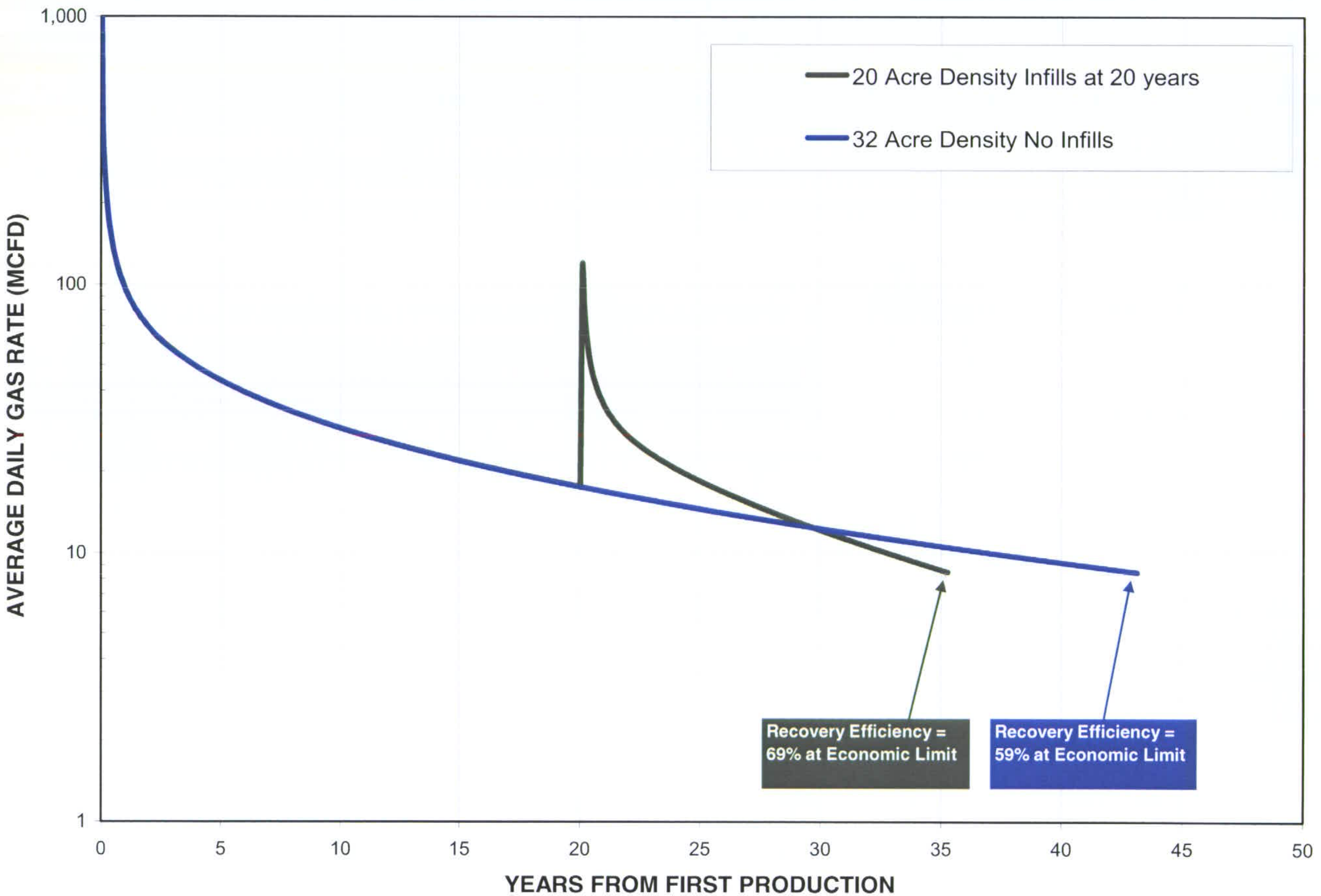
Pressures after 20 years of production from Infills (40 years production of original wells)



Infill at 20 years



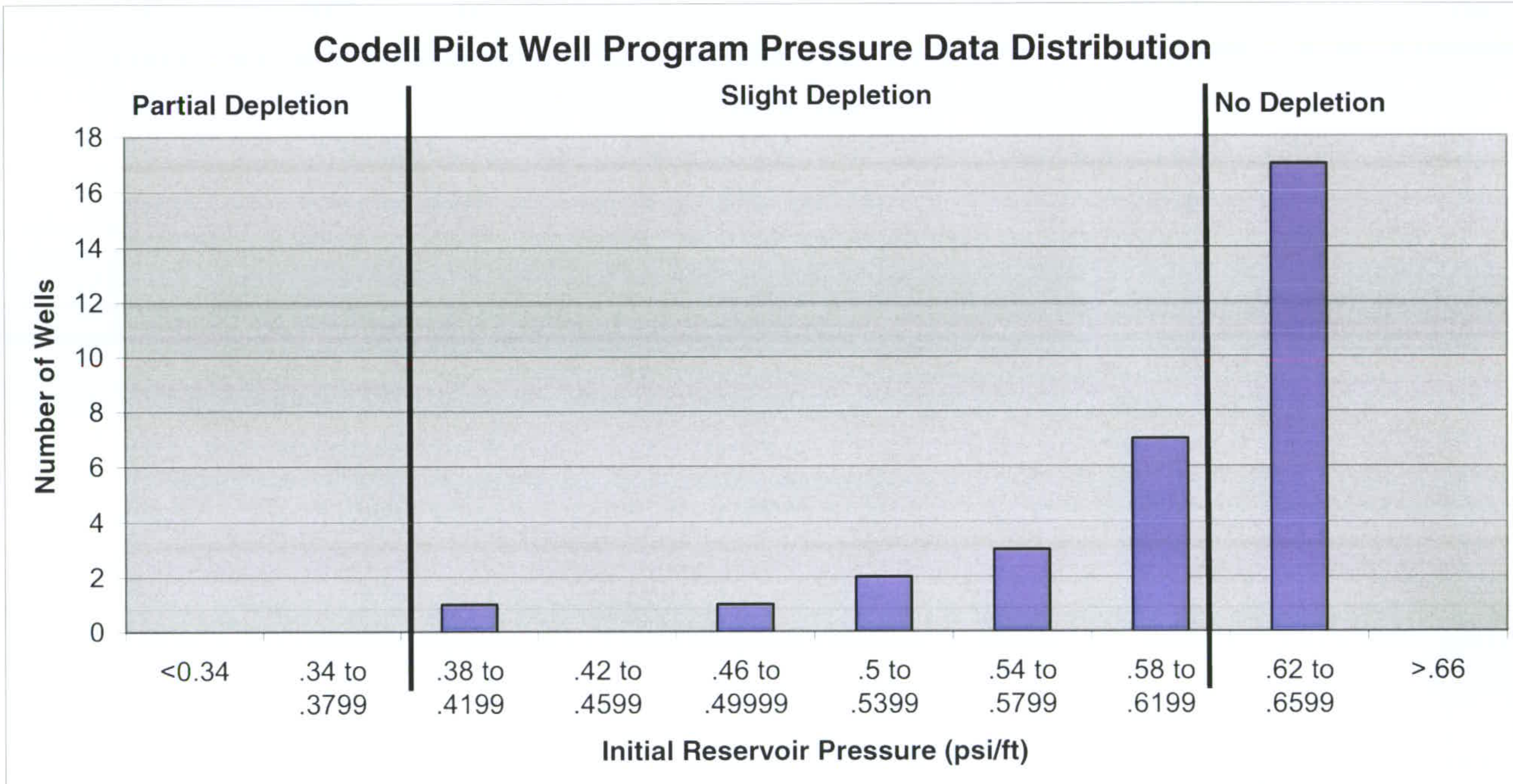
Production Forecast from Simulator



Observed Reservoir Pressures in Pilot and 5th Spot Wells

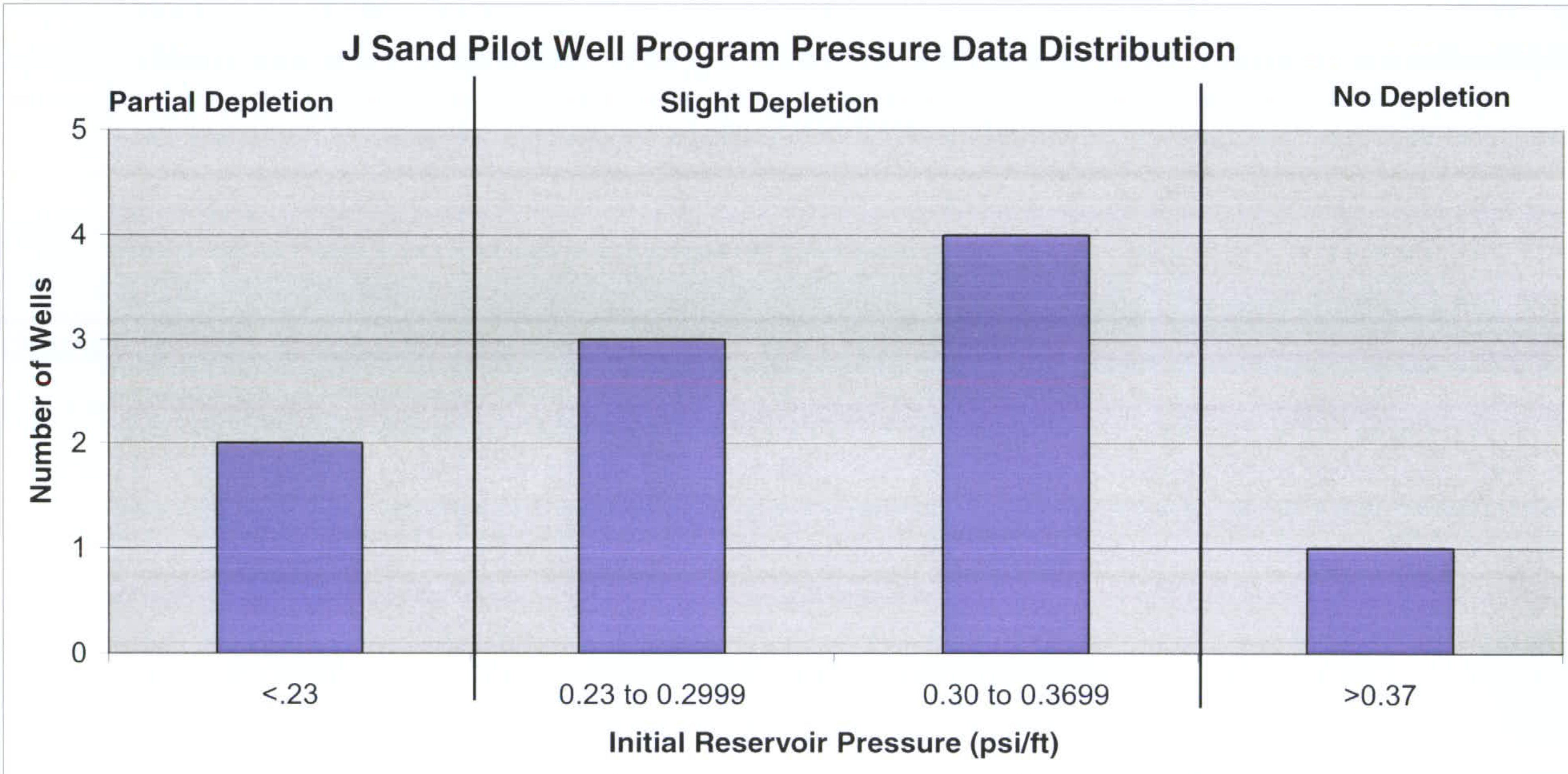
Pressure Gradients from Codell Pilot Wells

Published data indicates original pressure gradient is ~0.65 psi/ft



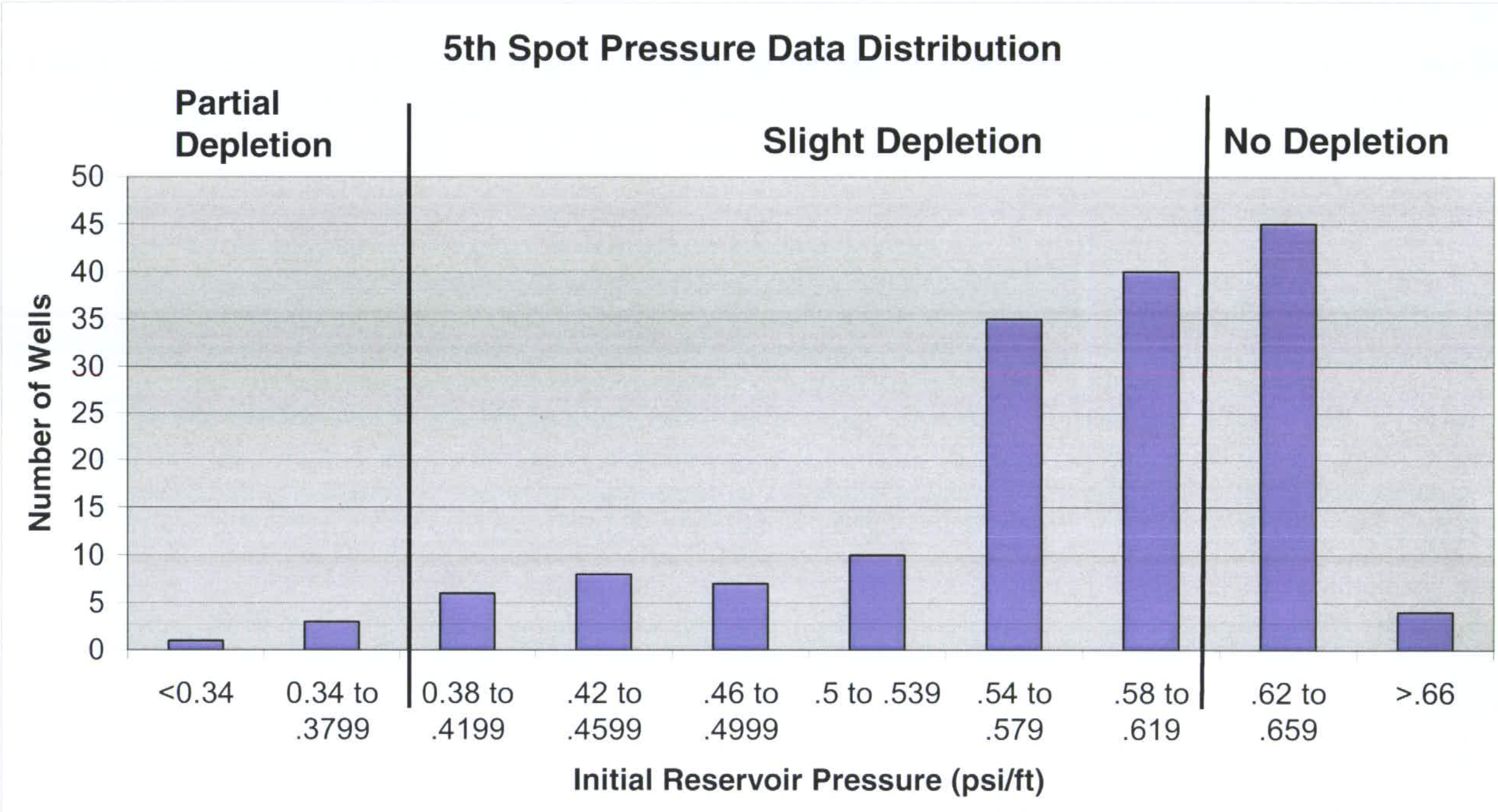
Pressure Gradients from J-Sand Pilot Wells

Published data indicates original pressure
gradient is ~0.367 psi/ft



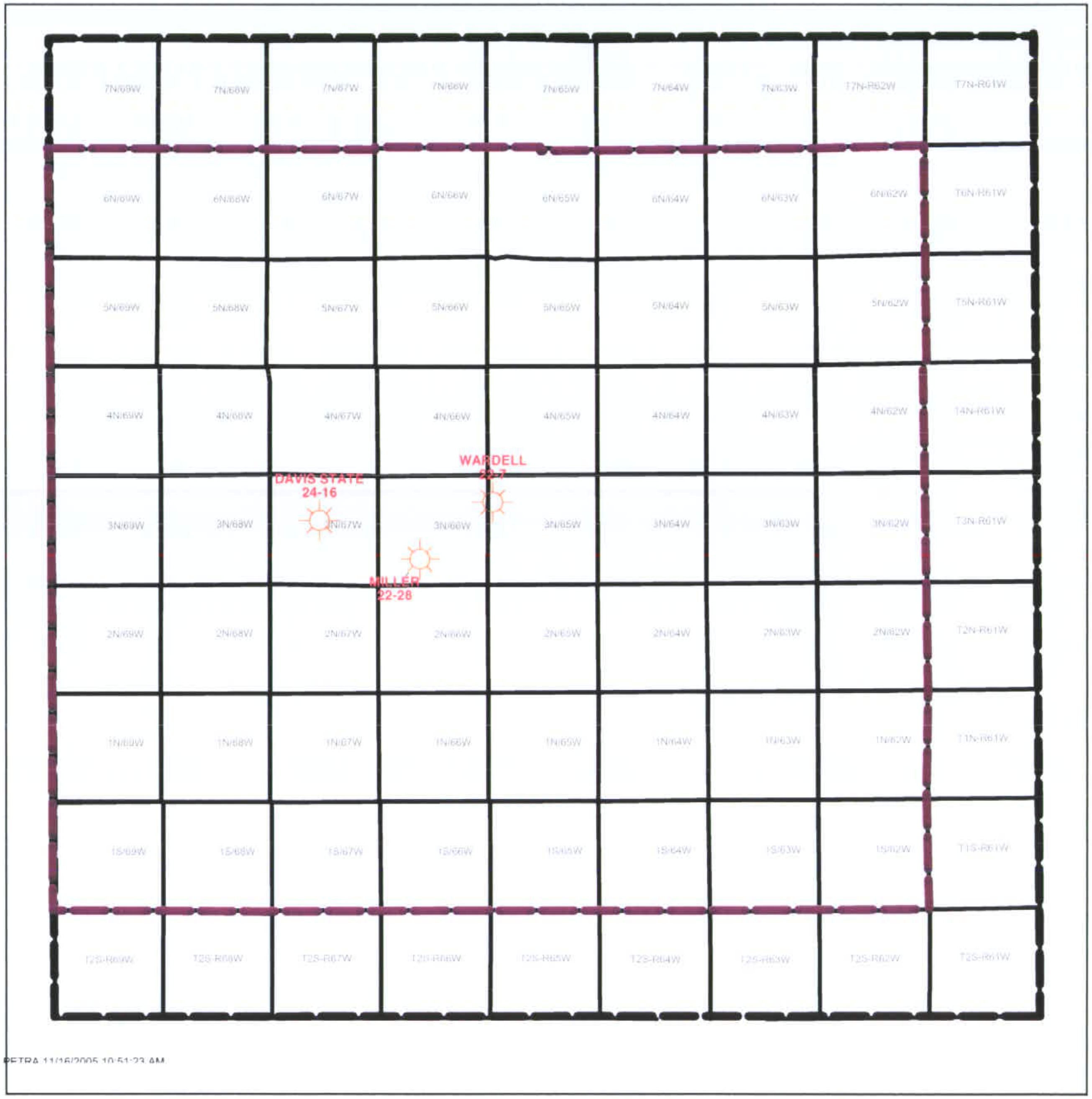
Pressures from 159 C/N 5th Spot Wells

Published data indicates original pressure gradient is ~0.65 psi/ft

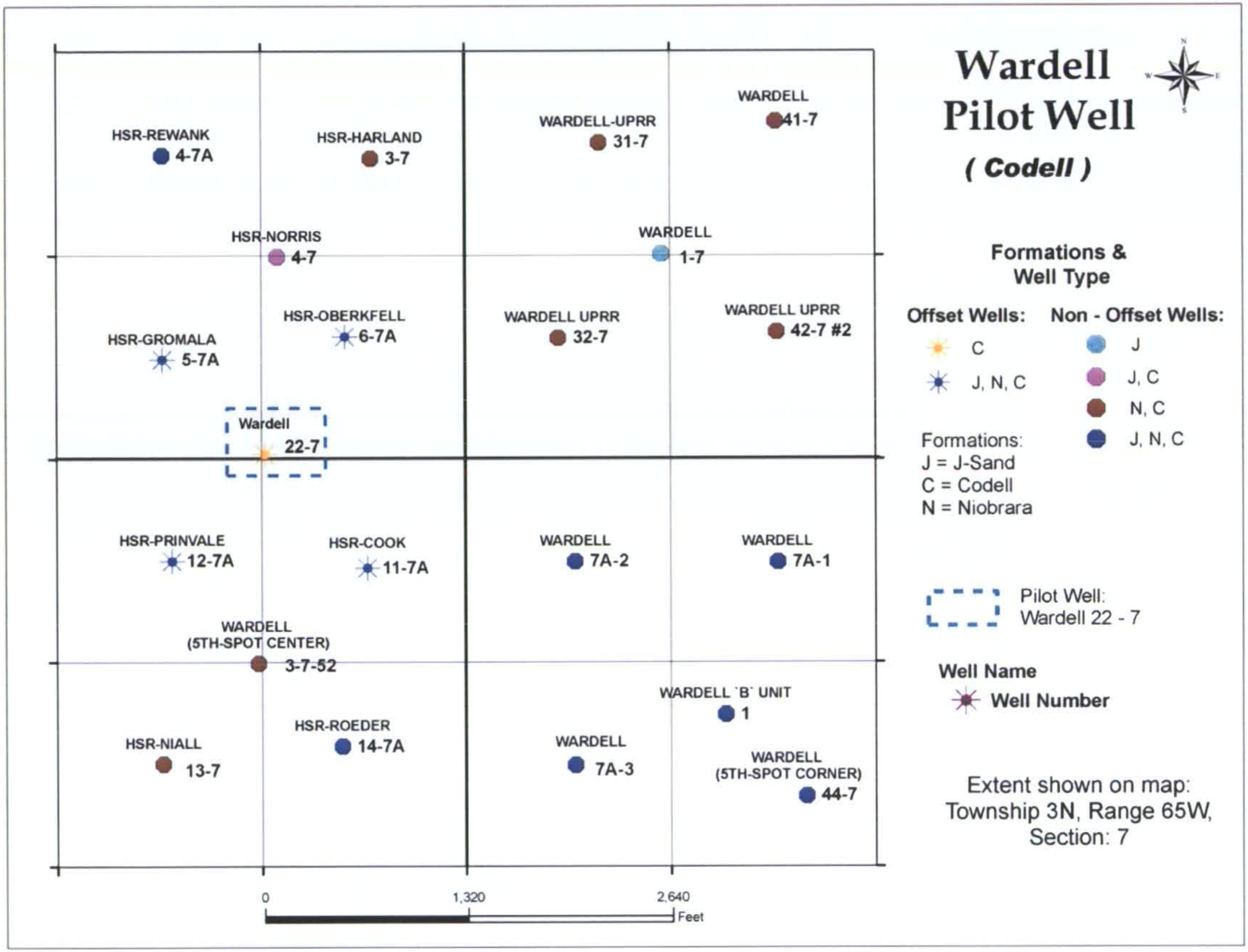


Example Pilot Well Production

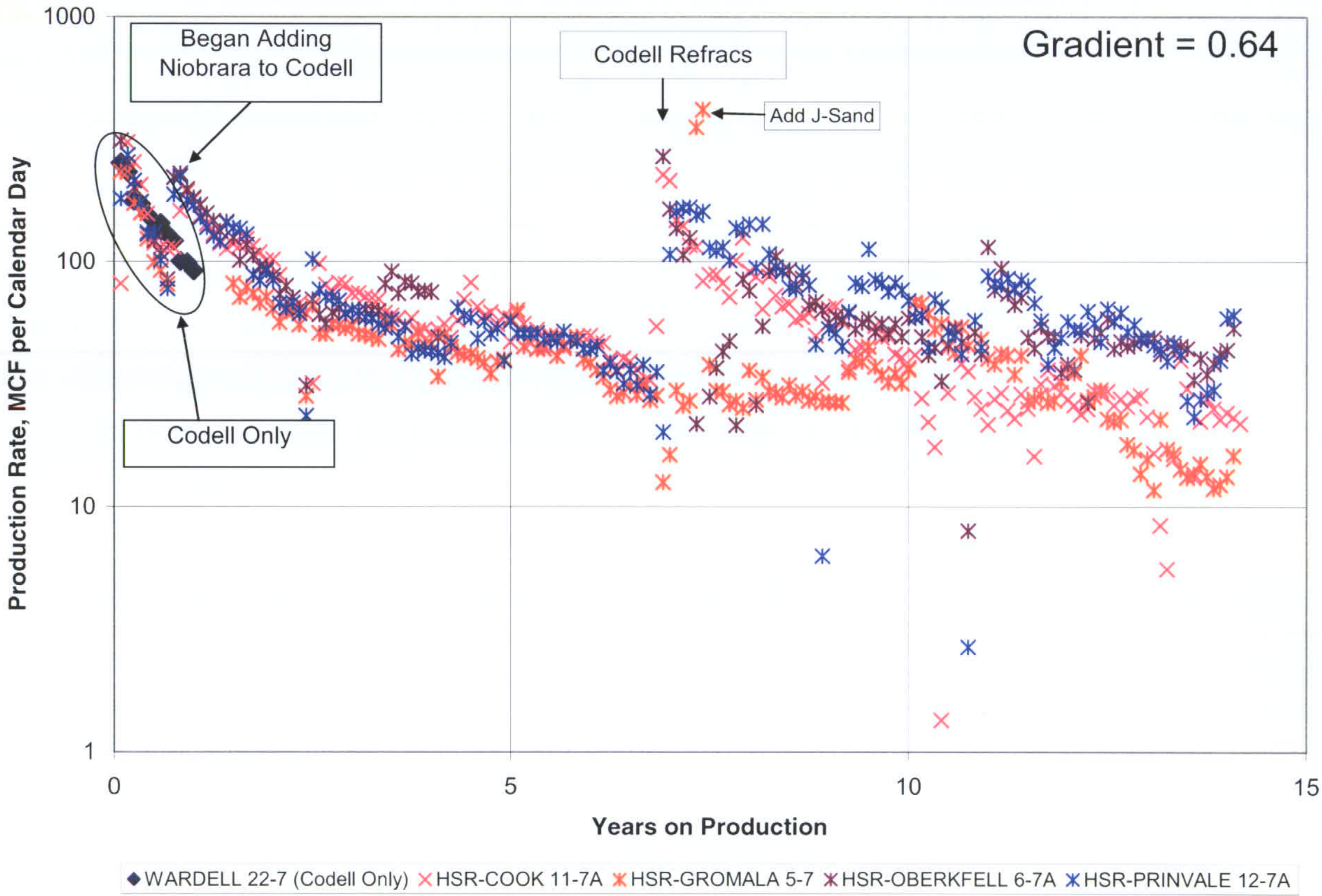
Index Map of 3 Example Codell Pilot Areas



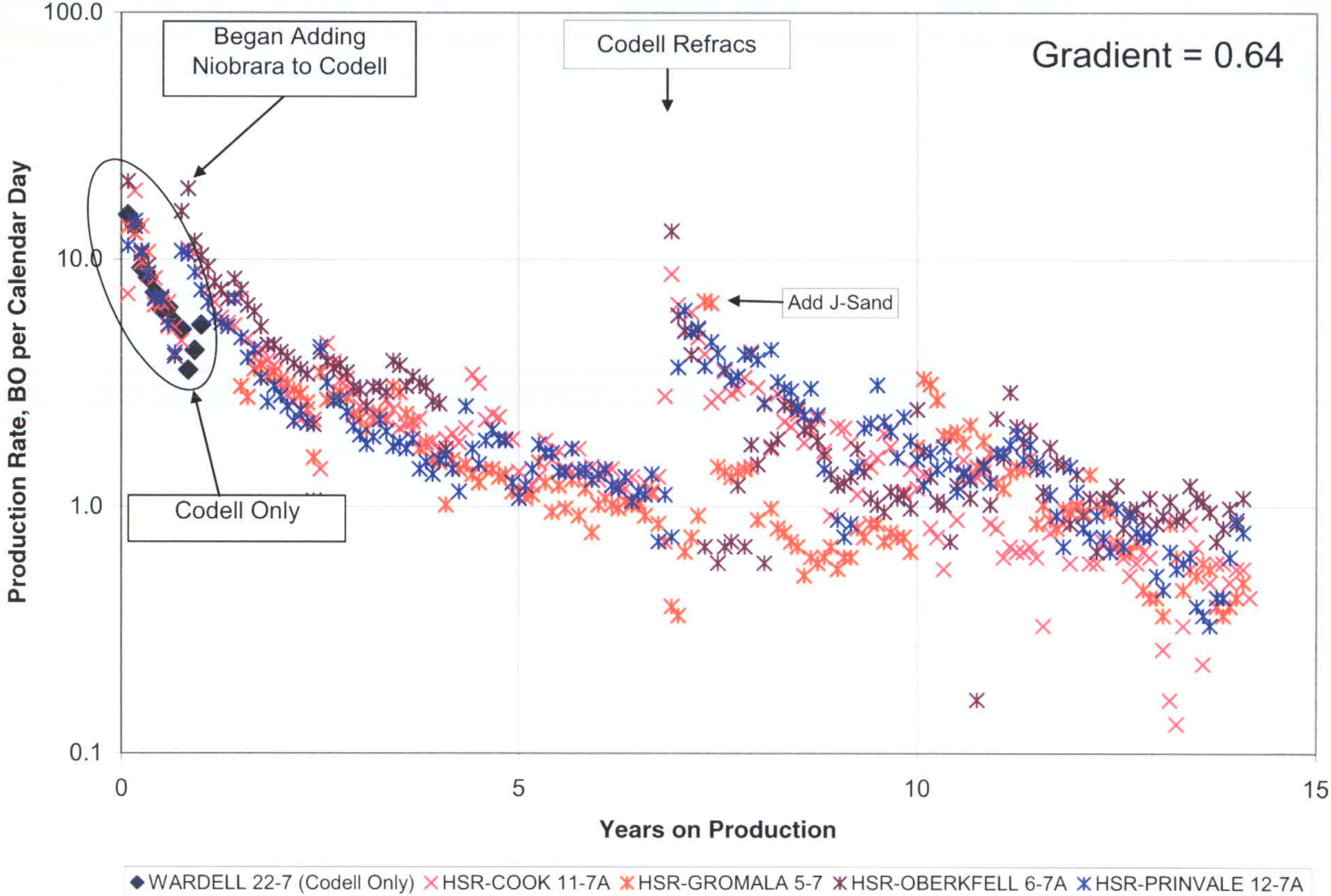
Wardell 22-7 Pilot Area



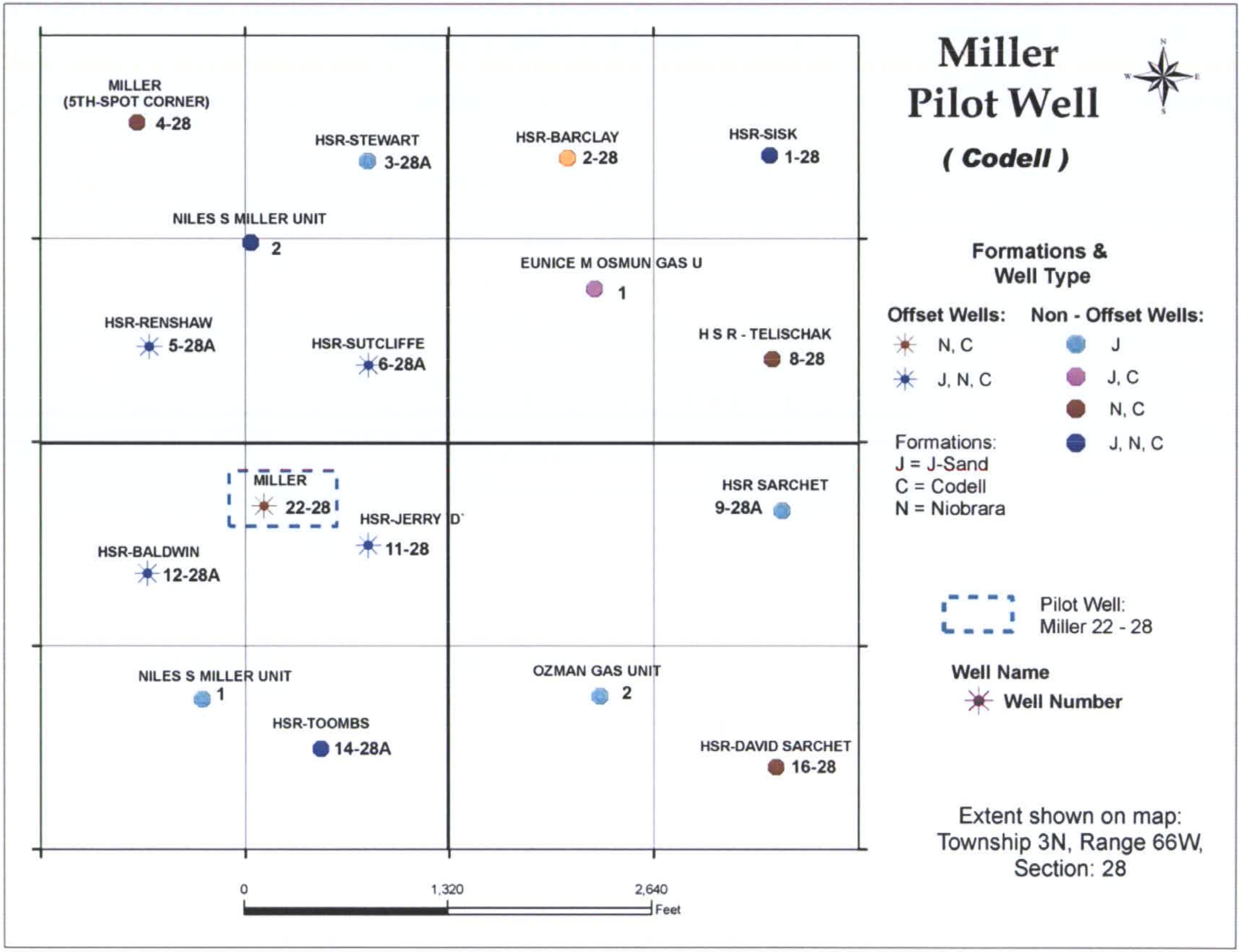
Wardell 22-7 Normalized Gas Production Rates



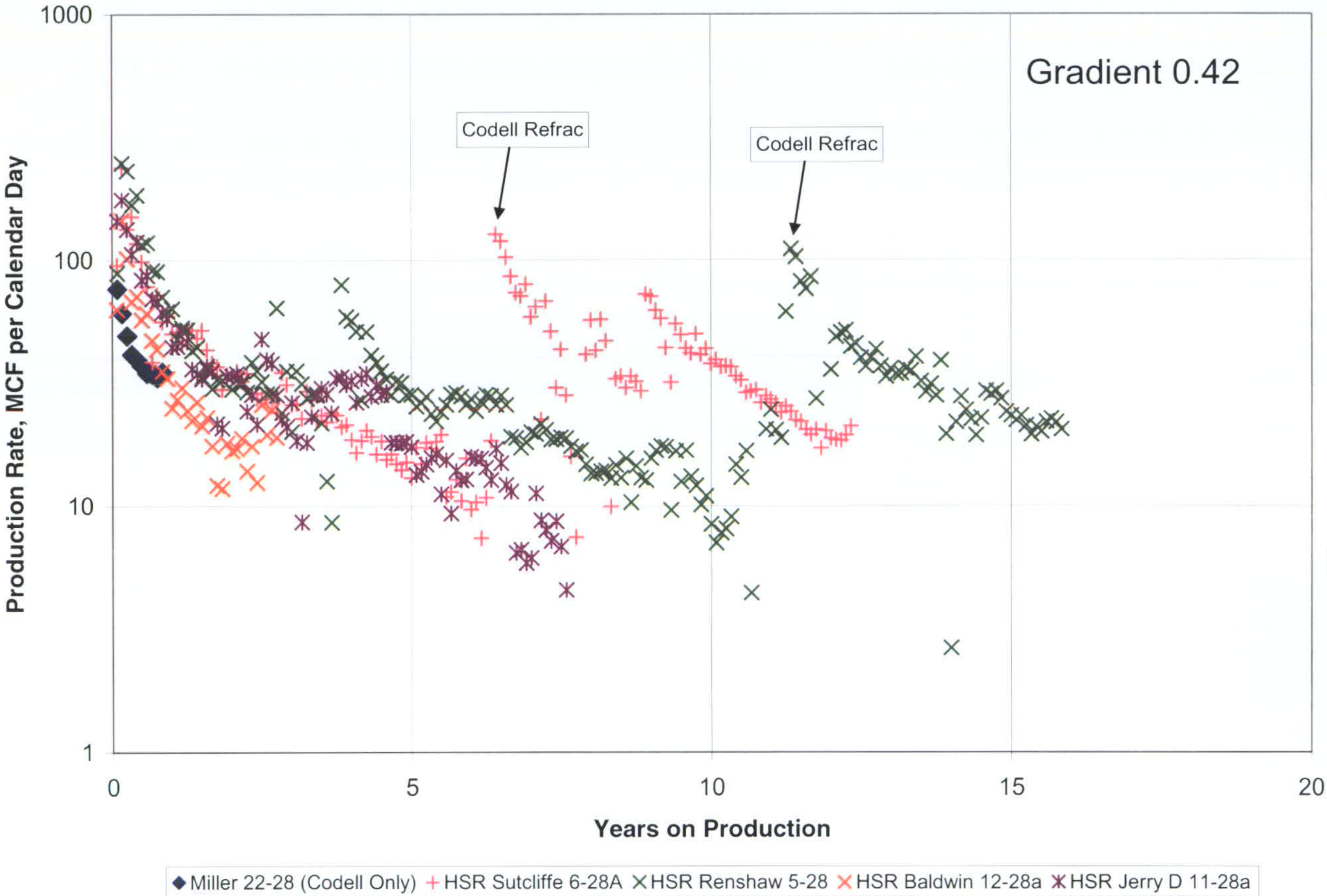
Wardell 22-7 Normalized Oil Production Rate



Miller 22-28 Pilot Area

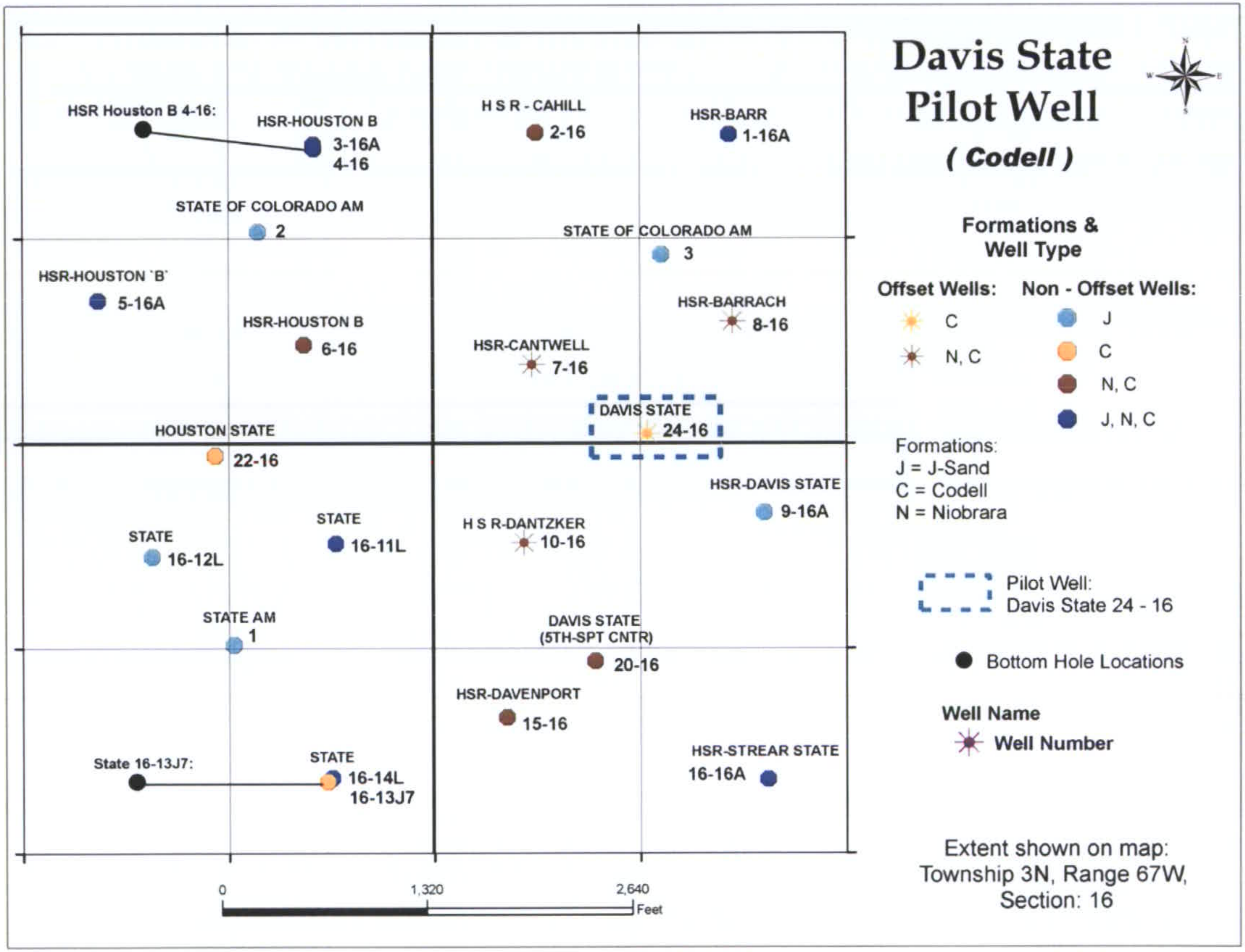


Normalized Miller C/N Gas Production Rates



Normalized Miller C/N Oil Production Rates

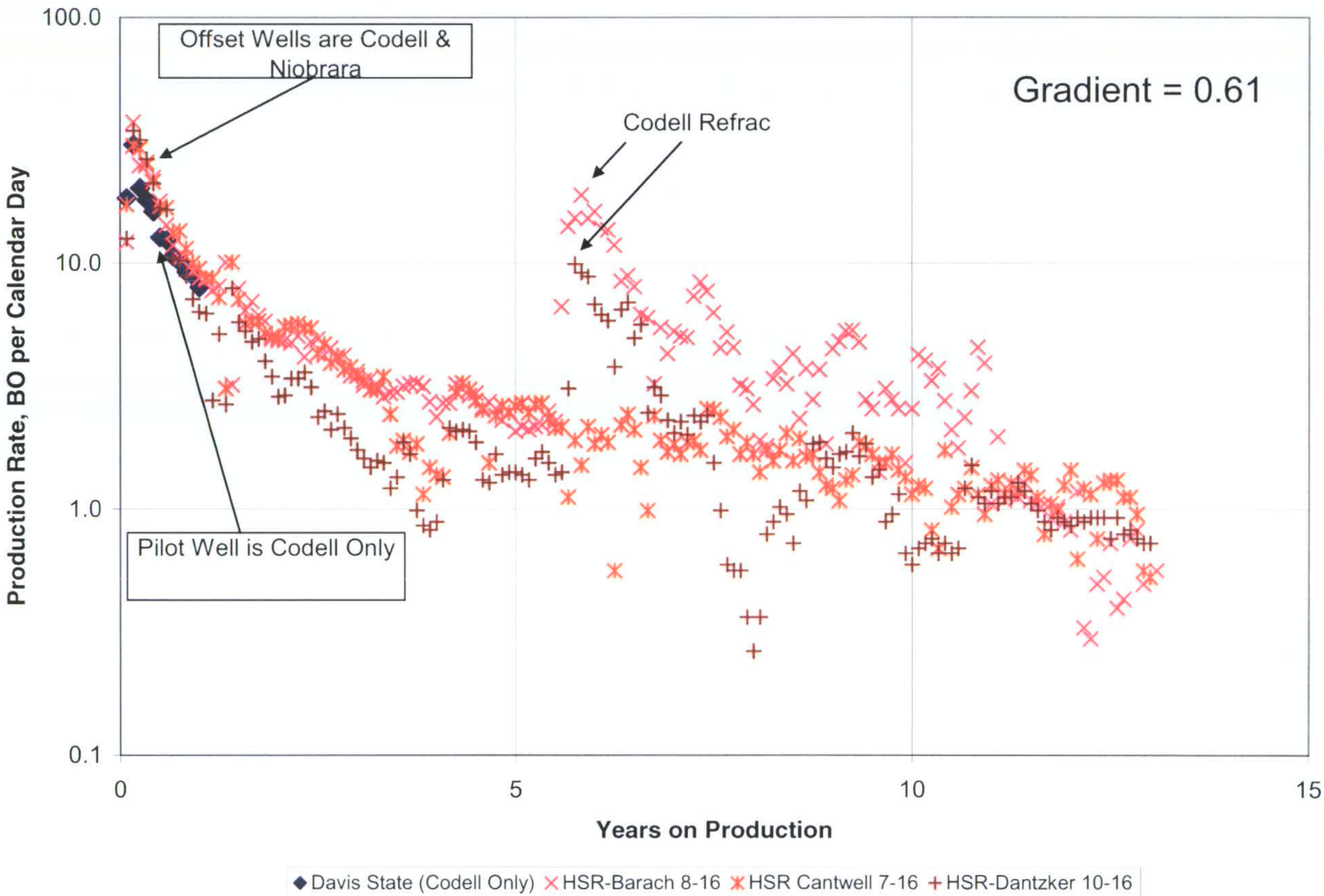
C/N Davis State Pilot Area



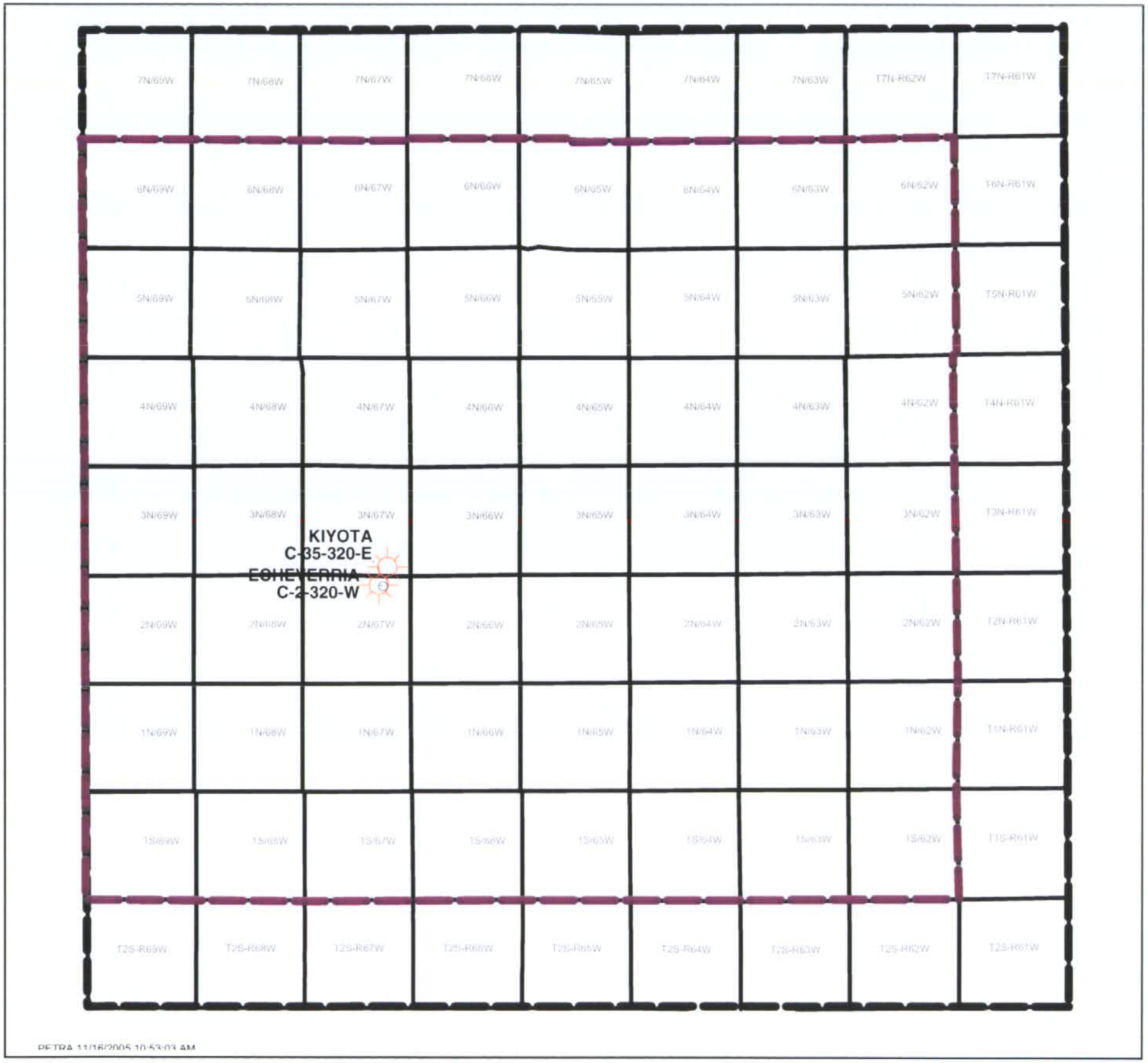
Normalized Davis State C/N Gas Production Rates

E-41

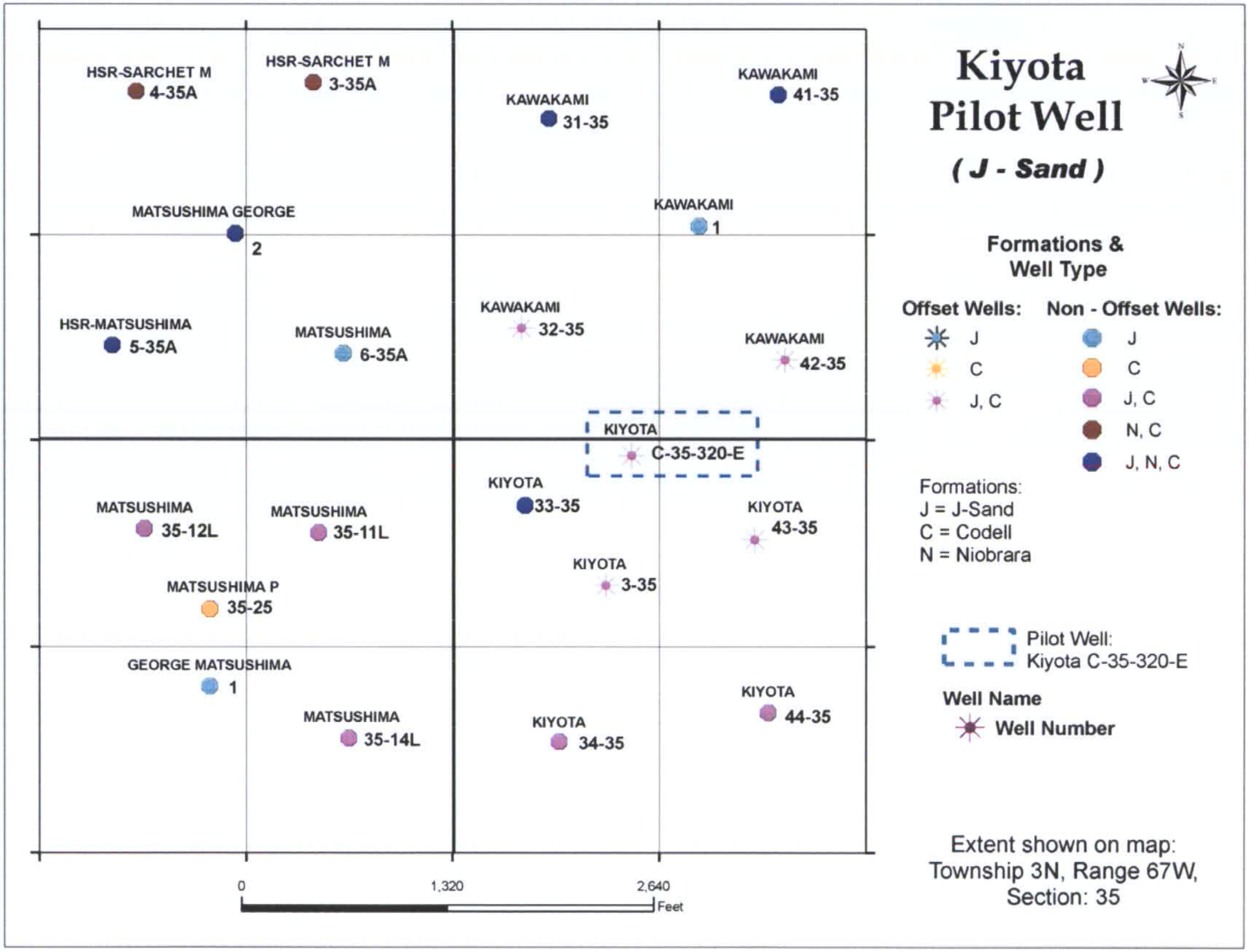
Normalized Davis State C/N Oil Production Rates



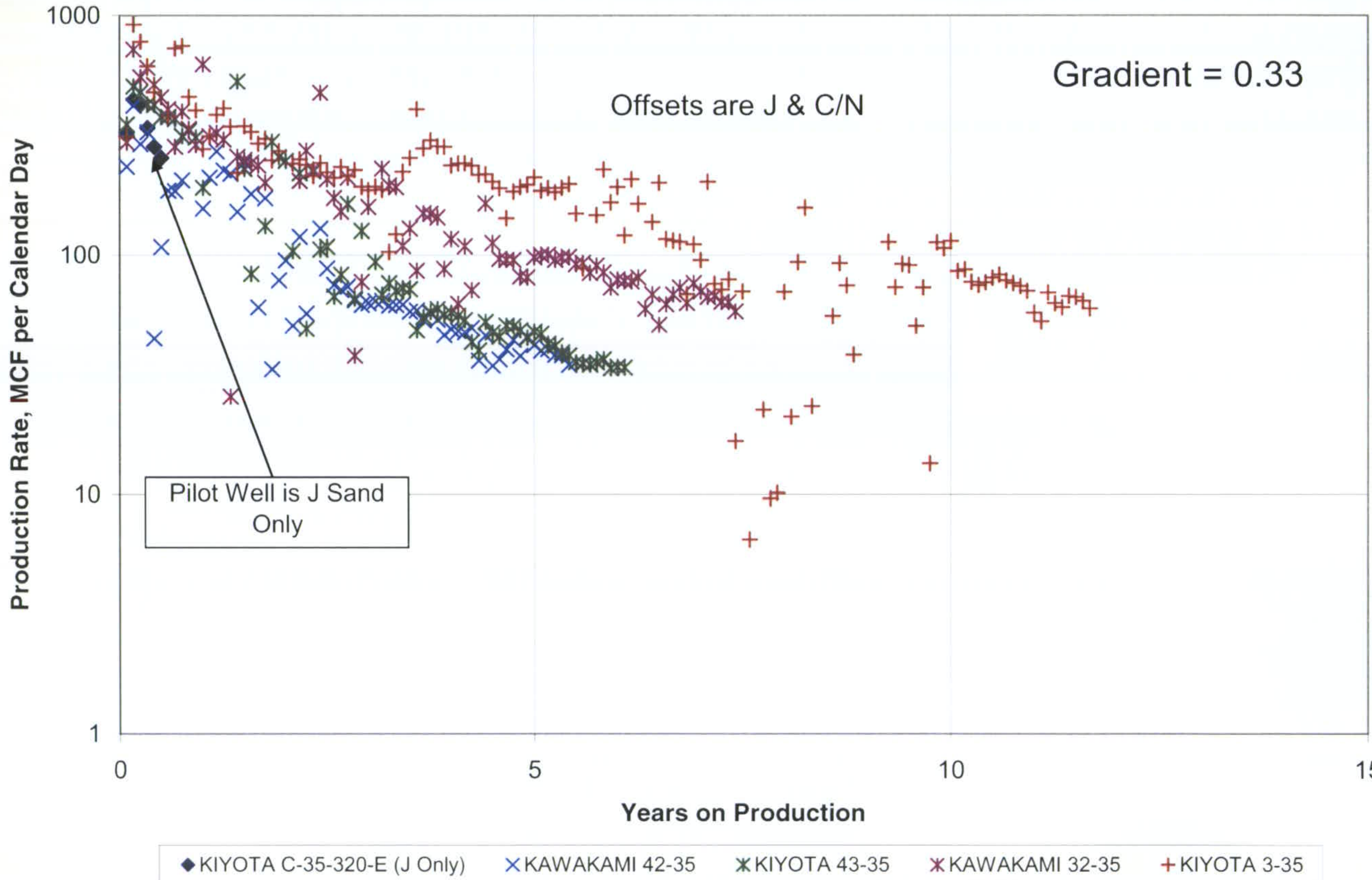
Index Map of 2 Example J Pilot Areas



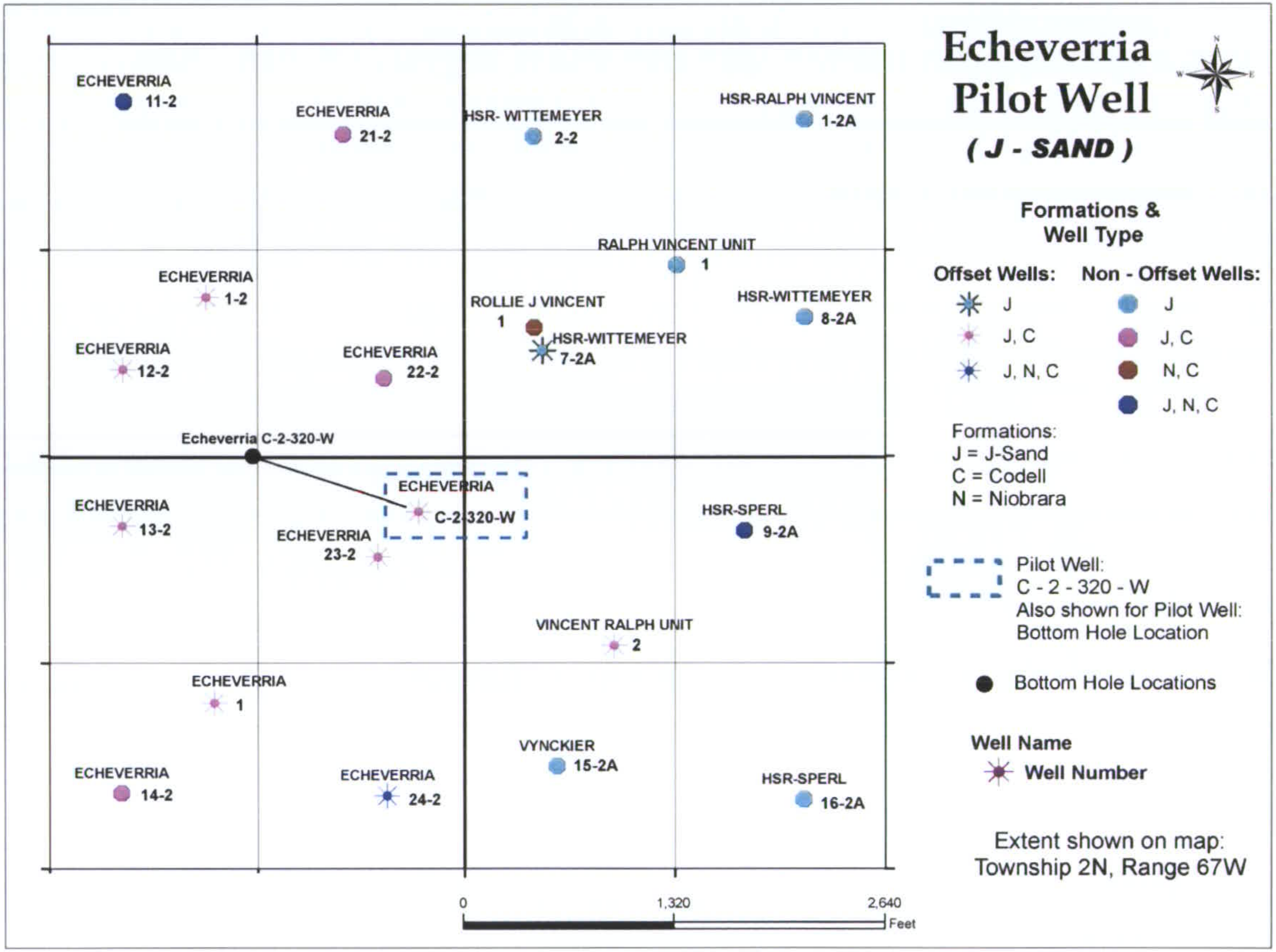
J Sand Kiyota C-35 Pilot Area



Normalized Kiyota J Sand Gas Production Rates

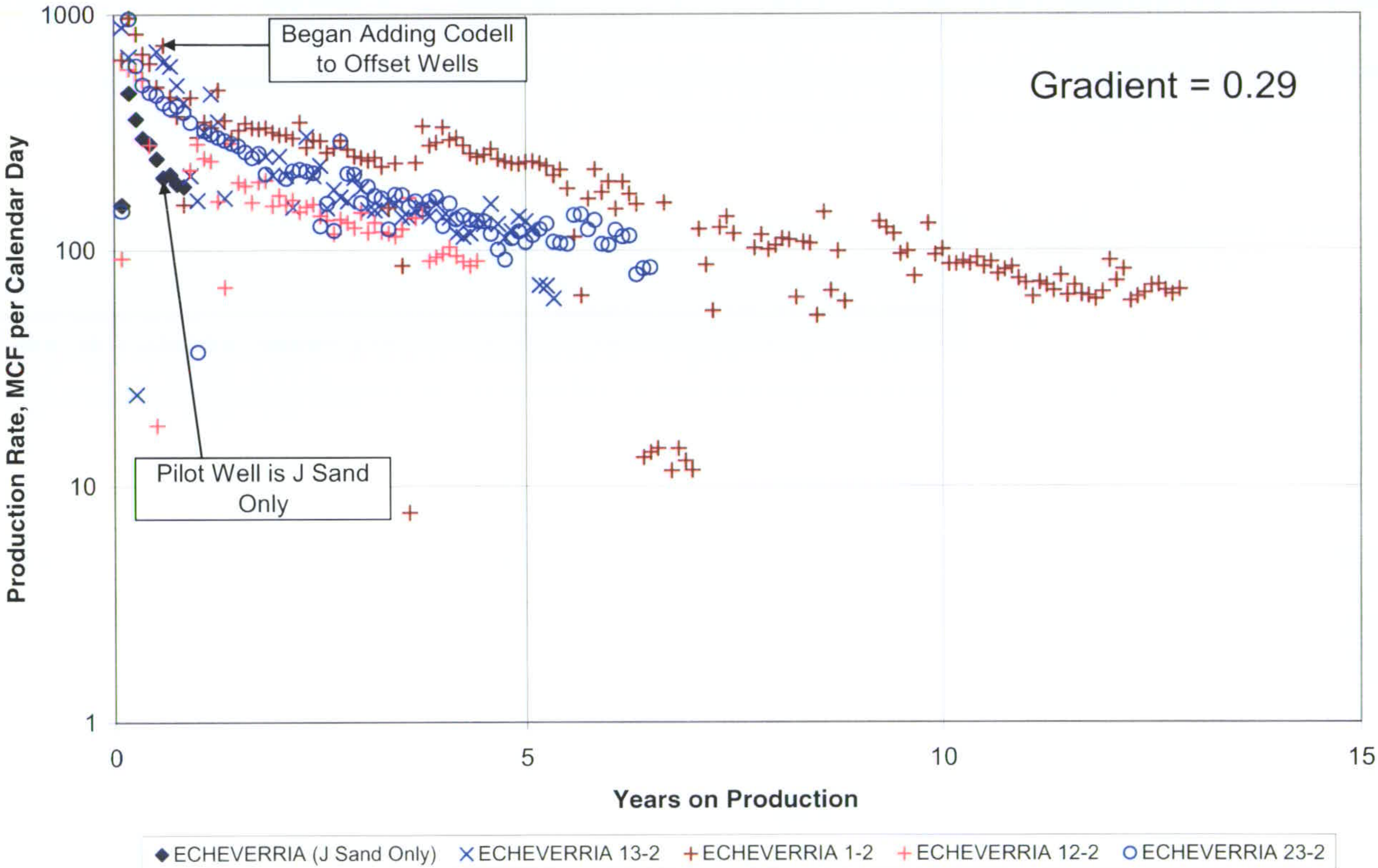


J Sand Echeverria C-320W Pilot Area



Normalized Echeverria J Sand Gas Production Rates

E-47



Engineering Summary

- Pressure data from Pilot Wells and 5th spot wells indicates little or no depletion in 20 acre increased density locations.
- Initial production rates for Pilot Wells and original offset wells very similar.
- Wells drilled in the 90's and 00's have equivalent or better production rates compared to wells drilled in the 70's and 80's indicating the field is not depleted.
- Increasing density will enable the recovery of additional gas from GWA.
- Increasing density will prevent waste of oil and gas reserves in the GWA.

Economics

- Assumptions for typical wells in GWA
  - General assumptions
    - Total Royalty of 15%
    - Commodity Pricing for economics
      - Oil price of $50.00 per barrel
      - Gas price of $7.00 per mmbtu
    - Production Taxes (combined severance and Ad Valorem) of 5.8% of revenue

Economics

- Assumptions for typical GWA Codell-Niborara and J Sand wells
  - Type production curves for Codell/Niobrara from median curves of all wells in GWA
  - Type production curves for J-Sand from Representative Reservoir Model at 20-year point including effects of acceleration
  - Operating expenses of $600 per month per well based on average costs provided by operators
  - Cost to drill, complete and connect wells for sales
    - Codell-Niobrara costs about $700,000 per well
      - $550,000 for drilling and completion
      - $100,000 additional cost for directional drilling
      - $50,000 for connection of well to gathering/sales system
    - J Sand costs about $575,000 per well
    - Combined Codell-Niobrara and J Sand costs about $800,000 per well

Projected Economics of Typical Infill Wells

	Codell-Niobrara	J Sand	C-N & J Sand
Gross Gas (MMcf)	179	100	285
Gross Oil (Mbbl)	18	0.5	18.6
Total (Mboe)	48	17	66
Gross Revenue (M$)	2,461	904	3,400
Royalties (15%) (M$)	(369)	(136)	(510)
Total Net Revenue (M$)	2,092	768	2,890
Total Net Taxes (M$)	(121)	(45)	(168)
Total Expenses (M$)	(375)	(200)	(550)
Investment (M$)	(700)	(575)	(800)
Total Net Cash Flow (M$)	894.9	(52)	1,320
NPV (10%) of Cash Flow (M$)	173	30	670
IRR of Cash Flow (%)	16%	14%	75%

Overall Economic Impact of Increased Density

- Impact of rule change on investment, taxes and royalties
  - Range of Codell-Niobrara and J Sand wells that could be drilled and completed in the GWA
    - About 200 to 300 new wells per year for over 20 years
  - Total incremental investment
    - Roughly $3.7 billion based on current drilling and completion costs
  - Total incremental taxes both severance and Ad Valorem
    - $700 million (5.8% of revenue) paid by royalty and working interest owners
  - Total incremental royalties (15%)
    - $2.1 billion

Summary Opinions

- The proposed rule promotes economic and efficient development of the Codell/Niobrara and J-Sand Reservoirs.
- The proposed rule will prevent waste and protect correlative rights.

established in the J-Sand that has transpired over the past 8 years. Doubled the number of J Sand producing wells for Kerr-McGee from the 850 purchased, with an additional 900 completions often using existing Codell wells to deepen to the J-Sand. Helped pioneer the use of small tools for deepening operations inside 4 ½' casing. Also, actively involved in the directional work periodically required in Codell wells that have faulted out sections and have to be sidetracked to find the Codell. Currently, manage all drilling and production work in Wattenberg field which includes drilling up to 200 J-Sand and Codell/Niobrara wells per year.

Directional Drilling in Wattenberg

Operators in Wattenberg have diligently worked to utilize directional drilling techniques when possible:

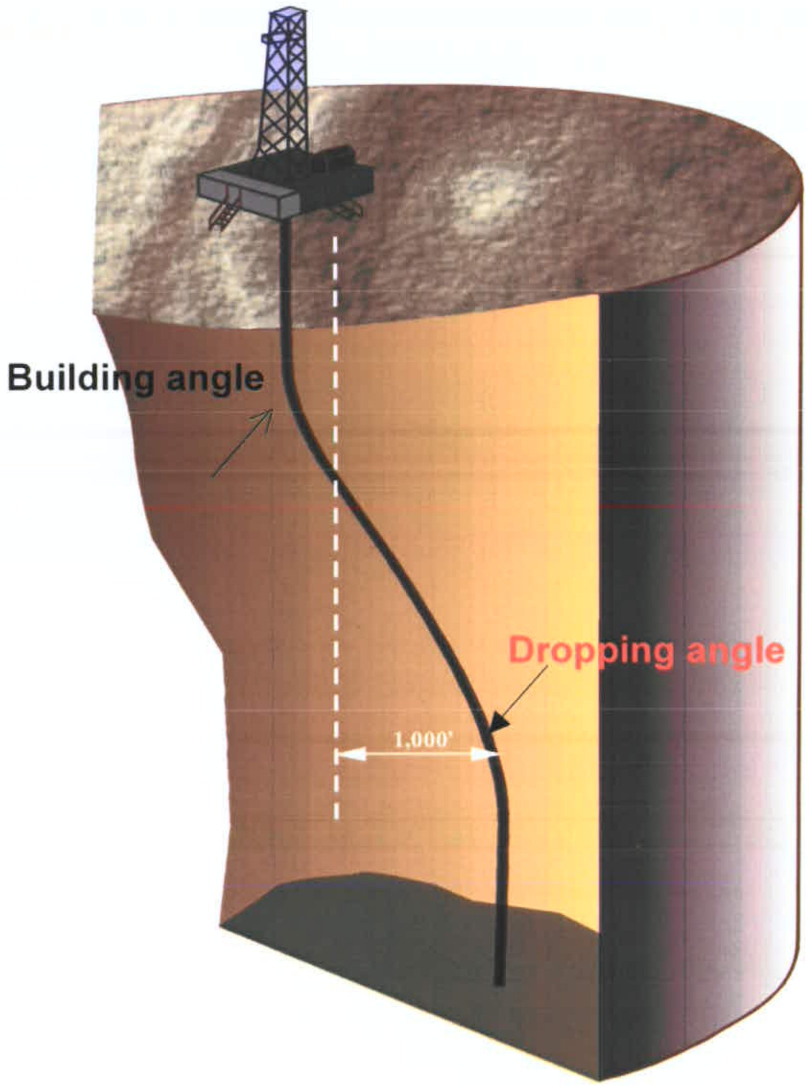
- to address geological constraints
- to avoid certain surface considerations such as wetlands, rivers, etc.

.....and have gained valuable experience.

- However, experience has shown directional drilling is:
  - more difficult
  - more time consuming – therefore more expensive
  - keeps the rig on location longer – irritation factor for surface owners
  - carries more associated operational risk than vertical drilling

- Operational risk is defined as getting "stuck":
  - differentially
  - "key seated" in the angle build or drop sections

Directional Drilling



Directional Drilling in Wattenberg

- One operator recently experienced severe operational problems:
  - 2 Cd./Nio. wells in 2 months have taken more than 30 days to drill
  - both wells were greater than 1,000' reach
- Compounding the operational risk:
  - losing expensive tools in the hole such as –
    - ✓ MWD equipment
    - ✓ mud motors
    - ✓ PDC bits
    - ✓ Drill collars and weight pipe

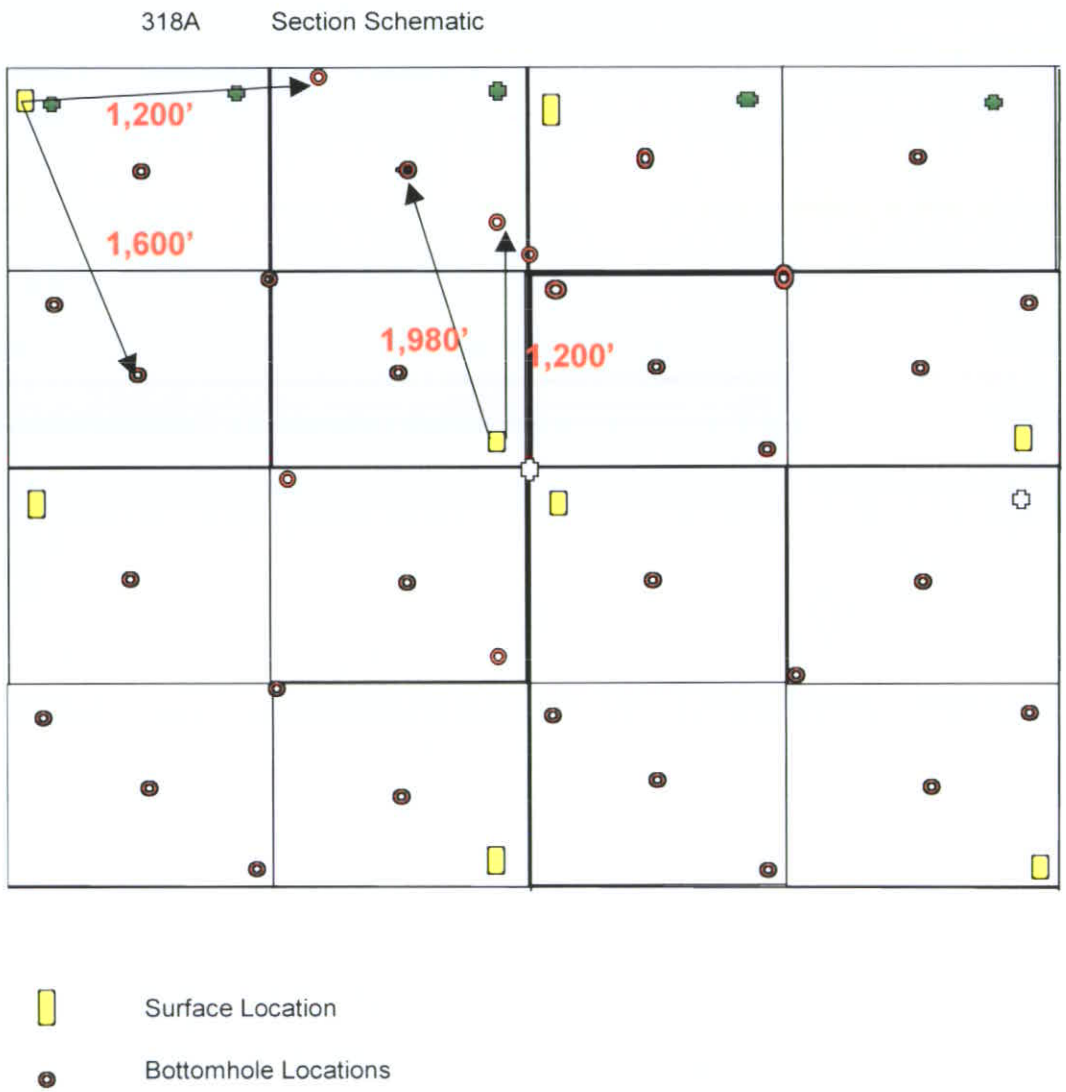
Directional Drilling in Wattenberg

- Directional displacements of 0' to 1,000':
  - routinely cost approximately $85,000 to $100,000 additional
  - periodically experience operational problems (about 1 out of 20)

- Directional displacements of <u>greater</u> than 1,000':
  - vary exponentially in risk and cost with magnitude of displacement
  - typically have incremental costs greater than $125,000 over a vertical wells
  - have a significant chance of experiencing problems ~50%.

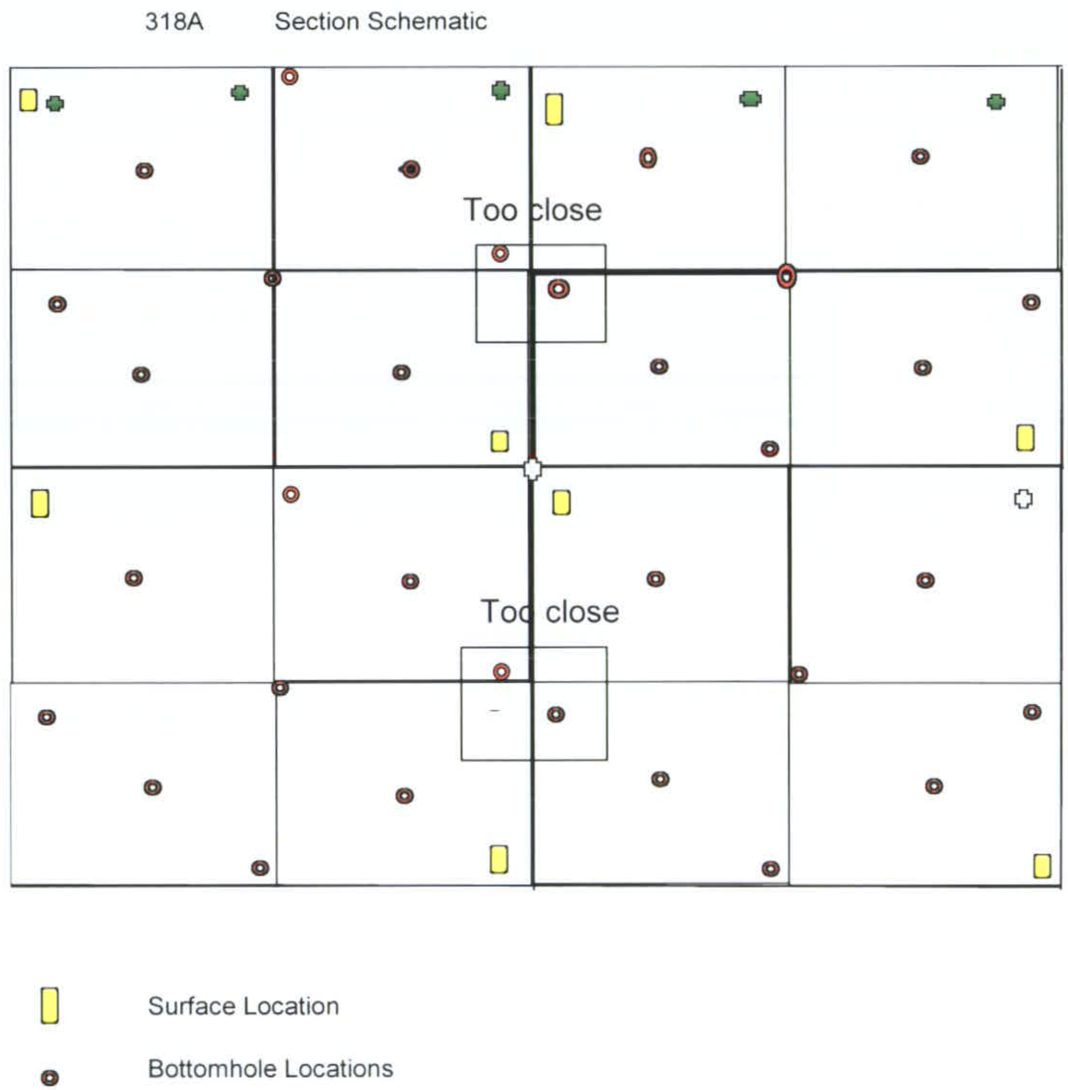
One Opposition Proposal: Directional Drilling from 2 Windows

One Opposition Proposal: Directional Drilling from 2 Windows



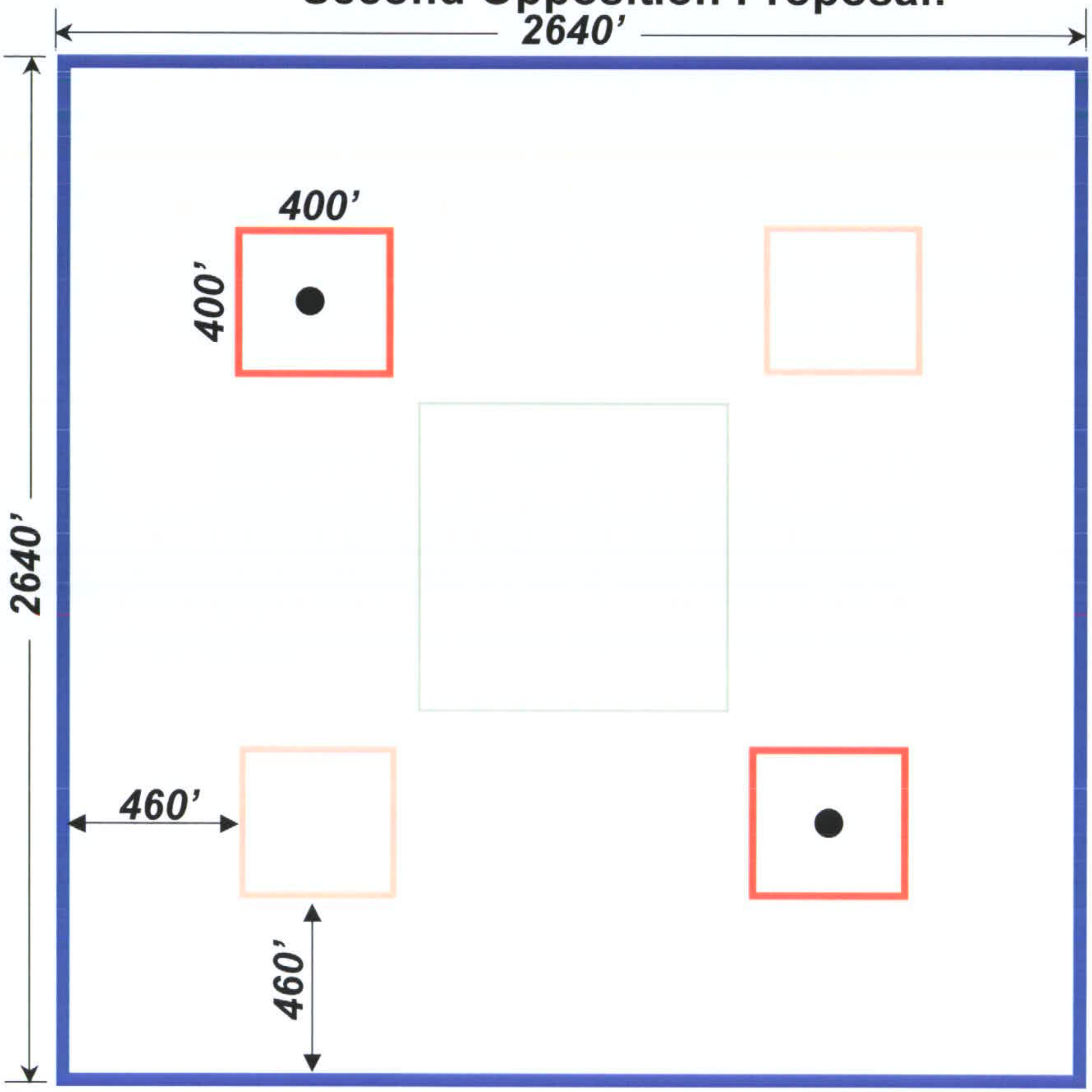
D6

One Opposition Proposal: Directional Drilling from 2 Windows



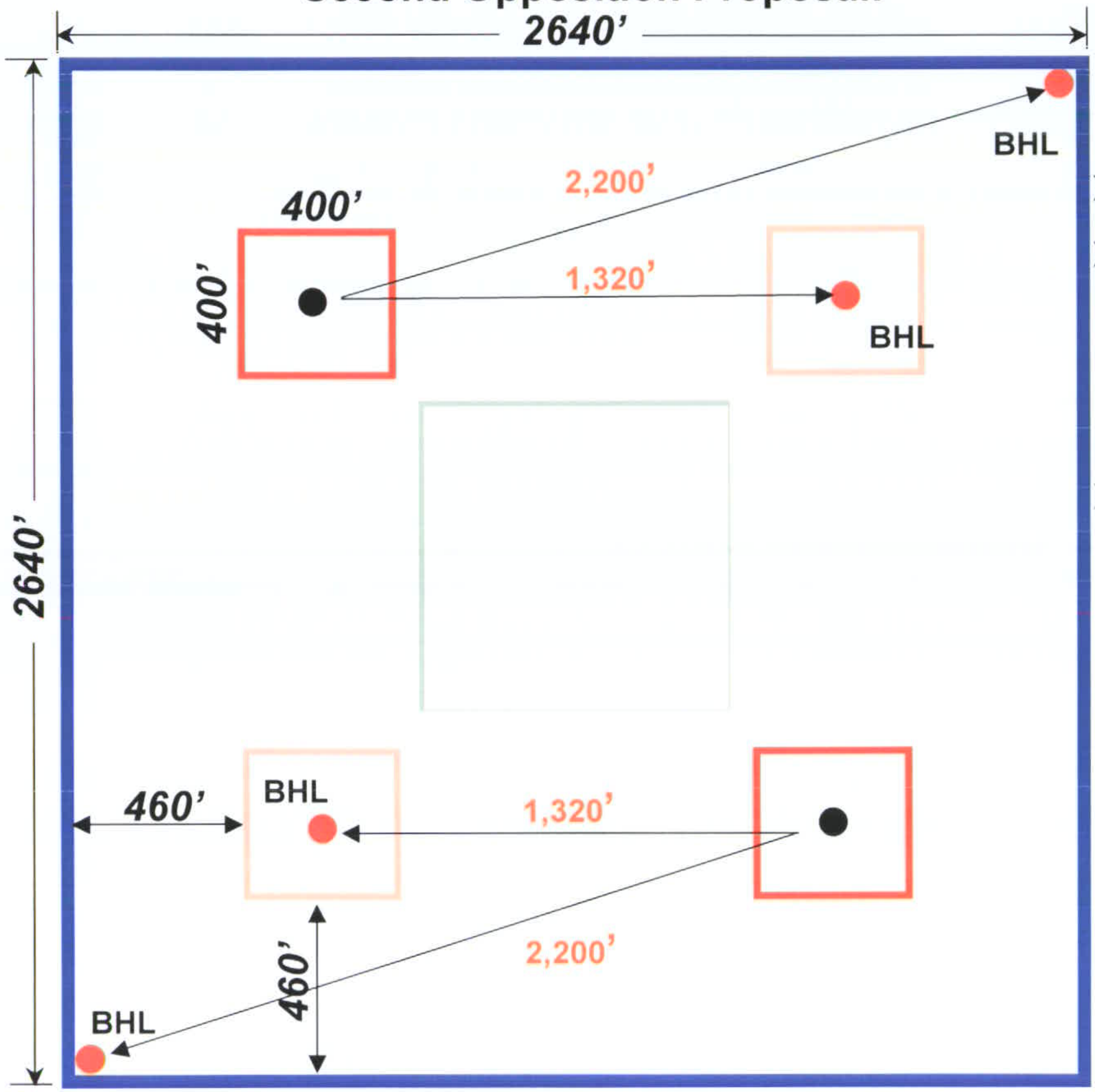
D7

Second Opposition Proposal:



Directional Drilling from 2 Existing Windows – NW & SE

Second Opposition Proposal:



- 4 locations > 1,000'
- At least 4 locations per 160 acres might be excluded from drilling due to economic risk.
- That's 752,000* boe per section or 27 MMboe per township left behind and wasted.

*assumes 47 MBOE per location for CdI/Nb.

Directional Drilling in Wattenberg

Conclusion –

- Wattenberg operators welcome the opportunity and challenge of directionally drilling for new reserves in the field.
- Retaining the existing five drilling windows in the revised GWA area is necessary to optimally place wells:
  1. to adequately drain reserves
  2. to limit operational and economic risk
  3. to prevent waste

Resumes

BIOGRAPHY

David W. Siple is Land Director, Rocky Mountain Region, for Noble Energy Production, Inc., a major independent oil and gas producer with operations throughout the Rocky Mountains, Mid-Continent, Gulf Coast and internationally. He earned a B.S. in Business, Mineral Land Management from the University of Colorado in 1981. Mr. Siple began his land career after graduation and has nearly 25 years of experience in surface use matters, leasing and regulatory compliance. Most recently, David served as Vice President of Land for Patina Oil & Gas Corporation from 1996 through its merger with Noble in 2005. From 1990 to 1996, Mr. Siple held several management positions with Gerrity Oil & Gas Corporation and Snyder Oil Corporation. Prior to that he held staff landman positions with PanCanadian Petroleum Corporation for nine years. Mr. Siple is a Certified Professional Landman and a member of the American Association of Professional Landmen and the Denver Association of Petroleum Landmen.

RESUME

ROBERT J. WEIMER

Professor Emeritus and Consultant
Department of Geology and Geological Engineering
Colorado School of Mines
Golden, Colorado 80401

Professional Engineer, Colorado #7356
AIPG Certified Professional Geologist #98
Certified Petroleum Geologist #4515

Member, National Academy of Engineering

Date and place of birth: September 4, 1926; Glendo, Wyoming
married Ruth Carol Adams, September 12, 1948; children: Robert Thomas; Loren Edward (dec); Paul Christner; Carl Scott.

Education:

	Peru State College, Peru, Nebr., 1944, U.S. Navy Air Corps V-5 Program
	University of Southern California, 1944-45, U.S. Navy ROTC Engineering Program
B.A.	University of Wyoming, 1948; Major in Geology
M.A.	University of Wyoming, 1949; Major in Geology
Ph.D.	Stanford University, 1953; Major in Geology

Work Experience:

1949–1954	Union Oil Company of California, Rocky Mountains, West Texas, Educational leave, District Geologist, Montana
1954–1957	Full time Consulting Geologist, Denver
1957–1960	Assistant Professor of Geology, Department of Geology, Colorado School of Mines
1960	Exchange Professor, University of Colorado, Boulder
1960–1964	Associate Professor of Geology, Department of Geology, Colorado School of Mines
1961	(Summer) University of Georgia Marine Institute, Sapelo Island, Georgia
1962	(Summer) Director, NSF Conference Geology of Southern Rocky Mountains
1964–1969	Professor and Head, Department of Geology, Director CSM Field Camp, Colorado School of Mines
1967	Fulbright Lecturer, University of Adelaide South Australia
1969–1978	Professor of Geology, Department of Geology, Colorado School of Mines
1978–1983	Getty Professor of Geological Engineering, Department of Geology, Colorado School of Mines
1970	Visiting Professor, University of Calgary
1975	Visiting Professor, Institut Teknologi Bandung, Bandung, Indonesia
1971–Present	(Summer program) 45 5-day courses on Stratigraphic Concepts in Fossil Fuel Exploration. Approximately 1,700 participants
1983–Present	Professor Emeritus, Colorado School of Mines
1983–1987	WeiTek, Inc., President
1983–Present	Consulting Geologist

Colorado School of Mines Activities:

Mines Medal, Brown Medal, Coolbaugh Award

CSM Graduate Thesis in Geology Department (1957–1983):

- Chairman or major advisor – 53 (46 M.Sc.; 7 Ph.D.)
- Committee member and/or minor advisor – 60 (59 M.Sc.; 8 Ph.D.)
- Member of thesis committees in departments other than Geology – 21 (12 M.Sc.: 9 Ph.D.)

Contacts with Universities other than CSM:

Outside Member of Ph.D. Thesis Committees: 4 in United States and Canada

Peer Review for Tenured Appointments at Universities: 8 in United States and Canada

Lectures and Awards at Universities: United States and Foreign

AAPG Distinguished Lecture Tours – 1964–65; 1984–85 (60 lectures for Universities and Geological Societies, in United States and Canada); 1994 – Huffington Lecture Tour to Asia (36 lectures); 1991–1992, 14 lectures on Sequence Stratigraphy (President's Tour)

University of Wyoming, Distinguished Alumni Award; A & S Exemplary Award

Society of Exploration Geophysicists (SEG Tour) 1979; (12 lectures for Universities and Geophysical Societies)

Professional Societies:

American Association of Petroleum Geologists (AAPG)
President 1991
Chairman or Member of 20 committees
Honorary Member
Sidney Powers Medal
Distinguished Educator Award
Certified Petroleum Geologist #4515

Society of Economic Paleontologists and Mineralogists (SEPM)
President 1972
Vice-President
Secretary-Treasurer
Chairman or Member of 10 committees
Honorary Member
Twenhofel Medal

Geological Society of America (GSA) (Fellow)
Chairman, Rocky Mountain Section
Chairman or member of 10 committees
Laurence L. Sloss Legend Award
Member GSA Foundation Board

Rocky Mountain Association of Geologists (RMAG)
  President 1969
  First Vice-President
  Honorary Member
  Scientist of the Year
  Petroleum Geology Legend Award

Colorado Scientific Society (CSS)
  President 1980
  Councilor
  Vice-President
  Honorary Member

Society of Exploration Geophysicists (SEG)
  Distinguished Lecturer, 1979 (14 universities and society chapters)

Membership in Other Societies:
  American Institute of Professional Geologists (AIPG),
    Certified Professional Geologist #98, Ben Parker Medal
  Wyoming Geological Association, Honorary Member
  Montana Geological Society
  American Association Advancement of Science (elected Fellow, 1991)
  Registered Professional Engineer, State of Colorado #7356
  American Geological Institute, Foundation Trustee
  Nigerian Mining and Geoscience Society, Honorary Member
  Canadian Society of Petroleum Geologists, Honorary Member

Government Boards or Committees:

U.S. National Research Council-National Academy of Sciences
  Associateship Fellowship Committee, 1970-1973
  Chairman, Earth Sciences Panel, 1972-1973

U.S. National Research Council-Member, Board of Mineral and Energy Resources, 1988

U.S. Department of Energy
  Member, Energy Research Advisory Board (ERAB) to Secretary of Energy, 1986-1990
  Geosciences Study Committee, 1986-87
  Member, Panel on Energy Competitiveness, 1987-88
  Testimony before Subcommittee on Energy Research and Development
    of the Committee on Science, Space and Technology,
    U.S. House of Representatives, July 15 and 16, 1987

National Academy of Engineering, elected member, 1992; chairman, Section II, Petroleum, Geological and Mining Engineering, 2000; Liaison to NRC on Geological Engineering, 1998–2001

Colorado
  Member, Selection Committee, Director, Colorado Geological Survey, 1965
  Energy Resources Field Trip, Western Colorado for Colorado legislators, 1982
  Colorado Commission on Higher Education,
    Member of Organized Research Program, 1981–82
  Governor's Task Force to Evaluate Colorado Geological Survey, 1987–88
  Member, Advisory Committee, Colorado Geological Survey, 1989–1992

(Chairman 1990–92)
Testimony before legislative committees

Lecture on U.S. Energy Problems, IOCC Meeting, Coeur d'Alene, Idaho, June 1987

Member, Technical Study Committee, Geoscience Institute for Oil and Gas Recovery Research University of Texas at Austin, Texas, 1988–90

Chairman, Review Panel for Texas Bureau of Higher Education Coordinating Board, 1990

Review Team, Nebraska Conservation and Survey Board, University of Nebraska, 1989

Review Team, Institute Sedimentary and Petroleum Geology, Calgary, Canada, 1989

National Academy of Science (NRC) – Romanian Academy Workshop on Integrated Resource Planning, Bucharest, Romania, November 8–17, 1992

National Research Council (NCR) Panel on the Review of the Oil Recovery Demonstration Program of the Department of Energy, 1995

Ford Foundation pre-Doctorate Fellowship Program for Minorities; Panel Member, 1999–2003

Consulting Activities (1954–1993):

Lectures or consulting for Petroleum Companies (21), Government Agencies (3),

Publications:

Involved in the publication of seven books and more than 100 scientific articles, of which 16 papers are related to the Greater Wattenberg Area.

NORWEST CORPORATION

John D. Wright, Ph.D., P.E.
President

QUESTA ENGINEERING CORPORATION
A NORWEST Company

EDUCATION

Ph.D.
Petroleum Engineering
Colorado School of Mines
"Pressure Behavior of Hydraulically Fractured Wells At and Below the Bubble Point Pressure."

B.S.
Petroleum Engineering
Colorado School of Mines

ASSOCIATIONS

Registered Professional Engineer,
Colorado (#14791)
Louisiana (#23574)
New Mexico (#11892)
Wyoming (#10198)

Society of Petroleum Engineers, Member

SPE Chairman, Distinguished Faculty Achievement Award Committee, 1992

SPE Distinguished Faculty Achievement Award Committee Member, 1993

SPE Treasurer, Denver Section, 1977

Association of International Petroleum Negotiators, Member

Society of Petroleum Evaluation Engineers, Member

SPEE National Board of Directors 2003–2005

SPEE Chairman Petroleum Economics Recommended Evaluation Practices Committee, 2003

Technical Committee Chairman SPEE Petroleum

PROFESSIONAL HIGHLIGHTS

More than thirty-five years domestic and international oil and gas experience as property evaluator, consultant, college professor, working interest owner, reservoir engineer, production engineer, expert witness, and short course instructor.

WORK EXPERIENCE

QUESTA ENGINEERING CORPORATION, GOLDEN, COLORADO
1988 – PRESENT: PRESIDENT AND CHIEF ENGINEER
1983 – PRESENT: SENIOR RESERVOIR ENGINEER

- Devised methodology to recreate the amount of money received from oil and gas operations in portions of eight U.S. states since 1887.
- Simulation of 300 MM bbl oilfield to optimize development using horizontal wells. Compared HPAI, waterflood, and CO2 for secondary recovery.
- Decision tree analysis of CBM exploration strategy
- Risk and economic analysis for multiple play CBM projects
- CBM exploration and development planning for projects in two foreign countries
- Coal mine litigation
- Economic analysis of North Slope power project
- Evaluated several fields on Tierra del Fuego, Chile to determine viability of a revitalization project.
- Evaluated secondary recovery project in North Dakota to compare benefits of high pressure air injection versus waterflooding utilizing horizontal wells.
- Simulated oil field in Kazakhstan for development plan.
- Valued gas contract in Oklahoma.
- Met with government ministers in Turkmenistan in support of a client seeking a PSC.
- Performed economic evaluation of two large Utah gas properties for acquisition.
- Evaluated large tight-gas field in SW Wyoming for purchase.
- Assisted attorneys for the government of a South American county in rewriting petroleum laws and regulations and model form contract in preparation for sale of onshore assets and offshore bidding round. Negotiated with potential purchasers on government's behalf.
- Evaluated well tests on major discovery of naturally fractured field in Colombia. Met with SEC and NASDAQ personnel to brief them on the potential of the Colombian field in preparation for the listing of our client.
- Analyzed and recommended changes to unitization agreement covering giant gas field in Colombia.
- Senior consultant for rehabilitation project in Southeast Asia utilizing more than 40 Questa personnel
- Evaluated proved developed and undeveloped gas wells in DJ Basin for potential purchase.
- Evaluated several hundred Codell-Niobrara gas wells in D-J Basin. Performed post-audit of results versus expectations for 400 well drilling program in D-J Basin. Developed and evaluated possible infill drilling project for major gas field in Colorado.
- Evaluated potential of concession onshore Cabinda, gas condensate reservoir offshore Trinidad and served as member of team evaluating business opportunities in Central Asian Republic of Former Soviet Union.

Economics Software Symposium 2004

SPEE Co-Chairman Petroleum Economics Recommended Evaluation Practices Committee, 2000

SPEE Special recognition "Contributions to Denver Chapter in 2000."

SPEE Special recognition "Service to the Society" presented 2002 national meeting

Society of Petroleum Well Log Analysts, Member

Society of Independent Earth Scientists, Member

SIPES Co-Chairman Advertising Committee for 2000 SIPES national convention.

SIPES Chairman of Denver Section, 2001 and 2002

Denver International Petroleum Society, Member

Canadian Petroleum Society, Member

The Association for the Advancement of Cost Engineering, Member

EXPERTISE

Oil and gas property evaluation

Risk analysis

Reservoir engineering

Reservoir simulation

Coalbed methane

Investor representative to technical committee for oil project in Kazakhstan.

- Reservoir simulations of dry gas field offshore Louisiana, gas condensate field onshore Louisiana, gas reservoir in Australia, oil field development in Kazakhstan and oil reservoirs in Russia.
- Expert witness in several take-or-pay and gas well valuation cases. Testified in Federal and State Court, arbitrations and before state regulatory commissions.
- Taught Risk Analysis in Australia, Waterflooding and Risk Analysis in Indonesia and courses on upstream operations to downstream employees of PetroBras.

1983 – 1987: ASSOCIATE CONSULTANT

- Involved primarily in compositional simulation and reservoir engineering projects.

COLORADO SCHOOL OF MINES

1995, 2002 Adjunct Associate Professor

- Taught graduate class in Advanced Petroleum Economics. Included application of oil and gas property evaluation, decline curve analysis, before and after federal income tax cash flows, risk analysis, decision trees, Monte Carlo simulation.

THOMPSON-WRIGHT ASSOCIATES, GOLDEN, COLORADO

1983 – Present Partner

- Presented short courses on Oil Property Evaluation and other petroleum engineering topics to industry and government personnel.
  - **Short Courses**
    - Applied Oil and Gas Property Evaluation (8 times)
    - Oil Property Evaluation and Decline Curve Analysis, in association with Denver Society of Petroleum Engineers.
    - Risk Analysis (Australia)
    - Production Decline Analysis and Economics for Geologists and Managers
  - **In-House Courses**
    - Applied Oil and Gas Property Evaluation to a group of 8 New York banks
    - Well Testing, Production Engineering, Waterflooding, Risk Analysis, and Oil Property Evaluation to Pertamina (Indonesian National Oil Company).
    - Applied Oil and Gas Property Evaluation to major oil company.
    - Economic Analysis and Production Sharing Contracts to major oil company in Indonesia.

COLORADO SCHOOL OF MINES, GOLDEN COLORADO

1980 – 1988 Associate Professor in Petroleum Engineering

- **Undergraduate Courses:**
  - Oil Property Evaluation
  - Production Engineering
  - Well Logging Lab
  - Computer Applications
  - Reservoir Engineering

economic analysis

Coalbed methane exploration and development

Well test design and analysis

Well log analysis

Production engineering

Expert witness

Former professor and adjunct professor at Colorado School of Mines

Short course instructor

Professional author of a textbook, numerous papers and short courses

- Secondary Recovery
- Rock Properties

- **Graduate Courses:**
  - Petroleum Economics
  - Risk Analysis
  - Systems Analysis
  - Multiphase Flow in Pipes
  - Numerical Methods in Petroleum Engineering

Supervised graduate student theses in decline curve evaluation techniques, analysis of effects of individual interpretation on reserve estimates, recovery methods from volatile oil reservoirs, unsteady state simulation of wells on plunger lift, multiphase flow in pipe, unsteady state simulation of gas lift wells, and time to pseudo steady state in hydraulically fractured wells.

Consulted for various companies on oil property evaluation. Worked in Aberdeen, Scotland for British Petroleum, Magnus Field, North Sea. Reservoir engineering on volatile oil reservoir in Middle East. Numerous property evaluations in U.S.

BERGESON & WRIGHT, LTD., GOLDEN, COLORADO
1975 – 1995 Secretary-Treasurer

- Working interest owner in various oil and gas properties in California, Colorado, and Canada.

GOLDEN ENERGY COMPANY, GOLDEN, COLORADO
1977 – 1980 Partner

- Partner and working interest owner in numerous oil and gas ventures located in Canada, California, Mid-Continent and Rocky Mountain regions. Provided engineering evaluation and operational support to drilling, completion and production activities.

Jerry R. Bergeson & Associates, Inc. (purchased by Intera Petroleum Technologies, Inc., in turn, purchased by Schlumberger)
Consulting Petroleum Engineers, Golden, Colorado
1975 – 1980 Co-founder, Director and Officer

- Provided senior consulting services in the areas of reservoir engineering, production engineering, and property evaluation (SEC reserve analysis). Performed well log analysis and property evaluations for SEC and bank loans in many states and Alberta, Canada. Completed oil and gas wells and supervised the installation of surface facilities in Colorado and Nevada as well as performing on-site analysis of logs and DSTs in Wyoming, Colorado, and Kansas for completion decisions. Revised participating areas in federal drilling units and designed waterfloods in Wyoming. Wrote economic software program used in-house for several years. Developed computer software for rod pumping design, log analysis, material balance solutions, vertical/ horizontal multi-phase flow analysis, and production database systems.

COLORADO SCHOOL OF MINES, GOLDEN, COLORADO
1974 – 1975 Instructor in Petroleum Engineering

- Courses

- Senior Seminar, Oil Property Evaluation; Production Engineering; Summer Field Session. Continuing Education Short Course (6 weeks) in Oil Property Evaluation for Denver Section of SPE-AIME, Fall 1974. Production Engineering Course (2 weeks) for H. K. vanPoollen and Associates in Malta, Summer 1973.

COLORADO SCHOOL OF MINES GOLDEN, COLORADO
1971 – 1974 Graduate Student

- Graduate studies in Petroleum Engineering and Operations Research. Teaching assistant to Dr. Bass, (Head of Petroleum Engineering Dept.) in reservoir engineering and evaluation economics.

CONTINENTAL OIL COMPANY (CONOCO), VENTURA, CALIFORNIA AND NEW ORLEANS, LOUISIANA
1969 – 1971 Production Engineer

- Field engineering responsibilities in the areas of artificial lift, electrical distribution systems, safety systems, and field automation systems. Engineering responsibilities included the design and installation of offshore production facilities, produced water treating facilities and onshore gas and oil handling and treating facilities. Area engineering responsibilities for the Grand Isle and West Delta Fields.

PAN AMERICAN PETROLEUM CORPORATION (BP-AMOCO), DENVER, COLORADO
1968 Professional Assistant, Drilling Department.

CONTINENTAL OIL COMPANY, FRANNIE, WYOMING
1967 Pumper, Roustabout

EXPERT WITNESS

Served as an expert witness in numerous take-or-pay and property valuation cases. Cases involved both contract interpretation and calculation of damages. Testified in Denver District Court as expert in Petroleum Engineering and Codell formation in particular. Testified before Oklahoma Corporation Commission on field rules. Accepted as expert in Reservoir Engineering. Testified in State District Court in Texas on damages calculation. Testified in arbitration on New Mexico take-or-pay contract. Testified in Federal District Court in New Mexico on take-or-pay contract. Testified in arbitration in California on numerous issues surrounding surface owner's attempt to force plugging and abandonment of numerous shut-in wells. Testified in Federal District Court in Wyoming on issues related to attempt to replace operator. Testified in Federal District Court in Washington, D.C. on estimating the revenue generated from oil and gas sales on certain Indian lands since 1887.

PUBLICATIONS

Books

Wright, John D., 2003, "Chapter 16. Petroleum Economics" for the next revision of the Petroleum Engineering Handbook to be published by SPE.

Thompson, R.S. and Wright J.D. 1984. Oil Property Evaluation. Thompson-Wright Associates, publishers. Golden, CO. Textbook used at Colorado School of Mines, University of Texas, Texas A & I, University of West Virginia, Mississippi State University, University of Alabama, University of Tulsa, Texas A & M, and

Oklahoma State University. Distributed by PennWell Publishing and Society of Petroleum Engineers.

Articles

- Wright, John D. 2003. "Irreducible Uncertainty – A Fact of Life in Reserve Estimates (*SPE 84146*)." Presentation at SPE Annual Technical Conference and Exhibition to in Denver, Colorado, U.S.A., 5–8 October 2003.
- Olds, Dan and Wright, John D..2003. "SPEE Recommended Evaluation Practices – A Status Report (*SPE 82038*)." Presentation at SPE Hydrocarbon Economics and Evaluation Symposium held in Dallas, Texas, U.S.A., 5–8 April 2003.
- Wright, John D. 2001. "Some Considerations in the Valuation of Gas Wells." Presentation at Wyoming Geological Association 52nd Annual Field Conference, Casper, Wyoming, September 8–12th 2001.
- Thompson, Robert S. and Wright, John D. 2001, "A Comparative Analysis of 12 Economic Software Programs (*SPE 68588*)." Presentation SPE Hydrocarbon Economics and Evaluation Symposium, Dallas, Texas, 2–3 April 2001.
- Thompson, R.S. and Wright, J.D. 1998. "Coupling Financial Profit Indicators to a Net Cash Flow Model for Production Sharing Contracts (*SPE 49179*)."Presentation 1998 SPE Annual Technical Conference and Exhibition, New Orleans, Louisiana, 27–30 September 1998.
- Wright, J.D. 1997. "Actual Performance Compared to a 20 Year Old Probabilistic Reserve Estimate (*SPE 38802*)." Presentation 1997 SPE Annual Technical Conference and Exhibition, San Antonio, Texas, 5–8 October 1997.
- Thompson, R.S. and Wright, J.D. 1989. "The Use of After-Tax Investments in Project Evaluation (*SPE 18932*)." Presentation SPE Hydrocarbon Economics and Evaluation Symposium, Dallas, Texas, March 9–10, 1989.
- Digert, S.A., Thompson, R.S., and Wright, J. D. 1987. "Error in Estimating Reserves Using Decline Curves (*SPE 16295*)." Presentation SPE Hydrocarbon Economics and Evaluation Symposium, Dallas, Texas, March 2–3, 1987.
- Shipley, S.E., Thompson, R.S. and Wright, J.D. 1987. "The Impact of the New Tax Law on Project Evaluation (*SPE 16312*)."Presentation SPE Hydrocarbon Economics and Evaluation Symposium, Dallas, Texas, March 2–3, 1987.
- Fields, R.A., Jr., and Wright, J.D. 1986. "A Review of the Production Characteristics of the Denver-Julesburg Basin Codell / Niobrara Play in Northeastern Colorado (*SPE 15554*)." Presentation 61st Annual Technical Conference and Exhibition, New Orleans, LA, October 5–8, 1986.
- Fields, R.A., Jr., and Wright, J.D. 1988. "Production Characteristics of the Denver-Julesburg Basin Codell / Niobrara Play." Journal of Petroleum Technology (Nov 1988) pp. 1457–1468.
- Economics Manual (Chapters), H. K. van Poollen and Associates, Inc., 1974.
- Production Engineering Manual (Portions), H. K. van Poollen and Associates, Inc., 1974

PUBLIC SPEAKING (LECTURER)

- WellDog, Inc. and Council of Energy Resource Tribes (CERT), Coalbed Natural Gas and the Future of Fossil Fuel Resources in Indian Country Symposium, January 20–21, 2005, Denver, CO, "Coalbed Natural Gas: The Next BIG Opportunity?"
- Society of Petroleum Evaluation Engineers (SPEE) Denver Chapter, April 2002, "Real Options – A different method of valuing oil and gas properties?"

- Texas Mid-Continent Oil & Gas Association's Annual Property Tax Representatives Conference, February 2002, "A Comparative analysis of 12 commercial economic programs."
- SPE – Denver, January 2002, "A Comparative analysis of 12 commercial economic programs."
- SPEE (Annual Meeting)– San Diego, June 7, 2001; 1-day short course on Recommended Evaluation Practices. Presented 8 REPs at the annual meeting which were approved by the members at the meeting to be voted on by the membership at large.
- SPEE – Houston, March 2, 2000; Petroleum Economics Software Symposium 2000 Co–chair of Analysis & Program for comparative analysis of 12 commercial economic programs. Full day symposium (1 of 2 principal speakers).
- SPEE – Denver, 2001, "A Comparative analysis of 12 commercial economic programs."
- SIPES – Denver, 2001, "A Comparative analysis of 12 commercial economic programs."
- Denver University Law School – "Production Sharing Contracts" (several times).
- Denver University Law School – "Upstream Economics."
- Colorado School of Mines – "Economic Analysis and Production Sharing Contracts" presented to two groups of visiting Chinese managers and engineers.
- Evanston / Salt Lake City section of SPE – "The Error in Estimating Reserves from Decline Curve Analysis."
- Reservoir Study Group Permian Basin Section, April 1987. "The Impact of the 1986 Tax Law on Project Evaluation."
- Department of Energy, Morgantown – "Risk Analysis."
- Denver Microcomputer Users Group – "Running Big Simulators on Little Computers."
- Ore Deposits and Petroleum: Exploration Potential of the Soviet Union (Conference) – "Russian Drilling and Production Practices." SPEE – "Russian Drilling and Production Practices."

Directional
Drilling

David P. Howell, PE

Education:
Bachelor of Science, Petroleum Engineering
Mississippi State University: January, 1972

Masters Business Administration
University of Colorado; December, 2002

License:
Registered Professional Engineer – State of Colorado
License #32548

Work Experience:
Over 33 years of practical work experience as a petroleum engineer with heavy focus on drilling techniques and applications.
1972 – 1977 Amoco Production Company.

From 1972 – 1974 Worked offshore Louisiana on actively developing drilling platforms.

From 1974 to 1978 – worked in Wattenberg field and assisted with early proration work on J-Sand and Sussex Shannon spacing in Spindle field.

1977-1982 El Paso Natural Gas Company – Drilling Engineer. Worked and lived in Farmington, New Mexico. Field engineer responsibilities included assignments to several drilling rigs and heavy associated drilling activity. Very heavily involved in the infill drilling program in the Mesa Verde and Dakota formations in the San Juan Basin. Hands-on experience with directional work, air, gas, and mud drilling. Lived on location and worked a 25 day on and 5 day off schedule for over 3 years. Later became the Division Drilling Engineer for El Paso and worked on numerous drilling projects all over the San Juan and Paradox Basins.

1982-1992 BASF Corporation – Drilling and Operations Engineer. Continued drilling and production efforts in the San Juan and also Powder River and West Texas Permian Basins.

1992-2005 – HS Resources/Kerr-McGee Rocky Mt. Corp. The last 14 years have been exclusively assigned to Wattenberg field. Managed an early Codell infill testing program in 1995 in which windows were cut in the 4 ½" casing of existing Codell wells and a 3 ¼" hole was directionally drilled across fault boundaries to establish the sealing nature of Codell faults and prove the existence of undrained fault blocks. Also, very active in the purchase of Amoco's properties in Wattenberg in 1997 and the subsequent infill drilling program that was