

Two Medicine Cut Bank Sand Unit (TMCBSU) Phase 1: Data Acquisition

Arkanova Energy Corporation

Operator: Provident Energy Associates of Montana, LLC

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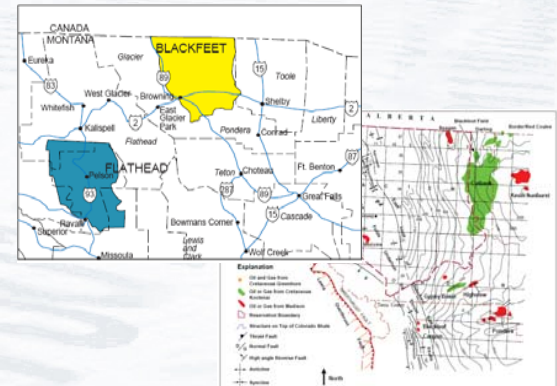
PET Team, DCS NGC

February 2009



Overview

- TMCBSU – Field Overview
 - Geology & Reservoir Characteristics
 - Production History
- Phase 1 – Data Acquisition
 - Objectives & Deliverables
 - Workflow
 - Results
- Phase 2
 - The way forward



Two Medicine Cut Bank Sand Unit (TMCBSU)

Glacier & Pondera County, Montana - Blackfeet Reservation

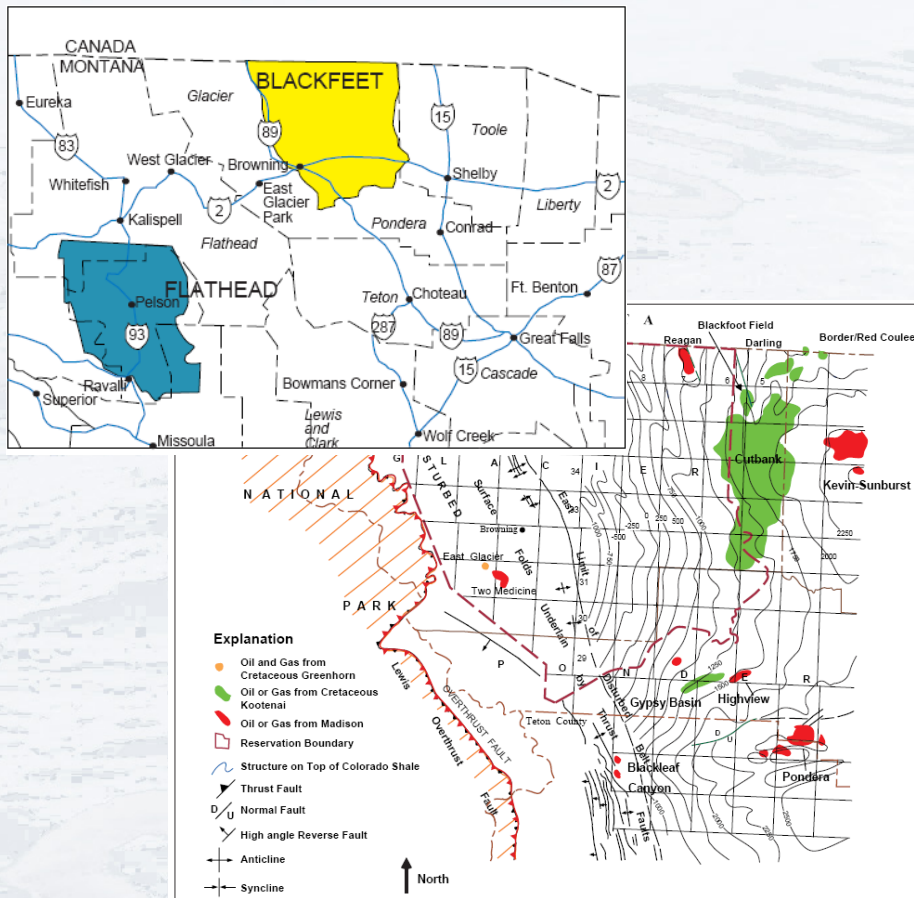


Figure BF-2.1. General structure map of reservation and surrounding region.

GENERAL PRODUCTION INFORMATION

U.S.G.S Geologic Province: North Central Montana

Tectonic Province: Sweetgrass Arch, Foreland Basin, Montana Disturbed Belt

Overall Production: 440 MMBO and 1.1 TCFG
from U.S.G.S. Play Production Province

No. of Fields: 170 discovered fields
58 greater than 1 MMBO or 6 BCFG

Fields Within Reservation Boundaries - (1995 Cummulative Production)

1941 Reagan	9.3 MMBO, 15 MMcf, 54 wells
1955 Two Medicine	9.3 MMBO, 15 MMcf, 54 wells
1926, 1929 Cutbank (est. 20% within boundary)	167.3 MMBO, 317 MMcf 447 wells oil, 235 wells gas

PLAY TYPES ENCOUNTERED

Conventional

- 1) Fractured/Folded Anticline Mississippian Carbonate Play (2807)
- 2) Jurassic-Cretaceous Sandstone Play (2808)
- 3) Mississippian/Devonian Carbonate Play (2805)
- 4) Montana Disturbed Belt-Imbricate Thrust Play (2701)

Unconventional or Hypothetical

- 5) Fractured Bakken (2804)
- 6) Cambrian Sands (2802)
- 7) Shallow Biogenic Gas (2810, 2811, 2812)

Geology & Reservoir Characteristics

*Reference: BLM Report 1996

- Southwest extension of the larger Cut Bank field
- Lower Cretaceous Cut Bank Sandstone
- Monocline situated on the west side of the Sweetgrass Hills Arch (dip west at ~100 ft/mile)
- Primary trapping mechanism: permeability pinchouts and erosional features.

- Two sands identified:
 - Upper Sand (not productive)
Thickness: 0-38 ft
 - Lower Sand (oil bearing)
Thickness: 0-47 ft

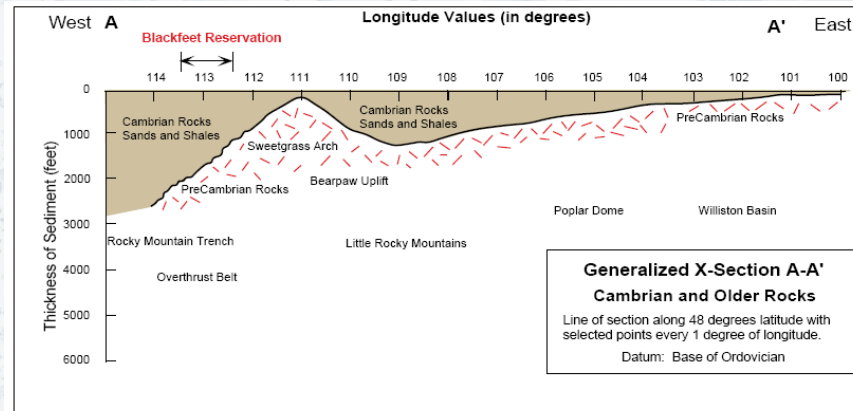


Figure BF-4.1. Generalized time slice cross-section of Cambrian paleo-topography along line of section A-A'.

PRODUCING HORIZON LEGEND							
S = Source Rock							
ERA	SYSTEM	SERIES	COLOR CODE	WILLISTON BASIN	POWDER RIVER BASIN	WESTERN WYOMING SOUTHERN MONTANA	WESTERN & NORTHERN MONTANA
CENOZOIC	TERTIARY			Fort Union	White River Wasatch Fort Union	Green River Wind River Wasatch Fort Union	Fort Union
		UPPER		Fox Hills Judith River Eagle Niobrara Greenhorn	Lance Teckla Mesaverde Teapot Parkman Sussex Shannon Niobrara Frontier	Lance Fox Hills Mesaverde Cody Shannon Niobrara Frontier	Hali Creek Judith River Clagget Eagle Telegraph Creek Niobrara Greenhorn Frontier
MESOZOIC	CRETACEOUS	LOWER		Dakota Group	Mowry Muddy Dakota Fall River Lakota	Mowry Muddy Bear River Dakota Cloverly	Blackleaf Bow Island Kootenai Cat Creek Moulton Sunburst Cut Bank
				Morrison Ellis Group Swift Reardon Piper Nasson	Morrison Sundance Canyon Springs Gypsum Spring	Morrison Sundance Stump-Prauss Twin Creek Nugget	Morrison Ellis Group Swift Reardon Sawtooth
	JURASSIC						

Geology & Reservoir Characteristics

*Reference: BLM Report 1996

- Relatively clean, porous, heterogeneous sand with little to no clay content
- Porosity: 0-18% (avg. 14.5%)
- BHP (1965): 480 psi

- 229 core samples from 13 of 114 wells ('72):

Porosity (Φ):	12.7% (avg)
Permeability (k):	44.6 mD (avg)
Actual perm test results (k):	1mD to 897 mD
Formation Water Saturation (S_w):	30%
Irreducible Water Saturation (S_{wirr}):	25%
Residual Oil Saturation (S_o):	33% of pore vol. (range: 29-38%)
GOR:	< 300 cf/bbl

- Acreage¹

- 1967: 137,494 acre-ft of oil bearing sand
- 1976: 168,092 acre-ft (result of infill drilling)

- OOIP & Reserves Estimates:

OOIP ² :	627 bbls/acre-ft ⇒ 105,390 Mbbls
RF (w/water flood):	26% (164 bbls/acre-ft) ⇒ 27,567 Mbbls
Primary RF:	7.7% (48 bbls/acre-ft) ⇒ 8,068 Mbbls

¹ Ownership: Tribal 61.4%, Allotted 25%, Private 11.7%, Communitized 1.9%
² Assuming: Φ_{avg} 12.7%, S_w 30%, B_o 1.1 res bbl/STB

Production History

*Reference: BLM Report 1996 & Arkanova 2008 Annual Report

Cum Production est.: 10.8 MM bbls of oil (Approx. 10% Recovery)

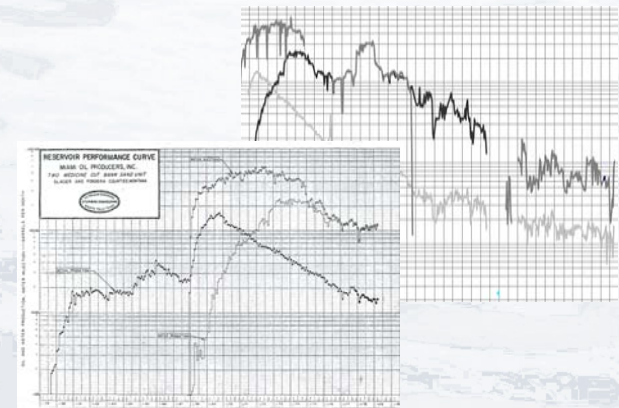
Estimated Remaining OIP: 94.590 MM bbls of oil

BLM estimated that an additional 16 -17 MM bbls of oil could be recovered with an active water flood.

Decline curve analysis of 71 wells) suggested a recovery of 250,000 bbls – 555,000 bbls.

Gustavson Associates (Aug '08):

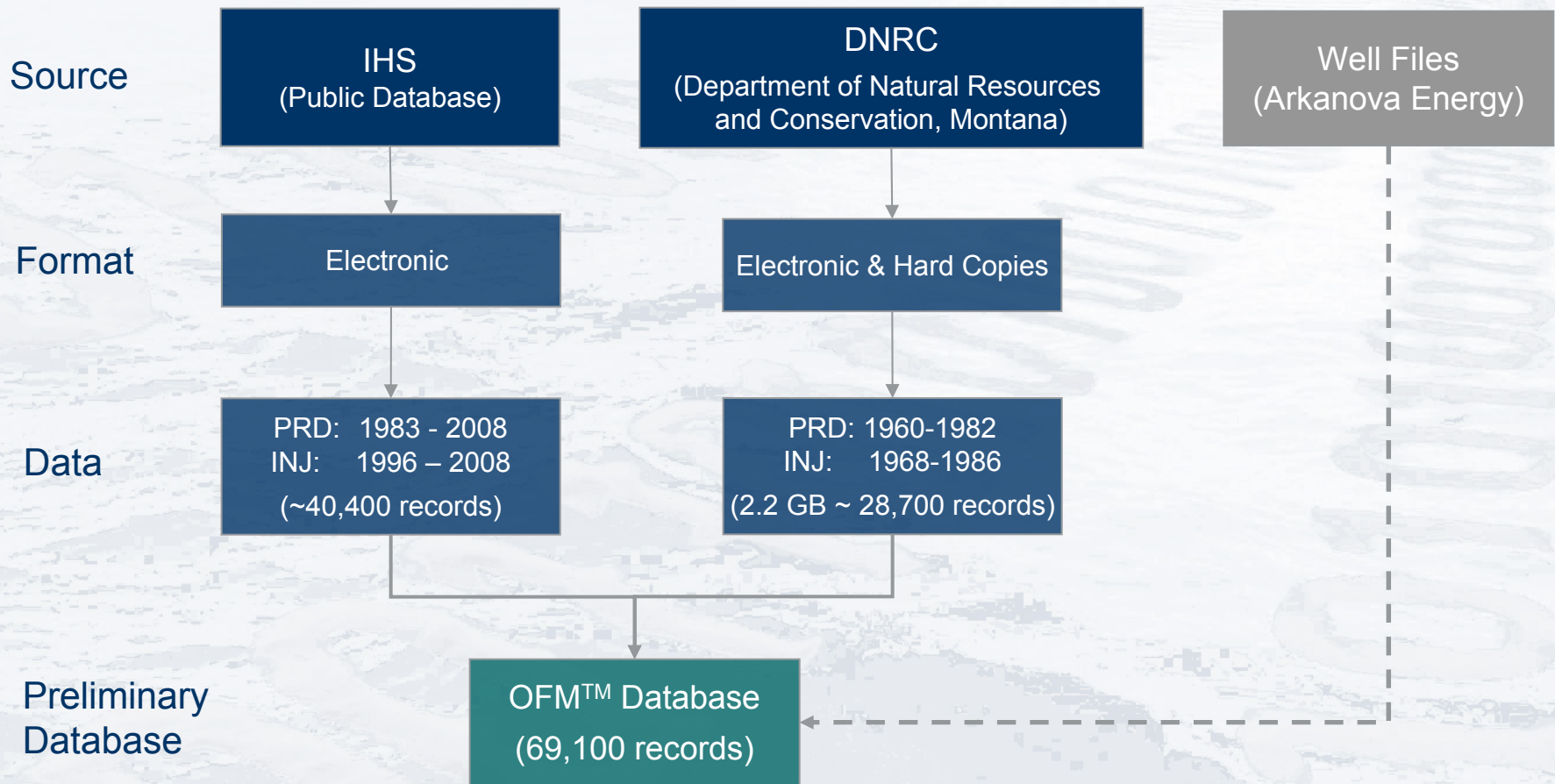
Reserve Category	Est. Net Reserves
	Oil (bbl)
Proved Developed Producing (14 wells)	187,725
Proved Developed Non-Producing (15 wells)	90,979
Proved Undeveloped (1 well)	13,405
Total (30 wells)	292,109



Phase 1: Data Acquisition

- Objective
 - Complete the IHS dataset for the TMCBSU (and immediate offset wells, if available), with monthly per well production and injection data from 1960-1986.
- Deliverables
 - List of TMCBSU Wells, with collected & compiled information
 - Digital copies of collected production and injection data

Phase 1: Workflow



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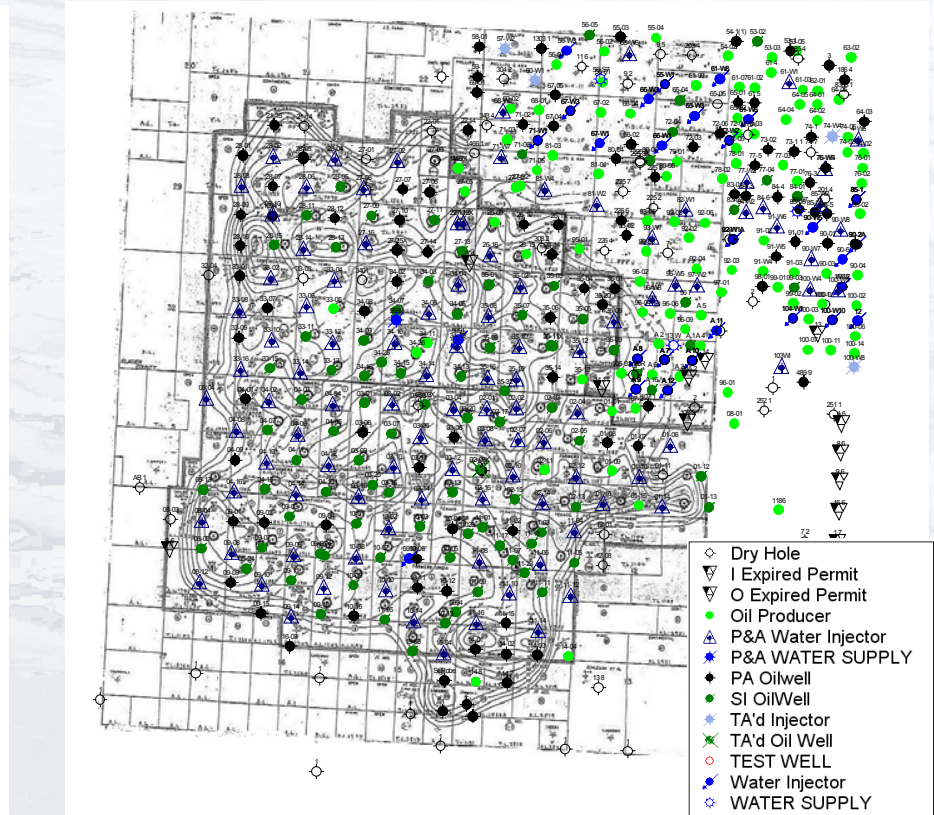
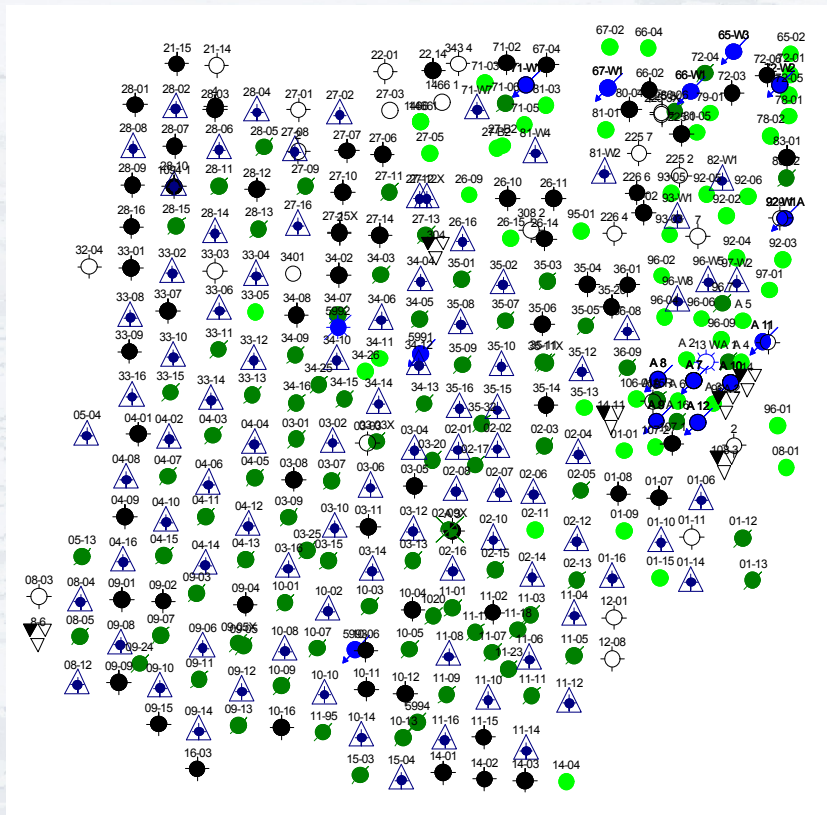


NOTE: No QA/QC performed on dataset
Collection & Data Entry only



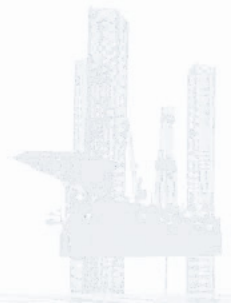
Phase 1 Results: OFM™ BaseMap

Database: 535 completions
 Interest Area: 234 completions

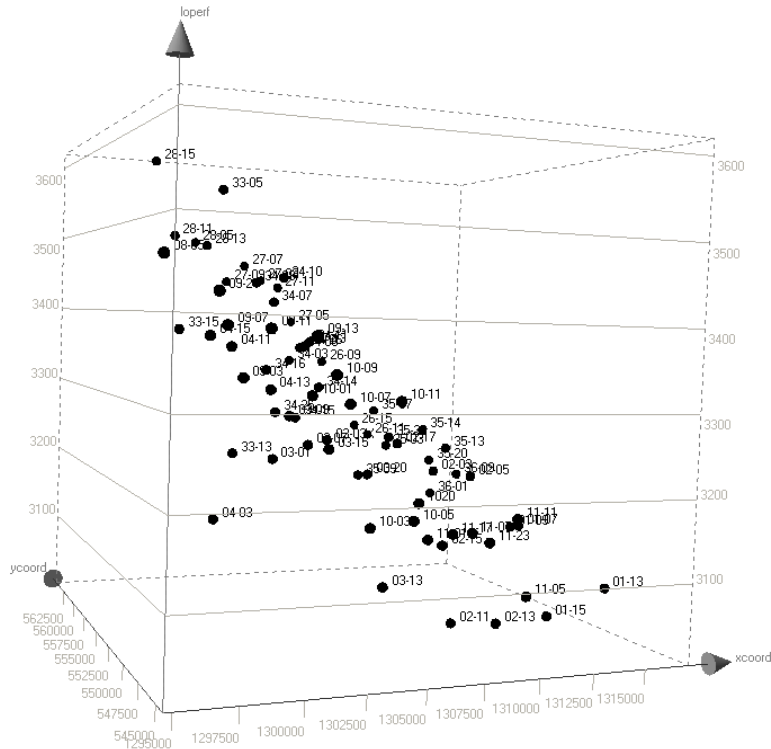


TMCBSU Perforation Distribution

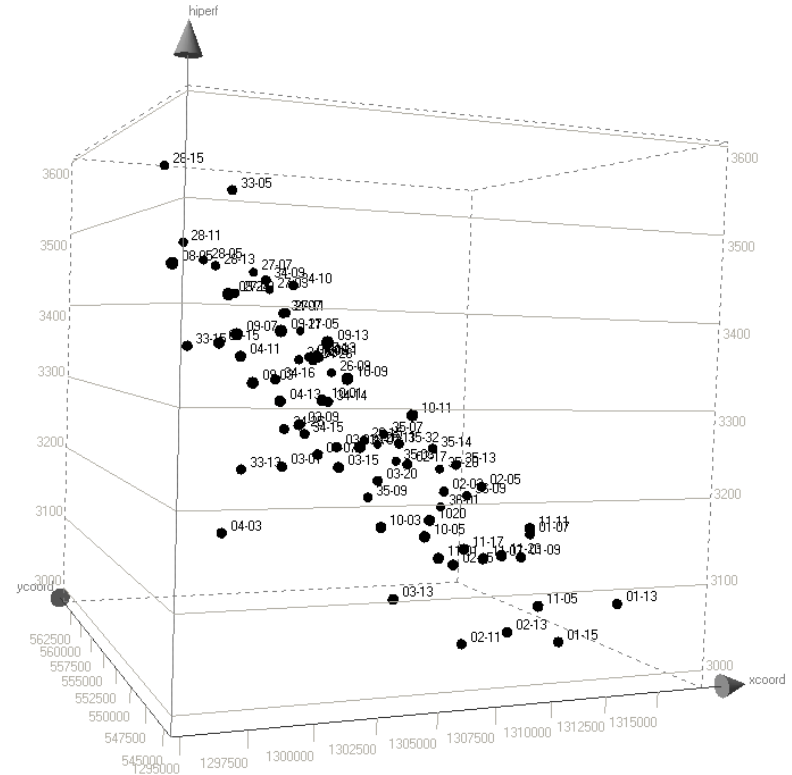
76 wells (3,600 – 3,000 ft)



3D_Loperf



hiperf

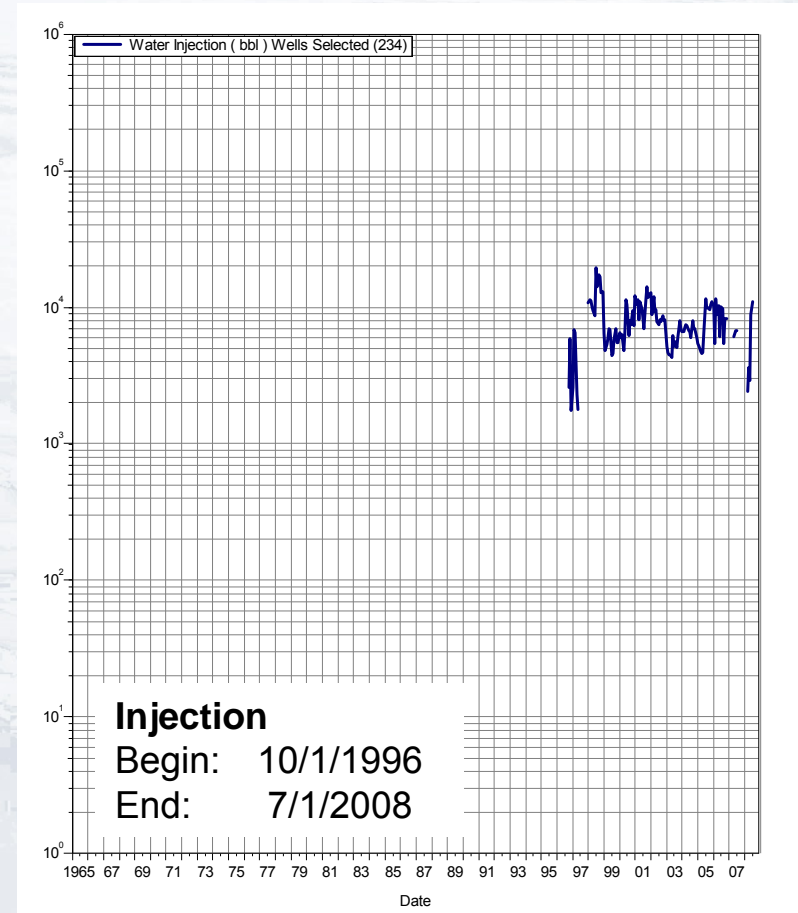
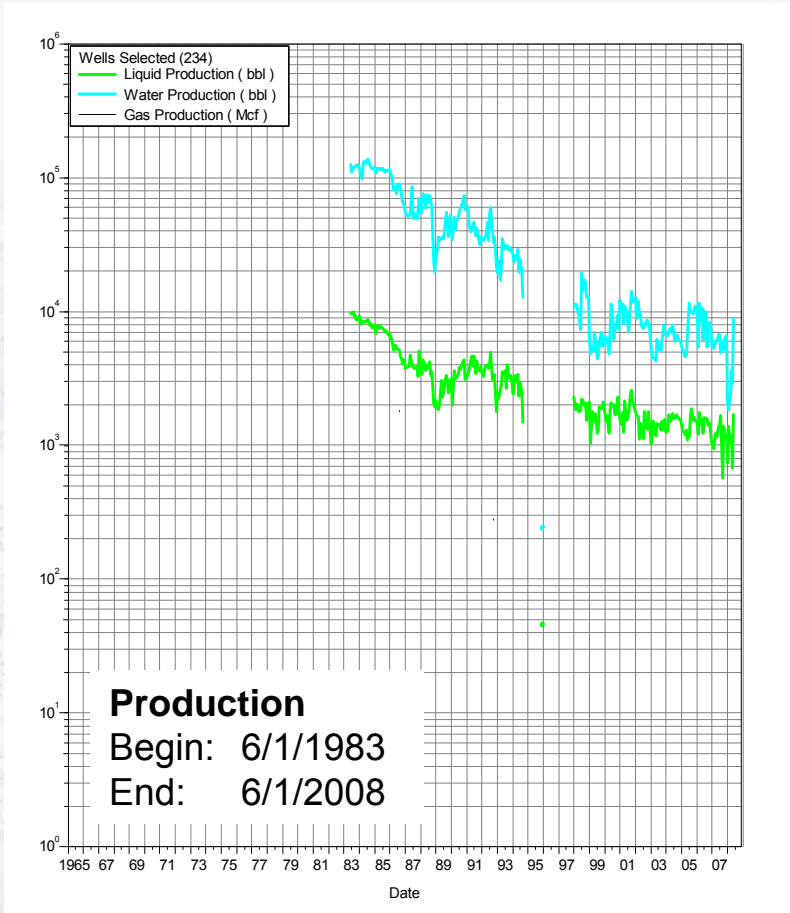
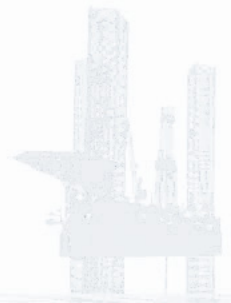


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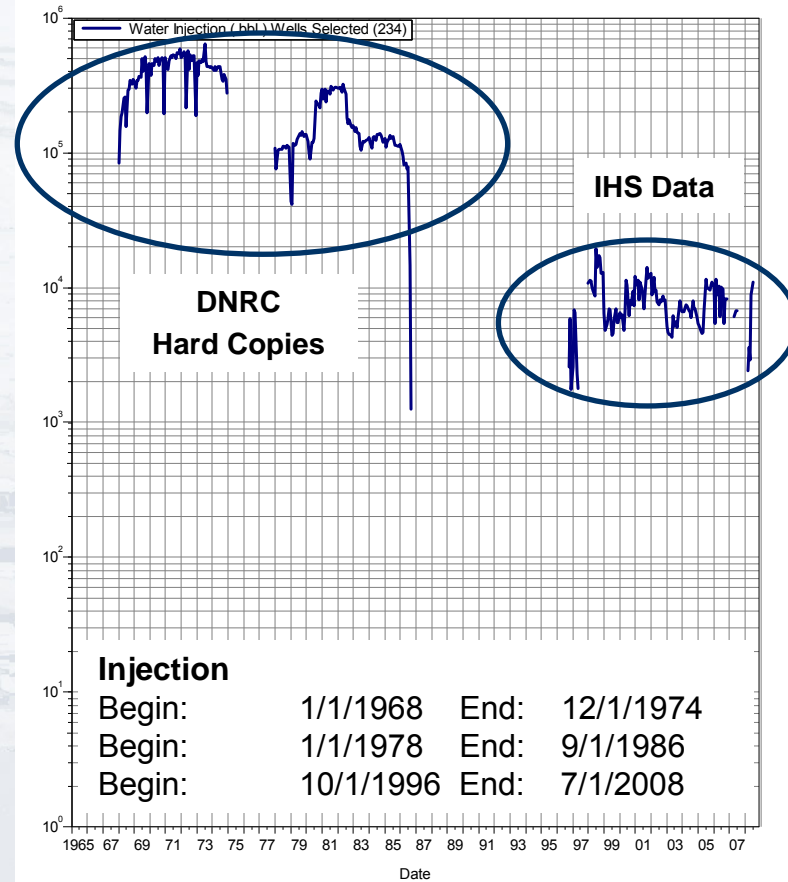
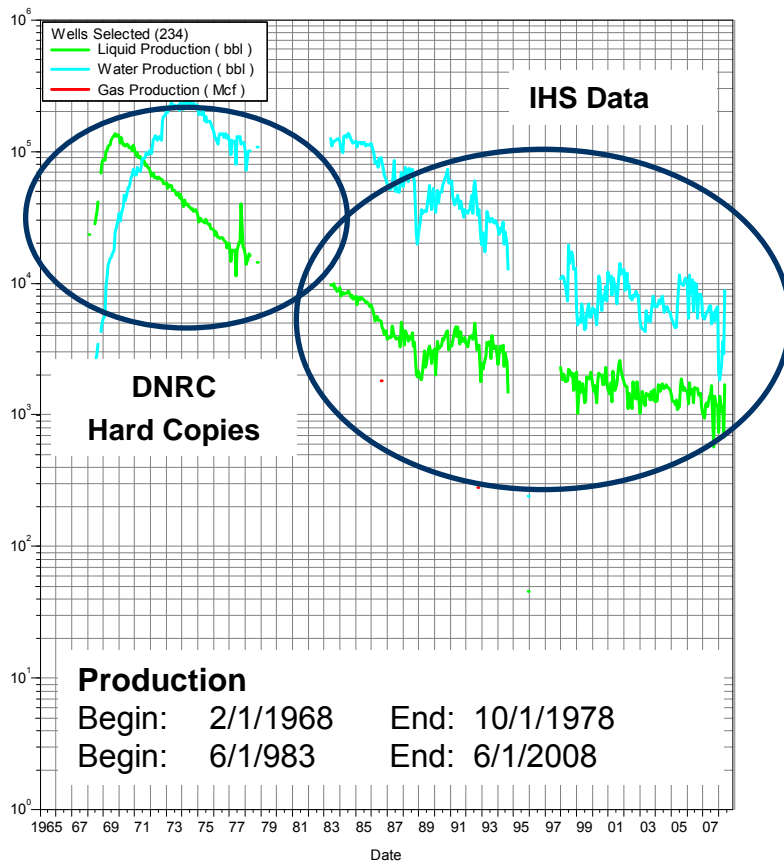


Monthly Production – IHS only

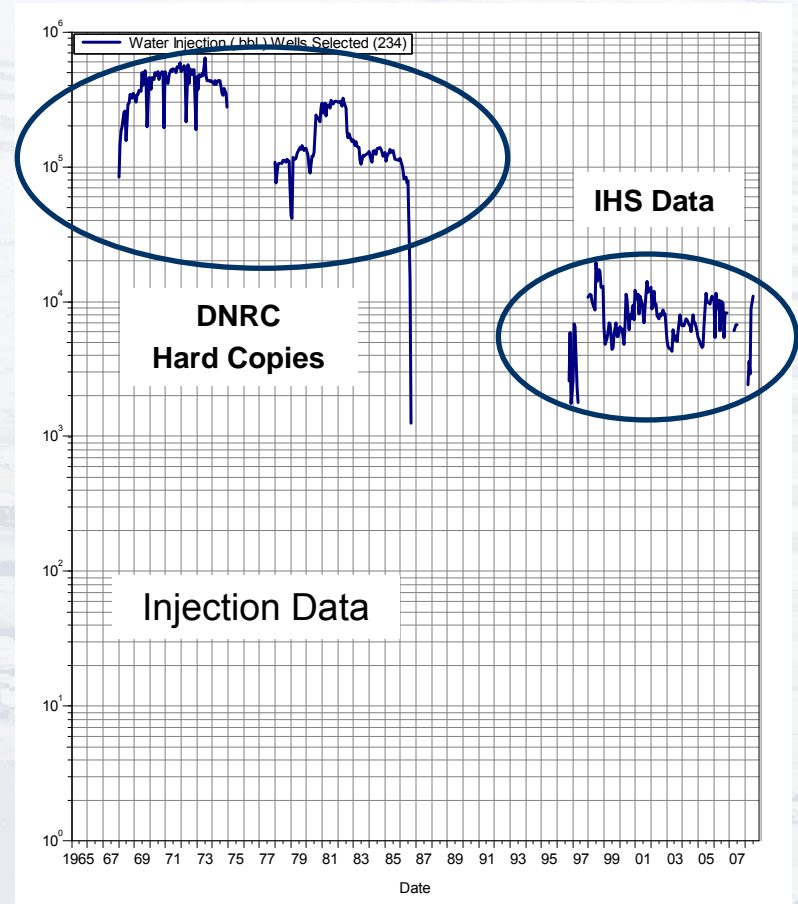
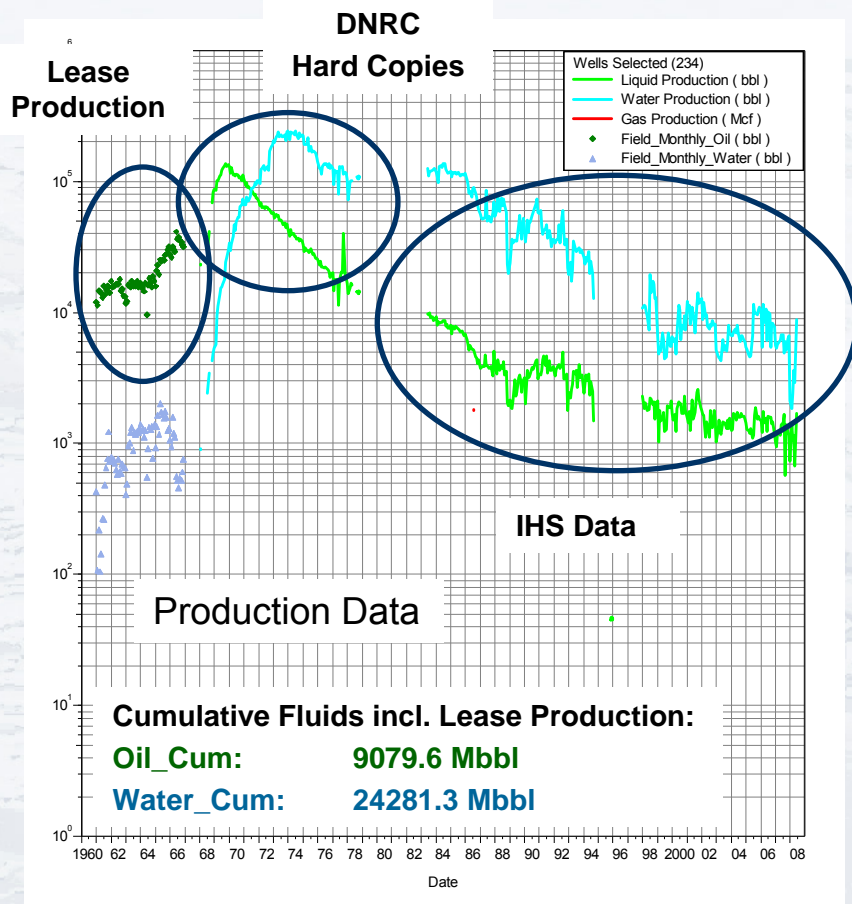
Limited information.



Monthly Production - IHS & DNRC data

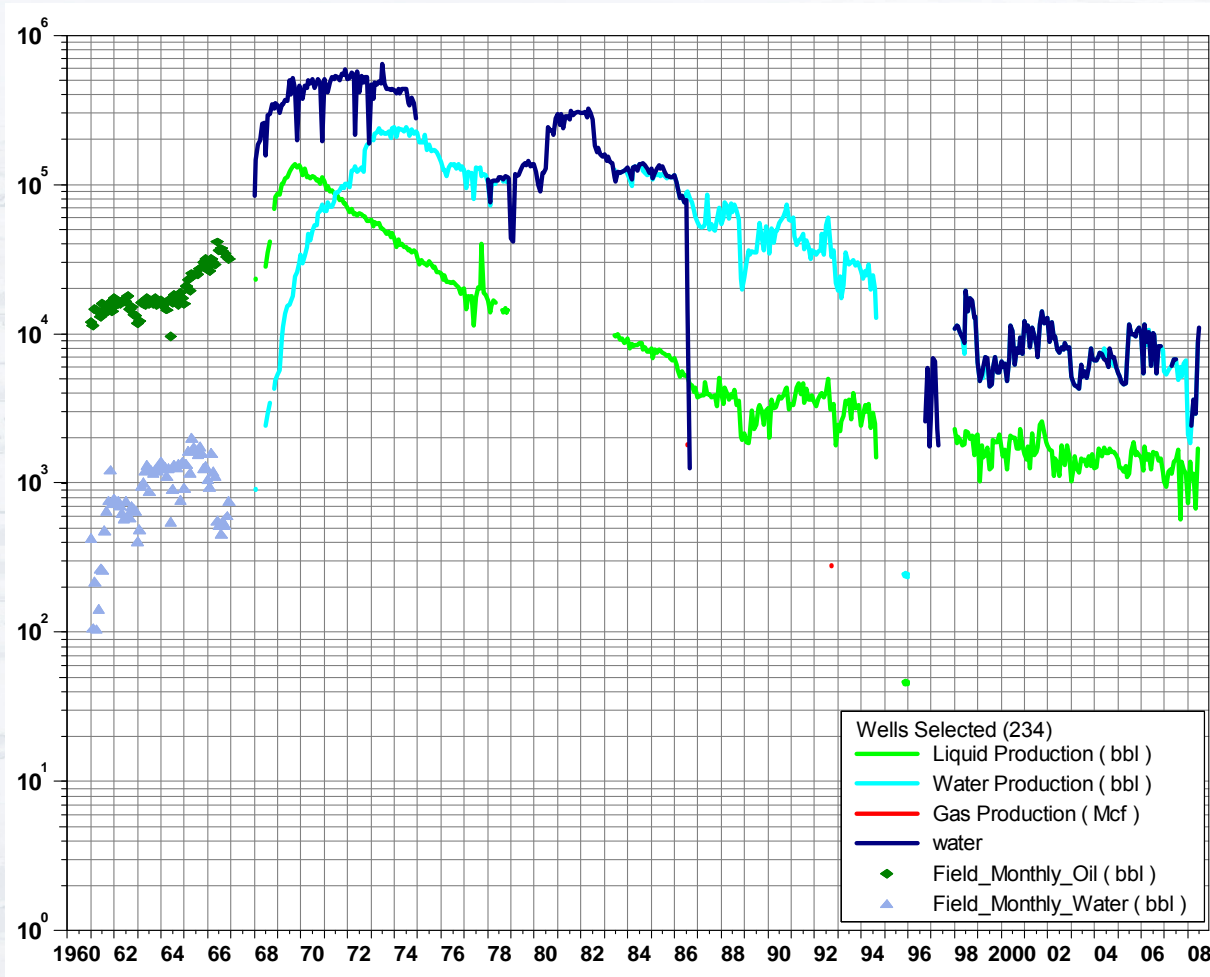


Monthly and Lease Production IHS & DNRC data

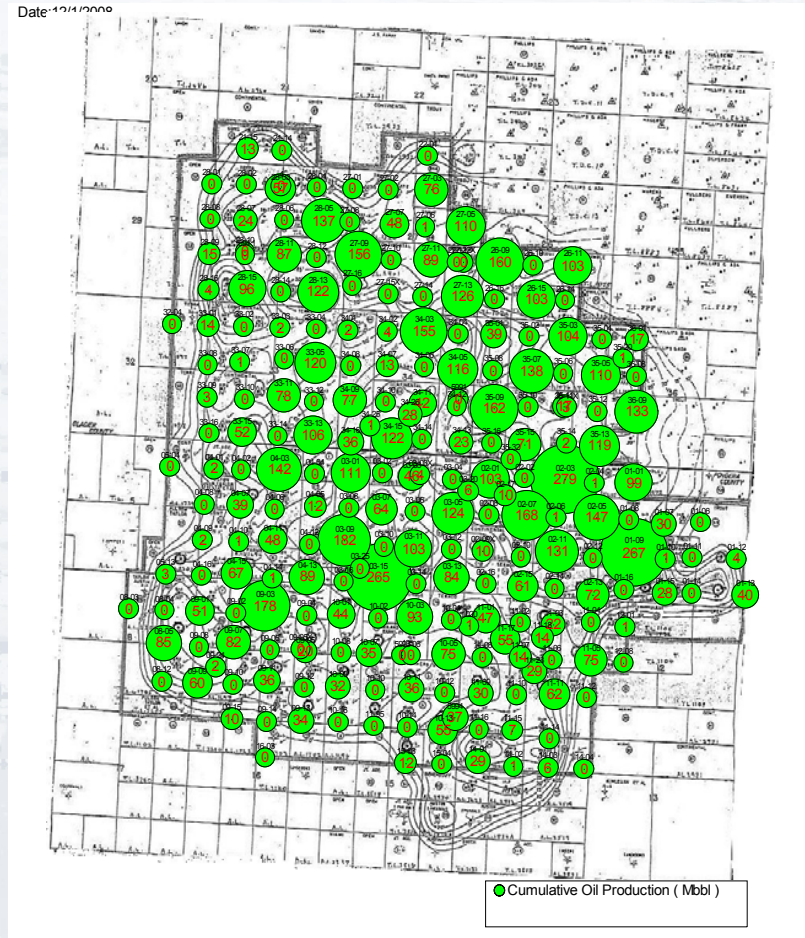
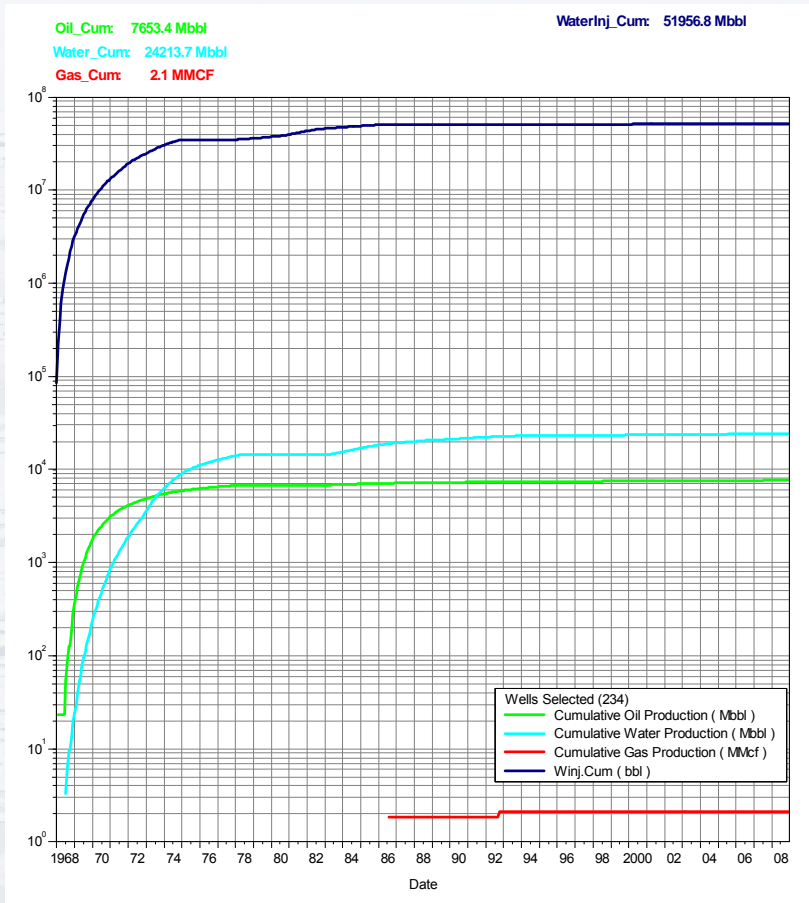


NOTE: Lease Production needs to be validated

Production and Injection Data (IHS & DNRC data)



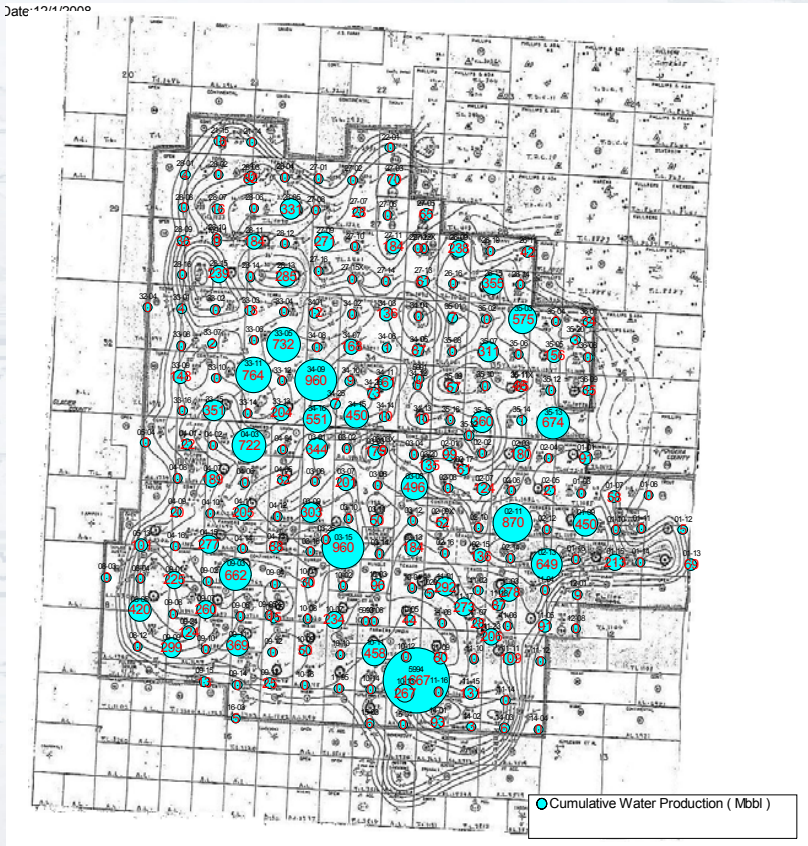
Cumulative Oil Production



Cumulative Water Production & Injection

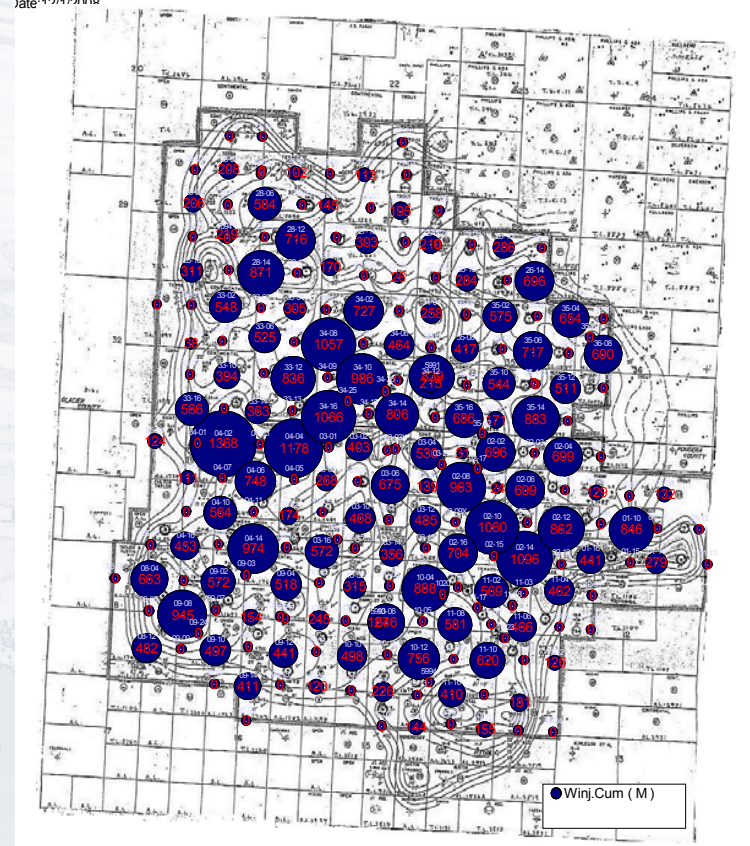
Water Production

Date: 12/1/2009



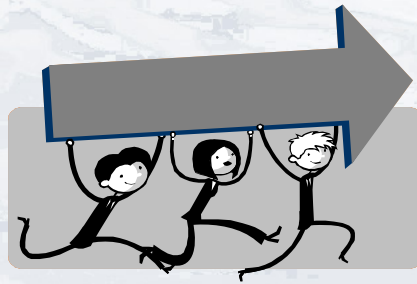
Water Injection

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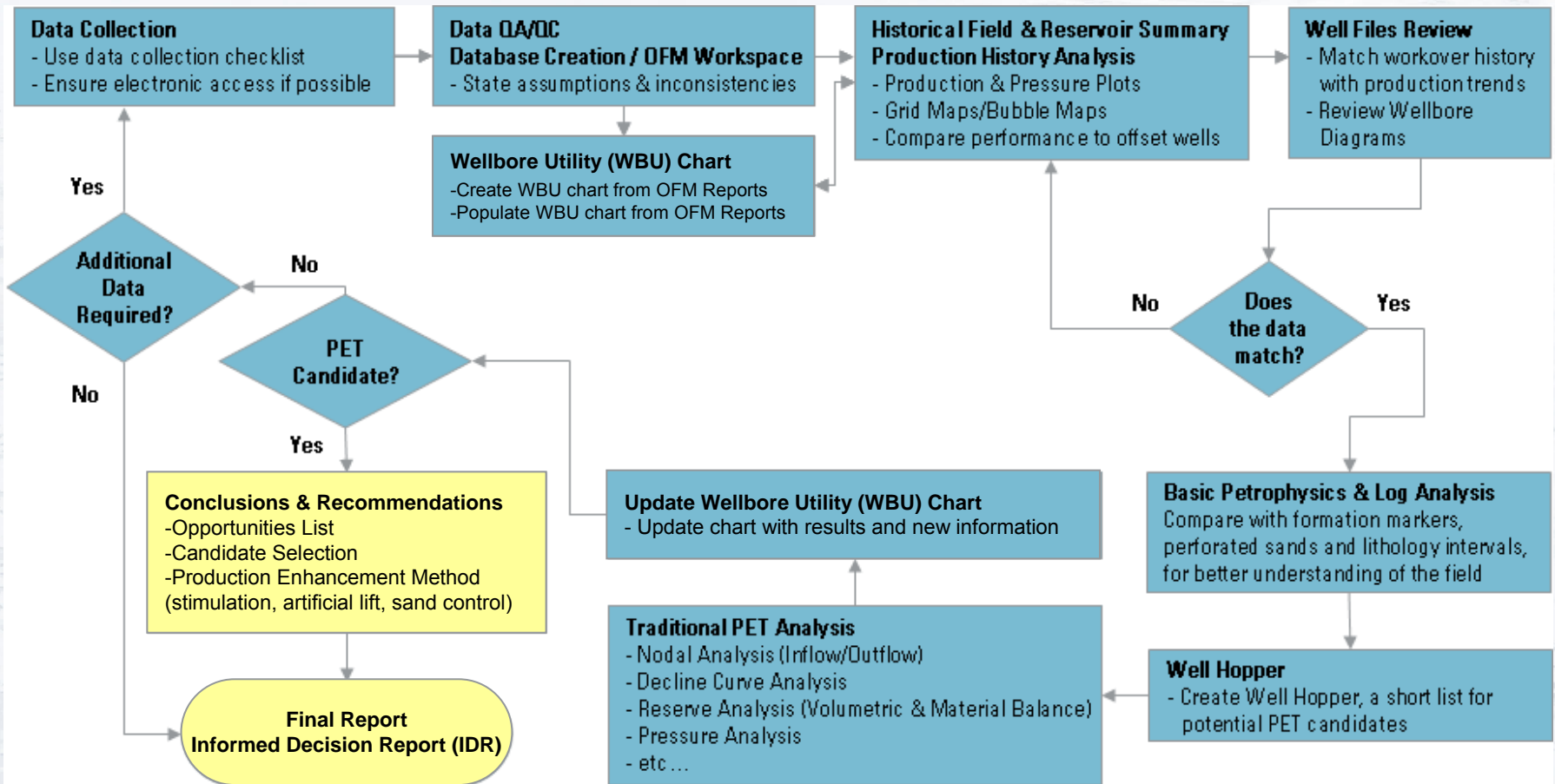
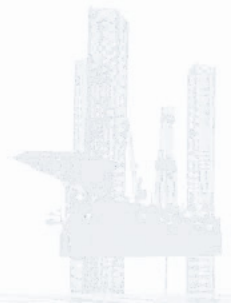


Phase 2

The Way Forward



Typical PET Workflow



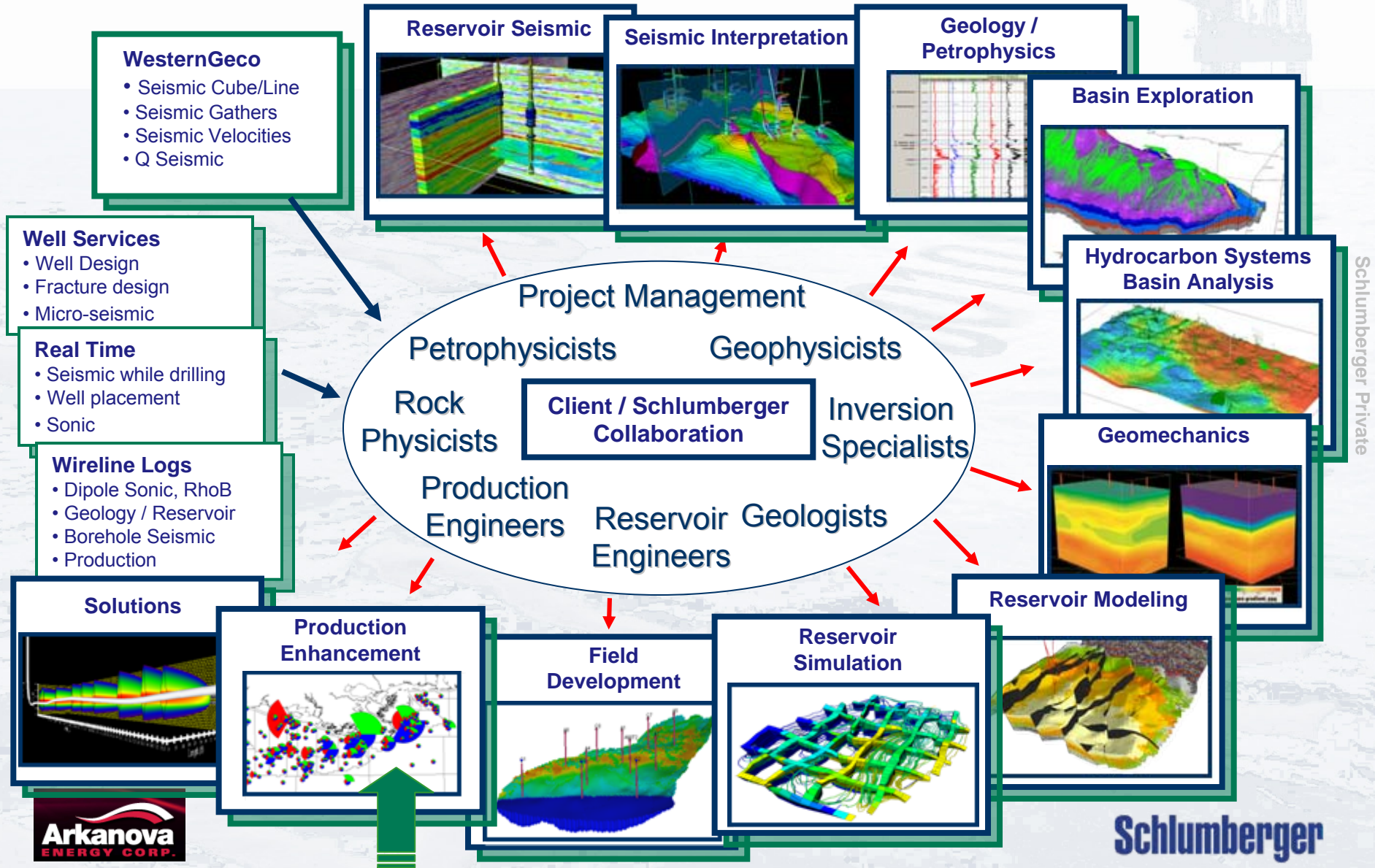
Phase 2

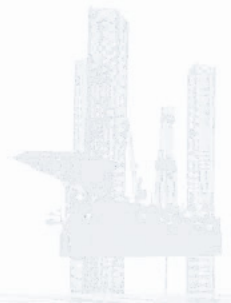
- QA/QC current Dataset
- Validate OFM™/Access Database
- Preliminary (PET) Review of TMCBSU
 - Review field/well potential
 - Identify Opportunities (best production areas/wells)
 - Recommend wells for restoring production / to stimulate etc.
 - Review requirements for reinstating waterflood
 - Recommend action items for longer term reserve recovery



Deliverable: Report & Presentation on Findings and Recommendations

Consulting Services Workflow





Thank you.

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