WATERFLOOD FEASIBILITY STUDY FOR THE PROPOSED QUAIL QUEEN UNIT (QQU)

LEA COUNTY,

NEW MEXICO

CHESAPEAKE ENERGY CORPORATION

AUGUST, 2007

WATERFLOOD FEASIBILITY STUDY FOR THE QUAIL QUEEN UNIT (QQU) PROJECT

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EXECUTIVE SUMMARY

QUAIL QUEEN UNIT (QQU)
PROPOSED WATERFLOOD

I. Purpose

Determine the feasibility of unitizing and implementing secondary recovery operations in the Queen sandstone in the Quail Field in Lea County, New Mexico.

II. Description

Location	Lea Co., NM
Producing Formation	Queen
Number of Wells	12 Active, 3 TA, 5 P&A,1 DH
Daily Production (average over three mos.)	23 BO, 0 MCF, 56 BW
Reservoir Parameters	
Depth, average	5,100'
Productive Area	1,150 acres
Unitized Area	840 acres
Reservoir Temperature	113°F
Initial Reservoir Pressure	1,848 Psi
Bubble Point Pressure	1255 Psi
Current Reservoir Pressure	450 Psi
Oil Gravity	33°API
Gas Gravity	0.9
Initial Solution GOR, est	300 Scf/Bbl

III. Recovery and Reserves

Original Oil In Place	4,467 Mbo
Cumulative Primary Recovery 7/1/2007	788 Mbo
Cumulative Secondary Recovery, estimated to 7/1/2007	11.4 Mbo
Remaining Developed Primary	78.7 Mbo
Proved Behind Pipe	0 Mbo
Ultimate Primary	867 Mbo
Ultimate Primary Recovery Efficiency	19 %
Percent of Primary Recovered to 7/1/2007	91%
Secondary Reserves	725 Mbo
Estimate of Total Recovery	1,592 Mbo
Estimate of Total Recovery Efficiency	36 %

IV. Capital Requirements

Initial Phase (Phase I) Capital Requirement:

Convert six wells to injection ($100k, each)	$ 600,000
Re-Enter and Restore Csg Integrity, Quail State SWD 1	$ 125,000
Injection Lines 10,030 feet x $12/ft	$ 120,360

Water Supply, Hornet St 1 Workover/Pipeline	$ 250,000
Battery Upgrades/Centralization	$ 500,000
Injection Facility	$ 500,000
Sub-Total	**$ 2,095,360**

Second Phase (Phase II) Capital Requirement:

Drill 1 Injector ($1MM) & One Producer($1.2MM)	$ 2,200,000
Re-Enter Mobil 1 as injection well	$ 200,000
Battery Upgrades/Centralization	$ 500,000
Sub Total	**$ 2,900,000**
Grand Total	**$ 4,995,360**

INTRODUCTION

The purpose of this engineering and geological study is to determine the feasibility of conducting secondary recovery waterflood operations in the Queen sand in the Quail Field; and whether these waterflood operations can recover additional reserves in sufficient quantities to be economically successful.

The Quail Field is located approximately 25 miles southwest of Hobbs, New Mexico in Lea County as shown in Attachment No. 1. The field was discovered in 1967 by Atlantic Richfield's State BG Well No. 1. After drilling to a total depth of 10,350' and finding the targeted Bone Springs non-commercial, the well was plugged back to the Queen, at 5,126'-5,336', and a completion was made in May, 1967.

The Queen sands that are continuous throughout the field and the most consistently productive have been sub-divided into two distinct zones, B and C. These two Queen sands will be the focus of this study. The "C" sand has the most prolific pore volume and areal extent of the two intervals. Several wells were cored with a maximum permeability range of 20-40 md and maximum porosity range of 20-23%. Logs from eighteen of the twenty wells were analyzed by NuTech Energy Alliance. PVT data was determined based on petroleum engineering correlations and not actual reservoir samples due to the lack of early time fluid samples and the existing advanced state of reservoir depletion. The reservoir is solution gas drive based on production performance. The estimated original reservoir pressure was 1,848 psi and engineering correlations indicate a bubble point pressure of 1,255 psi. Estimated current reservoir pressure is between 400 and 500 psi based on recent testing in Atlantic Richfield No. 1 during 2006.

The proposed 840 acre unit is made up of 9 tracts in Sections 11, 13 and 14 in Township 19 South and Range 34 East. Participation in the unit by working interest and royalty owners is determined by prorating each tract's contribution to the unit in four categories including: useable wellbores, average rate of production, ultimate primary recovery and reservoir pore volume.

There are twelve current producers, three temporarily abandoned wells and three plugged and abandoned wells in the field. The field has been developed on forty acre spacing. Current

production is 23 Bopd, 0 Mcfpd and 56 Bwpd. Cumulative production from the Queen is 799,248 BO, 524,385 MCF and 1,590,829 BW. Remaining primary PDP reserves are 78.7 MSTBO. Current watercut is 70 percent.

Information upon which this study and the estimates are based was obtained from Chesapeake, third parties and public records and is assumed to be correct. The study was conducted utilizing methods and procedures regularly used by petroleum engineers to estimate oil and gas reserves for properties of this type and character. However, future performance is dependent on many variables and often unpredictable factors. For this reason, Chesapeake cannot be held liable for the accuracy or completeness of these estimates.

FIELD DEVELOPMENT

After the discovery by Atlantic Richfield's State BG No. 1 in 1967, development continued for several years with the drilling of five additional wells but during the early and mid-seventies development drilling stalled. With the rising oil prices in the late seventies there was a resurgence of drilling when the well count peaked at 15 wells by the early eighties. Since then, primary depletion occurred up until 1997 when disposal of the fields produced water began in the Queen sand that was opened in the Quail State SWD No. 1. The total disposal volume for the field increased to approximately 100 bwpd by the year 2000 and continued at this rate through 2003. Oil response was observed in several of the offsets to the SWD during 2000-2003. The disposal was decreased and sporadic from 2004 until 2005 when casing problems occurred and the disposal well was temporarily abandoned. The current field map is included as Attachment No. 2 with well names and locations. Oil production is currently 23 bopd from twelve wells declining at an exponential yearly rate of approximately 5 percent. The field production plot as well as the individual well production plots, are included in Appendix A.

GENERAL GEOLOGY

The Quail Queen Field, covering approximately 800 acres, is situated locally in western central Lea County, New Mexico and regionally near the Northwest Shelf shelf margin of the Delaware Basin. The field consists of several thin north-northwest to south-southeast trending sandstones that pinch out to the east and west. The Queen Formation is Middle Guadalupian (Permian) in age overlain by the Seven Rivers and underlain by the Grayburg, both of which produce on the Northwest Shelf. During Guadalupian time, the Northwest Shelf was dominated by mixed shallow-water carbonate and siliciclastic sedimentation on a broad low-relief ramp.

DETAILED GEOLOGY

The Queen Formation was deposited on the Northwest Shelf in a backreef, shallow, evaporitic, marginal marine environment behind the Goat Seep shelf-edge complex. In general these deposits are composed of interfingering siliciclastics, carbonates, and evaporates (sandstone, dolomite, sandy and anhydritic dolomite, and shale). The Queen pay is described as a medium to fine-grained, subangular to subrounded friable sandstone with slight dolomite cement, silt, and occasional large round frosted quartz grains. Queen pay can get up to 10 feet thick with porosities ranging from 8-22%.

PRIMARY PERFORMANCE AND RESERVES

The current state of primary depletion is approximately 91 percent in this field and the average well produces a little less than 2 BOPD. The remaining primary reserves of approximately 79 MBO will predominantly come from three wells, the Quail State 2, State BG 2 and 3. The remaining nine active producers are at or near their ultimate primary performance capacity. Unless it is determined to waterflood this field soon, then the economic viability of this field will end. Attachment No. 3 is a structure map with the ultimate oil and gas recoveries along with the cumulative water production posted for each well. Ultimate recoveries were determined by decline curve analysis on each producing well. Production is more controlled by stratigraphy than structure as illustrated by the structure map. The structure dips from north to south at a rate of approximately 100 feet per mile. The best ultimate well in the field, the Atlantic Richfield No. 1 is one of the lowest structurally but is near the thickest part of the Queen sand. The average ultimate oil produced per well is approximately 44 MBO.

As mentioned earlier, the Queen sand has been subdivided into the Queen B and Queen C sands which are consistently present throughout the proposed unit area. Attachment 4 is a cross section with every well log in the field showing the Queen B & C which is the targeted common source of supply. This cross section also contains the perforated intervals for each well. Net isopach maps with over 14 percent density porosity over the Queen B and Queen C are included as Attachments 5 and 6. These maps were used to calculate the reservoir pore volume. Also shown is the proposed waterflood unit boundary. Average porosity and water saturations for the Queen B and Queen C were determined based on the Nu-Tech log analysis. Cross plots of porosity versus water saturation are included as Attachment Nos. 7 and 8. Volumetric original oil in place (OOIP) for the Queen B and Queen C sands has been calculated and is included in Appendix B. The OOIP for the Queen B is 988,800 STB and for the Queen C is 3,478,673 STB. The combined OOIP is 4,467,473 STB. Seventy-eight percent of the OOIP is in the Queen C sand.

Based on an investigation of all the pertinent data including well files, well logs and well histories, all of the current wells in the field have been perforated and adequately stimulated in the Queen B and Queen C sand intervals. Hence there are no remaining behind pipe or non-producing reserves in this field in the targeted waterflood sand intervals. The remaining secondary reserve potential and how best to recover it will be the focus as the study continues.

SECONDARY RESERVE ANALYSIS

Based on the historical performance, the Quail Queen Field is a solution gas drive reservoir. Primary recovery will be approximately 19 percent of the OOIP leaving 81 percent of the OOIP in play. The approach to water flood recovery potential in the Quail Queen Field includes the analysis of an actual case example, within the field, of sustained low volume disposal of produced water into the producing Queen zones of interest in the Quail State SWD #1. Also a nearby Queen waterflood analogy, the West Pearl Queen Unit, that was unitized and flooded beginning in 1964 will be evaluated. And lastly, a calculation of secondary performance utilizing generic relative permeability data, since this type core data is not available from any of the field wells, will be examined.

The Queen has been successfully flooded for years in the Permian Basin and, as mentioned, there is

a nearby analogy in the West Pearl Queen Unit approximately 2.5 to 3 miles to the southeast. In addition, the floodability of the Queen in the Quail field was demonstrated during the late nineties and early 2000's, when the Quail State No. 1 was converted to salt water disposal in the field's producing interval. Approximately 207,000 barrels of produced water, according to IHS records, was disposed of from 1997 to 2004 and oil increases as well as drastic GOR decreases were observed in several of the offset producing wells. Attachment No. 9 is a montage of the production plots for the four producers in the proposed eighty acre five spot pattern in this area. The field production curve as well as the individual plots on the State BG 3, Quail State 2, 3Y, 4 and 6 in Appendix B show clear evidence of moderate secondary response during the time of disposal into Quail State SWD #1. Approximately 22 percent, of the reservoir pore volume for this eighty acre five-spot pattern was injected into the center SWD well over a seven year period. During this time it is estimated that approximately 11,400 barrels of secondary oil was produced from five offset wells. The resulting positive response in five of the six direct producing offsets is an encouraging result that provides strong support to the waterflood program planned for this area. A waterflood analysis of the eighty acre five-spot pattern centered around the Quail State SWD #1 is included as Attachment No. 10. The disposal of produced water in the Quail State SWD #1 and subsequent results provide, in effect, a successful eighty acre five spot waterflood pilot for the field. Hence, there is a strong case for the secondary waterflood reserves developed for the proposed Quail Queen Unit (QQU) as being proven undeveloped when the unit order is received from the NMOCD.

The West Pearl Queen Unit (WPQU) was unitized in the summer of 1964. The proposed unitized interval in Quail Queen is correlative to the unitized interval in the WPQU and the reservoir parameters are similar. However, the upper part of the Queen is productive in West Pearl whereas it is wet or tight in the Quail area. The WPQU is located approximately 3 miles to the southeast of the Quail Field as shown in Attachment No. 11. It is approximately three times the size, at 2,520 acres, of the proposed Quail Queen Unit. The ultimate primary recovery in the WPQU was 2,686,000 STB which was 80 percent depleted upon unitization. In the 49 years since discovery, the WPQU has produced over 5 million barrels of oil. The secondary to primary (S:P) ratio is 0.88. The WPQU was developed on 40 acre spacing and the waterflood pattern for the WPQU was eighty acre five-spots which is also the proposed pattern for the QQU. If the QQU has a similar S:P ratio as the WPQU then the secondary reserves will be 763 MBO. Attachment No. 12 is a comparison of the proposed QQU to the analogous WPQU.

The last method used to estimate secondary recovery in the QQU is to calculate the recovery based on relative permeability data compiled by the 1984 National Petroleum Council. There is not any relative permeability data obtained from any of the core retrieved in the Quail Field area. Therefore it is necessary to use the default relative permeability relationships and parameters similar to those presented by Molina on page 2-23 to 2-24 of Smith & Cobb's "Waterflooding" text. These default relationships and parameters are based on the 1984 National Petroleum Council's Technical Committee recommendations. The waterflood calculations are presented in detail in Appendix No. C. The relative permeability curve, Attachment No. 13, was used to create the fractional flow curve which is shown in Attachment No. 14.

The volumetric sweep efficiency is a function of the mobility ratio and the permeability variation. The mobility ratio is 0.57 which is very favorable. The permeability variation, based on several of the cores taken in the Quail Field, is 0.828 and its calculation is shown in Attachment No. 15. The mobility ratio and permeability variation indicates a secondary recovery of 15.6 percent. The waterflood recovery is estimated to be 697,156 STB yielding a S:P ratio of 0.805 which is in reasonable agreement to the analogous WPQU S:P ratio of 0.88.

The injection rate per well, based on analogy, will be 200 – 300 BPD with initial injection pressures in the 1,500 to 2,000 psi range. As fillup is approached the injection pressures will increase so the injection system should be designed for 3,000 psi. Fillup volume is 1,423,862 BBLS with a current gas saturation of 14%. If an average injection rate of 200 BPD per injection well can be maintained then fillup will occur in less than three years.

UNIT PARTICIPATION

Attachment No. 16 is a tract map with the proposed 840 acre unit area shown. Noticeably missing from the proposed unit area is the 120 acre tract in the southeast quarter of Section 14. This 120 acre tract is a Federal tract that is unleased and cannot be nominated due to an ongoing sand dune lizard study scheduled for completion by 2009. Once this study is completed and if the results allow for the leasing of this tract, Chesapeake will make every effort to include this tract in the unit. Section 4 in the Unit Agreement stipulates the method for expansion of the unit and any future expansion of this unit will follow these guidelines.

There are nine tracts included in the unit with 100 percent of the minerals owned by the state of New Mexico. Participation in the unit by working interest and royalty owners is determined by prorating each tract's contribution to the unit in four categories including: useable wellbores, average rate of production, ultimate primary recovery and reservoir pore volume. The proposed weight factor for each category is as follows:

Useable Wellbores	40%
Average Monthly Rate (April - June, 2007)	40%
Ultimate Primary Recovery as of July 1, 2007	10%
Reservoir Pore Volume	10%

The tract participation factors (TPF) for each of the nine tracts are shown in Attachment No. 17. A list of the working interest owners with their proposed unit participation, based on these tract participation factors, is shown in Attachment No. 18.

WATER SUPPLY

The maximum daily volume of injection water required is approximately 300 BPD for each of the six injection wells or 1,800 BPD. Two different sources of water have been determined. The first and most economical will come from the Chesapeake 100 % operated Hornet State No. 1 located approximately one mile to the northwest in section 3 of T-19S R-34E. This well, drilled in 2003 to a depth of 13,796 feet, is awaiting a recompletion to the 3rd Bone Spring(BS), 10,559-69 feet. It is currently shut-in after making an original completion in the Wolfcamp in early 2004. The 3rd BS is a 44 feet thick dolomitic zone with about ten feet on top of water. The water will be tested for compatibility with the Queen and an idea of what the water producing capacity of this dolomite is, will be determined. If compatible, the rest of the zone will be perforated upon such time as the water is needed for injection in the QQU. Hopefully, this zone will provide the needed water for the unit. However, if it proves to lack the ability to produce the volumes required, then the second source of supply will be pursued. The West/East and South Pearl Queen Units, 2 to 3 miles to the southeast are all operated by Xeric Oil and Gas Corporation. Chesapeake has contacted Xeric and

they are agreeable to provide additional water as needed up to the 2,100 BPD needed. This option will cost more than the Hornet State option due to having to install a longer distance pipeline and involves a major road crossing.

CAPITAL REQUIREMENTS

The capital expenditures listed below are estimates by the Enhanced Oil Recovery Group based on industry experience and knowledge of the current market. The actual costs may be different depending on the market conditions at the time of expenditure. The operations group is currently reviewing these costs for accuracy. The capital costs are based on a two phase implementation process over 1.5 to 2 years. Due to the current state of useable wellbores in the proposed unit area no additional drill wells are proposed to be drilled in Phase one. Six producers will be converted to injection in Phase I. Attachments 19 and 20 are maps that show the proposed development plans, Phase I & II, respectively. Restoring the casing integrity of the Quail State SWD 1 in Phase I and the cost to install injection facilities and production facility upgrades are included for both phases. A two mile pipeline from the Hornet State No. 1 facility to the centralized QQU battery is included for delivery of 1,800 to 2,500 BWPD source water. Other costs in Phase II include drill cost for two wells and re-entry of the Mobil #1 as an injector

Initial Phase (Phase I) Capital Requirement:

Convert six wells to injection ($100k, each)	$ 600,000
Re-Enter and Restore Csg Integrity, Quail State SWD 1	$ 125,000
Injection Lines 10,030 feet x $12/ft	$ 120,360
Water Supply, Hornet St 1 Workover/Pipeline	$ 250,000
Battery Upgrades/Centralization	$ 500,000
Injection Facility	$ 500,000
Sub-Total	**$ 2,095,360**

Second Phase (Phase II) Capital Requirement:

Drill 1 Injector ($1MM) & One Producer($1.2MM)	$ 2,200,000
Re-Enter Mobil 1 as injection well	$ 200,000
Battery Upgrades/Centralization	$ 500,000
Sub Total	**$ 2,900,000**
Grand Total	**$ 4,995,360**

ECONOMIC ANALYSIS

The project evaluation has been based on future net cash flow, defined as that amount of future net income estimated to accrue to the 100% working interest and 79% net revenue interest by operating the project to the estimated limit of profitability.

The product prices, operating costs and capital requirements were estimated by Chesapeake Energy

Corporation. An initial oil price of $70 per barrel was held constant throughout the life of the project. Initial operating expenses started at current levels and were escalated in proportion to the escalating fluid volumes. Severance taxes appropriate for the state of New Mexico were applied to the oil and gas revenue. No provision was made for depreciation, depletion or State and Federal income taxes. No consideration was given to possible surplus and/or salvage values or to the cost of properly plugging and abandoning the wells at the conclusion of secondary operations. Attachment No. 21 includes a total unit plot including the estimated secondary performance. Attachment No. 22 are the total project economics including both phase I and phase II to the 100 percent unit working interest.

Economic data and parameters associated with the secondary operations are:

Revenue and Expense Forecast

Gross revenue less severance/ad valorem tax	$36,321,230
Operating expense	$ 4,255,307
Net operating income	$32,065,923

Present Worth

Discounted at 10%	$9,094,7480
Discounted at 25%	$2,878,1220

Rate of Return ---------- 78.09%

Discounted Return on Investment ---------- 3.28

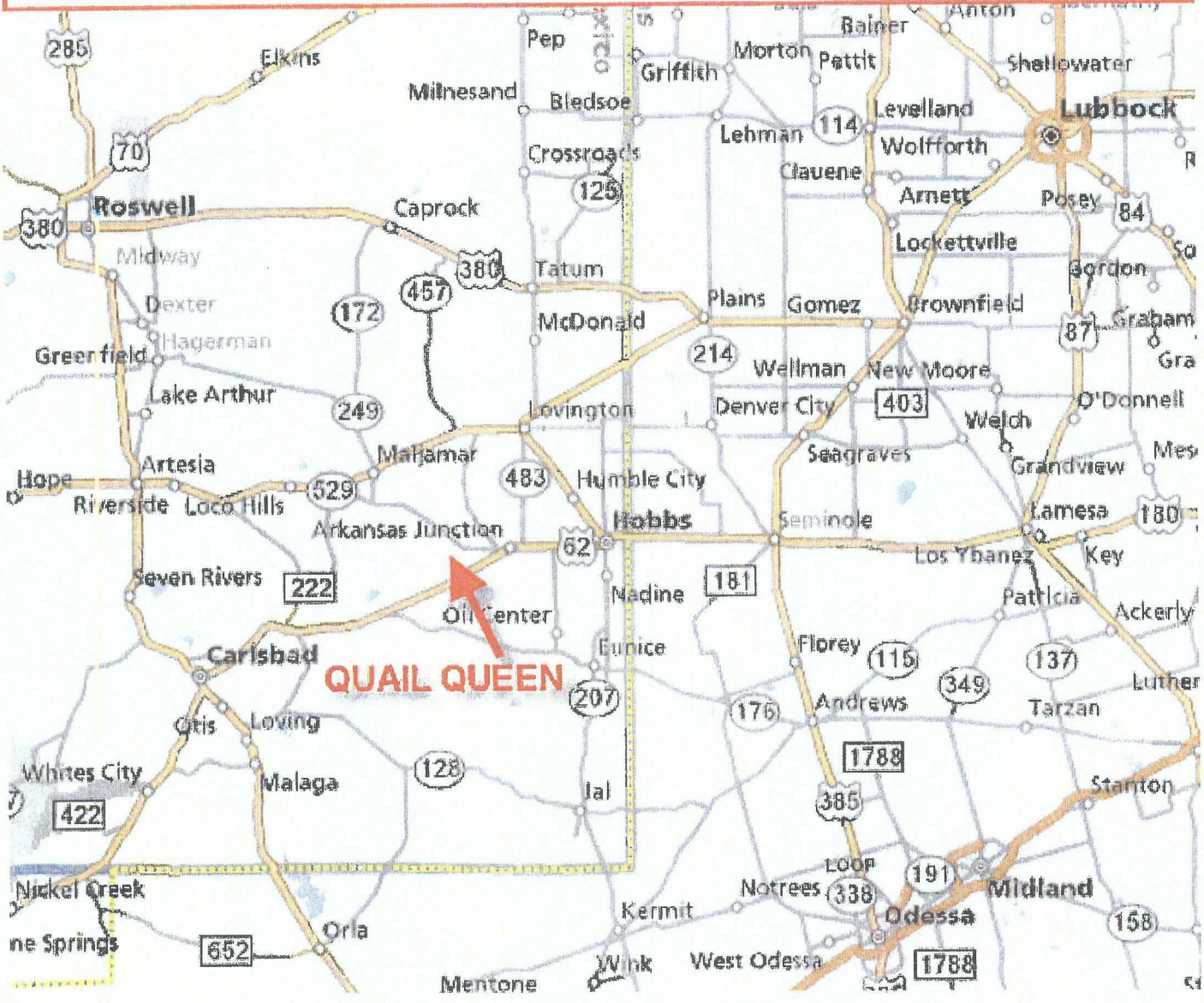
CONCLUSIONS

1. The field is a strong flood candidate
2. Waste will occur and up to 763 MBO in secondary reserves will be lost, if not flooded.
3. The fields primary reserves are 91 percent depleted.
4. There has been a case example in the field of response to water injection.
5. There is strong economic incentive to flood the field now.

RECOMMENDATIONS

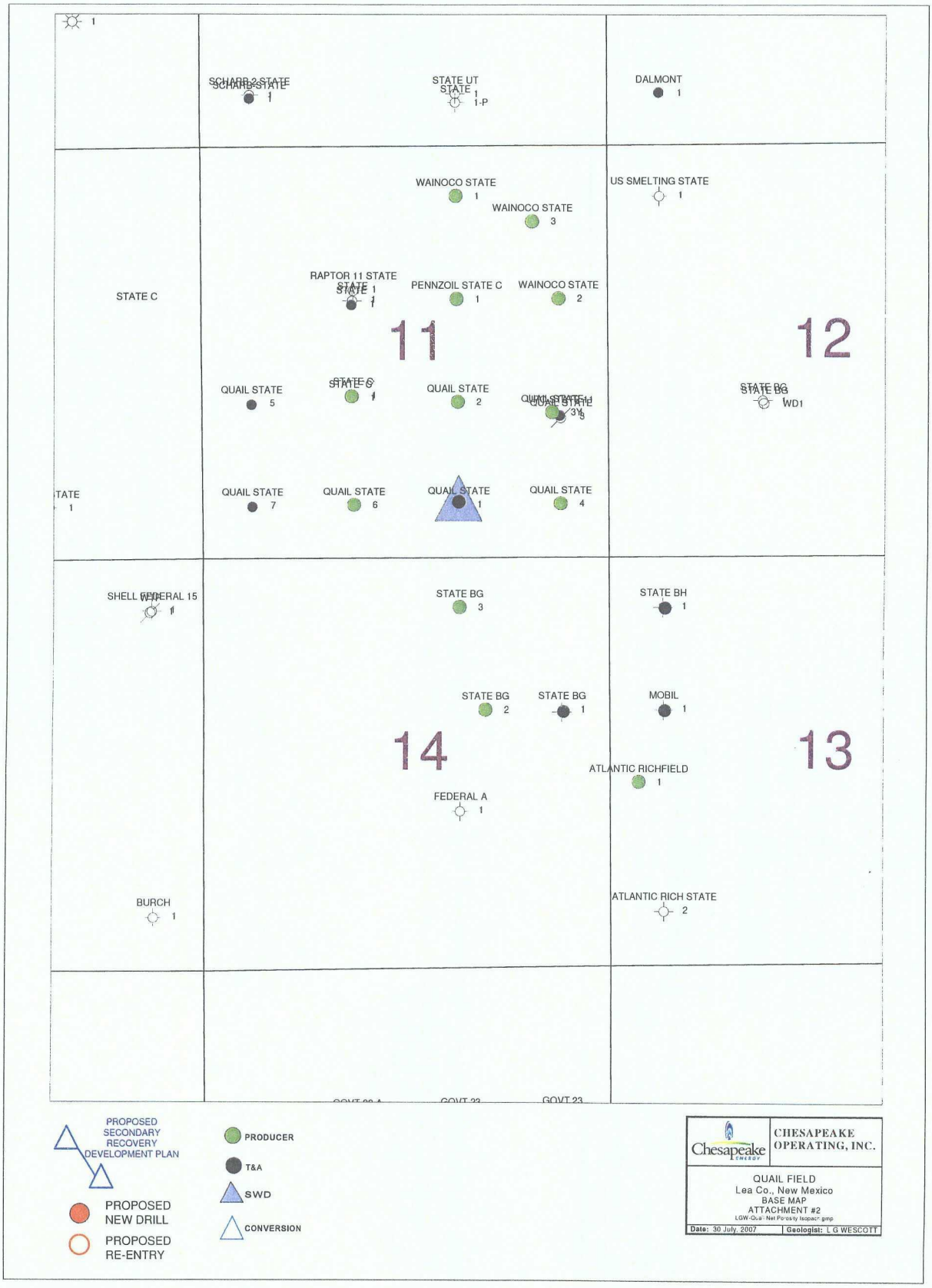
1. Form a unit as soon as possible.
2. Implement Phase I of the flood plan.
3. Observe and analyze the initial flood behavior
4. Perform additional drilling and conversions as needed.

QUAIL QUEEN LOCATOR MAP



ATTACHMENT #1

Attachment No. 1



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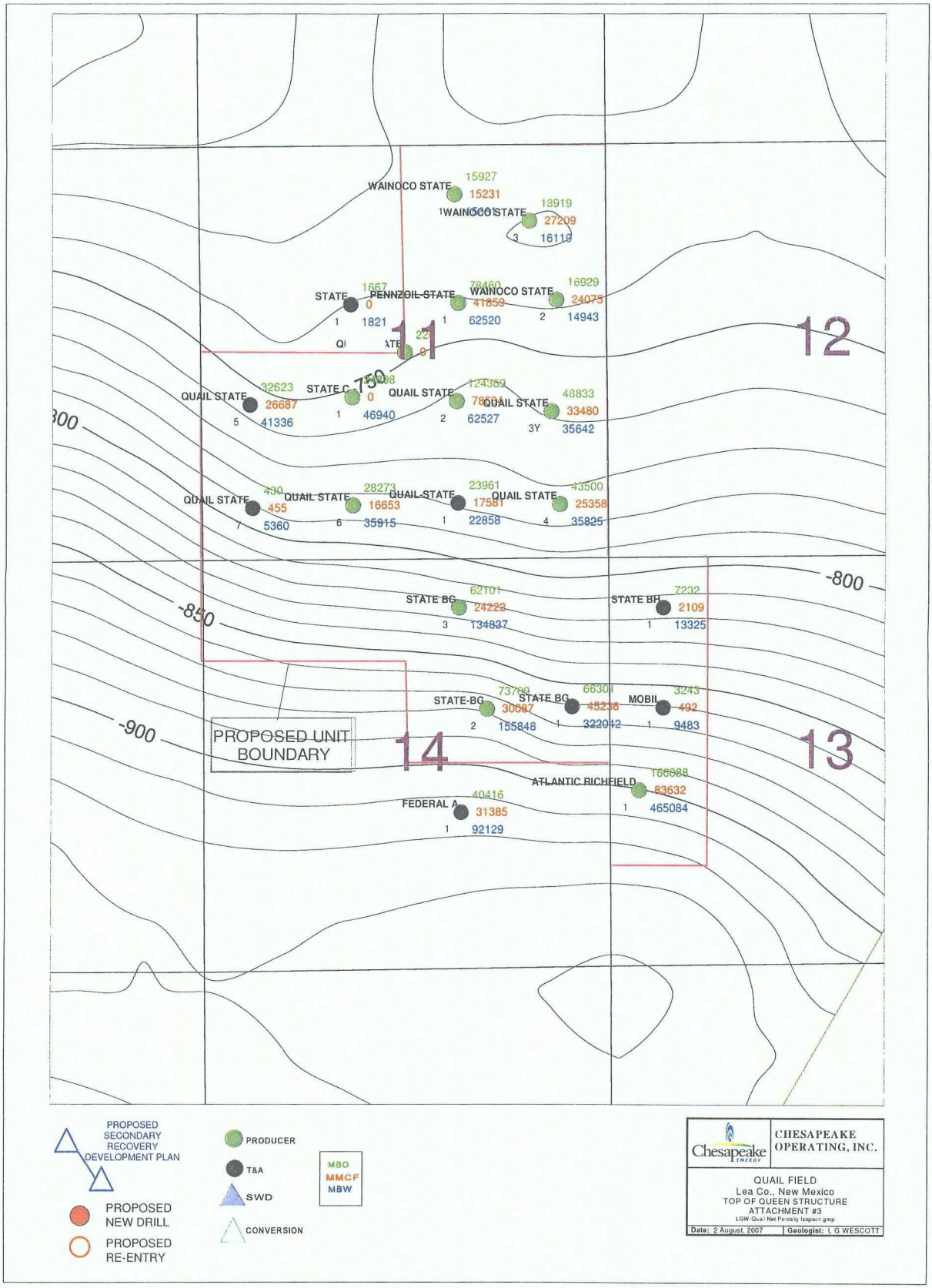

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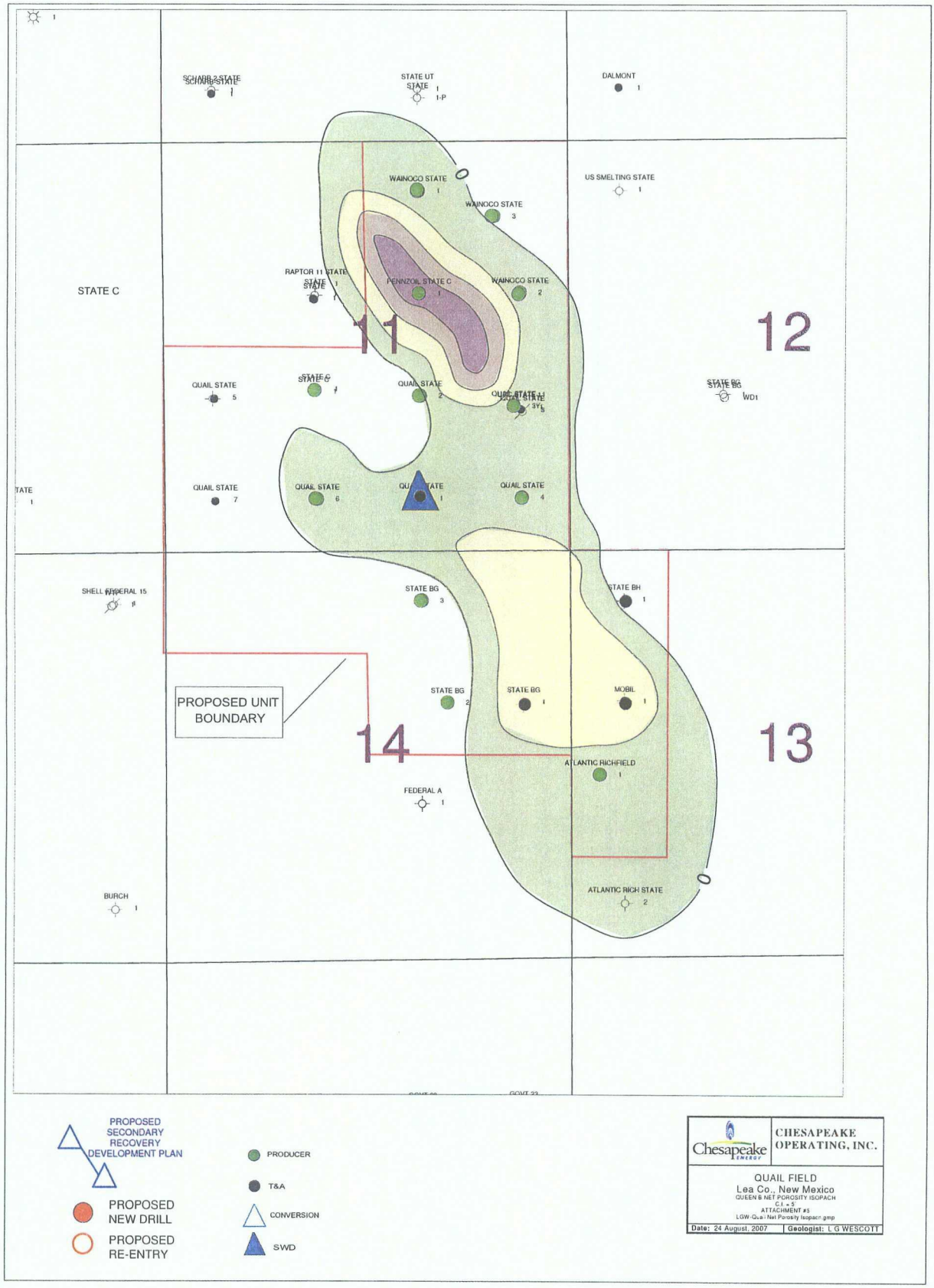

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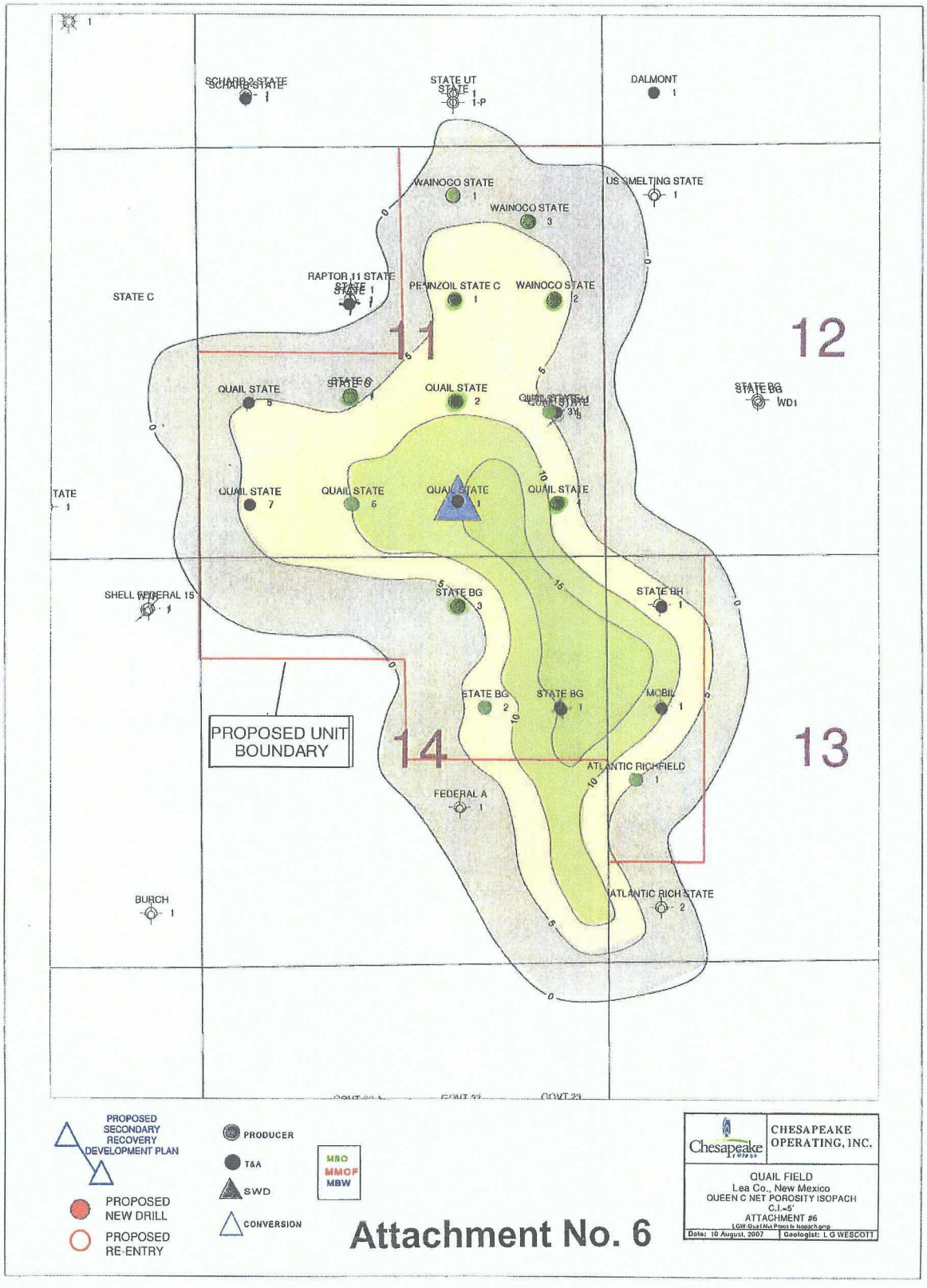


PROPOSED SECONDARY RECOVERY DEVELOPMENT PLAN

PROPOSED NEW DRILL

PROPOSED RE-ENTRY

PRODUCER

T&A

SWD

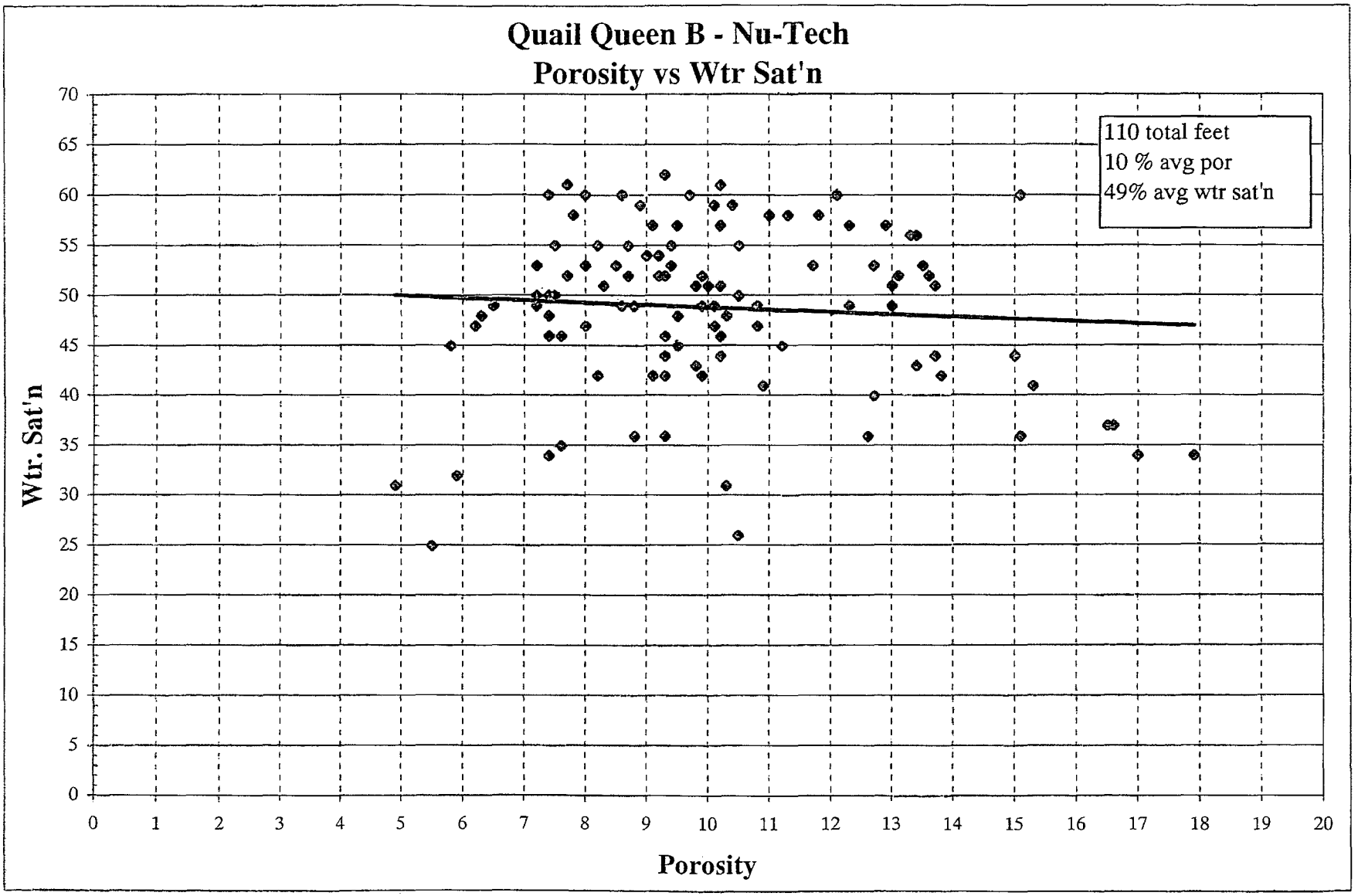
CONVERSION

MBO
MMCF
MBW

Attachment No. 6

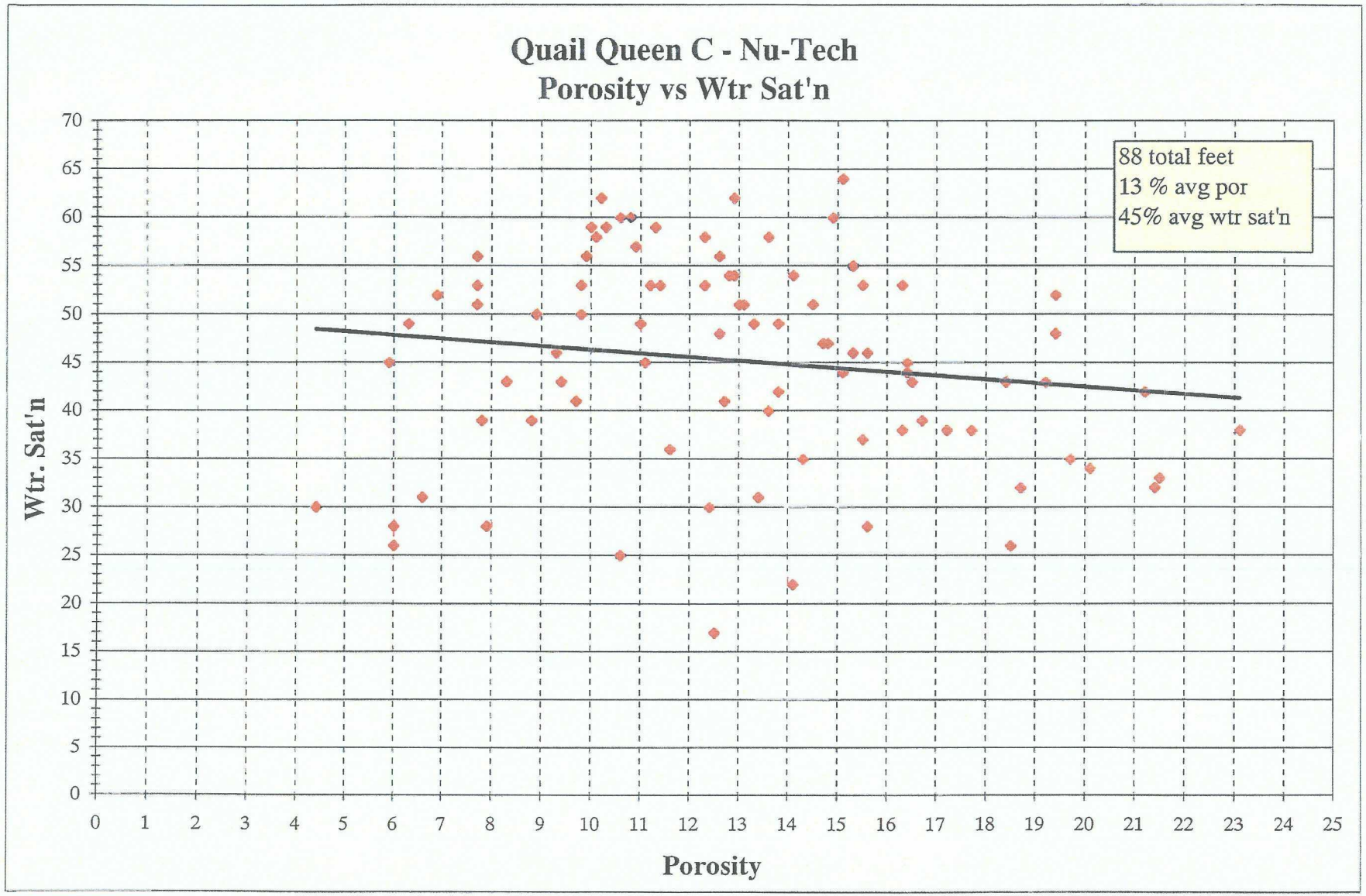
CHESAPEAKE OPERATING, INC.

QUAIL FIELD
Lea Co., New Mexico
QUEEN C NET POROSITY ISOPACH
C.I.=5'
ATTACHMENT #6
LGW-Qual Net Pmss h Isopach.grnp
Date: 10 August, 2007 | Geologist: L G WESCOTT



Attachment No. 7

Attachment No. 7

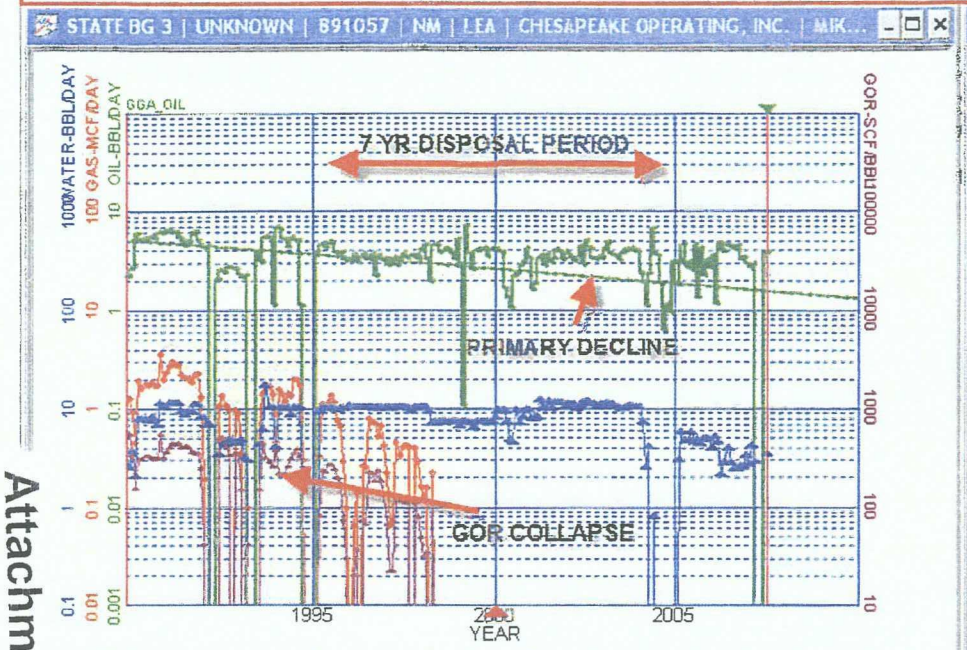


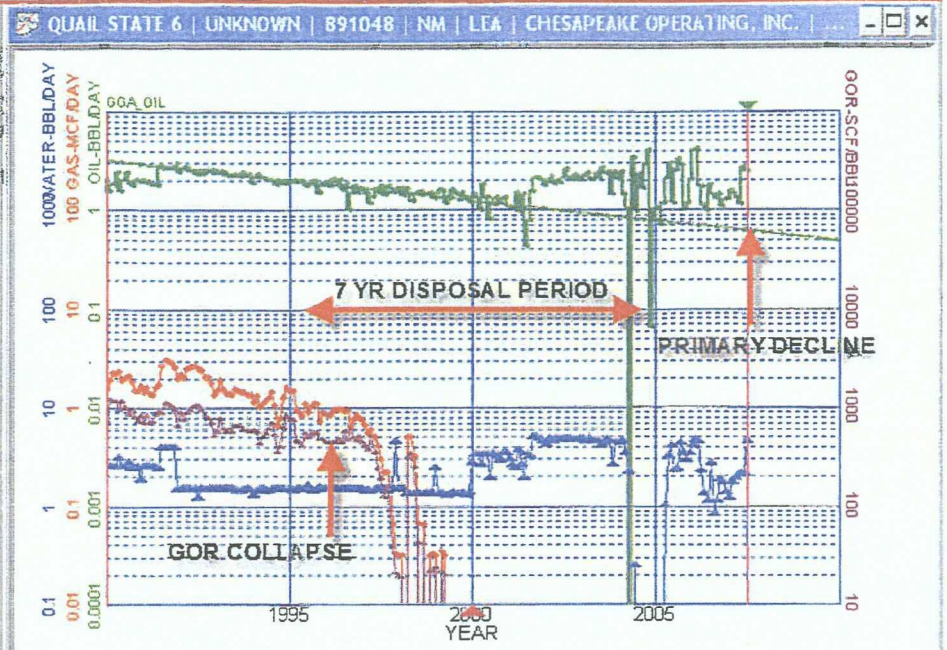
Attachment No. 8

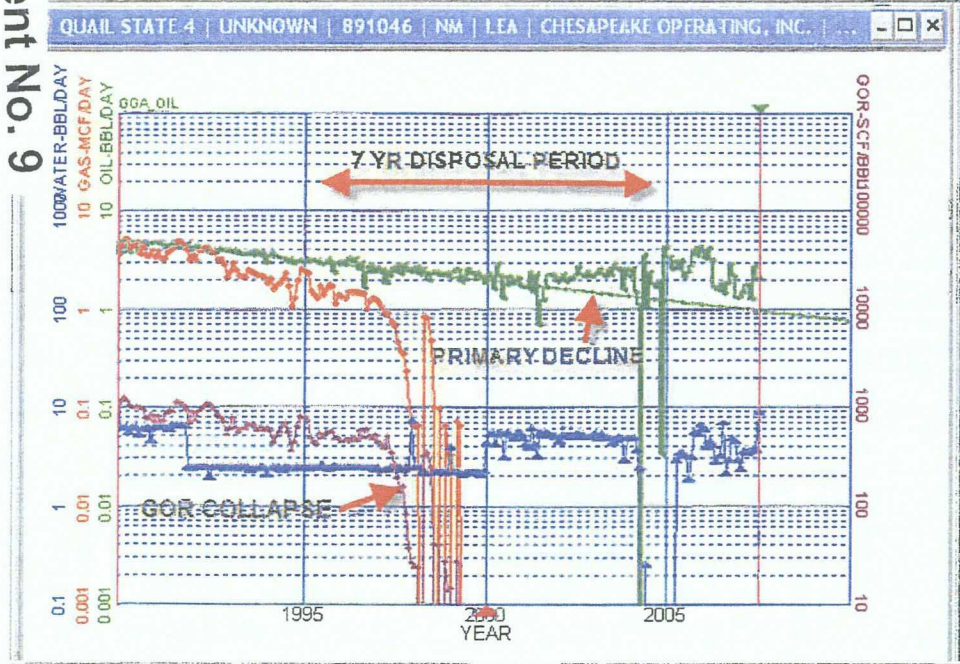
Attachment No. 8

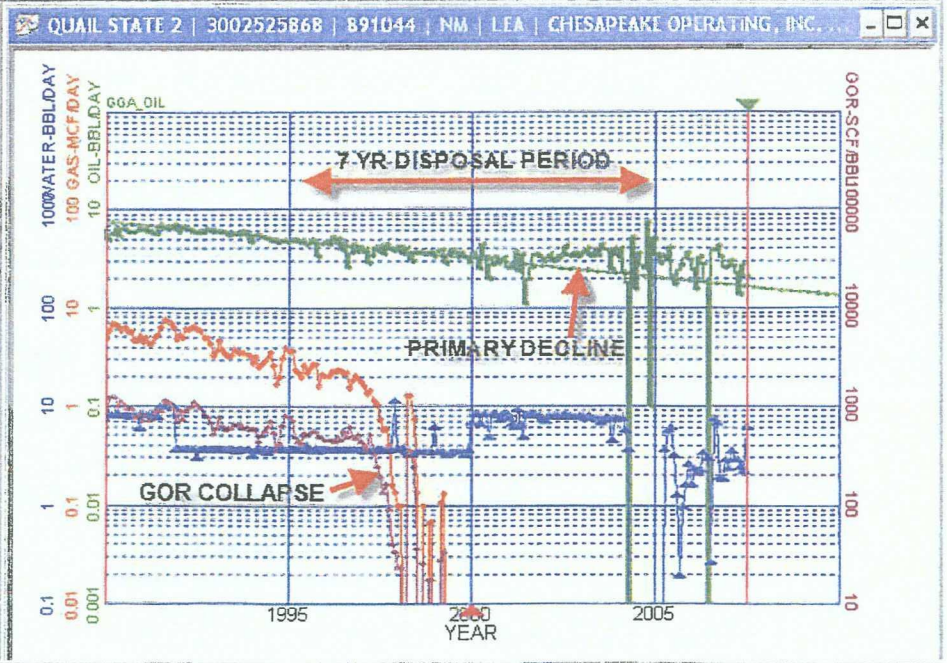
4 WELL MONTAGE CENTERED AROUND QUAIL STATE SWD #1

Attachment No. 9









ATTACHMENT #9

Quail Queen Waterflood Analysis of the Eighty Acre Five-Spot Pattern Centered Around Quail State #1

Well	Primary to 7/1/2007 Oil,BBLS	Pattern Fraction	Pattern Oil,BBLS	Secondary to 7/1/2007 Oil,BBLS	Pattern Fraction	Pattern Oil,BBLS	Total Pattern Oil,BBLS
Quail State 2	105,378	0.25	26,345	1,764	1.00	1,764	28,109
Quail State 4	37,307	0.25	9,327	2,061	1.00	2,061	11,388
State BG 3	40,894	0.25	10,224	3,227	1.00	3,227	13,451
Quail State 6	23,878	0.25	5,970	2,230	1.00	2,230	8,200
Quail State 1	23,961	1.00	23,961	-	1.00	-	23,961
	231,418		75,825	9,282		9,282	85,107

OOIP reservoir parameters for the 80 acre pattern:

Acres = 80
Avg height = 12.5 feet
Average porosity = 12%
Average water sat'n = 45%

Pore Volume (PV) = 7758*A*h*Φ
= 7758*80*12.5*0.12
= 930,960 BBLS

OOIP $= (PV*(1-Sw)) / \beta_{oi}$
$= (930,960*(1-0.45)) / 1.15$
= 445,242 STB

SWD/Injection to Date:

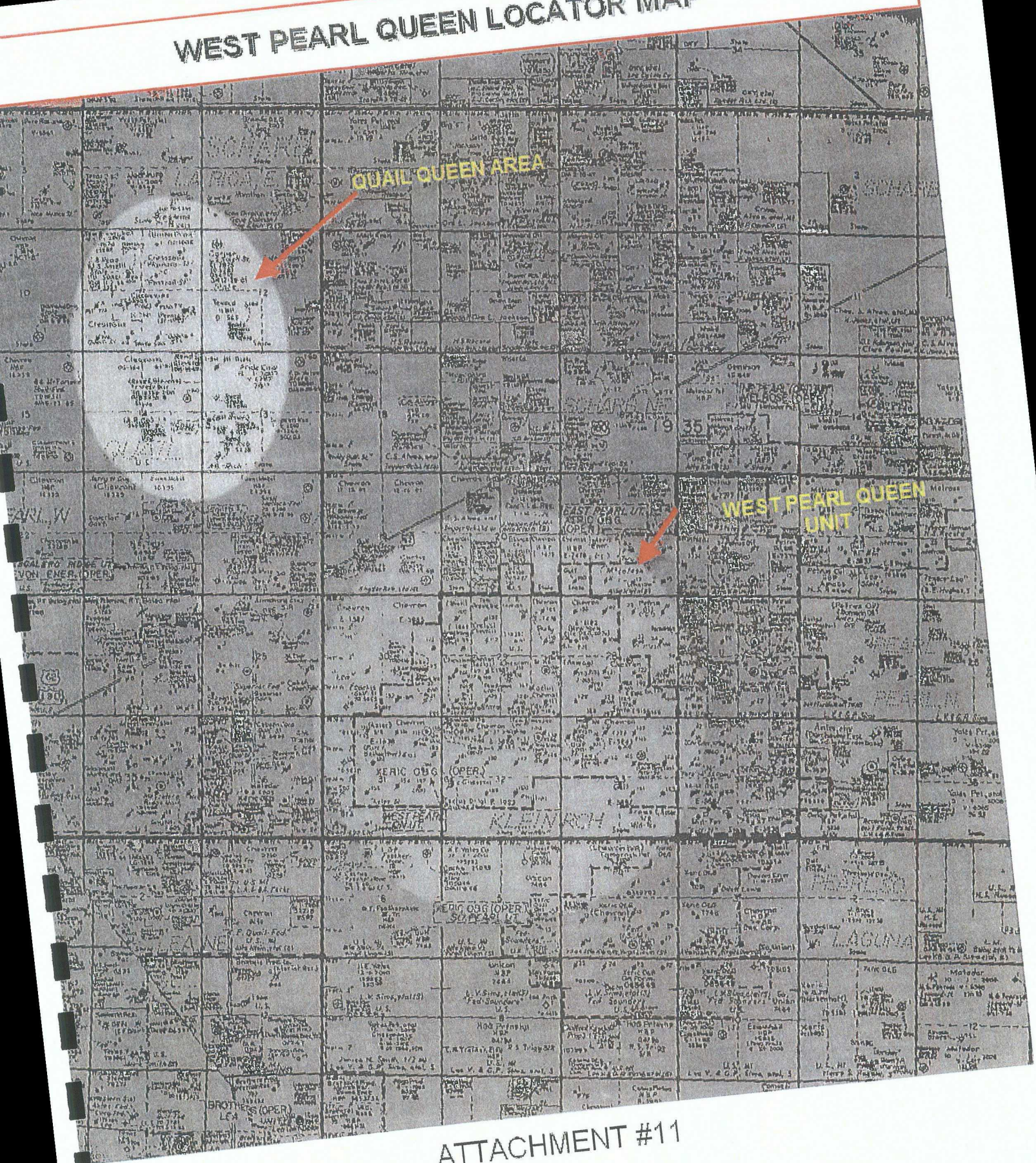
206,908 BBLS water injected over seven years
0.22 pore volumes injected

As of 7/1/2007:

Primary Recovery Efficiency	**17.03%**	
Secondary Recovery Efficiency	**2.08%**	with 22% of PV injected
Total	**19.11%**	

Attachment No. 10

WEST PEARL QUEEN LOCATOR MAP



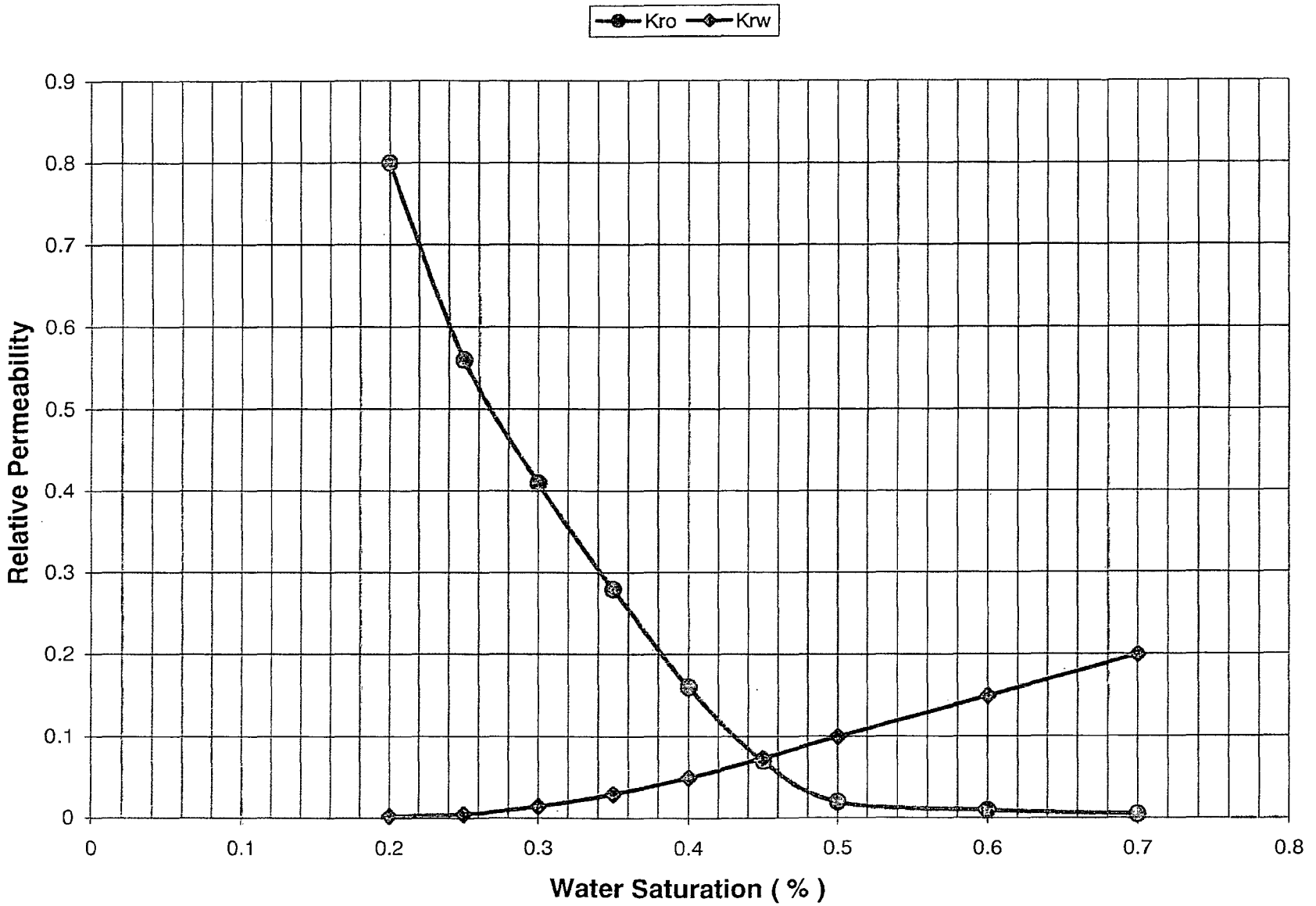
ATTACHMENT #11

QQU vs WPQU
Waterflood Analogy

Item of Comparison	Proposed QQU	Existing WPQU
Net Area (acres)	840	2,520
Thickness (feet)	12.5	18
Depth (feet)	5,100	4,900
Line Pressure (psia)	1,848	1,776
Bubble Point (psia)	1,255	1,400
B_{oi}	1.15	1.18
Porosity (%)	13	16.7
Φh	1.625	3.0
Volume (ΦAcft)	1,365	7,560
$S_{w\ (\%)}$	45	54
OOIP (MBO)	4,467	22,763
Primary (MBO)	867	2,686
% Primary	19.4	11.8
Secondary (MBO)	725	2,374
% Secondary	16	10
Sec: Pri	0.83	0.88
Total (MBO)	1,592	5,060
% Total	0.36	0.22

Attachment No. 12

Generic Sandstone Relative Permeability Curves

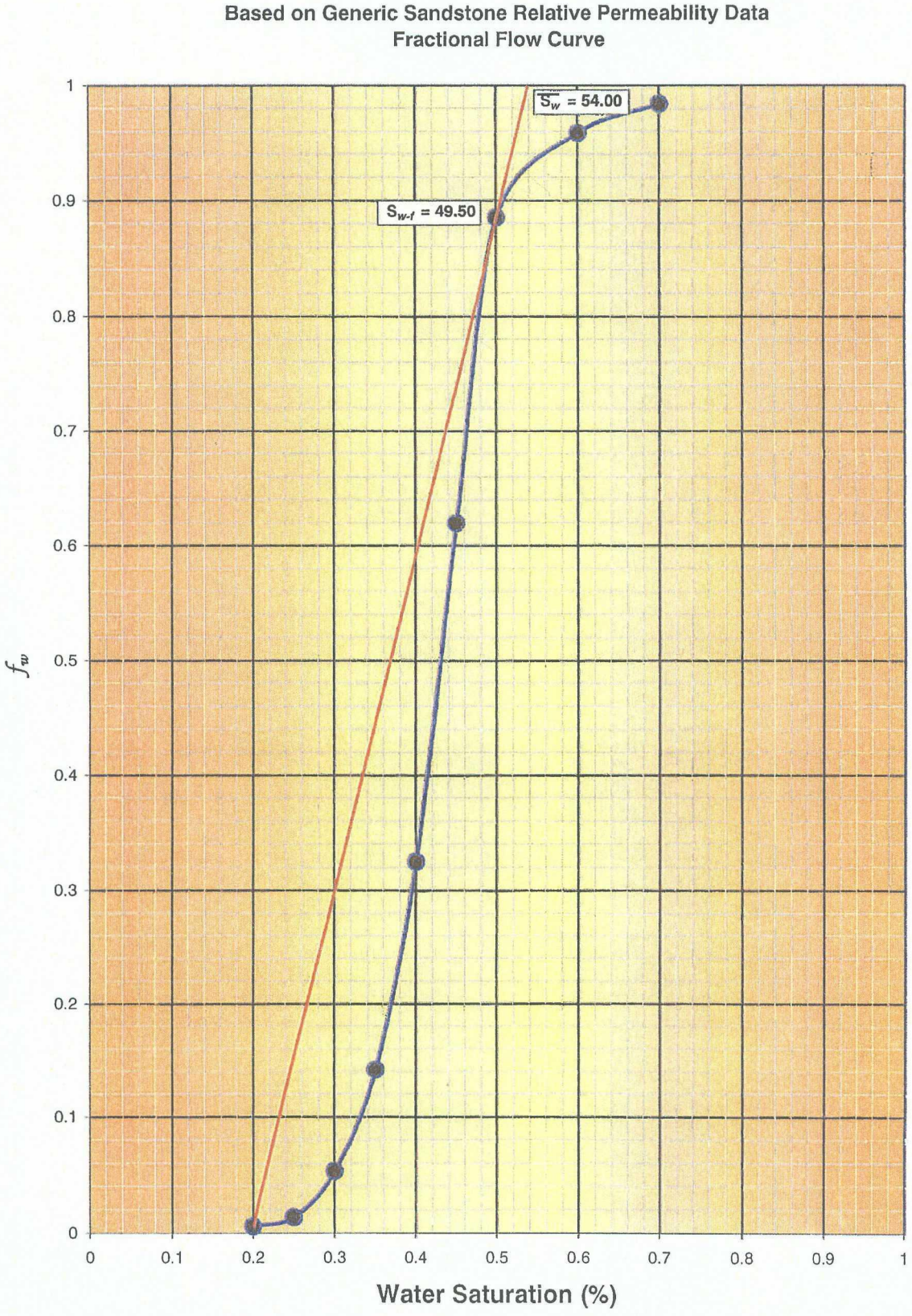


Attachment No. 13

Generic Sandstone Rel Perm.xls
Rel Perm Curves

Attachment No. 13

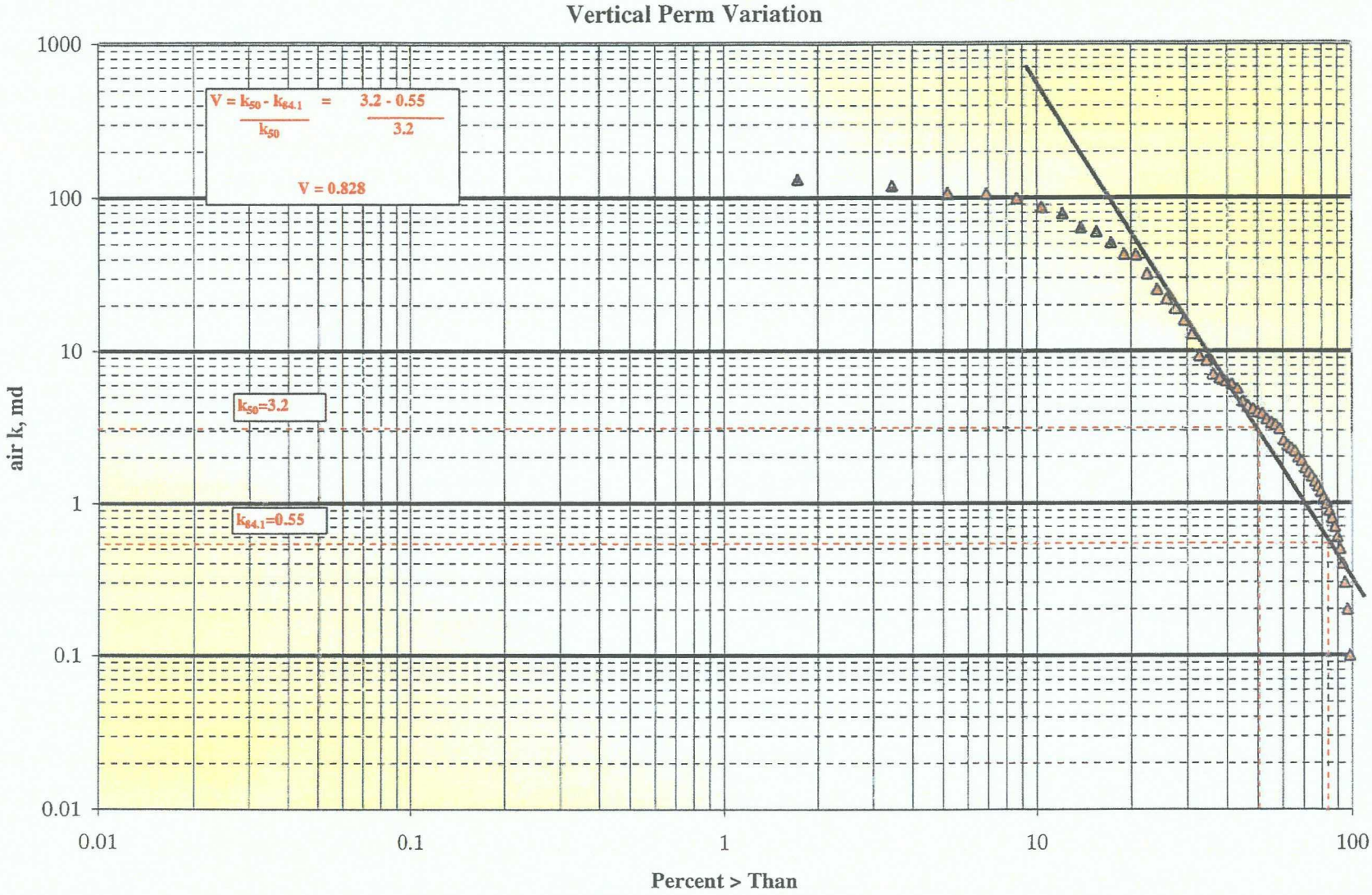
Fractional Flow Curve



Generic Sandstone Rel Perm.xls
fw curve

Attachment No. 14

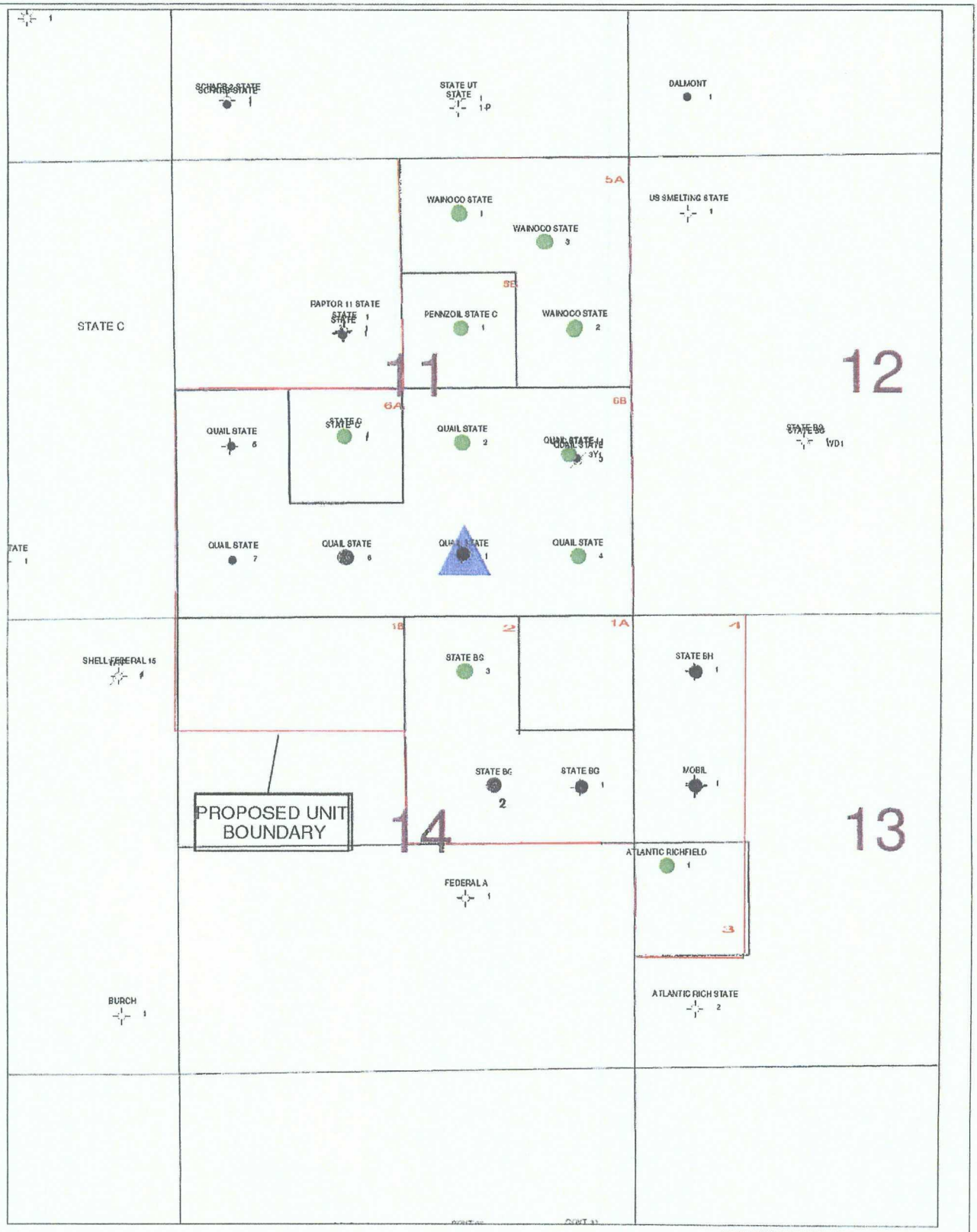
Quail Queen Field



Attachment No. 15

U:\WATERFLOODS\Quail\Perm Variation_Quail.xls Vert K Variation chart B&C

Attachment No. 15



PROPOSED SECONDARY RECOVERY DEVELOPMENT PLAN

PROPOSED NEW DRILL

PROPOSED RE-ENTRY

PRODUCER

T&A

SWD

CONVERSION

MBO
MMCF
MBW

Attachment No. 16

Chesapeake Energy

CHESAPEAKE OPERATING, INC.

QUAIL FIELD
Lea Co., New Mexico
QUEEN TRACT MAP
ATTACHMENT #16
USW-Quail Net Porosity Isopach.grd

Date: 10 August 2007 | Geologist: L.G.WESCOTT

Proposed Quail Queen Unit
Tract Participation Factors

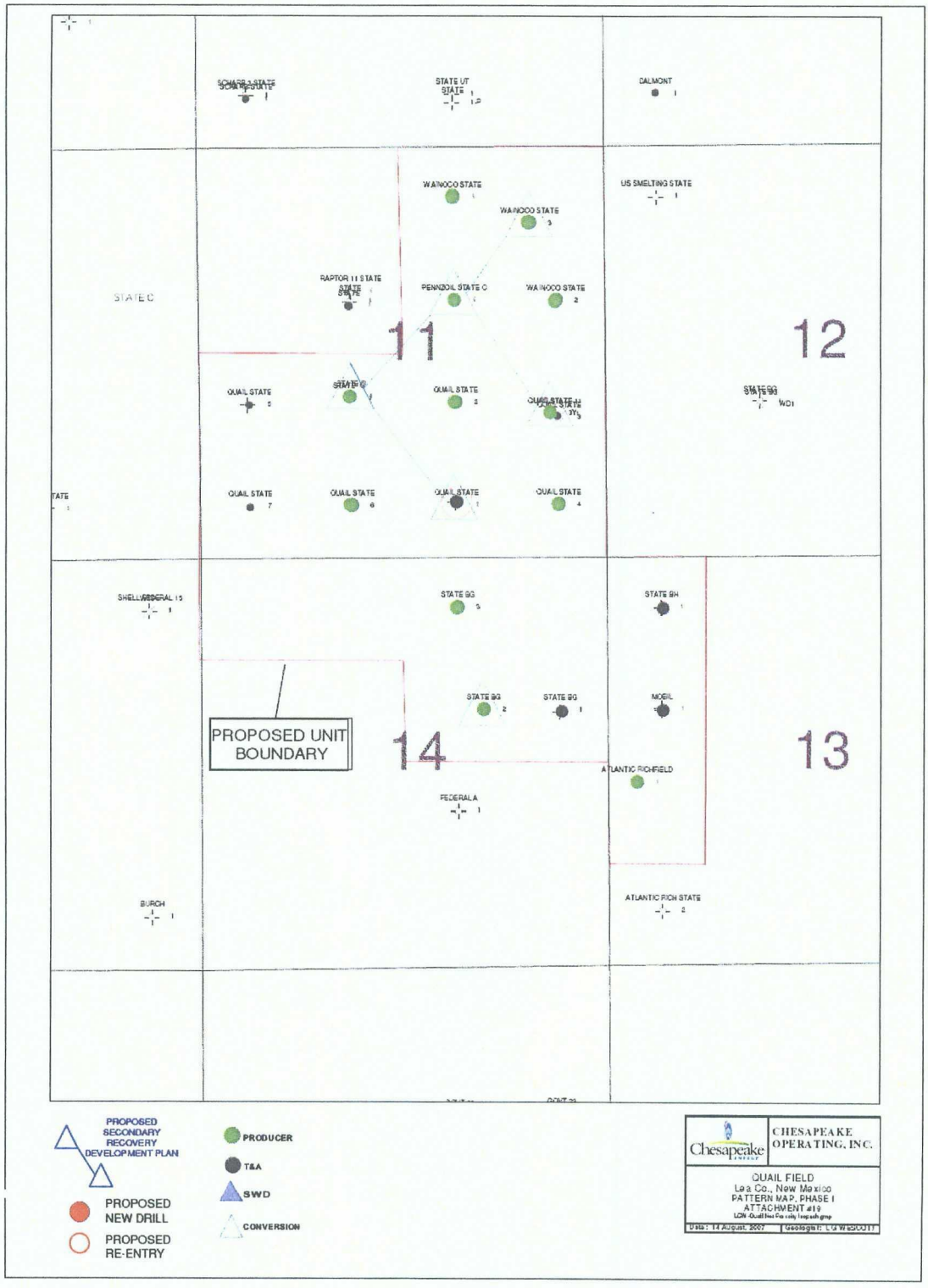
Tract	Usable Wells		Well	Avg. Rate (BOE/D)			Est. Ultimate Primary Oil					Res Pore Vol, Queen B,C		Tract Participation		
No.	No.	Tract %	Name	Well	Tract	Tract %	MBO	MMcf	MBOE	Tract	Tract %	Ac-Feet Volume	Tract %	Factor (%)		
1A			-									767.30	10.091	1.00907417	Wells	0.40000000
1B			-									201.70	2.653	0.26525513	Rate	0.40000000
2	2	16.67	State BG 2									994.70	13.081	26.18674939	Ult	0.10000000
			State Bg 3												Ac-ft	0.10000000
				9	9	39.57	202.111	99.545	218.702	218.702	23.825					
3	1	8.33	Atlantic Richfield 1	3	3	11.90	166.088	83.682	180.035	180.035	19.612	174.80	2.299	10.28275250		
4							10.475	2.601	10.909	10.909	1.188	994.10	13.073	1.42617110		
5A	3	25.00	Wainoco St 1									694.60	9.135	14.20432449		
			Wainoco St 2													
			Wainoco St 3													
				1	1	6.52	51.775	66.515	62.861	62.861	6.848					
5B	1	8.33	Pennzoil St 1	1	1	3.26	78.460	41.859	85.437	85.437	9.307	680.50	8.952	6.46420024		
6A	1	8.33	State C 1	1	1	3.33	24.898	0.000	24.898	24.898	2.712	214.40	2.820	5.21832097		
6B	4	33.33	Quail St 2									2,831.70	37.897	34.94315200		
			Quail St 3Y													
			Quail St 4													
			Quail St 6													
				8	8	35.42	301.988	198.848	335.129	335.129	36.508					
	12	100.00		23	23	100.00	835.795	493.050	917.970	917.970	100.000	7,604.000	100.000	100.00000000		

Attachment No. 17

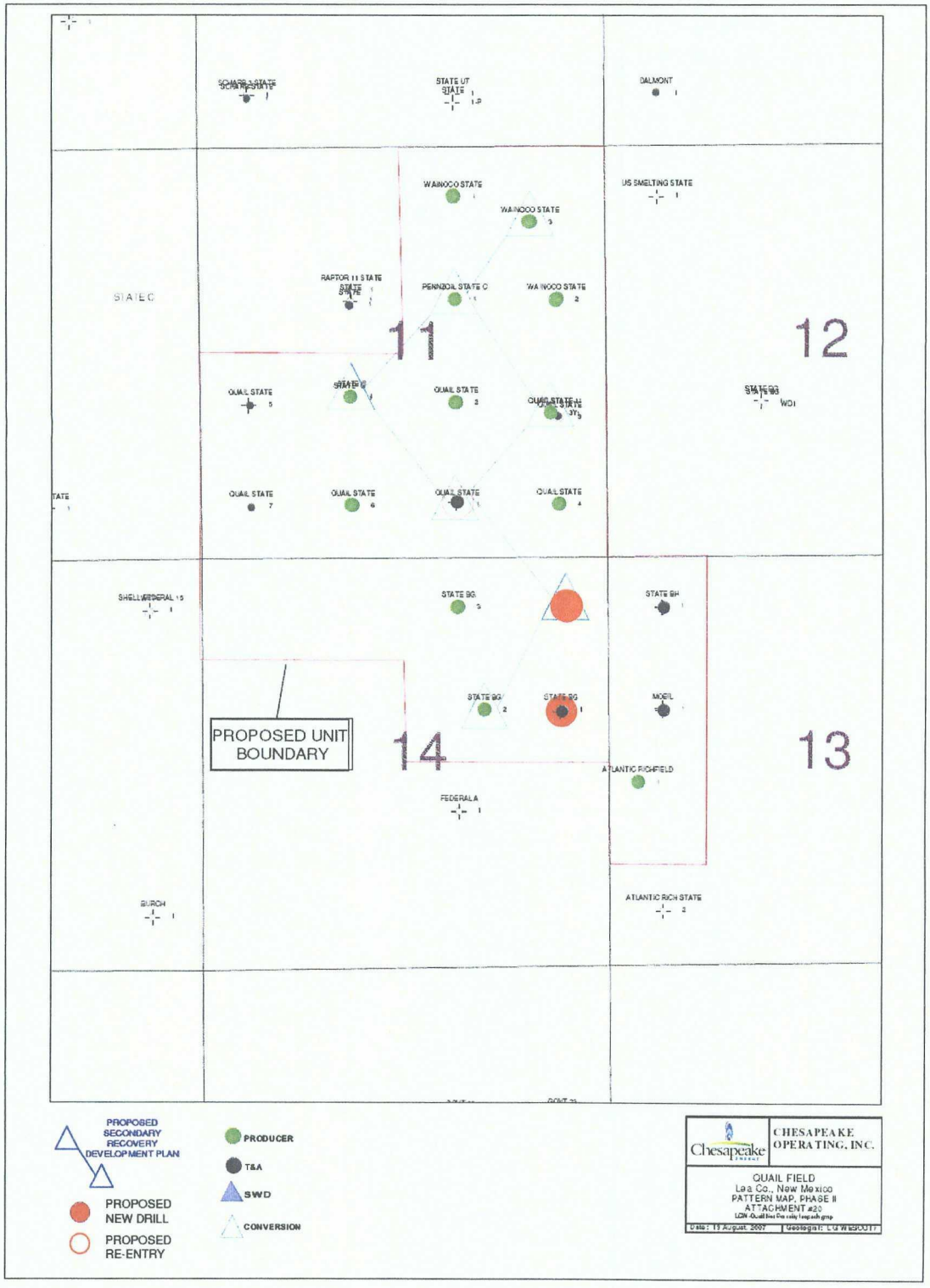
Attachment No. 17

QUAIL QUEEN UNIT
WIO Unit Participation BASED ON TPF'S

	Total of	
	All Tract's TPF	
Tracts Unit Participation Fraction	1.0000	
Working Interest Owner	**UNIT WI**	**UNIT NRI**
Chesapeake Exploration LP	0.88926063	0.70642158
Roy G. & Opal Barton Revocable Trust, Roy G. Barton Jr., aka George Barton Trust	0.00321336	0.00250642
Pintail Production Company, Inc.	0.02570688	0.02005137
New Mexico Western Mineral, Inc.	0.00642672	0.00501284
Read & Stevens, Inc.	0.00671780	0.00524708
Joe M. & Nancy Wigley	0.00022952	0.00017903
MRT Ltd	0.00022952	0.00017903
William D. Bradshaw	0.00022952	0.00017903
CLM Production Company	0.00022952	0.00017903
Patricia L. Pruitt	0.00022952	0.00017903
Laura K. Read	0.00022952	0.00017903
Marion P. Riley	0.00022952	0.00017903
Pride Energy Company	0.01426171	0.01188476
First Century Oil Inc.	0.00365079	0.00285275
Fisco Inc.	0.00365079	0.00285275
Gene A. Snow Operating	0.00182572	0.00142683
All Tex Royalty Ltd	0.04367894	0.03275921
	1.00000000	**0.79226879**



Attachment No. 19

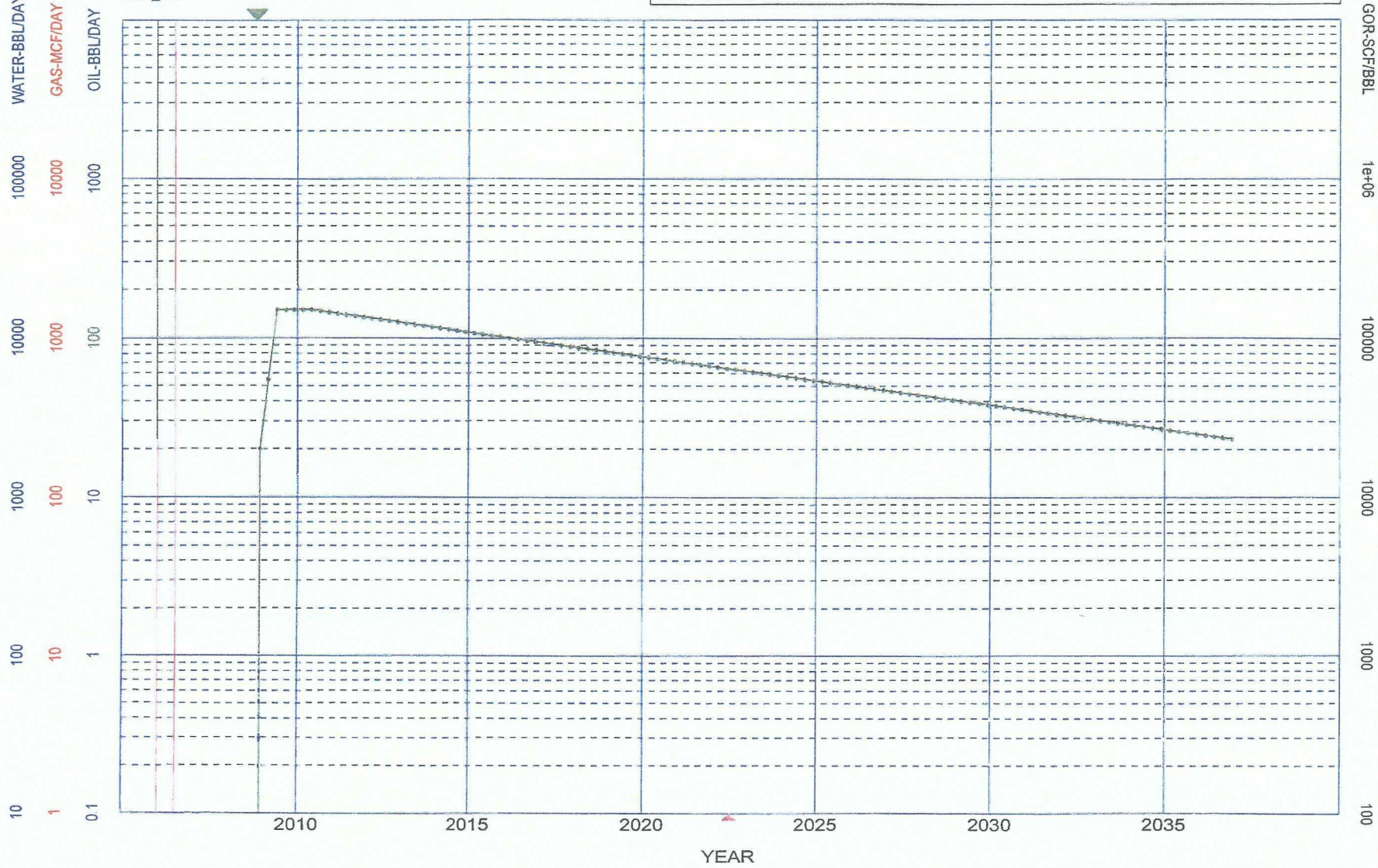


Attachment No. 20

SEQ #:1380 QUAIL QUEEN UNIT WATERFLOOD CASE

QUAIL
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 5PUD

GGA_OIL



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Qual=	GGA0306	Ref=	11/2008	Ref=	11/2008	Ref=	11/2008
Ref=	11/2008	Cum=	0	Cum=	0	Cum=	0
Cum=	1						
Rem=	725061						
EUR=	725062						
Yrs=	28.164						
Qref=	0.0						
De=	0.000000						
Dmin=	0.000						
b=	0.000000						
Qab=	23.1						

Attachment No. 21

Lease: QUAIL QUEEN UNIT WATERFLO
Field: QUAIL
Operator: CHESAPEAKE OPERATING,
County: LEA State: NM
Oil Differential: 0.000000 $/BBL
Gas Differential: 1.080663 $/MCF

DATE : 08/14/2007
TIME : 16:34:58
DBS : CHK0101
SETTINGS : CHK0707M
SCENARIO : CGA0707

RESERVES AND ECONOMICS

AS OF DATE: 07/2007

--END-- MO-YEAR	GROSS OIL PRODUCTION ---MBBLS---	GROSS GAS PRODUCTION ----MMCF---	NET OIL PRODUCTION ---MBBLS---	NET GAS PRODUCTION ----MMCF---	NET OIL PRICE ---$/BBL---	NET GAS PRICE ---$/MCF---	NET OIL SALES -----M$----	NET GAS SALES -----M$----	TOTAL NET SALES -----M$----
07-2007	0.000	0.000	0.000	0.000	70.000	0.000	0.002	0.000	0.002
12-2007	0.000	0.000	0.000	0.000	70.000	0.000	0.008	0.000	0.008
12-2008	0.723	0.000	0.573	0.000	70.000	0.000	40.108	0.000	40.108
12-2009	42.989	0.000	34.056	0.000	70.000	0.000	2383.930	0.000	2383.930
12-2010	54.104	0.000	42.861	0.000	70.000	0.000	3000.277	0.000	3000.277
12-2011	50.745	0.000	40.200	0.000	70.000	0.000	2814.001	0.000	2814.001
12-2012	47.299	0.000	37.470	0.000	70.000	0.000	2622.930	0.000	2622.930
12-2013	44.088	0.000	34.926	0.000	70.000	0.000	2444.833	0.000	2444.833
12-2014	41.094	0.000	32.555	0.000	70.000	0.000	2278.830	0.000	2278.830
12-2015	38.304	0.000	30.344	0.000	70.000	0.000	2124.097	0.000	2124.097
12-2016	35.703	0.000	28.284	0.000	70.000	0.000	1979.871	0.000	1979.871
12-2017	33.279	0.000	26.363	0.000	70.000	0.000	1845.437	0.000	1845.437
12-2018	31.019	0.000	24.573	0.000	70.000	0.000	1720.132	0.000	1720.132
12-2019	28.913	0.000	22.905	0.000	70.000	0.000	1603.335	0.000	1603.335
12-2020	26.950	0.000	21.350	0.000	70.000	0.000	1494.469	0.000	1494.469
S TOT	475.209	0.000	376.461	0.000	70.000	0.000	26352.260	0.000	26352.260
AFTER	249.852	0.000	197.933	0.000	70.000	0.000	13855.293	0.000	13855.293
TOTAL	725.061	0.000	574.394	0.000	70.000	0.000	40207.551	0.000	40207.551

--END-- MO-YEAR	AD VALOREM TAX -----M$----	PRODUCTION TAX -----M$----	DIRECT OPER EXPENSE -----M$----	INTEREST PAID -----M$----	CAPITAL REPAYMENT -----M$----	EQUITY INVESTMENT -----M$----	FUTURE NET CASHFLOW -----M$----	CUMULATIVE CASHFLOW -----M$----	CUM. DISC. CASHFLOW -----M$----
07-2007	0.000	0.000	5.000	0.000	0.000	0.000	-4.999	-4.999	-4.979
12-2007	0.000	0.001	25.001	0.000	0.000	0.000	-24.993	-29.992	-29.288
12-2008	0.552	3.325	63.616	0.000	0.000	0.000	-27.385	-57.376	-55.471
12-2009	32.795	197.628	274.947	0.000	0.000	2095.360	-216.799	-274.175	-332.955
12-2010	41.273	248.723	450.519	0.000	0.000	2900.000	-640.239	-914.414	-810.559
12-2011	38.711	233.281	553.724	0.000	0.000	0.000	1988.286	1073.872	548.844
12-2012	36.082	217.441	236.496	0.000	0.000	0.000	2132.911	3206.783	1874.447
12-2013	33.632	202.677	220.438	0.000	0.000	0.000	1988.087	5194.870	2997.714
12-2014	31.349	188.915	205.470	0.000	0.000	0.000	1853.096	7047.965	3949.530
12-2015	29.220	176.088	191.519	0.000	0.000	0.000	1727.271	8775.236	4756.064
12-2016	27.236	164.131	178.515	0.000	0.000	0.000	1609.989	10385.225	5439.492
12-2017	25.387	152.987	166.394	0.000	0.000	0.000	1500.670	11885.895	6018.603
12-2018	23.663	142.599	155.095	0.000	0.000	0.000	1398.775	13284.670	6509.321
12-2019	22.056	132.916	144.564	0.000	0.000	0.000	1303.798	14588.468	6925.138
12-2020	20.559	123.891	134.749	0.000	0.000	0.000	1215.270	15803.738	7277.485
S TOT	362.515	2184.602	3006.047	0.000	0.000	4995.360	15803.738	15803.738	7277.485
AFTER	190.600	1148.604	1249.260	0.000	0.000	10.000	11256.827	27060.566	9094.750
TOTAL	553.115	3333.206	4255.307	0.000	0.000	5005.360	27060.564	27060.566	9094.750

	OIL	GAS
GROSS WELLS	1.0	0.0
GROSS ULT., MB & MMF	725.062	0.000
GROSS CUM., MB & MMF	0.000	0.000
GROSS RES., MB & MMF	725.061	0.000
NET RES., MB & MMF	574.394	0.000
NET REVENUE, M$	40207.555	0.000
INITIAL PRICE, $	70.000	0.000
INITIAL N.I., PCT.	79.220	0.000

LIFE, YRS.	29.50
DISCOUNT %	10.00
UNDISCOUNTED PAYOUT, YRS.	3.96
DISCOUNTED PAYOUT, YRS.	4.10
UNDISCOUNTED NET/INVEST.	6.41
DISCOUNTED NET/INVEST.	3.28
RATE-OF-RETURN, PCT.	78.09
INITIAL W.I., PCT.	100.000

P.W. %	P.W., M$
5.00	14906.022
8.00	10972.667
10.00	9094.748
12.00	7621.411
14.00	6446.749
16.00	5496.724
25.00	2878.122
40.00	1106.350
60.00	276.008
100.00	-154.909

Attachment No. 22

APPENDIX A

FIELD PRODUCTION PLOT WITH PRIMARY FORECAST

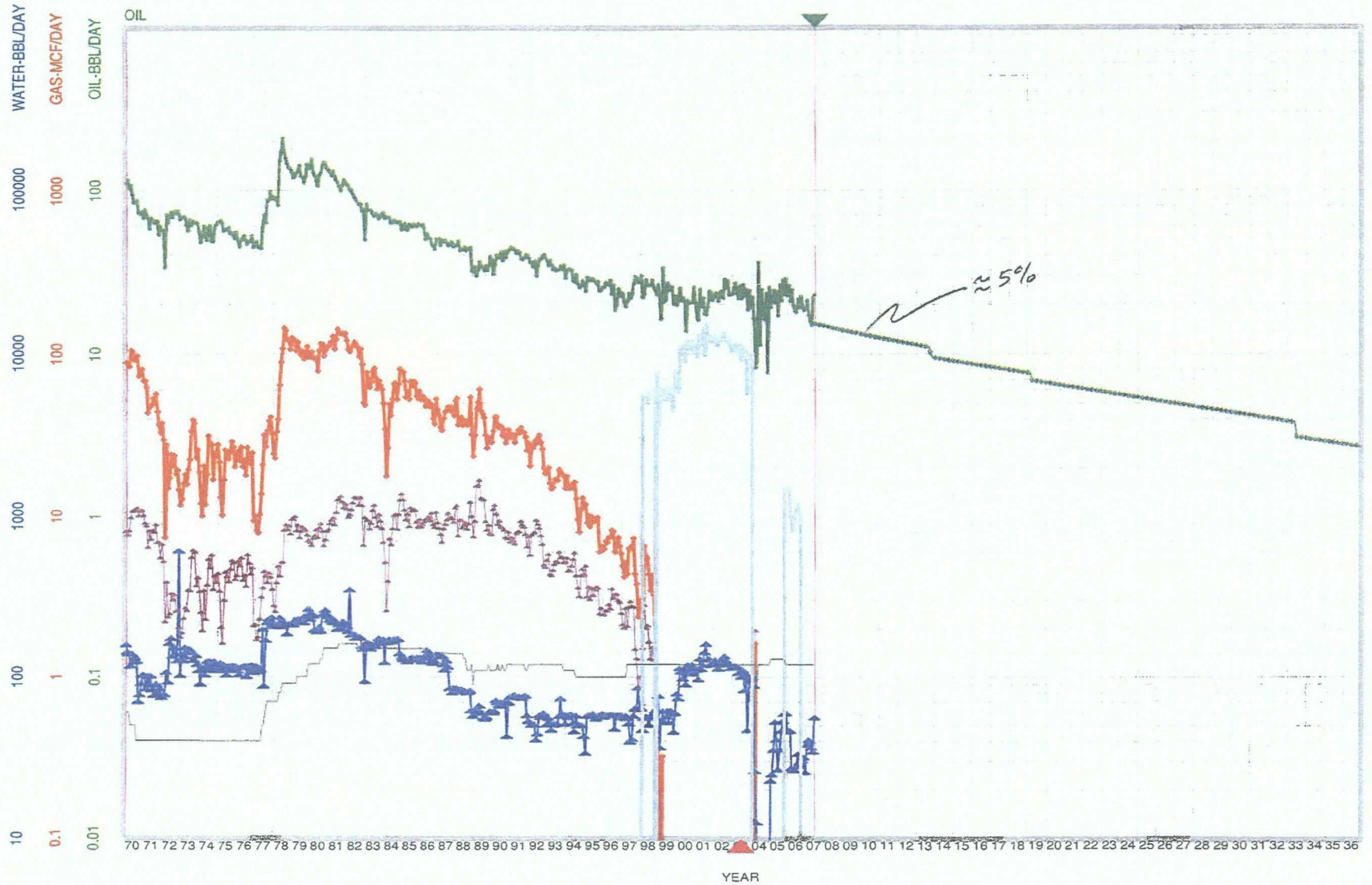
INDIVIDUAL WELL PRODUCTION PLOTS WITH PRIMARY FORECAST

PROPOSED QUAIL QUEEN UNIT

WATERFLOOD FEASIBILITY STUDY

AUGUST, 2007

[redacted] TO[redacted]L F[redacted]D
12 ACTIVE WELLS PLUS
8 INACTIVE WELLS



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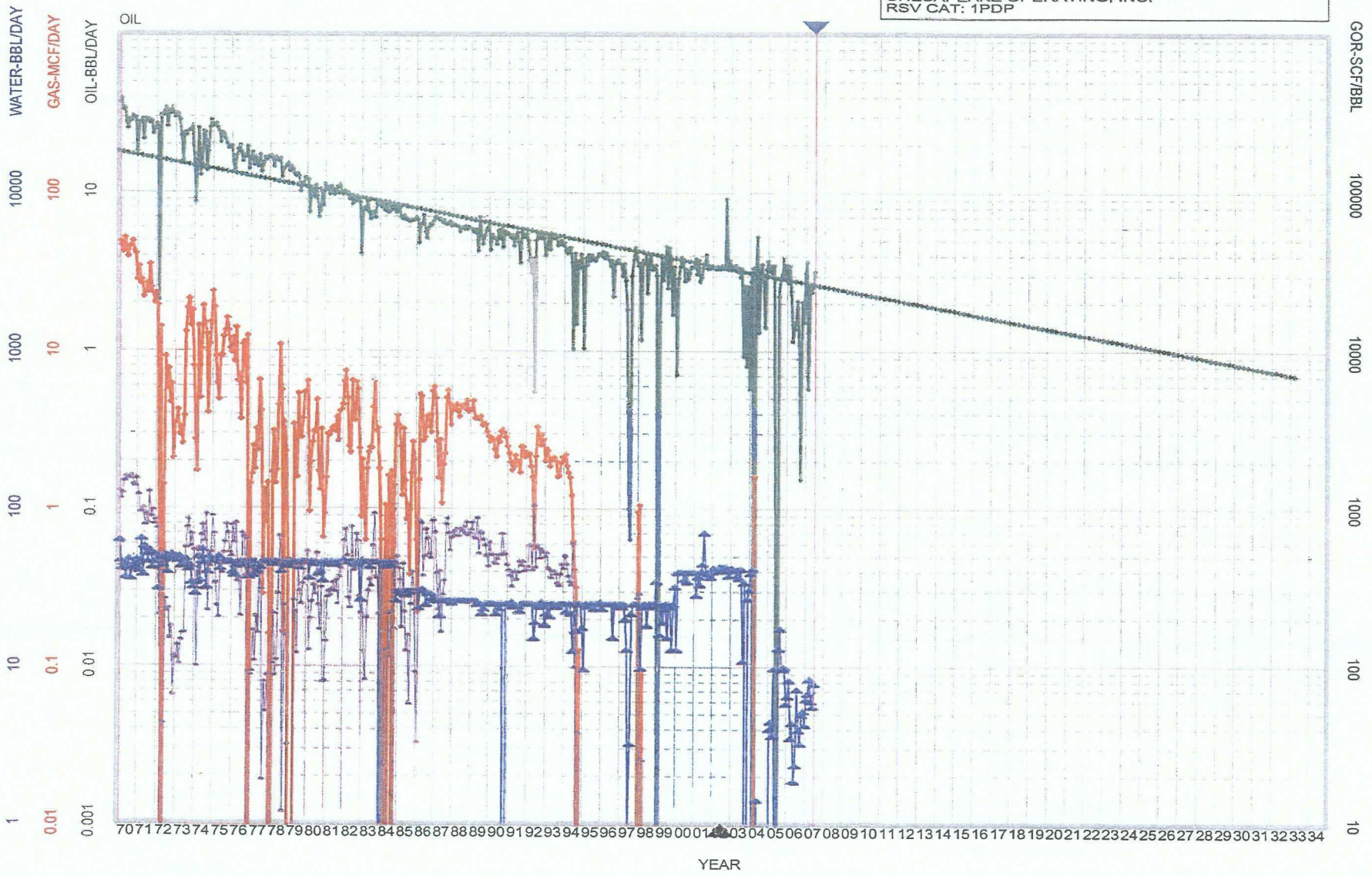
Qual=	GGA0707	Qual=	GAS - 1	Qual=	WATER - 1	Qual=	GOR - 1	Qual=	WATER_INJ - 1	Qual=	WELL_COUNT - 1
Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Cum=	799248	Cum=	0	Cum=	0	Cum=	0	Cum=	0	Cum=	0
Rem=	78720	Rem=	0	Rem=	0	Rem=	0	Rem=	0	Rem=	0
EUR=	877968	EUR=	0	EUR=	0	EUR=	0	EUR=	0	EUR=	0
Yrs=	31.663	Yrs=	0.000	Yrs=	0.000	Yrs=	0.000	Yrs=	0.000	Yrs=	0.000
Qref=	15.4	Qref=	0.0	Qref=	0.0	Qref=	0.0	Qref=	0.0	Qref=	0.0
De=	0.000000	De=	0.000000	De=	0.000000	De=	0.000000	De=	0.000000	De=	0.000000
Dmin=	0.000	Dmin=	0.000	Dmin=	0.000	Dmin=	0.000	Dmin=	0.000	Dmin=	0.000
b=	0.000000	b=	0.000000	b=	0.000000	b=	0.000000	b=	0.000000	b=	0.000000
Qab=	0.0	Qab=	0.0	Qab=	0.0	Qab=	0.0	Qab=	0.0	Qab=	0.0

QUAIL
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



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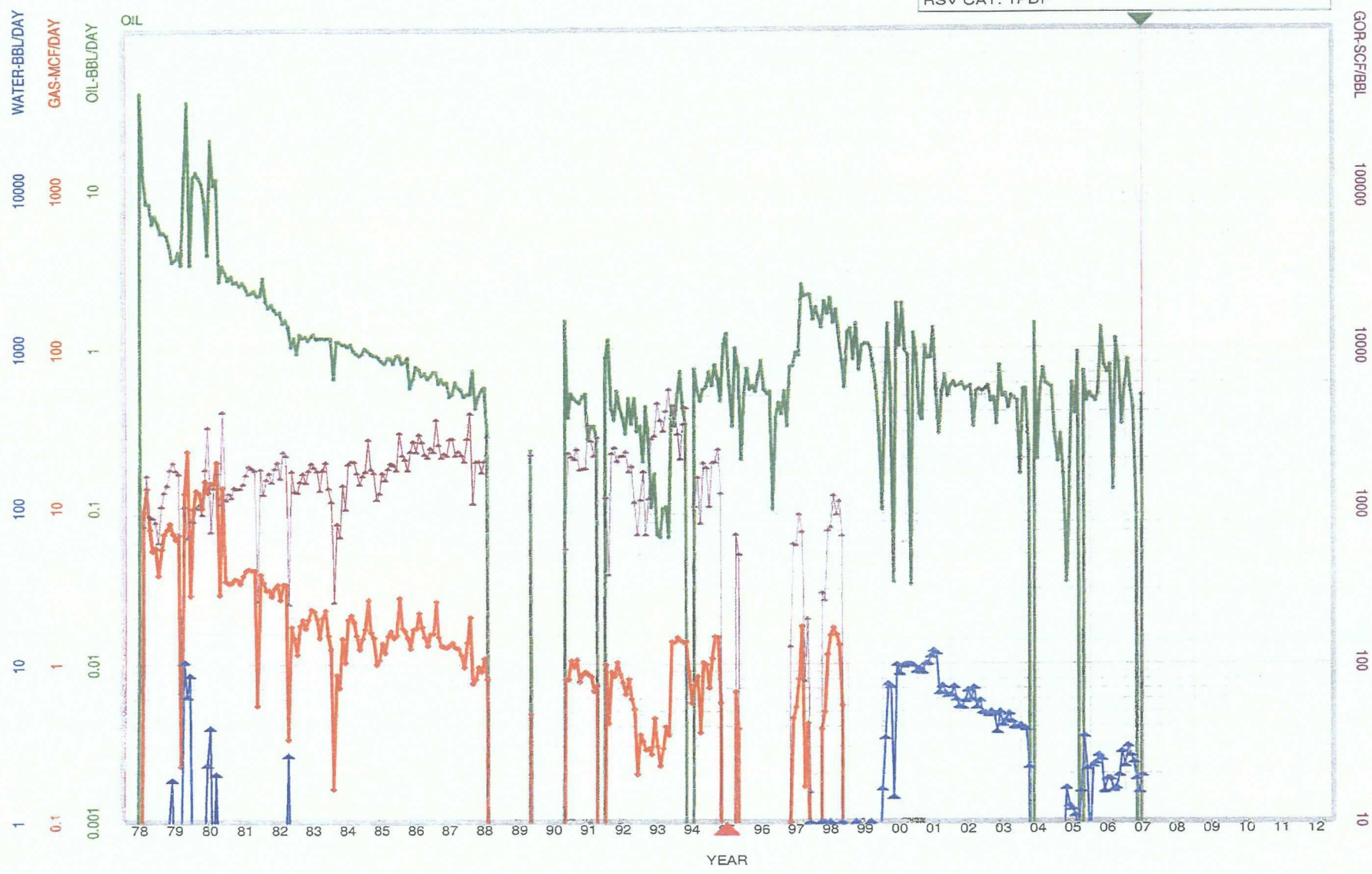
Ref=	7/2007	Cum=	83682	Cum=	465004	Cum=	24326
Cum=	152273						
Rem=	13815						
EUR=	166088						
Yrs=	25.997						
Qref=	2.6						
De=	5.000000						
Dmin=	0.000						
b=	0.000000						
Qab=	0.7						

[redacted] #:[redacted] W[redacted]IOC[redacted]STA[redacted]1
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



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Cum=	15927	Cum=	15231	Cum=	15898	Cum=	0

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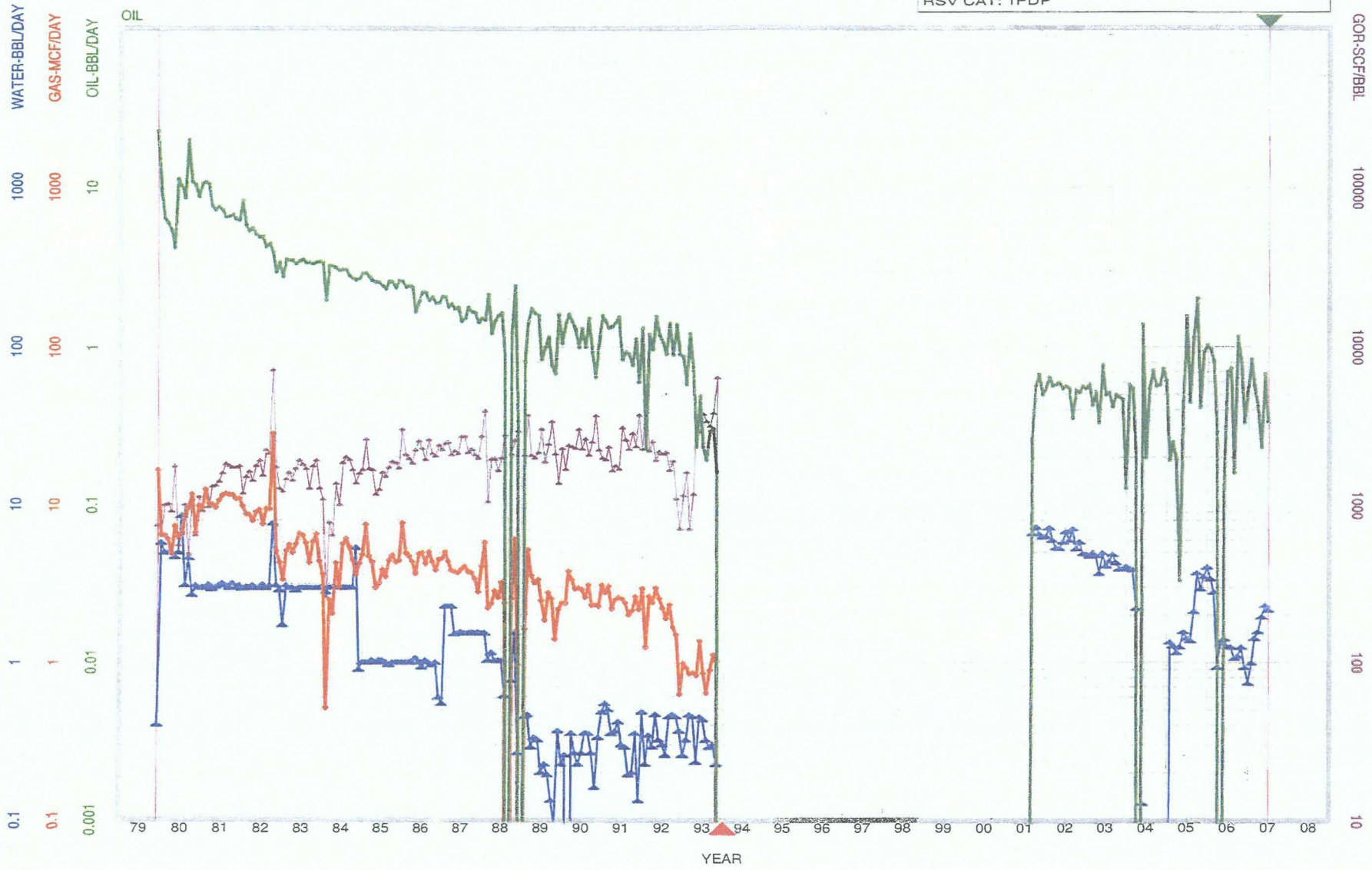
QUAIL ; QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Cum=	16929	Cum=	24075	Cum=	15188	Cum=	0

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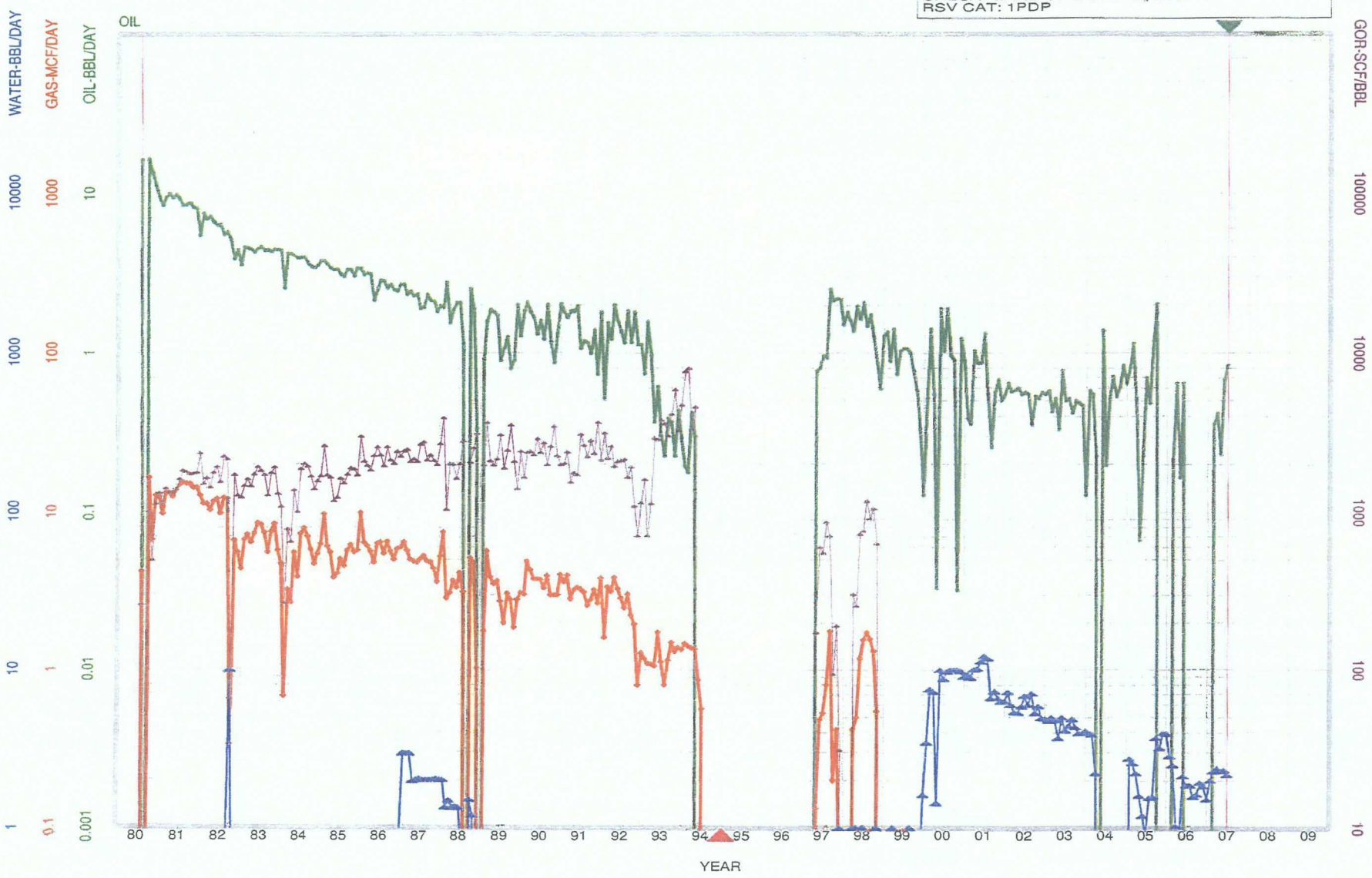
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
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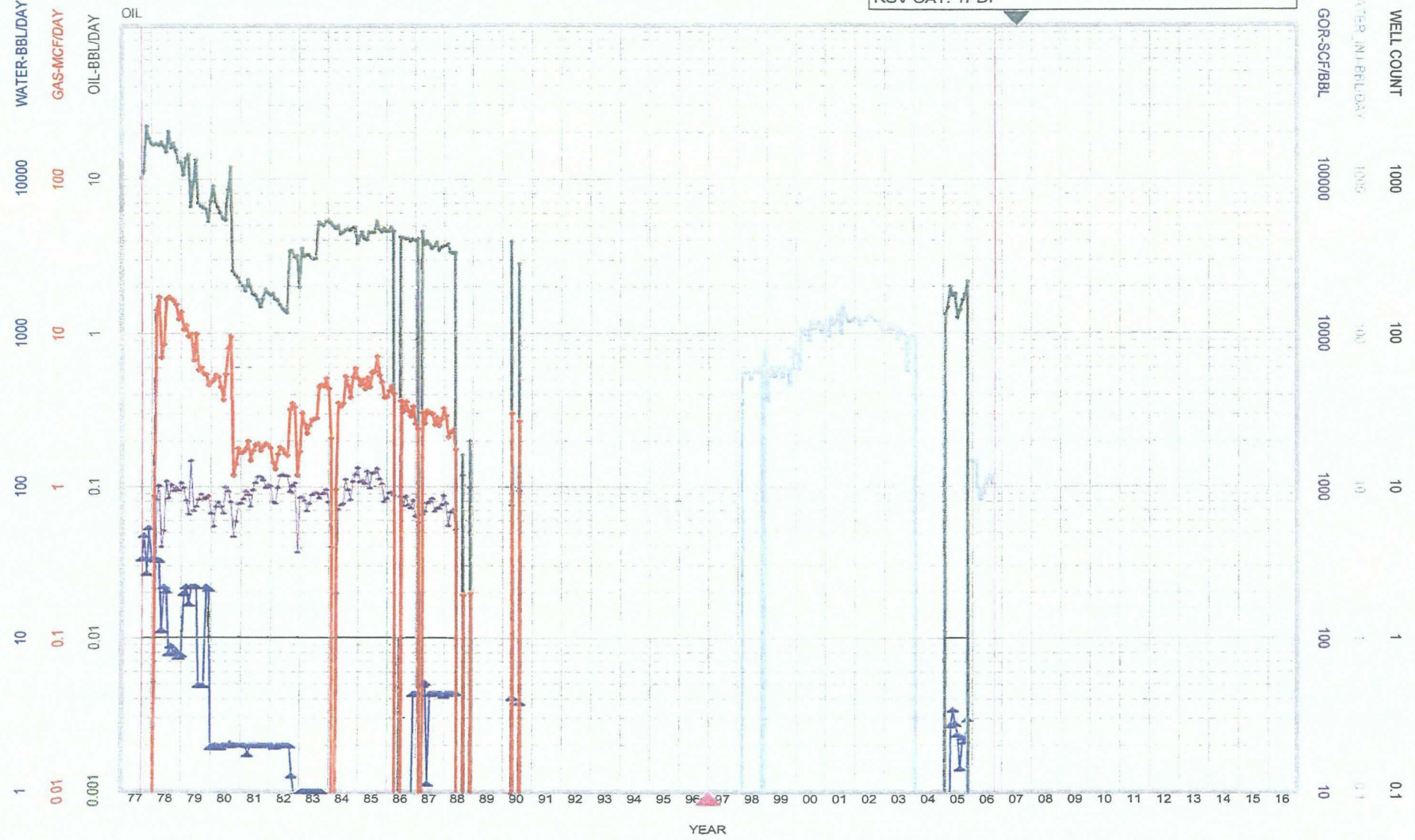
Cum=	18919	Cum=	27209	Cum=	16399	Cum=	0

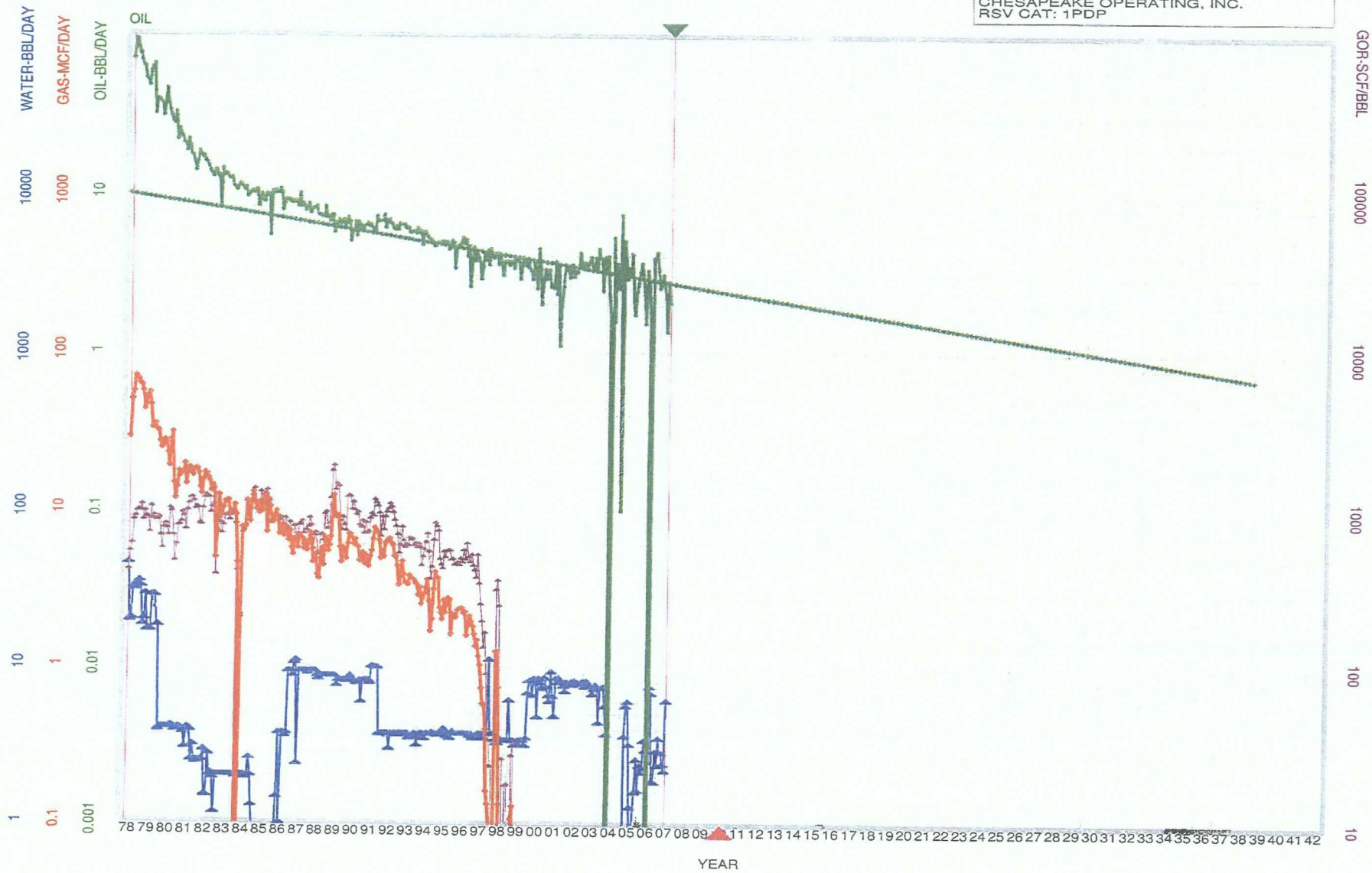
SEQ #:1370 QUAIL STATE 1 SI INJ
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	17581	Cum=	23472	Cum=	0	Cum=	206908	Cum=	142
Cum=	23961										
Rem=	0										
EUR=	23961										
Yrs=	0.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										

SE [redacted] 136 [redacted] QUA [redacted] STATE 2

QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



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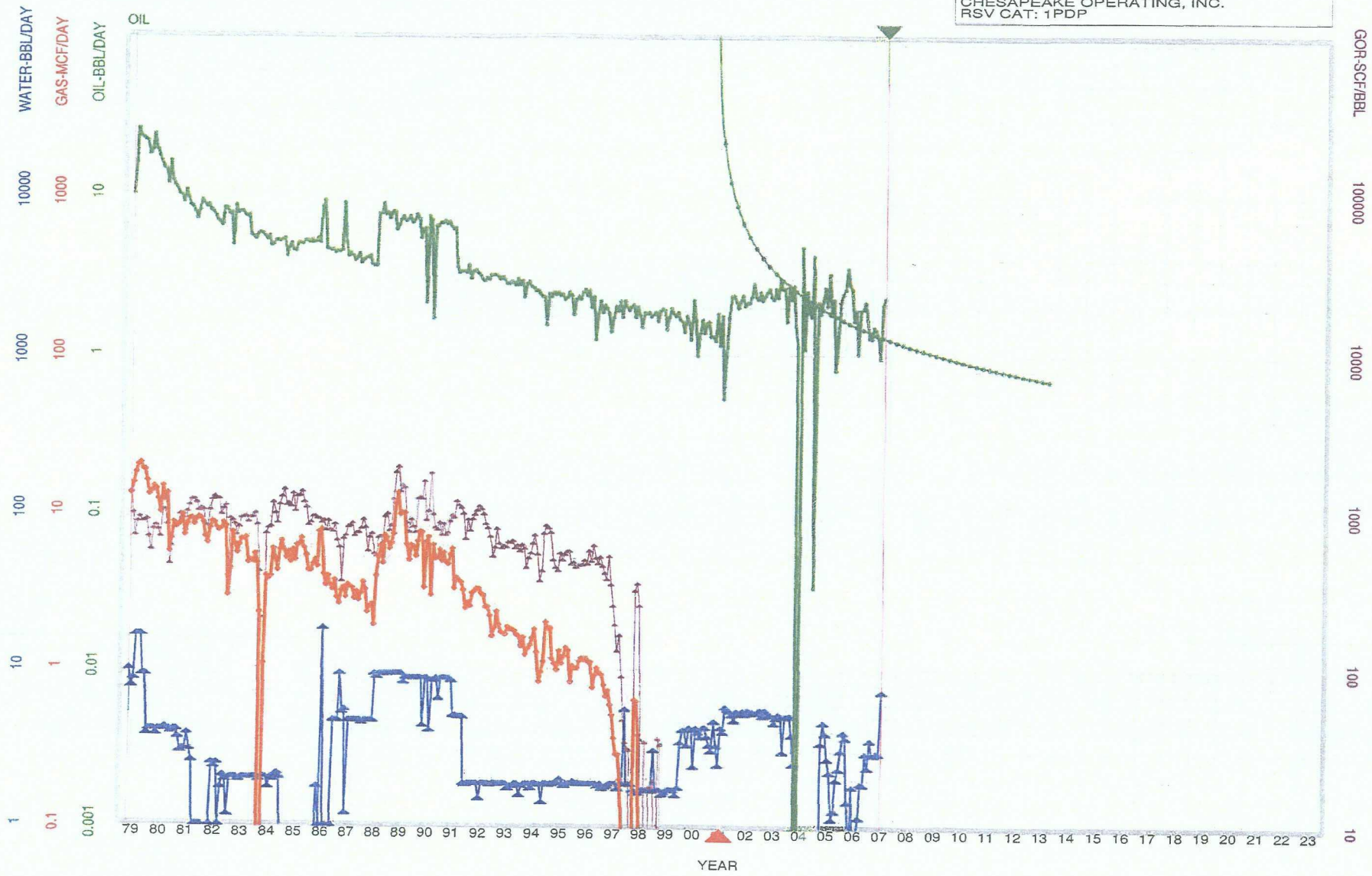
Ref=	7/2007	Cum=	78634	Cum=	62942	Cum=	0
Cum=	107142						
Rem=	17227						
EUR=	124369						
Yrs=	31.663						
Qref=	2.7						
De=	4.239793						
Dmin=	0.000						
b=	0.000000						
Qab=	0.7						

SEQ #:1368 QUAIL STATE SY

QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



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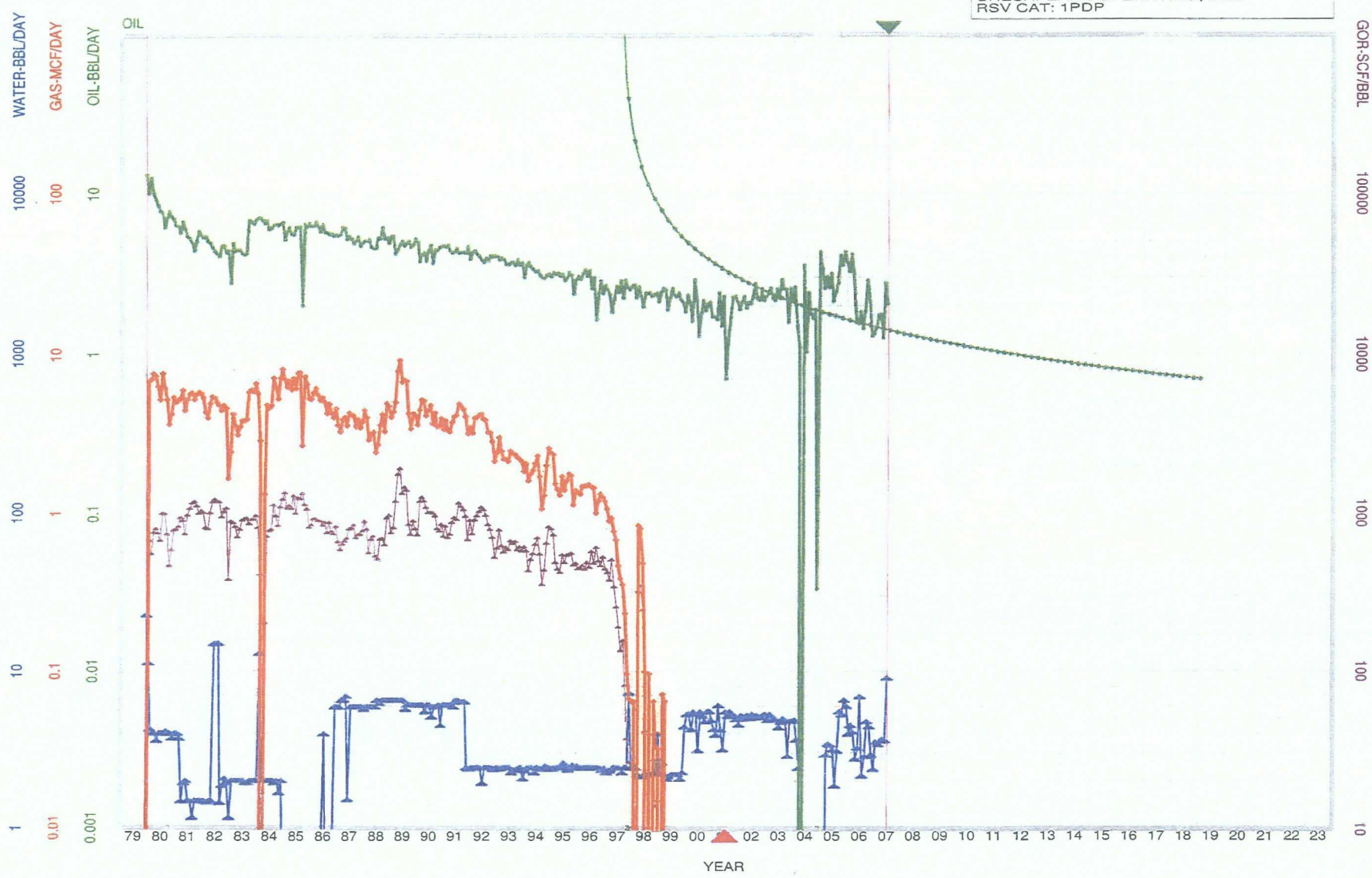
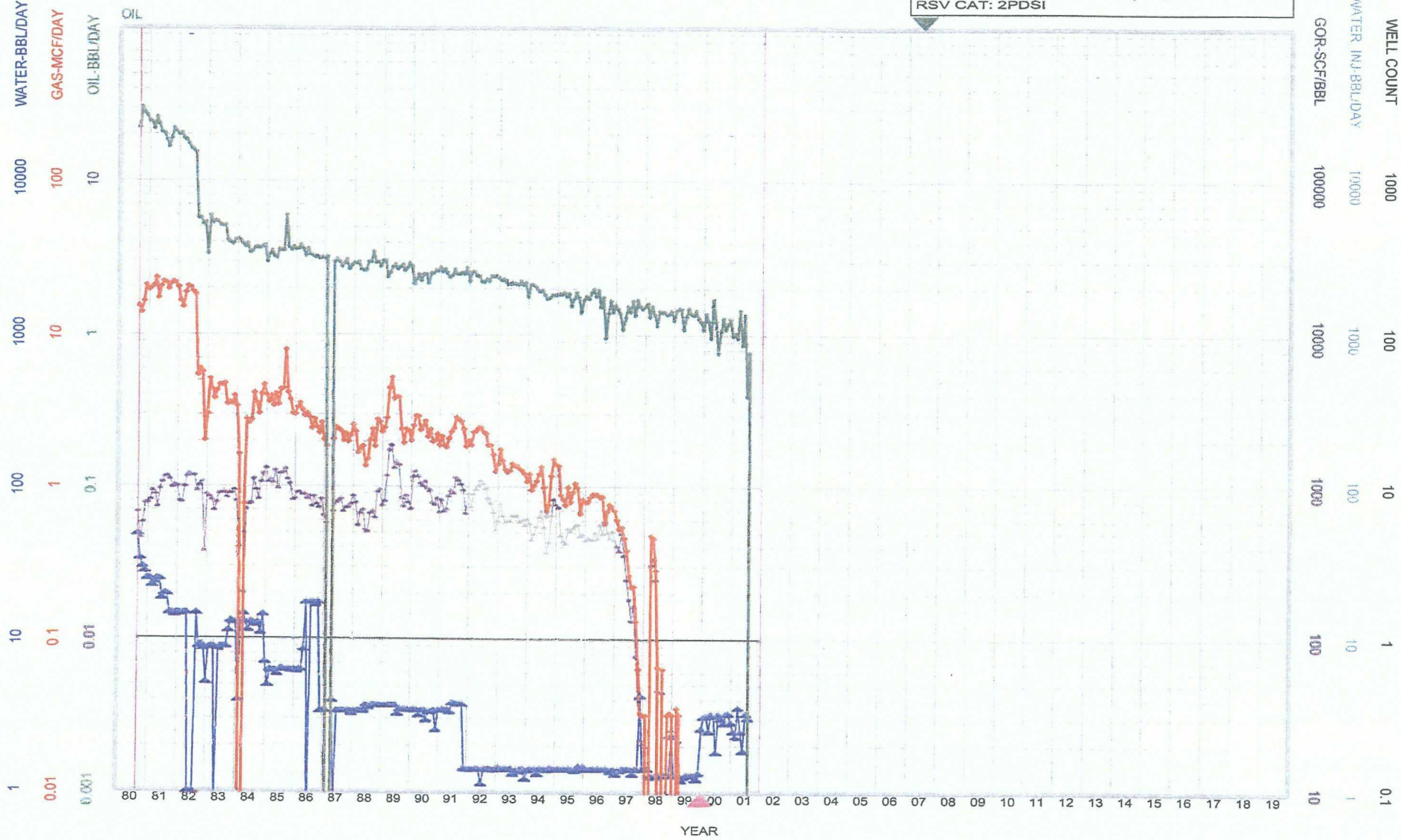
Ref=	7/2007	Cum=	33480	Cum=	36129	Cum=	0
Cum=	46709						
Rem=	2124						
EUR=	48833						
Yrs=	6.249						
Qref=	1.3						
De=	12.408345						
Dmin=	0.000						
b=	1.100000						
Qab=	0.7						

SEQ #:1307 QUAIL STATE 4
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



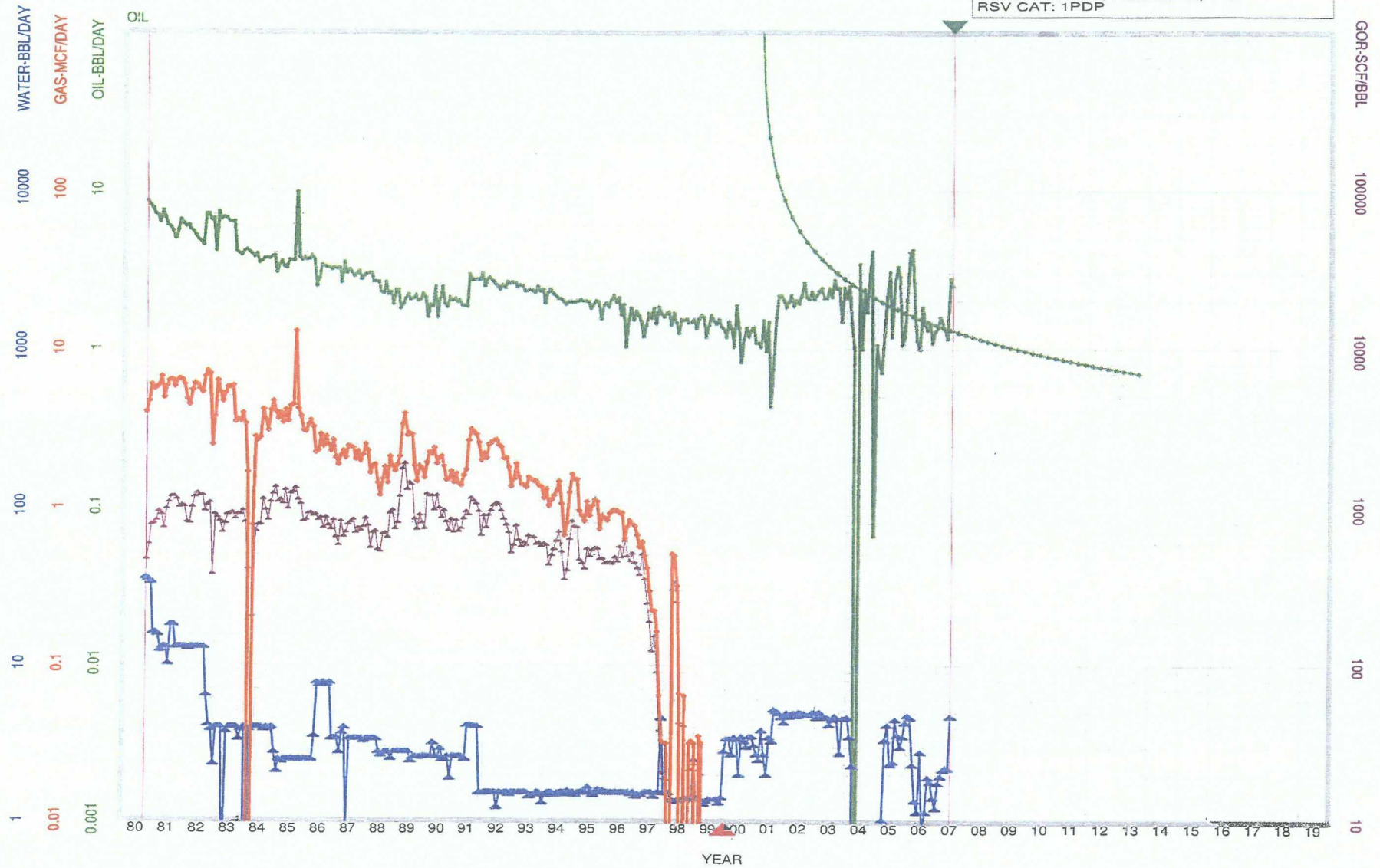
OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
Qual=	GGA0707	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	25358	Cum=	36434	Cum=	0
Cum=	39368						
Rem=	4132						
EUR=	43500						
Yrs=	11.748						
Qref=	1.4						
De=	8.362479						
Dmin=	0.000						
b=	1.100000						
Qab=	0.7						

SEQ #:1366 QUAIL STATE 5 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 2PDSI



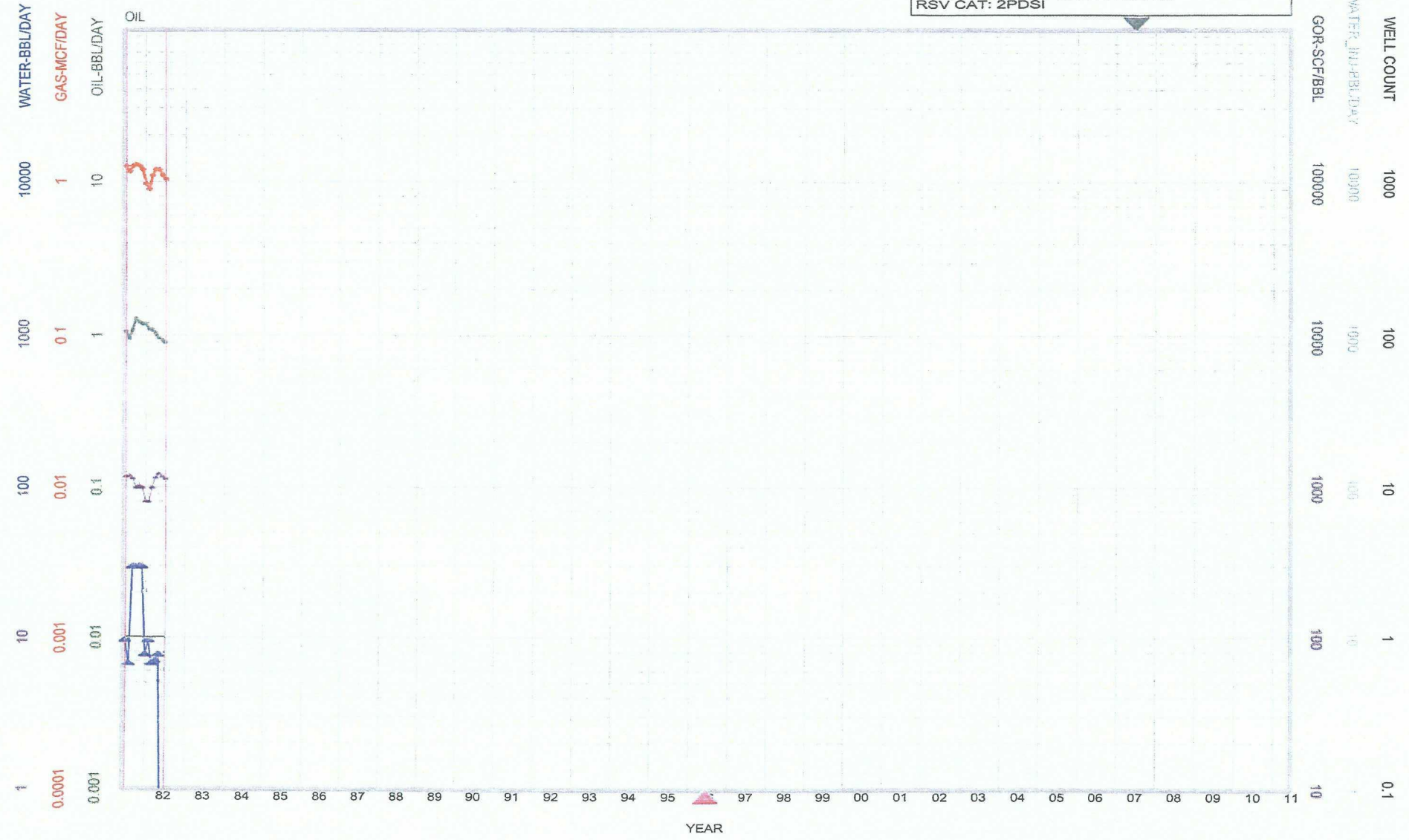
OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	26687	Cum=	41336	Cum=	0	Cum=	0	Cum=	257
Cum=	32623										
Rem=	0										
EUR=	32623										
Yrs=	0.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										

SEQ #:1365 QUAIL STATE 6
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP

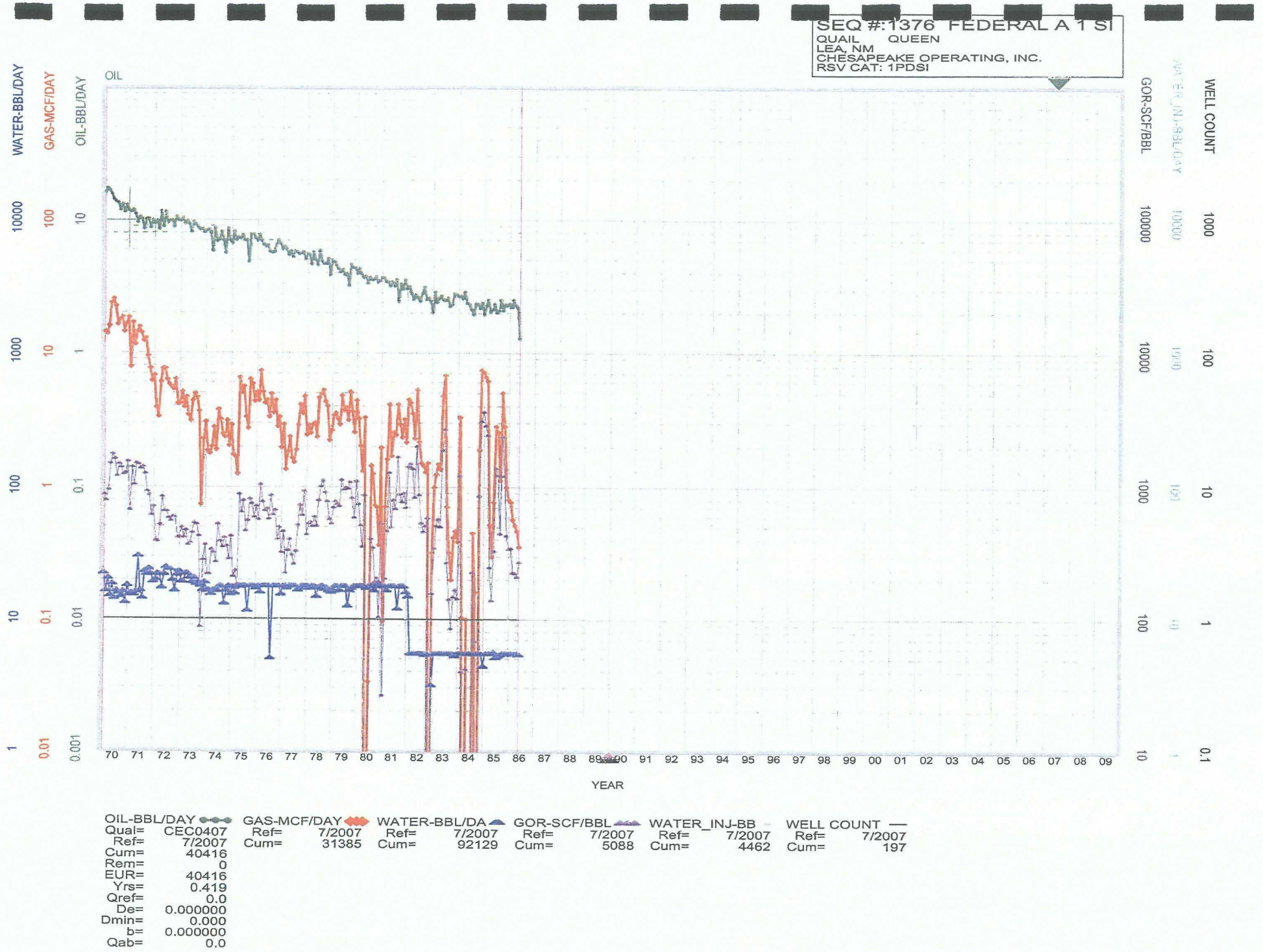


OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
Qual=	GGA0707	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	16653	Cum=	36260	Cum=	0
Cum=	26108						
Rem=	2165						
EUR=	28273						
Yrs=	6.334						
Qref=	1.3						
De=	12.408345						
Dmin=	0.000						
b=	1.100000						
Qab=	0.7						

SEQ #:1364 QUAIL STATE 7 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 2PDSI

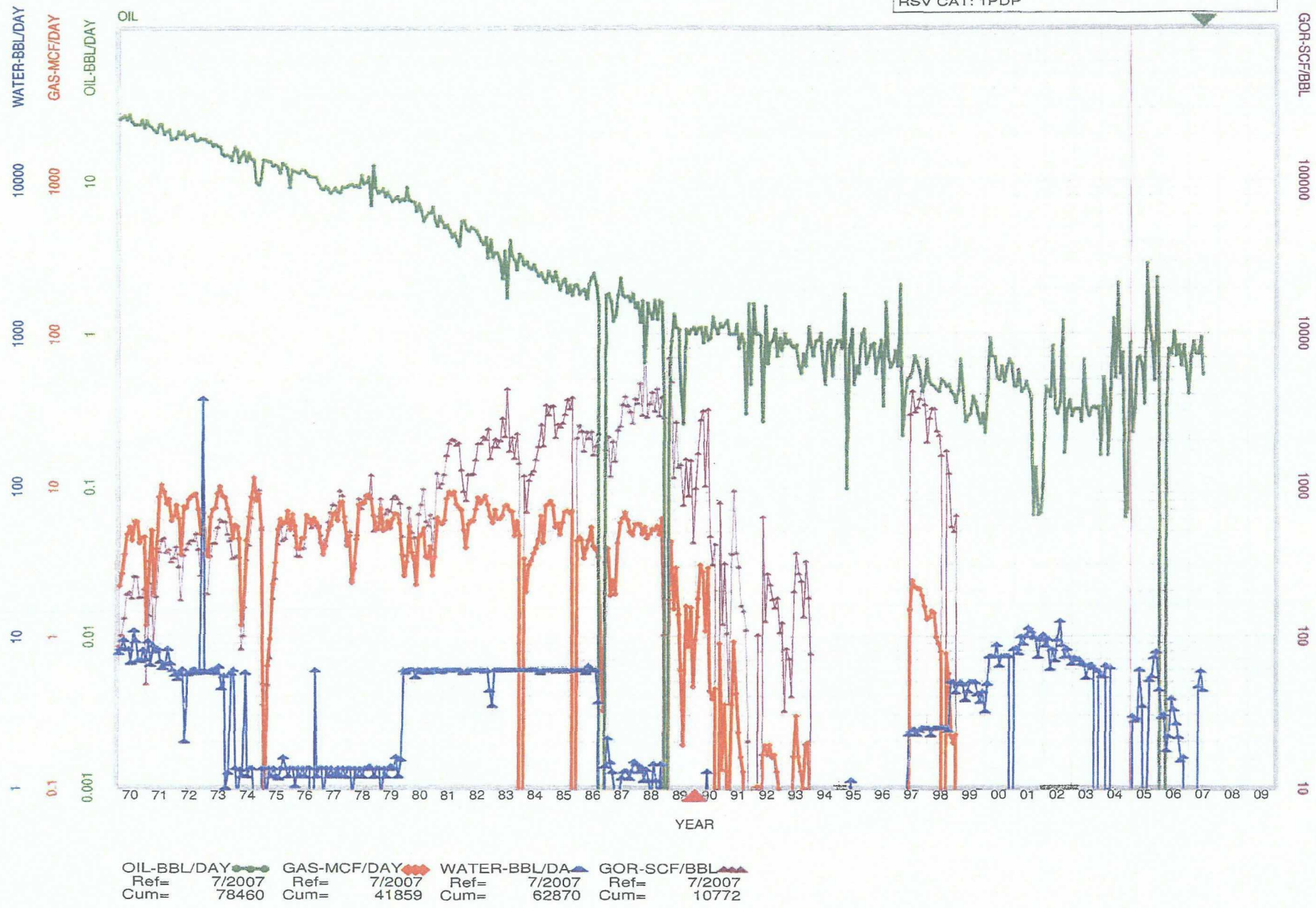


OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	455	Cum=	5360	Cum=	0	Cum=	0	Cum=	13
Cum=	429										
Rem=	0										
EUR=	429										
Yrs=	1.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										


SEQ #:1376 FEDERAL A 1 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDSI
OIL
WATER-BBL/DAY
GAS-MCF/DAY
OIL-BBL/DAY
GOR-SCF/BBL
WELL COUNT
YEAR
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09
OIL-BBL/DAY
Qual= CEC0407
Ref= 7/2007
Cum= 40416
Rem= 0
EUR= 40416
Yrs= 0.419
Qref= 0.0
De= 0.000000
Dmin= 0.000
b= 0.000000
Qab= 0.0
GAS-MCF/DAY
Ref= 7/2007
Cum= 31385
WATER-BBL/DA
Ref= 7/2007
Cum= 92129
GOR-SCF/BBL
Ref= 7/2007
Cum= 5088
WATER_INJ-BB
Ref= 7/2007
Cum= 4462
WELL COUNT
Ref= 7/2007
Cum= 197

[redacted] PENNZOIL STATE 1

QUAIL
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP

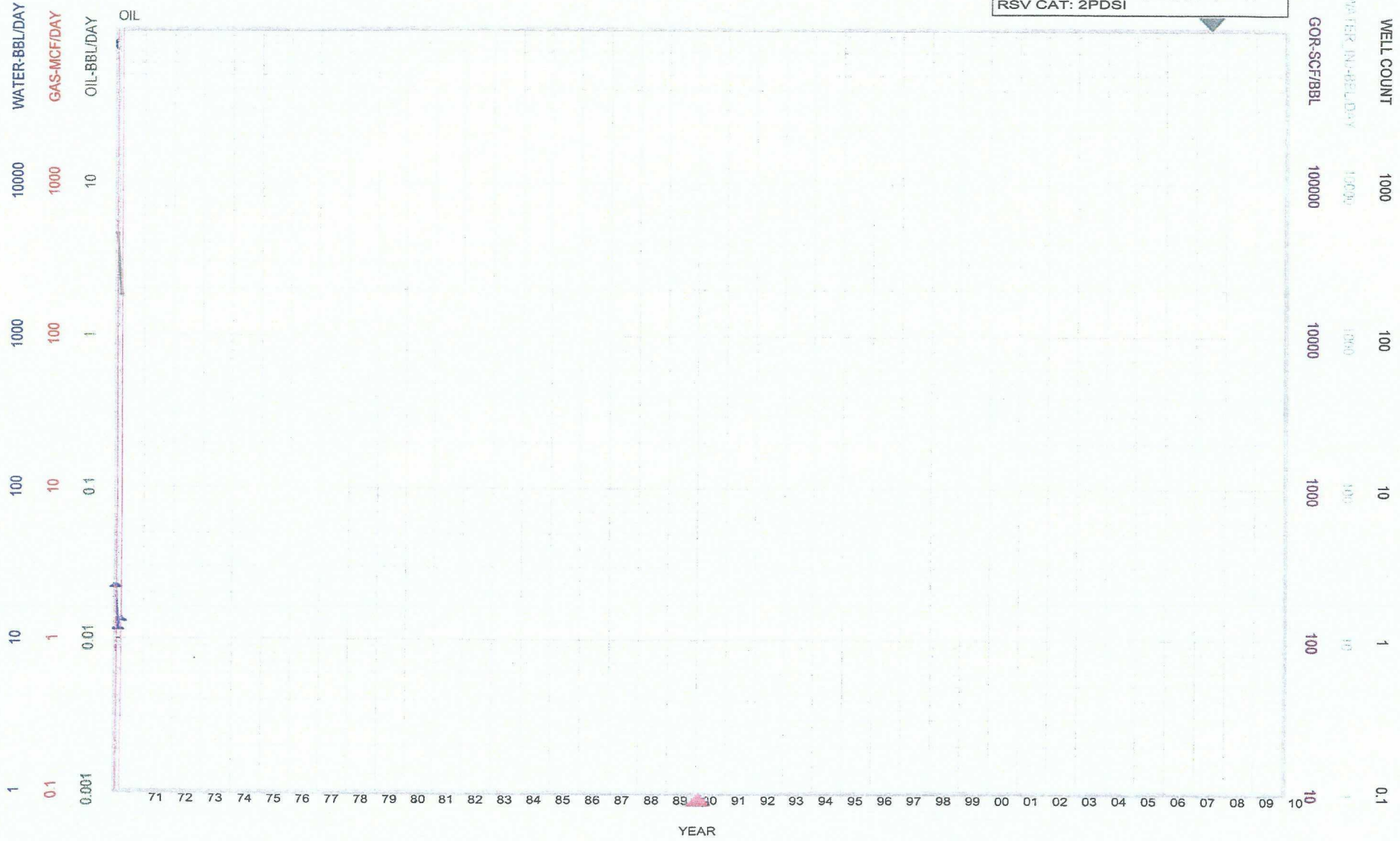


OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Cum=	78460	Cum=	41859	Cum=	62870	Cum=	10772

SEQ #:1379 STATE BH 1 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: UNKNOW

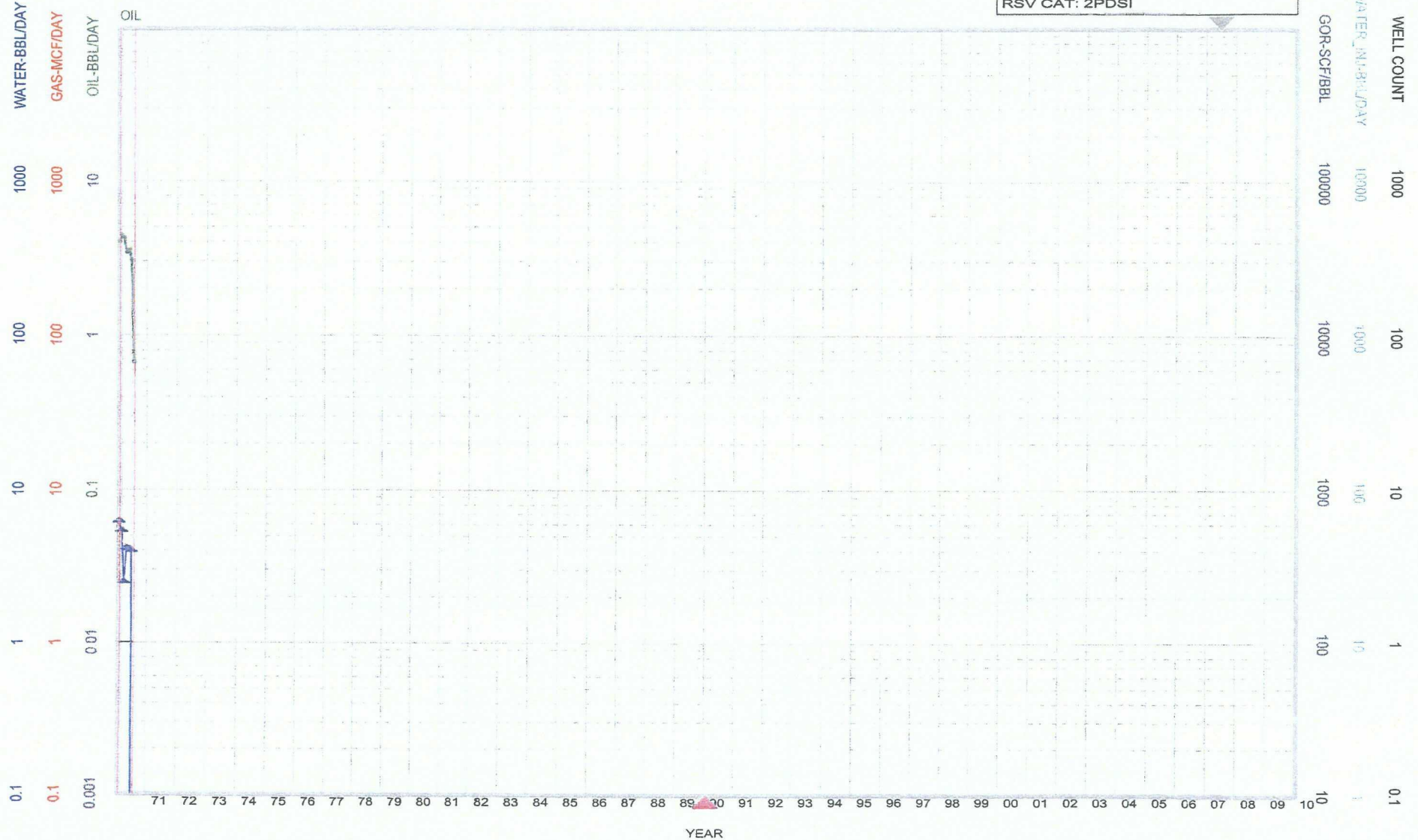
OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	2109	Cum=	13333	Cum=	7232	Cum=	13325	Cum=	0
Cum=	7232										
Rem=	0										
EUR=	7232										
Yrs=	0.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										

SEQ #:1374 MOBIL 1 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 2PDSI

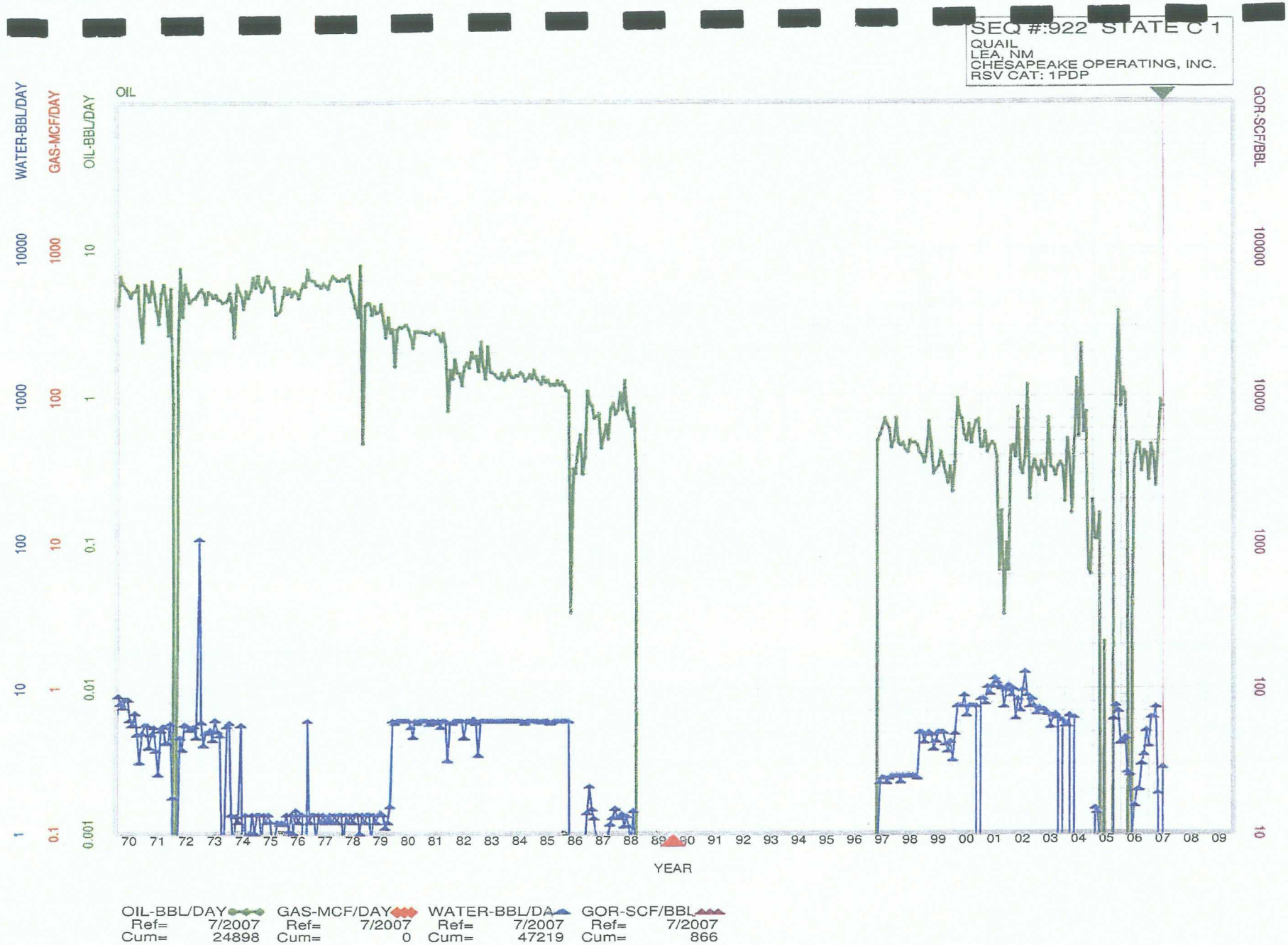


OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	492	Cum=	9483	Cum=	2969	Cum=	8039	Cum=	3
Cum=	3243										
Rem=	0										
EUR=	3243										
Yrs=	0.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										

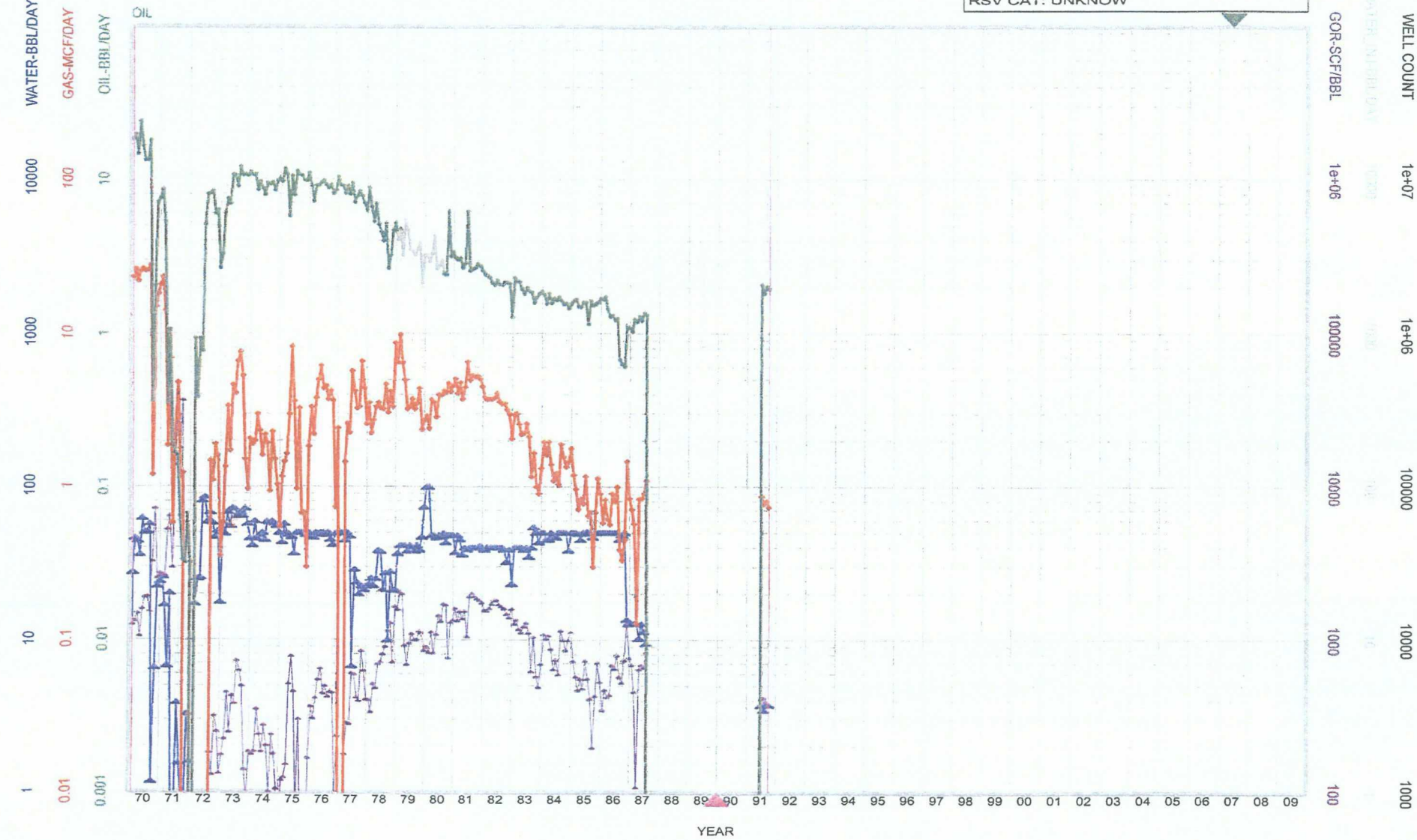
SEQ #:1377 STATE 1 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 2PDSI



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	0	Cum=	1821	Cum=	962	Cum=	1020	Cum=	7
Cum=	1667										
Rem=	0										
EUR=	1667										
Yrs=	0.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										

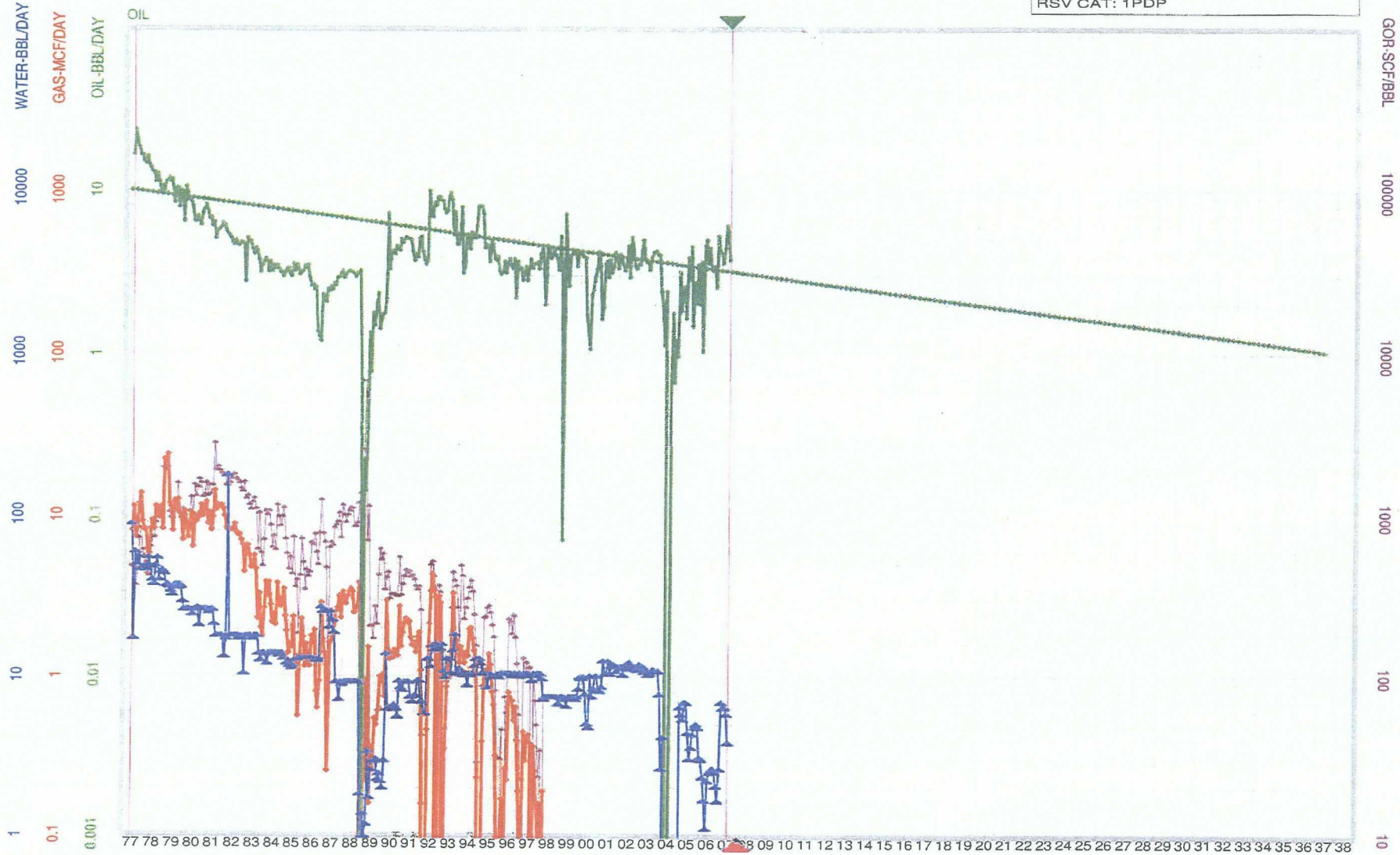

SEQ #:922 STATE C 1
QUAIL
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP
OIL
WATER-BBL/DAY
GAS-MCF/DAY
OIL-BBL/DAY
GOR-SCF/BBL
10000
1000
100
10
1
0.1
0.001
100000
10000
1000
100
10
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09
YEAR
OIL-BBL/DAY
Ref= 7/2007
Cum= 24898
GAS-MCF/DAY
Ref= 7/2007
Cum= 0
WATER-BBL/DA
Ref= 7/2007
Cum= 47219
GOR-SCF/BBL
Ref= 7/2007
Cum= 866

SEQ #:1378 STATE BG 1 SI
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: UNKNOW



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL		WATER_INJ-BB		WELL COUNT	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	45236	Cum=	321428	Cum=	33805	Cum=	57047	Cum=	0
Cum=	66301										
Rem=	0										
EUR=	66301										
Yrs=	0.419										
Qref=	0.0										
De=	0.000000										
Dmin=	0.000										
b=	0.000000										
Qab=	0.0										

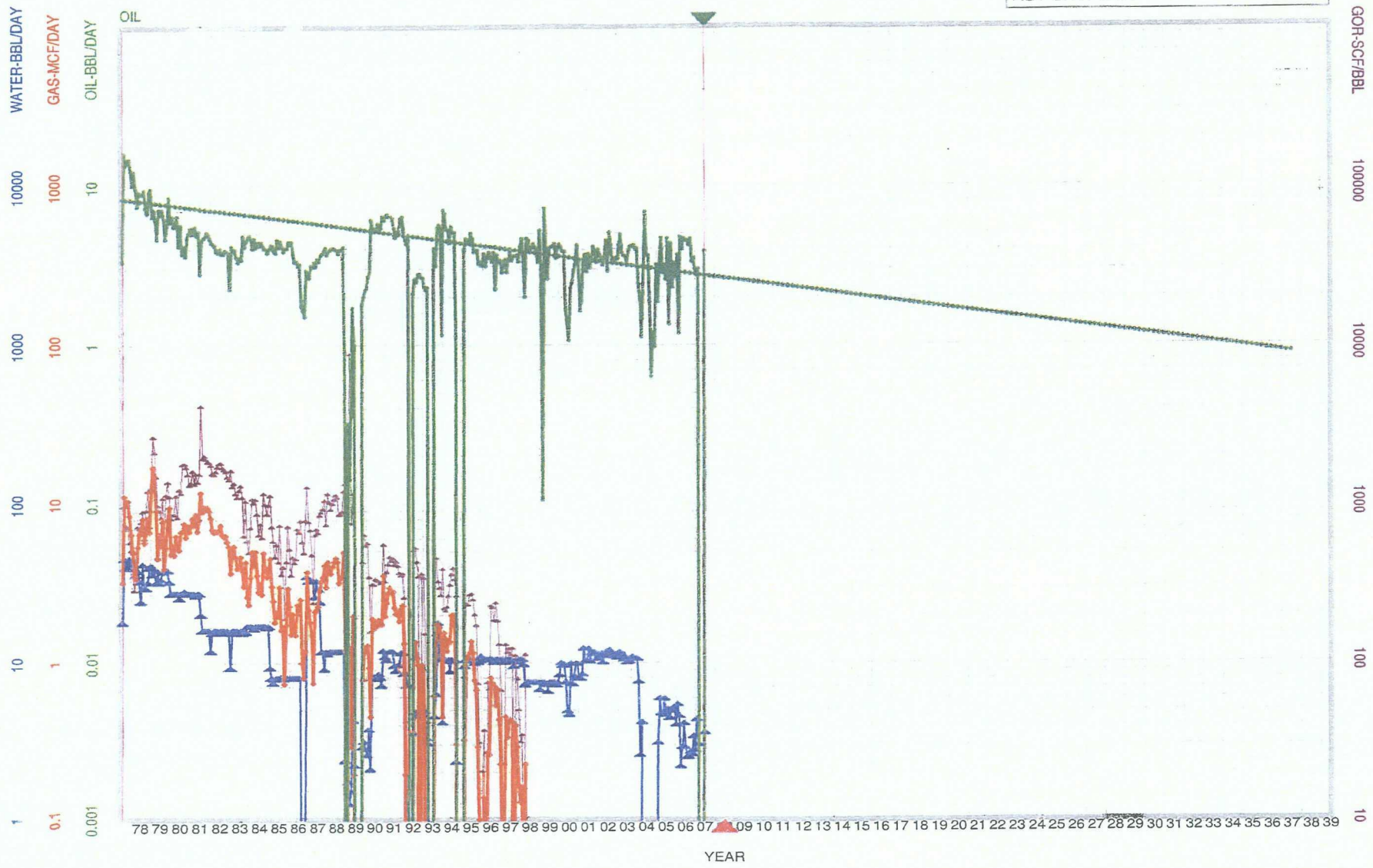
SEQ #:1372 STATE BG 2
QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
Qual=	CEC0407	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	30087	Cum=	156536	Cum=	0
Cum=	52522						
Rem=	21187						
EUR=	73709						
Yrs=	30.082						
Qref=	3.2						
De=	3.700000						
Dmin=	0.000						
b=	0.000000						
Qab=	1.0						

[redacted] #:[redacted]1 S[redacted]TE [redacted]3

QUAIL QUEEN
LEA, NM
CHESAPEAKE OPERATING, INC.
RSV CAT: 1PDP



OIL-BBL/DAY		GAS-MCF/DAY		WATER-BBL/DA		GOR-SCF/BBL	
Qual=	GGA0707	Ref=	7/2007	Ref=	7/2007	Ref=	7/2007
Ref=	7/2007	Cum=	24222	Cum=	135030	Cum=	0
Cum=	44121						
Rem=	17980						
EUR=	62101						
Yrs=	30.082						
Qref=	2.7						
De=	3.678537						
Dmin=	0.000						
b=	0.000000						
Qab=	0.9						

Quail Queen Field
OOIP Calculation

Appendix B

Reservoir Parameters:

BHT = 113°F	p_i = 1,848 psi	P_{sp} (est.) = 100 psi
p_b = 1,255 psi	T_{sp} (est.) = 90°F	R_{si} = 300 cf/bbl
Gas G = 0.9	β_{oi} = 1.15	Oil G = 33° API
β_{ob} = 1.15	p_{ab} = 250 psi	β_{oab} = 1.04
p_{cur} = 450 psi	β_{ocur} = 1.06	

OOIP Calculation:

Queen B

$$OOIP = \frac{7758 * Ah * \Phi * (1-S_w)}{\beta_{oi}} = \frac{7758 * 2874 * 0.10 * (1- 0.49)}{1.15}$$

= 988,800 STB

Queen C

$$OOIP = \frac{7758 * Ah * \Phi * (1-S_w)}{\beta_{oi}} = \frac{7758 * 7212 * 0.13 * (1- 0.45)}{1.15}$$

= 3,478,673 STB

Queen B and Queen C

OOIP = 988,800 + 3,478,673 = **4,467,473 STB**

Appendix C

Proposed Quail Queen Unit
Waterflood Calculations

Reservoir Parameters:

BHT = 113°F	p_i = 1,848 psi	P_{sp} (est.) = 100 psi
p_b = 1,255 psi	T_{sp} (est.) = 90°F	R_{si} = 300 cf/bbl
Gas G = 0.9	β_{oi} = 1.15	Oil G = 33° API
β_{ob} = 1.15	p_{ab} = 250 psi	β_{oab} = 1.04
p_{cur} = 450 psi	β_{ocur} = 1.06	μ_{ocur} = 4.21cp
μ_{wcur} = 0.915		

1. As previously calculated in Appendix B

   OOIP = N = 4,467,473 STB

2. Oil Saturation at primary abandonment pressure of 250 psi

$$S_{or\text{-}pri} = (1 - \Delta N_p/N)(\beta_{oab}/\beta_{oi})(1 - S_w)$$

$$= [1 - (866{,}568/4{,}467{,}473)](1.04/1.15)(1 - 0.45)$$

$$= (0.8060)(0.9043)(0.55)$$

$$= 0.4009$$

Estimating water injection to start by July 1, 2008 then oil saturation at start of flood is calculated with current pressure and another 8,390 bbls of oil produced.

$$S_{ocur} = [1 - (874{,}958/4{,}467{,}473)](1.06/1.15)(1 - 0.45)$$

$$= (0.8041)(0.9217)(0.55)$$

$$= 0.4077$$

3. Mobility Ratio = $\lambda_w/\lambda_o = (k_{rw}/\mu_w) / (k_{ro}/\mu_o)$

Mobility of the water in the water bank

The fractional flow curve shows the average water saturation in the water bank is 54 percent. At this water saturation the relative permeability curve shows the k_{rw} to be 0.12. The viscosity of the water at 450 psi is 0.915.

$$\lambda_w = k_{rw}/\mu_w = 0.12/0.915 = 0.13$$

Mobility of the oil in the oil bank

In the oil bank the relative permeability to oil is 100 percent.

$$\lambda_o = k_{ro}/\mu_o = 1.0/4.21 = 0.23$$

Mobility Ratio = M = 0.13/0.23 = 0.57

M is less than 1 which is favorable for waterflooding because it is easier for water to displace oil in the reservoir.

4. Permeability Variation (See Attachment No. 15)

$$V = \frac{k_{50} - k_{84}}{K_{50}} = \frac{3.2 - 0.55}{3.2} = \frac{2.65}{3.2} = 0.828$$

V less than 0.75 is good , so this value indicates a fairly high level of variation.

5. Volumetric Sweep Efficiency

Empirical correlation with 100 layer Higgins-Leighton streamtube model show WOR = 25, E_v = 70% and at a WOR = 50, E_v = 72%

Refer to Fig.'s 6.22 and 6.23, Page 206, Wilhite's SPE Text Vol. 3.

6. Waterflood Recovery

Secondary Reserves = 7758 Ah Φ ($S_{or\text{-}pri} - S_{or}$) E_v / β_{ocur}

= [7758 * 10,086 * 0.13 (0.4009 – 0.30) 0.72] / 1.06

= 697,156 STB

Secondary Recovery Factor = 697,156/4,467,473 = 0.156

Secondary : Primary Ratio = 697,156/866,568 = 0.805

7. Gas Saturation estimated at start of flood

Assume injection begins July 1, 2008

$S_{oc} = (1 - \Delta N_p / N) (\beta_{ocur} / \beta_{oi}) (1 - S_w)$

$= (1 - (866,568/4,467,473)) (1.06 / 1.15) (1-0.45)$

$= 0.806 * 0.9217 * 0.55$

$= 0.4085$

$S_{gc} = 1 - S_{oc} - S_w$

$= 1 - 0.4085 - 0.45$

$= 0.14$

8. Water Injection at Fillup

$W_{if} = 7758 A\Phi h S_{gc}$

$= 7758 (1788) (0.13) (5.64) (0.14)$

$= 1,423,862$ BBLS