GUIDE TO ARTICLES

SAMSON GEOLOGICAL EXHIBITS

RON JOHNSON
SENIOR GEOLOGIST

EXHIBIT #1

ROSWELL GEOLOGICAL SOCIETY SYMPOSIUM

Author: Symposium Committee
Affiliation: Roswell Geological Society
Date: September 15, 1966

Field Name: Osudo Morrow
Location: T-20 & 21-S, R-35 & 36-E
County & State: Lea County, New Mexico

Discovery Well: British American Oil Producing Co. #1 North Wilson Deep Unit
SW/4 SE/4, Section 31, T-20-S, R-36-E

Exploration Method Leading to Discovery: Seismic

Pay Zone:
Formation Name: Morrow **Depth & Datum Discovery Well:** 11350 (-7694)
Lithology Description: Sandstone, coarse, angular, poorly sorted, orthoquartzite

Approximate average pay: 20 gross 20 net **Productive Area** 3840 acres

Type Trap: Stratigraphic trap. Pay consists of pinchout of several small sand bodies along west side of a strong positive structure

Reservoir Data:
5-10 % Porosity, ____ Md Permeability, 25-40 % Sw, ____ % So
Oil: 51.2 gravity
Gas: .620 gravity
Water: none Na+K, ____ Ca, ____ Mg, ____ Cl, ____ SO_4, ____ CO_3, or HCO_3, ____ Fe
Specific Gravity ____ **Resistivity** ____ ohms @ ____ °F
Initial Field Pressure: 6800 psi @ -7550 datum **Reservoir Temp.** 165 °F
Type of Drive: Gas expansion

Normal Completion Practices: Set casing through pay, perforate, and complete natural. Some wells need stimulation.

Type completion: **Normal Well Spacing** 640 Acres

Deepest Horizon Penetrated & Depth: Devonian 12,670 -9014

Other Producing Formations in Field: Wolfcamp, Strawn, Atoka, Yates

Production Data:

YEAR	TYPE	No. of wells @ yr. end		PRODUCTION OIL IN BARRELS GAS IN MMCF		YEAR	TYPE	No. of wells @ yr. end		PRODUCTION OIL IN BARRELS GAS IN MMCF	
		Prod.	S.I. or Abd.	ANNUAL	CUMULATIVE			Prod.	S.I. or Abd.	ANNUAL	CUMULATIVE
1964	OIL	1		112	112		OIL				
	GAS			6	6		GAS				
1965	OIL	1		16,900	17,012		OIL				
	GAS			1,644	1,650		GAS				
1966*	OIL			12,913	29,925		OIL				
	GAS			1,501	3,151		GAS				
	OIL						OIL				
	GAS						GAS				

* Production to July 1, 1966

parameters used in the analysis were compiled from log data, completion data, drill stem test information, well performance curves, and P/Z (bottom hole pressure vs. time) curves. The data covered the period of time from the completion of the discovery well in April, 1960, up to approximately January, 1981.

The analysis demonstrated that the average drainage per well in this gas field was 257 acres. An original gas in place (OGIP) per acre was computed and then compared with the OGIP obtained from actual well performance as seen on P/Z curves. From this comparison, the calculated drainage per well was obtained. Pressure versus time plots were prepared for each well in the field. Well plots were then partitioned into three geographical sections and displayed.

Figure 19 illustrates some of well plots in the southern part of the field. Observed is a lack of interference between offset wellbores. As new wells were drilled, almost all initially were at or near virgin reservoir pressure. This was the case for most throughout the field. Note also the considerable variation in the bottom hole pressure of offset wellbores. Such plots verified that the connectivity of reservoir units was lower than previously thought, and that the Morrow sandstones reservoirs were not being effectively drained. An expected average ultimate gas recovery per well of 4.01 billion cubic feet was obtained from extrapolation of P/Z plots. It was estimated from this analysis that the drilling of WCP infill wells would recover at least an additional 1.48 billion cubic feet of gas per well.

Morrow Sandstone Reservoir Properties

Based on well logs, the thickness of the individual productive sandstone bodies ranges from 5 to 55 feet. The average thickness is 8 feet. Reservoir porosity varies from 5 to 20 percent with the average being 9 percent. Permeability varies from less than 1.0 millidarcy to 50 millidarcies, the former being the most prevalent. Water saturation averages 30 percent, but ranges from less than 10 percent to 47 percent.

Detailed petrographic analyses of well cuttings and cores from Morrow sandstones in southeastern New Mexico (e.g. Kauffman, 1974a) reveal that the sands are composed of 50-95 percent white monocrystalline quartz. They are poorly to well sorted, subangular to subrounded, and fine to coarse grained. The sandstones contain minor amounts of glauconite, calcite, feldspars, micas, pyrite, biotite, horneblende, zircon, and various clays, predominantly kaolinite and montmorillonite with traces of illite and chlorite (Kauffman, 1974a; Kauffman, 1974b; Mazzullo and Mazzullo, 1987). Some portions of the grains are strained, while others are minutely fractured, crushed or sheared. Occasional pressure solution and sutured contacts are observed (Kauffman, 1974a). Feldspars are present and include microcline, albite-oligoclase, and rare orthoclase, but constitute less than 3 percent of the total rock composition (Kauffman, 1974a). These petrographic analyses reveal that the parent rocks were granites and granite gneisses.

Pieces of coal and very carbonaceous materials are occasionally observed in well cuttings. Carbonates are present in most of the intervals and are second only to the quartz component in their abundance and distribution. Of the carbonate types observed, calcite dominates over dolomite and is both interstitial and matrix (Kauffman, 1974a). Lithologic units are moderately-consolidated to well-consolidated with calcite and quartz as the most prevalent cements. Shales are present as very thin laminae. Cements and clays reduce porosity and permeability by filling intergranular pores and increasing the specific surface area and tortuosity of the sands (Fig. 20) (Neasham, 1977; Wilson and Pittman, 1977). However, a certain amount of

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southeastern New Mexico during the early Pennsylvanian. The Delaware Basin is bordered by the Huapache Fault in the southwest, the Northwestern Shelf to the north, the Tatum Basin to the northeast, and the Central Basin Platform to the west (Figure 1). The Pedernal uplift to the Northwest provided the sediment filling for the Delaware Basin and the Northwest Shelf (Cys and Gibson, 1988).

The sediments that were deposited during Pennsylvanian time range from shallow-marine carbonates to basinal shales to several different siliciclastic materials. The Morrow was deposited during a time of alternating transgression and regression with maximum clastic deposition in the middle and lower Morrow intervals deposited on the Mississippian Formation. The upper Morrow (limestone), followed by the Atoka Formation, was deposited on top of

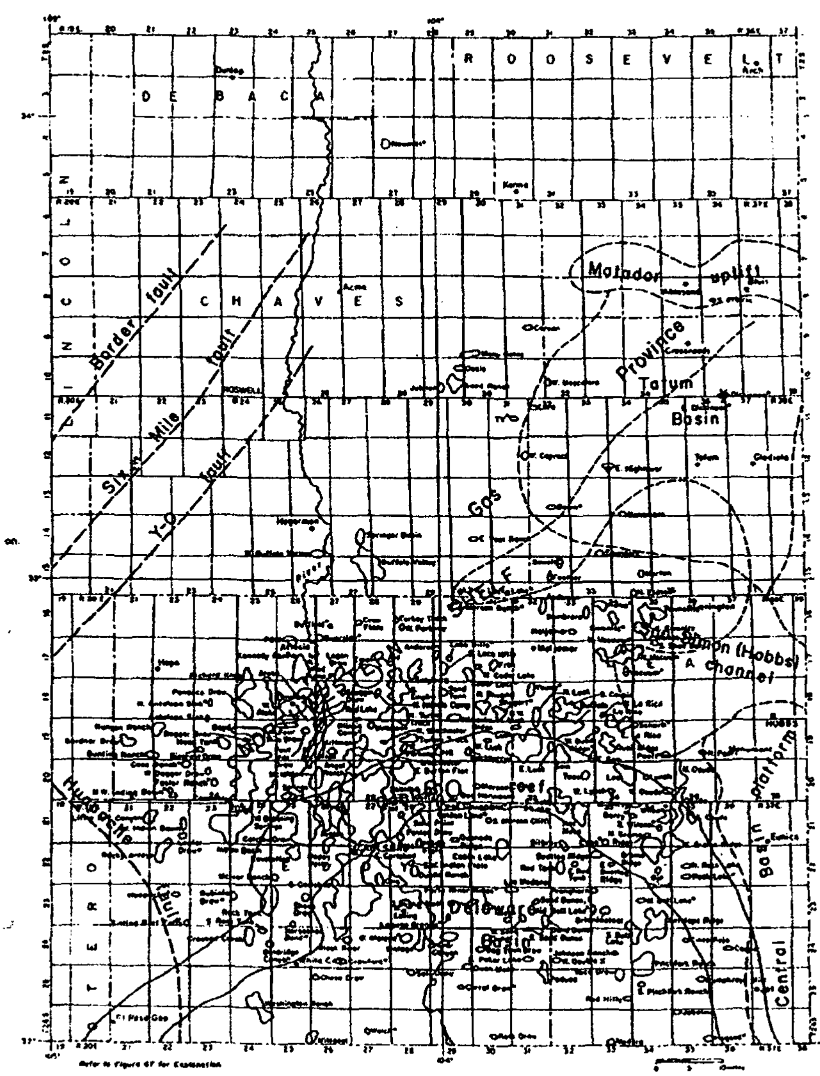

Figure 1. Oil and gas fields producing from the Morrow Formation, also illustrating major structural features (Grant and Foster, 1989)

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Four producing-zone maps have been prepared for the Pennsylvanian (Figs. 90 through 93). The first includes Cisco and Canyon production and those fields that produce both from the Upper Pennsylvanian and Wolfcamp. These fields also are shown on the Wolfcamp map (Fig. 86). Figures 91 through 93 are for the Strawn, Atoka, and Morrow intervals. As noted in the discussion of the Wolfcamp there is a fairly well defined pattern of oil and gas production. This also is true for the Pennsylvanian and the approximate boundary is shown on each map. Almost all of the oil fields have limestone as the reservoir rock and the majority of the gas fields have sandstone. This seems to be a more significant factor than depth except in the deeper parts of the Delaware Basin. The occurrence of oil is more restricted in the Atoka and Morrow intervals than in the Strawn or Upper Pennsylvanian.

Areas for exploration are fairly well defined by established production. A wide variety of trap conditions exists. Most important are stratigraphic and combination stratigraphic-structural traps. Reefs, phylloid algal mats, and anticlines are locally important. Pennsylvanian rocks are absent on the Central Basin platform and in the northwestern part of the area on the Pedernal and Lower Pennsylvanian uplifts.

A broad east–west uplift occurred across central and parts of northern New Mexico in Late Mississippian–Early Pennsylvanian time. This resulted in the removal mostly of Mississippian strata that had overlapped Devonian and older sediments. This uplift may have extended somewhat farther south between Roswell and Carrizozo. South of this line it appears that a fairly complete section of Pennsylvanian was deposited. To the north on the early uplift successively younger rocks of Pennsylvanian age overlap onto the eroded Precambrian. It is this area to the north and northwest that served as a source for the clastic deltaic deposits in the Atoka and Morrow. In Late Pennsylvanian–Early Permian time, the main period of north–south faulting occurred that resulted in the Pedernal uplift and removal of the Pennsylvanian and in most cases older Paleozoic rocks from the southern part of this uplift. The potential for unconformity traps exists in the Pennsylvanian where it overlaps older rocks. In the southern part of the Pedernal uplift and on the Central Basin platform additional unconformity traps could be present in the Pennsylvanian beneath the Permian.

(*Text continued on page 75.*)

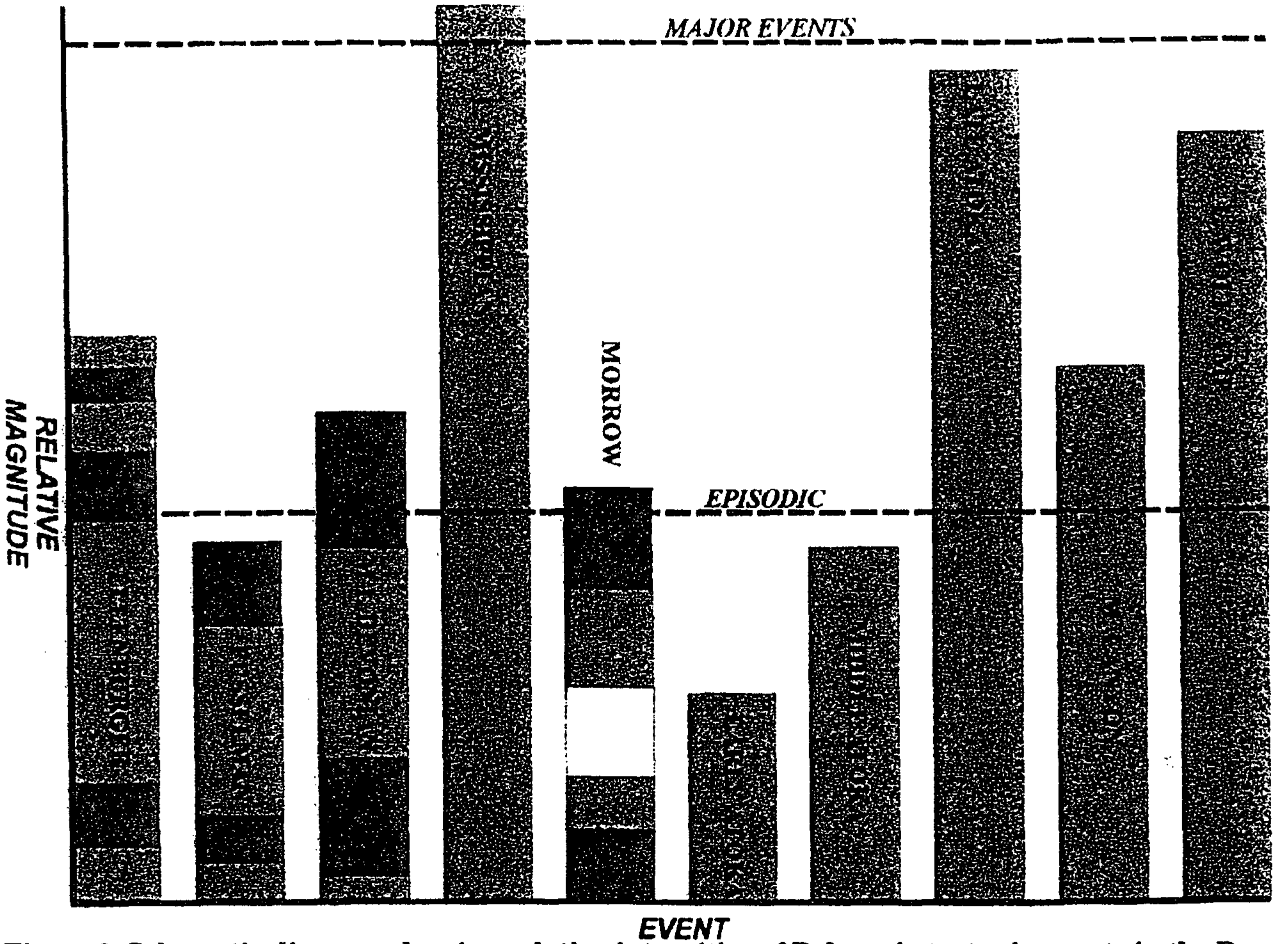

Figure 3. Schematic diagram showing relative intensities of Paleozoic tectonic events in the Permian Basin of southeastern New Mexico.

a significant tectonic uplift and exposure event in Middle Atokan time (Mazzullo, 1999b). As with earlier Paleozoic carbonates, these events influenced continuity or preservation of sandstone reservoirs throughout the Lower Pennsylvanian section.

Morrow Tectonic/Sedimentological Development

In the Permian Basin of southeastern New Mexico, geologic models of the Morrow often assume that its deposition occurred during a time of relative tectonic quiescence. The model often used assumes that prior to the Morrowan, the Upper Mississippian was subjected to a prolonged period of exposure and widespread peneplanation that provided a broad, sloping alluvial plain on which Morrow sediments were deposited, especially in areas of Eddy County where large, deep structures are not prevalent. On the contrary, the Lower Pennsylvanian in the area of present-day southeastern New Mexico was a time of relative tectonic and glacio-eustatic instability, as previously stated. The primary direct influence on Morrow sedimentation was the emergence of the ancestral Pedernal Uplift to the northwest, which supplied most of the detritus that makes up the Morrow clastics (Figure 1). The low-relief Central Basin Platform at the time provided minor amounts of sediments locally, but its continued uplift had more of an effect on post-depositional modifications to existing sediment packages in the Morrow clastics rather than as a source of sediments.

Tectonic uplifts during Morrow deposition have not been universally recognized outside of the region marginal to the Central Basin Platform (Figure 1). In that region, the Morrow was completely removed in places by early post-depositional and Atokan uplift and erosion (Mazzullo, 1999b). Outside of that region, however, tectonic uplifts coupled with glacio-eustatic sea level lowstands resulted in areas where parts of the Morrow clastic section were eroded off at different times during and after its deposition. In those areas, the Morrow section was subjected to more subtle changes that resulted from a combination of exposure during lowstands of sea level, recurrent movement along deeper faults or anticlines, and non-deposition on pre-ex-

"The Permian Basin: Providing Energy For America", D. T. Grace, G. D. Hinterlong, eds.,
West Texas Geological Society Publ. # 99-106

Significance of Intraformational Unconformities in the Morrow Formation of the Permian Basin

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ABSTRACT

The tectonic history of the Morrow Formation in the Permian Basin involved numerous syngenetic and post-depositional uplift and exposure events which locally profoundly modified its siliciclastic reservoir section. These multiple events created numerous internal stratigraphic truncations or discontinuities. Consequently, stratigraphic correlations of pay sandstones and reservoir trends in the Morrow are often difficult, even between closely-spaced wells. Intraformational unconformities or re-activation surfaces are easily missed with conventional mapping and may be very important when tracing a sandstone reservoir across a field area or in regional reservoir trend analysis. Presumptions made regarding depositional environments and reservoir trends based on log correlations alone can be misleading, and can result in either missed opportunities or dry holes.

INTRODUCTION

Natural gas reservoirs of the Lower Pennsylvanian Morrow Formation are once again in the spotlight as one of the hottest plays in the Permian Basin because of the recent drop in oil prices. Renewed interest in the play has recently resulted in an acceleration of exploration and infill drilling of Morrow sandstone targets in Eddy, Lea and Chaves Counties, New Mexico, and in the Delaware Basin of far west Texas (Figure 1). The Morrow, as with other deep gas plays in the same region, has always been an attractive target in times like this because of its potential for substantial gas reserves, but finding good Morrow wells has often been elusive. Diagenetic factors affect reservoir performance in the Morrow and have been discussed elsewhere (Mazzullo, 1999a; Mazzullo and Mazzullo, 1984; 1985). The purpose of this geologic note is to show how the geologic development of the Morrow section was more complex than previously thought, and how the tectonic development of the formation affected reservoir trends and continuity. An understanding of these mechanisms is fundamental to the success of any exploration or exploitation program for these reservoirs.

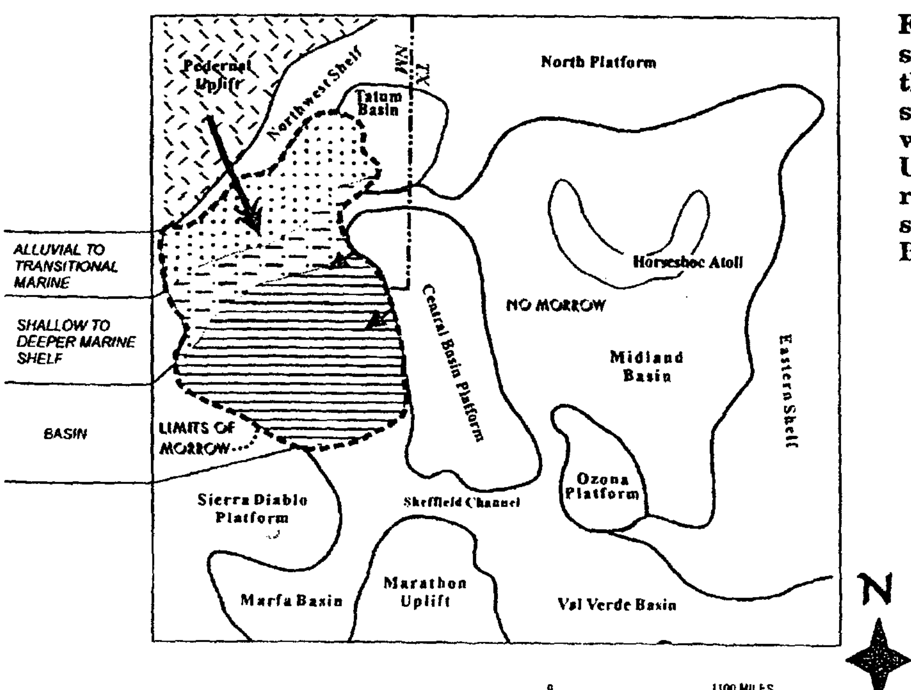

Figure 1. Location of the subsurface Morrow Formation in the Permian Basin. The major source for Morrow sediments was the ancestral Pedernal Uplift (large arrow). Small arrows denote limited source of sediments from the Central Basin Platform.

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Atokan reservoirs in the Midland Basin in Andrews and Midland Counties are composed of thin (15 to 20 ft [5 to 6 m]), silty to bioclastic-rich zones in the "Atoka" shale (Candelaria, 1990). During sea-level lowstands, carbonate detritus was carried from carbonate banks into relatively deeper water and deposited in extensive, sheetlike units up to 40 mi (64 km) long by 10 mi (16 km) wide (Candelaria, 1990). The Atoka reservoirs have porosity ranging from 6 to 8 percent; permeability is commonly less than 0.1 md (0.1×10^{-3} μm^2). Natural fractures are interpreted to enhance storage capacity, continuity, and fluid transmissibility in these low-porosity, low-permeability reservoirs (Candelaria, 1990). Wells are typically stimulated by fracturing with diesel or lease crude oil to minimize formation damage by water and injecting 50,000 to 100,000 pounds of sand proppant. Simple acidizing treatments can damage Atoka reservoirs (Candelaria, 1990).

Some workers correlate the "Atoka" shale in this area to the Lower Pennsylvanian (Morrowan or Atokan), whereas others correlate it to the Upper Mississippian (Chester) Barnett Shale (Candelaria, 1990). The Atoka reservoirs have been included with the Pennsylvanian Platform Carbonate play in this report. Moonlight (Mississippian) reservoir has also been assigned to the Pennsylvanian Platform Carbonate play because, despite its name, it is interpreted as producing from a zone of bioclastic wackestones within the "Atoka" shale (Candelaria, 1990), similar to the Atoka reservoirs in fields such as Desperado and Azalea.

Strawn reservoirs on the Central Basin Platform and in the Midland Basin produce from shallow-marine, fossiliferous limestone; the traps are anticlines and faulted anticlines (Kosters and others, 1989). The reservoir in Seminole SE and other Strawn fields in Gaines County consist of *Chaetetes* (coral or sponge) biolithite and associated ooid and skeletal grainstones (Mazzullo, 1982). Strawn limestones also form reservoirs on the Northwest Shelf, in Hockley,

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loss of beds at the top provides evidence of local uplifts prior to or during early Pennsylvanian deposition, but evidence is lacking to show general uplift of the entire platform area.

Areas of erosion indicated across the north part of the paleogeologic map are the result of orogenies which reached their climax at the end of Morrow time (early Pennsylvanian) and created the Amarillo-Wichita mountain system and the smaller Matador mountain system, and which rejuvenated the ancient Pedernal massif.

PENNSYLVANIAN

The Pennsylvanian sedimentary environment of the Permian Basin was characterized by an expanding sea in an intracratonic basin whose borderlands were mountainous land masses. Enormous volumes of detritus were dumped into the sedimentary catchment basin, but portions of the sea more remote from shore remained relatively free of clastics and accumulated large thicknesses of carbonate rocks. In the zones of gradation between clastics and carbonates the two types of rocks interfingered, and pulsatory crustal movements gave rise to cyclic sequences of deposition. These relationships established a sedimentary environment which produced strata of many lithologic facies, standing in strong contrast to the entire pre-Pennsylvanian history of uniform sedimentation across broad shelves having little apparent relief.

Lower Pennsylvanian (pre-Des Moines).—Because of similarities in the lithology of upper Mississippian and lower Pennsylvanian (pre-Des Moines) shale strata, the recognition of each, and their subdivision into correlatable units, have been difficult. Accordingly, the exact ages and outlines of some of the structural features formed during the time interval represented by these strata are subject to debate and revision (Fig. 20). It is not known, for example, how much thickness of rock above Mississippian limestone in the subsurface may be assigned to the Morrow Series, or what is the extent of Morrow strata. However, from regional information it is known that the principal uplift of the Amarillo-Wichita mountain system and the Matador alignment of smaller mountains occurred at the close of Morrow time (Van der Gracht, 1931, pp. 1010-11); succeeding Atoka strata contain coarse clastics derived from these areas and from the Pedernal massif, which were the principal provenance areas for clastic sediments in the north and west margins of the basin throughout Pennsylvanian time.

The greatest of the Pennsylvanian borderlands, in area and in topographic relief, undoubtedly was the Marathon-Ouachita element at the east and south rims of the basin. As the mountains rose by the action of strongly compressive forces, a narrow depositional trough sank rapidly in front of them, the waste of denudation being deposited in the trough and overflowing across the more stable sea bottom beyond. Continually reactivated forces deepened and compressed the trough and crowded it northwestward against the stable platform of the foreland as the mountains continued to rise, with the result that the thickest deposits of successively younger stratigraphic units are found at locations progressively northward in front of the Marathon belt and westward in front of the Ouachita belt. This history extended

March 30, 2005, but was signed later, on June 3, 2005. Chesapeake did not obtain a surface access agreement from the State Land Office.

3. Mike Hazlip, Chesapeake's Land Manager for the Permian Basin, testified concerning Chesapeake's meeting with the assistant land commissioner to discuss "trespass" issues in this case and concerning a letter from the State Land Office which commented on those issues. The letter was offered as evidence, but was not admitted.

4. David A. Godsey, a geologist employed by Chesapeake, testified to the following:

(a) The target Morrow interval in this area consists of the various sands in the Middle Morrow. The Osudo 9 well has almost 54 feet of developed Morrow sands in the upper intervals of the Middle Morrow and is producing around 21 million cubic feet of gas per day. Most of these same sands exist in the KF 4 well, but are only 17 feet thick.

(b) Prior to drilling the KF 4 State Well No. 1, Chesapeake mapped the thick sand deposits which exist in the Osudo 9 well as a wide pod, extending west within Section 9 and also north into the middle, lower portion of Section 4.

(c) The KF 4 well No. 1 was drilled by Chesapeake almost due north of the Osudo 9 well in order to be as close as possible to that prolific well. The well location was also influenced by the CC 3 State Well No. 1, drilled in 2004 in Section 3 to the east, which confirmed the presence of a Morrow reservoir in this vicinity.

(d) The KF 4 well was deviated while drilling to the same bottomhole location proposed by Samson et al in order to dispel future concerns that Chesapeake had diminished the value of that lease by drilling at a less desirable location.

(e) Chesapeake believes the general trend of the numerous Morrow channel sands in this area is in an east to west direction, based on the following:

(i) The source rocks for the Morrow formation in this area originated from the Central Basin Platform (the "CBP"). The CBP is located within walking distance, directly east and northeast of this area, and its subcrop within Sections 11, 2, and 3, one to two miles east of this area, trends in a southeast to northwest direction.

(ii) Using electric log data on existing wells to correlate the various Morrow streams, Mr. Godsey has mapped sand channels which may be trending east to west in Sections 21 and 22, and in Sections 15 and 16, both lying to the south of the Osudo 9 well, and separated from the Osudo 9 well and from each other by known points with considerably less Morrow thickness. The mapping of these east-west channels is consistent with pressure data indicating probable communication between wells within the respective channels.

(iii) The east to west trend of Morrow deposition Chesapeake projects in this area is in very close agreement with published literature concerning the general trend of sands coming off the Central Basin Platform.

(f) After studying the logs of the KF 4 well, the Hunger Buster Well No. 3 in the south half of Section 9, south of the Osudo 9 well, and Apache's dry hole in Section 10 to the east, Mr. Godsey mapped the trend in Sections 4, 9, and 10 in more of a southeast to northwest direction. The thick Morrow channel that exists at the Osudo 9 well, as now mapped by Chesapeake, extends west and slightly northwest, including a significant part of the southwest quarter of Section 4. Chesapeake's present mapping indicates an expectation of thicker Morrow sands in the southwest quarter of Section 4 than in the southeast quarter.

(g) After redrawing the maps, Chesapeake is no longer interested in drilling the proposed Cattleman 4 State Com Well No. 1 which was to be located directly north of the KF 4 well. Also, Chesapeake is now interested in drilling a well in the northwest quarter of Section 9 but has not yet proposed a well to Mewbourne in that location under the JOA covering the N/2 of Section 9. Chesapeake remains interested in drilling the Cattleman 4 State Well No. 2 in the NW/4 of Section 4 as permitted. Chesapeake is also interested in a future well in the SW/4 of Section 4.

(h) The Jake Hammon State well located in the west half of the middle one-third of Section 4 penetrated the Morrow and encountered three feet of sand but was not completed in or produced from the Morrow. This indicates that the west half of the middle third is not particularly attractive, but, based on the presence of some Morrow sands, cannot be condemned. The need to honor this three feet of sand was Mr. Godsey's basis for projecting the Morrow up into that quarter section on his current map.

(i) Structure maps in the Morrow can be drawn automatically using a computer contouring algorithm, but thickness or isopach maps stone in places is crinoidal, coarsely crystalline, and porous, and is an oil reservoir of local importance; irregularly distributed porous beds produce also in a few places in the Midland basin and on the Central Basin platform. Generally, however, despite the organic richness of its dark shale and argillaceous limestone which gives them the outward aspects of source beds, the Mississipian System produces little oil or gas. Its minor role in oil production must be attributed to low permeability, for it generally yields little water when tested. Like the oil in pre-Mississippian reservoirs, the Mississippian oil is generally sweet; that is, it contains relatively small amounts of sulfur. Recorded gravities range from 34° to 44° in most fields; a few are higher.

The dark shale which overlies the Mississippian limestone has a lithologic character so nearly like that of lower Pennsylvanian shale that the position of the time boundary is obscure.

The stratigraphic interval mapped in Figure 18 extends from the base of the Woodford shale to the approximate position of the Mississippian-Pennsylvanian boundary. It is an eroded interval, within which lithologic correlations provide some evidence that original thicknesses were greatest in the center of the Tobosa basin, but minor uplift of portions of the later Central Basin platform in late Mississippian or early Pennsylvanian time is indicated by present thin areas in the center of the basin. The total volume of rocks in this interval is estimated to be about 6,000 cubic miles. The shore lines of the Mississippian sea were beyond the present limits of distribution of Mississippian beds in the Permian Basin.

PRE-PENNSYLVANIAN UNCONFORMITY

Toward the close of Mississippian time some orogenies which were the principal environmental controls of the Permian Basin area throughout the Pennsylvanian Period were initiated, and widespread withdrawals of the sea produced a broad surface of erosion in which can be seen some of the principal orogenic elements and upwarps (Fig. 19). To the south and east the mountainous lands of the Marathon and Ouachita folded belts were rising, most of their erosional debris being trapped in adjacent sinking troughs which were beyond the limits of the area with which we now are concerned. It is the writer's belief that the pear-shaped area in the southeast part of the Permian Basin from which Mississippian strata have been removed (Figs. 18 and 19) is a portion of the Concho arch which was tilted northward at the initiation of the Marathon orogeny, thus becoming exposed to denudation.

Extending eastward across the south edge of the map is an area of pre-Mississippian subcrops outlining a large anticlinal structure which merges with the north-plunging pear-shaped area of erosion on the Concho arch. The eastward-trending anticline was uplifted at some time after Mississippian limestone deposition and prior to deposition of Atoka sediments, and is the structure to which the author has applied the name *Pecos arch.*

In some portions of the later Central Basin platform from which Pennsylvanian strata have not been completely removed, thinning of the Mississippian System by loss of beds at the top provides evidence of local uplifts prior to or during early Pennsylvanian deposition, but evidence is lacking to show general uplift of the entire platform area.

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from earliest Pennsylvanian time through early Permian time and is illustrated for the area of the Permian Basin by comparing the positions of the Marathon trough on Figures 20, 21, and 24.

Atoka strata consist predominantly of dark shale, argillaceous limestone, and fine- to coarse-grained sandstone. Apparently the Marathon-Ouachita shoreline lay

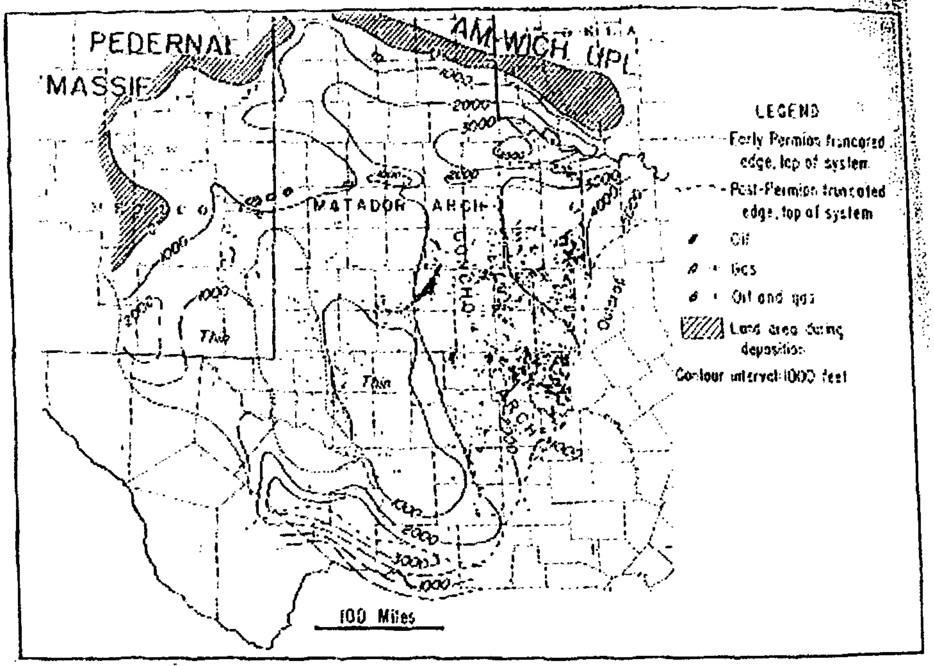

FIG. 21.—Pre-Permian thickness of Des Moines, Missouri, and Virgil Series. Principal land areas and submerged positive elements of upper Pennsylvanian time are labelled, except the Marathon-Ouachita folded belt and possible uplifts in the Diablo platform and Central Basin platform areas.

at some distance from the site of deposition, and the capacity of the intervening depositional trough was sufficient to accommodate most of the debris from that province.

The area of the Concho arch was still positive and received only a thin veneer of sediments prior to withdrawal of the Atoka sea, except at the north end where greater thicknesses were deposited in the newly formed Palo Duro basin between the rising Amarillo mountains and the archipelago of islands along the Matador arch. The Pecos arch and the northern highlands either were not completely covered or were exhumed during the period of erosion which followed Atoka sedimentation; the extent of land areas at this time is difficult to determine. The Central Basin platform probably was a relatively small positive area, and a basin lay in the present position of the Delaware basin, receiving sediments from the Pedernal massif and perhaps from an exposed Diablo platform, as well as influx from the Marathon trough.

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Oil production in upper Pennsylvanian strata is obtained principally from three types of traps—1. Anticlinal structures in porous reservoir strata, either limestone or sandstone; 2. Porous zones in limestone reefs; and 3. Lithologic or stratigraphic wedge edges of porous strata, either sandstone or limestone.

The oil from upper Pennsylvanian reservoirs is like that from Atoka strata, in the respect that it is sweet oil in most of the fields and has a gravity of 30° to 47°. There is no discernible pattern in the distribution of various gravities from field to field; even fields in gas-producing areas show no distinctive tendencies to either high or low gravities.

Of the estimated 3 billion barrels of oil which has been found in more than 30,000 cubic miles of upper Pennsylvanian strata, one third is expected to be produced from the Scurry reef.

The simple fact that the reservoirs in the Pennsylvanian System are isolated and separate from one another and from sources outside of the system, each having its own set of fluid and pressure levels, appears to be ample evidence that the oil is indigenous to the system. Bituminous shale is common throughout.

Most of the Pennsylvanian gas production is found in the southern and eastern parts of the Permian Basin and on the adjoining Bend arch, in localities which also have concentrations of Atoka gas fields, leading to the speculation that the Marathon and Ouachita troughs were the provinces in which conditions favored the generation of gaseous hydrocarbons.

PRE-PERMIAN UNCONFORMITY

At the close of the Pennsylvanian Period occurred the principal uplift of two subparallel features which had been intermittently but moderately positive throughout earlier Paleozoic time, the Central Basin platform and the Diablo platform (Fig. 23). The intervening Delaware basin was thereby accentuated in negative relief, and the Midland basin for the first time became clearly evident; the Delaware basin, however, remained the center of further subsidence. The area involved in the uplift of the Central Basin platform included the west part of the earlier Pecos arch and the Fort Stockton high, but the east part of the Pecos arch remained quiescent and retained its cover of upper Pennsylvanian strata, except locally. The entire extent of the Diablo platform is not yet known, but it seems perhaps to have overreached the south end of the Pedernal massif. The two new uplifts completed the framework which set the stage for all the events of Permian time.

PERMIAN

The theater of Permian sedimentation was a subsiding intracratonic basin without rising borderlands, in which occurred conspicuous carbonate build-ups on marginal platforms and contemporary deposition of fine clastics in adjacent lows, and finally the deposition of large amounts of evaporites in the shrinking sea.

The influence of the early Paleozoic Tobosa basin clearly persisted into Permian time, for the sites of the carbonate platforms, other than the Central Basin platform, appear to have been predetermined by the locations of the positive elements bounding the Tobosa basin, although admittedly the coincidences of location are not these conditions were preserved in the stratigraphic column to the present with their hydrocarbon wealth intact is remarkable.

It would also be remarkable and surprising if at least some of these structural and stratigraphic features were not repeated elsewhere in the less explored part of this region. For a structural element as prominent as the Central Basin platform to occur unaccompanied by less profound but depositionally influential features is unlikely.

This so-called "mature" province is in reality a relatively unexplored frontier region. The history of the search for oil is replete with examples of seemingly thoroughly developed petroleum provinces being rejuvenated to another exploration cycle by a serendipitous or systematic discovery. It also provides ample evidence that the best place to look for other big fields is where they are known to occur. If history repeats itself, this region hosts a number of undiscovered large oil fields.

Cross section D–D′ (Fig. 102) is a diagrammatic illustration of the geologic conditions. For an excellent regional overview of Pennsylvanian and Lower Permian deposition, see Meyer (1966).

Target exploration area 13, Central Basin platform—This region is in the extreme southeast corner of New Mexico south of Tatum and US–380. It includes the state's largest concentration of petroleum-dependent communities, Hobbs, Lovington, Eunice, and Jal. About 85 miles long in a north–south direction and about 20 miles wide, its approximately 1,700 square miles contain a large part of New Mexico's petroleum wealth.

Objectives—Up to 6,500 feet of Paleozoic strata from Cambrian through Pennsylvanian are present in the Delaware Basin west of the Central Basin platform. All of these predominantly marine strata are truncated on the flanks of the platform. Permian rocks covering its core of Precambrian and older Paleozoics are responsible for much of New Mexico's cumulative oil production. Eroded porous suites surrounding the platform offer potential for regional hydrocarbon accumulations if lessees holding acreage by production can be persuaded to evaluate their leases vertically.

Discussion—Although it is part of the Permian Basin, the Central Basin platform is a profound structural element that influenced sedimentation on and around it in Pennsylvanian and Permian time and the accumulation of oil and gas on and near it through the present. Adams (1965) offers explanations of regional tectonism that formed the Permian Basin and its appurtenant structural elements. He suggests that the Central Basin platform originated from compressional stresses related to crustal shortening requiring adjustments to compensate for a deeply sagging basin. He assumes an almost catastrophic foundering of the basin during Permian Wolfcamp time that squeezed the Central Basin platform horst upward several thousands of feet to separate the Delaware and Midland Basins and coincidentally stripped from the platform many of the preexisting Paleozoic rocks.

Figure 103 shows the approximate configura-

EXHIBIT #7

GEOLOGIC DEVELOPMENT

General

The Morrow Formation in southeastern New Mexico and west Texas produces from sandstone reservoirs that were deposited in environments ranging from fluvial through and including deeper water marine (Mazzullo and Mazzullo, 1985; Mazzullo, 1999a). The general patterns of major facies tracts in the Morrow reflect basinward (generally north to south) transitions from alluvial to deep water sedimentation along any given time line (Figure 1). The developmental history of the Morrow also involved numerous local to regional syngenetic and early post-depositional tectonic uplifts and glacio-eustatic exposure events that overprinted depositional facies. These modifications to the section, if not recognized, could create problems in correlating pay sands and tracing reservoir trends. It is not always obvious from subsurface mapping to what extent these factors affected the section in any given area.

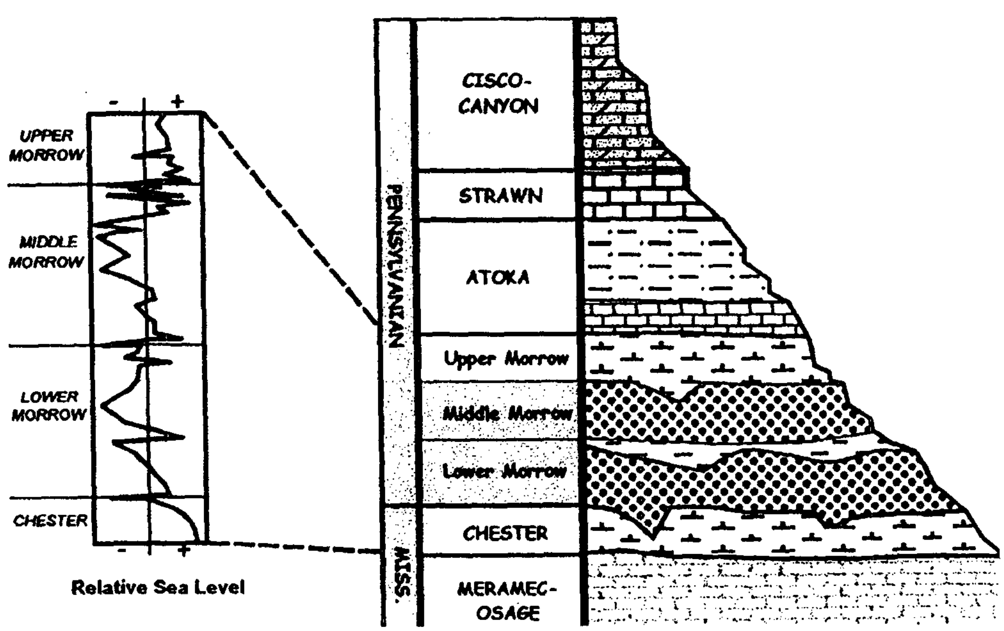
The Morrow Formation in southeastern New Mexico has been subdivided by many workers into informal lower, middle (both siliciclastic-rich) and upper (carbonate-rich) units (Figure 2), separated by what are assumed to be regional transgressive shale markers. Most of the significant natural gas reserves from the Morrow come out of sandstones in the lower and middle units, which together form the so-called "Morrow clastics" that are referred to in this paper. For the most part, the division between the lower and middle units holds up across large mapping areas, and is marked by a major highstand event followed by a drop in sea level in earliest middle Morrow time (Mazzullo, 1999a). The top of the middle Morrow unit, however, is not as easy to correlate and is often ambiguous, as are other shale markers that occur throughout the clastics section. These other shale units are also used by many workers as markers to correlate wells across fields or over larger mapping areas.

Paleozoic Tectonic History

The geologic record of the Permian Basin includes several major high-order Paleozoic tectonic episodes that have always been assumed to be the major events that shaped the basin outlines and structures. But a number of lower-order, episodic events were also important to the development and/or preservation of reservoirs, particularly throughout the Lower Pennsylvanian. Figure 3 is a schematic diagram that shows the relative magnitudes of tectonic events that were important to development of the Permian Basin. Tectonically influenced lithologic development and sporadic moderate-duration exposure events have been documented in Ordovician, Silurian, and Devonian carbonates (e.g., Holtz and Kerans, 1992; Troschinetz, 1992; Mazzullo, 1990), where they had profound influences on reservoir preservation and porosity development.

A major tectonic event occurred at the end of the Mississippian (Wright, 1979) at which time the outlines of the major features of the present-day Permian Basin began to take shape. The Central Basin Platform, for example, was a low-relief feature at this time. In some places, the initial structuring event was followed by large-scale tilting and erosion of part of the Upper to Lower Mississippian section (e.g., Mazzullo, 1999b). The next high-order basin-shaping event occurred in the Late Atoka, prior to deposition of the Strawn carbonate. Significant lower-order episodic tectonism and erosion, however, occurred throughout the Morrow and into the Early Atoka, culminating locally with

Figure 2. The major gas reservoirs in the Morrow are in sandstones of the lower and middle units. Depositional environments shifted laterally across a low-gradient shelf through time in response to repeated glacio-eustatic sea level changes. During low stands, exposure reactivated parts of the section, and concurrent uplifts contributed to localized truncation of reservoir sands (after Mazzullo, 1999a).



Pennsylvanian Platform Carbonate (Play 111)

The Pennsylvanian Platform Carbonate play has been expanded both geographically and geologically from the Pennsylvanian Platform Carbonate play that was described in the *Atlas of Major Texas Oil Reservoirs* (Galloway and others, 1983). As originally defined by Galloway and others (1983), the play consisted of reservoirs that produce from Middle and Upper Pennsylvanian (Strawn, Canyon, and Cisco) carbonates located on the east edge of the Central Basin Platform. The play has been expanded in this report to include Atoka through Cisco reservoirs on the Texas part of the Northwest Shelf and Central Basin Platform and in the Midland Basin (fig. 37). The expanded play has produced 340.5 MMbbl (5.41×10^7 m^3) from 74 reservoirs (table 16).

The Central Basin Platform was an active, high-relief uplift during much of the Pennsylvanian (Frenzel and others, 1988). Lower Pennsylvanian Atoka deposits are interpreted to have been deposited before uplift of the Central Basin Platform (Tai and Dorobek, 1999). Upper Strawn strata may be the earliest synorogenic deposits, deposited on a carbonate ramp that prograded eastward (Tai and Dorobek, 1999). The most intensive uplift of the Central Basin Platform postdated the Strawn and continued from Middle Pennsylvanian to Early Permian time (Tai and Dorobek, 1999). Atokan and Desmoinesian carbonates in the Midland Basin were deposited on low-relief ramps at a time of relatively low regional subsidence, whereas Missourian and Virgilian deposits were deposited on higher-relief carbonate platforms at a time of higher rates of regional subsidence (Hanson and others, 1991; Mazzulo, 1997). High-frequency glacioeustatic sea-level fluctuations during the Pennsylvanian resulted in highly cyclic depositional sequences (Wahlman, 2001).

section represents one long-term regression on the east side of the Central Basin Platform, and a major unconformity occurs at the top of the Pennsylvanian (Saller and others, 1999b). These studies illustrate that the reservoirs are developed in highly cyclic successions of shallow-water carbonate-platform facies. The deposits thin to the west, indicating that the Central Basin Platform was a depositional high during the Late Pennsylvanian and Early Permian (Saller and others, 1999b). Stratigraphic heterogeneity is created by cyclic alternations of porous and nonporous limestone facies and shales (figs. 38, 39). Additional heterogeneity is contributed by karst-related diagenesis at and below cycle tops during sea-level-fall events (Dickson and Saller, 1995). Porosity in these rocks is developed primarily in phylloid algal boundstones, thick

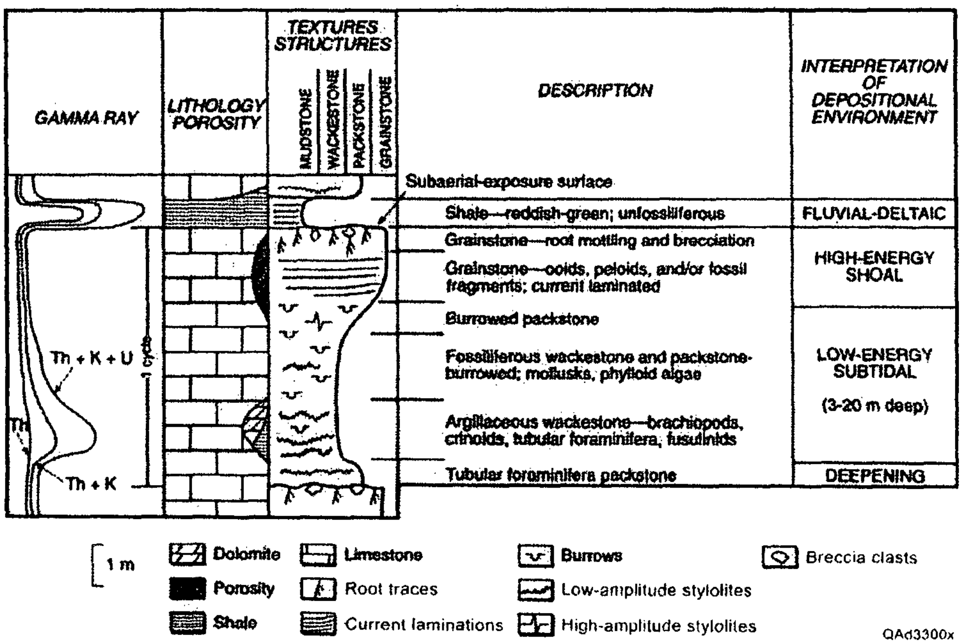


Figure 38. Idealized upward-shallowing cycle in Upper Pennsylvanian carbonates in the Southwest Andrews area. From Saller and others (1999b).

Wolfcamp. The lower and middle Wolfcamp in this area comprise interbedded dark shales and limestones and are basinal facies. The upper Wolfcamp, however, is composed dominantly of light-colored carbonates. At the Vacuum reservoir, the upper Wolfcamp has a mound-shaped appearance, and crosswell seismic tomography indicates that the productive interval has internal clinoformal bedding (Martin and others, 2002). On the basis of overall shape and internal bedding surfaces, Martin and others (2002) suggested that the upper Wolfcamp reservoir may be an isolated algal mound deposited on the Wolfcamp shelf. If this is the case, then the upper parts of the Vacuum and Corbin South reservoirs are in the Wolfcamp Platform Carbonate play (114) and the shelf edge prograded southward at least 10 to 12 miles during Wolfcamp time from the Kemnitz reservoir (fig. 48) to a position south of the Vacuum reservoir (fig. 51). If the upper part of the Vacuum reservoir is a shelf deposit, then general location and lithologic composition suggest that the upper part of the Corbin South reservoir was also deposited on the Wolfcamp shelf and not in the basin. Alternatively, the southward-prograding clinoforms seen via crosswell seismic tomography in the Vacuum reservoir may indicate southward-prograding slope deposits.

One New Mexico reservoir included in the play, Wantz Granite Wash, is productive from granite-wash clastics. Reservoirs in the Granite Wash subplay are productive from laterally discontinuous Wolfcampian-age conglomerates and "granite wash" arkosic sandstones deposited on the flanks of structural highs of Early Permian age and in paleotopographic lows on top of structural highs of Early Permian age (Bowsher and Abendshein, 1988; Speer, 1993). The sandstones are encased in shales that seal the sandstone and conglomerate reservoirs. Examination of drill cuttings and logs indicates that a part of the reservoir resides in fractured Precambrian granite that underlies the granite wash (A.L. Bowsher, cited in Speer, 1993). Low-displacement, high-angle faults, acting in concert with the lenticular geometry of reservoir where the sandstone wedges out updip on the flanks of a reef; Page field, Schleicher County, where zones of porosity in limestone disappear updip on a broad terrace; and the Arledge field, Coke County, where porosity decreases updip on a structural nose.

Examples of isolated reef limestone build-ups are the Salt Creek field, Kent County; Reinecke field, Borden County; Vealmoor field, Howard County; and Todd field, Crockett County. Most reef build-ups are overlain by confining beds of compacted shale.

OUTCROPS

Pennsylvanian strata discussed in this report outcrop in the Llano Uplift of Central Texas; Marathon region, Solitario Uplift, Marfa Basin, Sierra Diablo, Hueco Mountains and Franklin Mountains in West Texas; and, in the Sacramento Mountains and San Andres Mountains in New Mexico.

THICKNESS

Rocks of the Pennsylvanian system of West Texas and Southeast New Mexico range from a feather edge along truncation lines and near areas of non-deposition to over 2,000 feet in the Midland, Delaware and Palo Duro basins; 2,500 feet on the Eastern Shelf; to aggregate thicknesses of more than 3,600 feet in the Orogrande Basin of New Mexico; and 12,000 feet in the Marathon Basin.

DISTRIBUTION

Pennsylvanian strata overlie rocks ranging in age from Pre-Cambrian to Mississippian. In most areas they are overlain by beds of lower Permian age. Except in restricted areas of truncation or non-deposition, Pennsylvanian rocks cover the entire West Texas and Southeast New Mexico province.

GEOLOGICAL HISTORY

From the beginning of the Cambrian period to late Mississippian time, West Texas and Southeast New Mexico had been a region of mild structural relief and uniform sedimentation. Broad regional arches modified relatively flat, expansive landmasses and shallow depositional basins and troughs.

Near the close of the Mississippian period, tectonic readjustment produced regional warping which destroyed the Tobosa Basin as a distinct structural entity, giving rise to several new regional structural subdivisions which were accentuated into high relief structural provinces during Pennsylvanian time. The broad, low-relief upwarps were the Pedernal Arch, which extended south to north from Trans-Pecos Texas to North Central New Mexico; the Central Basin Platform, which extended northwest to southeast from Southeast New Mexico to eastern Pecos County, Texas; the Matador-Red River Uplift, oriented west to east from Easten New Mexico to North Texas. The Texas Peninsula, which was the exposed crest of the Texas Arch, sank slightly below sea-level.

Compressive orogenic forces from the southeast uplifted the Llanoria Landmass progressively in lower Mississippian and early Pennsylvanian time, raising the west to east Ouachita-Maraton mountain ranges along the cratonic border. Contemporaneous with these positive movements, cratonic-edge downbending depressed an extensive geosyncline which lay in front of and parallel to the north rim of the mobile belt, embracing the whole Marathon region. Clastic debris, stripped from the uplifted blocks of the mountain ranges, was deposited into the newly formed Llanoria Geosyncline, being the source material of the Tesnus formation, which evidently crosses the late Mississippian and early Pennsylvanian time boundary. The lowermost member of the Tesnus formation is considered to be of upper Mississippian age. The middle and uppermost members of the formation have been classified as Springer and Morrow, which are of lower Pennsylvanian age. Strata of Springer age are not known in the region beyond the boundaries of the Llanoria Geosyncline.

The pronounced late Mississippian - early Pennsylvanian uplift caused a general withdrawal of the sea, which subjected the exhumed region previously occupied by the Tobosa Basin to erosion. Subsidence at the close of Springer time permitted the sea to encroach northward from the Llanoria Geosyncline. Landward expansion of the sea, initiated by regional subsidence, continued throughout most of the Pennsylvanian period, gradually filling a broad regional embayment which extends east to west from the Texas Arch to the Pedernal Arch and which extended from south to north from the Ouachita - Marathon mobile belt to the Amarillo Uplift. Crests of the intra-embayment upwarps such as the Central Basin Platform and the Matador-Red River Uplift were exposed as chains of islands.

regional structural elements. Broad reef mounds developed along the southern edge of an early Strawn limestone platform situated in the north part of the Midland Basin and overlapping onto the Eastern Shelf, initiating the growth of the Horseshoe Reef Atoll.

Isolated reefs grew around the edges of intra-basin islands and over the crests of shallow submerged local structures. Shale, sandstone and large boulders of the Haymond formation, which possibly crosses the Bend-Strawn time boundary in the Marathon region, and the overlying conglomerate, sandstones and shale of the lower part of the Gaptank formation, were deposited in the Llanoria Geosyncline. Overflow sands from the slowly sinking depression were carried northward, sweeping over the southern part of the developing Eastern Shelf, which lies east of the Midland Basin and the Reagan Uplift. Well developed lenticular sandstone lenses flanked Strawn reefs. Coarse conglomerate and thick sand bodies in the Sacramento Mountains and sand deposits along the north and east margins of the New Mexico segment of the Pedernal Arch is evidence of clastic-source highlands in that region.

Continued subsidence of the West Texas and Southeast New Mexico embayment characterized both the Canyon and Cisco epochs. Deepening of the Delaware and Midland basins by continuing downwarping produced profound effects upon regional sedimentation. Depth of water and distance from clastic source precluded thick sedimentary deposits in the deeper parts of the basins comparable to earlier Pennsylvanian epochs. Widespread thin shale deposits covered basin floors, grading into limestone shelfward.

Isolated reefs over the crests and along the margins of local structures in basins and on the Reagan Uplift sank below sea-level and were drowned. A variety of upper Pennsylvanian ridge, round, chain or cluster reefs, and systems of composite reefs, grew on the Eastern Shelf. During both the Canyon and Cisco epochs extensive bedded and biostromal limestone deposits accumulated over the Northwestern Shelf. Limestone "shoulders" marked the upper flanks of the Central Basin Platform. Masses of limestone were erected over the Matador Uplift, completely covering the alignment of peaks during the Cisco epoch. Numerous Cisco reefs grew locally in the areas now occupied by the Hueco Mountains and the Sacramento Mountains. The exposed crests of the Central Basin Platform and Pedernal Arch shrank as the sea advanced landward and covered clastic deposits which had accumulated along shoreward margins.

The Horseshoe Reef Atoll grew dominantly vertically, gradually reducing in lateral extent as basinal subsidence increased water depth. The feature is considered to be a shell bank consisting of lithified organic debris. During its development, several periods of erosion occurred as sea-level fluctuated. The entire reef trend finally was submerged completely in early Permian time. Its curved shape is believed to be the result of the action of winds and currents.

In the northwestward migrating Llanoria Geosyncline, deposition of clastic sediments from the advancing Ouachita-Marathon highlands was interrupted by intervals of quiescence during which time thick beds of limestone were deposited. These strata represent the upper members of the Gaptank formation in the Marathon region. Canyon and Cisco sands derived from the highlands spread widely over the southern part of the Eastern Shelf, gradually decreasing in volume northward.

Sinking of the Llanoria Geosyncline during Pennsylvanian time is believed to have been accompanied by rapid filling of the depression as many thousands of feet of predominant clastic sediments accumulated in that region. The foreland to the north, in contrast, is characterized by slower subsidence of the embayment, predominant carbonate and shale deposition, and a thinner total Pennsylvanian section.

Limited outcrops and sparse subsurface control in the Marfa Basin demonstrate that Pennsylvanian sediments were deposited in that province. Strata are believed to be composed predominantly of shale, but contain limestone and some sandstone. Pennsylvanian sediments in the Orogrande Basin of New Mexico are mostly of upper Pennsylvanian age. Several thousand of feet of Cisco deltaic and basinal strata occupy the basin. Upper Pennsylvanian reefs, like those exposed in the Sacramento Mountains, are believed to have rimmed the north part of the basin.

The late Pennsylvanian and early Permian time boundary is marked by mountain-making movements with faulting and intense folding in West Texas and Southeast New Mexico. The greatest orogeny occurred in the Ouachita - Marathon mobile belt, where tightly-compressed northeast trending folds and overthrust sheets from the southeast raised the Llanoria Geosyncline. Associated downwarping to the north formed the deep, linear Val Verde Basin, which was filled by many thousands of feet of clastic material derived from the adjacent areas during the Wolfcamp epoch of the early Permian period.

Compressive forces uplifted the Central Basin Platform to its highest elevations. Highly deformed local structures formed ranges of mountains oriented generally parallel to the main axis of the platform. The Fort Stockton High in north Pecos County, Texas and the Eunice Uplift in southeast Lea County, New Mexico, terminated the south and north edges of the platform, standing at greater heights than intervening structures.

Local folds and fault blocks of the Reagan Uplift and the crests of en echelon trends in the basins were rejuvenated. Some were elevated above sea-level. The Pedernal Arch again became structurally active.

The epoch of intense deformation was followed by a long period of erosion which reduced the mountains of the Ouachita-Marathon mobile belt to low undulating topography and stripped the Central Basin Platform and structures of the Reagan Uplift and the basins to near base-level. Erosion completely unroofed the sedimentary cover from the crest of the Fort Stockton High, cutting hundreds of feet into the Pre-Cambrian core.

The expanding sea gradually encroached over broad eroded surfaces, truncated edges of sedimentary strata and new layers of arkose, sand, chert pebble and shale deposits, which had accumulated along the edges and on the flanks of both regional and local structures as the products of erosion.

The basic architecture of West Texas and Southeast New Mexico, established in Pennsylvanian time, persisted throughout the Permian period.

Life

The Pennsylvanian period is noted for the abundant coal deposits found in the eastern interior of the United States, where humid climatic conditions prevailed over vast regions. Such coal-forming plants as ferns, scouring rushes and scale trees, grew profusely in widespread swamps. Insects were numerous. Limited coal seams also are present on the Eastern Shelf in Texas.

In the seas, brachiopods and bryozoans grew abundantly; pelecypods and gastropods were common. Cephlapods were present but less numerous than in earlier geological periods.

The most useful Pennsylvanian fossils for correlation purposes in West Texas and southeast New Mexico are the fusulinids, a group of spindle-shaped foraminifera which commonly resemble grains of wheat. They are particularly useful in separating the various stratigraphic zones of the Pennsylvanian system.

Bend fusulinids are the Fusiella, Fusulinella and Eoschubertella; Strawn, Fusulina and Wedekindellina; Canyon, Triticites; Cisco fusulinids are Dunbarinella, Waeringella and advanced forms of Triticites.

PROSPECTS AND RECOMMENDATIONS

Many additional drillable Pennsylvanian prospects are expected to develop in West Texas and Southeast New Mexico. The Pennsylvanian system in the various geological provinces which merit further examination are herein briefly reviewed.

EASTERN SHELF

Pennsylvanian sandstones and reefs are significant producing horizons on the Eastern Shelf, requiring the definition of local reef highs and structural trends and the outlining of maximum sand deposition. Most Pennsylvanian wells are completely from sandstone reservoirs.

The search for reefs and bedded limestones draped over deep structures on the Eastern Shelf should uncover new prospects. Geologists have found that a reef trend on the shelf may follow a definite contour line, except where local and regional tilting has occurred after termination of reef growth. Such contour lines can narrow the margin of error in extrapolation between mapped reefs during the search for reef trends.

Discovery and development of lenticular sandstones flanking the Jameson reef field in Coke County several years ago initiated a brisk search for similar reservoirs along the north-

INTRODUCTION

The CBP (CBP) is a positive tectonic feature of the Permian Basin in the subsurface of West Texas and southeastern New Mexico (Figure 1). It is a NNW-SSE trending basement uplift that is bounded by complex, high-angle fault zones. The CBP trends at high angle to the Marathon fold-and-thrust belt to the south and separates the Delaware Basin to the west and the Midland Basin to the east (Figure 1). The CBP started to form inboard of and at about the same time as crustal shortening in the Marathon-Ouachita fold-and-thrust belt to the south and east during late Mississippian time (Hills, 1970; Wuellner et al., 1986; Ewing, 1991; Yang and Dorobek, 1995a). Uplift of the CBP peaked in late Pennsylvanian-late Wolfcampian time and was largely over by early Leonardian time (Ewing, 1991; Yang and Dorobek, 1995a). Since Late Permian time, the CBP has not been subjected to significant deformation, and its present structural configurations are basically the same as those that existed during late Paleozoic time (Frenzel et al., 1988).

The complex structural features, together with their associated pre-, syn-, and post-orogenic stratigraphic relationships, provide many important hydrocarbon traps across the CBP. In the past few decades of hydrocarbon exploration and production, however, most previous studies have focused on individual oil and gas fields across the CBP. Few studies have attempted to summarize these data and address the relationships between local structures and regional, basin-scale tectonic features.

One long-standing question regarding the CBP is the tectonic model responsible for its origin. Various tectonic models, involving either regional extension (Elam, 1984), compression (Galley, 1958; Ye et al., 1996), or strike-slip deformation (Harrington, 1963; Hills, 1970; Walper, 1977; Goetz and Dickerson, 1985; Gardiner, 1990a, Ewing, 1991; Shumaker, 1992; Yang and Dorobek, 1995a), have been proposed to explain the deformation that produced the CBP, the structural features associated with the CBP, the stress fields responsible for its formation, and the significance of the CBP to regional deformation across the Marathon-Ouachita foreland (Kluth and Coney, 1981; Ye et al., 1996).

Despite debates on the tectonic origin of the CBP, right-lateral strike-slip deformation due to SW-NE directed compressive stress appears to best explain most of the structural features along the margins of the CBP (Harrington, 1963; Hills, 1970; Ewing, 1991; Yang and Dorobek, 1995a). There are many observed structural features, however, that cannot be explained by right-lateral strike-slip deformation. For example, clockwise rotation of crustal blocks resulting from right-lateral shear couple (cf. Yang and Dorobek, 1995a) does not adequately explain either regional uplift of the CBP or the broader pattern of en echelon folding that developed across the eastern Delaware Basin, CBP, and western Midland Basin prior to major deformation and uplift of the CBP.

Reasonably detailed descriptions of the boundary fault zones of the CBP are given by Shumaker (1992) and Yang and Dorobek (1995a). To date, however, no study has been conducted on the slip motion along the boundary faults of the CBP. The amount of lateral displacement along the CBP's boundary faults is difficult to estimate because of uncertainties in establishing piercing points across either the eastern or western boundary fault zones of the CBP (Shumaker, 1992). By largely focusing on the late Paleozoic structural features along the margins of the CBP, most previous studies (Hills, 1970; Gardiner, 1990a; Shumaker, 1992; Yang and Dorobek, 1995a; Ye et al., 1996) have generally overlooked the comparatively low-relief late Paleozoic structures within the sub-basins that are adjacent to the CBP (e.g., the Pegasus-Amacker structural trend in the southwestern Midland Basin; Figures 1, 2; Tai and Dorobek, 1999). Thus, the kinematic relationships between these subtle structures within the basins and the CBP have not been examined, even though they may provide important constraints on the tectonic evolution of the Permian Basin region (Tai and Dorobek, 1999).

A better understanding of the structural features of the CBP and adjacent areas is important for unraveling the complex tectonic history of the Permian Basin. In this study, we utilized a data set that was donated to Texas A&M University by Chevron USA. This data set, which covers the southwestern Midland Basin and eastern CBP regions, includes five 3-D seismic surveys (covering over 800 km^2), numerous 2-D seismic profiles, over 200 digital well-logs, and production data. We first examined the various structural features across the southwestern Midland Basin and eastern CBP using seismic data, structural contour maps, and well-log cross sections. The timing of deformation was inferred from variations in the thickness of stratigraphic units on cross sections and recognition of unconformities on seismic profiles and well-log cross sections. We also integrated our observations with previously published information from the eastern Delaware Basin and other parts of the CBP in order to put these structural features into a regional tectonic framework. Finally, we used a simple geometric method to determine the nature of slip motion and the displacement vector along the boundary faults of the CBP, which in turn, lead to a new tectonic model for the formation of the CBP and adjacent areas. A better understanding of the tectonic history of the CBP and adjacent sub-basins may provide an important analog for understanding other basement uplifts (e.g., Diablo Platform, Ozona Arch) that developed across distal parts of the Marathon-Ouachita foreland region during late Paleozoic time.

the southwestern Midland Basin, these anticlines are important petroleum traps and also display an en echelon pattern relative to the boundary fault zones of the CBP (Figure 1; Harrington, 1966; Hills, 1970; Frenzel et al., 1988). The average trend of fold axes is N30°W. Compared to the en echelon folds within the eastern Delaware and western Midland Basin, the crest of folds from interior parts of the CBP are more deeply eroded, with a major post-Pennsylvanian unconformity that generally separates Permian rocks from underlying lower Paleozoic rocks. Cross faults that cut the asymmetric anticlines and terminate into the main boundary fault have been reported in the Andector, Dollarhide, Eunice, Martin, Embar, Andector, Fullerton, Halley, and TXL fields, and they are right-lateral strike-slip faults or normal faults with small displacement (Gardiner, 1990a; Ewing, 1991; Algeo, 1992; Shumaker, 1992; Montgomery, 1998).

The Sand Hills Fault is an intra-block fault located within the Fort Stockton Block (Figure 1; Gardiner, 1990a). This fault has a sigmoidal trace in map view and has been described as a scissor fault with changing sense of throw along the fault's strike. At its northern end, the Sand Hills Fault dips westward and Wolfcampian strata lie unconformably on the Ordovician Ellenburger Formation, whereas at its southern end, the fault dips eastward and Wolfcampian strata directly overlie the Precambrian basement rocks (Figure 1; Gardiner, 1990a).

Steeply dipping fault zones characterize the boundaries of the CBP (Figures 1, 4, 5, and 6; Hills, 1970; Bebout and Meador, 1985; Yang and Dorobek, 1995a). The eastern margins of the CBP are characterized by NNW-SSE trending (N16°W) high-angle reverse faults that dip 50°-60° westward toward the interior of the CBP (Figures 2a, 4, and 5; Yang and Dorobek, 1995a). Deformed pre-Permian rocks along the boundary fault zone commonly display asymmetrical positive flower structures (Figures 4, 5; Gardiner, 1990a; Turmelle, 1992). In map view, the eastern boundary faults of the CBP are not as laterally continuous as the western boundary faults. Instead, the traces of individual fault segments tend to display a jagged pattern (Figures 1, 2a). The greatest amount of vertical displacement along the eastern side of the CBP is found at the NE corners of the Andector and Fort Stockton blocks (Yang and Dorobek, 1995a). Vertical displacement progressively decreases from north to south along the eastern margins of Andector and Fort Stockton blocks. Calculated amounts of basement shortening also decrease southward along the eastern boundary of the Andector and Fort Stockton blocks, away from their NE corners. Normal faults at the SE corner of the Andector Block dip eastward into the Midland Basin (Yang and Dorobek, 1995a).

The western boundary of the CBP is an approximately 10-mile wide fault zone that separates the uplifted CBP from the Delaware Basin to the west (Figure 1, Hills, 1970). In general, the western boundary of the CBP has greater structural relief, vertical separation, and basement shortening than its eastern boundary (Yang and Dorobek, 1995a). The western boundary fault zone consists of several closely spaced and steeply dipping faults that bound narrow, elongate slices of basement, which rapidly step down to the west (Figures 1, 6; Hills, 1970; Bebout and Meador, 1985). The SW corners and western margins of the Andector and Fort Stockton blocks are characterized by NW-SE trending (N10°W-N45°W) steeply-dipping, basement-involved reverse faults that dip 50°-60° eastward toward the interior of the CBP (Figure 1, 6; Yang and Dorobek, 1995a). The greatest amount of vertical displacement is found at the SW corners of the Andector and Fort Stockton blocks; vertical displacement progressively decreases from south to north along the western margins of the Andector and Fort Stockton blocks (Ewing, 1991; Yang and Dorobek, 1995a), with maximum vertical separation of 10,000 to 25,000 feet at the SW block corners (Hills, 1985; Shumaker, 1992). Calculated amounts of basement shortening also decreases northward along the western boundary of the Andector and Fort Stockton blocks, away from their SW corners (Yang and Dorobek, 1995a). Some steeply dipping faults at the SW corner of the Fort Stockton Block are traceable along the western margin to NW corner of the block, where they become high-angle normal faults that dip westward toward the Delaware Basin (Yang and Dorobek, 1995a).

The boundary between the Andector and the Fort Stockton blocks is an ENE-WSW cross fault zone (Figure 1). This fault zone is characterized by flower structures, pop-ups, and near vertical faults (Yang and Dorobek, 1995a).

Another important structural feature along the western boundary of the CBP is the Puckett-Grey Ranch fault zone, which extends southward from the CBP to the Marathon fold-and-thrust belt (Figure 1). This high relief, steeply dipping fault zone extends southward from the western boundary fault zone of the CBP and disappears southward beneath the Marathon thrust sheets (Ewing, 1991). The Puckett-Grey Ranch fault zone separates the Val Verde Basin to the east from the southern Delaware Basin to the west (Figure 1). Several NW-SE trending faulted anticlines are distributed along this fault zone and are arranged in an en echelon pattern with the average fold axis trending at N34°W (e.g., Puckett, Grey Ranch, and Hokit fields; Figure 1).

INTERPRETATION OF STRUCTURAL FEATURES

In terms of the dominance of contractional structures (folds and reverse faults) across the study area straining bend (Crowell, 1974), which easily explains why thrust faults, large-scale overturned folds, and the greatest structural relief and basement shortening associated with the CBP are found at the SW corner of the Fort Stock Block (Figure 6; Shumaker, 1992; Yang and Dorobek, 1995a; Ye et al., 1996). Similar southward changes in fault strike are also found along the western margin of the Andector Block, where contractional styles of deformation such as trapdoor structures or compressive fault blocks have been identified at Keystone and similar fields at its SW corner (Figure 1; Harding and Lowell, 1979; Lowell, 1985).

The sigmoidal San Hills Fault within the Fort Stockton Block has a Z-shaped trace and changing senses of throw along strike (Figure 1). These characteristics are comparable to the sigmoidal cross faults that form between right-lateral convergent faults in analog models and indicate that the Sand Hills Fault formed under the influence of right-lateral transpression (Schreurs, 1994; Schreurs and Colletta, 1998).

The boundary between the Andector and Fort Stockton blocks has been interpreted as an ENE-WSW cross fault zone (Figure 1; Yang and Dorobek, 1995a). In addition to flower structures and near vertical faults (Yang and Dorobek, 1995a), laterally offset anticline on either side of the fault zone (e.g., Jordan field) indicates left-lateral strike-slip deformation (Figure 1; Moody, 1973). In the southwestern Midland Basin, N-NNE trending fold axes at Sweetie Peck, Warsan, and Pegasus fields are not coaxial with the consistent NW-trending en echelon anticlines within the Pegasus-Amacker structural trend (Figure 2a). We suspect these "anomalous" fold axes within an overall NW-trending regional fold pattern may reflect deformation above a deeply buried E-W trending left-lateral strike-slip fault that may extend from the E-W trending left-lateral cross fault zone between the Andector and Fort Stockton blocks (Figures 1, 2a).

Age of Uplift along the CBP: A pre-Atokan (late Mississippian–early Pennsylvanian) unconformity across parts of the CBP reflects the timing of initial uplift of the proto-CBP (Hills, 1970). Structural relief from the crest to the flank of various structural highs was apparently negligible after this initial deformation, which allowed for subsequent onlap of middle to late Pennsylvanian carbonate platform strata (Frenzel et al., 1988; Hanson et al., 1991). Another major regional unconformity, however, marks major uplift of the CBP (Bebout and Meador, 1985; Yang and Dorobek, 1995a). This intense uplift removed most Pennsylvanian strata and parts of the lower Paleozoic section along the margins of the CBP, whereas the interior of the CBP was eroded down to Precambrian basement (Gardiner, 1990a; Ewing, 1991). Uplift of the CBP reached a peak during late early Wolfcampian time and because most faults terminate below the Leonardian section, faulting and uplift of the CBP were probably over by late Wolfcampian time (Ewing, 1991; Yang and Dorobek, 1995a; Tai and Dorobek, 1999).

Summary of Late Paleozoic Deformation History of the CBP: On the basis of our observations, it appears that the fold and fault patterns mapped across the southwestern Midland Basin and eastern margin of the CBP were produced by right-lateral strike-slip deformation with an additional component of shortening during late middle Pennsylvanian-Wolfcampian time. Although normal faults are documented at the NW corner of the Fort Stock Block and SE corner of the Andector Block, the dominance of contractional structures strongly suggests a convergent strike-slip (transpressional) origin for the structural features of the CBP, eastern Delaware Basin, and western Midland Basin. These late Paleozoic contractile structures in the Permian Basin may be the products of transpressional strain transmitted through the basement by the Marathon fold-and-thrust belt, or the contractile component of partitioned transpressional stress (cf. Jones and Tanner, 1995; Teyssier et al., 1995). The timing of deformation can be inferred from regional unconformity development and fault terminations, which suggest that the initial uplift of the northwest-north trending anticlines across parts of the eastern Delaware Basin, proto-CBP, and western Midland Basin began in late Mississippian-middle Pennsylvanian time. Subsequent deformation distributed regionally across the eastern Delaware Basin, CBP, and western Midland Basin during late Pennsylvanian time. After late Pennsylvanian time, deformation became localized along the faulted boundaries of the CBP, where significant basement shortening and uplift took place. Faulting and uplift of the CBP ceased by late Wolfcampian time.

KINEMATIC ANALYSIS OF THE CBP BOUNDARY FAULTS

Descriptions of the boundary fault zones of the CBP are given elsewhere (Shumaker, 1992, Yang and Dorobek, 1995a), but little has been published regarding the slip motion and amount of displacement along the boundary faults (Hills, 1970; Gardiner, 1990b; Shumaker, 1992; Yang and Dorobek, 1995a). We begin our analysis of the CBP by examining the orientation of fold axes that can be used to estimate the direction of maximum principal stress. Because there was no apparent fold axis rotation during deformation, the NW-SE trending folds across the eastern Delaware Basin, CBP, and western Midland Basin appear to be related to NE-SW directed compressional stress (Hills, 1970), which would have been oblique to the boundary fault zones of the CBP. If this is true, the CBP's boundary fault zones must have accommodated

The Permian Basin: Proving Ground for Tomorrow's Technologies, W. D. DeMis, M. K. Nelis, and R. C. Trentham, eds.;
West Texas Geological Society Publ. # 00-109

Tectonic Model for Late Paleozoic Deformation of the Central Basin Platform, Permian Basin Region, West Texas

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ABSTRACT

The Central Basin Platform (CBP) is an important tectonic element in the subsurface of the Permian Basin region. It is a major intraforeland uplift that trends at high angle to the Marathon fold-and-thrust belt. This study examined structural features across the southwestern Midland Basin and eastern CBP along with a compilation of published information from the eastern Delaware Basin and other parts of the CBP in order to document the tectonic history of these areas.

Structural interpretation from seismic data, structure contour maps, and structural cross sections show that the southwestern Midland Basin, interior CBP, and eastern Delaware Basin are characterized by NW-SE trending en echelon folds. These folds are typically asymmetric in cross-section with the steeper limb of the fold being cut by steeply dipping reverse faults that trend sub-parallel to fold axes. The folds are arranged in a right-stepping en echelon pattern with low obliquity to the boundary fault zones of the CBP. At a larger scale, the CBP consists of two main crustal blocks that also are arranged in en echelon pattern with steeply dipping reverse and thrust faults, asymmetrical flower structures, and a few normal faults at boundaries. The western margin of the CBP has greater structural relief, vertical separation, and basement shortening than the eastern margin. The dominance of contractional structures and en echelon arrangement of these structures in map view indicate that the CBP and adjacent areas formed in a right-lateral convergent strike-slip (transpressional) tectonic setting.

A simple geometric method was applied to evaluate the slip motions along the boundary faults of the CBP. Geometric analysis shows that the NNW-NW trending boundary faults were subjected to right-lateral convergence-dominated oblique-slip deformation, whereas the ENE-WSW trending boundary faults were subjected to left-lateral strike-slip dominated oblique-slip deformation. The derived slip motions along the boundaries of the CBP explain the wide variety of structural features observed and also agree with previously proposed models that involve clockwise rotation of crustal blocks within the CBP.

The structural patterns associated with the eastern Delaware Basin, CBP, and western Midland Basin can be explained by considering these areas together as a transpressional deformation zone. Three stages of deformation can be recognized based on significant changes in the style of the deformation and by the area of active deformation through time. An initial NE-SW directed compressive stress caused minor en echelon folding across parts of the eastern Delaware Basin, CBP region, and western Midland Basin during late Mississippian-middle Pennsylvanian time. After a middle Pennsylvanian phase of relative tectonic quiescence, renewed and amplified compressive stress in late middle Pennsylvanian time generated right-lateral convergent shearing across the transpression zone and was responsible for the formation of regionally distributed en echelon faulted anticlines. During late Pennsylvanian-Wolfcampian time, strain partitioning occurred within the transpression zone. En echelon folding within the sub-basins ceased, but continued right-lateral oblique slip across the transpression zone was accommodated along the boundaries of the CBP, where pre-existing basement weaknesses were reactivated as high-angle faults. Major uplift of the CBP occurred during this last phase of late Pennsylvanian-Wolfcampian deformation.

The tectonic relationships between the subtle structures within the sub-basins and the CBP are an example of the sequential development of structures that can develop during progressive transpressional deformation across a foreland basin. Our study of the CBP and adjacent areas may provide insight into the origins of similar intraforeland basement uplifts that developed elsewhere across the interior of the North America during late Paleozoic time.

that have not yet been recognized (Mazzullo, 1990). With improved geological and geophysical methods and models, it may be possible to further develop this already significant play.

Mississippian Play

The Mississippian play in southeast New Mexico is relatively insignificant as to overall production, having accumulated a total of 2 MMBO and 19 BCF gas (Table 1) from 23 designated reservoirs. Production is obtained from northern Lea and eastern Chaves counties (Fig. 1) and comes mostly from isolated bioclastic limestone shoals of limited permeability. Hydrocarbons are trapped either stratigraphically or in combination with associated structures. Approximately 40% of the total production at the 10-well Austin reservoir has come from the 1957 discovery well.

Morrow Play

The Morrow Formation is one of the most significant gas producing zones in southeast New Mexico. The 219 designated Morrow reservoirs, located primarily in Eddy, Lea, and southernmost Chaves counties (Fig. 1), have combined production of over 3,062 BCF of nonassociated gas and 22 MMB of condensate (Table 1). Most of these reservoirs have been developed on 320 acre spacing. Depth to production ranges from less than 7,000 ft to more than 15,000 ft in the deeper portions of the Delaware Basin (Fig. 1). Average reservoir depth is 11,100 ft.

The Morrow section can be subdivided into three distinct zones, commonly designated as the lower ("A"), middle ("B"), and upper ("C") intervals. Productive reservoirs are found almost exclusively in the siliciclastic lower and middle Morrow intervals and are generally composed of angular to subangular, medium- to very coarse-grained quartzose sandstone deposited principally in fluvially dominated (lower Morrow) and wave dominated (middle Morrow) deltaic settings (Anderson, 1977; James, 1985; Mazzullo and Mazzullo, 1985). Net pay is generally 20–30 ft thick, but can be more than 80 ft in distributary channel facies. Trapping commonly occurs by a combination of stratigraphic, structural, and/or diagenetic factors; silica and clay cements significantly affect reservoir characteristics (Anderson, 1977; James, 1985; Mazzullo and Mazzullo, 1985).

Atoka Play

One hundred forty-one Atokan age reservoirs have combined to produce 529 BCF of primarily nonassociated gas and 6 MMB of condensate (Table 1) in southeast New Mexico. The bulk of these reservoirs lie either in the Delaware Basin or near its margin on the Northwest shelf. Reservoirs can be found at depths ranging from 8,500 ft to more than 14,000 ft. Production is generally obtained from fluvial-deltaic and strandline sandstones derived primarily from the Pedernal Highlands to the northwest. Porosity of productive sandstones averages 10%. However, significant, but scattered production is also found in southern Lea and Eddy counties from a trend of low porosity carbonate mounds (James, 1985). Reservoirs of limited extent are common in the Atoka and trapping generally occurs by a combination of structural and stratigraphic mechanisms. Many of the deeper Atoka reservoirs are significantly overpressured and require extreme care when drilling.

EXHIBIT #18

PB-10. GRANITE WASH (PERMIAN)

Stephen W. Speer

The Granite Wash play (Fig. PP-5.1) is confined to lower Permian clastic sediments deposited on or immediately adjacent to localized uplifts that remained in southeast New Mexico during early Permian time. The most prominent of these is the Eunice High, the apparent Precambrian crest of the Central Basin platform (Fig. PB-10.2). Granite Wash reservoirs here were developed in response to the final phase of uplift and burial of the highest portions of the Central Basin platform during early Wolfcampian time (Hills, 1984). The uplift and subsequent erosional unroofing and exposure of its granitic core resulted in the deposition of associated alluvial-fan and fluvial sediments in adjacent low areas (Bowsher and Abendshein, 1988) with the eventual burial of the high as it foundered in its own debris.

Wantz Granite Wash (Table PB-10.1, Fig. PB-10.3) is the only one of three reservoirs in this play to have cumulative production exceeding 5 BCF gas. Discovered in 1963, it has yielded 32 BCF of associated gas from 117 wells (Fig. PB-10.4). It is classified as an oil reservoir, having produced more than 6.6 MMBBLS of sweet, high-gravity oil (38–42° API). Average depth to the reservoir is 7,200 ft with most wells penetrating approximately 80 ft of gross pay interval and reaching total depth 50 ft into the Precambrian granite basement. The reservoir is normally pressured with most wells drilled with mud and completed through perforations in production casing. Moderately sized fracture completion treatments are utilized if necessary to improve production performance.

Traps for this play are generally structural-stratigraphic combinations. Hydrocarbons have migrated to this high area of the platform and are trapped in discontinuous sands and conglomerates surrounded by impermeable shales. Minor faulting within the reservoir, as evidenced by local areas of tight structure contours (Fig. PB-10.4), appears to have complicated the trapping mechanism by compartmentalizing the reservoir. Recently, reinterpretation of drill cuttings, log responses, and other reservoir characteristics indicates that much of the reservoir facies previously described as granite wash may be in situ fractured Precambrian granite (A. L. Bowsher, pers. comm. 1991).

Specific reservoir lithologies range from sandy conglomerates composed of gravelly unroofed sedimentary cover (limestone and dolomite) and granitic core material to immature, poorly sorted, medium- to coarse-grained sandstones. Net pay averages 28 ft with 14% intergranular porosity and 1.6 md horizontal permeability. Average hydrocarbon saturation is 45% (Bowsher and Abendshein, 1988).

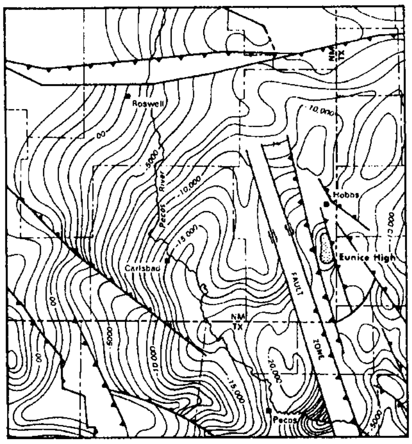


FIGURE PB-10.2—Precambrian basement structure map in the Permian Basin showing the Eunice High on the Central Basin platform. Datum is sea level. Contour interval is 1,000 ft. Modified from Hills, 1984.

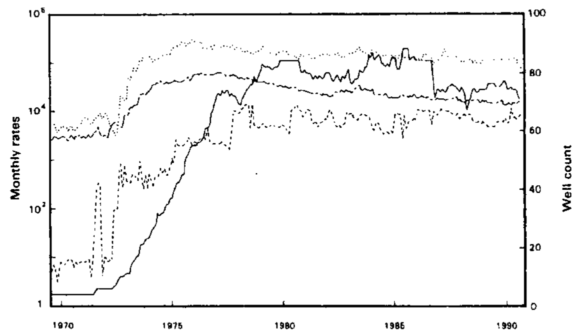


FIGURE PB-10.3—Historical production from the Wantz Granite Wash reservoir. ···, gas (MCF); — - —, oil (BBLS); ---, water (BBLS); —, wells. From INTERA Bergeson; data source, Dwight's Energydata, Inc.

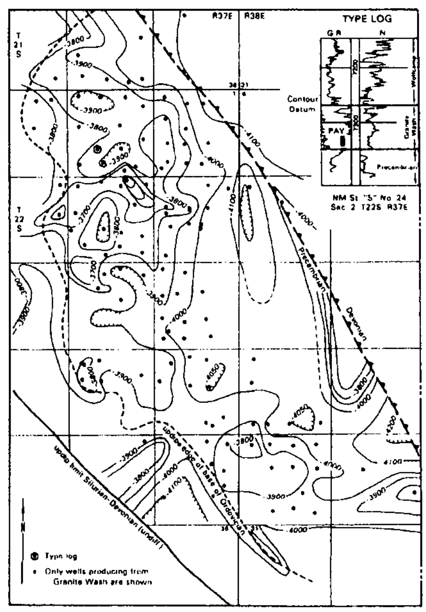


FIGURE PB-10.4—Structure map contoured on top of Granite Wash interval in Wantz reservoir. Irregular relief across the reservoir is due to the uneven underlying erosional surface combined with variable Granite Wash interval thicknesses. Datum is sea level. Modified from Bowsher and Abendshein, 1988.

TABLE PB-10.1—Geologic, engineering, and production data for the Granite Wash and Mississippian plays. Heads explained on last page.

St	County	Reservoir	Ty	Disc	Wells	Aban	Spa	Acres	Depth	Trap	Drl	Lith	DeEn	PostD	Por	Perm	Temp	PrGr	CumBCF	PDR
NM	Lea	Wantz (Granite Wash)	G	1963	83	34	40	9000	7200	Spm	SG	Siun	Afun	Coce	0.14	1.600	135	0.430	32.300	7.8
NM	Lea	Austin (Mississippian)	N	1957	8	2	320	2900	13310	Spm	PD	Gran	Pesb	Gren	0.06		191	0.430	10.600	3.0

EXHIBIT #1

ROSWELL GEOLOGICAL SOCIETY SYMPOSIUM

Author: Symposium Committee
Affiliation: Roswell Geological Society
Date: September 15, 1966

Field Name: Osudo Morrow
Location: T-20 & 21-S, R-35 & 36-E
County & State: Lea County, New Mexico

Discovery Well: British American Oil Producing Co. #1 North Wilson Deep Unit
SW/4 SE/4, Section 31, T-20-S, R-36-E

Exploration Method Leading to Discovery: Seismic

Pay Zone:
Formation Name: Morrow **Depth & Datum Discovery Well:** 11350 (-7694)
Lithology Description: Sandstone, coarse, angular, poorly sorted, orthoquartzite

Approximate average pay: 20 gross 20 net **Productive Area** 3840 acres

Type Trap: Stratigraphic trap. Pay consists of pinchout of several small sand bodies along west side of a strong positive structure

Reservoir Data:
5-10 % Porosity, ____ Md Permeability, 25-40 % Sw, ____ % So
Oil: 51.2 gravity
Gas: .620 gravity
Water: none Na+K, ____ Ca, ____ Mg, ____ Cl, ____ SO_4, ____ CO_2, or HCO_3, ____ Fe
Specific Gravity ____ **Resistivity** ____ ohms @ ____ °F
Initial Field Pressure: 6800 psi @ -7550 datum **Reservoir Temp.** 165 °F
Type of Drive: Gas expansion

Normal Completion Practices: Set casing through pay, perforate, and complete natural. Some wells need stimulation.

Type completion: **Normal Well Spacing** 640 Acres

Deepest Horizon Penetrated & Depth: Devonian 12,670 -9014

Other Producing Formations in Field: Wolfcamp, Strawn, Atoka, Yates

Production Data:

YEAR	TYPE	No. of wells @ yr. end Prod.	S.I. or Abd.	PRODUCTION OIL IN BARRELS GAS IN MMCF ANNUAL	CUMULATIVE	YEAR	TYPE	No. of wells @ yr. end Prod.	S.I. or Abd.	PRODUCTION OIL IN BARRELS GAS IN MMCF ANNUAL	CUMULATIVE
1964	OIL	1		112	112		OIL				
	GAS			6	6		GAS				
1965	OIL	1		16,900	17,012		OIL				
	GAS			1,644	1,650		GAS				
1966*	OIL			12,913	29,925		OIL				
	GAS			1,501	3,151		GAS				
	OIL						OIL				
	GAS						GAS				

* Production to July 1, 1966

cores from the Prairie Fire State #1 were obtained. Intervals within the middle and lower Morrow were sampled in each core.

Description of the middle and lower Morrow Formation in the Osudo Field is based on macroscopic and microscopic study of the three available whole cores and sidewall cores. Eleven lithofacies were distinguished in the middle and lower Morrow: 1) fossiliferous, fissile black shale, 2) gray siltstone, 3) interbedded shale and silty sandstone, 4) herringbone crossbedded, silty to fine-grained sandstone, 5) incline-bedded, silty to fine-grained sandstone, 6) rippled, silty to fine-grained sandstone, 7) trough crossbedded, silty to fine-grained sandstone, 8) gray to tan fine-grained sandstone, 9) gray to tan coarse-grained sandstone, 10) incline-bedded, coarse-grained sandstone, and 11) ooid grainstone.

Detailed stratigraphic analysis and interpretation of the depositional environments made it possible to construct 2-Dimensional depositional models utilizing cross sections. The depositional environments determined from the core were plotted onto the well logs and then correlated throughout the field. The cross sections demonstrate the complexity of the reservoir. A cross section constructed north to south shows an overall thickening of the Morrow clastics section. Cross sections going from the west side of the field to the east demonstrate the complexity and number of channels. The depositional environment of the entire field is interpreted to be marginal marine to deltaic.

Reservoir analysis shows that the majority of production comes from the middle Morrow. Table 1 summarizes the production information. The 19 wells marked as undetermined lack sufficient data. Either the wells were too new or too old to obtain complete perforation and other needed completion information. A structure map on the top of the middle Morrow indicates there could be two major faults and that the structure is highest to the northeast and lowest to the southwest stepping down across the faults. However, because there is post depositional faulting the present-day structure of the middle Morrow does not necessarily represent the topography at the time of deposition. In addition, a gross thickness map of the Morrow clastics show alternating thicks and thins from north to south across the field. It is possible that these thicks and thins could be attributed to minor faulting between the two major faults.

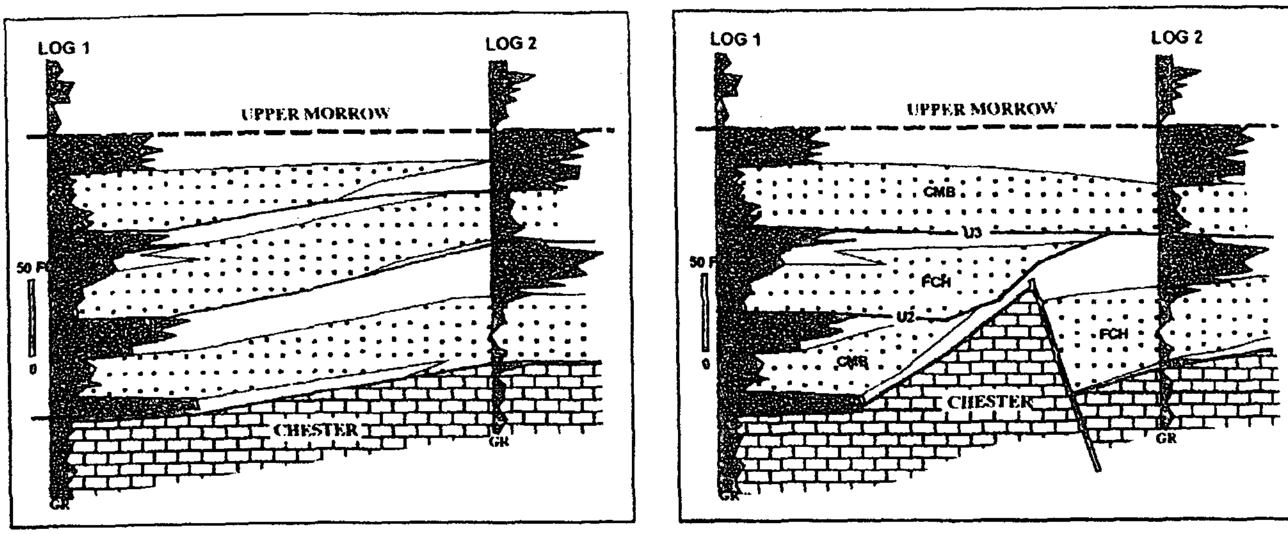
CONCLUSIONS

The focus of this study is the Morrow clastics interval of the Morrow Formation in the Osudo Field, Lea County, New Mexico. Through examination of core and

Table 1-Production by zone

ZONE	NO. WELLS	CUM PROD.	AVG CUM
Middle Morrow	68	208 BCF	3.1 BCF
Lower Morrow	5	6.5 BCF	1.3 BCF
Middle & Lower	5	6.5 BCF	1.3 BCF
Undetermined	19	20.7 BCF	1.1 BCF

EXHIBIT #7



MIS-CORRELATED TRUE CORRELATION

Figure 8. Two interpreted gamma ray log sections from the previous figure. The true correlation accurately reflects conditions shown in Figure 7.

markers may in fact be two entirely different time units, despite similarities in electric log signatures that are used for correlations. To illustrate this point, Figure 7 shows development of a hypothetical Morrow clastics section in present-day Eddy County, New Mexico that is a scenario common to the Morrow throughout the region. Pre-existing Late Mississippian faults in places may have influenced deposition of south-trending fluvial channels in the basal Morrow, during an initial lowstand event. These fluvial sands were superceded by deposition of an east-trending channel mouth bar or deltaic sand during a subsequent highstand. Prior to the end of the lower Morrow, the deep fault was reactivated, and movement along it caused tilting of pre-existing beds. Part of the channel mouth bar sand was eroded by an incised fluvial channel during another lowstand. Sometime in the middle Morrow, another highstand channel mouth bar unit built up and was partially reworked by wave energy as the sea advanced further shoreward.

Figure 8 shows gamma ray log sections through the Morrow illustrated in Figure 7, taken less than one mile apart. This figure illustrates how the Morrow section in closely-spaced wells can be easily mis-correlated based upon log signatures. The mis-correlated interpretation differs dramatically from the true correlation as depicted in figure 7. Reservoir mapping based on the mis-correlation would incorrectly project the orientations of the individual sand bodies that make up the section. For example, south-trending fluvial sands might be correlated to east-trending channel mouth bar sands in adjacent wells, resulting in a map interpretation with erroneous reservoir morphologies. New or offset wells based on such a map may not be optimally located.

EXPLORATION/DEVELOPMENT STRATEGIES

Log correlations alone are not a reliable means by which to map sequences in the Morrow clastics because in many instances, the mapper will inadvertently cross time lines and not correlate time-equivalent units. Biostratigraphic zonation of sandstone sequences is not possible because of the lack of diagnostic fossils. Although it may seem an impossible task to effectively map and correlate the Morrow, there is a vast database of well logs and well cuttings in southeastern New Mexico that, when used together, may help delineate correlative units much better.

The first practices that must be abandoned are the treatment of the Morrow section as a single unit and attempting to map too large an area at a time. Treatment of the whole section as a single geologic unit has two major drawbacks: (1) it blends different depositional environments that can exist in a single well bore or field area, and (2) it fails to recognize any missing section that can arise from intraformational unconformities. Mapping a large area increases the odds of correlation busts, especially in tectonically complex areas. In either case, the explorationist may either underestimate the potentials for multiple reservoir trends or project trends into areas where sands may be missing. The Morrow should be divided into smaller sequences, ideally no thicker than about 25 feet apiece, based initially upon "first pass" correlations using large-scale electric logs. These correlations may not all hold up under further analysis. The next step is to try and identify key time correlative markers with detailed sample analyses, looking for such features as soil horizons, unique and locally continuous marker beds, or laterally persistent lithologic as-which are superimposed on the second-order curve, and are key to understanding deposition of the Morrow in southeast New Mexico.

Figure 1-9 illustrates the breakout of the Morrow Series and the stage-level subdivision of the unit. Also shown is a type log for the Morrow rocks in the Northern Delaware Basin in the Perry R. Bass Big Eddy No. 86 Well. The contact between the Lower and Middle Morrow is shown by dashed lines in two positions above and below the well-known "Middle Morrow Shale", which is a good regional marker. The top of the Lower Morrow has been traditionally placed at the highest gamma ray spike above the sandstones of the Lower Morrow. As will be shown by this sequence stratigraphic study however, the "Middle Morrow Shale" is genetically connected to the Lower Morrow and constitutes a third-order highstand facies deposited following a major flooding of the basin. The top of the shale is picked at a basin-wide unconformity at the base of the Middle Morrow sequence.

The top of the Middle Morrow has been difficult to pick consistently on a regional basis. It has been typically picked at the base of the thick carbonate sequences that are characteristic of the Upper Morrow. For the purposes of this study an effort has been made to pick the "top" of the Middle Morrow at a consistent maximum flooding surface below the lowest significant carbonate unit of the Upper Morrow. In some locations, this occurs in a tidal flat to bay facies, and in other places, it has been cut out by a fluvial channel facies.

The climate during the Early Pennsylvanian was the primary driver of sea level changes that alternately created and destroyed accommodation space for accumulation of Morrow strata in the Northern Delaware Basin. Icehouse conditions developed during the Late Paleozoic and glacial ice accumulated in Gondwana (Crowley and Baum 1991). Yasamanov (1981) reports that ocean temperatures during the Morrowan were cooler on the basis of Ca:Mg ratios.

The Pennsylvanian Period lasted from 323 mya to 290 mya and the Late Paleozoic Ice Age discussed by Crowell (1999) lasted from 338 mya to 256 mya. Glacially driven transgressive-regressive cycles in the Early Pennsylvanian have been documented by Crowell (1978), Heckel (1986), and Veevers and Powell (1987), and the transition to icehouse conditions is postulated as the mechanism for the second-order lowstand shown in Figures 1-6 and 1-8.

The third-order cycles that are superimposed on the climatically driven, second-order lowstand in Figure 1-8 may be due to fluctuations in the ice sheets. Crowley and Baum (1991) postulate that changes in the Gondwanan ice area may have resulted in eustatic amplitudes ranging from 150 feet to 250 feet between lowstand and highstand. It is interesting to note that a sea level rise of 150 feet to 250 feet from lowstand to highstand would result in a landward shift in a shoreline of approximately 20 miles to 30 miles (i.e. 4 to 5 townships) across a basin floor with a slope of less than 0.08°. The flatter slopes that may have existed across some areas of the basin (0.01°) would have resulted in even greater dislocations of the shoreline.

In addition to climatic mechanisms, tectonism in the Pedernales highlands to the north of the study area probably influenced sediment flux into the Morrow rivers, and affected the stratigraphic architecture of the Morrow. Periods of uplift would have resulted in larger volumes of coarser-grained sediment being delivered to the basin, and enhanced the potential for progradation of deltas and coastal plains. During periods of reduced tectonism, the sediment volume and average grain size would have decreased, resulting in a tendency for the Morrow coastline to retrograde.

Discriminating a tectonic signal from a eustatic signal in the Morrow is complicated by the extensive downcutting and cannibalization of the fluvial channels as discussed in the next chapter. This has made detailed correlation of systems with well-vegetated floodplains and adequate sediment supply may anastomose as base level rises, producing stacked channels.

In the case of a static base level, rivers will typically meander and migrate laterally. Prolonged migration may yield extensive, laterally amalgamated point bar deposits, which will form laterally stacked sheet sands (Holbrook 1996; Olsen et al. 1995). Under these conditions, fluvial sands will form broad, continuous bodies. These units may be overlain by subaerial fine-grained sediments, which are subject to weathering and the development of paleosols.

In fine-grained, meandering fluvial systems, an increase in accommodation space will lead to vertically and laterally separated point bar sands in a mud-dominated valley fill (Holbrook 1996; and Smith and Smith 1980). These reservoirs tend to be isolated from each other as a result.

Fluvial crevasse splays are typically small-scale and attached to or associated with levee deposits. Mjøs et al (1993) report on the architectural aspects of crevasse splay lobes in the Ravenscar Group of Yorkshire, UK. They report width/thickness ratios for single lobe deposits of less than 1500 and length/thickness ratios of less than 2000. They also found that the units thinned rapidly outward, and that some of the thicker crevasse splay sands were in communication with their feeder fluvial channel.

Fluid communication within fluvial channel deposits is controlled to varying degrees by sedimentology. Depositional processes and the caliber of the supplied sediment influence sedimentary processes within the channel, creating a wide variety of bedforms that may erode, cross-cut or overly one another (Allen 1983). This leads to internal heterogeneities including shale drapes and abrupt textural changes, and may compartmentalize the reservoir (Hooke 2003; Miall 1985, 1988a, 1988b). Taylor and Ritts (2004) analyzed fluvial sandstones in the Uinta Basin of Utah and concluded that within channel and crevasse splay

The gradient was low, and there is no evidence for the hundreds of feet of valley relief that is seen in the Lower Morrow. Because of the low gradient, and limited accommodation space, these fourth-order sequences are thin. They are, however, locally dominated by fluvial sandstones that may exceed 15 to 20 feet thick. These channel sandstones are often coarse-grained and internally heterogeneous due to cut-and-fill processes.

Deposition of this sequence was terminated by a rise in sea level and development of a highstand systems tract over a flooding surface. Subsequently, a series of high-frequency sea level cycles resulted in the stacking of a succession of similar fluvial-dominated lowstand systems tracts capped by estuarine and/or bay-dominated highstand systems tracts. Figure 3-29 illustrates an example of one of the fourth-order lowstands in the upper portion of the Middle Morrow. A drop in sea level caused a basinward shift in the shoreline and incision of river systems on the exposed plain. The interfluvial divides shown in brown are underlain predominantly by highstand facies of underlying sequences. Subsequent highstand facies are dominated by finer grained bay and nearshore deposits, which will possess coarsening upward log signatures and more lobate geometries.

As documented in Table 2-2, **fluvial reservoirs are the most abundant and most important reservoir type in the Middle and Lower Morrow of the Northern Delaware Basin**. Based on this study they may be most commonly recognized in well logs by their sharp-based, fining-upward character. **Fluvial channel reservoirs will be oriented parallel to depositional dip**, and associated reservoir facies include crevasse splays and avulsion channels. These reservoirs, and the fluvial valleys that contain them, broadly trend northwest to southeast in the western half of the basin, and become more north to south in the eastern half.

Where individual channels have meandered and eroded into coeval channels, they may be in communication. Lateral communication will be controlled by 1) the depth of incision and width of the river valley; 2) the extent of lateral migration of the river systems and the frequency with which the migrating channels cut into each other; and 3) the presence or absence of mud drapes or grain size changes along the contact between the two channel sandstones that may form baffles in the reservoir.

Sea level changes during Lower and Middle Morrow time resulted in the deposition of multiple, stacked and "nested" sequences containing fluvial sandstone reservoirs capped by estuarine and bay sediments. These sequences grade from fluvial-dominated successions up-dip to shoreface and deltaic successions down-dip. These down-dip facies are typically thinner bedded, finer grained, and have greater along-strike dimensions than the fluvial reservoirs. All of the non-fluvial channel facies in this core study together constitute less than half of the total facies thickness of the Morrow (Table 2-2).

Based on this stratigraphic analysis and the paleogeographic reconstructions in Figures 3-26 through 2-29, the Lower Morrow river systems tend to be concentrated in the northern two-thirds of the study area (ie., north of T24S). Fluvial channels will be the most significant reservoir type in these areas; whereas south of T24S deltaic and shoreface/shelf sands will be more common. In the case of the Middle Morrow, the fluvial channel sands are typically thinner than the Lower Morrow, and the point at which the reservoirs grade from fluvial to transitional facies (deltaic and shoreface/shelf) is further north, possibly as far north as T22S.

sociations. The aim here is to place each general sequence into its proper depositional facies context. Sandstones should be related both laterally and vertically to the facies in which they are encased (Mazzullo, 1999). Once gross depositional sequences are isolated, the log correlations can be adjusted if needed, and isopach maps of each small sequence drawn to determine (1) the precise geometry and orientation of each reservoir, and (2) any potential terminations of reservoirs due to intraformational unconformities. **In field extension studies, production histories and bottom hole pressure data (if available) of each Morrow well may be useful in determining pressure separation between zones in adjacent wells that were thought to be correlative. They can also be used to identify suspected permeability barriers that exist between closely-spaced sand bodies that may actually reflect mis-correlated, pressure-separated sand bodies.**

CONCLUSIONS

The Morrow Formation of southeastern New Mexico is a complicated depositional system that had been subjected to syn- and post-depositional tectonically-induced changes that are not always recognized or obvious to the exploration or development geologist. Many dry holes or poor producers have been drilled in the Morrow when it seemed a sure bet that "the thickest sand is going off in that direction". Whereas loss of reservoir sands can be related to such phenomena as clay plugging in the case of a fluvial channel, it can also be attributed to re-activation and at times, complete removal at an intraformational unconformity. It is important to know where these surfaces are in a section, and also important to realize that abrupt changes in section can happen within very short lateral distances and more than once within a single well. Consequently, it may be an exercise in futility to try and map too large an area of the Morrow at a time; efforts should focus on smaller mapping areas and vertical sequences.

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STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 13492

APPLICATION OF SAMSON RESOURCES COMPANY, KAISER-FRANCIS OIL COMPANY, AND MEWBOURNE OIL COMPANY FOR CANCELLATIN OF TWO PERMITS AND APPROVAL OF A DRILLING PERMIT, LEA COUNTY, NEW MEXICO.

CASE NO. 13493

APPLICATION OF CHESAPEAKE PERMIAN, L.P. FOR COMPULSORY POOLING, LEA COUNTY, NEW MEXICO.

ORDER NO. R-12343-B

STIPULATION BY THE PARTIES AS TO UNDISPUTED EVIDENCE TO BE CONSIDERED BY THE COMMISSION

The parties hereto, Samson Resources Company, Kaiser-Francis Oil Company and Chesapeake Operating, Inc., join in stipulating that the following facts and exhibits represent evidence that is not in dispute, that they ask to be made part of the record in this *de novo* proceeding before the Oil Conservation Commission and be considered by the Commission as with other evidence.

A. Section 4 of Township 21 South, Ranch 35 East, NMPM, in Lea County, is an irregular section consisting of approximately 950.8 acres, more or less, and is approximately one mile wide from east to west, and one and one-half miles long from north to south. The subdivisions of Section 4 are as follows:

(1) the southeast quarter (geographically, the east half of the south one-third), consisting of lots 17, 18, 23 and 24;

(2) the southwest quarter (geographically, the west half of the south one-third), consisting of lots 19 through 22;

(3) lots 9, 10, 15 and 16, being the quarter section immediately north of the southeast quarter, hereinafter called "the east half of the middle one-third;" and

(4) lots 11 through 14, being the quarter section immediately north of the southwest quarter, hereinafter called "the west half of the middle one-third."

(5) lots 1 through 5, consisting of 310.8 acres, more or less, being the two northern most quarter sections.

B. Oil and gas minerals within the entire Section 4 (as well as the surface) are owned by the State of New Mexico, and all acres have been leased. Lease status and ownership are as follows:

(1) The southeast quarter is leased under State of New Mexico Lease No. B-1481. Kaiser-Francis, Samson, and Mewbourne own all the working interest.

(2) The southwest quarter is leased under State of New Mexico Lease No. VO-7063. Chesapeake Permian LP owns all the working interest.

(3) The middle one-third of Section 4 is leased under State of New Mexico Lease No. VO-7054. Samson owns all the working interest.

(4) The northern one-third of Section 4 is leased under State of New Mexico Lease No. VO-7062. Chesapeake Permian LP owns all the working interest.

(5) Chesapeake does not own any interest in the southeast quarter of Section 4, and has not owned any such interest at any time relevant to this case. Chesapeake has no contractual right with respect to the mineral estate in the southeast quarter of Section 4 unless such right arises by virtue of approval by Samson of an AFE (authorization for expenditures) issued by Chesapeake for the KF 4 well, under circumstances detailed below.

C. On February 27, 2005, Mewbourne ran electric logs showing over 40 feet of Morrow porosity on its Osudo 9 State Com. Well No. 1 (API No. 30-025-36828) (the "Osudo 9 well") located in the southeast quarter of the northeast quarter of Section 9, Township 21 South, Range 35 East, NMPM, being the quarter section immediately south of the southeast quarter of Section 4. On March 8, 2005, Mewbourne placed that well on line and began selling natural gas. The Osudo 9 well is a prolific producer of natural gas from the Morrow formation and is owned by Mewbourne, Chesapeake, and Finley Resources.

D. On March 10, 2005 Chesapeake Operating, Inc. filed an APD for the KF 4 well, designating a lay-down spacing unit consisting of the southeast and southwest quarters of Section 4. The Division approved Chesapeake's APD on March 11, 2005.

E. On March 9, 2005, Chesapeake sent a letter to Samson (received on March 11, 2005) proposing the drilling of the KF 4 well "in the south half of Section 4" and requesting the recipient to elect whether or not to participate. The letter also invited Samson to enter into negotiations for sale of their interest to Chesapeake, but stated, "be advised that entering into negotiations to sell Samson's interest does not excuse or allow Samson to delay the required election under this well proposal." Chesapeake also sent a similar proposal letter to Kaiser-Francis. Chesapeake did not send a proposal letter to Mewbourne because Mewbourne had not yet obtained an interest in the proposed spacing unit.

F. There was no operating agreement between Chesapeake and Samson or Kaiser-Francis that would require an election, and Chesapeake knew that there was no such agreement.

G. On March 22, 2005 Samson signed and returned Chesapeake's election letter and AFE, indicating that it elected to participate in the proposed KF 4 well, but did not send its portion in of the dry hole costs as requested in the letter.

H. On March 28, 2005 Mewbourne, as operator on behalf of Samson et al., filed an APD for its proposed Osudo 4 State Com. No. 1. The Mewbourne APD proposed a location in the southeast quarter and the east half of the middle third of Section 4. The Division rejected Mewbourne's APD on March 30, 2005, by reason of the earlier approval of Chesapeake's APD.

I. On March 30, 2005 Samson sent a letter and fax to Chesapeake stating that, "Samson hereby rescinds and revokes its invalid election to participate in [the KF 4 well]."

J. On April 15, 2005 Chesapeake began site construction for the KF 4 well.

K. On April 20, 2005 Mewbourne, as the last of the designated parties (Kaiser-Francis, Samson, and Mewbourne), signed a communitization agreement providing for a communitized unit in the Morrow consisting of the southeast quarter and the east half of the middle third of Section 4.

L. On April 26, 2005 the applications in these cases were filed with the Division.

M. On April 27, 2005, the New Mexico State Land Office approved the Communitization Agreement described above, noting that, "[t]he effective date of this approval is April 1, 2005."

N. On April 27, 2005 Chesapeake spudded the KF 4 well.

O. The well was completed and placed on production on January 2006.

P. As of April 2006, the well had produced 270,279 Mcf of gas and 2,286 barrels of oil.

The following stipulated Exhibits are attached and incorporated herein:

Stip. Ex. 1: Plat of Section 4-21S-35E showing well locations

Stip. Ex. 2: Plat of Section 4-21S-35E showing lease ownership as of 3-10-05.

Stip. Ex. 3; Plat of Section 4-21S-35E showing Communitization Agreement acreage

Stip Ex. 4: Chesapeake APD, March 10, 2005, Form C-101 KF 4 State

Stip. Ex. 5:	Chesapeake Well Location Plat, March 10, 2005, Form C-102 KF 4 State
Stip. Ex. 6:	Chesapeake Sundry Notice, March 10, 2005, Form C-103 KF 4 State
Stip. Ex. 7:	Oil Conservation Division Rule – Rules 19.15.13.1102 (Form C-102) and 19.15.13.1103 (Form C-103)
Stip. Ex. 8:	Oil Conservation Division C-102 Instructions
Stip. Ex. 9:	Commissioner of Public Lands, Communitization Approval, April 27, 2005
Stip. Ex. 10:	Chesapeake Pooling Application
Stip. Ex. 11:	March 9, 2005 letter from Chesapeake to Samson re Well Proposal for KF 4 State No.1 with election by Samson
Stip. Ex. 12:	March 30, 2005 letter from Samson re Withdrawal of Election
Stip. Ex. 13	April 4, 2005 letters from Chesapeake to Kaiser Francis and Samson enclosing Joint Operating Agreement
Stip. Ex. 14:	April 5, 2005 letter from Samson to Chesapeake re JOA

Chesapeake Operating Inc.

By: ______________________
Its Attorney

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Samson Resources Company and
Kaiser-Francis Oil Company

By: ______________________
Their Attorney

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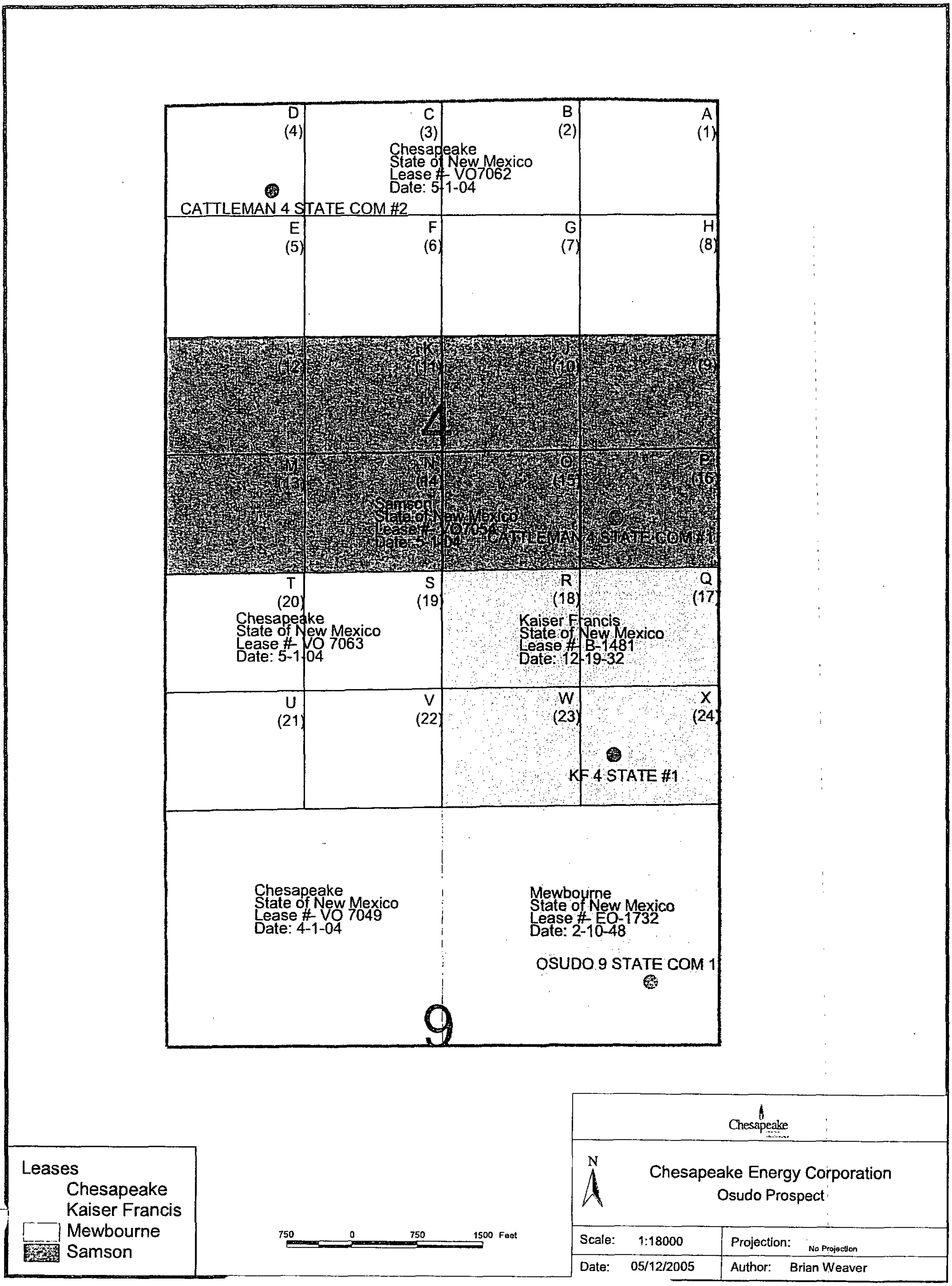
Scott Hall
Miller Stratvert P.A.
P.O. Box 1986
Santa Fe, NM 87504-1986



Stipulated Exhibit 1

NMOCD Case Nos. 13492 / 13493

Lease No. 4
V-7062

Chesapeake Exploration Limited Partnership - 75%

Rubicon Oil & Gas I, LP - 25%

Lease No. 3
V-7054

Samson Resources Co. - 100%

Lease No. 2
V-7063

Chesapeake Exploration Limited Partnership - 75%

Rubicon Oil & Gas I, LP - 25%

Lease No. 1
B-1481

Samson Resources Co. - 12.5%

Kaiser-Francis Oil Company - 87.5%

SECTION 4-21S-35E

OWNERSHIP AS OF 3/10/05

Stipulated Exhibit 2
NMOCD Case Nos. 13492 / 13493

April 1, 2005
Communitization Agreement
between
Samson Resources Co.
Kaiser-Francis Oil Company
Mewbourne Oil Company

Approved by Commissioner
of Public Lands,
State of New Mexico

SECTION 4-21S-35E

COMMUNITIZATION AGREEMENT

Stipulated Exhibit 3
NMOCD Case Nos. 13492 / 13493

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Ave., Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

orm C-101
Permit 8104

APPLICATION FOR PERMIT TO DRILL

Operator Name and Address	OGRID Number
CHESAPEAKE OPERATING, INC. PO Box 11050 Midland, TX 79702-8050	147179
	API Number
	30-025-37129

Property Code	Property Name	Well No.
34679	KF 4 STATE	001

Surface Location

UL or Lot	Section	Township	Range	Lot Idn	Feet From	N/S Line	Feet From	E/W Line	County
X	4	21S	35E		660	S	990	E	Lea

Proposed Pools

OSUDO;MORROW, SOUTH (GAS) 82200

Work Type	Well Type	Cable/Rotary	Lease Type	Ground Level Elevation
New Well	GAS		State	3621
Multiple	**Proposed Depth**	**Formation**	**Contractor**	**Spud Date**
N	12100	Morrow		03/18/2005

Proposed Casing and Cement Program

Type	Hole Size	Casing Size	Casing Weight/ft	Setting Depth	Sacks of Cement	Estimated TOC
Surf	17.5	13.375	48	450	500	0
Int1	12.25	9.625	40	5350	1300	0
Prod	8.75	5.5	17	12100	1350	4000

Casing/Cement Program: Additional Comments

13 3/8 csg: Lead 295 sx 35:65 Poz C + additives, Tail 205 sx Cl. C + additives, circ to surface; 9 5/8 cmt: 1,150 sx 50:50 Poz Cl C + additives, Tail 150 sx Cl. C + additives circ. to surface; 5 1/2 Prod Csg. 1st Stage Lead 275 sx 50:50 Poz Cl. H + additives, 1st Stage Tail 470 sx 50:50 Poz Cl H + additives; 2nd stage 555 sx 50;50 Poz Cl. H + additives, 2nd stage Tail 50 sx 50:50 Poz Cl H + additives.

Proposed Blowout Prevention Program

Type	Working Pressure	Test Pressure	Manufacturer
Annular	5000	5000	
Double Ram	5000	5000	

I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Electronically Signed By: Brenda Coffman
Title: Regulatory Analyst
Date: 03/10/2005 | Phone: 432-685-4310

OIL CONSERVATION DIVISION
Electronically Approved By: Paul Kautz
Title: Geologist
Approval Date: 03/11/2005 | Expiration Date: 03/11/2006
Conditions of Approval:
There are conditions. See Attached.

Stipulated Exhibit 4
NMOCD Case Nos. 13492 / 13493

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Ave., Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

orm C-102
Permit 8104

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Name	Pool Code
30-025-37129	OSUDO;MORROW, SOUTH (GAS)	82200
Property Code	**Property Name**	**Well No.**
34679	KF 4 STATE	001
OGRID No.	**Operator Name**	**Elevation**
147179	CHESAPEAKE OPERATING, INC.	3621

Surface And Bottom Hole Location

UL or Lot	Section	Township	Range	Lot Idn	Feet From	N/S Line	Feet From	E/W Line	County
X	4	21S	35E		660	S	990	E	Lea

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
320			

OPERATOR CERTIFICATION	SURVEYOR CERTIFICATION
I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.	*I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.*
Electronically Signed By: Brenda Coffman	Electronically Signed By: Gary L Jones
Title: Regulatory Analyst	Date of Survey: 03/10/2005
Date: 03/10/2005	Certificate Number: 7977

Per   :t Conditions Of Approval
C-101, Permit 8104

Operator: CHESAPEAKE OPERATING, INC. , 147179
Well: KF 4 STATE #001

OCD Reviewer	Condition
PKAUTZ	Re-seeding mixture will must be approved or authorized by surface owner
PKAUTZ	Notice is to be given to the OCD prior to construction of the pit(s)
PKAUTZ	Pit construction and closure must satisfy all requirements of O.C.D. Rule 19.15.2.50, and the Pit and Below-Grade Tank Guidelines

DISTRICT I
1625 N. French Dr., Hobbs, NM 88240
DISTRICT II
811 South First, Artesia, NM 88210
DISTRICT III
1000 Rio Brazos Rd., Aztec, NM 87410
DISTRICT IV
[illegible]

State of New Mexico
Energy, Minerals and Natural Resources Department

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, New Mexico 87504-2088

Form C-102
Revised March 17, 1999

Submit to Appropriate District Office
State Lease – 4 Copies
Fee Lease – 3 Copies

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Code	Pool Name
30-025-37129	82200	Osudo, S. Morrow (GAS)

Property Code	Property Name	Well Number
34679	KF "4" STATE	1

OGRID No.	Operator Name	Elevation
147179	CHESAPEAKE OPERATING INC.	3621'

Surface Location

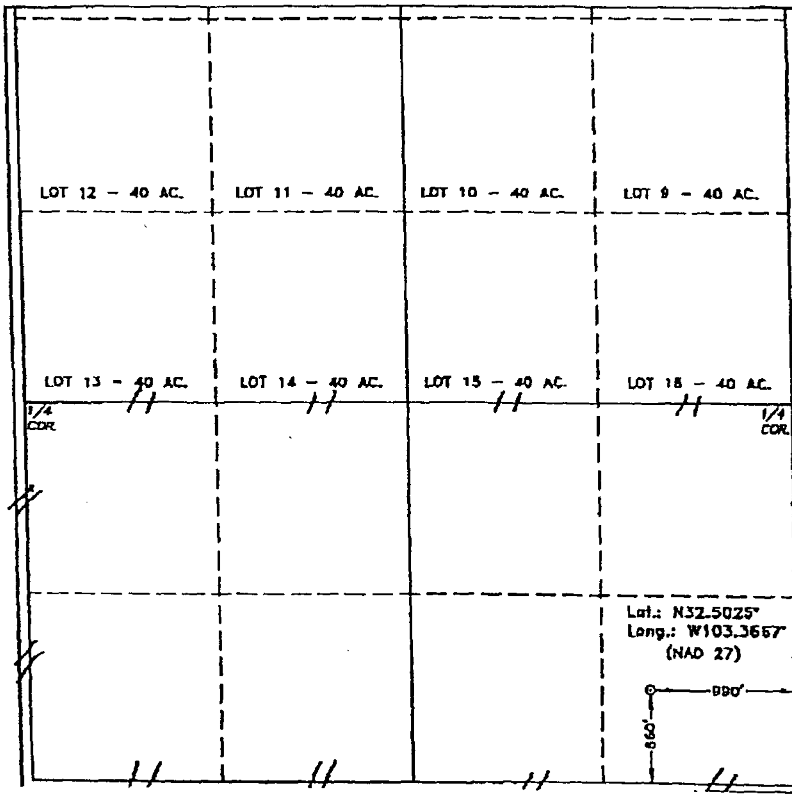
UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
X	4	21 S	35 E		660	SOUTH	990	EAST	LEA

Bottom Hole Location If Different From Surface

UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
320			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



OPERATOR CERTIFICATION

I hereby certify the the information contained herein is true and complete to the best of my knowledge and belief.

Brenda Coffman
Signature
Brenda Coffman
Printed Name
Reg Analyst
Title
3-10-05
Date

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervison and that the same is true and correct to the best of my belief.

MARCH 10, 2005
Date Surveyed
Signature & Seal of Professional Surveyor
NEW MEXICO
7977
No. 5206
Certificate No. Gary L. Jones 7977
BASIN SURVEYS

Stipulated Exhibit 5
NMOCD Case Nos. 13492 / 13493

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Ave., Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
May 27, 2004

WELL API NO. 30-025-37129

5. Indicate Type of Lease
STATE ☒ FEE ☐

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name
KF 4 State

1. Type of Well: Oil Well ☐ Gas Well ☒ Other

8. Well Number 001

2. Name of Operator
Chesapeake Operating, Inc.

9. OGRID Number
147179 82200

3. Address of Operator P. O. Box 11050
Midland, TX 79702-8050

10. Pool name or Wildcat
Osudo, & Morrow, South (gas)

4. Well Location
Unit Letter X / P : 660 feet from the South line and 990 feet from the East line
Section 4 Township 21S Range 35E NMPM County Lea

11. Elevation (Show whether DR, RKB, RT, GR, etc.)
3621

Pit or Below-grade Tank Application ☒ or Closure ☐

Pit type Drilling Depth to Groundwater 150 Distance from nearest fresh water well 1000 Distance from nearest surface water 1000

Pit Liner Thickness: 12 mil Below-Grade Tank: Volume 12139 bbls; Construction Material

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
PERFORM REMEDIAL WORK ☐	PLUG AND ABANDON ☐	REMEDIAL WORK ☐	ALTERING CASING ☐
TEMPORARILY ABANDON ☐	CHANGE PLANS ☐	COMMENCE DRILLING OPNS. ☐	P AND A ☐
PULL OR ALTER CASING ☐	MULTIPLE COMPL ☐	CASING/CEMENT JOB ☐	
OTHER: Close Pit ☒		OTHER: ☐	

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

Chesapeake plans to close the drilling pit for this well according to current NMOCD guidelines Section B3b.

(320 AC. S/2)

I hereby certify that the information above is true and complete to the best of my knowledge and belief. I further certify that any pit or below-grade tank has been/will be constructed or closed according to NMOCD guidelines ☒, a general permit ☐ or an (attached) alternative OCD-approved plan ☐.

SIGNATURE Brenda Coffman TITLE Regulatory Analyst DATE 03/10/2005

Type or print name Brenda Coffman E-mail address: bcoffman@chkenergy.com Telephone No. (432)687-2992

For State Use Only

APPROVED BY: [signature] TITLE PETROLEUM ENGINEER DATE MAR 1 1 2005

Conditions of Approval (if any):

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Ave., Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
May 27, 2004

WELL API NO. 30-025-37129

5. Indicate Type of Lease: STATE [X] FEE [ ]

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS
(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

1. Type of Well: Oil Well [ ] Gas Well [X] Other

2. Name of Operator: Chesapeake Operating, Inc.

3. Address of Operator: P. O. Box 11050, Midland, TX 79702-8050

4. Well Location
Unit Letter ~~X~~ P : 660 feet from the South line and 990 feet from the East line
Section 4 Township 21S Range 35E NMPM County Lea

7. Lease Name or Unit Agreement Name: KF 4 State

8. Well Number: 001

9. OGRID Number: 147179 82200

10. Pool name or Wildcat: Osudo, & Morrow, South (gas)

11. Elevation (Show whether DR, RKB, RT, GR, etc.): 3621

Pit or Below-grade Tank Application [X] or Closure [ ]

Pit type Drilling Depth to Groundwater 150 Distance from nearest fresh water well 1000 Distance from nearest surface water 1000

Pit Liner Thickness: 12 mil Below-Grade Tank: Volume 12139 bbls; Construction Material

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
PERFORM REMEDIAL WORK [ ]	PLUG AND ABANDON [ ]	REMEDIAL WORK [ ]	ALTERING CASING [ ]
TEMPORARILY ABANDON [ ]	CHANGE PLANS [ ]	COMMENCE DRILLING OPNS. [ ]	P AND A [ ]
PULL OR ALTER CASING [ ]	MULTIPLE COMPL [ ]	CASING/CEMENT JOB [ ]	
OTHER: Close Pit	[X]	OTHER:	[ ]

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

Chesapeake plans to close the drilling pit for this well according to current NMOCD guidelines Section B3b.

(320 AC. S/2)

I hereby certify that the information above is true and complete to the best of my knowledge and belief. I further certify that any pit or below-grade tank has been/will be constructed or closed according to NMOCD guidelines [X], a general permit [ ] or an (attached) alternative OCD-approved plan [ ].

SIGNATURE Brenda Coffman TITLE Regulatory Analyst DATE 03/10/2005

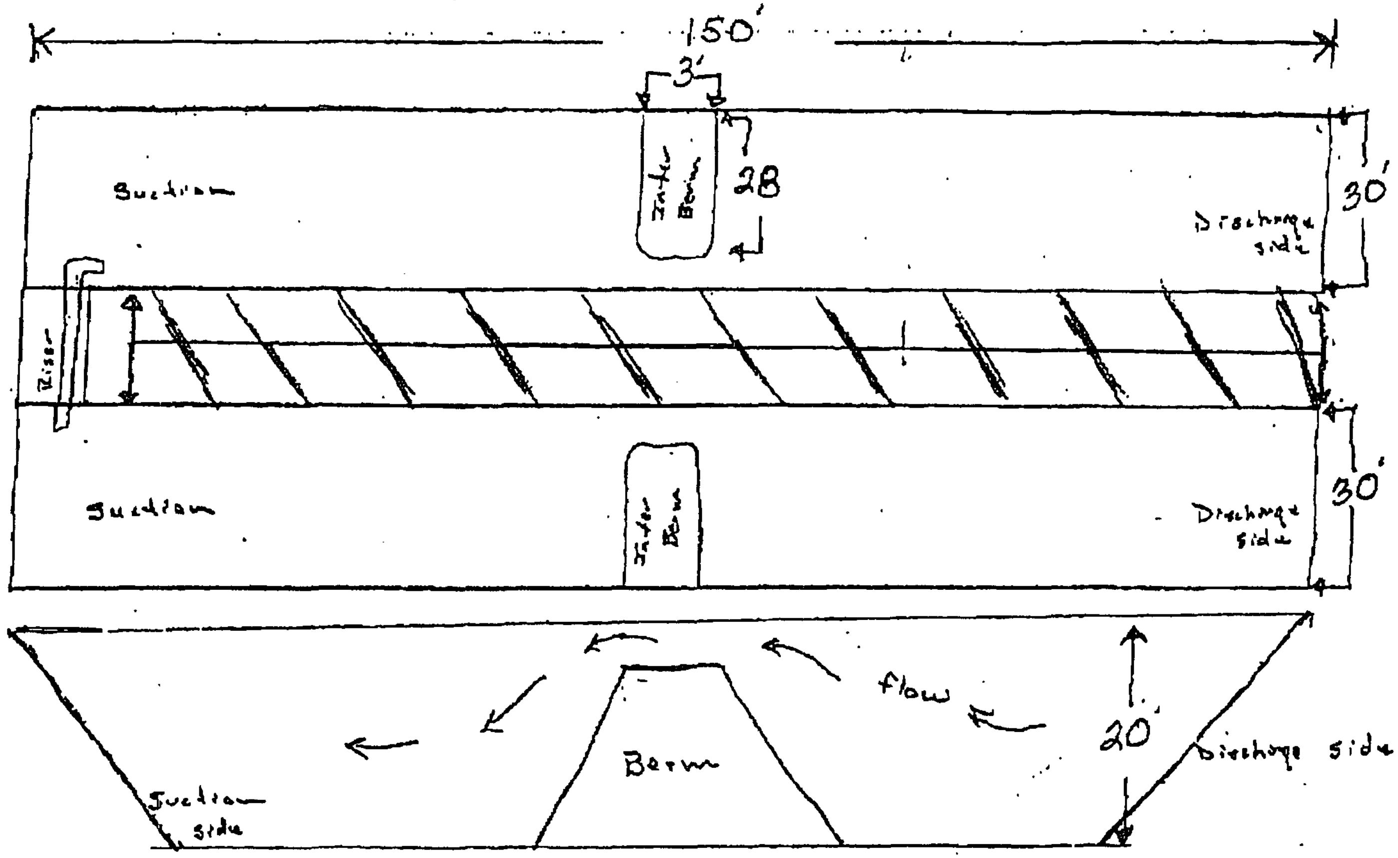
Type or print name Brenda Coffman E-mail address: bcoffman@chkenergy.com Telephone No. (432)687-2992

For State Use Only

APPROVED BY: [signature] TITLE PETROLEUM ENGINEER DATE MAR 11 2005
Conditions of Approval (if any):

Stipulated Exhibit 6
NMOCD Case Nos. 13492 / 13493

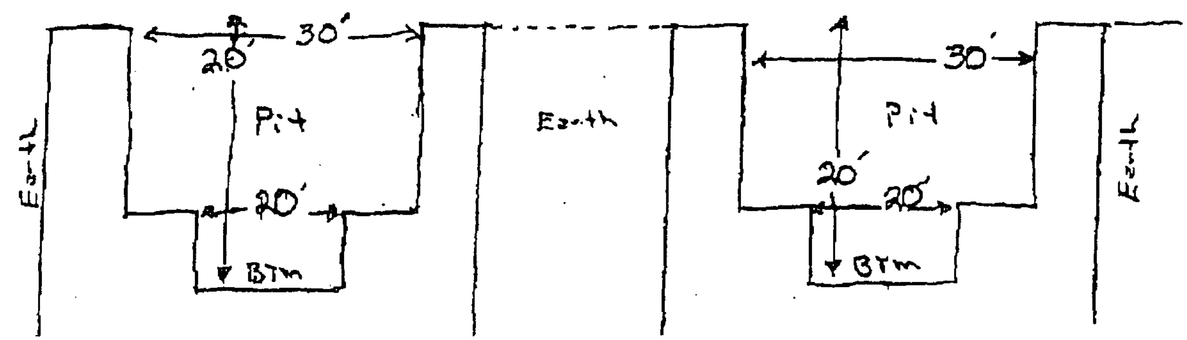
hesapeake Energy Double Pit Guideline 3A



Top View

Side View

; x 140' = 75600 ft^3 ÷ 5.6146 = 13464.8 bbls x 2 = 26929.7 bbls. with 18' of fluid & cuttings in pits.
x 30 x 140 = 90000 ft^3 ÷ 5.6146 = 16029.6 bbls x 2 = 32059.2 bbls with 20'



End cross section

DISTRICT I
1625 N. French Dr., Hobbs, NM 88240
DISTRICT II
811 South First, Artesia, NM 88210
DISTRICT III
1000 Rio Brazos Rd., Aztec, NM 87410
DISTRICT IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources Department

OIL CONSERVATION DIVISION

2040 South Pacheco
Santa Fe, New Mexico 87504-2088

Form C-102
Revised March 17, 1999

Submit to Appropriate District Office
State Lease - 4 Copies
Fee Lease - 3 Copies

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Code	Pool Name
30-025-37129	82200	Osudo, S. Morrow (GAS)

Property Code	Property Name	Well Number
34679	KF "4" STATE	1

OGRID No.	Operator Name	Elevation
147179	CHESAPEAKE OPERATING INC.	3621'

Surface Location

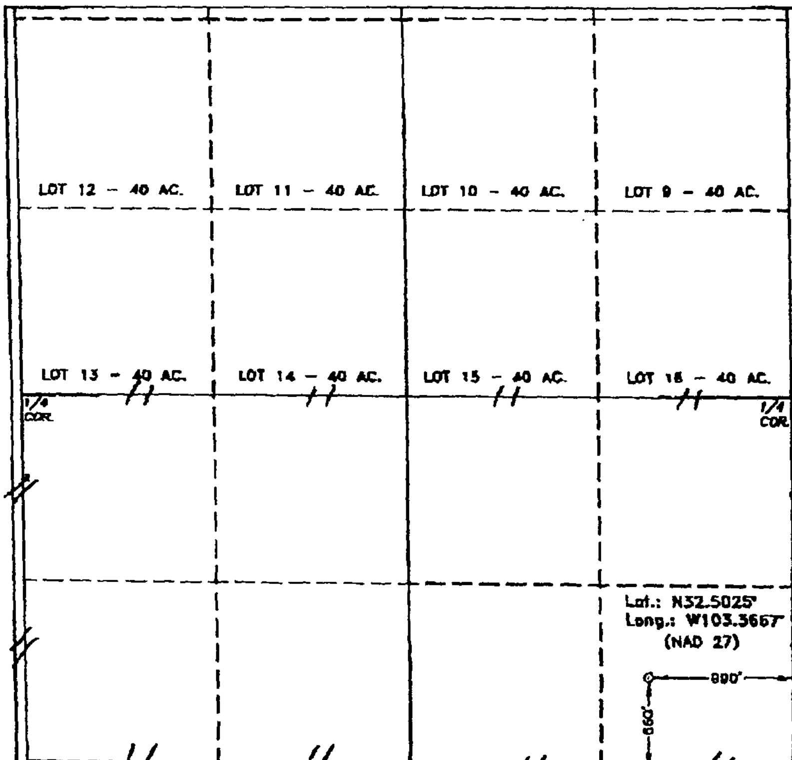
UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
X	4	21 S	35 E		660	SOUTH	990	EAST	LEA

Bottom Hole Location If Different From Surface

UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
320			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



OPERATOR CERTIFICATION

I hereby certify the the information contained herein is true and complete to the best of my knowledge and belief.

Brenda Coffman
Signature
Brenda Coffman
Printed Name
Reg Analyst
Title
3-10-05
Date

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervison, and that the same is true and correct to the best of my belief.

MARCH 10, 2005
Date Surveyed
Signature & Seal of Professional Surveyor

NEW MEXICO
7977
No. 5206P

Certificate No. Gary L. Jones 7977

BASIN SURVEYS

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Ave., Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
May 27, 2004

WELL API NO. 30-025-37129
5. Indicate Type of Lease STATE ☒ FEE ☐
6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name KF 4 State
1. Type of Well: Oil Well ☐ Gas Well ☒ Other
8. Well Number 001
2. Name of Operator Chesapeake Operating, Inc.
9. OGRID Number 147179
3. Address of Operator P. O. Box 11050 Midland, TX 79702-8050
10. Pool name or Wildcat Osudo;Morrow,South (Gas)
4. Well Location
Unit Letter X : 660 feet from the South line and 990 feet from the East line
Section 4 Township 21S Range 35E NMPM County Lea
11. Elevation (Show whether DR, RKB, RT, GR, etc.) 3621 GR

Pit or Below-grade Tank Application ☐ or Closure ☐
Pit type____ Depth to Groundwater____ Distance from nearest fresh water well____ Distance from nearest surface water____
Pit Liner Thickness: mil Below-Grade Tank: Volume bbls; Construction Material

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
PERFORM REMEDIAL WORK ☐	PLUG AND ABANDON ☐	REMEDIAL WORK ☐	ALTERING CASING ☐
TEMPORARILY ABANDON ☐	CHANGE PLANS ☐	COMMENCE DRILLING OPNS. ☒	P AND A ☐
PULL OR ALTER CASING ☐	MULTIPLE COMPL ☐	CASING/CEMENT JOB ☒	
OTHER: ☐		OTHER: ☐	

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

4-27-05 Spud 17 1/2" surface hole @ 10:30 p.m.
4-29-05 Ran 10 jts. 13 3/8" 48# H-40 STC csg. set @ 408. Cmt'd w/240 sx Premium Plus + additives; tail in w/225 sx Premium Plus + additives. Cmt. Circulated to ground surface. WOC 24 hrs.
4-30-05 Tested to 1000# - OK.

I hereby certify that the information above is true and complete to the best of my knowledge and belief. I further certify that any pit or below-grade tank has been/will be constructed or closed according to NMOCD guidelines ☐, a general permit ☐ or an (attached) alternative OCD-approved plan ☐.

SIGNATURE Brenda Coffman TITLE Regulatory Analyst DATE 05/02/2005

Type or print name Brenda Coffman E-mail address: bcoffman@chkenergy.com Telephone No. (432)687-2992

For State Use Only

APPROVED BY: ____ TITLE PETROLEUM ENGINEER DATE MAY 1 6 2005
Conditions of Approval (if any):

of Approval

(47) Form C-140 Application For Qualification of Well Workover Project and Certification of Approval

[1-1-50...2-1-96; 19.15.13.1100 NMAC - Rn, 19 NMAC 15.M.1100, 06/30/04]

19.15.13.1101 APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK (Form C-101):

A. Before commencing drilling or deepening operations, or before plugging a well back to another zone, the operator of the well must obtain a permit to do so. To obtain such permit, the operator shall submit to the division five copies of form C-101, application for permit to drill, deepen or plug back, completely filled out. If the operator has an approved bond in accordance with 19.15.3.101 NMAC, one copy of the drilling permit will be returned to him on which will be noted the division's approval, with any modification deemed advisable. If the proposal cannot be approved for any reason, the forms C-101 will be returned with the cause for rejection stated thereon.

B. Form C-101 must be accompanied by three copies of form C-102, well location and acreage dedication plat. (See 19.15.13.1102 NMAC.)

C. If the well is to be drilled on state land, submit six copies of form C-101 and four copies of form C-102, the extra copy of each form being for the state land office.

[1-1-64...2-1-96; 19.15.13.1101 NMAC - Rn, 19 NMAC 15.M.1101, 06/30/04]

19.15.13.1102 WELL LOCATION AND ACREAGE DEDICATION PLAT (Form C-102):

A. Form C-102 is a dual purpose form used to show the exact location of the well and the acreage dedicated thereto. The form is also used to show the ownership and status of each lease contained within the dedicated acreage. When there is more than one working interest or royalty owner on a given lease, designation of the majority owner et al. will be sufficient.

B. All information required on form C-102 shall be filled out and certified by the operator of the well except the well location on the plat. This is to be plotted from the outer boundaries of the section and certified by a professional surveyor, registered in the state of New Mexico, or surveyor approved by the division.

C. Form C-102 shall be submitted in triplicate or quadruplicate as provided in 19.15.13.1101 NMAC.

D. Amended form C-102 (in triplicate or quadruplicate) shall be filed in the event there is a change in any of the information previously submitted. The well location need not be certified when filing amended form C-102.

[1-1-65...2-1-96; 19.15.13.1102 NMAC - Rn, 19 NMAC 15.M.1102, 06/30/04]

19.15.13.1103 SUNDRY NOTICES AND REPORTS ON WELLS (Form C-103):

Form C-103 is a dual purpose form to be filed with the appropriate district office of the division to obtain division approval prior to commencing certain operations and also to report various completed operations.

A. Form C-103 as a notice of intention

(1) Form C-103 shall be filed in triplicate by the operator and approval obtain from the division prior to:

(a) Effecting a change of plans from those previously approved on form C-101 or form C-103.

(b) Altering a drilling well's casing program or pulling casing or otherwise altering an existing well's casing installation.

(c) Temporarily abandoning a well.

(d) Plugging and abandoning a well.

(e) Performing remedial work on a well which, when completed, will affect the original status of the well. (This shall include making new perforations in existing wells or squeezing old perforations in existing wells, but is not applicable to new wells in the process of being completed nor to old wells being deepened or plugged back to another zone when such recompletion has been authorized by an approved form C-101, application for permit to drill, deepen or plug back, nor to acidizing, fracturing or cleaning out previously completed wells, nor to installing artificial lift equipment.)

Stipulated Exhibit 7

NMOCD Case Nos. 13492 / 13493

New Mexico Oil Conservation Division
C-102 Instructions

IF THIS IS AN AMENDED REPORT, CHECK THE BOX LABELED "AMENDED REPORT" AT THE TOP OF THIS DOCUMENT.

Surveyors shall use the latest United States government survey or dependent resurvey. Well locations will be in reference to the New Mexico Principal Meridian. If the land is not surveyed contact the appropriate OCD district office. Independent subdivision surveys will not be acceptable.

1. The OCD assigned API number for this well.
2. The pool code for this (proposed) completion.
3. The pool name for this (proposed) completion.
4. The property code for this (proposed) completion.
5. The property name (well name) for this (proposed) completion.
6. The well number for this (proposed) completion.
7. Operator's OGRID number.
8. The operator's name.
9. The ground level elevation of this well.
10. The surveyed surface location of this well measured from the section lines. NOTE: If the United States government survey designates a Lot Number for this location use that number in the 'UL or lot no.' box. Otherwise use the OCD unit letter.
11. Proposed bottom hole location. If this is a horizontal hole indicate the location of the end of the hole.
12. The calculated acreage dedicated to this completion to the nearest hundredth of an acre.
13. Put a Y if more than one completion will be sharing this same acreage or N if this is the only completion on this acreage.
14. If more than one lease of different ownership has been dedicated to the well show the consolidation code from the following table:

C	Communitization
U	Unitization
F	Forced pooling
O	Other
P	Consolidation pending

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION!

15. Write in the OCD order(s) approving a non-standard location, non-standard spacing, or directional or horizontal drilling.
16. This grid represents a standard section. You may superimpose a non-standard section over this grid. Outline the dedicated acreage and the separate leases within that dedicated acreage. Show the well surface location and bottom hole location, if it is directionally drilled, with the dimensions from the section lines in the cardinal directions. (Note: A legal location is determined from the perpendicular distance to the edge of the tract.) If this is a high angle or horizontal hole, show that portion of the well bore that is open within this pool.

    Show all lots, lot numbers, and their respective acreage.

    If more than one lease has been dedicated to this completion, outline each one and identify the ownership as to both working interest and royalty.
17. The signature, printed name, e-mail address, and title of the person authorized to make this report, and the date this document was signed.
18. The registered surveyors certification. This section does not have to be completed if this form has been previously accepted by the OCD and is being filed for a change of pool or dedicated acreage.

Stipulated Exhibit 8

NMOCD Case Nos. 13492 / 13493

PATRICK H. LYONS
COMMISSIONER

State of New Mexico
Commissioner of Public Lands

310 OLD SANTA FE TRAIL
P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148

COMMISSIONER'S OFFICE
Phone (505) 827-5760
Fax (505) 827-5766
www.nmstatelands.org

April 27, 2005

Mewbourne Oil Company
Post Office Box 7698
Tyler, Texas 75711

Attn: Allen Brinson

Re: Communitization Agreement Approval (Pennsylvanian)
Osudo 4 State Com Well No. 1
Lots 9, 10, 15, 16, and SE4, Section 4, Township 21 South, Range 35 East
Lea County, New Mexico

Dear Mr. Brinson:

The Commissioner of Public Lands has this date approved the Osudo 4 State Com Well No. 1 Communitization Agreement for the Pennsylvanian formation for lots 9, 10, 15, 16, and SE4 of Section 4, Township 21 South, Range 35 East, Lea County, New Mexico.

The effective date of this approval is April 1, 2005 and the term of the agreement is for one year, and so long thereafter as communitized substances are produced from the communitized area in paying quantities. Enclosed are five Certificates of Approval.

If we may be of further service, please contact Jeff Albers at (505) 827-5759.

Sincerely,

PATRICK H. LYONS
COMMISSIONER OF PUBLIC LANDS

BY: [signature]
JAMI BAILEY, Director
Oil, Gas & Minerals Division
(505) 827-5744
PHL/JB/ja

Stipulated Exhibit 9
NMOCD Case Nos. 13492 / 13493

NEW MEXICO STATE LAND OFFICE

CERTIFICATE OF APPROVAL

COMMISSIONER OF PUBLIC LANDS, STATE OF NEW MEXICO

Mewbourne Oil Company
Osudo 4 State Com Well No. 1
Lea County, New Mexico
Lots 9, 10, 15, 16, and SE4, Section 4, Township 21 South, Range 35 East
Pennsylvanian

There having been presented to the undersigned Commissioner of Public Lands of the State of New Mexico for examination, a Communitization Agreement for the development and operation of acreage which is described within the referenced agreement, dated **April 1, 2005** which has been executed, or is to be executed by parties owning and holding oil and gas leases and royalty interests in and under the property described, and upon examination of said agreement, the Commissioner finds:

(a) That such agreement will tend to promote the conservation of oil and gas and the better utilization of reservoir energy in said area.

(b) That under the proposed agreement, the State of New Mexico will receive its fair share of the recoverable oil or gas in place under its lands in the area.

(c) That each beneficiary institution of the State of New Mexico will receive its fair and equitable share of the recoverable oil and gas under its lands within the area.

(d) That such agreement is in other respects for the best interests of the State, with respect to state lands.

NOW, THEREFORE, by virtue of the authority conferred upon me, under Sections 19-10-45, 19-10-46, 19-10-47, New Mexico Statutes Annotated, 1978 Compilation, I, the undersigned Commissioner of Public Lands of the State of New Mexico, for the purpose of more properly conserving the oil and gas resources of the State, do hereby consent to and approve the said agreement, and any leases embracing lands of the State of New Mexico within the area shall be and the same are hereby amended to conform with the terms thereof, and shall remain in full force and effect according to the terms and conditions of said agreement. This approval is subject to all of the provisions of the aforesaid statutes.

IN WITNESS WHEREOF, this Certificate of Approval is executed, with seal affixed, this **27th day of April, 2005**.

Patrick H. Lyons

COMMISSIONER OF PUBLIC LANDS
of the State of New Mexico

STATE/STATE
OR
STATE/FEE
REV. 2/92

COMMUNITIZATION AGREEMENT

STATE OF NEW MEXICO)   KNOW ALL MEN BY THESE PRESENTS:

COUNTY OF LEA   )

THAT THIS AGREEMENT is entered into as of the April 1, 2005, by and between the parties subscribing, ratifying or consenting hereto, such parties hereinafter being referred to as "Parties hereto";*

WHEREAS, the Commissioner of Public Lands of the State of New Mexico is authorized by the Legislature, as set forth in Sec. 19-10-53, New Mexico Statutes, Annotated, 1978, in the interest of conservation of oil & gas and the prevention of waste to consent to and approve the development or operation of State lands under agreements made by lessees of oil & gas leases thereon, jointly or severally with other oil & gas lessees of State Lands, or oil and gas lessees or mineral owners of privately owned or fee lands, for the purpose of pooling or communitizing such lands to form a proration unit or portion thereof, or well-spacing unit, pursuant to any order, rule or regulation of the New Mexico Oil Conservation Division of the New Mexico Energy, Minerals and Natural Resources Department where such agreement provides for the allocation of the production of oil or gas from such pools or communitized area on an acreage or other basis found by the Commissioner to be fair and equitable.

WHEREAS, the parties hereto, own working, royalty, or other leasehold interests or operating rights under the oil and gas leases and lands subject to this agreement, which leases are more particularly described in the schedule attached hereto, marked Exhibit "A" and made a part hereof, for all purposes; and

WHEREAS, said leases, insofar as they cover the Pennsylvanian formation (hereinafter referred to as "said formation") in and under the land hereinafter described cannot be independently developed and operated in conformity with the well spacing program established for such formation in and under said lands; and

WHEREAS, the parties hereto desire to communitize and pool their respective interests in said leases subject to this agreement for the purpose of developing, operating and producing hydrocarbons in the said formation in and under the land hereinafter described subject to the terms hereof.

NOW THEREFORE, in consideration of the premises and the mutual advantages to the parties hereto, it is mutually covenanted and agreed by and between the undersigned as follows:

1. *The lands covered by this agreement (hereinafter referred to as the "communitized area") are described as follows:*

*This agreement not to be used for helium or carbon dioxide

Township 21 South, Range 35 East, N. M. P. M.

Section 4: Lots 9, 10, 15, 16 and SE/4

Lea County, New Mexico,

Containing 320.00 acres, more or less. It is the judgment of the parties hereto that the communitization, pooling and consolidation of the aforesaid land into a single unit for the development and production of hydrocarbons from the said formation in and under said land is necessary and advisable in order to properly develop and produce the hydrocarbons in the said formation beneath the said land in accordance with the well spacing rules of the Oil Conservation Division of the New Mexico Energy, Minerals and Natural Resources Department, and in order to promote the conservation of the hydrocarbons in and that may be produced from said formation in and under said lands, and would be in the public interest;

AND, for the purposes aforesaid, the parties hereto do hereby communitize for proration or spacing purposes only the leases described in Exhibit "A" hereto insofar as they cover hydrocarbons within and that may be produced from the said formation (hereinafter referred to as "Communitized Substances") beneath the above-described land, into a single communitization, for the development, production, operation and conservation of the hydrocarbons in said formation beneath said lands.

Attached hereto and made a part of this agreement for all purposes, is Exhibit "A" showing the acreage, and ownership (Lessees of Record) of all leases within the communitized area.

2. *The communitized area shall be developed and operated as an entirety with the understanding and agreement between the parties hereto that all communitized substances produced therefrom shall be allocated among the leases described in Exhibit "A" hereto in the proportion that the number of surface acres covered by each of such leases and included within the communitized area bears to the total number of acres contained in the communitized area.*

3. *Subject to Paragraph 4, the royalties payable on communitized substances allocated to the individual leases and the rentals provided for in said leases shall be determined and paid in the manner and on the basis prescribed in each of said leases. Except as provided for under the terms and provisions of the leases described in Exhibit "A" hereto or as herein provided to the contrary, the payment of rentals under the terms of said leases shall not be affected by this agreement; and except as herein modified and changed or heretofore amended, the oil and gas leases subject to this agreement shall remain in full force and effect as originally issued and amended.*

4. *The State of New Mexico hereafter is entitled to the right to take in kind its share for the communitized substances allocated to such tract, and Operator shall make deliveries of such royalty share taken in kind in conformity with applicable contracts, laws, and regulations.*

*This agreement not to be used for helium or carbon dioxide

5. *There shall be no obligation upon the parties hereto to offset any well or wells situated on the tracts of land comprising the communitized area, nor shall the Operator be required to measure separately the communitized substances by reason of the diverse ownership of the separate tracts of land comprising the said communitized area; provided, however, that the parties hereto shall not be released from their obligation to protect the communitized area from drainage of communitized substances by wells which may be drilled within offset distance (as that term is defined) of the communitized area.*

6. *The commencement, completion, and continued operation or production of a well or wells for communitized substances on the communitized area shall be considered as the commencement, completion, continued operation or production as to each of the leases described in Exhibit "A" hereto.*

7. *The production of communitized substances and disposal thereof shall be in conformity with the allocations, allotments, and quotas made or fixed by any duly authorized person or regulatory body under applicable Federal or State laws. This agreement shall be subject to all applicable Federal and State laws, executive orders, rules and regulations affecting the performance of the provisions hereof, and no party hereto shall suffer a forfeiture or be liable in damages for failure to comply with any of the provisions of this agreement if compliance is prevented by or if such failure results from compliance with any such laws, orders, rules and regulations.*

8. *Mewbourne Oil Company shall be the Operator of said communitized area and all matters of operation shall be determined and performed by Mewbourne Oil Company.*

9. *This agreement shall be effective as of the date hereinabove written upon execution by the necessary parties, notwithstanding the date of execution, and upon approval by the Commissioner of Public Lands, shall remain in full force and effect for a period of one year from the date hereof and as long thereafter as communitized substances are produced from the communitized area in paying quantities; provided, that this agreement shall not expire if there is a well capable of producing gas in paying quantities located upon some part of the communitized area, if such a well is shut-in due to the inability of the operator to obtain a pipeline connection or to market the gas therefrom, and if either: (a) a shut-in royalty has been timely and properly paid pursuant to the provisions of one of the State of New Mexico oil and gas leases covering lands subject to this agreement so as to prevent the expiration of such lease; or (b) each of the State of New Mexico oil and gas leases covering lands subject to this agreement is in its primary term (if a five-year lease), or in its primary or secondary term (if a ten-year lease), or is held by production from another well. Provided further, however, that prior to production in paying quantities from the communitized area, and upon fulfillment of all requirements of the Commissioner of Public Lands with respect to any dry hole or abandoned well drilled upon the communitized area, this Agreement may be terminated at any time by mutual agreement of the parties hereto. This agreement shall not terminate upon cessation of production of communitized substances if,*

*This agreement not to be used for helium or carbon dioxide

within sixty (60) days thereafter, reworking or drilling operations on the communitized area are commenced and are thereafter conducted with reasonable diligence. As to lands owned by the State of New Mexico, written notice of intention to commence such operations shall be filed with the Commissioner within thirty (30) days after the cessation of such production, and a report of the status of such operations shall be made by the Operator to the Commissioner every thirty (30) days, and the cessation of such operations for more than twenty (20) consecutive days shall be considered as an abandonment of such operations as to any lease from the State of New Mexico included in this agreement.

10. *Operator will furnish the Oil Conservation Division of the New Mexico Energy, Minerals and Natural Resources Department, and the Commissioner of Public Lands of the State of New Mexico, with any and all reports, statements, notices and well logs and records which may be required under the laws and regulations of the State of New Mexico.*

11. *It is agreed between the parties hereto that the Commissioner of Public Lands, or his duly authorized representatives, shall have the right of supervision over all operations under the communitized area to the same extent and degree as provided in the oil and gas leases described in Exhibit "A" hereto and in the applicable oil and gas regulations of the State of New Mexico.*

12. *If any order of the Oil Conservation Division of the New Mexico Energy Minerals and Natural Resources Department, upon which this agreement is predicated or based is in anyway changed or modified, then in such event said agreement is likewise modified to conform thereto.*

13. *This agreement may be executed in any number of counterparts, no one of which needs to be executed by all parties, or may be ratified or consented to by separate instruments, in writing, specifically referring hereto, and shall be binding upon all parties who have executed such a counterpart, ratification or consent hereto with the same force and effect as if all parties had signed the same document.*

14. *This agreement shall be binding upon the parties hereto and shall extend to and be binding upon their respective heirs, executors, administrators, successors and assigns.*

*This agreement not to be used for helium or carbon dioxide

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the day and year first above written.

OPERATOR: ***Mewbourne Oil Company***

By: James Allen Brinson
James Allen Brinson
Attorney In Fact

LESSEES OF RECORD: ***Samson Resources Company***

By: Marlin R. Garrett
Marlin R. Garrett
Vice President

Kaiser-Francis Oil Company

*By:*____________________________

*By:*____________________________

*This agreement not to be used for helium or carbon dioxide

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the day and year first above written.

OPERATOR: ***Mewbourne Oil Company***

*By:*____________________________
James Allen Brinson
Attorney In Fact

LESSEES OF RECORD: ***Samson Resources Company***

*By:*____________________________

Kaiser-Francis Oil Company

By: Wayne A. Fields
WAYNE A. FIELDS
ATTORNEY-IN-FACT

*By:*____________________________

*This agreement not to be used for helium or carbon dioxide

STATE OF TEXAS)
)ss
COUNTY OF Smith)

*The foregoing instrument was acknowledged before me this 20th day of April 2005 by James Allen Brinson, as Attorney in Fact for **Mewbourne Oil Company**, a Delaware Corporation, on behalf of said corporation.*

R. A. Sharpling
Notary Public

My Commission Expires

R.D. SHARPLING
Notary Public
STATE OF TEXAS
My Comm. Exp. 12-14-2008

STATE OF Texas)
)ss
COUNTY OF Midland)

The foregoing instrument was acknowledged before me this 12th day of April, 2005 by Marlin R. Barrett, *as* Vice President *of/for* Samson Resources Company, *on behalf of said* corporation.

Thena Anderson
Notary Public

My Commission Expires

THENA ANDERSON
MY COMMISSION EXPIRES
October 14, 2008

STATE OF ______________)
)ss
COUNTY OF______________)

The foregoing instrument was acknowledged before me this _____ day of _______, 2005 by ________________________________, as ________________________________ of/for ________________________________, on behalf of said ________________________________.

______________________ ______________________
My Commission Expires Notary Public

*This agreement not to be used for helium or carbon dioxide

STATE OF ________________)
)ss
COUNTY OF ________________)

The foregoing instrument was acknowledged before me this _____ day of ___________ 2005 by James Allen Brinson, as Attorney in Fact for ***Mewbourne Oil Company****, a Delaware Corporation, on behalf of said corporation.*

_____________________ _____________________
My Commission Expires *Notary Public*

STATE OF oklahoma)
)ss
COUNTY OF Tulsa)

The foregoing instrument was acknowledged before me this 4th day of April, 2005 by Wayne A. Fields, as Attorney-in-Fact of/for Kaiser-Francis Oil Company, on behalf of said Corporation.

11-17-06
My Commission Expires

Notary Public

Notary Public Oklahoma
OFFICIAL SEAL
Deborah McCullough
Tulsa County
No. 02017425 Exp. 11-17-06

STATE OF ________________)
)ss
COUNTY OF ________________)

The foregoing instrument was acknowledged before me this _____ day of ______, 2005 by ____________________, as ____________________ of/for ____________________, on behalf of said ____________________.

_____________________ _____________________
My Commission Expires Notary Public

*This agreement not to be used for helium or carbon dioxide

RECAPITULATION

TRACT NO.	*NO. OF ACRES COMMITTED*	*PERCENTAGE OF INTEREST IN COMMUNITIZED AREA*
Lease No. 1	*160.00*	*50%*
Lease No. 2	*160.00*	*50%*
	320.0	*100%*

05969

STATE OF NEW MEXICO
COUNTY OF LEA
FILED

MAY 13 2005
at 10:34 o'clock A M
and recorded in Book
Page
Melinda Hughes, Lea County Clerk
By Deputy

COUNTY CLERK LEA COUNTY, NEW MEXICO SEAL

*This agreement not to be used for helium or carbon dioxide

KELLAHIN & KELLAHIN
Attorney at Law

W. Thomas Kellahin
Recognized Specialist in the Area of
Natural Resources-oil and gas law-
New Mexico Board of Legal Specialization

P.O. Box 2265
Santa Fe, New Mexico 87504
117 North Guadalupe
Santa Fe, New Mexico 87501

Telephone 505-982-4285
Facsimile 505-982-2047
kellahin@earthlink.net

April 26, 2005

2005 APR 26 PM 1 43

HAND DELIVERED

Mr. Mark E. Fesmire, Director
Oil Conservation Division
1220 South Saint Francis Drive
Santa Fe, New Mexico 87505

Re: KF "4" State Well No. 1 (**API #30-025-37129**)
Location: Unit X
Dedication: S/2 of Irregular Section 4, T21S, R35E
Application of Chesapeake Permian, L.P.
for compulsory pooling,
Lea County, New Mexico

Dear Mr. Fesmire:

On behalf of Chesapeake Permian, L.P., please find enclosed our referenced application which we request be set for hearing on the Examiner's docket now scheduled for May 19, 2005. Also enclosed is our proposed advertisement of this case for the NMOCD docket.

Very truly yours,

W. Thomas Kellahin

cc: Chesapeake Operating, Inc.
Attn: Lynda Townsend

BEFORE THE
OIL CONSERVATION DIVISION
Case # 13492&13493 Exhibit No.
Submitted By:
Chesapeake Inc.
Hearing Date: August 22, 2005

Stipulated Exhibit 10
NMOCD Case Nos. 13492 / 13493

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE APPLICATION
OF CHESAPEAKE PERMIAN, L.P.
FOR COMPULSORY POOLING,
LEA COUNTY, NEW MEXICO.

CASE NO.

APPLICATION

CHESAPEAKE PERMIAN, L.P. ("Chesapeake") by its attorneys, Kellahin & Kellahin, and in accordance with Section 70-2-17.C NMSA (1978) seeks an order pooling all mineral interests from the top of the Wolfcamp formation to the base of the Morrow formation underlying the S/2 of Irregular Section 4, T21S, R35E, NMPM, Lea County, New Mexico, forming a standard 320-acre gas spacing and proration unit for any production for any and all formations/pools developed on 320-acre gas spacing within that vertical extent, including but not limited to the South Osudo Morrow Pool. This unit is to be dedicated to its KF 4 State Well No. 1 (**API#30-025-37129**) that is being drilled at a standard well location in Unit X of this section. Also to be considered will be the costs of the drilling and completing this well and the allocation of the costs thereof as well as actual operating costs and charges for supervision, designation of Chesapeake Operating, Inc. as the operator of the well and, pursuant to Commission Order R-11992, a risk charge of 200% for the risk involved in this well.

In support of its application Chesapeake states:

(1) Chesapeake is the current lessee of State of New Mexico Oil & Gas Lease #VO-7063-1, effective May 1, 2004, covering the SW/4 of Irregular Section 4.

(2) The SE/4 of this section is subject to a State of New Mexico Oil & Gas Lease #B1481, effective December 19, 1932 that as of March 9, 2005 the working interest owners were: Kaiser Francis Oil Company with 43.75% interest and Samson Resources Company with 6.25% interest.

(3) On March 9, 2005, Chesapeake, by letter including an AFE, proposed the drilling of its KF State 4 Well No. 1 for an estimated completed well costs of $2,012,000.00 to be dedicated to a standard 320-acre gas spacing unit consisting of the S/2 of this irregular section to both Kaiser Francis Oil Company and Samson Resources Company.

(4) On March 10, 2005 Chesapeake staked the subject well and on March 11, 2005, obtained Division approval of Chesapeake's application for permit to drill ("APD")

(5) By letter dated March 16, 2005, Samson Resources Company, on its behalf and for all its related affiliates including Geodyne Nominee Corporation, **elected to participate** in Chesapeake's proposed well and spacing unit.

(6) By letter dated March 30, 2005, Samson Resources Company **attempted to rescind** its March 16, 2005 election to participate contending that there was no JOA between the parties despite the fact that Chesapeake well proposal was not made pursuant to any JOA.

(7) The validly of Samson Resources Company attempt to rescind its election is disputed by Chesapeake.

(8) By letter dated April 4, 2005, Chesapeake sent its Joint Operating Agreement ("JOA") to Samson Resources Company and to Kaiser Francis Oil Company.

(9) By letter dated April 5, 2005, Samson Resources Company, still assuming that it could rescind its prior election to participate, acknowledge receipt of Chesapeake's JOA and advised that its would not sign it.

(10) On April 5, 2005, Jim Wakefield, on behalf of Kaiser Francis Oil Company, informed Chesapeake that he owed Mewbourne Oil Company and "big favor" and was assigning it what amounted to 7.1875% interest the SE/4 and therefore decline to participate in Chesapeake's proposal.

(11) By its actions, Kaiser Francis Oil Company has apparently conspired with Mewbourne Oil Company in an attempt to avoid Chesapeake proposal for its well and spacing unit.

(12) Because of Kaiser Francis Oil Company action, Chesapeake has concluded that it will be unable to reach a voluntary agreement with Kaiser Francis Oil Company.

(13) As an alternative to litigation whether Samson Resources Company has validly rescinded its prior election to participate, Chesapeake seeks to have Samson Resources Company interest pooled by the Division.

(14) Neither Kaiser Francis Oil Company nor Mewbourne Oil Company has provided Chesapeake with any document concerning any transfer of interest or it there any such documents of record as of the dated this application was filed.

(15) But in the event that Mewbourne Oil Company may have an interest in the SE4 of this section, then Chesapeake seeks any order that pooled all interests in the SE/4 of this section including any held by Mewbourne Oil Company.

(16) Pursuant to Commission Order R-11992, effective August 15, 2003, Chesapeake requests that the 200% risk charge be applied.

(17) Pursuant to Section 70-2-17.C NMSA (1978) and in order to obtain its just and equitable share of potential production underlying this spacing unit, Chesapeake needs an order of the Division pooling the identified and described mineral interests involved in order to protect correlative rights and prevent waste.

(18) In accordance with the Division's notice requirements, a copy of this application has been sent to the parties whose interest is to be pooled as listed on Exhibit "A" notifying each of this case and of the applicant's request for a hearing of this matter before the Division on the next available Examiner's docket now scheduled for May 19, 2005.

WHEREFORE, Chesapeake, as applicant, requests that this application be set for hearing on May 19, 2005 before the Division's duly appointed examiner, and that after notice and hearing as required by law, the Division enter its order pooling the mineral interest described in the appropriate spacing unit for this well at a standard well location upon terms and conditions which include:

(1) Chesapeake Operating, Inc. be named operator;

(2) Provisions for applicant and all working interest owners to participate in the costs of re-entering, completing, equipping and operating the well;

(3) In the event a mineral interest or working interest owner fails to elect to participate, then provisions to recover out of production, the costs of the drilling, completing, equipping and operating the well, including a risk factor penalty of 200%;

(4) Provision for overhead rates per month drilling and per month operating and a provision providing for an adjustment method of the overhead rates as provided by COPAS

(5) For such other and further relief as may be proper.

RESPECTFULLY SUBMITTED:

W. THOMAS KELLAHIN
KELLAHIN & KELLAHIN
P. O. Box 2265
Santa Fe, New Mexico 87504
Telephone: (505) 982-4285
Fax: (505) 982-2047

EXHIBIT "A"

Kaiser Francis Oil Company
P. O. Box 21468
Tulsa, Oklahoma 74121-1468
Attn: Jim Wakefield

Samson Resources Company
2 W. 2nd Street
Tulsa, Oklahoma 74103
Attn: Mono Ables

Mewbourne Oil Company
500 West Texas, Suite 1020
Midland, Texas 79707

CASE____: **Application of Chesapeake Permian, L.P. for compulsory pooling, Lea County, New Mexico. Applicant seeks an order pooling all mineral interests from the top of the Wolfcamp formation to the base of the Morrow formation underlying the S/2 of Irregular Section 4, T21S, R35E, NMPM, Lea County, New Mexico, forming a standard 320-acre gas spacing and proration unit for any production for any and all formations/pools developed on 320-acre gas spacing within that vertical extent, including but not limited to the South Osudo Morrow Pool. This unit is to be dedicated to its KF 4 State Well No. 1 (API #30-025-37129) that is being drilled at a standard well location in Unit X of this section. Also to be considered will be the costs of the drilling and completing this well and the allocation of the costs thereof as well as actual operating costs and charges for supervision, designation of Chesapeake Operating, Inc. as the operator of the well and, pursuant to Commission Order R-11992, a risk charge of 200% for the risk involved in this well. This unit is located approximately 6 miles west from Oil Center, New Mexico.**

Chesapeake
Natural Gas.
Natural Advantages.

Lynda F. Townsend, CPL/ESA
Senior Landman

March 9, 2005

VIA FACSIMILE (918) 591-1796
& EXPRESS MAIL

Ms. Mona Ables
Samson Resources Company
2 W. 2nd St.
Tulsa, OK 74103

Re: Chesapeake's Proposed KF State 4 #1
S/2 Section 4-21S-35E
Lea County, New Mexico

Dear Sir or Madam:

Chesapeake Operating, Inc., on behalf of Chesapeake Permian, LP ("Chesapeake"), hereby proposes to drill the KF State 4 #1 well to an approximate depth of 12,100', or a depth sufficient to test the Morrow Formation and all other potentially productive formations encountered in the captioned well.

Please indicate the option of Samson Resources Company's ("Samson") choice below, sign and return this letter by facsimile, if available, to our office at (405) 767-4251, followed by a hard copy in the mail. If Samson elects to participate in the proposed operation, please also execute and return the enclosed AFE along with a check in the amount of $76,812.50 (6.250000% WI X $1,229,000.00), which represents Samson's share of the AFE dry hole costs. Please also include a Well Requirement Sheet containing a contact name, facsimile number and e-mail address, if available, to insure receipt of well information.

As an alternative to the above, Chesapeake would be interested in purchasing Samson's interest, including any producing well bores, subject to the negotiation of a mutually agreeable price and terms. If Samson is interested in pursuing this alternative, please so indicate in the space provided below and/or contact the undersigned. We will immediately forward this information to our Acquisitions and Divestitures Department for follow up. However, please be advised that entering into negotiations to sell Samson's interest does not excuse or allow Samson to delay the required election under this well proposal.

Stipulated Exhibit 11
NMOCD Case Nos. 13492 / 13493

EXHIBIT
P8

Ms. Mona Ables
March 9, 2005
Page 2 of 2

Your early attention and response to this proposal will be greatly appreciated. Should you have any questions, please contact the undersigned.

Sincerely,

Chesapeake Operating, Inc.

Lynda F. Townsend

Lynda F. Townsend

_✓_ Samson Resources Company hereby elects to participate in the KF State 4 #1.

_____ Samson Resources Company hereby elects not to participate in the KF State 4 #1.

SAMSON RESOURCES COMPANY

By: Marlin R Garrett

Name: Marlin R Garrett

Title: Vice President

Date: 3/22/05

_____ Samson Resources Company is interested in selling its interest in this unit including any producing well bores. Please contact me to discuss.

CHESAPEAKE OPERATING, INC.

AUTHORIZATION FOR EXPENDITURE

Project Area: Permian New Mexico
Well Name: [illegible]
Operator: Chesapeake Operating, Inc
AFE #: [illegible]
Spacing Unit: S/2 Section [illegible]

County, State: Lea, New Mexico
Date: [illegible]
Total Depth: 12,100'
Formation: [illegible]
Property #: [illegible]

CODE	INTANGIBLE COSTS	WORK DESCRIPTION	DRY HOLE	PRODUCER
[illegible]	Location:	Roads, Location, Pits	$40,000.00	$40,000.00
[illegible]		Damages	$12,000.00	$12,000.00
[illegible]		Governmental Permits	$2,000.00	$2,000.00
[illegible]		[illegible]	$0.00	$0.00
[illegible]		Restoration	$5,000.00	$5,000.00
[illegible]		Top Drive	$0.00	$0.00
[illegible]	Drilling:	Pipeline Construction	$0.00	$0.00
[illegible]		Fuel	$55,000.00	$55,000.00
[illegible]		Drilling Contractor: [illegible] days @ $12800 per day	$380,000.00	$413,000.00
[illegible]		Directional Services	$5,000.00	$5,000.00
[illegible]		Rig Mobilization/Demobilization	$100,000.00	$100,000.00
[illegible]		Contract Labor	[illegible]	[illegible]
[illegible]		Bits	[illegible]	[illegible]
[illegible]		Supplies and Utilities	[illegible]	[illegible]
[illegible]		Cement Conductor	$0.00	$0.00
[illegible]		Cement Surface Casing	[illegible]	[illegible]
[illegible]		Cement Intermediate Casing	[illegible]	[illegible]
[illegible]		Cement Production Casing	$0.00	[illegible]
[illegible]		Cement Drilling Liner	$0.00	$0.00
[illegible]		Cement Production Liner	$0.00	$0.00
[illegible]		Mud Logging	$14,000.00	$14,000.00
[illegible]		Drilling Fluids, Mud, Chem.	[illegible]	[illegible]
[illegible]		Drill String Inspection	$3,000.00	$3,000.00
[illegible]		Open Hole Logging	[illegible]	[illegible]
[illegible]		Fishing	$0.00	$0.00
[illegible]		Downhole Rental Equipment	$44,000.00	$71,000.00
[illegible]		Completion Unit	$0.00	[illegible]
[illegible]	Completion:	Cased Hole Services/Perforating	$0.00	[illegible]
[illegible]		[illegible]	$0.00	$0.00
[illegible]		Formation Stimulation	$0.00	[illegible]
[illegible]		Surface Equipment Rental	[illegible]	[illegible]
[illegible]	General:	Transportation	[illegible]	$10,000.00
[illegible]		[illegible]	$0.00	$0.00
[illegible]		[illegible]	$0.00	$0.00
[illegible]		Supervision	$11,000.00	[illegible]
[illegible]		Technical Labor	$11,000.00	[illegible]
[illegible]		[illegible] Labor	[illegible]	[illegible]
[illegible]		Consultants	[illegible]	[illegible]
[illegible]		Company Overhead	[illegible]	[illegible]
[illegible]		Insurance	[illegible]	[illegible]
[illegible]		Plug & Abandon	$0.00	$0.00
		5% Contingency	$0.00	$0.00
TOTAL	INTANGIBLES	Total Intangible Costs	[illegible]	[illegible]

CODE	TANGIBLE COSTS	WORK DESCRIPTION			DRY HOLE	PRODUCER
[illegible]	Tubulars:	Conductor			$0.00	$0.00
[illegible]		Surface Casing	13-3/8"	425'	[illegible]	[illegible]
[illegible]		Intermediate Casing	8-5/8"	5,200'	[illegible]	[illegible]
[illegible]		Production Casing	5-1/2"	12,100'	$0.00	[illegible]
[illegible]		Drilling Liner			$0.00	$0.00
[illegible]		Production Liner			$0.00	$0.00
[illegible]		Float Equipment			[illegible]	[illegible]
[illegible]		Tubing	2-7/8"	12,000'	$0.00	[illegible]
[illegible]	Lease Equipment:	Wellhead Equipment			[illegible]	[illegible]
[illegible]		Downhole Equipment			$0.00	[illegible]
[illegible]		Artificial Lift-Pumping Unit			$0.00	$0.00
[illegible]		Production Equipment			$0.00	[illegible]
[illegible]		Compressor/Compression			$0.00	$0.00
[illegible]		Pipeline Equipment			$0.00	$0.00
[illegible]		Non-Controllable Equipment			$0.00	$0.00
		5% Contingency			$0.00	$0.00
TOTAL	TANGIBLES	Total Tangible Costs			[illegible]	[illegible]
		Total Costs			[illegible]	[illegible]

2,012,000

Prepared by: DPD Approved by: Carl

OPERATOR'S APPROVAL: [signature] Operations/Geology DATE:

OPERATOR'S APPROVAL: [signature] Land/Marketing DATE: 3/8/05

NON-OPERATOR'S APPROVAL: Mac R Garrett DATE: 3/22/05

The costs on this AFE are estimates only and may not be construed as ceilings on any specific item or the total cost of the project. In executing this AFE, the participant agrees to pay its proportionate share of actual costs incurred, including legal, curative, regulatory, brokerage and well costs under the terms of the applicable joint operating agreement, regulatory order or other agreement covering this well. The Operator may contract with an affiliated entity to drill the well at prevailing rates in the area. Participant shall be covered by and billed proportionately for Operator's well control and general liability insurance unless participant provides Operator a certificate evidencing its own insurance in amounts acceptable to the Operator by the date of spud.

Samson

Centennial Tower
200 N. Loraine, Suite 1010
Midland, TX 79701
USA
432/683-7063
Fax 432/683-6847

March 30, 2005

Chesapeake Permian, L. P.
Attn. Lynda F. Townsend
P. O. Box 18496
Oklahoma City, OK 73154-0496

VIA Facsimile 405-767-4251

Re: Chesapeake's Proposed KF State 4 #1
S/2 Section 4-21S-35E
Lea County, New Mexico

Gentlemen:

Reference is made to Samson Resources Company's letter of March 16, 2005 in response to your letter dated March 9, 2005. Upon reviewing Samson's records we have determined that there is actually no JOA between the parties which would support an election for this well. In addition, the timeframe for the purported election has not yet expired. **Accordingly, please be advised the Samson hereby rescinds and revokes its invalid election to participate in Chesapeake's proposed KF State 4#1 well.**

If you have any questions please call me at 432-686-6312.

Sincerely,

Tim C. Reece
Senior Landman

TCR:

Stipulated Exhibit 12
NMOCD Case Nos. 13492 / 13493

Samson

Centennial Tower
200 N. Loraine, Suite 1010
Midland, TX 79701
USA
432/683-7063
Fax 432/683-6847

March 30, 2005

Chesapeake Permian, L. P.
Attn. Lynda F. Townsend
P. O. Box 18496
Oklahoma City, OK 73154-0496

VIA Facsimile 405-767-4251

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S/2 Section 4-21S-35E
Lea County, New Mexico

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If you have any questions please call me at 432-686-6312.

Sincerely,

Tim C. Reece
Senior Landman

TCR:

Samson
Centennial Tower
200 N. Loraine, Suite 1010
Midland, TX 79701
USA

RECEIVED
APR 0 4 2005
MAILROOM

U.S. POSTAGE
PAID
MIDLAND TX
79701
APR 01 05
AMOUNT
$4.42
00031829-02

7003 1680 0006 6364 8376

9264 73154

Chesapeake Permian, L. P.
Attn. Lynda F. Townsend
P. O. Box 18496
Oklahoma City, OK 73154-0496

73154-0496