BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

RE: CASE NO. 14 - HOBBS POOL
HEARING DEC. 6, 7 & 8, 1939

STATEMENT OF THE GULF OIL CORPORATION

The Gulf Oil Corporation in the presentation of evidence before the Commission attempted to clarify as much as possible the conditions as they have existed in the Hobbs Pool. Also to present in an impartial manner the factors, considered by engineers in the industry, essential in the distribution of oil allowable under a proration plan. These factors were taken from the reports presented at technical society meetings and as such had general application without reference to company participation. Certain of these factors were admitted by the authors as unavailable in actual practice and others which did not have application in certain types of pools. Through a process of elimination it was found that only three factors had general application in the Hobbs Pool: Static Bottom Hole Pressure, Potential, and Acreage. These factors have been recognized not only by engineers but also by oil company executives and have been applied by State Commissions throughout the oil producing states. Essentially all authors recognized the value of potential and the reports or papers written since the advent of static bottom hole pressures measurements recommend the use of this factor to adjust the potential or the allowable of the well. The acreage factor considered most frequently as a part of the suggested proration plans had reference to the number of acres per well rather than being a flat percentage allowable. This acreage factor is already properly handled in New Mexico by the 40-acre unit. Other authors justified the use of a certain percentage for acreage on the basis of establishing a minimum allowable. A search of the technical publications does not disclose a single author who recommends the use of 100% acreage or per unit allowable as a means of affording each operator the opportunity to recover from each property his just and equitable share of the recoverable oil underlying that property. (Reference L. L. Foley 1937 Transaction API)

It is not believed necessary to quote lengthy passages from the evidence presented by Mr. Gray and Mr. Knappen but a short resume of exhibits presented by Gulf will probably help in clarifying the issues involved.

Gulf Exhibit O

This map shows the productive units in the Hobbs Pool and is colored to show the various types of 40-acre producing units. The one unit, colored pink, has received a special allowable for a number of years which has been greater than the normal allowable. The three units colored green are marginal units being able to produce only from 4 to 6 barrels daily each and are permitted to produce at capacity. The remaining 248 units colored yellow are non-marginal units and come under the provisions of the proration plan which allocates allowable among the units on the basis of 40% for adjusted potential and 60% for acreage. The term "adjusted potential" should be clarified. It is the last physically tested potential of the well which has been adjusted at intervals of six months in accordance with the proration formula by static bottom hole pressure. It should more properly be termed the"pressure-potential"factor or the"potential-anti-drainage" factor.

Gulf Exhibit No. 1

Exhibit No. 1 is a map of the Hobbs Pool with the producing acreage colored or hatched to show the holdings of different operators. To illustrate, all leases owned by Stanolind Oil & Gas Company are blue, Shell Oil Company, Inc. pink, and Gulf Oil Corporation light green. Due to an inadequate number of colors and tints the properties of the Getty, Two State, Oil Well Drilling, Magnolia, Mid-Continent and Walker Companies are not colored. It will be noted that Gulf leases are scattered throughout the central and northern portions of the pool while Stanolind's are more or less grouped in the southern portion.

Gulf Exhibit No. 2

This is a map of the Hobbs Pool showing the structure of the top of the white lime or Hobbs dolomite which is the principal producing formation. All wells drilled within the producing limits of the pool and a few dry holes on the outskirts of the pool are shown on the map. The map was prepared by the Hobbs Engineering Committee and published in January 1936. It was revised, however, in May 1939 to show the additional information obtained from a few wells which were drilled subsequent to January 1936. The structure map shows by means of contour lines the relief of the top of the white lime. The elevation shown on each contour line is the distance below sea level and for that reason the lines showing the smaller figures represent the higher portions of the structure. The elevation at which each well penetrates the top of the white lime is shown just below the well location and it is by the use of these elevations that the geologist or engineer is enabled to locate and draw the contour line on the map. The difference in elevation between each contour line is 25 feet so that when they are spaced far apart it indicates a gentle slope, but when close together a relatively steep slope is indicated. For convenience in picturing the higher and lower portions of the structure the map has been colored. For areas below 450' subsea it is colored green and areas above 450' subsea are colored yellow. This is merely another way of saying that green represents areas having less than 150' of thickness of the producing formation and yellow for areas having more than 150' of producing formation.

The highest part of the structure lies in the central portion of the field which is the northeast portion of Section 32 and the northwest portion of Section 33. Here the Amerada State "A" No. 2 encountered the top of white lime at 312' below sea level. It is interesting to note that from this point northwestward to the farthest producing wells the structure is nearly level. The most northwestern producing well in the pool is only 31' lower than the highest well in the pool. Southeastward the structure slopes down gradually to the Texas No. 1 Selman which found the top of the white lime at 550' below sea level or 238' lower than the highest well. The structure slopes off more rapidly to the northeast and southwest. The lowest wells in the pool are Two State No. 1 Morris and Ohio No. 1 State in Section 9. Both of these wells encountered the top of the white lime at 583' below sea level or 271' lower than the highest well.

The structure of a pool is always of vital interest to an oil man during the exploration and early development. Since he naturally wishes to buy and develop leases near the top of the structure. This is the area that has the thickest pay and, other things being equal, will have the greatest amount of oil underlying it and should have the least trouble from water encroachment.

Gulf Exhibit No. 5

In order to exhibit more clearly the structure of the Hobbs Pool a cross section of the producing formation from the northwest to the southeast along the general axis of the pool was prepared. Exhibit No. 5 shows the location of the wells which have been used in constructing this cross section. The wells used are shown in red circles and joined by red lines. It will be noted that the line is not straight, it zigzags from well to well. This is due to the fact that we had more complete and detailed geological and engineering information on these wells. The wells, however, are in an approximate straight line and give a very good picture of the structure of the Hobbs Pool.

Gulf Exhibit No. 4

This is a cross section of the oil producing zone in the Hobbs Pool along the red line shown in Exhibit No. 3. It is as an observer would see it looking from the southwest toward the northeast. The oil producing zone has been colored red, the top limit of the colored portion being the top of the white lime or Hobbs dolomite. In the central portion of the colored area there is a heavy black line which depicts the top of the sand break. This is a well defined geological marker which has been identified in the formation samples from most of the wells. The section shows how the structure rises precipitously in the northwest, then a gentle rise to the top of the structure, then a greater slope downward to the southeastern portion of the field. The bottom of the colored portion which is shown by a straight horizontal line is at 614' subsea and is the Hobbs Geological Committee's estimate of the bottom of the oil pay. This would be what is commonly called the initial oil-water contact and has been variously estimated at from 600 to 614' below sea level. Originally the structure was filled with oil from this elevation to the top of the white lime. All the engineering and geology in oil exploration and production depend upon the basic fact that oil is lighter than water and gas is lighter than oil. The structure merely acts as a trap and if these materials are contained in the structure the gas will collect at the top, the oil below the gas and the water below the oil. We are not certain that there was any free gas in the Hobbs Pool when it was first discovered but there were large volumes of gas dissolved in the oil. As oil was removed from the field and the pressure on the oil reduced, some of the gas came out of solution in exactly the same way that gas comes out of solution in ginger ale or soda when the cap is taken off the bottle. Accordingly shortly after production began gas began accumulating in considerable volume in the top portions of the structure, forcing the oil downward.

As previously stated, the initial oil-water contact was approximately 600' below sea level. No operator wished to produce water with his oil, therefore drilling was stopped at the lowest point at which the operator believed he could safely drill without encountering water. The vertical lines on the exhibit indicate wells drilled and the bottom of the lines, the depth to which they were drilled. Wells high on structure drilled deep into the oil zone while wells on the flank could only drill relatively short distances before the operator felt he was in danger of encountering water. For this reason the bottoms of the wells, in general, lie between 550' and 600' below sea level.

Gulf Exhibit No. 5

This is a structure map of the Hobbs Pool the same as used in Exhibits 2 and 3 except that the areas have been colored by 50' thick zones. That is to say, all of the pink area lies between the structure contours 325 and 375, all the green between 375 and 425, etc. As shown in the last exhibit the operator high on structure could safely drill much deeper into the producing formation than the operator on the side of the structure where there was less thickness of pay. This is not mere theory but is a fact recognized by all operators in the pool. This recognition is shown by the depth to which the wells were drilled. For example, on top of the structure the wells were drilled an average of 217' into the producing formation; in the pink area the average is only 182'. In the green area the average was 156'; in the purple area they averaged 112'; in the brown area the average was only 73'. The brown area covers a range of 100' and if broken down into the 50' zones used in other areas the thickness penetrated would be 60 and 44' respectively. This means that the operator on top of the structure penetrated five times as much producing formation as the operator did in the areas between 525' and 575' below sea level. Thickness of producing formation is not the only means of determining capacity of the formation to produce. If everything else were equal the operator with the thickest pay would have the most oil under the lease and would therefore be entitled to produce the largest volume of oil. If thickness of pay were the only basis of determining the oil under the land the operator in the yellow area would be entitled to produce five times as much oil as the operator in the lower portion of the brown area. However, not all of the producing formation contains oil. Much of the zone consists of rock which is so tight and solid that no oil is present. Accordingly, we have to look for a better measure of oil in place underground than the simple consideration of pay thickness. The amount of oil under a 40-acre unit depends (1) on the thickness of the pay, (2) on porosity of the pay, and (3) on the extent of saturation of the pay. So far as we know in the Hobbs Pool essentially all the pore space above the water table was originally filled with oil. The volume of oil-filled pore space determines the amount of oil under the unit. The recoverable oil under the unit, however, is the only product of interest so a recovery factor must be introduced which depends upon the permeability, bottom hole pressure, amount of adhesion of the oil to the surface area of the pore space, as well as several other factors. Porosity is a measure of the volume of the space which can be filled with oil. Permeability is a measure of the rate at which the liquid may move through the rock.

In the Hobbs Pool there are areas of high porosity and very high permeability and other areas that have low porosity and low permeability. In addition there is a wide range in the thickness of the producing formation and in the portion of this formation that is porous. A well drilled into a zone of high porosity, high permeability and thick producing zone will produce oil rapidly and its potential will be high. If on the other hand the permeability is low, the producing section thin, and/or the porosity slight, the potential of the well will be low because the oil can come into the well only at a slow rate. Accordingly the best first measure of the amount of recoverable oil underground is the potential of the well. Wells with high potentials indicate large volumes of oil beneath the surface.

The potential, however, is not an entirely satisfactory measure of oil in place. If a well encounters a fissure only half an inch wide the oil will be produced at a very high rate and give the well a high potential. If, however, the surrounding rock has very low porosity the oil will be quickly exhausted. Accordingly, the potentials while being used as the first measure of oil in place should be repeatedly corrected upward or downward according to whether the bottom hole pressure remains high or falls off rapidly.

Gulf Exhibit No. 6

Bottom hole pressure is the pressure under which the oil, water and gas exist in the pool. Before the first well was drilled at Hobbs, pressure at any given elevation in the producing formation was the same. Over millions of years oil, water and gas had accumulated in the pool. Water lay beneath the oil and all of the fluids in the reservoir were under high pressure. If there had been differences in pressure in the pool those differences would have forced the fluids to move from points of high pressure to points of low pressure until the pressure was brought into equilibrium. The movement of oil, gas and water in any oil pool move under exactly the same rules as water moves through the distributing mains of a city water system. It moves from points of high pressure to points of low pressure. Accordingly, if an operator is to recover the oil under his land without losing oil to adjoining leases or draining from them, the pressure on his land must remain the same as the pressure on adjoining leases. If an operator reduces his pressure below the pressure of adjoining leases oil will be drained from his neighbors to his well. The ideal way to operate an oil field is to maintain the pressure as nearly equal as possible throughout the field. Mr. Fred E. Wood, Chief Production Engineer of the Standard Oil Company of Indiana, (the parent company of the Stanolind Oil & Gas Company,) has well expressed this rule; if the allowable on any lease is set too high the bottom hole pressure under the lease will fall off too rapidly. The allowable on this lease should be diminished thereafter so that its bottom hole pressure will rise or so that its bottom hole pressure will drop less rapidly than the offset operators. By maintaining the pressures equal on adjoining leases the drainage of oil from one lease to another can be prevented.

As previously stated, the pressure in Hobbs Pool was uniform before the first well was completed. As soon as oil was removed from this well the pressure at that point was reduced and there was a tendency for the oil to move in from all other points of the pool to this lower pressure point. As more wells were completed and more oil was produced the pressure was dropped still further. There was a further movement of oil to low pressure points and the water tended to move into the field to replace the oil. Originally the oil was saturated with gas which means that the oil contained all the gas it could dissolve. As soon as the pressure dropped some gas came out of solution, the amount that came out of solution depending entirely upon how much the pressure was lowered. The lower the pressure the greater the volume of gas coming out of solution. This gas moved into the higher parts of the field under the rule that gas is lighter than oil so that a gas cap developed.

From the date of discovery in December 1928 until July 1930 the only restriction on production at Hobbs was the limitation of market outlet. In July 1930 after a thorough study of proration plans the so-called 75-25 plan was adopted by voluntary agreement of the operators and state officials. Under that plan 75% of the production was distributed in proportion to the potentials of the wells and 25% of the total was distributed equally to the 40-acre units. The 25% allowed in equal amounts was intended to permit production from every well in sufficient amount so that the operator would be able to pay the operating expenses and recover the investment in his well. Until July 1930 there had been no proration and no attempt to take oil in proportion to the oil under the property. Each property was produced as rapidly as the operator was able to market the oil. As a result some properties produced at such high rate the pressure under those properties dropped below the average in the pool.

The first survey of bottom hole pressure was made in December 1931. At that time the average bottom hole pressure in the field was 1431 lbs. per sq. in. Original bottom hole pressure has been estimated by the Hobbs Engineering Committee at from 1500 to 1525 lbs. per sq. in. In three years of production the average pressure in the pool had dropped about 84 lbs. per sq. in. The drop, however, was not uniform.

Exhibit 6 shows the bottom hole pressure survey of December 1931. On this map lines have been drawn through points of equal bottom hole pressure. These pressures were all taken or adjusted to a common datum of 400' below sea level. Since these lines are drawn through points of equal bottom hole pressure there would be no tendency for oil, gas or water to move along any one of these lines because there would be no force tending to move fluids along a line of equal pressure. There is, however, a strong tendency for oil to move across the pressure lines. Where these lines are close together the tendency to move is very great and rapid drainage will occur. Where the lines are far apart there is relatively less tendency for drainage or movement.

On this map more than 80% of the pool shows a pressure between 1400 and 1450 lbs. per sq. in. There are, however, three low pressure areas in which the pressures are less than the pool average, indicating that production had been excessive in those areas. Since there was no pressure survey prior to December 1931 we have no way of knowing how great the pressure differences were at the time the 75-25 plan was adopted. At the time of the December 1931 survey the highest pressure in the field was 1483 lbs. per sq. in. in the Shell McKinley B No. 1, and the lowest pressure was 1275 lbs. per sq. in. in Stanolind Leech No. 24 in the southeastern portion of the field. This means that there was a pressure difference, in a distance of 5 miles, of 208 lbs. per sq. in. tending to move the oil from the Shell well toward the Stanolind well. With the exception of the southeastern end of the field this pressure map indicates fairly satisfactory pressure distribution through the field but of course the lower the pressure differential the less movement there can be of reservoir fluids.

<u>Gulf Exhibit No. 7</u>

This is the bottom hole pressure survey made in October 1933. At that time the pool had operated more than three years under the 75-25 plan. The map is colored in the same way as Exhibit 6, the yellow color being used for the average pool pressure which at that time was about 1350 lbs. per sq. in. Since the first survey the pressure has dropped 85 lbs. per sq. in. There is, however, evidence of equalization of pressures during this time. The highest pressure is 1395 lbs. per sq. in. in the Amerada Harden No. 1, and the lowest pressure is 1245 lbs. per sq. in. in Repollo Crump No. 2 in southeastern part of the pool. The differences in pressures from the highest to the lowest in the field is only 150 lbs. per sq. in. as compared with 208 lbs. per sq. in. about two years earlier. There are now only two low pressure areas and the average pressure covers a much larger part of the field. The map shows that under the 75-25 plan the field was being produced in such a way that each operator was securing his oil from beneath his land with little drainage from one property to another. About the time this pressure survey was made the proration plan was changed permitting an increase in allowable for certain wells producing water. Under this plan any well producing 2% or more water was allowed to produce on the basis of 60% for potential and 40% for acreage.

<u>Gulf Exhibit No. 8</u>

This is a bottom hole pressure map of the survey August 1936. At this time the pool had operated for about six years under the 75-25 plan, three years of which 60% for potential and 40% for acreage was permitted for wells producing water. This survey shows that several areas were producing excessive amounts of oil. The highest pressure in this survey is still in the northeastern part of the field where Shell State No. 2 in Section 24 had a pressure of 1320#, and the lowest pressure was in Repollo Crump No. 1 in the southeastern corner of the field with a pressure of 1000#. In the 1933 survey pressure differential across the field was only 150# and had diminished from the 1931 survey. In 1936 the pressure differential had increased and excessive production is indicated by the closely crowded pressure lines in the southeastern part and east central part of the field. It is indicated that the water allowable should have been reduced and adjustment for bottom hole pressure should have been increased in order to secure more uniform pressures throughout the field. Instead, the proration plan was changed on January 1, 1937, to give 80% of the pool's allowable to the units regardless of their potential and only 40% of the pool's allowable was assigned on the basis of potential.

Gulf Exhibit No. 9

The result of the change in the proration plan is shown in the bottom hole pressure survey of September 1939, the last survey which has been made. On this survey the highest pressures are still shown in the northwestern part of the field where several wells have a pressure of 1245# and the lowest pressures are shown in the eastern part of the field where the Texas No. 1 Selman has a pressure of only 881 lbs. per sq. in. The pressure differential has increased to 374 lbs. per sq. in. This increase in pressure differential has greatly accelerated the drainage from high pressure areas to low pressure areas. Not only has the pressure differential increased in the last three years but pressure in the southeastern area is barely 2/3 of the pressure in the northwest and less than 75% of the pool average. The closely crowded pressure lines in the southeastern part of the field indicate a tendency for rapid movement of oil from a large portion of the field into the southeastern area. The only way in which this unfair condition can be corrected is by restoration of the plan allocating 25% of the pool allowable equally to the 40-acre units and 75% of the pool allowable on a potential basis with a proper adjustment for bottom hole pressure.

It will be noted that only four bottom hole pressure surveys have been shown by these exhibits. Bottom hole pressure surveys have been made from one to five times per year and the presentation of this mass of data would add little if any pertinent information. Exhibit #6 shows the first general bottom hole pressure survey, Exhibits #7 and 8 were the last surveys before each change made in the proration plan and Exhibit #9 shows the last survey completed. The pressures shown on each map are for non-packer wells only so this series of exhibits shows the effect of each proration plan on the reservoir pressure.

Gulf Exhibit No. 10

This exhibit repeats the geological cross section previously shown in Exhibit 4 and in addition shows in the chart at the bottom the pressure surveys which have been shown on previous exhibits for the wells represented in the cross section. The highest line on the chart shows the December 1931 pressure along the line of wells used in making the cross section. This shows that throughout the major portion of the field the bottom hole pressures of the wells were reasonably uniform. Unfortunately, however, pressures were not taken in wells in the extreme southeastern portion. The second line shows the pressures for October 1933 which indicates that at that time the pressure situation was fairly satisfactory. The third line indicates the pressure for August 1936 and shows that all of the section northwest of Section 10 was above the pool average and the wells in the southeastern part of the field were below the field average. It shows, just as water runs down hill, so reservoir fluids from the areas of high pressure will move to areas of low pressure, and the pressure line indicates the direction of drainage of oil in the field. The last line shown on the chart is for February 1939. It shows the disastrous effect of the order of 1937 which gave 60% of the pool's allowable outlet to each unit and allotted only 40% on the basis of adjusted potential. There has been a sharp increase in the pressure differential and the wells close to the low pressure area have dropped in pressure much faster than the average wells in the pool, and there has been a continuation and magnification of the drainage from high pressure areas to the low pressure area.

Gulf Exhibit No. 11

Repeats the pressure map of August, 1936, the last pressure survey prior to the time when the proration plan was changed in January 1937. On this map, however, colors depict the manner in which the allowable was changed. The units colored red is where the allowable per day increased 20 barrels or more as a result of the plan change, and all units colored green were decreased 20 barrels or more as result of the change. There is a scattering of red units or large gain units around the fringe of the pool but primarily the gains are concentrated in the low pressure southeastern areas. On the other hand, the heavy losses are spread throughout the high pressure area showing that the order of January 1937 reduced the allowable of the high pressure wells and increased the allowable of the low pressure wells. This naturally resulted in the increase in pressure differential as shown on the last exhibit.

Gulf Exhibit No. 11-A

In order that the effect of the water allowable order and the order of January 1937, bottom hole pressure map of October 1933 when pressures were most nearly equalized, is repeated. Next is shown that area where the large increases in production are concentrated as shown on Exhibit 11 and which was obviously the area of low pressure in October 1933, when the pressure distribution was most nearly ideal during the history of the pool. At the right is shown the present bottom hole pressure survey. Increased allowable in this southeastern area has greatly increased pressure differentials and greatly increased the drainage of oil from the northwest into the southeast portion of the pool.

Gulf Exhibit No. 12

So far we have been concerned mainly with potentials, acreage, pay thickness and pressure differentials. Mr. Tesch of the Stanolind introduced the radial flow formula. This formula may be utilized to determine the amount of movement across any given line if full information is available. In Exhibit 12 there are indicated three wells located on the diagonal red line whose potentials and bottom hole pressures are known over a long period and which are offset to the north by three wells and to the south by three wells on which we have frequent pressure surveys. From the potential of the wells, their spacing and pay thickness, the productivity of the formation may be calculated. Using these data we find that the wells produce 2 barrels per day for each pound of pressure drop in the well.

After the wells have produced for a time there will be an accumulation of gas bubbles in the pay which interfere with the movement of oil through the producing formation. This is a principle which has long been recognized and is commonly known to petroleum engineers as the Jamin Effect. The Jamin Effect will reduce the productivity of the formation about 1/4 but in order to be very conservative in estimation a reduction of 37½% was used, making the productivity 1.25 barrels per day per pound drop in pressure. The pressures are known in the wells to the north and to the south and from these pressures and the productivity of the wells along the red line a linear relationship can be established and the amount of drainage from the northwest to the southeast across this line can be determined in barrels per day. The calculation shows that in September 1939 there was a movement of 362 barrels every day toward the southeast. This means that the low pressure southeastern area was taking from the higher pressure northwest, 362 barrels every day. Over the producing history of the pool the drainage has varied with the difference in pressure between the wells northeast of the line and southeast of the line, being less when the pressure difference was less and being greatest at the present time.

Taking into consideration the differences in pressures which have existed at various times, it is calculated that the total movement of oil from northwest to southeast across the red line has been 551,000 barrels. Up to September 1, 1939, the production from wells southeast of the red line had been only 3,488,000 barrels. Since these wells have drained 551,000 barrels of oil from the northwestern area, it appears that the wells in the southeastern part of the pool have taken 15.8% of their total production away from the high pressure and more prolific areas to the northwest. It should be remembered that this calculation is very conservative, first, because of the high value given to the Jamin Effect; second, because calculation has been made only for drainage across the diagonals of three 40-acre units. There are actually six 40-acre units along the red line and its possible extensions. It has not been possible to make the calculation for the drainage across all six units because we did not have pressure data on wells northwest and southeast of all six of these units. It seems reasonable, however, to conclude that the drainage by the southeastern area has been far in excess of 551,000 barrels and that these wells have taken much more than 16% of their production from properties under which the oil originally accumulated. It may easily be that the amount of this drainage has been as much as 25% of all the oil so far produced by these wells, and the present rate of drainage, 362 barrels daily, will continue to increase as long as the present excessive allowables are granted to the wells in the southeastern area.

STATIC BOTTOM HOLE PRESSURE AND MOVEMENT OF FLUIDS IN THE RESERVOIR

The principle that fluids move from points or areas of high pressure to those of low pressure has been recognized and used by scientists and engineers since the beginning of our knowledge of hydraulics. If the conditions are known, such as in a pipe system, any competent engineer can calculate with a high degree of accuracy the volume of fluid or liquid that will be moved in any given length of time. Every major hydro-electric system or well planned city water system was calculated in minute detail before any actual work on the project was begun. In a complex system, such as a porous lime reservoir having varying degrees of porosity and permeability and in which liquid and gas are moving, the calculation is more difficult and the degree of accuracy less. However, by the use of recognized published formulae, this also can be done with reasonable accuracy. Mr. Tesch of the

Stanolind Oil and Gas Company presented to the Commission the radial flow formula from Dr. Muscat's book. (Stanolind Exhibit F) One of the basic features of that formula is the recognized fact that fluids (both liquids and gases) flow from areas of high pressure to those of low pressure. Both Mr. Tesch and Mr. Card recognized this principle in considering flow to a well bore but refused to understand how it could be applied when considering areas and static bottom hole pressures. Judging from their testimony these men agreed there would be movement of reservoir fluids if the reservoir pressure varied but did not believe that static bottom hole pressures represented relative reservoir pressures.

It is, of course, obvious that a bottom hole pressure taken in a well upon completion but before being produced represents the reservoir pressure. The Hobbs Engineering Committee has estimated that the initial reservoir pressure in the Hobbs Pool was between 1500-1525 lbs. per sq. in. If there was no movement of reservoir fluids due to pressure differences the initial bottom hole pressures of all newly completed wells would have been 1500 lbs. per sq. in. History of the Hobbs Pool, on the other hand, clearly shows that the initial bottom hole pressures of newly completed wells were progressively lower as development progressed and, in essentially all cases, reasonably represented the average bottom hole pressure of offsetting wells which had been producing for a considerable period of time. (Hobbs Engineering Committee Records) If the well was drilled in a low pressure area its initial BHP was low; if in a high pressure area its initial pressure was comparable to producing offsets. Dr. Knappen testified, page 125 and 126, regarding the relation of BHP in Continental Grimes No. 3, a new well, to the producing offsets Continental Grimes No. 1 and Samedon Moon No. 1. These two wells were one-half mile apart with a difference in pressure of 25 pounds. The initial pressure of Continental Grimes No. 3, which was midway between, was within 5½ pounds of the average pressure of the other two wells.

Mr. Card testified that the pressure at the boundary line was the point of interest rather than the pressure at the well. The pressure of Continental Grimes #3 midway between two other producing wells indicates that the pressure gradient between given wells is reasonably constant. On the same basis the boundry line pressure could reasonably be calculated in proportion to its distance from the wells tested. Such a plan could be used but its calculation would consume so much time that its application would be unreasonable, particularly since it is obvious there would be no essential difference in the unit allowables.

The records of the Hobbs Engineering Committee show only 11 wells in which bottom hole pressures were taken within 60 days after completion. The potentials of the wells ranged from 2788 to 16192 barrels per day and the average total oil recovery was 3496 barrels per well which was not enough to seriously effect the initial pressure. The average BHP of these wells was 1299 pounds as compared to an average of 1298 pounds for all measured offsetting wells that had been producing for a considerable period of time. In the Hobbs Pool maximum static bottom hole pressures, properly taken and adjusted are, without question, a reasonable reflection of the reservoir pressure.

This does not mean there is no difference in pressure difference between offsetting units but that the pressure gradient between wells on the units is reasonably constant.

NATURE OF THE WATER DRIVE AND WATER PACKERS IN NORTHWESTERN PORTION OF POOL

Contrary to statement (Page 3, Stanolind statement) water encroachment does not encircle the field. Active water movement is shown only from the west and north. The water being produced in Sections 19 and 20 is apparently moving in from the neighborhood of Section 18, in all other areas from the west. Water production from eastern wells, such as Samedan Turner B-1, is due to excessive penetration. That particular well penetrated the formation below the initial water table. (Reference Hobbs Engineering Committee Records) Apparently there is no effective water movement from the eastern side of the Hobbs Pool.

Wells most remote from the effective water drive will have the longest life. This would include wells in the eastern, southeastern and highest structural areas. Ultimately water will undoubtedly encroach to these wells and in the last stages of production in the pool it will be necessary to produce large quantities of water in order to properly drain the pool. These wells will then be in the same condition as certain wells in the southwestern and northwestern areas where packers cannot be set to shut off the water. The production of water in a pool such as Hobbs is essential in order to obtain the greatest ultimate oil recovery.

Mr. Card inferred (Page A 17) that operators in the northwestern part of the pool had not set packers because by so doing their allowable would have been reduced. Under cross examination he admitted that Stanolind (Page 43-44) had failed to get a water shutoff in two wells in the southern portion of the field but attributed the failure to a thin producing section such that a separation of the water and oil could not be accomplished.

Mr. Card's inference that operators did not set packers in the northwestern portion of the pool for selfish reasons is most unfair. Gulf attempted to shut off water in three wells on the Graham State and Hardin leases, without success. Packers were run a total of five times in Graham State No. 4. Packers were set three times in each of the Hardin wells without changing the percentage of water produced. (Hobbs Engineering Committee Records) It was not a case of the packer not holding but that all pays open in the wells produced water. Other companies have had the same experience. In the extreme north and northwestern portion of the pool, packers are only occasionally successful, which accounts for the small number of installations in that area.

Stanolind's Leadership Questionable

Stanolind's contention that it was a leader in the setting of packers is misleading. The following is the order of companies setting packers: Texas, Standard of Texas, Shell, Sun, Gulf, Continental, Amerada, Stanolind, Tide Water, Humble, Ohio, Getty, Samedan and Cities Service. (Hobbs Pool General Report) Stanolind was the eighth company to set a packer and 12 packers had been set before Stanolind's first packer. In addition most of the water packers set by Stanolind were in wells incapable of or were having difficulty in producing the allowable oil. Some of their wells were producing such large volumes of water that its handling and disposal was a serious operating problem. Mr. Card admitted (Page 41) that even the last two wells in which the Stanolind set water packers had to be swabbed in order to obtain the allowable production before the packers were set.

The following table calculated from the records of the Hobbs Engineering Committee shows the relative position of the several companies who have set water or gas packers.

	1 % of Wells In Which Packers Have Been Set	2 % of Packer Wells In Pool	3 % of Non-Marginal Wells in Pool	4 Ratio Column 2 ÷ Column 3
Amerada	37.5	6.9	6.2	1.11
Cities Service	12.5	1.2	3.1	.38
Continental	55.6	11.5	7.0	1.64
Getty	50.0	2.3	1.5	1.53
Gulf	43.5	11.5	8.9	1.29
Humble	33.3	5.8	5.8	1.00
Ohio	55.6	5.8	3.5	1.65
Shell	41.0	18.4	15.1	1.22
Samedan	14.3	2.3	5.4	.43
Std. of Texas	66.7	4.6	2.3	2.00
Stanolind	32.8	21.9	22.4	.98
Sun	100.0	4.6	1.5	3.06
Texas	12.5	1.2	3.1	.38
Tide Water	22.2	2.3	3.5	.66

Stanolind ranks ninth in the percentage of their wells in which packers have been set. They also rank ninth in the ratio of percentage of total packer wells to their percentage of total pool non-marginal wells. The rank of eighth and ninth certainly does not constitute leadership.

There is no intention to belittle Stanolind's achievements since the positions of both Gulf and Stanolind might properly be termed average. This is a result of circumstance rather than intent for apparently all companies have carried out remedial work as prudent operators should.

The Present Percentage of Allocation Based
on Acreage Much Too High

Mr. Card testified regarding a group of wells having no adjusted potential and therefore were allowed oil only on the 60% acreage factor. It is quite obvious that the present percentage of allowable distributed equally to the 40-acre units is far too much. The range in average penetration into the producing formation by 50' structural contours is from 44' to 217' or a ratio of 1 to 5 (Gulf Exhibit #5). It is true that thickness of producing section without regard to quality is very misleading but the comparison of 1 to 5 was arrived at by an average within a 50' structure contour internal. The range from the thinnest to the thickest would be much greater as also would be the range of potentials. It is interesting to note that the 1 to 5 ratio would indicate a 20% acreage factor while the proration plan which embodied 25% for acreage maintained the best reservoir conditions at Hobbs. When the amount of oil produced per year is taken into consideration, much greater bottom hole pressure differentials have been established in the 2½ years since the 60% acreage factor became effective than during the previous six years.

Mr. Tesch testified,(page 77) "I believe that is right", in answer to Dr. Muscat's question, "If you did know the reservoir pressure in the southeastern area, and if you found those to be lower than elsewhere, in spite of the fact that less oil had been recovered, and considering the fact that water had not come in to displace the oil recovered, wouldn't that be evidence of the fact that originally they had less oil in place?" This is an admission that the area for which Stanolind is requesting a large allowable increase had less initial oil in place than other areas and that it has already depleted the initial reserve more than other areas for it has been established that (1) a number of these wells have produced no water. (2) The wells which produce water are producing it as fast as it enters the area, thus eliminating any effective water drive as indicated by (a) progressively lower bottom hole pressure toward the south and (b) the fact that there has been no apparent movement of the water front in that area for over four years. (3) The bottom hole pressure is much lower than in other areas. (4) It has been established that static bottom hole pressure reasonably reflects relative reservoir pressure.

It is a reasonable conclusion that the units which now participate in the 60% acreage factor only have produced a much larger proportion of the original oil in place than other units in the pool and by reason of this now have low bottom hole pressure. It is essential that the allowable of such wells be reduced if the distribution is to be on a reasonable basis and this can be done only by reducing the percentage allocated on the basis of "acreage".

Comparison of Potential and Recoverable Oil in Place

Stanolind made quite a point that potential is not a measure of oil in place. Gulf has not contended that potential is a precise measure of recoverable oil in place (Knappen, page 118) but that it was the best first rough indicator of relative recoverable oil in place. Not a single term commonly used in precise estimates of recoverable oil in place will in itself evaluate even relative recoverable oil. These terms are porosity, permeability, pay thickness, bottom hole pressure, per cent saturation, per cent recovery and acreage. If any one of these terms ix equal to zero there will be no recoverable oil; likewise, if any of the terms equal zero, there can be no potential. It is a reasonable conclusion that potential integrates between all of these terms and, when modified by the number of producing acres, is a good first indicator of relative recoverable oil. It should, however, be frequently and properly adjusted by static bottom hole pressure (an anti-drainage factor) in order that the owner of each property may be afforded the opportunity to recover the recoverable oil underlying that property.

Stanolind Experiment

The experiment presented by Mr. Tesch was quite misleading because he failed to mention a number of factors contributing to oil recovery and the analogy to the Hobbs Pool. Three of these are worthy of further discussion.

(1) In the experiment it was explained that the porosity in the two sands was essentially equal but one sand was finer grained than the other. It was demonstrated that the "oil in place" was equal and inferred that all other conditions were equal and analogous to conditions in the Hobbs Pool. He did not mention that recoverable oil and

not oil in place is the product under consideration and that recoverable oil varies with the size of the pores of the porosity if other conditions are equal. Geologists and petroleum engineers have recognized this principle from the beginning of their analysis of oil reservoirs. As an illustration many shales contain more oil in place than loose sands or conglomerates yet the recoverable oil from shales by normal methods is nil while from loose sands and conglomerates it is very high. He failed to recognize the essential recovery factor.

(2) He failed also to recognize that in recovering "2½ times the liquid" from the "loose sand" he had permitted its bottom hole pressure to drop below that of the "tight sand". Had this occurred in a reservoir it would have resulted in migration from the high to the low pressure unit. (Christie cross examination, page 69). On the other hand, had frequent and proper adjustments been made for bottom hole pressure, the allowable rates would have been varied such that ultimately both sands would have the same pressure and no migration exist. (Knappen, page 160)

(3)It was inferred (page 68-69) that such a condition (equal porosity but widely different permeabilities) was common in the Hobbs Pool. Such an inference is of course difficult to deny by the use of factual data. We can not minutely examine the producing formation both vertically and horizontally but must rely upon information obtained from a small bore hole, geological opinion as to the type and cause of the porosity and permeability or conditions in similar formations which it is possible to minutely examine. The situation might be compared to the Carlsbad daverns, which are a porous permeable limestone, if they were filled with oil. The operator whose property was underlain by the "Big Room" would have a very high potential compared to the operator who drilled into the relatively nonporous lime bordering the "Big Room". As a matter of fact, the operator who penetrated the big room would have more recoverable oil than the potential would indicate so other factors would be needed to evaluate the allowable rate his property justified. Certainly acreage would not be a proper measure. An anti-drainage factor appears to be the only reasonable solution. If the operator having the low potential believes a portion of the "Big Room" underlies his property he should be permitted to establish that fact by acidation, shooting or to crowd the boundary by drilling a 330-ft. location. Certainly he should not be granted equal allowable merely by confusingly stating that there is a wide variation in conditions and because of that fact all 40-acre tracts should be rated the same.

Geologists and petroleum engineers generally agree that the effective porosity and permeability at Hobbs is secondary. That is, it was formed by the solutioning action of percolating waters. This is the manner in which the Carlsbad caverns were formed. It is not believed that the range of conditions is nearly so great as at Carlsbad but Mr. Wahlstrom's description of "from mouse holes to caverns" (page 103) appears quite fitting, particularly since a stalactite was actually blown from a well at Hobbs. Virtually at Hobbs there is effective porosity only by reason that the initial slight permeability permitted ground waters to circulate which in turn, due to solution action, increased both the porosity and permeability. This would indicate that in the Hobbs pool there is a relationship between porosity and permeability. It also indicates that another statement of Mr. Wahlstrom's "The only index of porosity in the Hobbs field is the initial production of oil", is also true (page 103).

Attorney for Stanolind appears to be confused as to the meaning of the last sentence of a paragraph of Mr. Wahlstrom's report which he insisted upon being read into the record (page 199). Mr. Wahlstrom wrote, "The top productive member of the 'white lime' is cavernous on the crest of the structure, fairly porous on the flanks, and off structure is in places only slightly porous, in other places somewhat porous. On the flanks the lower porous member, particularly the Capps pay, all relatively unimportant on the Crest, generally yield much more oil than the top member". The following assumed table illustrates the meaning of the author:

		Crest Location	Flank Location
Recoverable oil	Top Member	300,000	15,000
	Middle Member	200,000	25,000
	Lower Member	100,000	75,000

Relatively the lower member is unimportant at the Crest location but is relatively most important at the flank location, but it does not mean that the lower member on the flank is relatively more important than the upper member on the Crest. This is the correct interpretation of what the author intended and did say. Had Mr. Woodward understood the true technical meaning of the sentence it is doubtful if he would have insisted that it be read into the record.

Attorney for Stanolind (page 9 Stanolind Statement) referred to Gulf Exhibits 6, 7, 8 and 9 as follows: "Attention is called to the fact, however, that these exhibits do not reflect the formation in which such pressures were taken, nor do they reflect, as a matter of fact, that such pressures were taken in different formations, at different periods, and in many cases comparative pressures for offset wells may have been for entirely different formations". The statement is not based on the facts or record and is a fair example of a number of other fallacious statements. Great care was taken in preparing Gulf Exhibits 6, 7, 8 and 9 that the pressures shown were for non-packer wells only and as such would be comparable from one survey to another and that the pressures taken would be in the same formation.

Contrary to the Stanolind Statement, page 10, Mr. Knappen made no point that oil from the northwest portion of the pool migrated the entire distance to the southeast portion but merely that the trend was in that direction as shown by bottom hole pressures. It was only under cross examination by Mr. Woodward that he outlined the manner in which it could occur, page 175. If, as Mr. Woodward states, there is a high pressure barrier along the township line there could be no migration past that line but there would be migration from it. The progressively lower pressure to the southeast definitely shows that migration must exist. (Gulf Exhibit #9). Since the area involves at least eight separate leaseholds and since Continental, Sun, Atlantic, Texas, Shell, Samedan, Skelly, Repollo and Walker own leases within the general area of Stanolind's block, it appears that both landowners and companies are involved. Certainly it is indicated that the "anti-drainage" or so-called "adjusted potential factor" should be increased in percentage participation.

Stanolind Witnesses Unfamiliar with Conditions at Hobbs

The testimony of Stanolind witnesses clearly shows that they were presenting technical alibis for Stanolind's expressed position in the case. Their testimony not only showed unfamiliarity with actual conditions within the pool, the reasons certain factors were incorporated in the proration plan, but was also shot through with contradictions. Mr. Card on direct examination testified that packers were set in Stanolind water wells for reasons of conservation (Page A15) and that large volumes of oil remained above the water packers, (Page 56) while some wells in which gas packers were set could not produce the allowable oil (page 54) and that very little oil remained above the gas packers. This group of answers shows unfamiliarity with conditions and/or a studied attempt to mislead the Commission. Upon cross examination Mr. Card admitted that even the last two Stanolind wells had to be swabbed in order to get the allowable production before the water packer was set and that packers were usually set in water wells when trouble was encountered in operating the well or difficulty was experienced in treating the oil. (Page 41-42). He did not know that some Stanolind water wells could not produce the allowable even when pumped nor that one Stanolind well, State 11, Section 5, was at the point of abandonment when The Texas Company demonstrated the technique of setting a packer to shut off water (Page 62). He could not name a single well that could not produce its allowable before the gas packer was set and vaguely replied that the condition was "often the case in other fields and probably was true of some wells in the Hobbs Field". The facts could not more grossly have been misconstrued. Every well in the Hobbs Pool in which a gas packer has been set could easily produce its allowable and the setting of the packer was for the purpose of conservation only. (Can be established by examination of the Hobbs proration statements.)

Mr. Card testified (Page 60) "the engineers did not have in mind maintaining the pressure in any particular part of the reservoir, but the reservoir generally". Mr. Tesch testified,"You have got me--- I could not tell. Many don't think there is one", when asked "what is the theory of bottom hole pressure (adjustment) in the Hobbs field?" Both Mr. Card and Mr. Tesch were assistants to Mr. E. A.Wahlstrom who prior to March 1937 was Division Engineer for Stanolind at Fort Worth. Mr. Wahlstrom was quite familiar with Plan 2A Bottom Hole Pressure Adjustment and was favorably impressed by it.

Contrary to Mr. Card's statement, Plan 2A Bottom Hole Pressure adjustment of potential had a two-fold purpose: (1) to decline the potential of all wells by a common fraction $\frac{\text{Present Pool Average BHP-1000}}{\text{Previous Pool Average BHP-1000}}$.

(The 1000 was later changed to 2/3 of previous pool average BHP). This was for the purpose of keeping the potential of Hobbs Pool wells in line with declining average pressures. (2) To further adjust the potential up or down, depending upon whether the well was above or below average bottom hole pressure for the purpose of increasing the allowable of high pressure wells and decreasing the allowable in low pressure wells. (Reference minutes and records of Hobbs Engineering Committee). This in turn would tend to reduce the rate of pressure decline in the lower pressure wells, tend toward pressure equalization within the reservoir resulting in minimizing the movement of reservoir fluids.

The plan is both sensible and workable. It was designed to operate with adjusted potential a 75% participation factor and, of course, was inadequate when adjusted potential was reduced to a 40% participation factor.

Stanolind's Sincerity Questioned

Mr. Card testified regarding the so-called "loss" of oil from Stanolind's properties in Sections 4 and 5, Township 19 South, Range 38 East. He stated the "loss" was due to the application of an inequitable proration plan and proposed that the plan should now be changed to 100% acreage (per unit allowable) in order to correct the condition. Upon cross examination (page 48) he admitted that the units from which the "loss" allegedly occurred would receive a lower allowable under the plan he proposed. When asked how that would correct the condition he replied "You have to consider all of our leases". In substance (page 48-49) he testified that Stanolind would gain 300 barrels of oil allowable per day if the proration plan was changed to 100% acreage. That the units from which Stanolind claimed loss would be reduced in allowable but that units in the southeastern area would receive such large allowable increases as to give a net gain of 300 barrels daily.

This same Southeastern, low pressure, low potential, thin producing section, area accounted for all of Stanolind's net allowable gain of 422 barrels daily when the proration plan was changed January 1, 1937. (Gulf Exhibit #11). The fallacy of that change is now indicated by the greatly accelerated bottom hole pressure decline and by the fact that the gas-oil ratio in that area has increased five times more than the balance of the pool. (Knappen page 139).

Gulf Exhibit #12 evaluated the drainage into a small portion of this Southeastern area. Mr. Tesch presented the basic formula in Stanolind Exhibit F which was used in the calculation. Attorney for Stanolind in the Stanolind statement page 12 "If Gulf Drainage Theory Hold True Stanolind Leases Would Drain to Stanolind Leases". In the first portion of Stanolind's statement is quoted Section 12 of the existing conservation law, a portion of which reads as follows:"Shall ---afford to the owner of each property in the pool the opportunity to produce his just and equitable share of the oil and gas in the pool -----". It appears that the proper interpretation of the law would be that the lease (each property) is the unit to be considered rather than the total productive acreage of a company. It would be inferred that it was the intention of the Legislature to prohibit a company from obtaining production from one lease at the expense of another or other leases owned by the same company as well as from leases owned by other companies. Surely it could not have been the intention of the Legislature to permit the Stanolind to obtain a reduced allowable for leases from which it claimed drainage but permit a greatly increased allowable for leases from which no drainage was claimed. Under the Stanolind plan there would be a transfer of allowable from the high bottom hole pressure, higher potential, thick producing section and lower gas-oil ratio areas to areas of low potential, low bottom hole pressure, thin producing section and high gas-oil ratios. It is also the area that received the large allowable increase in January 1937 which caused the gas-oil ratios in that area to increase precipitously and the bottom hole pressure to drop more rapidly. (Gulf Exhibit 11A and Knappen, page 139).

It appears that if Stanolind was sincere about correcting the status of the leases from which loss is claimed, it would propose changes in the proration plan, such as an increase in bottom hole pressure adjustment, since it was claimed that the wells had high bottom hole pressure and a change in the manner of adjusting the potential or allowable of the packer wells and an increase in the percentage of the adjusted potential factor. Each of these would improve the allowable of Stanolind wells in the area from which loss is claimed. Gulf proposed these changes: Gray's testimony, page 90, and Knappen's testimony, page 143.

No impartial observer could reasonably deny that there had been movement of reservoir fluids in the Hobbs Pool. Stanolind claimed movement in the southwestern area due to water drive and reservoir pressure differences (Card page A16). The two terms are synonymous for water drive is merely another means of implying pressure differences. Oil and gas do not move by virtue of the presence of water but because in a water drive pool there is a pressure differential between the water front and certain other areas. Stanolind seemed to have a clear understanding of the situation when applied to movement off its properties, but denied the condition when the formula presented by Mr. Tesch was applied showing movement to its leases in the southeastern portion of the pool. It is not a question whether there has been movement but how much and where it moves and whether, so far as an individual lease is concerned, there was counter movement. The real problem is the means by which the movement can be stopped or reduced. When a company claims loss and requests a proration plan which would improve its allowable as a whole but not for the properties from which loss is claimed the sincerity of the claims must be questioned.

If the proposition is put on a company basis, the question should be, has the company sustained greater loss than other companies? Stanolind has 24 units to which water has encroached or 42% of its wells compared to a pool total of 114 or 46% while Gulf has 13 or 59.9%. (Stanolind Exhibit C). Stanolind has 6 units with gas packers or 10.5% as compared to 41 units for the pool or 16.5% while Gulf has 5 or 22.7%. (Calculated from records of Hobbs Engineering Committee). In spite of this apparent advantage Stanolind has requested a proration plan which would increase the allowable of a group of its wells having the least amount of recoverable oil.

Recommendations

Records of the Hobbs Engineering Committee and testimony of witnesses together with the statements of attorneys and representatives of a number of companies indicate that there are a few inequities in the Hobbs Proration Plan that should be corrected, as follows:

1. The potential adjustment of packer wells has not worked out as intended. It is recommended that the potential of packer wells be readjusted from the time the packer was set or from June 1, 1935, whichever was the latest, in accordance with the percentage change in total pool potential except, of course, the potential of new wells as they are completed will not be used in calculating the percentage potential change; and that this manner of adjustment be used in the future except as modified in (2) below.

2. Some packer wells have high bottom hole pressures. Since there is no intention of penalizing the packer wells it is recommended that in the future the potential of such wells be adjusted as in (1) above or in accordance with the bottom hole pressure of the packer well at the option of the operator.

3. In a very few cases it is indicated that the bottom hole pressures do not quite reach the maximum in 36 hours. It is recommended

that the time limit for shutin be eliminated and that the operator be notified only the date the pressure will be taken and that such notice be delivered at least six days before the pressure is to be measured.

4. It is obvious that wide differences in reservoir pressure exist which is permitting the migration of reservoir fluids. To correct this condition it is essential that the effect of the bottom hole pressure adjustment be increased.

5. The difference in reservoir pressures and gas-oil ratios has increased precipitously in certain portions of the pool since January 1, 1937 when the participation factors were changed. It is recommended that the participation factor be changed to 75% for adjusted potential and 25% for acreage. Conditions within the pool were much more nearly ideal when these percentage factors were in use and a return to them at this time would probably also satisfactorily correct the conditions referred to in (4) above.

It is obvious that the proposals of Stanolind Oil & Gas Company are merely an attempt to disguise its real purpose; to botain an increase in allowable. The changes it proposed would increase the allowable of an entirely different group of leases and wells than the ones from which loss was claimed.

The proposals of the Gulf Oil Corporation, on the other hand, did not all tend to increase Gulf allowable as, for instance, the change in the treatment of packer wells. This would increase Stanolind's allowable and decrease Gulf allowable. All of the changes proposed by Gulf would improve the status of well allowables for the area from which Stanolind claimed loss and would most nearly afford the owner of <u>each property</u> in the pool the opportunity to recover (from that property) his just and equitable share of the (recoverable) oil and gas in the pool.

(Signed)

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