CERTIFICATE OF APPROVAL BY COMMISSIONER OF PUBLIC LANDS, STATE OF NEW MEXICO OF UNIT AGREEMENT FOR DEVELOPMENT AND OPERATION OF BIG EDDY UNIT AREA, LEA AND EDDY COUNTIES, NEW MEXICO

There having been presented to the undersigned Commissioner of Public Lands of the State of New Mexico for examination, an agreement for the development and operation of the Big Eddy Unit Area, Lea and Eddy Counties, New Mexico, dated the 10th day of April, 1952, in which Richardson & Bass, a Co-partnership, is designated as Operator, and which has been executed by various parties owning and holding oil and gas leases embracing lands within the Unit Area and upon examination of said Agreement, the Commissioner finds:

- That such Agreement will tend to promote the conservation of oil and gas and the better utilization of reservoir energy in said field;
- (b) That under the operations proposed, the State will receive its fair share of the recoverable oil or gas in place under its land in the area affected;
- That the Agreement is in other respects for the best interest of the State;
- (d) That the Agreement provides for the unit operation of the field, for the allocation of production, and the sharing of proceeds from a part of the area covered by the agreement on an acreage basis as specified in the agreement

10W, THEREFORE, by virtue of the authority conferred upon me by the Laws of the State of New Mexico, 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 above referred to Big Eddy Unit Agreement as to the lands of the State of New Mexico committed thereto, and all oil and gas leases embracing lands of the State of New Mexico committed to said agreement shall be and the same are hereby amended so that the provisions thereof will conform to the provisions of said Unit Agreement and so that the length of the secondary term of each such lease as to the lands within the unit area will be extended, in so far as necessary, to coincide with the term of said Unit Agreement, and in the event the term of said Unit Agreement shall be extended as provided therein such extension shall also be effective to extend the term of each oil and gas lease embracing lands of the State of New Mexico committed to said Unit Agreement which would otherwise expire, so as to coincide with the extended term of such Unit Agreement.

IN WITNESS WHEREOF, this certificate of approval is executed as of this the 1876 day of June, 1952.

Commissioner of Public Lands of the State of New Mexico

CERTIFICATION - DETERMINATION

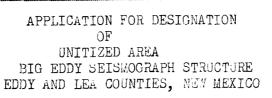
Pursuant to the authority vested in the Secretary of the Interior, under the Act approved February 25, 1920, 41 Stat. 437. 30 U.S.C. Secs. 181 et seq., as amended by the Act of August 6, 1946, 60 Stat. 950, and delegated to the Director of the Geological Survey pursuant to Departmental Cráer 2365 of October 8, 1947, 43 C.F.R. Sec. 4.611, 12 F.L. 6764, I do hereby:

- A. approve the attached agreement for the development and operation of the Big Eddy Unit Area, State of New Mexico.
- B. Certify and determine that the unit plan of development and operation set forth in the attached agreement is necessary and advisable in the public interest and is for the purpose of more properly conserving the natural resources.
- C. Certify and determine that the drilling, producing, rental, minimum royalty, and royalty requirements of all Federal leases committed to said agreement are hereby established, altered, changed, or revoked to conform with the terms and conditions of this agreement.

Dated 00T 1 1952

Acting

United States Geological Survey



SID W. RICHARDSON AND PERRY R. BASS

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EXHIBIT "B

APPLICATION FOR THE DESIGNATION OF A UNIT AREA (UNPROVEN)

BIG EDDY SEISHOGRAPH STRUCTURE

EDDY AND LEA COUNTIES. NEW MEXICO

An application for the designation of a unit area subject to logical development under a unit or cooperative agreement, as outlined under Unit Plan Regulations, is hereby respectfully presented by the partnership of Sid W. Richardson and Perry R. Bass in the above designated area. The area is more particularly described as centering eighteen miles east and four miles north of the town of Carlsbad, Eddy County, New Mexico, and falling in Townships 19, 20, 21, 22 and 23 South, Ramges 28, 29, 30, 31 and 32 East.

Although there has been some slight indication of structure in the area under consideration, the presence of an important deep seated structure has been obscured by the sedimentary dips and conditions of deposition associated with the Upper Permian reef building and by the location of the reef front with respect to the seismograph structure. As no drilling of sufficient depth has been done in the area to indicate the presence of structure below the Delaware formation, we can only speculate as to the shallowest stratigraphic sequence which has been influenced by the uplift.

A reflection seismograph map, designated as Map No. 1 in this report, is attached. This map shows a large faulted anticline, having a minimum closure of 1000 feet and covering an area of some 133,000 acres. In each instance the minus values and contours indicate the minimum dips that could be taken from the seismograph profiles. We have reasons to believe that the application of logical techniques by experienced personnel, together with the presence of dips of magnitudes several times the margin of error, lends an accuracy to the seismograph mapping unusual in a difficult shoeting area. The proposed unit area is shown enclosed by the orange and blue lines.

A fee ownership map, designated as Map No. 2 in this report, shows the outline of the proposed unit area, the surveyed acreage in each section, and the surveyed acreage in each sectional subdivision as recorded in the United States Department of Interior Land Management Division. The purpose in presenting this map is to show accurately the number of acres in the proposed unit and the percentage of Federal, state and patented land involved.

Accompanying this report there is a columnar section, designated Plate I, showing what is believed to be the maximum stratigraphic section likely to be present on some portion of this anticline. This section has been compiled from an actual well sample examination of the cuttings obtained from the Humble Oil and Refining Company's No. 1 Federal-Wiggs, Section 31, Township 24 South, Range 27 East, Eddy County, New Mexico, and located

twenty-five miles southwest of the crest of the anticline as mapped by seismograph. In view of the magnitude of the uplift in the Big Eddy anticline area and taking into consideration the thinning of the stratigraphic section in other known and proven areas of similar uplift, we anticipate considerable thinning, even truncation, of some segments of the formations below the top of the Lower Permian. It can be shown from several case histories that the greatest amounts of convergence and divergence occur in the Lower Permian and throughout the Pennsylvanian formations. We anticipate considerable convergence of the Pennsylvaniam formations over this structure with possibilities of truncation in the Pre-Pennsylvanian beds. The apparent large range of possibilities with regard to the thickness of sediments to be penetrated leads us to offer a maximum and a minimm stratigraphic section to be penetrated. The maximum thickness of sedimentary beds penetrated in a flank well would be similar to that encountered in the Humble well mentioned above. A tabulation of the formations and the depths at which they would be encountered follows:

Formation	Depth	Thickness
Base Salt	2,0401	
Top Delaware Mountain	2,2401	3,5001
Top Bone Spring (Leonard)	5,7401	3,9801
Top Wolfcamp	9,7201	1,0701
Top Pennsylvanian	10,790'	1,6801
Top Mississippian	12,470	6901
Top Devenian	13,160	1,110'
Top Monteya	14,2701	2401
Top Simpson	14,510	2581
Top Kllenburger	14,768*	

Deep drilling in the West Texas Permian Basin area has

disclosed that certain Pre-Permian beds are more likely to be missing on the crest of major uplifts than are others.

The following tabulation shows the age of beds most likely to be present on top of the structure without truncation, in the order of the highest probability of their presence:

- 1. Ellenburger (Ordovician)
- 2. Simpson (Ordevician)
- 3. Siluro-Devonian
- 4. Pennsylvanian
- 5. Mississippian

Due to the lack of reliable velocity data in the area, it is hazardous to estimate the depth or the age of formations that are being mapped seismically. However, we have prepared a northwest - southeast schematic cross section. designated as Plate II, which shows the dips as indicated by seismograph on the Pre-Permian formations encountered (with the exception of the Pre-Cambrian granite) in the Humble Oil and Refining Company's No. 1 Federal-Wiggs test referred to above. We consider the possibility of Lower Permian beds resting on Pre-Cambrian granite on top of the structure to be good and it can not be ruled out by the data available. If the Pre-Permian beds are present on top of the Pre-Cambrian granite uplift, it is highly probable that a gas cap of considerable proportions will be present as illustrated in the Cross Section of the Keystone Field, Winkler County, Texas, shown here as Plate III. To complete the case history of the Keystone Field we enclose a subsurface structural map, Plate IV, contoured on the top of the Ellenburger dolomite. Plate V, for the purpose of this report, is a schematic cross section showing Lower Permian resting on Pre-Cambrian granite. The cross section is in reality a portion of the Central Basin Platform showing the deformation of southeastern Lea County, New Mexico, a reprint from Plate I, Bulletin 23, New Mexico State Bureau of Mines and Mineral Resources.

Even though there is a definite possibility of encountering shallow granite and a resulting abbreviated sedimentary section similar to that illustrated by Plate V, we have indicated as the minimum sedimentary section the section tabulated below which we believe to be the one most likely to be encountered in a productive area outside of a gas cap. In the event of shallow granite, most of the exploratory drilling for flank production would take place in a flank area having an average sedimentary section as indicated below.

Minimum Section

<u>Formation</u>	Depth	Thickness
Base Salt	2,0401	
Top Delaware	2,240	3,5001
Top Bone Spring	5,7401	3,9801
(Leonard)	•	·
Top Bevonian	9,7201	1,0001
Top Montoya	10,7201	2001
Top Simpson	10,9201	2501
Top Ellenburger	11,170'	

We propose to allocate our drilling under the fellowing conditions. It is possible, although not probable, that

a full sedimentary section as found in the Humble Oil and Refining Company's No. 1 Federal-Wiggs dry hole could be found at the apex of the Big Eddy structure. In such an eventuality a well of sufficient depth which encountered water in the Ellenburger (Ordovician) without finding production at a shallower depth would preclude the necessity of further drilling to test the structure under the unit plan. On the other hand, should a test well near the apex of the structure show that known reservoir beds are not present due to the intrusion of granite, then one or more test wells located on the flank of the seismograph structure will be drilled to test for production in stratigraphic traps due to truncation, thinning of the beds or faulting. The depth to which these additional or flanking tests would be drilled is dependent upon the depth of the first major unconformity, the penetration of which would disclose the greatest amount of deformation. It is anticipated that this point would be Pre-Permian in age.

In conclusion, we summarize the pertinent facts supporting this application for unitisation as follows: First, it is evident that there has been presented sufficient data to outline the presence of deep seated structure approaching

an anticlinorium in size; Second, that in the event of unitization, we would drill a test to a depth of 14,500 feet, or water in the Ellenburger formation, provided commercial production, granite or an impenetrable formation is not encountered at a shallower depth; and Third, that should a test well on the top of the structure prove up shallow granite or a large gas cap, we would drill one or more wells on the flank of the structure to test for stratigraphic reservoirs.

Respectfully submitted,

PARTNERSHIP OF RICHARDSON & BASS

SID W. RICHARDSON	-
PERRY R. BASS	

Fort Worth, Texas July 1, 1951

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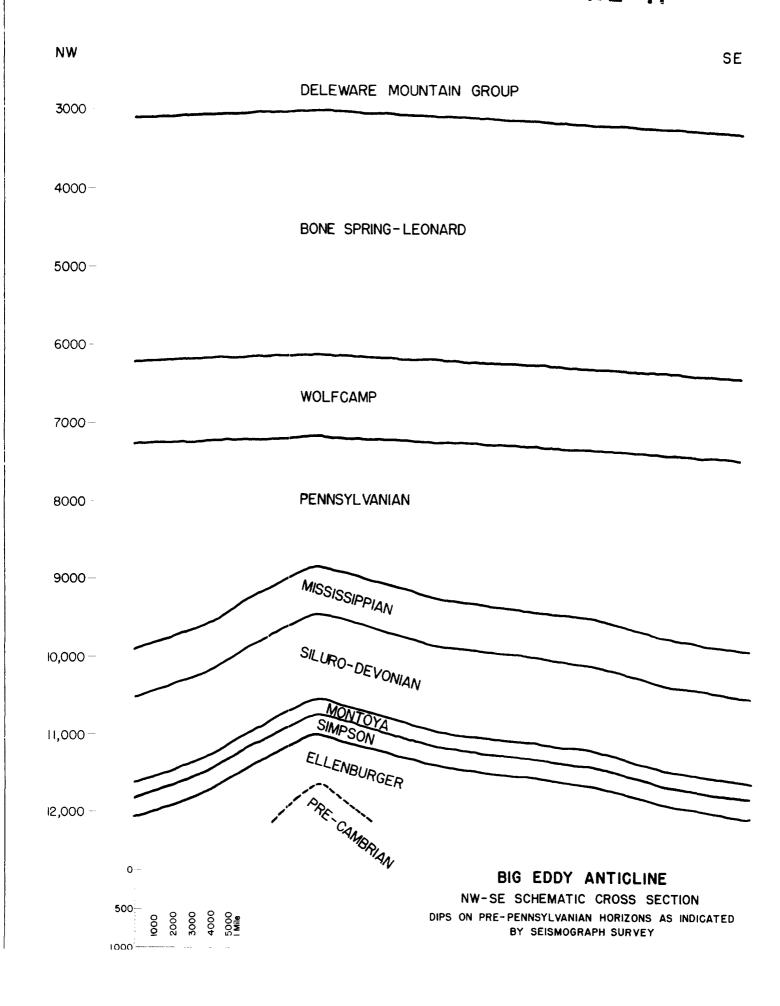
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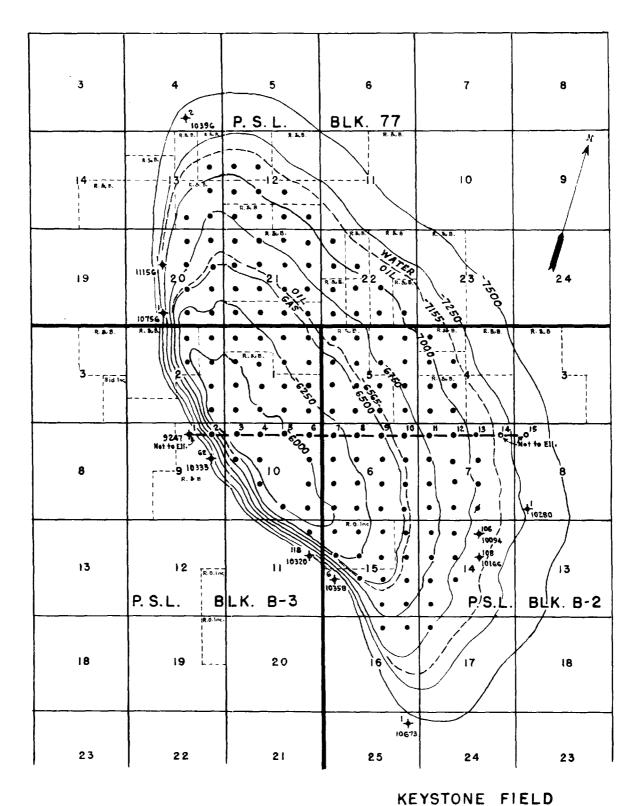
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PLATE 11



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PLATE IV



WINKLER CO. TEXAS
CONTOURS ON ELLENBURGER

INTERVAL - 250 FEET

6-8-51

O I MILE FEET

