

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

CAUSE NO. 2-4-86, A HEARING SCHEDULED)
AT THE INITIATIVE OF THE SUPERVISOR)
TO CONSIDER SPACING FOR WELLS DRILLED)
FOR GAS BELOW THE TOP OF THE GLENWOOD)
MEMBER OF THE BLACK RIVER GROUP IN)
SPECIFIED AREAS OF THE STATE)

SPECIAL ORDER NO. 1-86
Effective: August 8, 1986

OPINION AND ORDER OF THE SUPERVISOR OF WELLS

On April 29, 30 and May 20, 1986, a technical evidentiary hearing was held before the Supervisor of Wells and Advisory Board. A prehearing conference was held on April 14, 1986. Additionally, public comment hearings to address policy issues were held on April 2 and 3, 1986. The hearings were conducted pursuant to 1939 PA 61, as amended, and the promulgated rules.

The purpose of the hearings was to receive statements concerning policy and technical evidence concerning spacing and location requirements for wells drilled for gas below the Glenwood Member of the Black River Group in 51 counties in Michigan.

FINDINGS OF FACT

1. Currently there is no uniform approach for the development of deep gas reserves discovered below the Glenwood Member of the Black River Group (Glenwood). Depending on the geographical location, wells may be drilled on 40-or 80-acre units. Several special orders have been issued addressing the spacing for specific reservoirs. However, most of the area believed potentially productive below the Glenwood has not been specifically spaced except as required by the Supervisor of Wells' Order No. 1-73 and the General Rules. Recent discovery wells and continued active drilling programs indicate we are at the threshold of significant further development for deep gas. The situation parallels that of the Salina-Niagaran development in the early 1970's. That development was different than the oil and gas development which had preceded it. In 1973, Special Order 1-73 was issued, recognizing the difference in the needs for orderly efficient development. That order lent stability and predictability to the future course of development and prevented waste.

The development of deep gas reserves in an orderly and sound manner presents a similar challenge to chart a course for future action. It is because this development presents both an opportunity and challenge to set a predictable and sound course for future development of this important natural resource that the hearing was called. It is the opinion of the Supervisor that existing spacing orders do not adequately address the needs of future development. The prevention of waste is the cornerstone of the Supervisor's power. The presence of wasteful activity compels the Supervisor to act.

2. The notice of hearing proposed the following counties for consideration of a special spacing order: Alcona, Alpena, Antrim, Arenac, Barry, Bay, Benzie, Charlevoix, Clare, Clinton, Crawford, Eaton, Genesee, Gladwin, Grand Traverse, Gratiot, Huron, Ingham, Ionia, Iosco, Isabella, Kalkaska, Kent, Lake, Lapeer, Leelanau, Livingston, Macomb, Manistee, Mason, Mecosta, Midland, Missaukee, Montcalm, Montmorency, Muskegon, Newaygo, Oakland, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Ottawa, Roscommon, Saginaw, Sanilac, Shiawassee, St. Clair, Tuscola, and Wexford. These counties are underlain by potentially productive zones below the Glenwood at depths greater than 7,000 feet. Other areas of the state are also underlain by similar potentially productive horizons. Those areas were excluded from consideration for two reasons. First, the shallower depth could be productive of oil which may require different regulatory treatment. Second, the surface use implications and economic considerations of shallower drilling are less marked. Therefore, this hearing did not address other areas of the state that may be productive below the Glenwood.

3. According to the testimony, approximately 40 wells have been drilled below the Glenwood. Of those wells, 11 have been productive. The early development was marked by limited success. Recent experience has been considerably more successful. The techniques for the location of production have improved substantially as a result of the knowledge gained through past drilling. Today we see the exploration and development of deep gas reserves as an area of substantial interest and activity. The increased technical knowledge and activity make it now appropriate to examine the future direction for orderly development. Knowledge of the reservoirs is not perfect; many questions will only be answered by future development and production. A century of oil and gas development has shown that decisions for subsequent development must be made early in that development to assure that it is orderly and not wasteful. If we are to await a substantial and unassailable body of data, a situation unlikely to occur, we would have the benefit of hindsight and a corresponding inability to correct the mistakes of the past.

4. The development of deep gas reserves requires a large commitment of capital. The estimates of well costs offered at the hearing range from in excess of \$1 million to over \$3 million. Additional costs for completion, surface equipment and processing will also be incurred. If problems are encountered during drilling, the cost can escalate substantially. The Ruwe Gulf 1-19 and Ballentine 1-35 Wells both encountered problems downhole that necessitated abandoning the

original well bore and directionally drilling a replacement well. Mechanical or drilling problems are always a risk; however, in deep gas wells, they are exceptionally costly.

To determine spacing, a well must economically and efficiently drain the unit. Several witnesses testified as to the economic parameters of deep gas drilling. It is clear that drilling on 40- or 80-acre units is not economic. The capital expenditure and anticipated reserves of gas make such units unfeasible. To date, units of larger size have been formed voluntarily or by a Supervisor's spacing order. None of the expert witnesses believed that wells would be economic on a unit size less than 320 acres, nor did they suggest that wells would be uneconomic on 640-acre units. In fact, the economic considerations were most favorable at 640 acres. The difference of opinion related to 320-acre units; that is, units of 320 acres were characterized as uneconomic, marginal or economic, depending on the witness. In part, the difference must be attributed to the differing financial approaches of each operator. Inherent in such projections are capital and drilling costs, anticipated reserves, rate of return and anticipated sales price for gas. The substantial evidence indicates that wells are economic on 640-acre units and may be economic on 320-acre units.

5. The maximum area to be efficiently and economically drained by one well is also a consideration. There was a considerable amount of testimony concerning the expected drainage area for a deep gas well. Extensive production and test data does not exist. Most wells have had limited production to date. The wells have shown a productive capability in the range of several million cubic feet of gas per day. Generally, gas is flared during tests. To successfully perform reservoir limit tests on these wells, very large volumes of gas would have to be produced with the attendant waste of the gas. Prudence dictates that such testing is not appropriate.

The primary objective of deep gas is the Prairie du Chien Group. There has been production from the Glenwood and production is anticipated below the Prairie du Chien.

The Prairie du Chien Group is approximately 1,000 feet in thickness. To date, descriptive terminology for the zones within the Prairie du Chien is not yet settled. Various zones have been called the Zone of Unconformity, the Foster and the Bruggers. In spite of the differences in terminology, there are a number of observations that can be made about the Prairie du Chien.

Exhibit Nos. 15-26 provide petrophysical data for six productive fields. I find these data are generally representative of productive Prairie du Chien fields. In the western portions of the basin the Prairie du Chien is shallower, with thicker producing zones and better rock porosity and permeability, than in the eastern portions of the basin. The average well has 38 feet of net pay, a porosity of 11.4% and 38% water saturation. For purposes of determining productive net pay, a 5% porosity cutoff and 60% water saturation were used. A 5% porosity cutoff is conservative; that is, wells may be productive at a lesser

porosity. The 60% water saturation appears to be high; however, it is believed that most of the water encountered on logs is in a secondary porosity and is not movable. The productive zones show good permeability in relation to porosity development.

To determine the maximum area to be effectively drained by one well, the general producing characteristics must be examined. Enough data exist to form the basis for predicting the likely drainage area for wells. Those wells that are producing have demonstrated strong stable production. It is clear that some of the wells are capable of draining very large areas. The permeability is generally very good for gas reservoirs. The drive mechanism appears to be a depletion drive.

Available production in the initial testing stage and production histories will yield a radius of investigation which is an indication of drainage area. To determine the true influence of a well, it is necessary to run a reservoir limit test or interference test between wells in the same reservoir. The witnesses were of the opinion that the radius of investigation was probably less than the actual drainage area. Additionally, it is not uncommon to see a skin effect in the early testing. Further treatment and production has, in most cases, reduced the skin effect and increased the productive capability of wells.

After considering all the geologic, petrophysical and engineering data, it is my conclusion that one well can economically and efficiently drain 640 acres. It is also clear that some of the wells are capable of draining much larger areas. At this point in time, with the available data, it is most appropriate to be conservative. If future production data should indicate a greater well density, infill drilling can be authorized.

6. After finding that 640-acre units are appropriate, the next question to be addressed is: How are the units to be formed? At the hearing, various methods were suggested. Principally, it was proposed that $\frac{1}{2}$ $\frac{1}{2}$ sections, $\frac{1}{4}$ sections, or full sections be used to create the units. Full sections offer appeal in that they are easily described, certain, and would leave no open spaces or corridors between wells; sections also are inflexible. It is the inflexibility of sections that is unacceptable to the Supervisor. An operator should be able to select a drilling unit that reasonably conforms to the target structure. There are limitations on the predictability of reservoir size and limits before actual drilling. It is my opinion that units formed of $\frac{1}{4}$ sections, placed together in a square, is the most reasonable approach. Flexibility to align units with prospects is presented, while $\frac{1}{2}$ sections work to limit windows and lessen gerrymandering of units to conform with ownership. I find as a matter of fact, therefore, that drilling units should be approximately 640 acres, and formed of four contiguous $\frac{1}{4}$ sections of land in a square.

Further, I find as a matter of fact that to assure orderly development of reservoirs and to avoid corridors and create uniformly spaced units, a spacing pattern should be established by commencement of a well. Once diligent drilling has begun for a well (not setting

conductor pipe) like spacing should be applicable to the eight contiguous 640-acre units, forming a spaced area of nine (9) square miles in the shape of a square. If the well does not result in a discovery, the spacing requirement for the 8 contiguous units should no longer be applicable.

7. The parties offered various proposals for the location of wells. The location of wells is important for two reasons. First, location requirements restrict or limit the places where a well may be placed. Restrictions on well location can cause operational problems in that much of the drilling is in old fields with existing surface features that must be avoided. Therefore, many operators argued for maximum flexibility. The second aspect of well location is the relative well location for drainage purposes. Wells should be located so as to encourage uniform drainage and minimize interference between wells. A spacing pattern that allows wells too close together could result in the crowding of wells and waste.

The available data suggest that beyond 1,000 feet between wells, the potential interference between wells begins to lessen considerably. Witnesses suggested distances from 1,280 to 2,640 between wells as appropriate. The selection of a setback must balance the competing factors, avoidance of surface features, and uniform drainage. To provide reasonable setbacks and flexibility, I find that all wells should be located at least 990 feet from a drilling unit boundary. This provides a minimum of 1,980 feet between wells which will provide orderly development.

8. An important consideration in any spacing decision is the equity and correlative rights of all mineral owners. To assure perfect equity a well would be drilled on each individual's property. The infancy of the oil industry was marked by just such development. Such development spurred the need for regulation. As technical knowledge grew the spacing concept gained acceptance. Spacing is not perfect, nor is any other method of regulation; however, spacing has, as its basis, reasonably predictable scientific fact. There is now enough evidence to set a course of future conduct. A similar question of how equity and correlative rights might be addressed was raised in Cause No. 7-6-85. I believe the rationale is applicable here.

"Many mineral owners that are concerned that large units will substantially dilute their interest in production have proposed 160-acre and 320-acre spacing. The different proposals also relate to how units are to be configured. Spacing is prospective in nature and is to provide for the orderly future development and if it is not done prospectively only chaos can result. Spacing has to be the result of the best evidence available at a given point of time. If tremendous financial resources are to be committed, there must be a plan for development.

To assure perfect equity each tract of diverse ownership would have to be drilled. An approach must be pursued which is reasonable for all concerned. All interests large and small must be considered. In a sense a road map is being prepared to guide the future course of development. To draw that map the available scientific tools must be utilized. These scientific tools tell us the conservative approach is to space on 640-acre units. This is the maximum area to be effectively and efficiently drained by one well. The argument has been advanced that within the proposed spaced area there are included lands which appear to be unproductive. All spacing plans suffer from a similar infirmity. Experience has shown that some areas believed productive will not be and other areas believed nonproductive will produce. That is the nature of oil and gas exploration. The drill bit is the final arbiter of such disagreements. Prospective spacing gives everyone that same opportunity to develop lands. As between those drilling units that prove productive the Public Service Commission is mandated to assure that each unit receive an equitable portion of gas reserves attributed to that unit. Correlative rights will be protected with 640-acre spacing." Order No. 7-6-85, August 30, 1985.

Two other concerns affect correlative rights. One concern is that there is a right to an exception to all spacing orders. This order will set a general course of conduct and applicability. There is no question that some of the future development will be better served by another method. At that time, following a hearing dealing with site specific facts, an appropriate spacing pattern and unit configuration can be established. It has been argued that spacing should be done on a case-by-case basis following a discovery well. I believe that approach is the opposite of what ought to be done. A general method appropriate to the producing formation should be established and exceptions granted from the norm. This lends certainty and reasonable predictability which are necessary to assure the commitment of resources necessary for development.

The other area affecting equity and correlative rights is proration. Gas proration is within the jurisdiction of the Michigan Public Service Commission. Their proration attempts to assure equity between units, crediting each with its appropriate reserves.

The availability of exceptions and the method of proration provide safeguards to potential inequities that could possibly result from uniform spacing.

9. Several participants in the hearing have asked that an order be issued which would apply to existing or permitted wells. I believe such spacing would be inappropriate. The purpose of the hearing was to set a standard for future development, not to affect existing wells.

CONCLUSIONS OF LAW

1. 1939 PA 61, as amended, states in part in Section 13 as follows:

"A drilling unit, as contemplated herein, means the maximum area which may be efficiently and economically drained by 1 well..."

2. The spacing requirements for wells drilled below the Glenwood within the proposed spaced area are set by the General Rules R 299.1201 and Special Order No. 1-73 depending on the geographic location. These spacing requirements are for 40- and 80-acre units respectively. Based on the foregoing Findings of Fact I conclude that development of gas reservoirs below the Glenwood on 40- or 80-acre units is wasteful and would require the drilling of unnecessary wells.

1939 PA 61, as amended, states in part in Section 13 as follows:

"The drilling of unnecessary wells is hereby declared waste as such wells create fire and other hazards conducive to waste, and unnecessarily increase the production cost of oil and gas to the operator, and thus also unnecessarily increase the cost of the products to the ultimate consumer."

3. I conclude, as a matter of law, that drilling units of 640 acres are the maximum size to efficiently and economically drain reservoirs below the Glenwood.

DETERMINATION AND ORDER

Wherefore, based on the evidence and after consulting with and considering the recommendations of the Advisory Board, the Supervisor finds that a special spacing Order is necessary and desirable.

Now, therefore, It is Ordered:

1. A special spacing order is established, as an exception to Rule 201 (R 299.1201) and Special Order No. 1-73, where applicable, for all wells drilled for gas below the top of the Glenwood Member of the Black River Group in the following described counties: Alcona, Alpena, Antrim, Arenac, Barry, Bay, Benzie, Charlevoix, Clare, Clinton, Crawford, Eaton, Genesee, Gladwin, Grand Traverse, Gratiot, Huron, Ingham, Ionia, Iosco, Isabella, Kalkaska, Kent, Lake, Lapeer, Leelanau, Livingston, Macomb, Manistee, Mason, Mecosta, Midland, Missaukee, Montcalm, Montmorency, Muskegon, Newaygo, Oakland, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Ottawa, Roscommon, Saginaw, Sanilac, Shiawassee, St. Clair, Tuscola, and Wexford. This order shall not apply to the wells that are in existence or permitted, nor to lands subject to a special spacing order applicable to the same formations at the effective date.

2. A drilling unit shall consist of four $\frac{1}{4}$ sections of land joined together to form a square. Once diligent drilling has begun for a well (not setting conductor pipe), like spacing shall be applicable to the eight contiguous 640-acre units, forming a spaced area of nine (9) square miles in the shape of a square. If the well does not result in a discovery, the spacing requirement for the 8 contiguous units shall no longer be applicable.

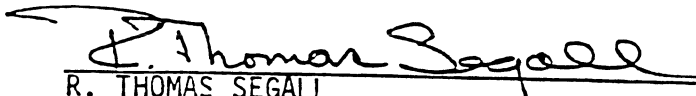
3. All wells shall be located not closer than 990 feet from any unit boundary.

4. The Supervisor may issue a permit to drill for gas on a drilling unit described in this order which is not totally pooled, nor communitized on condition that the application for permit is accompanied by a certified statement detailing efforts that have been made to obtain the lease or leases or to obtain a communitization agreement to form the full drilling unit and that such effort has failed. Should a well be completed on such drilling unit, a pooled drilling unit shall be formed by voluntary or compulsory pooling. This pooled unit shall conform to this order or shall conform to a drilling unit adopted following public hearing.

5. Exceptions to the spacing and location requirements of this order may be granted after notice and hearing.

6. The Supervisor after receiving technical data that one well may not economically and efficiently drain a drilling unit and consulting with the Advisory Board may allow a second well on a unit. All mineral interest and equity within the unit will remain the same should a second well be drilled on a unit.

Dated: August 8, 1986


R. THOMAS SEGALL
ASSISTANT SUPERVISOR OF WELLS