



Anadarko Canada Corporation

Applications for Special Gas Well Spacing

May 4, 2004

ALBERTA ENERGY AND UTILITIES BOARD

Decision 2004-034: Anadarko Canada Corporation, Applications for Special Gas Well Spacing

May 4, 2004

Published by

Alberta Energy and Utilities Board
640 – 5 Avenue SW
Calgary, Alberta
T2P 3G4

Telephone: (403) 297-8311
Fax: (403) 297-7040
Web site: www.eub.gov.ab.ca

ALBERTA ENERGY AND UTILITIES BOARD
Calgary Alberta

ANADARKO CANADA CORPORATION
SPECIAL GAS WELL SPACING
WESTEROSE SOUTH FIELD

Decision 2004-034
Applications No. 1305189 and 1305190

DECISION

The Alberta Energy and Utilities Board having considered the findings and recommendations set out in the following examiner report, adopts the recommendation, and directs that Applications No. 1305189 and 1305190 be approved.

DATED in Calgary, Alberta, on May 4, 2004.

ALBERTA ENERGY AND UTILITIES BOARD

(Original signed by)

Neil McCrank
Chairman

**EXAMINER REPORT RESPECTING
ANADARKO CANADA CORPORATION
SPECIAL GAS WELL SPACING
WESTEROSE SOUTH FIELD**

**Decision 2004-034
Applications No. 1305189 and 1305190**

1 RECOMMENDATION

Having considered the evidence provided, the examiners recommend that Applications No. 1305189 and 1305190 be approved.

2 INTRODUCTION

2.1 Applications

Anadarko Canada Corporation (Anadarko) applied pursuant to Section 79(4) of the *Oil and Gas Conservation Act* and Section 5.190 of the *Oil and Gas Conservation Regulations* (OGCR), and in accordance with *Guide 65*, to establish separate holdings for the production of gas from the Glauconitic Sand in Section 29 (Application No. 1305189) and Section 30 (Application No. 1305190) of Township 44, Range 1, West of the 5th Meridian (Sections 29 and 30-44-1 W5M) (Sections 29 and 30 respectively), and for the suspension of the drilling spacing unit and target area provisions within those holdings. The applicant proposed that within each holding, a maximum of two wells per section would be produced from the same pool, a producing well would be a minimum of 600 metres (m) from any other well producing from the same pool, and a producing well would be a minimum of 300 m from the boundaries of the holding.

2.2 Interventions

Objections to the applications were filed by Canadian Forest Oil Ltd. (Canadian Forest) and Cansearch Resources Ltd. (Cansearch), working interest owners in Section 32-44-1 W5M (Section 32) which offsets the areas of application to the north. Canadian Forest did not appear at the hearing; however, Cansearch indicated that Canadian Forest's interests were aligned with those of Cansearch.

The EUB also received an objection to the applications from Mabelle Sorensen, a freehold lessor in Section 25-44-2 W5M. However neither Ms. Sorensen nor her representative appeared at the hearing.

The attached figure shows the areas of application and the interests of the parties involved.

2.3 Hearing

The applications were considered at a public hearing on February 5 and 6, 2004, in Calgary, Alberta, by Board-appointed examiners R. J. Willard, P.Eng. (Chair), W. Elsner, P.Geol., and B. C. Hubbard, P.Eng.

TABLE 1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in report)	Witnesses
Anadarko Canada Corporation (Anadarko) R. L. Mooney C. Wilton	M. Bures, P.Geol. T. Curzon, P.Geol. M. Hong C. Willenborg
Cansearch Resources Ltd. (Cansearch) A. Harvie	E. Toews, P.Eng. M. Jackson, P.Geol.
Alberta Energy and Utilities Board staff G. Bentivegna, Board Counsel K. Fisher A. Beken, P.Eng., P.Geol. J. Meckelborg	

2.4 Background

The EUB defines the Glauconitic Sand in the general area of application as forming the Westeros South Glauconitic A Pool. The pool is a nonassociated gas pool currently defined as underlying 224 sections in portions of Townships 43 to 46, Ranges 1 to 4, W5M. The pool was discovered in 1977 and has been producing since that time. During 2003, 153 wells in the pool were on production at an average rate of 13 thousand cubic metres per day ($10^3 \text{ m}^3/\text{d}$). Special spacing of two wells per section per pool exists for 63 sections in the pool, including 5 sections offsetting the area of application. There are three wells of interest in the sections directly involved in the application – Sections 29 and 30 where Anadarko has an interest, and Section 32 where Cansearch has an interest. Summary information for these wells is noted in Table 2. The production data for the 2-29 and 11-30 wells is for the Glauconitic Sand. In the 4-32 well, production from the Glauconitic and Basal Quartz Sands has been commingled since the commencement of production. However, Cansearch is of the view that contribution from the Basal Quartz sand is nominal.

Table 2 Information for 2-29, 11-30, and 4-32 Wells

Well	Well Licensee	Finished Drilling Date	On Production Date	Average Gas Production Rate for December 2003 ($10^3 \text{ m}^3/\text{d}$)	Cumulative Gas Production to December 2003 (million [10^6] m^3)
2-29	Anadarko	August 1986	November 1988	31.8	361.3
11-30	Anadarko	October 1979	October 1981	13.4	134.2
4-32	Canadian Forest	June 1987	April 1988	25.2	210.6

3 ISSUES

The examiners note that the requested holdings would establish the equivalent of reduced gas well spacing and they therefore consider that the applications must satisfy at least one of the requirements stated in section 4.040(3) of the OGCR.

Section 4.040(3) of the OGCR states that

The Board shall not grant an application for an order ... that would reduce the size of drilling spacing units to less than the size of normal drilling spacing units unless the applicant shows that

- (a) improved recovery will be obtained,*
- (b) additional wells are necessary to provide capacity to drain the pool at a reasonable rate that will not adversely affect recovery from the pool,*
- (c) the drilling spacing units would be in a pool in a substantial part of which there are drilling spacing units of such reduced size, or*
- (d) in a gas field, increased deliverability is desirable.*

The examiners believe that the issues are

- whether the applications meet one or more of the requirements set out in section 4.040(3) of the OGCR for the establishment of reduced gas well spacing, and
- whether reduced gas well spacing would result in any unacceptable inequity.

4 CONSIDERATION OF THE APPLICATIONS

4.1 Views of Anadarko

Anadarko submitted that the proposed reduced gas well spacing satisfied the tests of section 4.040(3) of the OGCR and that the applications should therefore be approved. It noted that the requested spacing would improve recovery from the pool, allow for reasonable accelerated production, and would be in a pool in a substantial part of which there are drilling spacing units of such similar reduced size. Anadarko also maintained that the reduced well spacing would not result in any inequity.

The applicant interpreted the marine Glauconitic Sand underlying the area to be deposited in southwest to northeast trending sediment wedges, with the sand being comprised of upper, middle, and lower units. Only the middle and lower units are present in the area of application. The applicant interpreted the marine sands in the area of application to be cut by a channel system which was later filled with sand and mud, forming the updip trap for the pool (see figure attached). Anadarko submitted that significant heterogeneity in reservoir quality exists throughout the pool, as illustrated by log and core data, and by the pressures of infill wells drilled in 2002 and 2003 which showed pressure gradients across the pool.

Anadarko disagreed with the argument made by Cansearch that the similarity of wellhead pressures measured in 2003 at the 2-29, 11-30, and 4-32 wells after an 18-day shut-in was evidence of good communication between these wells and of uniform depletion of the reservoir underlying the area involved. It argued that these pressure measurements only indicated an instantaneous wellhead pressure after the wells had been shut in, and should not be considered either an extrapolated pressure or an average reservoir pressure. It noted that the estimated bottomhole pressures obtained from the wellhead pressures assumed a gas column in the wellbores. Further, as these wells had produced into the same pipeline at the same flowing pressure for an extended period of time, it was not surprising for them to experience instantaneous wellhead pressures that were similar during buildup. The applicant also argued that the wellhead pressures should not be taken as accurate as not only were they taken at the surface, but the gauge used had major increments of 1379 kilopascals (kPa) (200 pounds per square inch [psi]) and minor increments of only 172 kPa (25 psi).

Anadarko calculated reserves for the wells of interest volumetrically based on its mapping and by production decline analyses, and estimated the drainage radius for the wells, as shown on Table 3 attached.

The applicant noted that its volumetric reserves estimates were lower than its estimates using production decline analyses and considered this to be due to the heterogeneous nature of the pool, where reserves not recognized by volumetric analyses were contributing to production from the wells.

Anadarko submitted that infill wells were needed to capture reserves that otherwise would not be produced because of the heterogeneities in the pool. It estimated that each infill well would recover $36.6 \times 10^6 \text{ m}^3$ (1.3 billion cubic feet (Bcf)) of incremental reserves. The applicant indicated that infill wells drilled to obtain incremental recovery or for purely accelerated production would be economic, as demonstrated by the substantive increases in net present value for the cases.

Anadarko's production decline analyses indicated the remaining well life for the 2-29, 11-30, and 4-32 wells to be between 40 and 60 years. It submitted that this was an excessive length of time over which to recover the reserves, and that accelerating production by drilling infill wells was a valid means of recovering the reserves in a reasonable period of time. It stated that the life of the currently producing wells would be shortened only a small amount by the production of the proposed infill wells, but it was unable to estimate what the shortened well life would be. The applicant submitted that there was no evidence that infill wells would adversely affect ultimate recovery from the pool.

The applicant submitted that the establishment of the same reduced spacing elsewhere in the pool as requested in the subject applications also justified approval of its applications. It noted that since 1995, the EUB has approved reduced spacing for the Glauconitic Sand for 78 sections in the Westrose South Field. Anadarko argued that the extent of the reduced spacing showed that the EUB has agreed that the most efficient means to recover the reserves is by drilling two wells per section. The applicant said that Sections 29 and 30 were geologically similar to other areas of the pool where reduced spacing had been established and successful infill wells had been drilled.

Anadarko submitted that the requested spacing would not have any adverse equity impacts. It gave evidence that production from 11 infill wells drilled in the pool in the general area had not had any detectable effect on production from the original well drilled in the section, even after five years of production from the infill well. In Anadarko's opinion, it was therefore unlikely that production from Cansearch's 4-32 well would be adversely affected by infill wells producing from Sections 29 and 30. The applicant also said that, with its licensed infill well at the 11-29 location and the proposed infill well at the 2-30 location being 1000 and 1800 m respectively from the 4-32 well, production from these wells would be unlikely to affect the 4-32 well, given the low permeability of the reservoir.

Anadarko noted that the EUB was previously satisfied that establishing reduced well spacing in the subject pool with a minimum 600 m interwell distance and a 300 m buffer zone from the side of the holding was appropriate to protect the correlative rights of offsetting mineral owners. The applicant noted that its request is consistent with other special spacing already established for the pool.

The applicant also maintained that even though infill wells drilled in Sections 29 and 30 would not drain reserves underlying Section 32, its geological interpretation of the pool suggests that Cansearch has an opportunity to drill an infill well in the southeast quarter of Section 32 if it felt it needed to for competitive reasons. Based on its seismic and well data, Anadarko interpreted an incising channel cutting across Section 32 located as shown on the attached figure. The applicant considered that there is a high probability for a successful well of similar if not better quality than the 4-32 well to be drilled south of the channel edge. Anadarko argued that if Cansearch chooses not to drill an infill well in Section 32, this should not impair Anadarko's opportunity to do so on its lands.

Finally, Anadarko submitted that it should have the same opportunity to recover reserves as the operator to the south of its sections where reduced spacing has been established. In addition, the applicant noted that it would not oppose an application by Cansearch to establish the same reduced spacing for Section 32 as proposed in the subject applications.

4.2 Views of Cansearch

Cansearch submitted that the applications should be dismissed because Anadarko did not show that there would be significant incremental recovery of gas through infill wells drilled under reduced well spacing, and because the requested reduced spacing would result in inequitable drainage of Section 32.

Cansearch agreed with Anadarko that the Glauconitic Sand is part of a southwest to northeast trending barrier bar system that is intersected by transversely cutting tidal channels that act as an updip trap. Its analysis showed the channel cutting across Section 32 to be located to the south of Anadarko's interpreted location (see attached figure). Cansearch said that there were opportunities to drill infill wells where there are significant heterogeneities, but in the area of application, reserves were being adequately drained by the existing wells, and there was no need for further drilling.

With respect to current reserves recovery, Cansearch noted that the pressures measured at the 2-29, 11-30 and 4-32 wells after an 18-day shut-in in 2003 were within 68.9 kPa (10 psi) of each other, demonstrating that depletion of reserves in this area of the pool is uniform and that the

wells are in good communication. It disagreed with Anadarko's assessment that the pressure data were questionable. Cansearch considered the buildup time for the pressures to be consistent with practice in the area. It further submitted that the buildup of pressure is a function of the reserves remaining in the reservoir, and once the wells were shut in, the fact that they were flowing into the same gathering system at the same pressure did not have an impact on the buildup of the pressure as claimed by Anadarko.

Cansearch estimated reserves and drainage areas for the wells of interest as set out in Table 3 attached.

Cansearch submitted that existing infill wells have not demonstrated that they encountered incremental reserves but on the contrary showed a steep pressure or production decline, suggesting that the original well in the section was draining the reservoir at the infill well location and was interfering with the production of the infill well. It also argued that eventually, new infill wells would impact the original well in the section. Cansearch estimated that incremental reserves of $24.8 \times 10^6 \text{ m}^3$ (0.88 Bcf) could be produced by Anadarko's proposed infill wells, but considered that these reserves would not justify the 1.2 million dollar cost to drill each of the proposed wells. It argued that the requested reduced spacing simply represented an acceleration of pool depletion rather than significant incremental recovery of reserves.

Cansearch acknowledged that economic analyses would justify an infill well based solely on acceleration of production, but in its opinion such economics would not be optimal. It noted that Cansearch is a private, family-owned company and its management has been directed to operate the company assets with the goal of providing long-term stable cash flow. On that basis, its business philosophy would be to look for new discoveries rather than accelerate production by drilling infill wells.

Cansearch agreed with Anadarko that the remaining life of the three wells of interest was from 40 to 60 years. In response to questioning, it speculated that if infill wells were drilled in Sections 29, 30, and 32, the additional production would shorten well life in the order of 10 years or so. Consistent with its corporate philosophy, Cansearch did not see a problem in not accelerating the production of reserves from the pool by drilling infill wells, since even after 30 years, the revenues from those reserves are in real dollars available to future members of the family owning the company.

In response to the suggestion that reduced spacing is justified for the application area because such spacing already exists in a substantial part of the pool, Cansearch said that it was not materially affected by previous applications that resulted in the special spacing, and these applications should not be a precedent for the current application area. It submitted that each application should be considered on its own merits, and in this case, there was no justification for approval of the applications.

Cansearch said that even if the Board determined that there are significant incremental reserves to be recovered by infill drilling, the applications should still be dismissed because the production of infill wells on Sections 29 and 30 would cause inequitable drainage from Section 32. Using production decline analysis, it calculated that $49.0 \times 10^6 \text{ m}^3$ (1.74 Bcf) of gas would be drained from Section 32. Cansearch also submitted that it would not be able to mitigate drainage caused by infill wells as it did not have a reasonable geological opportunity for a second well on

the section. Cansearch considered that while there is virtually no risk for Anadarko to drill infill wells between existing wells, the risk for drilling on Section 32 is significant because in its opinion there is uncertainty where the incised channel edge across Section 32 is located. It noted that its current interpretation, which is based on well data, shows no reasonable second drilling location in Section 32 (see attached figure).

Cansearch was opposed to approval of the applications, but said that if the applications were approved, it would not suggest any other interwell or buffer distances other than the established ones which have been requested in the applications.

4.4 Views of the Examiners

The examiners note that the parties were in agreement that the Glauconitic Sand in the area was deposited in three units in southwest to northeast trending bars, but had a difference of opinion on where the channel cutting across Section 32 is located, as shown on the figure. They note that the parties also had different analyses for the reserves in the general area of application, and that there were inconsistencies between the reserves as calculated by production decline and as calculated on a volumetric basis. This leads the examiners to conclude that current geological interpretations are incomplete in identifying productive reservoir. On that basis the examiners relied more on the production decline analysis. The examiners believe that the inconsistencies in the reserves analyses, the characteristics of the well logs, and the deliverability and production data set out in the hearing submissions indicate reservoir heterogeneities in the part of the pool under consideration here.

The examiners note the pressure data relied on by Cansearch to indicate that the pool is being uniformly drained under Sections 29, 30, and 32, and that it is Anadarko's view that these pressures are not reliable indicators of stabilized reservoir pressure. As the pressure data was not filed at the hearing and could not be tested, the examiners are not fully able to resolve this issue. In particular the examiners are not able to determine whether the measured wellhead pressures are representative of a stabilized reservoir pressure.

The examiners believe that the drilling of additional wells would assist in accessing gas in this heterogeneous pool and recover some incremental gas that would not be produced by existing wellbores in Sections 29 and 30. The examiners do not consider it critical to quantify the incremental gas that would be recovered if there is justification for reduced spacing under subsections 4.040(3)(b) or 3(c) of the OGCR. The examiners accept that such recovery would be modest, in the range of the values estimated by Anadarko and Cansearch.

The examiners note that Anadarko and Cansearch are in general agreement that the remaining life of the 2-29, 11-30, and 4-32 wells is between 40 and 60 years. In the opinion of the examiners, this represents an extraordinary long well life. The examiners also note Cansearch's speculation that drilling two additional wells would shorten well life by only about 10 years. The resulting well life is still a considerable period over which to recover these reserves. The examiners believe that where the gas can be recovered more quickly without jeopardizing ultimate recovery and without being inequitable, accelerating recovery to enhance overall economics is reasonable. While the examiners appreciate the rationale for Cansearch's business approach, it is their opinion that economic parameters more typically used in the industry would suggest a benefit from accelerating production in this case. Where pools are being competitively produced, individual companies may not be in a position to independently pursue a unique

strategy. EUB rules attempt to provide a consistent standard and process for change that offers a fair opportunity to all parties. In this regard the examiners conclude that section 4.040(3)(b) is satisfied and accelerated development is warranted. The examiners further believe that with respect to ultimate recovery, there is some risk in not accelerating production and instead relying on aging infrastructure to recover diminishing production that would not justify reinvestment if new capital is required to continue production.

The examiners acknowledge that there is considerable reduced spacing already established in the pool, including for some sections adjacent to Sections 29 and 30. They have determined that section 4.040(3) applies to these applications. In the absence of mitigating factors, the examiners conclude that reduced spacing in Sections 29 and 30 is justified to provide Anadarko with an equal opportunity to benefit from reduced spacing as other operators who have reduced spacing on their property.

The final issue that the examiners considered is whether reduced spacing would result in any inequity. In the examiners' opinion, evidence presented on the characteristics of the 2-29, 11-30, and 4-32 wells suggest reservoir heterogeneity in this area of the pool. The examiners also note the well interference data submitted by Anadarko which show no effect to date of other infill wells drilled on the original wells in those sections. The examiners considered Cansearch's wellhead pressure measurement evidence but found this to be inconclusive in proving good communication between the three existing wells. The examiners are satisfied that, given Anadarko's proposed buffer distances, the infill wells would not have any unacceptable equity impact on Cansearch.

With respect to whether Cansearch could drill another well in Section 32, the examiners are of the view that whether Cansearch interprets the pool to underlie only a portion of its lands, and whether it is prepared to take a risk drilling a second well are not matters that should preclude Anadarko from the opportunity to drill a second well on its lands. Based on the differing geological interpretations presented at the hearing, the examiners believe that there may be some potential for Cansearch to further evaluate the opportunity for a second well location in Section 32. The examiners note that Anadarko has stated that it would not oppose an application to establish the same reduced spacing for Section 32 as proposed in the subject applications. In any event the examiners are of the view that it would not be appropriate to attempt to mitigate normal exploration risks through regulatory avenues.

Finally, the examiners accept that the minimum interwell distance, buffer zones, and well density provisions proposed by the applicant are consistent with reduced spacing already established and in their view there would be no reason to have different interwell or buffer zones for the area of application if reduced spacing is established for the area.

5 CONCLUSION

In view of the foregoing, the examiners are satisfied that the applications meet the criteria upon which the Board may authorize reduced spacing. Specifically, reduced spacing would result in improved recovery from the pool, additional wells are needed to drain the pool at a reasonable rate, and the reduced spacing would be in a pool in a substantial part of which the Board has already approved spacing units of such reduced size. As well, the examiners conclude that the

requested reduced spacing would not result in any inequitable drainage of Cansearch's gas. If Cansearch believes that it will need a second well on its land to maintain its competitive position in the pool, it too can apply for reduced spacing for Section 32. The examiners therefore recommend that the applications be approved.

Dated in Calgary, Alberta, on April 22, 2004.

ALBERTA ENERGY AND UTILITIES BOARD

(Original signed by)

R. J. Willard, P.Eng.

(Original signed by)

W. Elsner, P.Geol.

(Original signed by)

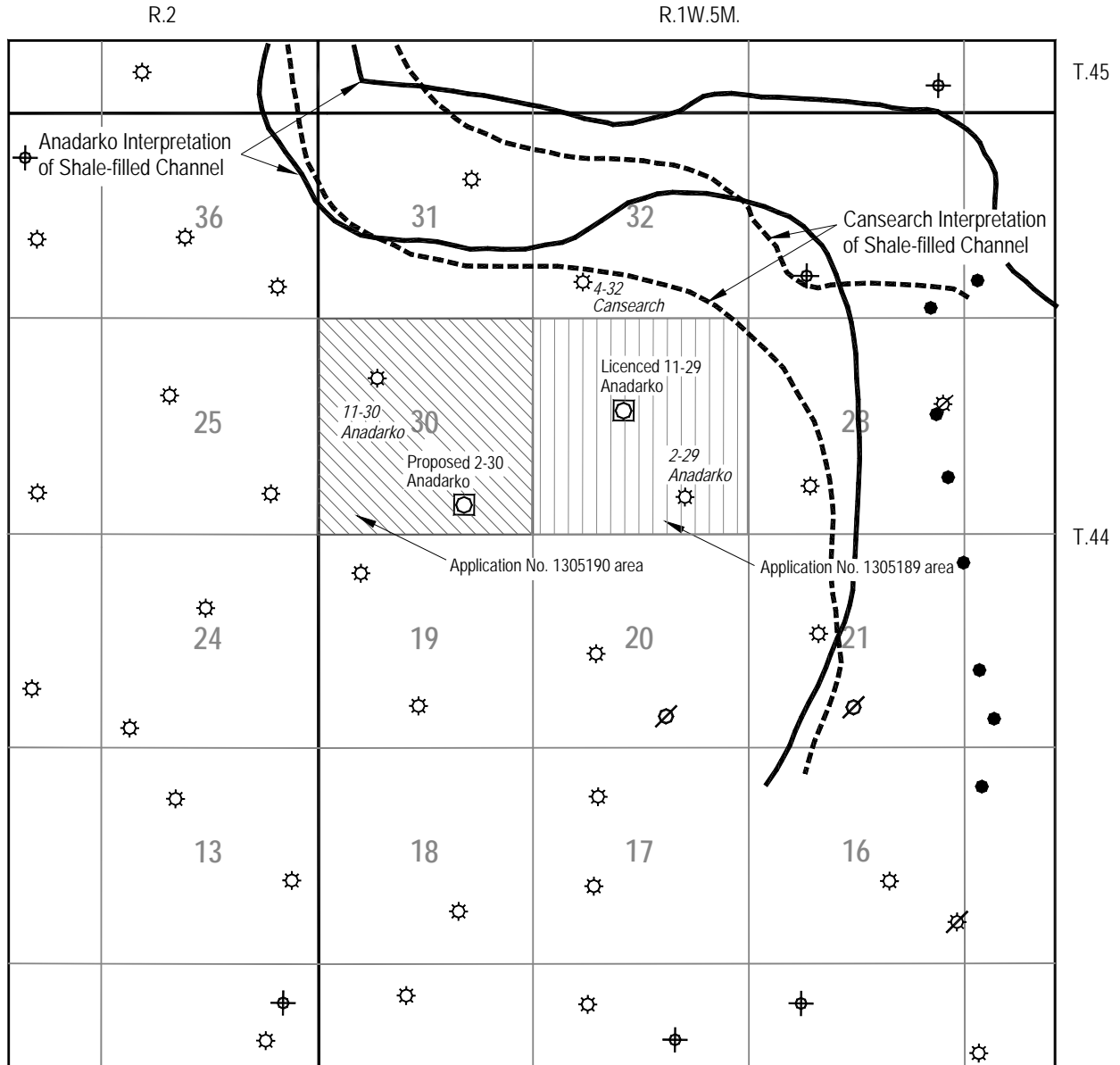
B. C. Hubbard. P.Eng.

Table 3 Anadarko and Cansearch Estimates of Gas Reserves and Drainage Areas
Anadarko

Well	Original Gas in Place by Volumetric Analysis		Estimated Ultimate Recovery by Production Decline Analysis		Estimated Drainage Radius (sections)
	10⁶ m³	Bcf	10⁶ m³	Bcf	
2-29	480.1	17.040	494.1	17.539	1.3
11-30	475.5	16.877	200.1	7.101	0.5
4-32	85.9	3.049	434.2	15.411	3.0

Cansearch

Well	Original Gas in Place by Volumetric Analysis		Estimated Ultimate Recovery by Production Decline Analysis		Estimated Drainage Radius (sections)
	10⁶ m³	Bcf	10⁶ m³	Bcf	
2-29	366.3	13.0	501.5	17.8	1.69
11-30	400.1	14.2	200.0	7.1	0.63
4-32	214.1	7.6	419.8	14.9	2.44



Legend

- | | | |
|--|------------------------------|--------------------|
| Anadarko Interpretation of Shale-filled Channel | Application No. 1305189 area | Gas well |
| Cansearch Interpretation of Shale-filled Channel | Application No. 1305190 area | Oil well |
| | | Abandoned well |
| | | Suspended well |
| | | Suspended gas well |

Westrose South Field
 Applications No. 1305189 and 1305190
 Anadarko Canada Corporation