



## Butte Energy Inc.

Application for Special Oil Well Spacing  
Chigwell Field

April 23, 2013

**ENERGY RESOURCES CONSERVATION BOARD**

Decision 2013 ABERCB 005: Butte Energy Inc., Application for Special Well Spacing, Chigwell Field

April 23, 2013

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Energy Resources Conservation Board  
Suite 1000, 250 – 5 Street SW  
Calgary, Alberta  
T2P 0R4

Telephone: 403-297-8311  
Toll free: 1-855-297-8311  
E-mail: [infoservices@ercb.ca](mailto:infoservices@ercb.ca)  
Website: [www.ercb.ca](http://www.ercb.ca)

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**ENERGY RESOURCES CONSERVATION BOARD**

Calgary, Alberta

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**BUTTE ENERGY INC.  
APPLICATION FOR SPECIAL OIL WELL SPACING  
CHIGWELL FIELD**

**2013 ABERCB 005  
Application No. 1712582**

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**DECISION**

The Energy Resources Conservation Board has considered the findings and recommendation set out in the following examiner report, adopts the recommendation, and directs that Application No. 1712582 be denied.

Dated in Calgary, Alberta, on April 23, 2013.

**ENERGY RESOURCES CONSERVATION BOARD**

B. T. McManus, Q.C.  
Acting Chairman



## **ENERGY RESOURCES CONSERVATION BOARD**

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Calgary, Alberta

**BUTTE ENERGY INC.  
APPLICATION FOR SPECIAL OIL WELL SPACING  
CHIGWELL FIELD**

**2013 ABERCB 005  
Application No. 1712582**

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### **RECOMMENDATION**

[1] Having considered the evidence provided, the examiners recommend that Application No. 1712582 (application) be denied.

### **INTRODUCTION**

#### **APPLICATION**

[2] Butte Energy Inc. (Butte) applied to the Energy Resources Conservation Board (ERCB/Board), pursuant to section 79(4) of the *Oil and Gas Conservation Act (OGCA)* and section 5.190 of the *Oil and Gas Conservation Regulations (OGCR)*, to suspend the drilling spacing units and target areas and establish a holding for the production of oil from the Viking Formation in the south half and northwest quarter of Section 35, Township 42, Range 26, West of the 4th Meridian (collectively Section 35). Butte proposed that a producing well be a minimum of 100 metres (m) from the boundaries of the holding and that there be a maximum of two producing wells per pool per quarter section.

#### **INTERVENTION**

[3] An objection to the application was filed by Glencoe Resources Ltd. (Glencoe), operator of Chigwell Viking Units 1, 2, 3, and 4 and holder of Enhanced Oil Recovery (EOR) Approval No. 10865E for an enhanced recovery scheme that offsets Section 35 to the north, west, and south. Glencoe was concerned that the proposed development on Section 35 would adversely impact its adjacent EOR scheme.

#### **BACKGROUND**

[4] The ERCB defines the Viking Sand within the Viking Formation in the area of application as part of the Chigwell Viking E Pool (E Pool). The area of application and adjacent lands are shown in Figure 1. The E Pool was discovered in 1980 and was produced under primary production from 1982 until 2007. Three wells on Section 35 produced oil under primary production from the E Pool: 06-35-042-26W4M (6-35 well), 08-35-042-26W4M (8-35 well), and 14-35-042-26W4M (14-35 well). The wells produced intermittently from 1983 until 2001, with the 6-35 well producing for a total of six months, the 8-35 well producing for a total of nearly three years, and the 14-35 well producing for a total of eight years.

[5] In the late 1980s, Glencoe was acquiring mineral rights in the area, including those for Section 35, which it obtained through a series of assignments. In 2006 and 2007, Glencoe and

Mrs. Marsha Turney, who owns the Freehold mineral rights for Section 35, were negotiating the continuation of Glencoe's leases for Section 35 but did not execute a lease continuation.

[6] Glencoe is the licensee of the 6-35, 8-35, and 14-35 wells. Glencoe completed zonal abandonments of the Viking Sand in the 8-35 well in November 2007, in the 6-35 well in April 2011, and in the 14-35 well in May 2011. The wells remain licensed to Glencoe with a current status of observation wells.

[7] In 2007 and 2009, Glencoe created the Chigwell Viking Units 1 and 2, respectively. Section 35 is not included in either of these units because an agreement between Glencoe and the Freehold owner, Mrs. Turney, could not be reached.

[8] In July 2007, the ERCB issued Approval No. 10865 to Glencoe for an experimental scheme for enhanced recovery of oil by miscible displacement using carbon dioxide (CO<sub>2</sub>) for areas within Unit 1. Since then, the scheme approval has been amended five times to add area, add injectors, and modify approval clauses. The approved scheme now includes Unit 2 and the majority of the E Pool. In the immediate vicinity of Section 35, Glencoe operates injection wells at 14-26-042-26W4M (14-26 well) and at 08-02-043-26W4M (8-2 well) and a producing oil well at 08-34-042-26W4M (8-34 well). Table 1 provides summary production information for wells in and around the area of application.

[9] In April and September 2011, Glencoe received approval for special oil well spacing for production from the Viking Formation within Units 1 and 2. The approved spacing is subject to a 200 m south and east buffer and a well density of two producing wells per pool per quarter section.

[10] On May 5, 2011, Richfield Oil Inc. (Richfield) acquired a mineral lease for Section 35. On May 29, 2011, Richfield assigned its mineral rights to Sand Hills Energy Inc. (Sand Hills). On December 21, 2011, Sand Hills submitted Application No. 1712582 to the ERCB. On April 23, 2012, Butte acquired an interest in the Section 35 mineral rights from Sand Hills and took over the subject application and related submissions.

[11] In April 2012, Butte drilled a well at 04-35-042-26W4M (4-35 well). This well is the only producing oil well within Section 35. In December 2012, Butte licensed a well at 13-35-042-26W4M for production from the Viking Formation.

Table 1. Information for wells in and around the area of application as of December 2012

Well	Well licensee	Well status	Finish drilling date	On-production date	Cumulative oil production (m <sup>3</sup> )*	Cumulative gas production (thousand m <sup>3</sup> )	Cumulative water production (m <sup>3</sup> )
4-35	Butte	Oil flow	2012/04/08	2012/05/22	505.9	552.5	250.8
6-35	Glencoe	Observation	1985/11/14	1985/12/07	618.6	2 038.7	111.7
8-35	Glencoe	Observation	1983/06/01	1983/07/08	94.0	839.4	40.5
14-35	Glencoe	Observation	1984/06/27	1984/08/02	2 413.5	8 206.0	146.5

(continued)

Well	Well licensee	Well status	Finish drilling date	On-production date	Cumulative oil production (m <sup>3</sup> )*	Cumulative gas production (thousand m <sup>3</sup> )	Cumulative water production (m <sup>3</sup> )
8-34	Glencoe	Oil flow	1984/08/31	1984/10/03	50 357.5	71 545.1	2 628.5
14-26	Glencoe	Injector	1984/02/28	1984/07/12	11 694.3	6 766.1	1 874.1
8-2	Glencoe	Injector	1984/08/03	1984/09/02	24 904.2	11 067.9	3 238.9
02/4-6†	Glencoe	Abandoned	1988/08/18	2000/10/23	11.6	5 544.7	338.4

\* m<sup>3</sup>: cubic metre

† 02/4-6: 02/4-06-043-25W4M

## HEARING

[12] The Board scheduled a hearing for October 10, 2012, in Calgary, Alberta, and at the request of the parties, adjourned and rescheduled the hearing for January 2013. The hearing commenced on January 29, 2013, and concluded on February 1, 2013, before Board-appointed examiners G. W. Dilay, P.Eng. (Presiding Member), B. A. Austin, P.Geol., and B. C. Hubbard, P.Eng. Those who appeared at the hearing are listed in Appendix 1.

## ISSUES

[13] In considering an application for a holding, the Board must have regard for section 5.190(3) of the *OGCR*. In addition, the Board must ensure that the purposes of the *OGCA*, as set out in section 4 of the act, which also provides the authority to grant a holding, are met and that approval of a holding is in the public interest. Therefore, the examiners consider the issues respecting the application to be

- whether the application meets the requirements of section 5.190(3) of the *OGCR*,
- whether the holding would result in a conservation loss or reduction of oil ultimately recoverable from the E Pool,
- whether each owner in the E Pool has an opportunity to obtain the owner's share of production, and
- whether the holding would result in orderly and efficient development.

[14] In reaching the determinations contained within this report, the examiners have considered all relevant materials constituting the record of this proceeding, including the evidence and argument provided by each party. Accordingly, references in this report to specific parts of the record are intended to assist the reader in understanding the examiners' reasoning relating to a particular matter and should not be taken as an indication that the examiners did not consider all relevant portions of the record with respect to that matter.

## WHETHER THE APPLICATION MEETS THE REQUIREMENTS OF SECTION 5.190(3) OF THE *OGCR*

[15] Section 5.190(3) of the *OGCR* sets out the test that must be met to allow the Board to consider granting an application for a holding. It reads:

- (3) The Board shall not grant an application for an order pursuant to subsection (1) unless, in the opinion of the Board, 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 the recovery of the pool, or
  - (c) the proposed holding would be in a pool, in a substantial part of which there are existing drilling spacing units or holdings with similar provisions.

## Evidence

[16] Butte submitted that the application needed to satisfy only one of the criteria set out in section 5.190(3), but that its application satisfied all three criteria in any event.

[17] Butte stated that approval of its application would result in improved recovery because increased well density on Section 35 would enhance areal sweep efficiency.

[18] Butte submitted that approval of its application was necessary to provide capacity to drain the pool in a reasonable time. Butte noted declining production from Glencoe's units and stated that there was a finite amount of time remaining during which the central production facilities would continue to operate and that Butte needed to recover the oil from Section 35 while those facilities were operating. Butte stated that recovery from the pool would not be adversely affected.

[19] Finally, Butte noted that the adjacent Glencoe units cover the majority of the E Pool and are approved for two wells per quarter section, which is the same well density that Butte has requested in its application.

[20] Glencoe submitted that Butte's application did not meet any of the three criteria set out in section 5.190(3).

[21] Glencoe submitted that rather than improve recovery, approval of Butte's application would result in a loss of oil recovery. Factors contributing to this loss would be inappropriate venting of CO<sub>2</sub> by Butte, producing wells on Section 35 adjacent to or within the E Pool gas cap, difficulty in maintaining the minimum miscibility pressure (MMP) in Glencoe's EOR scheme, and withdrawal locations not compatible with the existing EOR scheme.

[22] Glencoe submitted that criterion (b) in section 5.190(3), that additional wells were necessary to provide capacity to drain the pool at a reasonable rate without adversely affecting recovery from the pool, was also not met because of the conservation losses identified by Glencoe.

[23] Finally, Glencoe stated that the increased well density already approved in the E Pool was granted for the purpose of producing tertiary oil within an EOR scheme. Glencoe reasoned that the increased well density was justified by the importance of achieving an efficient sweep of oil, given the different drive mechanism that operates with EOR. Glencoe further noted that increased well density was never granted to the E Pool for the purpose of primary depletion. Accordingly, in Glencoe's view, Butte's holding application requesting two wells per quarter section for primary recovery is qualitatively different than the spacing already established in the

E Pool for EOR, so Butte's application does not meet the final criterion set out in section 5.190(3).

## **Analysis and Findings**

[24] The examiners note that section 5.190(3) of the *OGCR* is prohibitive in that it restricts the ERCB from granting an application for a holding unless one of the three criteria is satisfied. In this case, the examiners find that section 5.190(3)(c) is met, since the requested holding would have the same provision regarding well density as that already approved in a substantial part of the E Pool. The examiners do not agree with Glencoe's argument that clause 5.190(3)(c) is not met because increased well density for primary recovery is different than the increased well density already established in the E Pool for EOR since clause 5.190(3)(c) does not differentiate between different recovery mechanisms, but considers whether the existing approved spacing has similar provisions.

[25] Having found that the application meets the test, the examiners conclude that the Board's authority to grant the application for the holding is established and the Board may approve the application if it finds that it is in the public interest.

## **WHETHER THE HOLDING WOULD RESULT IN A CONSERVATION LOSS OR REDUCTION OF OIL ULTIMATELY RECOVERABLE FROM THE E POOL**

[26] The examiners note that section 4(a) of the *OGCA* states that one of the purposes of the *OGCA* is to effect the conservation of, and to prevent the waste of, the oil and gas resources of Alberta. Waste is defined as wasteful operations, which include

- (a) the locating, spacing, drilling, equipping, completing, operating or producing of a well in a manner that results or tends to result in reducing the quantity of **oil or gas ultimately recoverable from a pool** under sound engineering and economic principles. [Emphasis added.]

Accordingly, the examiners must ensure that approval of increased well density in the application area would not cause a reduction of ultimate oil recovery from the E Pool.

[27] Due to the volume and complexity of the information provided on this issue, for ease of reading and understanding the examiners have organized the information into three areas: (1) the extent, association with oil, and impact of the gas zones; (2) the impact of increased well density on ultimate recovery of oil; and (3) the adequacy of the maximum rate limitation (MRL) and gas-oil ratio (GOR) penalty to mitigate any reduction in ultimate recovery.

## **Evidence**

### *Extent, association with oil, and impact of the gas zones*

[28] In the application area, Butte interpreted there to be a gas pool that was limited in extent to the 6-35 and 14-35 wells. This was based on Butte's interpretation of gas being indicated on the logs for these wells. Butte did not assign gas pay to the 8-35 well. Butte argued that production from the 6-35 and 14-35 wells had depleted this gas pool on Section 35 by December 2000. Butte noted that the 02/4-06-043-25WM well (02/4-6) commenced gas production in October 2000 and stated that the continued gas production from the 02/4-6 well indicated that it produced from a gas pool that was separate from the pool depleted by the 6-35 and 14-35 wells. Butte did

not interpret gas to be present in the 06-01-043-26W4M well (6-1 well) and argued that the GOR performance of the well was on trend with the GOR performance of wells that contained only oil pay. Butte pointed out that the 07-01-043-26W4M (7-1 well), 10-01-043-26W4M (10-1 well), and 14-01-043-26W4M (14-1 well) wells were drilled and abandoned, and therefore did not include these wells as part of the gas pool. In summary, Butte contended that the performance of the 02/4-6 and 6-1 wells, in conjunction with the dry holes at 7-1, 10-1, and 14-1, proved the areal extent of the gas pool penetrated by the 6-35 and 14-35 wells was limited to Section 35. Butte stated that its material balance analysis also confirmed the limited extent of the gas zone.

[29] Butte also interpreted a gas zone to be present at the 14-26 well. Based on the well's production performance, which showed that the well started producing at a very high GOR that rapidly decreased, Butte interpreted the gas pool to be very small in extent and structurally separate from the gas pool encountered by the 6-35 and 14-35 wells.

[30] Butte interpreted the gas zones on Section 35 and in the 14-26 well to be nonassociated with the underlying oil zone because of a tight interval present between the gas and oil in the 14-26, 6-35, and 14-35 wells. Butte interpreted the tight interval to be a transgressive erosional feature of laterally continuous dark grey marine shale, but it did not submit any core data to support this interpretation. Although Butte's position was that the gas zone was not associated with the underlying oil zone, Butte did comment that there was some communication between the gas and oil zones.

[31] In support of its argument that the gas was not associated with the underlying oil, Butte submitted that the oil was undersaturated. Based on Standings and Vasquez-Beggs correlations, Butte estimated the bubble point pressure of the oil to be 6198 kilopascals (kPa) and 7125 kPa, respectively, compared with an estimated initial pool pressure of 9916 kPa.

[32] Based on its interpretation that the gas zone on Section 35 was separate from the underlying oil zone, Butte argued that the existence of the gas zone was not relevant to the future recovery of the oil on Section 35. Butte further argued that even if the gas had been associated with the oil, the pore space initially occupied by the gas would have been filled with oil that migrated into it under primary depletion. Butte contended that, as a result of Glencoe's repressurization of the reservoir by CO<sub>2</sub> injection, the reservoir now contained oil charged with CO<sub>2</sub> and some mobile water.

[33] Butte submitted that its 4-35 well is producing a gas with a composition that appears to be essentially CO<sub>2</sub> and hydrocarbon gas injectate, rather than native gases from the E Pool. Butte referred to two gas samples from the 4-35 well that showed a CO<sub>2</sub> content of 92–93 per cent. The samples also showed a different hydrocarbon profile than that of the E Pool solution gas. Butte concluded that there is no, or at least very little, solution or gas-cap gas being produced by the 4-35 well.

[34] Butte argued that approval of concurrent production (CCP) for Section 35 was not required because the gas was not associated with the underlying oil. Butte provided a letter dated September 10, 2012, from the ERCB's Enforcement and Surveillance Section that stated the 4-35 well was not producing gas-cap gas at that time so CCP approval was not required.

[35] Glencoe interpreted the Viking gas on Section 35 to be part of a larger gas pool that had an areal extent of about 4.5 sections, which included parts of Section 36-042-26W4M, Section

6-043-25W4M, and Sections 1 and 12-043-26W4M. Glencoe submitted that the pressure at the 02/4-6 well decreased from 6698 kPa in October 1988 to 6072 kPa in October 1999 while the well was shut in, and this pressure depletion indicated that the 02/4-6 well was most likely in communication with the wells on Section 35. Glencoe also included the abandoned wells at 7-1, 10-1, and 14-1 in the same gas pool as the wells on Section 35 and referred to a drillstem test for the 7-1 well.

[36] Similar to Butte's interpretation, Glencoe interpreted the gas zone in the 14-26 well to be a small gas accumulation separate from the gas pool on Section 35. Glencoe interpreted the separation to be due to a permeability barrier or restriction north of the 14-26 well. Glencoe argued that the GOR performance of the 8-34 well and the lower-than-expected pressure measured at the 4-35 well also indicated the presence of a permeability barrier or restriction north of the 14-26 injector.

[37] Glencoe acknowledged that gas-oil contacts are difficult to determine from logs because, except for the 14-26 well, the neutron porosity and density logs only show approach rather than crossover. Glencoe interpreted there to be a gas-oil contact based on structural, drillstem test, and production data.

[38] Glencoe pointed out that the log signatures in the Viking sands of the E Pool can be skewed by the presence of siderite nodules and other impurities in the sands. As a result, core data needed to be reviewed to understand the reservoir. Glencoe used the Viking core data and visually examined the core to identify the presence of an interval of reduced permeability between the gas and the oil in the 14-26, 6-35, and 14-35 wells. Glencoe interpreted this interval to be composed of shale interbeds or laminae that could be sideritic (iron-rich and calcareous). Glencoe further stated that these shale laminations were part of a shoreface succession and were likely laterally discontinuous. Based on these considerations, Glencoe interpreted that the interval of reduced permeability did not constitute a barrier between the gas and oil zones, and hence the gas was associated with the underlying oil on Section 35.

[39] Glencoe argued that the fluid properties used by Butte in its correlations were grossly erroneous: the API gravity of the oil is 37–38, not 33.4; the initial solution GOR is 60–70 m<sup>3</sup>/m<sup>3</sup>, not 34 m<sup>3</sup>/m<sup>3</sup>; the initial reservoir pressure is 8000 kPa, not 9916 kPa; and the reservoir temperature is 56–58°C, not 40°C. As a result, Glencoe contended that Butte's conclusion that the oil was undersaturated was incorrect. Glencoe submitted two reservoir fluid studies conducted on recombined fluid samples taken from wells 14-07-042-25W4M (14-7) and 06-18-042-25W4M (6-18). The study from the 14-7 well indicated an undersaturated fluid with a bubble point pressure of 7481 kPa, compared with an initial reservoir pressure of 7726 kPa at 546.1 metres subsea (mss). The study from the 6-18 well indicated a saturated fluid with a bubble point pressure of 8350 kPa, compared with an initial reservoir pressure of 7780 kPa at 554 mss.

[40] Glencoe contended that the production of gas-cap gas would cause oil to migrate into the gas cap and result in a conservation loss. Glencoe also argued that because of the high mobility of gas, production from wells in the vicinity of a gas cap could drop the reservoir pressure below the MMP and result in a further conservation loss. Glencoe viewed the area of application as a risky area of operations due to the presence of a gas cap and the impact the gas cap could have

on its EOR scheme. Glencoe indicated that it pressured up this area first in order to mitigate any potential conservation risk.

[41] Glencoe submitted that the 4-35 well is adjacent to a gas cap and production in the vicinity of a gas cap would result in gas from the gas cap being produced. Glencoe concluded that any producing wells on Section 35 should require CCP approval.

*Impact of increased well density on ultimate recovery of oil*

[42] Butte stated that there was no reservoir drive energy remaining at the conclusion of primary production, so there was no potential left to recover oil from Section 35 under primary production. Butte argued that the reservoir on Section 35 is now being influenced by Glencoe's CO<sub>2</sub> injection, and because of this, oil recovery would be improved by increased well density. Butte explained that the poor mobility ratio of a CO<sub>2</sub> flood results in poor areal sweep efficiency, which could be improved by producing more wells. Butte submitted that the additional wells it planned to drill or reactivate for production on Section 35 if its holding application were approved would recover oil from areas that would otherwise be unrecoverable by the 4-35 well. Butte noted that based on the operation of the offset EOR scheme, one well per pool per quarter section is not adequate to get optimal sweep efficiency.

[43] Butte stated that Section 35 has significant development potential under enhanced recovery, with remaining recoverable oil estimated to be 177 thousand (10<sup>3</sup>) m<sup>3</sup>. Butte further submitted that allowing only one producing well per quarter section risks stranding resources because all of the recoverable oil on Section 35 would not be produced before the end of the operating life of the area's central facilities. Butte argued that the production from Glencoe's units is declining, indicating to Butte that there is a finite amount of time remaining to produce the oil out of Section 35 while the facilities are operating. Butte hoped that the time would be longer than a year, but believed that it would definitely be less than 20 years. Thus its development plan is to sweep the entire section at once rather than focus on one area at a time. Approval of its holding application would allow for the additional wells needed to do this.

[44] Butte disputed Glencoe's evidence that declining production performance at Glencoe's 8-34 well was due solely to Butte commencing production at its 4-35 well. Butte pointed out that rising GORs and declining oil production at the 8-34 well actually occurred before Butte started producing the 4-35 well. Butte suggested that this was caused by declining pressure in the area of the pool in the vicinity of the 8-34 well due to insufficient voidage replacement. Butte did acknowledge that since the 4-35 well has been producing, it would be contributing to some decline in oil production at the 8-34 well because the 4-35 well is intercepting oil previously being swept from Section 35 to Glencoe's 8-34 well. However, Butte contended that this was not a decrease in recovery from the pool, but that the oil was simply coming out of a different wellbore.

[45] Butte submitted that the holding application is an early step in its overall development plan for Section 35 that will lead to implementation of an EOR scheme for its lands. Butte argued that increased well density was a necessary step before implementation of EOR because the additional wells would produce additional CO<sub>2</sub> for injection.

[46] Butte agreed that maintaining miscibility in an EOR scheme is optimal for displacing oil out of the reservoir rock. Butte disagreed with Glencoe's allegation that increased production

from Section 35, including removal of gas-cap gas and CO<sub>2</sub> from the reservoir, would result in pool pressures below the MMP. Butte argued that reservoir pressure was related to voidage and that voidage created by Butte's 4-35 well was small relative to voidage created by Glencoe's 8-34 well, which was accounting for 97½ per cent of the injectate being produced by the two wells. Butte concluded that if its holding application were approved, wells on Section 35 would not produce enough injectate to damage Glencoe's EOR scheme and submitted that even their small contribution to voidage could be remedied by returning produced injectate into the reservoir, which it had offered to do by returning the currently produced CO<sub>2</sub> to Glencoe and by ultimately implementing its own EOR scheme.

[47] Glencoe agreed with Butte's interpretation that all oil that was recoverable from Section 35 under primary recovery had been recovered prior to commencement of Glencoe's EOR scheme. With Butte's renewed primary recovery operations on Section 35 offsetting Glencoe's EOR scheme, Glencoe highlighted four issues associated with Butte's request for increased well density on Section 35 that would each contribute to loss of oil recovery from the E Pool.

[48] Glencoe's first issue was inappropriate venting of CO<sub>2</sub> by Butte. Glencoe submitted that it has spent considerable effort and money to place CO<sub>2</sub> in the reservoir to implement EOR on its lands. Glencoe noted that initial production testing of Butte's 4-35 well indicated that the produced gas comprised about 90 per cent CO<sub>2</sub> and that the reservoir contained no indigenous CO<sub>2</sub>. Glencoe further noted that Butte is venting the CO<sub>2</sub> and hydrocarbon gas produced at its 4-35 well instead of reinjecting it into the reservoir, which Glencoe submitted causes a conservation loss. As of December 31, 2012, Butte had already vented 552 10<sup>3</sup> m<sup>3</sup> of CO<sub>2</sub>. Glencoe applied a CO<sub>2</sub> utilization ratio of 710 m<sup>3</sup> of CO<sub>2</sub> per m<sup>3</sup> of oil recovered from the reservoir to estimate that in just four months 778 m<sup>3</sup> of future oil recovery had been lost due to the venting of CO<sub>2</sub> produced from the 4-35 well. Glencoe contended that additional producing wells on Section 35 would also encounter CO<sub>2</sub> and if Butte vented that CO<sub>2</sub>, the additional wells would result in further conservation loss. Regarding Butte's offer to return the CO<sub>2</sub>, Glencoe stated that its facilities were at full capacity and it had significant concerns with Glencoe bearing the entire burden of cost and risking its capital for processing and injecting the CO<sub>2</sub> for others' operations.

[49] Glencoe's second issue was gas-cap production. Glencoe interpreted that Section 35 lies within a gas cap to the E Pool. Glencoe submitted that similar to a situation with a hydrocarbon gas-saturated reservoir overlying oil-saturated rock, in a CO<sub>2</sub> scheme the gas-saturated reservoir rock provides a preferential path for flow. Glencoe pointed out that this phenomenon causes conservation losses because the gas-cap energy is depleted prior to the oil portion of the pool, causing oil to migrate to the gas-cap pore space and the loss of reservoir energy to gas production that could have aided oil production. Glencoe argued that any production in the vicinity of the gas cap will draw gas from the gas cap, and Glencoe interpreted Butte's 4-35 well to be immediately adjacent to the gas cap. Glencoe submitted that with the 4-35 well's producing GOR, each cubic metre of oil produced by the 4-35 well is accompanied by an additional 13.6 m<sup>3</sup> of reservoir volume, all of which is not being replaced. Glencoe further noted that the GOR for the 4-35 well is rising, having tripled in the last four months. Glencoe submitted that the 4-35 well is likely in the most downdip location that can be drilled on Section 35 and that any further development wells on Section 35 could only be expected to be upstructure.

[50] Glencoe's third issue was the need to maintain the MMP in its EOR scheme. Glencoe submitted that its EOR scheme relies on miscibility as a recovery mechanism, and stated that the expected recovery by miscible CO<sub>2</sub> flooding is three or more times what was recovered under primary recovery. Glencoe stated that removal of energy from the gas cap, which it interprets to be extensive and has high transmissibility, could drop the pressure below the MMP and result in a large area losing the recovery potential available under miscible displacement. Glencoe stated that its current MMP is 13 700 kPa and noted that the available pressure data indicated that the reservoir pressure varied in the vicinity of the area of application: the pressure at the 6-1 well was about 15 000 kPa, the pressure at the 16-34-042-26W4M well was essentially at the MMP of 13 700 kPa, and the pressure at the 4-35 well was 10 995 kPa. Glencoe further asserted that producing from the reservoir in the vicinity of the gas cap, as is the case with Butte's 4-35 well, accelerates reservoir pressure reduction and thus loss of miscibility.

[51] Glencoe's fourth issue was inappropriate withdrawal locations. Glencoe stated that inappropriate withdrawal locations, such as immediately adjacent to the gas cap or off pattern to designed flood patterns, will induce pressure drops and cause conservation losses by inducing channelling of gas across established solvent-bank flood fronts and by causing solvent-bank instability and loss of miscibility. Glencoe argued that increasing the number of primary production wells in this part of the E Pool, as requested by Butte, would be disruptive to the current depletion plan for the pool, and therefore impact Glencoe's existing EOR scheme.

[52] Glencoe stated that production from the 4-35 well has already caused irreparable damage to its offsetting EOR scheme and the proliferation of withdrawal locations on Section 35 would only exacerbate this situation. Glencoe believed that the unrestricted production of Butte's 4-35 well during its new oil well production period (NOWPP) had already negatively impacted production at Glencoe's 8-34 well. Glencoe stated that commencement of production at the 4-35 well correlated with a drop in production at the 8-34 well, with the 8-34 well experiencing a production decrease two to three times greater than what Butte's 4-35 well produced over the same period. Glencoe indicated that the pressure withdrawals on Section 35 may have already disrupted miscibility, destabilized solvent banks, and drawn down and resaturated the gas cap, resulting in irreparable harm to its EOR scheme. Allowing for additional wells to be produced as requested by Butte would create a further adverse impact.

[53] Glencoe responded to Butte's argument that the central processing facilities that serve the EOR scheme had a limited remaining life by stating that its EOR scheme was expected to continue for at least 20 more years. Glencoe clarified that production to date is only from wells south of the Battle River, which runs through the middle of Sections 34 and 35 in an east-west direction. Glencoe stated that although Unit 2 lands north of the Battle River have been pressured up above the MMP, significant capital is required to move the well effluent north to the production facilities in the Nelson Unit. Glencoe further stated that production gains from its EOR operations are in their infancy, with repressuring still to happen in Units 3 and 4, which are in the southern and northern portions of the pool, respectively, and that significant capital investments are required.

[54] Glencoe also submitted that Butte's development plan for Section 35 that included implementing an EOR scheme compatible with Glencoe's scheme was only speculative.

### *Adequacy of the MRL and GOR penalty*

[55] Butte submitted that the MRL and GOR penalty applied to the area of application are sufficient to protect Glencoe's offsetting EOR scheme. Butte indicated that while the MRL is 8 cubic metres per day per well (m<sup>3</sup>/d/well), the 4-35 well is only producing about 3 m<sup>3</sup>/d. With respect to the GOR penalty, Butte stated that it believed the GOR penalty should be based on just the native hydrocarbon component of the produced gas and not the CO<sub>2</sub>. Regarding the four-month, penalty-free period allowed under the NOWPP, Butte argued that the NOWPP for the 4-35 well had not damaged the reservoir because the well only produced a small part of the allowed oil volume of 2400 m<sup>3</sup>.

[56] Glencoe did not agree with Butte that the MRL and GOR penalty would address Glencoe's concerns. While the MRL and GOR penalty would help, Glencoe submitted that continued withdrawals in an area that is highly sensitive because of the presence of a gas cap still presented a risk to its EOR scheme. Glencoe contended that approval of increased well density would undermine the MRL and GOR penalty. Glencoe submitted that production from the 4-35 well during the NOWPP had negatively impacted its 8-34 well. Glencoe also raised the concern that a well's overproduction is allowed to be retired at an unpenalized rate after the well has been shut in for three consecutive months.

### **Analysis and Findings**

#### *Extent, association with oil, and impact of the gas zones*

[57] With respect to the extent of the gas pool on Section 35, the examiners agree with Butte and Glencoe that gas was present in the 6-35 and 14-35 wells. However, the examiners interpret the extent of the gas pool to have been larger than that interpreted by Butte. Based on production data, the examiners interpret the 8-35 well to have been part of the same gas pool as the 6-35 and 14-35 wells. With respect to Butte and Glencoe's different interpretations regarding the pooling of the 02/4-6 well, the examiners accept that the evidence submitted by Glencoe indicates there was pressure depletion at the 02/4-6 well between October 1998 and October 1999 while the well was shut in. In addition, the initial pressure of 6698 kPa measured at the 02/4-6 well appears to the examiners to be a depleted pressure when compared with Glencoe's and Butte's estimated initial pressures for the E Pool of 8000 kPa and 9916 kPa, respectively. Considering the locations of the wells on Section 35 relative to the 02/4-6 well and their production history, the examiners interpret that the wells on Section 35 contributed to the pressure depletion observed in the 02/4-6 well. Because of the distance between the wells on Section 35 and the 02/4-6 well, the examiners believe some gas could have remained to be recovered from the 02/4-6 well after production from the wells on Section 35 stopped. Therefore, the examiners interpret the 02/4-6 well to be in the same pool as the wells on Section 35. The examiners are not convinced that the gas pool was as large as mapped by Glencoe. Based on the information provided at the hearing, it is not clear to the examiners whether gas was present in the 06-36-042-26W4M or 02/11-06-043-25W4M well. Also, the examiners are not convinced that the evidence provided by Glencoe is sufficient to include the abandoned wells at 7-1, 10-1, and 14-1 in the pool.

[58] The examiners agree with Butte and Glencoe that the production performance of the 14-26 well indicates the gas pool penetrated by that well was very small and was not connected to the gas pool in Section 35. With respect to Butte's argument that the 14-26 well is structurally

separate from the gas pool on Section 35 and Glencoe's argument that a permeability barrier or restriction north of the 14-26 well could be used to explain the separation between the gas pools, the examiners accept that both interpretations offer a possible explanation, although there is no direct geological information to support either argument. However, considering the very small size of the gas pool interpreted by both Butte and Glencoe to have been encountered by the 14-26 well, the examiners believe that the extent of Glencoe's permeability barrier or restriction could be much smaller than the size shown in its submission. While such a permeability barrier or restriction could affect the flow path of the CO<sub>2</sub> injected at the 14-26 well, the production of CO<sub>2</sub> at the 4-35 well and the pressure measured at the well indicates to the examiners that at least part of the southwest quarter of Section 35 is being influenced by the injection of CO<sub>2</sub> at the 14-26 well.

[59] The examiners recognize that the thinness, grain-size distribution, and mineralogy of the Viking sand may affect log responses, and therefore the interpretation of the log data. Specifically, thin zones may not be accurately assessed from logs and gas-oil interfaces are likely to be indistinguishable, meaning that fluid interfaces have to be inferred. Therefore, the examiners agree with Glencoe that core analysis data should be relied upon to determine the geological properties within the Viking zone. The examiners agree with Glencoe that there is a very thin interval of reduced permeability in the 6-35, 14-35, and 14-26 wells. Further, the examiners note that the core analysis submitted by Glencoe describes this interval as being composed of very fine to medium grained sandstone with silty, limey, and/or sideritic material. This is consistent with Glencoe's interpretation of a laterally discontinuous shoreface deposit. Although this interval of reduced permeability could be interpreted as very thin shale from logs alone, the core description does not support Butte's interpretation of a laterally continuous marine shale. As well, the examiners note that although Butte interpreted a laterally continuous tight interval between the gas and oil on Section 35, Butte did acknowledge that there would be some communication between the gas and oil. Considering the thinness and nature of the reduced-permeability interval, the examiners interpret that the gas was associated with the oil.

[60] With respect to whether the oil on Section 35 was saturated or undersaturated, the examiners are of the view that Glencoe's challenge of the correctness of the fluid properties used by Butte in its correlations makes Butte's results uncertain. Also, the examiners consider the reservoir fluid studies provided by Glencoe to be inconclusive since one study indicated the oil was saturated while the other indicated the oil was undersaturated. Therefore, the examiners find that neither Butte's nor Glencoe's evidence is definitive in determining whether the oil on Section 35 was saturated or undersaturated.

[61] The examiners believe that the primary production that has occurred and the subsequent repressurization of the reservoir by CO<sub>2</sub> injection have affected the distribution of fluid saturations on Section 35. Since the current distribution of fluid saturations on Section 35 was not provided at the hearing, it is not clear to the examiners what impact the gas zone on Section 35 might have on the production from any additional wells on Section 35 or whether there is any requirement for CCP approval.

*Impact of increased well density on ultimate recovery of oil*

[62] The examiners note that both Butte and Glencoe agree that the E Pool, including the area of application, was produced to depletion under primary recovery and that the oil being recovered from the E Pool is now due to Glencoe's injection of CO<sub>2</sub> into the reservoir. The examiners believe there are two opposing arguments regarding the impact of increased well density in the application area on ultimate recovery of oil. One argument is that increased well density could improve the CO<sub>2</sub> areal sweep efficiency on Section 35, albeit because of CO<sub>2</sub> injected by Glencoe and not Butte, resulting in improved oil recovery. The other argument is that increased production from the application area without reservoir voidage replacement could have a detrimental impact on Glencoe's CO<sub>2</sub> flood and reduce oil recovery from the E Pool. As pointed out by Glencoe, a CO<sub>2</sub> flood is a complex process that requires careful management of several factors, such as the need to operate at a MMP and to maintain the stability of the solvent bank. Production from additional wells from the application area without reservoir voidage replacement could reduce the pressure below the MMP in part of the E Pool and destabilize the solvent bank. The examiners note that the pressure data for the 4-35 well indicated that the reservoir pressure in the vicinity of that well is below the MMP.

[63] In order to determine whether there would be a net gain or loss in oil recovery from the E Pool if increased well density were approved for the application area, the examiners believe that a quantitative assessment of the two opposing arguments would need to be done. Since a quantitative assessment was not provided at the hearing, it is not clear to the examiners whether there would be a net gain or loss in oil recovery.

[64] The examiners are of the view that for there to be improved areal sweep on Section 35 as a result of increased well density, the wells would need to be produced at significant and steady rates in order to cause the CO<sub>2</sub> to flow to and displace oil to the wells. The examiners note that the 4-35 well is severely penalized because of its high GOR caused by the production of CO<sub>2</sub>. The current penalized allowable for the well is only 0.5 m<sup>3</sup>/day. At the time of the hearing, although the well had only produced for two months beyond its NOWPP (during which GOR penalties were not applied), the well had already been overproduced and will have to be shut in to retire the overproduction. The examiners also note that the previously drilled wells on Section 35 (6-35, 8-35, and 14-35) also produced at high GORs, due to the production of hydrocarbon gas, not CO<sub>2</sub>. Although the current distribution of fluid saturations on Section 35 was not provided at the hearing, considering the recent performance of the 4-35 well and the past performance of the previously drilled wells, as well as the low structural position of the 4-35 well relative to the rest of Section 35, the examiners believe that any new wells drilled (or old wells reactivated) in the application area could encounter high gas saturations and produce at high GORs. If this were to occur, the wells would be severely penalized and be unable to produce at significant and steady rates, limiting any improvement in areal sweep on Section 35 if increased well density were approved. However, at the same time, the restricted production from the wells would limit any detrimental impact of production without reservoir voidage replacement on the adjacent EOR scheme.

[65] While there was a difference in interpretation between Butte and Glencoe regarding the impact of production from the 4-35 well on the 8-34 well, the examiners note Butte acknowledged that the 4-35 well has contributed to some of the decline in the production rate of the 8-34 well. Because of the limited amount of production data since the 4-35 well was put on

production, the examiners are of the view that it is too early to conclude whether the decline in the production rate of the 8-34 well will result in a loss in ultimate oil recovery or whether the oil is just being produced at a different well.

[66] Regarding Butte's statement that under the existing spacing resources on Section 35 could be stranded because the oil would not be produced before the end of the operating life of the area's central facilities, the examiners understand that the facilities Butte is referring to are owned by Glencoe. Considering Glencoe's evidence that it expects its EOR scheme to continue for at least 20 more years, the examiners do not believe that Butte has provided sufficient reason to conclude that the resources on Section 35 could be stranded under the existing spacing. If Glencoe's facilities were not available, Butte could pursue alternatives to ensure the recovery of oil on its land.

#### *Adequacy of the MRL and GOR penalty*

[67] The examiners do not agree with Butte's view that the CO<sub>2</sub> produced and vented by its wells should not be included in the calculation of the GOR penalty. As stated in *Directive 007-1: Allowables Handbook, Guidelines for the Calculation of Monthly Production Allowables in Alberta*, GOR penalties are imposed to limit production primarily to optimize oil and gas conservation. Since the injected CO<sub>2</sub> is providing the mechanism for oil recovery from the E Pool, the examiners believe that producing and venting CO<sub>2</sub> does not optimize oil conservation, and hence the CO<sub>2</sub> should be included in the calculation of the GOR penalty.

[68] The examiners are of the view that the MRL and GOR penalty would provide limited protection for Glencoe's EOR scheme that offsets the area of application if increased well density were approved. One limitation to the protection provided by the GOR penalty is that it would not be applied during a well's four-month NOWPP. A second is that although each well would be restricted after its NOWPP, allowing more wells to be produced would result in more production without voidage replacement.

#### *Summary – Main finding*

[69] Without a quantitative assessment of the possible increase in oil recovery because of improved areal sweep on Section 35 versus the possible reduction in oil recovery because of a detrimental impact on Glencoe's EOR scheme, the examiners are not able to determine whether approval of increased well density in the application area would result in a loss of oil recovery from the E Pool.

### **WHETHER EACH OWNER IN THE E POOL HAS AN OPPORTUNITY TO OBTAIN THE OWNER'S SHARE OF PRODUCTION**

#### **Evidence**

[70] Butte submitted that a fundamental purpose of the *OGCA* is to afford each owner the opportunity to obtain the owner's share of the production of oil and gas from any pool. Butte submitted that the minerals in the south half and northwest quarter of Section 35 are owned by Mrs. Turney, and Butte, through a series of assignments, currently holds those mineral rights. Butte submitted that Glencoe is sweeping oil from Section 35 and that Butte filed its application,

in part, to allow itself and the Turneys to address this inequity by producing the reserves on Section 35, which are rightfully theirs.

[71] Mr. Robert Turney, on behalf of his wife Mrs. Turney, appeared as a witness for Butte and explained the exclusion of Section 35 from Glencoe's EOR operations. Mr. Turney stated that Glencoe originally held the mineral rights on Section 35, but that an agreement could not be reached regarding renewal of the mineral rights and inclusion of Section 35 into Glencoe's units due to concerns related to surface access, confidentiality, and tract factors.

[72] Butte stated that in the part of the E Pool with good permeability, under primary production the difference in oil recovery between a well density of one well per quarter section and two wells per quarter section would be minimal. Butte submitted that the western part of Section 35 has good permeability and that there is a decrease in permeability only at the 8-35 well.

[73] Butte stated that the application area is under the influence of Glencoe's EOR scheme and oil is being swept from Section 35. Butte contended that oil is being swept by Glencoe's 14-26 injector to Glencoe's 8-34 producer at a rate of 20–30 m<sup>3</sup>/d, and Butte estimated that Glencoe had swept over 23 800 m<sup>3</sup> of oil from Section 35. Butte made this estimate by considering that all the oil produced by the 8-34 well after December 2007 (the date Butte considered the 8-34 well to have been produced to depletion under primary production) came from Section 35. Butte argued that the 8-2 CO<sub>2</sub> injector was not effective in sweeping oil to Glencoe's 8-34 producer because of the distance between the wells. This was based on Butte's observation that shortly after the 8-2 well commenced CO<sub>2</sub> injection, the well 16-02-043-26W4M gassed out without producing any incremental oil. This indicated to Butte that two legal subdivisions (LSDs) was too great a distance between an injector and producer to be effective, and Butte noted that the 8-2 and 8-34 wells were four LSDs apart.

[74] Glencoe contended that there was no longer any primary oil recovery potential from the application area as all the primary oil was recovered during the primary depletion phase. Glencoe concluded that any voidage from production in the application area would cause inequitable drainage from its EOR scheme, and the additional voidage created by increased well density for primary depletion would exacerbate the inequitable drainage. Glencoe also argued that it is the owner of the CO<sub>2</sub> injected into the reservoir through its EOR scheme, including any injected CO<sub>2</sub> on Section 35, and that it remains the owner of the CO<sub>2</sub>. Glencoe pointed out that Butte does not have Glencoe's approval to use the CO<sub>2</sub> and Butte has not compensated Glencoe for the use of the CO<sub>2</sub>.

[75] Glencoe stated that it had gone to great lengths in the past to include Section 35 in its EOR scheme, but ultimately it was unsuccessful and Unit 2 was formed in 2009 without Section 35 as Glencoe needed to begin injection of CO<sub>2</sub>. Glencoe submitted that it had formed many units for its EOR operations and the failed negotiation with the Turneys was Glencoe's only unsuccessful attempt at acquiring leases for its EOR schemes. Glencoe pointed out that because of Mrs. Turney's ownership of the minerals in the north half of Section 26 and east half of Section 34, Mrs. Turney has a tract-factor participation in Units 1 and 2.

[76] Glencoe submitted that the 14-26 well was selected as an injection well as it was an ideal location to flood the southern part of the E Pool. While Glencoe acknowledged that some of the oil produced by its 8-34 well is possibly coming from Section 35, it argued that most of the oil is

coming from its lands. It disagreed with Butte that the 8-2 injector is too far away from the 8-34 producer and submitted that the production performance of the 8-34 well showed the production rate plateaued in 2009 and then rose in early 2010 due to the injection of CO<sub>2</sub> at the 8-2 well, which started in September 2009. Glencoe contended that most of the oil being swept to the 8-34 well is coming from the 8-2 injector through the best part of the reservoir. Glencoe argued that there had been drainage of oil into Section 35 because it had pressured up the reservoir by injecting CO<sub>2</sub> on its lands and the flow of reservoir fluids is from high pressure areas to low pressure areas.

## **Analysis and Findings**

[77] As mentioned in paragraphs 42 and 47, Butte and Glencoe agree that the E Pool was produced to depletion under primary recovery and that the only opportunity to now recover oil from the E Pool is through enhanced recovery, such as the CO<sub>2</sub> miscible flood scheme being operated by Glencoe.

[78] It is evident to the examiners that the portion of the E Pool underlying Section 35, or at least the southwest quarter, is being influenced by Glencoe's EOR scheme and oil recovery is occurring under the same recovery mechanism as that in the pool on the offsetting land. This is based on the oil production obtained by Butte from its 4-35 well, the CO<sub>2</sub> content in the produced gas, and the pressure measured at the well. The examiners conclude that Butte is receiving the benefit of EOR without implementing its own EOR scheme for Section 35 or participating with Glencoe in its EOR scheme.

[79] The examiners find inconsistency between Butte's argument that Section 35 is actually under EOR and therefore should have increased well density to improve recovery and Butte's inaction to seek approval of its own EOR scheme on Section 35. By not being within an approved EOR scheme, there are no obligations regarding EOR for development of Section 35, such as replacing voidage and maintaining reservoir pressure at or above the MMP. As a result, Section 35 is correctly administered as a primary production area, subject to the rules for primary production.

[80] The examiners note that increased well density was not approved in the E Pool for primary depletion; rather, the justification for increased well density and the opportunity afforded by it followed implementation of EOR. There is no evidence to suggest that the holding is required for primary depletion, under which Section 35 is currently being administered. The examiners note Butte's statement that in the good-permeability part of the E Pool, under primary production there would be minimal difference in oil recovery between well densities of one and of two wells per quarter section. Further, as stated in paragraph 77, the E Pool was produced to depletion under primary production and, but for Glencoe's EOR operations, no oil would currently be obtainable from Section 35 under primary depletion.

[81] The examiners recognize that oil production from Butte's 4-35 well is severely restricted because of its GOR penalty, which is being applied for a conservation reason, while Glencoe's 8-34 well is allowed to produce at rates only restricted by the ability of the scheme to replace reservoir voidage and maintain the pressure at the MMP. Butte's recourse to have the GOR penalty removed from its 4-35 well would be to implement an EOR scheme on its land. Doing so would also likely support the need for increased well density as Butte would be taking steps to remove restrictions and increase recovery from the pool.

[82] Considering the locations of the 14-26 and 8-34 wells relative to Section 35, the examiners accept that CO<sub>2</sub> injection at the 14-26 well has swept some oil from Section 35 to the 8-34 well. However, the examiners are not convinced that the amount of swept oil is as large as estimated by Butte. While Butte attributed all the oil produced by the 8-34 well after December 2007 as being swept from Section 35, the examiners consider Glencoe's interpretation to be reasonable—that the production data for the 8-34 well indicates an increase in the production rate following the commencement of CO<sub>2</sub> injection at the 8-2 well. The examiners also recognize that if there were a permeability barrier or restriction north of the 14-26 injector, as contended by Glencoe, the amount of oil swept from Section 35 to the 8-34 well would be reduced. The examiners understand that the 14-26 and 8-34 wells were drilled on corner target areas in accordance with the rules in place at the time, so the examiners believe that it would be expected that the wells could drain some oil from Section 35. As long as the wells are being operated in accordance with the ERCB's rules, the examiners do not consider any drainage to be improper.

[83] Based on the above considerations, which recognize that Butte's area of application is under primary production administration while Glencoe's lands are within an approved EOR scheme and subject to the provisions of the EOR approval, the examiners find that Butte has an appropriate opportunity to obtain its share of oil production from the E Pool. Butte can seek the same opportunity as Glencoe by pursuing the approval of an EOR scheme on its land, which would also result in Butte having to meet certain obligations, such as replacing voidage and maintaining reservoir pressure at or above the MMP.

## **WHETHER THE HOLDING WOULD RESULT IN ORDERLY AND EFFICIENT DEVELOPMENT**

### **Evidence**

[84] Butte submitted that its application for increased well density was just one step in its overall development plan for Section 35. Butte stated that it intends to apply for approval of an EOR scheme on Section 35 that is compatible with Glencoe's adjacent EOR scheme. However, Butte argued that it needs to first drill and produce its wells to determine their production capabilities before it applies for an EOR scheme. Butte also stated that its only source of CO<sub>2</sub> is the CO<sub>2</sub> that would be produced by its wells on Section 35. Butte contended that it could not economically justify an injection well until it has a CO<sub>2</sub> source, but it could not get additional CO<sub>2</sub> without additional production wells on Section 35.

[85] Butte contended that Glencoe had developed its EOR scheme first and then applied for increased well density because Glencoe had initially believed that the existing well density was adequate. In Butte's view, the performance of Glencoe's EOR scheme has shown that increased well density is required, and so Butte believes that increased well density in the application area should be approved now.

[86] Butte stated that it had offered to return the CO<sub>2</sub> being vented at its 4-35 well to Glencoe and that it would construct the pipeline needed to transport the CO<sub>2</sub> to Glencoe's facilities.

[87] Glencoe submitted that Butte should first establish a proper and compatible EOR scheme for Section 35 before it applies for increased well density, as Glencoe had done. Glencoe argued that it had built CO<sub>2</sub> capture plants and facilities to clean and compress the CO<sub>2</sub>, constructed a pipeline to transport the CO<sub>2</sub> to the E Pool, and then injected the CO<sub>2</sub> into the pool to enhance oil

recovery. Glencoe contended that rather than incur the required investment and effort to develop a proper EOR scheme, Butte is attempting to benefit from the efforts and investment made by Glencoe. As stated in paragraph 48, Glencoe also noted that Butte is venting the CO<sub>2</sub> being produced at its 4-35 well instead of reinjecting it, as Glencoe does.

[88] Glencoe explained that it had not agreed to Butte's offer to return the CO<sub>2</sub> it was venting at its 4-35 well since Glencoe's facilities, which were designed to serve its own scheme, were already full because of its own operations. Also, Glencoe viewed acceptance of the offer as providing a means for Butte to continue to harm Glencoe's EOR scheme and to allow Butte to avoid having to take on any capital risk.

[89] Glencoe noted that the penalized allowable for Butte's 4-35 well under primary production administration is only a portion of a cubic metre per day. In Glencoe's view, the production performance of the 4-35 well to date and the predictable allowable into the future show that there is no opportunity to realize any commercial production from any primary production activity in the application area, and therefore no need to increase the well density as there is no reason for further drilling.

### **Analysis and Findings**

[90] The examiners note that at its 4-35 well, Butte is venting CO<sub>2</sub> that has been captured, processed, transported, and injected by Glencoe for EOR. The examiners believe that approving increased well density in the application area that would result in more CO<sub>2</sub> venting would not result in orderly and efficient development. With respect to Butte's statement that it had offered to return the CO<sub>2</sub> it produces to Glencoe, the ERCB does encourage operators to cooperate with one another in the development of a pool. However, the ERCB does not have jurisdiction to force parties to enter into unit agreements even where it may be an appropriate tool to ensure orderly development of a pool.

[91] The examiners have considered Butte's statement that its application for increased well density is part of a plan to develop its own EOR scheme on Section 35. In this regard, the examiners have a concern with Butte's statement that its only source of CO<sub>2</sub> is the CO<sub>2</sub> that would be produced by its wells on Section 35. Setting aside any possible issue about the ownership of the CO<sub>2</sub>, since that is a matter for the Alberta courts, such a source of CO<sub>2</sub> would not provide for replacement of the reservoir voidage created by the oil and water production and a make-up CO<sub>2</sub> source would be required. Also, such a source of CO<sub>2</sub> may not be reliable since it would depend on where and how much CO<sub>2</sub> Glencoe injects. Because of this concern, the examiners are of the view that the development would not be orderly and efficient if the application for increased well density were approved without a companion application for EOR so that the source of CO<sub>2</sub> for Butte's planned EOR scheme can be addressed.

[92] The examiners note Glencoe's argument that because oil production from wells in the area of application is likely to be restricted due to GOR penalties, there is no opportunity to realize any commercial production from any primary production activity in the application area and therefore no need to increase the well density. As discussed in paragraph 64, the examiners recognize that any new wells drilled (or old wells reactivated) in the application area could produce at high GORs and consequently be limited in their ability to produce oil because of severe GOR penalties. The examiners are not convinced that approving increased well density in an area where the wells are being severely restricted due to ERCB requirements would result in

orderly and efficient development. The examiners believe that it would be more appropriate for any approval of increased well density in the application area to be done in conjunction with approval of an EOR scheme. This would allow Butte to replace reservoir voidage and have any MRL and GOR penalties on its wells removed.

[93] Based on the above considerations, the examiners find that approval of increased well density in the application area would not result in orderly and efficient development. This also accords with the ERCB's mandate, under section 4 of the *OGCA*, to prevent wasteful operations, which includes the inefficient dissipation of reservoir energy and the failure to use enhanced recovery operations when those operations appear probable to increase the ultimate recovery.

## **CONCLUSION**

The examiners find that one criterion under section 5.190(3) of the *OGCR* is met and this allows the Board to consider granting the application if it is in the public interest. In this regard, the examiners are not able to determine whether approval of increased well density in the application area would result in a loss of oil recovery from the E Pool. They find that Butte has an appropriate opportunity to obtain its share of oil production under the current primary production administration of Section 35. Finally, they find that approval of increased well density would not result in orderly and efficient development. The examiners, therefore, conclude that approval of the application would not be in the public interest. Further, as Butte stated that it intends to do, Butte can apply for its own EOR scheme, which would provide it with an opportunity to obtain its share of production under enhanced recovery and could result in a need to increase well density. Therefore, the examiners recommend that the application be denied.

Dated in Calgary, Alberta, on April 23, 2013.

## **ENERGY RESOURCES CONSERVATION BOARD**

G. W. Dilay, P.Eng.  
Presiding Member

B. A. Austin, P.Geol.  
Examiner

B. C. Hubbard, P.Eng.  
Examiner

## APPENDIX 1 HEARING PARTICIPANTS

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### Principals and Representatives (Abbreviations used in report)

### Witnesses

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Butte Energy Inc. (Butte)  
M. B. Niven, Q.C.  
L. Grice

T. Pfeifer  
R. Mireault, P.Eng.  
J. Benoit  
L. Dean, P.Geol.  
R. Turney

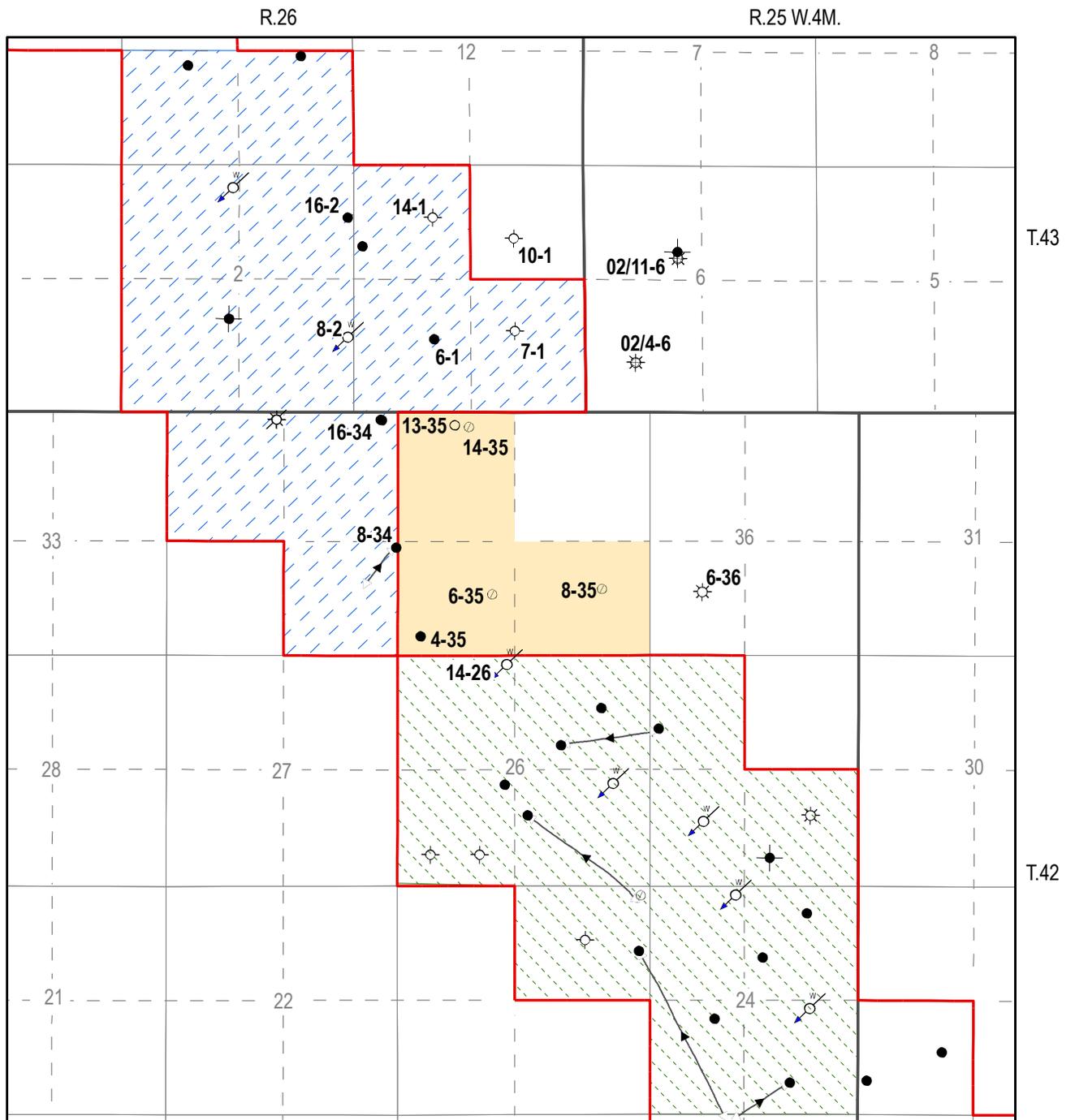
Glencoe Resources Ltd. (Glencoe)  
D. Farmer

D. Barnes  
D. Geeraert, P.Eng.  
D. Kelly, P.Eng.  
M. Woofter, P.Geol.

### Energy Resources Conservation Board staff

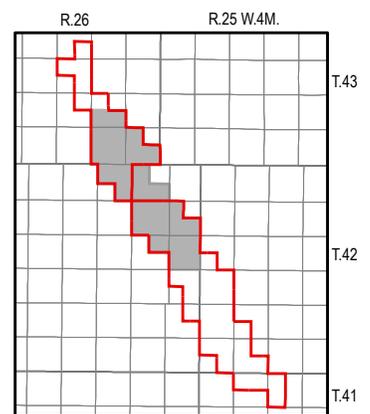
D. Burns, Board Counsel  
S. Sexton, Board Counsel  
V. Burnic  
S. Mangat  
V. Burnside  
L. Maliki, P.Eng.  
E. Armeneau, P.Geol.  
N. Lyubimova, P.Geol.

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**Legend**

- |                      |  |
|----------------------|--|
| ● Oil well           | ⊙ Observation well                       |
| ☀ Gas well           | ○ Undefined well                         |
| ⊕ Abandoned well     | ↔ Direction line (top to bottomhole)     |
| ⊕ Abandoned oil well | ■ Area of application                    |
| ⊕ Abandoned gas well | ▨ Glencoe Chigwell Unit 1                |
| ☀ Suspended gas well | ▨ Glencoe Chigwell Unit 2                |
| ⊕ Injection well     | ▭ Glencoe EOR Scheme Approval No. 10865E |



Data used in map were obtained from Exhibit 87.02

**Figure 1. Location Map**