

Pure Environmental Waste Management Ltd.

Applications for the Hangingstone Project

February 27, 2020

Alberta Energy Regulator

Decision 2020 ABAER 005: Pure Environmental Waste Management Ltd., Applications for the Hangingstone Project

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2020 ABAER 005

Pure Environmental Waste Management Ltd. Applications for the Hangingstone Project

Applications 934887, 1918189, 1918260, 1919152, 1919312, and 1920277; mineral surface lease applications MSL181075 and MSL190384; and licence of occupation applications LOC181213 and LOC190487

Decision

[1] The Alberta Energy Regulator (AER) approves application 1920277 for the disposal scheme associated with Pure Environmental Waste Management Ltd.'s existing 1-24 well, subject to the condition in appendix 2, and denies applications 1918260, 1919152, 1918189, 1919312, and 934887; mineral surface lease (MSL) applications MSL181075 and MSL190384; and licence of occupation (LOC) applications LOC181213 and LOC190487.

[2] In reaching its decision, the AER considered all relevant materials properly before it, including the evidence and argument provided by each party. Accordingly, references to specific portions of the evidence in this decision are intended to assist the reader in understanding the AER's reasoning on a particular matter and do not mean that the AER did not consider all relevant portions of the evidence.

Introduction

Applications

[3] Pure filed ten applications as part of its Hangingstone waste management project located about 25 km south of Fort McMurray. The applications are listed in table 1.

[4] The applications all relate to three disposal wells and a single pipeline that would connect one of the disposal wells to Pure's previously approved Hangingstone waste management facility at Legal Subdivision (LSD) 10, Section 25, Township 85, Range 10, West of the 4th Meridian.

[5] Pure applied under the *Oil and Gas Conservation Act (OGCA)* to drill two horizontal wells (0.00 moles per kilomole H₂S) to dispose of brine, waste, and water resulting from the solution mining and operation of salt caverns at its approved Hangingstone facility. The 1-36 well would have a surface location at LSD 02-01-085-09W4M and a bottomhole location at LSD 01-36-084-09W4M. The 4-32 well would have a surface location at LSD 04-05-085-08W4M and a bottomhole location at LSD 04-32-084-08W4M. The two wells would be 14 to 16 km southeast of Pure's approved Hangingstone facility.

[6] MSL 181075 is an application under the *Public Lands Act (PLA)* for a surface well site for the 4-32 well at LSD 04-05-085-08W4M. The associated LOC 181213 is an application under the *PLA* for a Class V frozen-access road.

[7] MSL 190384 is an application under the *PLA* for a surface well site for the 1-36 well at LSD 02-01-085-09-W4M. The associated LOC 190487 is an application under the *PLA* for a Class V frozen-access road.

[8] Pure applied under the *OGCA* to operate the proposed 4-32 and 1-36 wells as Class Ib and II disposal wells, which would be used to dispose of Class Ib waste and Class II produced water/brine fluids into the Keg River Formation. Pure also applied to operate its previously drilled 1-24 well (surface location LSD 10-25-085-10W4M, bottomhole location LSD 01-24-085-10W4M) at its approved Hangingstone facility as a Class Ib and II disposal well to dispose of Class Ib waste and Class II produced water/brine fluids into the Keg River Formation and the Shell Lake Member of the Prairie Evaporite Formation.

[9] Pure applied under the *Pipeline Act* to construct a pipeline to connect the proposed 4-32 well to its approved Hangingstone facility. The pipeline would be 19.77 km long, with a maximum outside diameter of 183.2 mm and a maximum hydrogen sulphide (H₂S) concentration of 0.0 moles per kilomole (mol/kmol). Pure has not applied for a pipeline to connect the 1-36 well to the approved Hangingstone facility.

Table 1. Summary of the applications

Application	Purpose	Location/length	Filing date
1918260	Single injection well 4-32	Surface location: 04-05-085-08W4M Bottomhole location: 04-32-084-08W4M	January 18, 2019
1919152	Single injection well 1-36	Surface location: 02-01-085-09W4M Bottomhole location: 01-36-084-09W4M	February 20, 2019
MSL 181075	Well site for 4-32 well	04-05-085-08W4M	November 15, 2018
LOC 181213	Class V frozen-access road for 4-32 well	2.32 km	November 15, 2018
MSL 190384	Well site for 1-36 well	02-01-085-09W4M	May 21, 2019
LOC 190487	Class V frozen-access road for 1-36 well	250 m	May 21, 2019
1918189	Disposal into the 4-32 well	04-32-084-08W4M	January 17, 2019
1919312	Disposal into the 1-36 well	01-36-084-09W4M	February 75, 2019
1920277	Disposal into the 1-24 well	01-24-085-10W4M	April 5, 2019

934887	B120 pipeline	10-25-085-10W4 to 04-05-085-08W4 (19.77 km)	January 15, 2019
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[10] The AER issued a notice of hearing for this proceeding (proceeding 384) on July 2, 2019.

[11] The AER received requests to participate in this proceeding from Suncor and Alberta Agriculture and Forestry (AAF). In its request to participate, Suncor stated that it was concerned that Pure's proposed disposal wells and pipeline would be in the area of Suncor's Meadow Creek East and West in situ oil sands projects. Suncor submitted that Pure's applications would directly and adversely impact Suncor's ability to access and extract bitumen at the Meadow Creek East and West in situ projects. In AAF's request to participate, AAF stated that it was concerned that the proposed pipeline crosses the Grayling Creek Fire Base and access road and that the pipeline would impact operations during the fire season and restrict future development of the fire base. The panel granted Suncor and AAF full participation rights in the hearing.

[12] On July 9, 2019, the AER advised Suncor and Pure that it had decided to grant Suncor's request for regulatory appeal of the AER's January 30, 2019, decision to issue approval WM 211 for the approved Hangingstone facility. The regulatory appeal was subsequently set down for hearing as proceeding 386. The same panel was assigned to conduct proceeding 384 and proceeding 386.

[13] Suncor requested that the applications for the disposal wells and pipeline that are the subject of this proceeding be considered together at the same hearing considering Suncor's regulatory appeal of the AER's decision to issue approval WM 211 for the approved Hangingstone facility. Suncor submitted that the applications and the approved Hangingstone facility were all part of the same project and that hearing the matters together would allow the AER to resolve all matters in the most efficient manner. Pure requested that the two proceedings be managed as two separate hearings and requested that the regulatory appeal proceeding (proceeding 386) be heard before the proceeding on the applications (proceeding 384).

[14] On September 17, 2019, the AER issued an amended notice of hearing for proceedings 384 and 386. The amended notice stated that the AER would hold a hearing to consider the applications comprising proceeding 384, after which it would hold a hearing for proceeding 386.

[15] The hearing for proceeding 384 was held in Calgary, Alberta, before hearing commissioners P. Meysami (presiding), A. H. Bolton, and J. Daniels. The evidentiary portion of the hearing was held from November 18, 2019, to November 22, 2019. Closing arguments were heard on November 28, 2019, and the hearing was closed on November 29, 2019.

Regulatory Framework

Responsible Energy Development Act

[16] In deciding whether to approve each of the applications before us, we must consider certain factors set out in our governing legislation, including the AER's mandate. Section 2 of the *Responsible Energy Development Act (REDA)* states that the AER's mandate is to "provide for the efficient, safe, orderly, and environmentally responsible development of energy resources in Alberta."

[17] For Pure's applications filed under the *Pipeline Act* and the *OGCA*, section 15 of *REDA* and section 3 of the *Responsible Energy Development Act General Regulation* require the panel to also consider the applications' social and economic effects, environmental effects, and effects on landowners.

Oil and Gas Conservation Act

[18] In considering Pure's applications filed under the *OGCA*, the panel must have regard for the purposes of the *OGCA* as outlined in section 4 of that act:

- (a) to effect the conservation of, and to prevent the waste of, the oil and gas resources of Alberta;
- (b) to secure the observance of safe and efficient practices in the locating, spacing, drilling, equipping, constructing, completing, reworking, testing, operating, maintenance, repair, suspension and abandonment of wells and facilities and in operations for the production of oil and gas or the storage or disposal of substances;
- (c) to provide for the economic, orderly and efficient development in the public interest of the oil and gas resources of Alberta;

Pipeline Act

[19] In assessing an application under the *Pipeline Act*, in addition to ensuring the application meets the requirements of the *Pipeline Rules* and associated directives, sections 2 and 15 of *REDA* and section 3 of the *REDA General Regulation* require that we consider public interest factors.

Public Lands Act

[20] The AER is responsible for administering parts of the *PLA* in respect of energy resource activities in a manner that ensures that the allocation and management of public lands in Alberta is carried out responsibly.

Other Considerations

[21] The Hangingstone project is in the *Lower Athabasca Regional Plan* area. Section 20 of *REDA* requires the AER to act in accordance with the *Lower Athabasca Regional Plan* and any subregional plans that are in force. The panel must ensure that Pure's applications are consistent with the intended regional outcomes identified in the *Lower Athabasca Regional Plan*, which include the optimization of

the economic potential of the oil sands resource and the management of landscapes to maintain ecosystem function and biodiversity.

[22] For the panel to meet its obligations under *REDA*, the energy resource enactments, and the *REDA General Regulation*, we must have regard for the Hangingstone project as a whole. While proceedings 384 (a hearing on applications) and 386 (a hearing of a regulatory appeal) are separate proceedings and hearings, both relate to the Hangingstone project. We cannot ignore the broader context within which the applications that comprise proceeding 384 were made: to support the Hangingstone project. We note that in its written evidence filed in this matter, Pure itself referred to the previously approved Hangingstone facility and the applications that are the subject of this proceeding as the Hangingstone project.

[23] Given Suncor's participation in this matter and its concern about the impact of Pure's applications on Suncor's Meadow Creek East and Meadow Creek West in situ oil sands projects, the panel considered the purposes of the *Oil Sands Conservation Act (OSCA)*, the legislation under which Suncor applied for those projects. The purposes of *OSCA* are set out in section 3 of that act. While the panel is not deciding an application under *OSCA*, the AER administers that legislation, and the intent of the legislature of Alberta with regard to oil sands development under the AER's authority is relevant in this proceeding. In particular, we considered the legislature's direction to the AER to effect the conservation and prevent the waste of the oil sands resources of Alberta.

Key Issues

[24] Based on the evidence and arguments provided by Pure, Suncor, and AAF, the following are the key issues we considered in deciding whether to approve the applications:

- Is there a need for the disposal wells and disposal scheme?
- What rights do Pure and Suncor have to access disposal capacity within the Keg River Formation, and if disposal capacity is limited, how should disposal capacity be allocated?
- Does the Keg River Formation have sufficient disposal capacity in the Hangingstone / Meadow Creek area to accommodate both Suncor's and Pure's anticipated disposal volumes?
- Would Pure's proposed disposal wells and disposal schemes result in adverse effects to Suncor's Meadow Creek East or Meadow Creek West projects or result in the sterilization of bitumen resources?
- Are other disposal options available to Pure in the Hangingstone / Meadow Creek area?
- Would approval of Pure's disposal wells and disposal scheme be consistent with the AER's statutory mandates and in the public interest?
- Given our conclusions on Pure's disposal wells and disposal scheme, should the proposed surface facilities and pipelines be approved?

There Is a Need for Disposal Wells and Access to Disposal Capacity to Support the Hangingstone Project

Parties' Submissions

[25] Pure said that investment in the Hangingstone project began in 2016 and that development of the project is substantially advanced. Pure said that to date it has acquired the necessary salt mineral interests to allow development of the proposed salt caverns, drilled two salt cavern wells, obtained approvals to solution mine the caverns, drilled an on-site disposal well (the 1-24 well), completed construction of civil works for the approved Hangingstone facility and access road, advanced engineering for the approved Hangingstone facility to the point of construction, obtained a waste management approval for the approved Hangingstone facility, and paid the associated security deposit to the AER. Pure said that in developing the Hangingstone project to this point it has invested millions of dollars, followed appropriate AER processes, and been diligent in finding the right location for the project and in engaging its neighbours.

[26] Pure said that hundreds of thousands of cubic metres of Class Ib and II waste fluids are produced each year in the Athabasca Oil Sands Area and that currently there are no local waste disposal providers that can manage all the complex waste streams produced. As a result, Pure stated that operators must truck oilfield and industrial waste over large distances (often to Edmonton or beyond), and that this results in a number of safety and environmental risks, significant haulage costs, and increased highway traffic.

[27] Pure said that salt cavern disposal facilities are uniquely qualified to manage the complex waste streams produced by oil sands operators in the region. Pure said that the Hangingstone project is just south of Fort McMurray off Highway 63, and that the Hangingstone project would be the northern-most cavern facility in Alberta, with close proximity to Athabasca oil sands operations. Pure said this is an underserved area where producers north and south of Fort McMurray have to truck waste products south for management and disposal. Pure further stated that the approved Hangingstone facility is designed to process and manage complex waste streams generated by the region's oil sands operators and that the Hangingstone project would save them, depending on location, four to ten hours trucking to suitable disposal options south.

[28] Pure argued that the Hangingstone project would deliver direct and immediate value by reducing the need for long-haul trucking for waste management and the associated risks, costs, and emissions. Pure suggested this would reduce the total environmental footprint of the energy sector while delivering bottom-line value to its customers and that it would make oil sands operations more competitive.

[29] Based on its base case of processing 2500 m³ of oilfield waste per day, Pure estimated that producers would save approximately \$26.4 million annually in transportation costs from operation of the approved Hangingstone facility. Pure calculated this estimate by multiplying the average cost per cubic

metre of waste shipped by the distance to the next-closest facility that could accept the waste. In arriving at this estimate, Pure assumed that fluids would go to the White Swan facility at Atmore and that sludges would go to Tervita's facility at Lindbergh.

[30] Pure estimated that greenhouse gas emissions savings resulting from the Hangingstone project would be approximately 38 000 tonnes annually. Pure developed this estimate by multiplying the average emission per kilometre for a fully loaded truck by the distance to the next-closest facility that could accept the waste.

[31] Pure said that many jobs have been created and supported to date in advancing the Hangingstone project, including through contracts with local and First Nations companies, and that many more would be supported as construction of the approved Hangingstone facility is completed and operations commence. Pure estimated that the Hangingstone project would support 300 jobs during the construction phase and 35 full-time jobs during the operational phase.

[32] Pure provided letters of support for the Hangingstone project from Athabasca Oil Corporation, Japan Canada Oil Sands limited (JACOS), Greenfire Oil and Gas Limited, and Christina River Enterprises (operated by Fort McMurray #468 First Nation).

[33] Pure initially took the position that the applications for the disposal wells and pipeline were separate from and independent of the approved Hangingstone facility, which is the subject of proceeding 386. However, in its hearing submission for this proceeding, Pure confirmed that the proposed disposal wells and pipeline form an integral part of the Hangingstone project. Pure acknowledged that its approved Hangingstone facility cannot operate without sufficient disposal capacity to allow solution mining (washing) and operation of the salt caverns. Pure confirmed that 2500 to 3000 m³/day of disposal capacity is required to support construction and operation of the salt caverns at the approved Hangingstone facility and that its previously drilled disposal well at 1-24 is not currently capable of providing the necessary disposal capacity to support full-scale operations. Based on the maximum wellhead injection pressure assumed in its disposal scheme application (application 1920277), Pure anticipates that the 1-24 disposal well may only be capable of accepting 300 m³/d of fluids. This is discussed further in a later section.

[34] Suncor questioned the commercial need for and economic benefits of the Hangingstone project and the associated disposal wells and pipeline. Suncor noted that the letters of support for the Hangingstone project were limited in number and lacked firm commitments or details about the volume of wastes that might go to the approved Hangingstone facility. Further, Suncor suggested that should Pure attempt to appropriate the transportation cost savings for itself through disposal fees, there may be little financial benefit to oil sands producers resulting from the Hangingstone project.

[35] Suncor said that if Pure's disposal wells were approved and adversely affected Suncor's planned disposal activities for its Meadow Creek East and West projects, Suncor may have to implement alternative waste disposal plans, such as zero-liquid-discharge technology. Suncor further stated that any such alternative waste disposal plans would be energy intensive and costly and would result in an increase in greenhouse gas emissions from Suncor's Meadow Creek East and West projects. As a result, Suncor argued that any greenhouse gas emission savings that may result from the Hangingstone project could be offset by increases in greenhouse gas emissions at Suncor's projects.

[36] In light of the above, Suncor argued there was little need for the Hangingstone project and certainly no critical need. Suncor argued that while the Hangingstone project may provide some private benefits to Pure in the way of profit, it would provide little in the way of public benefits.

[37] Pure said that it had completed a market analysis as part of its business case for the Hangingstone project and would charge market rates for its services. Pure also argued that the competitive economics of Pure's project are not at issue in this proceeding and are not matters that are relevant to the applications that are before the AER.

Panel's Analysis and Findings

[38] We find it difficult to confirm the level of commercial interest in the Hangingstone project based on the evidence provided in this proceeding. While Pure provided some letters of support for the Hangingstone project, the letters of support were few in number and generally lacked firm commitments or details about the nature and volumes of wastes that might be sent to the approved Hangingstone facility.

[39] However, we acknowledge that there are significant volumes of waste generated in the Athabasca oil sands area and that this is expected to continue for the foreseeable future. We accept Pure's argument that until a waste management facility is approved and construction is complete or close to complete, there is little incentive for producers to enter into firm contracts for waste disposal services. There is therefore some truth to the strategy of "build it and they will come," assuming that commercial terms are reasonable and there is a net benefit to producers. Although Suncor suggested that there may be little cost savings benefit to producers if Pure were to attempt to appropriate all of the potential transportation cost savings to producers as profit, we believe this is an unlikely scenario.

[40] Pure is in the business of providing waste management services and must be competitive with other waste management service providers to attract clients. While we understand that Pure will appropriate some of the costs savings as profit, if they were to attempt to capture all of the cost savings to producers as profit for themselves there would be little cost incentive for producers to send their wastes to the Hangingstone facility, and Pure may find itself out of business. Although Pure did not provide a detailed business case or market analysis for the Hangingstone project in its submissions for this

proceeding for competitive reasons, we accept that such an analysis was completed and used by Pure to make its decision to proceed with investment in the Hangingstone project.

[41] As salt caverns are able to handle a wide variety of waste types and the approved Hangingstone facility would be the most northerly and closest facility of this type to existing and proposed oil sands operations in the Fort McMurray area, the panel finds that it would provide a local waste management disposal option that would reduce the need to transport some waste types significant distances to more southerly waste management facilities. Other waste management facilities in the area are much smaller than the approved Hangingstone facility, are limited in the type of waste they can process, or are far from the bitumen producers along Highway 63, necessitating long-distance trucking. Although there is some uncertainty about the waste volumes that would go to the approved Hangingstone facility we find that we have sufficient information to demonstrate a need for the facility. This is consistent with the panel's finding in 2020 ABAER 004 resulting from proceeding 386 that there is a need for an oilfield waste management facility in this region that can handle a wide range of wastes.

[42] While the magnitude of the benefits resulting from transportation cost savings, increased traffic safety, and emission reductions are subject to some uncertainty, we find that having a locally available waste management solution would generally be of benefit to oil sands producers and in the public interest, assuming regulatory requirements are satisfied and potential adverse effects on other activities are considered and appropriately mitigated.

[43] With respect to the need for the disposal wells and disposal scheme that are the subject of the applications in this proceeding, we understand that solution mining and operation of the salt caverns at the approved Hangingstone facility requires access to sufficient disposal capacity to accommodate brine and waste fluids generated from the washing and operation of the caverns. Further, based on Pure's evidence, we accept that Pure's existing 1-24 disposal well by itself does not currently provide sufficient injection capacity to support development and commercial operation of the salt caverns. Given Pure's estimate of 16.3 million m³ of disposal capacity required to support the Hangingstone project, trucking of wastewater resulting from washing and operation of the salt caverns does not appear to be a feasible long-term option and would reduce or eliminate some of the claimed benefits of the project. We therefore find that there is a need for disposal wells and disposal capacity to support construction and operation of Pure's approved Hangingstone facility.

Crown Mineral Activity Authorizations Do Not Limit the AER's Authority to Consider the Applications

Parties' Submissions

[44] Pure and Suncor both obtained Crown Mineral Activity (CMA) authorizations to dispose into the Keg River Formation from Alberta Energy under section 54(5) of the *Mines and Minerals Act*. Pure's

CMA authorizations allow it to dispose into the Keg River Formation from its existing 1-24 disposal well and its proposed 1-36 and 4-32 disposal wells. Suncor's CMA authorizations allow it to dispose into the Keg River Formation from its existing disposal wells at LSD 03-31-084-08W4M (the 3-31 well) and LSD 11-29-084-08W4M (the 11-29 well).

[45] Pure noted that in their current form, the CMA authorizations do not grant the holder an exclusive right to use a formation or priority access. Accordingly, Suncor does not have preferential access to the subsurface reservoir. Pure argued that its disposal rights were equal to Suncor's disposal rights and that Suncor's entitlement to dispose does not trump Pure's right to dispose in the same formation. Pure suggested that if we were to deny approval of its disposal scheme so as to ensure all available Keg River pore space remains available for Suncor, its CMAs would be nullified. Pure also suggested that we have no jurisdiction to do that.

[46] Suncor noted that obtaining a CMA authorization is only one step in the regulatory process required to drill and perform operations in an undisposed formation. Suncor stated that the CMA authorizations issued by Alberta Energy are subject to a number of conditions, including an obligation to satisfy AER requirements. In particular, Suncor noted that CMA authorizations include standard conditions indicating that the Crown consent does not displace other requirements administered by the AER.

[47] Suncor quoted Alberta Energy's *Crown Mineral Activity (CMA) Authorization Application Requirements For New Disposal Operation Requests In Undisposed Crown Rights*:

Operators must obtain approval from the AER for a disposal scheme under the *Oil and Gas Conservation Act*. Issuance of a Crown authorization in no way influences AER decisions regarding disposal approvals nor does it predetermine the outcome of any such application to the AER.

[48] Suncor also quoted the AER's *Bulletin 2019-21: AER Approval Still Required for Disposal Schemes With a Crown Mineral Activity Authorization*:

On June 24, 2019, Alberta Energy released *Mineral Rights Information Bulletin 2019-01*, which discusses when a disposal operator requires a Crown mineral activity authorization (CMA). We wish to clarify that a CMA holder is still required to obtain approval from the AER for a disposal scheme under section 39 of the *Oil and Gas Conservation Act*. Issuance of a CMA in no way influences our decisions regarding disposal approvals.

[49] Suncor stated that the AER is required to assess all of Pure's applications, including the disposal scheme applications, in light of the AER's broad public interest mandate. Suncor said that it was not challenging the consents issued to Pure; rather, Suncor asked that the AER evaluate the applications in accordance with that mandate.

[50] Suncor argued that as part of its mandate, the AER should consider the potential for adverse impacts on resource conservation in the Meadow Creek area if the applications, including the proposed

pipeline and disposal scheme applications, are approved. Suncor said such considerations are consistent with the AER's obligation under *REDA*.

[51] Suncor pointed to a number of decisions of the AER and its predecessors which Suncor said establish a history of constraining the mineral tenure rights of other operators if the exercise of those mineral tenure rights could adversely affect effective, economic, and efficient access to oil sands resources. Suncor stated that, in the face of uncertainty over the potential adverse impacts of an activity on bitumen production, commercial oil sands deposits must not be put at risk.

Panel's Analysis and Findings

[52] For a disposal application, a CMA authorization is required for unleased Crown land. While a CMA authorization issued by Alberta Energy is a necessary prerequisite for the approval of a disposal scheme, Alberta Energy's *CMA Authorizations Application Requirements For New Disposal Operation Requests in Undisposed Crown Rights* and recently issued CMA authorizations (such as the authorizations most recently issued to Pure) confirm that CMA authorizations do not provide any preferential right to the holder to access disposal capacity within a formation. It is also clear from the Alberta Energy document and AER *Bulletin 2019-21* that the issuance of a CMA authorization does not constrain the AER's decision-making authority with respect to applications for disposal schemes.

[53] While the CMA authorizations issued by Alberta Energy do not provide any preferential or priority rights to their holders, we are also not aware of any legislation, regulations, or directives that obligate parties to share disposal zones equitably or that provide explicit guidance on how disposal capacity should be shared if there is a conflict.

[54] In considering applications for disposal schemes, the AER has broad authority to consider whether the applications are consistent with its statutory mandates and are in the public interest. The AER's authority is not constrained in the manner suggested by Pure. The AER must have regard for, among other things, the efficient, orderly, and economic development of the province's energy resources. With respect to applications for disposal schemes the AER has wide authority to consider the applications on their merits and may reject them despite the Crown having issued a CMA authorization.

[55] An important use of subsurface disposal capacity is to support bitumen production; however, we do not interpret this to mean that Suncor should have exclusive use of all of the available disposal capacity within its oil sands lease boundary. This is for two reasons. First, there is no government policy specifying that subsurface disposal rights are attached to or somehow follow oil sands mineral leases. Second, the Hangingstone project and the associated disposal schemes are also in aid of bitumen production because the Hangingstone project would provide waste management services for other oil sands producers.

[56] If the disposal capacity in the Keg River Formation is not sufficient to accommodate both Pure's and Suncor's anticipated disposal volumes, then we are of the view that disposal capacity should be allocated based on the relative benefits of Pure's and Suncor's projects and the potential for Pure's proposed disposal wells and disposal scheme to adversely affect bitumen recovery at Suncor's Meadow Creek East and West projects. These factors need to be considered and weighed to inform our public interest determination and our decision on the applications.

The Disposal Capacity of the Keg River Formation in the Vicinity of Pure's Proposed 1-36 and 4-32 Disposal Wells Is Limited and Not Sufficient to Accommodate Both Suncor's and Pure's Anticipated Disposal Volumes

Parties' Submissions

[57] Pure believes that the Keg River Formation has a relatively large disposal capacity and is capable of supporting Pure's disposal needs without adversely affecting Suncor's disposal needs for the Meadow Creek East and West projects.

[58] Pure said that the Keg River aquifer within the Hangingstone area is a complex, water-saturated reservoir, which is not known to contain any hydrocarbons. Pure interprets the Keg River Formation to consist of lower platform carbonates overlain by younger stacked carbonate platforms that include porous and permeable reef and inter-reef deposits, capable of accepting large volumes of disposal fluids over an extended period of time. According to Pure, the Keg River Formation is an ideal target for subsurface wastewater disposal within the Athabasca Oil Sands Area.

[59] Based on geological and seismic data, Pure estimated the areal extent of upper Keg River buildup in the Hangingstone / Meadow Creek area to be approximately 430 km², with a pore space volume of 1.2 billion m³ in the region and 140 to 145 million m³ in the immediate vicinity of Pure's proposed disposal wells. Pure said that this significantly exceeds Pure's forecasted disposal volume of 16.3 million m³ over a 20-year operational period. Pure said it also significantly exceeds the disposal volumes that Suncor would apparently require over the next forty years for its Meadow Creek East and West projects based on the daily disposal volumes indicated in Suncor's Meadow Creek East and West application submissions.

[60] In contrast, Suncor believes the disposal capacity available in the Keg River Formation is quite limited and is not capable of supporting both Suncor's proposed Meadow Creek East and West projects and the Hangingstone project.

[61] Suncor said it has spent considerable time and resources evaluating Keg River disposal capacity in the vicinity of its Meadow Creek East project. Suncor's disposal scheme for the Meadow Creek East project involves two conditionally approved, drilled disposal wells at LSD 03-31-084-08W4M (the 3-31 well) and LSD 11-29-084-08W4M (the 11-29 well) and two conditionally approved, undrilled disposal

wells at LSD 04-12-085-09W4M and LSD 05-36-084-09W4M. These disposal wells would also support operations at Meadow Creek West. The 11-29 well is expected to serve as the primary disposal well, with the 3-31 well providing backup disposal capacity. The two additional disposal wells in the Keg River Formation may be developed if required. Suncor said future disposal wells will be tested, drilled, and completed in compliance with AER requirements.

[62] Suncor said that the upper Keg River complex in the Meadow Creek area is of finite size, isolated from other occurrences of upper Keg River carbonates in the region, and completely encased in impermeable evaporites. Suncor submitted that the basal, lateral, and top stratigraphic seals for the upper Keg River complex limit the potential for fluid and pressure leakoff from the upper Keg River complex to other formations. Suncor also submitted that the lower Keg River dolostones across the region provide insignificant fluid and pressure leakoff opportunities from the base of the upper Keg River buildup, and that the subregional core control does not support the presence of a regionally developed, well-connected, open fracture network within the lower Keg River that can provide sufficient leakoff over the life of the Meadow Creek East and West projects. Suncor maintained that without significant fluid and pressure leak off, disposal capacity within the Keg River Formation would be limited.

[63] Suncor believes that the lower Keg River platform does not have sufficient porosity and permeability to support commercial injection rates. Suncor also believes that the mere presence of an upper Keg River buildup is not sufficient to indicate disposal capacity, as not all of the upper Keg River Formation has the reservoir properties needed to support injection operations. Suncor believes suitable porosity and permeability necessary for injection are limited to the northeast-facing windward margin of the Keg River buildup where higher-energy depositional facies occur. This is where Suncor's 3-31 and 11-29 disposal wells are. Suncor estimates that this comprises less than five per cent of the area of the upper Keg River buildup. Suncor does not believe the lower-energy back-reef facies that comprise the majority of the upper Keg River buildup have sufficient porosity and permeability to support injection, largely due to salt/anhydrite plugging as well as unfavourable depositional environments.

[64] Suncor's interpretation of disposal capacity is based on well log and core data, petrophysical analysis, seismic data, and injection test results. Suncor estimates that the disposal capacity available in the Keg River Formation would only support about 10 years of Meadow Creek production without considering Pure's Hangingstone project. Suncor estimates that its disposal needs for the first 10 years of operations at the Meadow Creek East and West projects will be approximately 8 million m³. This is based on a combined disposal requirement of 2200 m³/d: 1500 m³/d for Meadow Creek East and 700 m³/for Meadow Creek West.

[65] Suncor used core and injection test data gathered since 2003 to develop a 2-D numerical model for the purpose of simulating Meadow Creek disposal activities in the Keg River Formation. According to Suncor, the numerical model was intentionally designed to represent an overly optimistic case that can directionally inform the disposal capacity of the Keg River Formation. The optimistic case considered

only the 11-29 well and 03-31 well operating at a disposal rate consistent with what Suncor provided in its Meadow Creek applications, approximately 2200 m³/d.

[66] Suncor provided figures with the model results and described the results as follows:

- The modelled pressure response in the 03-31 well shows pressures reaching 12 235 kPa after 145 hours and then reaching the maximum wellhead injection pressure of approximately 15 500 kPa after 3625 hours.
- At approximately 3046 hours, the injection rate steadily decreases until it reaches a long-term rate of approximately 10 m³/hr at approximately 22 years.
- The modelling results show the pressure response from injection activities continually moving out from the injection wells, which experience elevated pressure after only 145 hours of operations and reach maximum wellhead injection pressure after 151 days, resulting in reduced injection rates.
- The pressure continually moves away from the injection wells into areas known to Suncor to be tight with very low permeability and into areas where there is confirmed salt plugging.

[67] Suncor said that the numerical model confirms that even in an optimistic case, Suncor would not be able to run disposal operations at a level needed to satisfy the needs of the Meadow Creek East and West projects for the duration of their lifespans. According to Suncor, the size of the porous barrier area, reservoir quality, measured porosity and permeability, channel-bounded flow, and the low compressibility of the Keg River Formation all act to constrain the disposal capacity in the formation. Furthermore, Suncor said that its injection tests from 2002 to 2014, core studies, and seismic interpretation undertaken to understand the confines of the disposal container are evidence that the Keg River Formation cannot support any additional demand for disposal from other operations in the region.

[68] Pure submitted that there was no merit to Suncor's claims of adverse effects resulting from limited available pore space. Based on Pure's analysis, which included a review of well log and core data, a petrophysical analysis, seismic data, a geomechanical study, and a hydrodynamic study of the Keg River Formation at Long Lake, Pure concluded that the Keg River Formation does not act as a closed aquifer and that it may over time have a virtually unlimited storage capacity as disposal fluids continuously flow through the formation.

[69] Pure provided a report by its geology expert, Darrell Cotterill, to support its position. Based on his review of the available geological data, Mr. Cotterill concluded that key wells indicated favourable effective porosities, permeabilities, and thickness in the range of 50–60 m in the Keg River Formation that are conducive to large-volume disposal schemes, and that the lateral extent of the upper Keg River deposits in the Hangingstone area was 430 km². He also concluded that faulting and fracturing identified in selected wells through petrophysical analysis, combined with local reactivation along known fault lines, provided evidence of significant areal connectivity of the Keg River Formation within the

Hangingstone region and beyond. Mr. Cotterill further reported that downhole pressure data indicates the Keg River Formation is severely (50 per cent) under-pressured.

[70] Pure noted that there was very limited well control in the interior of the upper Keg River buildup because most of the wells are near the margins of the buildup. Pure believes that porosity and permeability in the back-barrier portions of the buildup are higher than interpreted by Suncor and that the buildup is not fully plugged by salt/anhydrite. Pure also believes that Suncor has not fully mapped the upper Keg River buildup to the north, northwest, and northeast of Suncor's proposed injection scheme and that Suncor has therefore further underestimated the disposal capacity of the Keg River Formation. Pure suggested that the interior of the upper Keg River buildup and the additional buildup not originally included in the analysis represent prospective targets for disposal wells.

[71] Pure's geophysical expert, Alex Wright, estimated that the Keg River Formation has approximately 1.2 billion m³ of pore space available for disposal, with approximately 145 million m³ of pore space available in the immediate vicinity of Pure's proposed disposal wells. Mr. Wright also said his analysis of seismic data confirms the presence of faulting and fracturing throughout the Keg River Formation. According to Mr. Wright, this provides at least three benefits to the Hangingstone project:

- The presence of faults and fractures increases the overall pore space available to store waste fluids.
- Faults and fractures increase the permeability of the Keg River Formation (particularly in a NE–SW direction), which makes it easier to inject disposal fluids into the formation.
- Pressure buildups caused by injecting fluids into the formation would be dissipated through the fault and fracture network.

[72] Pure submitted a geomechanical analysis conducted by its expert, Ken Glover. According to Mr. Glover's report, faults are present in the Keg River Formation, and these faults transect the entire upper and lower Keg River Formation. The report also states that some of these faults have associated open fractures. According to Mr. Glover's analysis, some faults and fractures in the Keg River Formation are pressure sensitive and would slip (faults) or open (fractures) when subjected to increased pressure caused by fluid injection. The result would be to significantly increase the overall permeability of the Keg River Formation in a NE-to-SW direction, parallel to the direction of the maximum horizontal stress forces acting upon the formation. Mr. Glover said that this enhanced permeability would increase access to disposal capacity and limit any interference between disposal fluids injected into the Keg River by Pure and Suncor.

[73] Pure also submitted a report by its reservoir expert, Alvin Winestock, that Pure said provided further evidence of the unbounded nature of the Keg River Formation. The Winestock report provided an analysis and modelling of injection and pressure data from CNOOC's (formerly Nexen) disposal operations at Long Lake to the east of Suncor's Meadow Creek East and West projects. According to Mr.

Winestock, CNOOC has been disposing into the Keg River Formation at Long Lake for over ten years, an area close to and with similar geological characteristics to the Keg River Formation at Hangingstone. Based on his analysis, Mr. Winestock interpreted the Keg River Formation to be an extensive reservoir that behaves as an “infinite-acting” system capable of accepting large volumes of fluid while maintaining its reservoir integrity.

[74] Suncor questioned the appropriateness of using CNOOC’s Long Lake operations as an analogy for the Hangingstone / Meadow Creek area and the conclusions in the Winestock report.

[75] Suncor said the lack of lateral continuity of the upper Keg River disposal container is supported by disposal exploration work done by other operators in the region, including CNOOC. According to Suncor, CNOOC drilled an exploratory well and discovered disposal at Long Lake at LSD 09-28-085-06W4. CNOOC subsequently drilled 13 additional Keg River wells in four different leases with mostly poor results. Suncor suggested that if the Keg River was continuous and extensive, all of the wells CNOOC drilled would have resulted in equal disposal opportunity. Instead, Suncor noted that only three of the wells CNOOC drilled had economic disposal rates, and that only one was capable of a rate greater than 1000 m³/d. Suncor said that CNOOC’s Keg River disposal study concluded that in order to have disposal in CNOOC’s operating area, open fractures are required in the reservoir for near-wellbore permeability, and the well needs to be in good primary-barrier facies and in an area of significant evaporite dissolution.

[76] Suncor said that it has mapped barrier facies associated with Suncor’s 3-31 and 11-29 disposal wells and along trend to the northwest at its 12-14 well (LSD 12-14-085-09W4M). Suncor said the barrier facies are limited to the eastern margin of the Keg River buildup at Meadow Creek and that this defines the limited extent of the disposal container. Suncor noted that although the Long Lake project is in an area of significant evaporite dissolution and that the dissolution of plugging salts from the pore and fracture system can enhance permeability, the Meadow Creek area is not in an area of significant evaporite dissolution and salt plugging is widespread. Based on its analysis, Suncor said that the only core that showed evidence of a material amount of open fractures was from the 11-29 well.

[77] Suncor also said that pressure monitoring results at Long Lake do not support the Winestock report’s conclusions that the reservoir is acting as a laterally extensive system with radial flow extending out to 49 km. According to Suncor, some monitoring wells show an increasing pressure trend indicating the presence of boundaries, while other wells show little or no pressure response even though they are within 7 km of CNOOC’s disposal wells.

[78] Suncor said that its program to evaluate disposal capacity for its Meadow Creek East and West projects has been ongoing since 2002. The program initially targeted the basal McMurray, Keg River, and Granite Wash (La Loche) Formations; however, it was determined that the basal McMurray and Granite Wash Formations were least likely to support disposal operations. Suncor identified the 3-31 and 11-29

wells as disposal wells for the Meadow Creek East and West projects and performed injection testing on these wells in 2002, 2003, and 2014.

[79] Suncor used derivative analyses to identify all aquifer flow regimes (i.e., how water will flow through an aquifer) present in pressure transient data and estimate the values of the hydraulic parameters. Suncor stated that the derivatives consistently show flow boundaries in the late time period, and that linear flow due to fractures is not present in the derivative in the early time period of the tests. Suncor said that these test results indicate that flow is constrained by the presence of boundaries. Suncor found that its 2014 well test results are consistent with the 2002 and 2003 test results, which show channel-bounded flow (i.e., barriers on two sides). Based on these analyses, Suncor identified boundaries ranging in distance from 500 m to 2000 m. Suncor said there was no evidence of pressure leakoff in the tests.

[80] According to Suncor, the injection test results consistently show that the pressure propagation from injection activities occurs within a bounded channel, as evidenced by rapid pressure responses in the 11-29 well in response to injection at 3-31 and in the 12-14 well in response to injection activities at the 11-29 well. Suncor said that the bounded channel trend occurs in a NW–SE orientation and corresponds to the location of the higher-energy reef facies within the upper Keg River buildup.

[81] While Pure attributes a strong and rapid pressure response in the 12-14 well (approximately 8 km to the northwest of the 11-29 well) during injection testing of the 11-29 well as evidence of high permeability and significant disposal capacity, Suncor attributes the rapid pressure response to low storativity (compressibility) of the reservoir, which indicates a very low storage capacity. According to Vance Matthews, Suncor's hydrogeology and well testing expert, the propagation of the pressure transient is a function of the hydraulic diffusivity, which is inversely proportional to the storativity term. Mr. Matthews stated that very low storativity means there will be very high diffusivity (pressure propagation).

[82] Additionally, while Pure asserted that basement faults trending SW–NE through the reef-barrier facies into the back-barrier facies would provide a conduit allowing for pressure leakoff and more disposal, Suncor said this is not observed in the injection test results. According to Suncor, the derivative does not flatten out during late time as it would be expected to if these faults were acting as a conduit. Suncor also said that the rapid pressure response observed in the 12-14 well during injection testing of the 11-29 well refutes Pure's claim that the presence of SW–NE trending faults and fractures would prevent or minimize interference effects between Pure's and Suncor's injection activities.

[83] During questioning by the AER, Mr. Winestock was asked to estimate the storage capacity of the Keg River Formation assuming no pressure leakoff occurred. Mr. Winestock indicated the number would be a very small portion of the estimated 1.2 billion m³ of pore space available as it is dependent largely on compressibility, which is very small. In doing the requested calculation, Pure ignored the leakoff mechanisms they believe are present, such as faults transecting both the upper and lower Keg River and the small but measurable vertical permeability. Using an estimate of the total effective compressibility of

the reservoir of 1×10^{-5} /psi divided by 6.89 to convert to kPa, Mr. Winestock estimated the storage capacity to be approximately 5 million m³.

[84] While Pure completed the calculation as requested, they did not consider the assumption of zero pressure leakage to be realistic. Mr. Winestock submitted that very low permeabilities over an area of 430 km² can result in significant fluid flow. Mr. Cotterill observed that if it is assumed there is zero leakage from the Keg River Formation, then there would be no disposal possible in the Keg River due to the low estimated disposal capacity.

Panel's Analysis and Findings

[85] Suncor's interpretation of limited disposal capacity in the Keg River Formation is based on more than 15 years of data collection and interpretation that integrates well log and core data, petrophysical analysis, seismic data, hydrogeological investigations, and injection well test results. We find that Suncor's evidence supports its interpretation that disposal capacity in the Keg River Formation may be limited to higher-energy reef facies near the northeast margin of the buildup. Particularly persuasive in this regard are the results of injection tests from Suncor's 3-31 and 11-29 wells, which consistently show the presence of flow barriers at distances of 500 m to 2000 m from the injection wells.

[86] We do not accept Pure's argument that, because the estimated distance to the flow barriers varies between tests, flow barriers do not exist or the test results are unreliable. Different methodologies and parameters used for the injection tests may result in some differences in results. However, the results are generally consistent between tests and support Suncor's interpretation that flow barriers exist and that these barriers are close enough to Suncor's injection wells that injection operations and disposal capacity would likely be affected.

[87] The results of Suncor's 2-D reservoir modelling show that interference between the 3-31 and 11-29 disposal wells starts to occur shortly after injection commences and that within 3650 days (10 years) the limits of disposal capacity are being reached. We acknowledge that Suncor's 2-D model is based on Suncor's interpretation of the distribution and reservoir properties for the Keg River Formation and that Pure is concerned that some of the underlying data that Suncor relies on in its interpretation (particularly Suncor's 2-D and 3-D seismic data) were not provided as evidence in this proceeding. However, we find that the level of information provided by Suncor to support the 2-D model is consistent with what we would expect and is sufficient. The model parameters are provided in Suncor's evidence as are injection test results and the Keg River isopach used in the model. The majority of well log and core data are publicly available and discussed in Suncor's evidence. It would be unusual for an applicant to provide all of the seismic data used to support such a model unless it was specifically requested. The panel did not require that information. The model results provide some support for Suncor's view that there is insufficient disposal capacity in the area of Suncor's disposal wells to accommodate both Suncor's and Pure's anticipated disposal volumes.

[88] While Pure's interpretation of a laterally extensive Keg River reservoir with significant disposal capacity is also based on a review of existing well log and core data, petrophysical analysis, and seismic data, as well as a geomechanical study and hydrodynamic study of the Keg River at Long Lake, Pure's interpretation is not as well supported by empirical evidence.

[89] The estimates of total porosity in the Keg River Formation developed by Pure based on geological and seismic mapping do not necessarily equate to a large disposal capacity within the formation. As Pure's experts acknowledged, the porosity is already filled with water which must be displaced to accommodate additional fluids. The ability of a fully saturated (100 per cent fluid filled) reservoir to store injected water is dictated by the reservoir's specific storage coefficient, which is made of two parts: rock compressibility and fluid compressibility. Of these, rock compressibility has the larger effect on storage capacity as rock compressibility for reservoirs and aquifers is commonly orders of magnitude higher than fluid (single phase liquid) compressibility. As Mr. Winestock confirmed through his calculation, in the absence of mechanisms for fluid and pressure leakoff, only a small fraction of the total available pore space may be available as storage capacity.

[90] Given the estimated effective compressibility of the formation used by Mr. Winestock and the available pressure differential in the reservoir (the reservoir is about 50 per cent under-pressured), we believe Mr. Winestock may have underestimated the amount of available storage capacity that would be available if no leakoff were to occur. However, we would still expect that the available disposal capacity would be a small fraction, equivalent to 5 per cent or less, of the total available pore space mapped by Pure. This would equate to 60 million m³ of the 1.2 billion m³ of pore space mapped by Pure for the Hangingstone / Meadow Creek area and 7 million m³ of the 145 million m³ of pore space mapped by Pure in the vicinity of its proposed disposal wells.

[91] Pure's interpretation of large disposal capacity in the Keg River Formation relies on the presence of faults and open fractures to enhance permeability and allow reservoir pressure leakoff and access to disposal capacity. We accept that faulting and fracturing is present in the Keg River Formation based on the seismic mapping and petrophysical analysis provided by Pure and Suncor; however, there was conflicting evidence about the extent of open fractures. We also accept, based on the geomechanical study prepared by Mr. Glover, that increased reservoir pressure resulting from injection could possibly result in the slipping or opening of some faults and fractures, contributing to enhanced permeability. However, while this is theoretically possible, there is currently limited empirical evidence to support Pure's view that significant open fractures currently exist or would be created by injection where fracture pressures are not exceeded and that those faults and fractures would materially contribute to disposal capacity. The most conclusive evidence of the contribution of faults and fractures to injection and disposal capacity would come from injection test results, which are currently limited to the results of testing of Suncor's injection wells and Pure's 1-24 well. In the injection test results provided by Suncor, there was no evidence of pressure leakoff due to faults or fractures in the tests performed. Pure did not provide any

injection test data to support its interpretation that faults and fractures would materially contribute to disposal capacity.

[92] While it is theoretically possible that fractures or faults may allow water to move to other formations or areas of the Keg River Formation, such as the lower Keg River platform, this is unproven, as is the possibility that fluids would leak laterally to adjacent back-barrier facies. While increased permeability is important and may increase the ease with which water may be injected, storage capacity is still needed to retain the fluids. No evidence was provided that demonstrates that the lower Keg River platform has sufficient reservoir properties to meaningfully contribute to disposal capacity even if it were connected to the upper Keg River by faults or fractures.

[93] We did not find the hydrodynamic study of the Keg River at Long Lake to be persuasive. The study results do not appear to adequately explain the observed injection performance and pressure data in CNOOC's injection wells. Also, the details of history matching were not provided, and the thickness of 88 m used in the study is significantly greater than aquifer thickness of 21.6 m to 46.3 m stated in Mr. Cotterill's report.

[94] We recognize that there is limited well control in the interior of the upper Keg River buildup, as most of the wells are near the buildup margins. We also note that while salt/anhydrite plugging is common in many of the wells, it is variable, and that some open porosity is observed in some wells. We therefore agree with Pure that there is insufficient data to conclude that salt/anhydrite plugging is pervasive throughout the interior of the buildup.

[95] We acknowledge that there is some uncertainty about the amount of disposal capacity available in the Keg River Formation in the Hangingstone / Meadow Creek area. If the mechanisms that Pure relies on, such as porosity and permeability in the interior back-barrier facies of the upper Keg River buildup and the presence of faults and open fractures that allow pressure leakoff to occur, exist, then the amount of disposal capacity may not be limited to the barrier-reef facies as currently interpreted by Suncor. However, in the absence of evidence to confirm that such mechanisms exist, we find that the disposal capacity in the Keg River Formation, specifically in the vicinity of Suncor's 3-31 and 11-29 disposal wells and Pure's proposed 1-36 and 4-32 disposal wells, appears to be limited and not sufficient to accommodate both Pure's and Suncor's anticipated disposal volumes.

[96] As referenced above, Pure suggested that Suncor failed to produce information that was essential to support Suncor's position regarding the disposal capacity of the Keg River Formation. Pure noted that Suncor did not produce certain documentation relating to its evidence, including 3-D seismic, 2-D seismic, and reservoir mapping. Pure also argued that Suncor's evidence in this proceeding in respect of disposal capacity in the Keg River Formation contradicts some of Suncor's early interpretations and analyses of the Keg River from its Meadow Creek East and West project applications.

[97] We are satisfied that we had sufficient evidence to reach our conclusions regarding limited disposal capacity in the Keg River Formation in the vicinity of Pure's proposed 1-36 and 4-32 wells without the underlying seismic data and reservoir mapping evidence that was not provided. We placed particular weight on other evidence, such as the results of injection tests from Suncor's 3-31 and 11-29 wells, that we were able to review and technically evaluate. Further, Suncor provided a reasonable and to-be-expected explanation for not producing some of the "missing" documentation: it was proprietary. That is the normal position of energy companies that acquire such information. Other information related to the 2-D seismic was publicly available. Had we considered this information necessary, we would have compelled Suncor to produce it. Further, we do not see discrepancies between information in Suncor's prior applications and its submissions in this proceeding as affecting the veracity of its evidence; interpretations based on geological and hydrogeological data evolve and change over time. We note that Pure did not file a motion, either before or during the hearing, requesting that we compel Suncor to produce the documentation which Pure says Suncor should have produced.

[98] Notwithstanding our finding of limited disposal capacity in the vicinity of Pure's proposed 1-36 and 4-32 disposal wells, we agree with Pure that Suncor's evidence was not sufficient for us to conclude that disposal capacity within the Keg River Formation in the Hangingstone / Meadow Creek area is limited to the area immediately surrounding Suncor's disposal wells and that no other disposal opportunities exist in the area. We acknowledge that well data is limited for some areas of the upper Keg River buildup in the Hangingstone / Meadow Creek area, and that there are few injection test results available outside of the area of Suncor's conditionally approved disposal scheme that can be used to evaluate disposal capacity. Furthermore, as Suncor did not provide its proprietary 2-D and 3-D seismic that was used in its interpretation of the distribution and reservoir properties of the Keg River Formation for the larger upper Keg River buildup in the Hangingstone / Meadow Creek area, we were not able to rely on this data to support Suncor's interpretation of limited disposal capacity throughout the entire buildup.

Pure's Proposed 1-36 and 4-32 Disposal Wells and Disposal Scheme May Result in Adverse Effects to Suncor's Meadow Creek Projects

Parties' Submissions

[99] Suncor's anticipated bitumen production from its two Meadow Creek projects is 120 000 barrels of oil per day: 80 000 barrels of oil per day from Meadow Creek East and 40 000 barrels of oil per day from Meadow Creek West.

[100] Suncor said that the scheme approval for Meadow Creek East was received in 2003. Oil sands exploration work and subsurface resource delineation in the Meadow Creek region has continued since 2003. Suncor did further work on the project between 2012 and 2015, applied for approval of the Meadow Creek East project in 2015, and received approval from the AER in 2017. Suncor applied for the

Meadow Creek West project in 2017 and received notice from the AER on October 24, 2019, that the AER would be approving the Meadow Creek West application upon receiving authorization from the Lieutenant Governor in Council.

[101] Suncor said it has spent more than \$500 million advancing the Meadow Creek East and Meadow Creek West projects to date.

[102] At the time the Meadow Creek West project was submitted, Suncor expected the project to generate an estimated

- \$1.2 billion in positive contribution towards provincial GDP,
- \$700 million in household income based on construction activities alone,
- \$159 million in annual expenditures for facilities once the project is fully operational, and
- \$65 million in expenditures for field activities on an annual basis.

[103] Over its lifetime, Meadow Creek West is expected to contribute approximately \$7 billion in provincial taxes and royalties and \$1.4 billion in federal income tax. Suncor said that the estimated benefit of the Meadow Creek East project is approximately double the benefit of the Meadow Creek West project based on bitumen production.

[104] Suncor stated that the approval for Meadow Creek East included conditional approval for disposal wells and surface land locations for the entire project life cycle. In its application, Suncor applied for approval to dispose of up to 1500 m³/d of wastewater into the Keg River Formation using the 11-29 and 3-31 disposal wells. The AER conditionally approved the scheme for disposal of Class Ib fluids through the 11-29 and 3-31 wells.

[105] Suncor said that the Hangingstone project poses substantial risks to Suncor's ability to produce oil sands resource in the Meadow Creek area. Suncor submitted that the Hangingstone project would compromise the efficient, orderly and economic recovery of bitumen and could result in bitumen sterilization by consuming limited and valuable disposal capacity and interfering with well pad placement.

[106] Suncor is concerned that Pure's proposed 1-36 and 4-32 disposal wells are in close proximity to Suncor's conditionally approved disposal wells for the Meadow Creek East project and that the Keg River Formation in the Meadow Creek area has limited capacity to accept injected disposal volumes. Suncor noted that the horizontal trajectory of Pure's proposed 4-32 disposal well is directly towards Suncor's conditionally approved disposal wells. According to Suncor, the starting point of the horizontal section within the Keg River Formation for the 4-32 disposal well is approximately 1.52 km from Suncor's existing disposal well at 3-31, and the horizontal section terminates approximately 0.54 km from the 3-31 well. Suncor noted that the horizontal trajectory of Pure's proposed 1-36 disposal well is also directly

towards Suncor's conditionally approved disposal wells, and maintained that the horizontal section of the well is as close as 0.9 km from Suncor's nearest existing disposal well at 3-31.

[107] Suncor argued that if Pure is allowed to dispose into the Keg River Formation where Suncor is approved to dispose, Pure may consume all or the majority of disposal capacity available in the Keg River Formation before Suncor starts operations, which could impact Suncor's ability to extract bitumen. Suncor confirmed that final investment decisions have not yet been made for either Meadow Creek East or Meadow Creek West. Once final investment decisions are made, it would take three to four years to construct the initial well pads and project facilities for each project, and it would be six to seven years before full production was achieved at Meadow Creek East and Meadow Creek West. If during this period Pure were to consume all or the majority of disposal capacity available in the vicinity of Suncor's disposal wells, this would affect the base case for the Meadow Creek East and West projects, which anticipate approximately 10 years of subsurface disposal into the Keg River Formation.

[108] Suncor acknowledged that, given the 25- to 40-year life of the Meadow Creek projects, Suncor will require additional or alternative disposal options in the future. Suncor said that disposing of waste solely by trucking would be very problematic due to the volumes involved. Suncor indicated that they would therefore rely on an on-site disposal well or other on-site facility to process wastewater. To this end, Suncor said that if there is a risk of limited disposal capacity in the early years of the Meadow Creek projects, the projects as currently designed and planned would be materially affected, and development of mitigation options would need to start immediately.

[109] Suncor said a reduction in available disposal capacity in the Keg River Formation could necessitate implementation of costly waste disposal alternatives, such as a zero-liquid-discharge facility, in the first few years of operations at the Meadow Creek projects. Suncor estimated the upfront cost of implementing zero-liquid-discharge technology at the Meadow Creek projects to be approximately \$200 million, with annual operating costs of about \$15 million. Suncor said this cost would have a material impact on the project economics on which a final investment decision would be based. Suncor also said that the resulting change in project scope could delay the start of development for the Meadow Creek East project by two to three years due to the need for engineering redesign and additional regulatory process.

[110] Suncor also noted that zero-liquid-discharge technology is energy intensive, and that this could increase greenhouse gas emissions associated with the Meadow Creek projects. Suncor estimated the greenhouse gas emission impact of deploying zero-liquid-discharge technology at the Meadow Creek projects to be approximately 88 000 tonnes of CO₂ equivalent per year.

[111] According to Suncor, fluid volumes must be properly controlled to protect the integrity of the reservoir. Suncor said it purposely located its two disposal wells in close proximity to increase the efficiency of injection into the disposal container as the pressure increase within the Keg River is spread

over a larger area. Suncor said that results of its 2-D modelling of injection performance for the 3-31 and 11-29 well confirmed Suncor's understanding that well interference between its 3-31 and 11-29 disposal wells would occur, and that there would be a need to operationally manage injection rates and pressures within the area. Given the close proximity of Pure's proposed 1-36 and 4-32 disposal wells to Suncor's disposal wells, Suncor expects that additional interference between Pure's and Suncor's wells would occur and would need to be managed.

[112] Pure submitted there is no merit to Suncor's position that if it runs out of disposal space in the Keg River Formation it will incur additional costs and that these additional costs may make it uneconomical to continue the project. Pure said that, in substance, this is a collateral attack on the Crown's decision to grant the CMA authorizations to Pure.

[113] Pure submitted that if Suncor requires ongoing and sustained hydrogeological storage capacity in order to dispose of waste fluids from the Meadow Creek projects, then, based on Suncor's own evidence, it cannot obtain that capacity from the Keg River Formation. Thus, if the costs of implementing alternative disposal methods mean that the Meadow Creek projects are not economically viable, the logical implication of that position is that the Meadow Creek projects were never economically viable in the first place. Pure also argued that to the extent it is a business imperative for Suncor to secure all disposal rights to the entirety of the Keg River Formation in the Hangingstone / Meadow Creek area, it is open to Suncor to contract with Pure for such needs, when and if they materialize. Pure said that the inherent economics of Suncor's nonexclusive Keg River disposal rights do not and cannot establish that Suncor is directly and adversely affected by Pure's applications.

[114] Pure submitted that Suncor possibly incurring greater waste disposal costs does not impair Suncor's ability to extract bitumen pursuant to its mineral leases or equate to resource sterilization. According to Pure, resource sterilization only occurs where one party's actions physically and permanently prevent another party from extracting a resource. Pure stated that the economics of resource extraction in a competitive marketplace pose no such barrier.

Panel's Analysis and Findings

[115] We understand that Suncor has invested significant time and financial resources to develop the Meadow Creek projects. Suncor has received approval for the Meadow Creek East project and was advised by the AER that approval of the Meadow Creek West project would follow Lieutenant Governor in Council authorization. At the time of the hearing, that authorization had not been issued; this fact did not influence our decision in this proceeding. While we recognize that Suncor has not yet made a final investment decision to proceed with the projects, we find that should Suncor proceed with the Meadow Creek East and Meadow Creek West projects, the projects would provide significant economic benefits to Alberta through employment, capital and operational expenditures, taxes, and royalties.

[116] The AER's approval for the Meadow Creek East project includes conditional approval of the disposal scheme for Suncor's previously drilled 3-31 and 11-29 disposal wells and Suncor's planned but undrilled 4-12 and 5-36 disposal wells. The approval is conditional upon Suncor providing copies of current CMA authorizations from Alberta Energy as well as additional information required to demonstrate that the wells satisfy the requirements of *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements* before starting injection operations.

[117] Pure's proposed disposal wells at 1-36 and 4-32 are in close proximity to Suncor's conditionally approved disposal wells. As discussed previously, based on the evidence presented in this proceeding, the disposal capacity in the Keg River Formation in the vicinity of Pure's proposed disposal wells appears to be limited and not sufficient to accommodate both Suncor's and Pure's anticipated injection volumes. Suncor's 2-D modelling indicates that there would be interference between Suncor's 3-31 and 11-29 disposal wells that would need to be managed. Given the close proximity of the proposed 1-36 and 4-32 disposal wells to Suncor's disposal wells, it is likely that Pure's injection activities would also result in interference that would need to be managed. We do not accept Pure's view that zones of higher permeability in a NE–SW direction associated with faults or open fractures will minimize or prevent interference between Pure's and Suncor's disposal wells. Pure has not provided sufficient evidence to demonstrate that this would be the case. In contrast, the injection test results presented by Suncor show rapid and significant pressure communication across mapped faults. Consequently, we find that interference between Pure's and Suncor's injection wells is likely to occur.

[118] Given the proximity of Pure's 1-36 and 4-32 disposal wells to Suncor's disposal wells, it is also likely that Pure's operations would consume disposal capacity that would otherwise support Suncor's conditionally approved disposal scheme. We note that Pure's anticipated injection volumes of 16 million m³ over the life of the Hangingstone project are approximately twice Suncor's anticipated injection volumes of 8 million m³ for the first 10 years of the Meadow Creek projects. Given that Pure could start solution mining and operation of its salt caverns shortly after its applications are approved, and that it would take Suncor 3 to 4 years to construct the Meadow Creek East project and commence operations after a final investment decision is made, we find that it is likely that Pure could use up a significant portion of the available disposal capacity before Suncor commences operations. It is also likely that Pure's injection operations could increase the reservoir pressure in the vicinity of Suncor's disposal wells to the point where Suncor may be prevented from injecting any volumes.

[119] We accept that subsurface disposal capacity is a valuable resource that supports bitumen recovery. The Meadow Creek projects, as currently planned by Suncor, rely on access to subsurface disposal to accommodate waste fluid volumes during their early stages. If a significant portion of the anticipated disposal capacity is lost, then Suncor will need to implement alternative disposal options earlier in the life of the projects. We accept that trucking is not a feasible alternative given the large volume of waste fluids involved and that the capital and operating costs associated with deploying zero-

liquid-discharge technology would be significantly higher than for on-site subsurface disposal. We accept Suncor's evidence that having to commence alternative disposal options such as zero liquid discharge earlier in the life of the Meadow Creek projects would have an adverse and significant effect on the economics of the Meadow Creek projects.

[120] We do not agree with Pure's position that the loss of disposal capacity and increased disposal costs in no way impairs Suncor's ability to extract bitumen. Access to cost-effective disposal options is required to support bitumen production, and bitumen resources may not be developed if cost-effective disposal options are not available. Although there is some merit to Pure's argument that the resources are not physically and permanently sterilized, the effect of increased production costs may be the same given that the resources may never be produced.

[121] We therefore find that Pure's proposed 1-36 and 4-32 disposal wells are likely to adversely affect Suncor's proposed Meadow Creek projects by significantly reducing the amount of available disposal capacity and that this could adversely affect the economics of bitumen recovery at Suncor's Meadow Creek projects.

[122] In contrast, we find that there is little potential for interference between Pure's existing 1-24 disposal well and Suncor's conditionally approved disposal wells given that the 1-24 well is 14 to 16 km from Suncor's disposal wells and in an area that Suncor does not consider to be prospective for injection. While we acknowledge that there could be some pressure communication between the two areas, if Suncor is correct that disposal capacity in the Keg River is limited to reef-barrier facies along the eastern edge of the upper Keg River buildup, then Pure's injection operations at 1-24 would not be expected to have a significant effect on Suncor's disposal scheme or bitumen production.

Other Disposal Options Are Available to Pure in the Hangingstone Area

Parties' Submissions

[123] Pure considered the Keg River Formation to be the only viable subsurface disposal zone within the Hangingstone area. According to Pure, other geological formations that are commonly targeted for wastewater disposal in the Athabasca region are either too far away or are not sufficiently thick and laterally extensive in the area to be viable. Pure was not aware of any successful injection into other zones in the Hangingstone area.

[124] Suncor expressed a similar view. Although the Meadow Creek disposal program has been ongoing since 2002 and Suncor initially targeted the basal McMurray, Keg River, and Granite Wash (La Loche) Formations, Suncor subsequently determined that the basal McMurray and Granite Wash Formations were the least likely to support disposal operations.

[125] Pure said that by mid-2016 it had identified three potential disposal well locations for the Hangingstone facility: the 1-24 location at the Hangingstone facility and the 1-36 and 4-32 locations as alternative locations should the 1-24 well not provide sufficient disposal capacity.

[126] In 2017, Pure evaluated the Keg River Formation beneath the approved Hangingstone facility for cavern wash water disposal by drilling a vertical well to the base of the Keg River succession. According to Pure, the Keg River Formation was found to be anomalously thin beneath the site, and the well was interpreted to be situated in an off-reef setting. Pure drilled a horizontal section from this well oriented due south but did not intersect thicker Keg River deposits until the last several hundred metres of the wellbore. Initially, Pure believed it had encountered thicker Keg River deposits at a measured depth of 2300 m in the 1-24 well, comprising the last 600 m of the wellbore.

[127] Pure noted that the average porosity in the Keg River Formation in the 1-24 well is not much lower than the porosities recorded in Suncor's disposal wells to the southeast; however, Pure noted that the estimated permeability and flow capacity values are significantly less. Pure said that core reviewed from the closest well at LSD 11-19-085-09W4 contained salt and anhydrite-plugged vuggy porosity. At the time it submitted its applications for the 1-36 and 4-32 disposal wells and associated disposal schemes, Pure said that a poor injectivity test and petrophysical results for the 1-24 well suggested the Keg River was unlikely to accept adequate volumes of wastewater required for cavern mining and operation.

[128] Pure said that three step rate injection tests were conducted on the 1-24 well. The first step rate test was conducted in August 29, 2017, and began injection above fracture gradient. The second step rate test was performed in June 4, 2018, and had pumping issues. Rate changes made the results of this test inconclusive. The third step rate test was conducted on June 6, 2018. The results of this test differed from the previous two tests in that the stabilization time was not consistent across the intervals.

[129] Due to the inconsistency and uncertainty associated with the test results and to ensure conservatism, in its application for the disposal scheme for the 1-24 well, Pure chose to accept the maximum wellhead injection pressure prescribed in *Directive 065* instead of conducting another step rate injection test. Pure said that the horizontal nature of the 1-24 well requires a long stabilization period to get conclusive results and that the longer the stabilization period the greater the water required to conduct the test, making the water volume prohibitive. For the 1-24 well, Pure anticipates the disposal rate to be 300 m³/d with a maximum well head injection pressure of 3550 kPa.

[130] Pure said that a more recent analysis of drill cuttings for the lateral section of the 1-24 well showed that the well penetrated the upper Keg River Formation at a measured depth of 2100 m rather than at 2300 m measured depth, as previously thought. According to Pure this means that the 1-24 well traverses 837 m of the Keg River Formation rather than only 600 m. Further, Pure said there was also doubt about the accuracy of the poor results from initial injection testing on the 1-24 well. Pure said that

subsequent investigations have revealed that some manner of blockage occurred at 1760 m measured depth in the horizontal section of the 1-24 well, which is 340 m before the point where the 1-24 well intersects the Keg River Formation. Pure believes this blockage explains the poor results from initial injection testing.

[131] Suncor submitted that the 1-24 well injection test results show a reservoir response, does not indicate blockage of the wellbore, and confirms that the Keg River Formation has poor injectivity in this area.

[132] Pure said that poor reservoir quality near the approved Hangingstone facility forced an evaluation of the Keg River Formation further from the facility. According to Pure, regional subsurface mapping combined with additional petrophysical appraisals within the region pointed to an area 14 km to the southeast in the vicinity of Suncor's 3-31 well.

[133] Pure confirmed that the 1-36 and 4-32 locations were selected using commercially available well information from the AbaData database (<http://abadata.ca/>). Pure said that the wells were on either side of Suncor's 3-31 well to minimize the risk of failing to encounter reservoir with the properties required to support injection. As there are only a few wells drilled into the Keg River Formation in the area of Pure's approved Hangingstone facility, and the 3-31 well showed good reservoir properties, drilling close to that well would increase the potential for encountering similar quality reservoir. Pure said that it had approached Suncor about purchasing the 3-31 well but that Suncor was not willing to sell it to Pure.

[134] Pure confirmed that the mapping and evaluation of Keg River buildups submitted as evidence in this proceeding occurred recently and in preparation for the hearing and were not available at the time the 1-36 and 4-32 locations were selected. Pure's experts confirmed that they were not involved in the selection of those well locations.

[135] Pure took the position during the proceeding that Suncor was significantly underestimating the available disposal capacity in the Keg River Formation in the Hangingstone / Meadow Creek area. Pure said that this was in part due to Suncor's interpretation that the interior of the upper Keg River buildup lacked the necessary porosity and permeability to support injection due to widespread salt/anhydrite plugging. Pure said that because there were very few wells drilled into the interior of the buildup, Suncor's interpretation was not well supported. Pure presented evidence of open porosity in some of the wells and said that there was also evidence of faulting and fracturing in this area and that this would contribute to pressure leakoff and disposal capacity in the interior of the buildup. As a result, Pure said it considered the interior of the upper Keg River buildup to be prospective for injection operations.

[136] Pure said that it continued to look for alternatives to its proposed 1-36 and 4-32 wells to provide disposal capacity for its approved Hangingstone facility given Suncor's concerns about the proposed wells. Pure indicated it had recently applied to the AER for a mineral surface lease for a disposal well at

LSD 07-20-085-09W4M. Pure said that this location was closer to its approved Hangingstone facility and, if approved, could potentially be Pure's number one disposal option; however, it acknowledged that there was some uncertainty about this as potential injection wells have to be drilled and tested to confirm their disposal capacity.

[137] Pure also said Suncor had underestimated disposal capacity in the Keg River by failing to map some upper Keg River buildups. Based on seismic mapping Pure interpreted there to be an upper Keg River buildup in Sections 31 and 32-085-09W4M, immediately to the northeast of its approved Hangingstone facility, that was not included in Suncor's mapping. Pure considered this buildup to be a prospective disposal target. Pure questioned Suncor's plans to drill a disposal well at LSD 02-29-085-09W4M (2-29 well), which is close to its approved Hangingstone facility, and suggested this was inconsistent with Suncor's position that this area was not prospective for injection operations.

[138] Suncor said that it did not see a seismic buildup in sections 31 and 32, and in any event did not believe the mere presence of an upper Keg River buildup equates to disposal capacity. Suncor confirmed that it was planning to drill the 2-29 well this winter but said the well was not intended to test the buildup identified by Pure or planned as a disposal well; it was planned as an observation well to test whether this area represents the northern limit of the disposal container that includes Suncor's 3-31 and 11-29 disposal wells.

[139] Suncor said Pure initially took the position that its 1-24 well showed poor injectivity and could not support the necessary injection volumes for the Hangingstone project. However, Suncor noted that, in Pure's reply submission, Pure asserted that the poor injectivity is attributed to blockage within the wellbore and that Pure appears to consider the 1-24 well a viable disposal option as it is significantly closer to the approved Pure facility. Suncor noted that Pure had also applied for the 7-20 injection well, near the approved Hangingstone facility, on lands included in Suncor's oil sands leases.

[140] Suncor argued that, with this optionality, and considering Pure's interpretation that there is a plethora of available disposal capacity all over the Keg River Formation, there is no basis for Pure to have submitted the applications. Suncor maintained that disposing immediately next to Suncor's conditionally approved disposal wells and running a pipeline almost 20 km across the development areas for the Meadow Creek projects should not be Pure's preferred option.

Panel's Analysis and Findings

[141] We accept that the Keg River Formation is the only viable subsurface disposal option in the Hangingstone / Meadow Creek area.

[142] Pure acknowledged that it did not conduct a thorough review of geological and seismic information to select the location of its proposed 1-36 and 4-32 disposal wells. Given the limited well control in the Keg River Formation in the area, Pure selected the locations to be as close as possible to

Suncor's existing 3-31 disposal well to increase the likelihood that it would encounter reservoir of similar quality.

[143] Pure's proposed disposal wells are 14 to 16 km from the approved Hangingstone facility and would require an approximately 20 km pipeline to connect them to the facility. Given that Pure took the position in this proceeding that the Keg River Formation is an extensive reservoir with a very large disposal capacity, it does not seem necessary or optimal to locate its disposal wells so far away from the approved Hangingstone facility and so close to Suncor's 3-31 well. If Pure's interpretation of the Keg River Formation's disposal capacity is correct, then Pure should be able to locate its disposal wells closer to the approved Hangingstone facility and in an area where there is less potential to interfere with Suncor's approved disposal scheme.

[144] Based on Pure's evidence, we find that Pure has options available to it other than the 1-36 and 4-32 wells to secure additional disposal capacity within the Keg River Formation for the approved Hangingstone facility. Pure can clean out and retest the 1-24 well to confirm whether it can, as Pure believes, accept additional injection volumes. Pure can also drill a disposal well closer to its approved Hangingstone facility within the interior of the Keg River buildup, as Pure suggests it may do at LSD 07-20-085-09W4M. Additionally, Pure can drill a well into the Keg River buildup Pure identified in Sections 31 and 32-085-09W4M, which Pure considers to be prospective for injection.

Approval of Pure's 1-36 and 4-32 Disposal Wells and Associated Disposal Scheme Is Not Consistent With Efficient and Orderly Development and Is Not in the Public Interest

Panel's Analysis and Findings

[145] The AER's mandate under *REDA* is to ensure the efficient, safe, orderly, and environmentally responsible development of energy resources in Alberta. When making decisions on applications, the *REDA General Regulation* requires the AER to consider, among other things, the economic effects of energy resource activities.

[146] As stated earlier in this decision, the purposes of the *OGCA* include securing the observance of safe and efficient practices in the locating, constructing, operating, suspension, and abandonment of wells and facilities and in operations for the disposal of substances. Under *OSCA*, the legislature has directed the AER to effect the conservation and prevent the waste of the oil sands resources of Alberta.

[147] We agree with Suncor that each of these statutes and their regulations must be read in the context of the others. In doing so, we must determine whether Pure's applications are consistent with the AER's regulatory mandates, are in the public interest, and should be approved.

[148] With respect to the applications for the 1-36 and 4-32 disposal wells and the associated disposal scheme, we find that approval would not be consistent with the AER's mandate of efficient, economic,

and orderly development or in the public interest as the proposed activities are likely to result in adverse effects to Suncor's Meadow Creek East and West in situ oil sands projects, potentially impacting bitumen recovery. As a result, we do not approve these applications.

[149] While we find that there is a need for disposal capacity to support mining and operation of the salt caverns at the approved Hangingstone facility, we find that Pure did not fully evaluate alternative disposal well locations before deciding to locate its 1-36 and 4-32 disposal wells immediately adjacent to Suncor's disposal wells. Based on the evidence provided by Pure, it appears that alternative disposal well locations are available to Pure.

[150] Pure's proposed 1-36 and 4-32 disposal wells are close to Suncor's conditionally approved disposal wells for its Meadow Creek East project. We find that disposal capacity in the Keg River Formation appears to be limited in this area and that it is likely that Pure's disposal activities would interfere with Suncor's planned disposal activities. We also find that it is likely that, should Pure's applications be approved, Pure would be in a position to commence disposal operations several years before Suncor could commence disposal operations and that there is therefore a risk that Pure would consume a significant portion of Keg River disposal capacity that would otherwise support Suncor's conditionally approved disposal scheme. We find that this loss of disposal capacity would adversely affect the economics of Suncor's Meadow Creek projects and could adversely affect bitumen recovery.

[151] While the panel finds that Pure's Hangingstone project would likely provide benefits to oil sands producers through reduced transportation costs and emissions, and that this would be in the public interest, the expected magnitude of the economic benefits is relatively small when compared to the expected economic benefits to Alberta resulting from Suncor's Meadow Creek projects. The potential loss of economic benefits to Alberta resulting from a loss of disposal capacity for the Meadow Creek projects, and the resulting adverse effects to project economics and bitumen recovery, could be significant. For this reason, the panel finds that the potential benefits of Pure's Hangingstone project are not sufficient to outweigh the potential risk to Suncor's Meadow Creek projects that could result from approval of the 1-36 and 4-32 disposal wells. Our decision on these two wells is not a decision on the Hangingstone project; it is a decision on the wells at these proposed locations. As noted above, Pure may have other options for waste disposal which may allow the Hangingstone project to proceed.

[152] Given the potential for the proposed 1-36 and 4-32 disposal wells and the associated disposal scheme to adversely affect bitumen recovery at Suncor's Meadow Creek projects, we do not believe that approving Pure's applications for these wells and the associated disposal scheme is consistent with the AER's efficient and orderly development mandate or in the public interest. Therefore applications 1918260 and 1919152 for the 1-36 and 4-32 disposal wells and applications 1918189 and 1919312 for the associated disposal scheme are denied.

Approval of the Disposal Scheme for Pure's 1-24 Disposal Well Is Consistent With Efficient and Orderly Development and Would Not Adversely Affect Suncor's Meadow Creek Projects

Panel's Analysis and Findings

[153] Despite our decision on the applications for the 1-36 and 4-32 disposal wells and associated disposal scheme, we approve application 1920277 for the disposal scheme for Pure's 1-24 disposal well, subject to a maximum well head injection pressure of 3550 kPa.

[154] We accept that Pure requires disposal capacity in order to operate its approved Hangingstone facility. The 1-24 well is already drilled and is located at the approved Hangingstone facility. As discussed earlier, the well is in an area that Suncor does not consider prospective for disposal and in an area where disposal operations are not likely to have an adverse effect on Suncor's conditionally approved disposal wells.

[155] Pure's disposal scheme application for the 1-24 disposal well includes all of the information required by *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements*. This data confirms the hydraulic isolation of fluids injected through the 1-24 well.

[156] While the 1-24 disposal well by itself may not provide sufficient disposal capacity for the Hangingstone project, in light of our decision not to approve the applications for the 1-36 and 4-32 disposal wells, it is one of the options available to Pure to provide at least a portion of the required disposal capacity needed for the project.

[157] For the reasons provided above, we find that Pure's application for the disposal scheme at the 1-24 well is consistent with the AER's mandate of orderly development, is in an area that is not likely to adversely affect bitumen recovery at Suncor's Meadow Creek projects, and is in the public interest.

Applications MSL181075, MSL190384, LOC181213, LOC190487, and 934887

Parties' Submissions

[158] Pure applied for these applications because they would be necessary to construct, operate, and provide access to its proposed disposal wells, if approved.

[159] Pure submitted two mineral surface lease applications for the 4-32 and 1-36 disposal well sites along with two associated LOC applications. The four applications all involve Crown land that is partially within the Meadow Creek East project area.

[160] MSL 181075 is an application for a disposal well site at LSD 04-05-085-08-W4M (the 4-32 well). The associated LOC 181213 is for a Class V frozen-access road to access the 4-32 well.

[161] MSL 190384 is an application for a disposal well at LSD 02-01-085-09-W4M (the 1-36 well). The associated LOC 190487 is for a Class V frozen-access road to access the 1-36 well.

[162] Pure submitted application 934887 for a 19.77 km pipeline to transport produced saline water. The proposed pipeline would start from Pure's approved Hangingstone facility at LSD 10-25-085-08W4M, cross through the Grayling Creek Fire Base and end at Pure's proposed 4-32 disposal well.

[163] Both Suncor and AAF had extensive objections to these applications. Suncor was concerned that Pure's proposed pipeline would interfere with its Meadow Creek East and Meadow Creek West projects. AAF has a disposition reservation (DRS 800130) associated with its Grayling Creek Fire Base that it says will be affected by the proposed pipeline; AAF was opposed to the portion of the pipeline that would cross the Grayling Creek Fire Base. Pure's position was that these concerns were without merit or could be mitigated.

Panel's Analysis and Findings

[164] The MSL and LOC applications relate to the surface well sites and access for the 1-36 and 4-32 disposal wells. As we have decided to deny the applications for these disposal wells, there is no need for the mineral surface leases and associated access for these wells. It is not a responsible use of public lands to grant dispositions for them where there is no need for those dispositions. We therefore deny applications MSL181075, MSL190384, LOC181213, and LOC190487.

[165] Similarly, the applied-for pipeline licence relates to a pipeline that proposes to transport produced saline water from the approved Hangingstone facility to the 4-32 well for disposal. As the disposal well applications are not being approved, there is no need for the pipeline. It is neither orderly nor in the public interest to approve pipelines for which there is no need. We therefore deny application 934887.

Conclusion

[166] For the above reasons, application 1920277 is approved. The following applications are denied: applications 934887, 1918189, 1918260, 1919152, and 1919312; mineral surface lease applications MSL181075 and MSL190384; and, licences of occupation applications LOC181213 and LOC190487. The denial decisions are made without prejudice to Pure's right to apply in the future for disposal well licences for alternative locations and for the associated authorizations and dispositions required to support them.

Dated in Calgary, Alberta, on February 27, 2020.

Alberta Energy Regulator

Parand Meysami, M.Sc., P.Eng.
Presiding Hearing Commissioner

Alex Bolton, P.Geo.
Hearing Commissioner

Jude Daniels, LL.B.
Hearing Commissioner

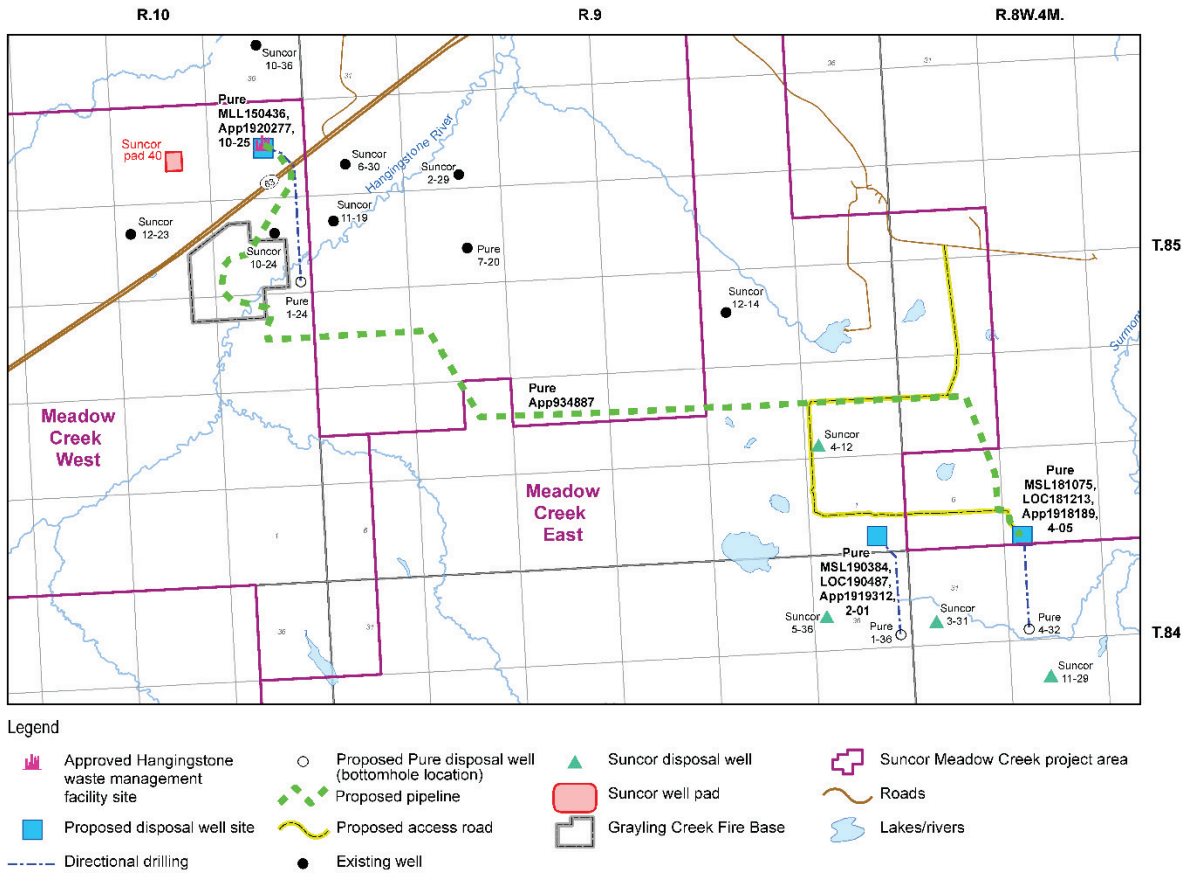


Figure 1. Project area map

Appendix 1 Hearing Participants

Principals and Representatives

(Abbreviations used in report)

Witnesses

Pure Environmental Waste Management Ltd.

(Pure)

S. Dhalla

A. MacKinnon

L. Manning

D. Baillie

R. Bogzaran

D. Cotterill

K. Glover

D. Schooley

A. Winestock

A. Wright

Suncor Energy Inc. (Suncor)

B. Roth

C. Graham

A. Altosaar

B. Braaten

R. Chan

C. Debiasio

N. Hunter

V. Matthews

D. Walters

Alberta Agriculture and Forestry (AAF)

No Counsel

B. Schmidt

Alberta Energy Regulator staff

M. LaCasse, AER Counsel

F. De Luca, AER Counsel

N. Aimo

B. Banaj

L. Forbes

S. Harbidge

S. Hardie

T. Hauck

L. Kirkpatrick

E. Laratta

A. Panwar

V. Pugh
T. Rempfer
L. Shen
A. Shukalkina
T. Turner

Appendix 2 Summary of Conditions

Conditions are requirements in addition to or otherwise expanding upon existing regulations and guidelines. An applicant must comply with conditions or it is in breach of its approval and subject to enforcement action by the AER. Enforcement of an approval includes enforcement of the conditions attached to that licence. Sanctions imposed for the breach of such conditions may include the suspension of the approval, resulting in the shut-in of a facility. The conditions imposed are summarized below.

Conditions

- The disposal scheme for Pure's 00/01-24-085-10W4M is subject to a maximum wellhead injection pressure of 3550 kPa (gauge).