

Imperial Oil Resources Limited

Application for Kearl Mine's Tailings Management Plan

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Abbreviations

AER	Alberta Energy Regulator
BML	Base Mine Lake
<i>EPEA</i>	<i>Environmental Protection and Enhancement Act</i>
EPL	end-pit lake
ETA	external tailings area
FMFN	Fort McKay First Nation
<i>ICAF</i>	<i>Integrated Compliance Assurance Framework</i>
ITA	in-pit area
MCFN	Mikisew Cree First Nation
ML 1909	Métis Nation of Alberta Local Council 1909 Lakeland
ML 1935	McMurray Métis Local 1935
MMSC	McKay Métis Sustainability Centre
MNA R1	Métis Nation of Alberta – Region 1
<i>OSCA</i>	<i>Oil Sands Conservation Act</i>
OSEC	Oil Sands Environmental Coalition
PCA	Pleistocene Channel Aquifer
RTR	ready to reclaim
SOC	statement of concern
<i>TMF</i>	<i>Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands</i>
TMP	tailings management plan
TSRU	tailings solvent recovery unit
TT	thickened tailings

Executive Summary

The Alberta Energy Regulator (AER) approves Imperial Oil Resources Limited's (Imperial's) application 1872083, subject to the approval terms and conditions in appendix 1.

Background

The AER regulates tailings arising from oil sands mining operations to ensure that the tailings are managed in an efficient, safe, orderly, and environmentally responsible manner over their entire life cycle. Tailings are a by-product of the process used to extract bitumen from mined oil sands and consist of water, silt, sand, clay, and residual bitumen.

The AER applies a risk-based approach to regulating, where higher-risk activities receive the greatest regulatory oversight. Given the nature and scale of fluid tailings generated by oil sands mine operations, and the ongoing research and development of tailings treatment technology, fluid tailings management is one of Alberta's higher-risk industrial activities.

The regulation of tailings has been an evolving issue in Alberta. In 2009, the Energy Resources Conservation Board released *Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*, introducing specific performance criteria for the reduction of fluid tailings and the formation of trafficable deposits. To further manage and decrease liability and environmental risk resulting from the accumulation of fluid tailings on the landscape, the Government of Alberta issued the *Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands (TMF)* in 2015.

The *TMF* sets out the objective that fluid tailings accumulation is minimized by ensuring that fluid tailings are treated and reclaimed progressively during the life of a project and all fluid tailings associated with a project are ready to reclaim (RTR) within 10 years of the end of mine life. In addition, the *TMF* establishes four outcomes: land use must be returned to Albertans, sustainable ecosystem, liability is minimized to Albertans, and environmental effects are managed. As part of the implementation of the *TMF*, the AER released *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, which set out new requirements for fluid tailings management plans (TMPs), including both existing fluid tailings (i.e., legacy) and new fluid tailings.

Imperial's Approval

Imperial's Kearl oil sands mine site was approved by a joint Alberta Energy and Utilities Board and Government of Canada panel in 2007 (*Decision 2007-013*). Kearl started production in April 2013 and tailings placement began in the external tailings area (ETA) (site map provided in appendix 2). Imperial commissioned its thickeners in 2016, commencing tailings treatment.

On November 2, 2016, the AER registered application 1872083, filed by Imperial pursuant to section 13 of the *Oil Sands Conservation Act (OSCA)* for the TMP for Kearl.

The AER enhanced involvement by providing opportunities for Imperial and statement of concern (SOC) filers—the Oil Sands Environmental Coalition, Fort McKay First Nation, Mikisew Cree First Nation, McMurray Métis Local 1935, Métis Nation of Alberta – Region 1, Métis Nation of Alberta Local Council 1909 Lakeland, and McKay Métis Sustainability Centre—to provide feedback on draft approval conditions.

Ongoing Stakeholder and Indigenous Community Engagement

Both the *TMF* and *Directive 085* highlight the importance of transparency and involvement of stakeholders and indigenous communities in tailings management. Given this overarching principle, together with the concerns expressed by SOC filers, the approval requires Imperial to engage with stakeholders and indigenous communities on the activities undertaken in respect of fluid tailings management. This engagement will include conducting an annual forum and reporting to the AER on these engagement activities.

Fluid Tailings Profile

The AER is approving Imperial's new fluid tailings profile, subject to the approval terms and conditions. Imperial does not have a legacy fluid tailings profile.

The AER is concerned with Imperial's new fluid tailings profile. Given the stage of operations at Kearl, the profile is based on Imperial's conservative assumptions regarding treatment technology performance and tailings deposit performance. As operations progress the new fluid tailings profile may not represent the actual performance of Kearl's treatment technology and tailings deposit. Furthermore, the end of mine life target appears to be greater than five years of fluid tailings production.

Therefore, Imperial is required to provide an updated new fluid tailings profile by December 31, 2020.

The AER has set the thresholds based on the approved new fluid tailings profile.

Tailings Treatment Technology and Performance

Imperial is authorized to use thickeners with secondary chemical treatment to treat fluid tailings, subject to the approval terms and conditions. Thickened tailings (TT) are created by processing fluid tailings in a thickener, which results in the removal of water. Once the TT is created, it is transferred by pipeline to the tailings deposit; prior to deposition, a chemical is injected into the TT through a process known as secondary chemical treatment.

Given that Imperial has only been operating its thickeners for about two years, there is limited data on Kearl's treatment technology and deposit performance. Imperial acknowledged that it requires more time to verify its predicted performance. Therefore, Imperial is required to submit an updated TMP by December 31, 2020. Further assessment of Kearl's treatment technology and East ETA deposit performance will be undertaken through the AER's review of the updated 2020 TMP.

Furthermore, the AER is concerned with Imperial's proposed water-capping technology. Imperial proposes to place 125 million m³ of untreated fluid tailings in one tailings deposit and to cover that deposit with water to create a water-capped deposit as a closure landscape feature ("water-capped pit lake"). Imperial indicated that it intends to make a final decision on whether to implement water-capping technology for Kearl no later than 2031.

SOC filers raised concerns with water-capping technology and pit lakes. Water-capping technology is subject to further assessment, research, and future policy. Therefore, the approval prohibits water-capped pit lakes and requires Imperial to meet future policy on water-capped pit lakes.

To provide the AER with assurance that the *TMF*'s objective and outcomes can be met and to ensure compliance with *Directive 085* requirements, Imperial is required to provide an updated TMP by December 31, 2020 that describes how it will develop alternative tailings treatment technologies and an implementation plan to treat the volume of fluid tailings that Imperial currently proposes to water cap.

In the event that Imperial maintains its plan to use water-capping technology and so as to ensure sufficient time for Imperial to deploy an alternative technology to water capping, Imperial is required to provide feasible alternative tailings treatment technologies and an implementation plan in the updated TMP by September 30, 2027. If the feasibility of water-capped pit lakes is demonstrated and the Government of Alberta implements policies permitting their use, Imperial must apply to the AER to amend their approval.

Ready-to-Reclaim (RTR) Criteria

Imperial is required to meet the following RTR criteria for the East ETA TT deposits:

- 65 per cent solids content by weight, based on deposit sampling, within one year of treated fluid tailings placement;
- groundwater is monitored in accordance with the *Environmental Protection and Enhancement Act (EPEA)* approval.

The AER does not authorize Imperial's proposed subobjective 1 RTR criterion of 40 per cent solids content in the TT prior to secondary chemical treatment. This proposed RTR criterion does not provide the AER with assurance that the deposit's physical properties are on a trajectory to support future stages of activity in an appropriate timeframe.

Imperial's proposed the following subobjective 2 RTR criterion: industrial wastewater control systems have been constructed to capture potentially process affected surface water and return it to the ETA. This proposed subobjective 2 criterion is *not* authorized. In accordance with *Directive 085*, RTR criteria must not measure something already captured under other indicators. Imperial did not identify how the proposed criterion was distinct from the authorized subobjective 2 RTR criterion of groundwater monitoring. Further, *Directive 085* requires that Imperial identify criteria to demonstrate the effectiveness of design features. Imperial did not specify what criteria it would use to demonstrate the effectiveness of the wastewater control system.

Imperial's proposed subobjective 2 RTR criteria of design reports and annual performance reports for each structure is also not authorized. In accordance with *Directive 085*, there must be a clear relationship between the proposed RTR criteria and the subobjective (i.e., the effect the deposit has on the surrounding environment and ensuring the deposit will not compromise the ability to reclaim). Imperial did not describe a clear relationship between design reports and annual performance reports and subobjective 2. Although the AER is not authorizing this proposed subobjective 2 criteria, both the design reports and annual performance reports for each structure are important and Imperial will continue to provide structure design and performance reports in accordance with the dam safety requirements in the *Water (Ministerial) Regulation*.

Enhancements to Research

Research is key to manage risk and resolve site-specific uncertainties in Imperial's TMP. The AER is relying on a number of research conditions in the EPEA approvals to manage risk and resolve uncertainties. Further, Imperial is required to provide a capping research plan for its TT deposits by December 31, 2020.

A summary of the milestones, along with the various plans and updates required by the approval, is in appendix 3.

20180716A

**Imperial Oil Resources Limited
Application for Kearl Mine's Tailings Management Plan**

Application 1872083

Decision

[1] The Alberta Energy Regulator (AER) approves Imperial Oil Resources Limited's application 1872083, subject to the approval terms and conditions, and issues *Oil Sands Conservation Act (OSCA)* Approval No. 10829H (appendix 1).

[2] In reaching its decision, the AER considered all relevant material constituting the record of Imperial's application. The record consists of the application, which includes supplemental information requests; supplemental information filed by Imperial; the statements of concern (SOCs) filed by the Oil Sands Environmental Coalition (OSEC), Fort McKay First Nation (FMFN), Mikisew Cree First Nation (MCFN), McMurray Métis Local 1935 (ML 1935), Métis Nation of Alberta – Region 1 (MNA R1), Métis Nation of Alberta Local Council 1909 Lakeland (ML 1909), and McKay Métis Sustainability Centre (MMSC); and the feedback on draft conditions of approval provided by Imperial and the SOC filers.

[3] References in this decision to specific parts of the record are intended to assist the reader in understanding the AER's reasoning on a particular matter and does not mean that the AER did not consider all relevant portions of the record with respect to the matter.

[4] This report highlights the AER's consideration of the application.

Application

[5] Imperial's Kearl oil sands mine site was approved by a joint Alberta Energy and Utilities Board and Government of Canada panel in 2007 (*Decision 2007-013*). The Kearl mine site is located about 70 kilometres north of Fort McMurray, Alberta, in the Regional Municipality of Wood Buffalo (site map provided in appendix 2). Kearl started production in April 2013 and tailings placement began in the external tailings area (ETA). Imperial commissioned its thickeners in 2016, commencing tailings treatment in 2016.

[6] On November 2, 2016, the AER registered Imperial's tailings management plan (TMP) application for Kearl (application 1872083), made pursuant to section 13 of the *OSCA*.

[7] Under application 1872083, Imperial sought approval for its TMP to 2066, which is ten years after end of mine life.

Statements of Concern and Enhanced Involvement

[8] The AER published a public notice for application 1872083 and received seven SOC's:

- MNA R1: SOC 30498
- ML 1909: SOC 30499
- OSEC: SOC 30508
- FMFN: SOC 30507
- ML 1935: SOC 30560
- MCFN: SOC 30561
- MMSC: SOC 30578

[9] Imperial provided technical review responses to FMFN, MMSC, ML1935, and MCFN on June 12, 2017, and September 15, 2017, addressing the specific technical concerns they raised in their SOC's.

[10] Imperial responded individually to OSEC on September 22, 2017, and to MNA R1 and ML 1909 on October 4, 2017.

[11] On January 22, 2018, the AER circulated draft conditions of approval for feedback from Imperial and the SOC filers to enhance involvement in the application review and inform the decision on application 1872083. The AER decided to circulate the draft conditions of approval for feedback, rather than conduct a facilitated technical meeting with Imperial and the SOC filers, based on a number of factors, including the nature and magnitude of the changes proposed in the application, the nature and extent of the information provided by Imperial, and the stage of Kearl's operations.

[12] The AER subsequently extended the deadline for feedback on the draft conditions of approval. The AER received written feedback from Imperial and all SOC filers.

[13] Upon receipt of the feedback, the AER reviewed the entire record, considered the SOC's and submissions by the SOC filers and Imperial, and made its decision on application 1872083.

Approval Discussion

Introduction

[14] Imperial's TMP is aligned with the *TMF*'s objective. Given the early stage of operations, Imperial requires time to verify its tailings treatment technology and deposit performance. Imperial has acknowledged the uncertainties in its technology and deposit performance, and committed to providing an updated TMP in 2020. The approach in the approval granted by the AER reflects the *TMF* outcomes and sets conditions that ensure appropriate information is captured in a timely manner to manage risk and make appropriate regulatory decisions over the course of the Kearl mine operation.

[15] The approval conditions address

- stakeholder and indigenous community engagement;
- project-specific thresholds for new fluid tailings;
- tailings treatment technology and deposit performance plans and updates, including mitigation measures and research, monitoring, evaluation, and reporting; and
- environmental effects and implications

[16] The approval conditions are subject to the AER's *Integrated Compliance Assurance Framework (ICAF)* and *Manual 013*. In addition, the management actions as set out in the *TMF* and *Directive 085* are new tools available to the AER. A common theme in *ICAF*, the *TMF*, and *Directive 085* is a flexible approach; namely, to allow for the discretion to choose the tools appropriate to the specific circumstances to ensure the most effective compliance or enforcement outcome.

[17] The TMP was submitted as an application under *OSCA* and the decision on the application was made pursuant to *OSCA*. This decision report also makes reference to other approvals, in particular the *Environmental Protection and Enhancement Act (EPEA)* approval issued to Imperial in relation to this project. Further, various letters issued pursuant to *OSCA*, the *Water Act*, and *EPEA* approvals that are related to the matters discussed in this report have been attached to this report.

Stakeholder and Indigenous Community Engagement

[18] The *TMF* and *Directive 085* describe the importance of transparency, engagement, and enhancing the understanding of fluid tailings management.

Decision Summary and AER Findings

[19] FMFN raised the importance of engagement on future activities, and ML 1935 indicated that they require continued engagement on tailings management.

[20] To increase transparency, information sharing, and involvement of others in tailings management, Imperial is required to engage stakeholders and indigenous communities on tailings management activities undertaken pursuant to the approval. The AER expects that

- the required engagement efforts will include the SOC filers on this application;
- over the life cycle of Imperial's mine operations, the stakeholders and indigenous communities who are engaged may change to reflect the issues and concerns of the day, and, as such, the AER expects Imperial to conduct its engagement activities accordingly; and
- Imperial's engagement will incorporate its research and lessons learned from ongoing operations and will be timely and meaningful.

[21] Imperial is also required to hold an annual forum with stakeholders and indigenous communities regarding tailings management activities undertaken pursuant to the approval. The AER is not specifying the format of the forum (e.g., workshop, meeting) as the AER believes that it is appropriate to leave the design and scope of the event to Imperial. However, the AER expects that the annual forum will be tailored to what has occurred in the past year and what is upcoming regarding tailings management activities. It can be used to provide information, gather input, and describe plans on how engagement will occur for the upcoming year. In addition, it is expected that the following annual forums may be more robust:

- in 2019, as this is one year prior to Imperial submitting an updated TMP
- in 2020, as Imperial will be submitting an updated TMP by December 31, 2020
- in 2026, as Imperial will commence placement of fluid tailings in ITA2 and this is one year prior to Imperial submitting an updated TMP, which will include Imperial's water-capping technology decision and, should water-capping technology be proposed, will include feasible alternative tailings treatment technologies and an implementation plan
- in 2027, as Imperial will submit an updated TMP in 2027
- in 2028, as Imperial will commence placement of treated tailings in ITA2

Imperial is required to report to the AER annually on its engagement efforts.

Fluid Tailings Profiles and Project-Specific Thresholds

[22] The *TMF* and *Directive 085* require that new and legacy fluid tailings must be treated and progressively reclaimed during the life of a project, with all fluid tailings RTR within ten years of end of mine life. The *TMF* and *Directive 085* provide guidance that operators must consider in the development of their TMPs.

[23] The fluid tailings profile represents the volume of fluid tailings that are not RTR (e.g., do not meet RTR criteria). Both the new and legacy fluid tailings profiles are important tools by which the performance of an operator will be measured.

Legacy Fluid Tailings Profile

Context

[24] Legacy fluid tailings are fluid tailings that existed before January 1, 2015. All legacy fluid tailings must be RTR by end of mine life.

[25] Imperial has 5 million m³ of legacy fluid tailings, which have been placed in the ETA. Imperial is also placing new fluid tailings in the ETA. As a result, Imperial cannot differentiate between new and legacy fluid tailings. Imperial requested that all fluid tailings in the ETA be classified as new fluid tailings, which are accounted for in Imperial's new fluid tailings profile.

Decision Summary and AER Findings

[26] The AER accepts Imperial's request to deem all fluid tailings as new fluid tailings as the volume of legacy fluid tailings is small (5 million m³), the mine is at an early stage of operations, and the legacy and new fluid tailings placed in the ETA are indistinguishable. The separate management of legacy fluid tailings does not contribute to the achievement of the *TMF*'s outcome. Therefore, Imperial is not required to provide a legacy fluid tailings profile.

New Fluid Tailings Profile

Context

[27] The *TMF* defines new fluid tailings as fluid tailings that are produced after January 1, 2015. All new fluid tailings must be RTR within ten years of end of mine life. Imperial's thickeners were commissioned in 2016. Given the brief length of time the thickeners have been operational, Imperial had limited operational data at the time it submitted the TMP.

Decision Summary and AER Findings

[28] Based on Imperial's technology and deposit performance assumptions, its new fluid tailings profile meets the *TMF*'s objective, as all new fluid tailings achieve RTR status by 2066, ten years after the end of mine life. Imperial's new fluid tailings profile is authorized as shown in appendix B of the approval (appendix 1) and figure 1.

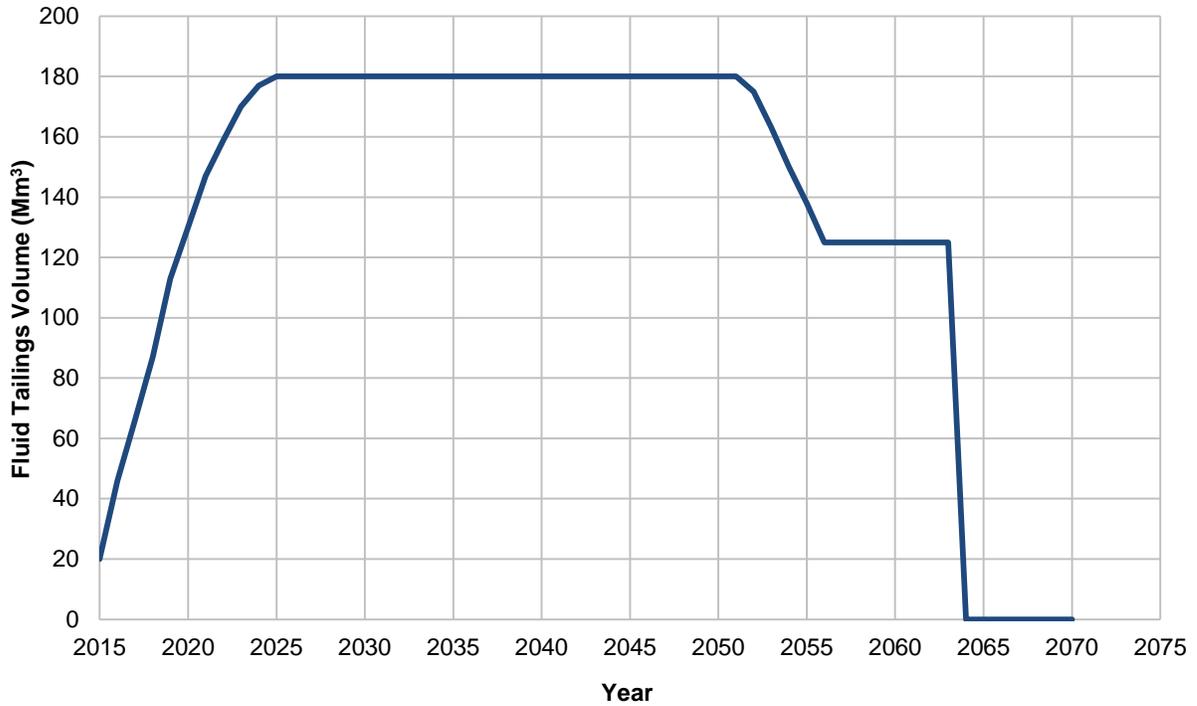


Figure 1. New fluid tailings profile

[29] Nevertheless, there are three issues with respect to Imperial’s new fluid tailings profile.

[30] First, given the stage of operations at Kearl, the profile is based on Imperial’s conservative assumptions regarding treatment technology performance and tailings deposit performance. Imperial acknowledged that it requires more time to verify its tailings treatment technology and deposit performance, and as a result Imperial used conservative assumptions to develop the new fluid tailings profile. The AER is concerned that as operations progress the new fluid tailings profile may not represent the actual performance of Kearl’s treatment technology and tailings deposit. Some SOC filers share this concern.

[31] Second, some SOC filers were also concerned with Imperial’s end of mine life target. The AER shares their concern.

[32] The *TMF* and *Directive 085* require the end of mine life target to be equivalent to five years or less of fluid tailings accumulation. Imperial’s end of mine life target appears to be more than the five years of fluid tailings accumulation.

[33] To address the two issues above, Imperial is required to submit an updated new fluid tailings profile in the updated 2020 TMP by December 31, 2020. The updated new fluid tailings profile must

- incorporate current tailings treatment technology and tailings deposit performance data,
- incorporate predicted tailings treatment technology and tailings deposit performance, and
- have an end of mine life target that is no greater than five years accumulation of fluid tailings production.

[34] The timing of the update aligns with Imperial's commitment to provide an updated new fluid tailings profile by 2020. The revised new fluid tailings profile must be supported by evidence to justify the technology and RTR criteria, as required by *Directive 085*.

[35] As Imperial's end of mine life is not until 2056, the AER expects Imperial will work to maximize fluid tailings treatment to minimize the volume at the end of mine life in support of the *TMF's* outcomes.

[36] Third, SOC filers have expressed concern with Imperial's proposed use of water-capping technology. The AER shares these concerns, and notes that water capping is subject to further assessment, research, and future policy. The AER's findings on water-capping technology are in the section "Water-Capping Technology" and on RTR for water-capped deposits in the section "Water-Capped Deposits."

Thresholds

Context

[37] The volume of accumulated fluid tailings is the primary indicator in the *TMF* used to manage and decrease liability and environmental risk resulting from the accumulation of fluid tailings. Triggers and a limit (collectively referred to as "thresholds") will be set relative to the fluid tailings profiles. The thresholds will ensure that fluid tailings are not accumulating beyond a volume or at a rate that precludes operators from meeting the *TMF's* objective. These are tools to be used to manage risks associated with TMPs. Various management actions are required when thresholds are exceeded.

[38] Three project-specific thresholds are set based on an operator's new fluid tailings profile in accordance with the *TMF* and *Directive 085*.

[39] The three thresholds are the profile deviation trigger, the total volume trigger, and the total volume limit:

- Profile deviation trigger
 - Alerts regulators and operators when the volume of fluid tailings is growing 20 per cent faster than that approved for the profile. Additional management action is required when the profile deviation trigger is exceeded.

- This trigger is based on when the fluid tailings volume growth is 20 per cent higher than that in the approved profile.
- The *TMF* states that the profile deviation trigger would consider a five-year rolling average to account for year-over-year variability.
- Total volume trigger
 - Indicates that the volume of fluid tailings has exceeded its approved maximum accumulation and requires additional management action.
 - The *TMF* states that this trigger is based on 100 per cent of the greater of the maximum approved fluid tailings volume profile or the end of mine life target.
- Total volume limit
 - Indicates that the volume of fluid tailings presents an unacceptable risk to the environment and potential long-term liability. Exceedance of this limit will compromise the ability of an operator to have all of their fluid tailings in an acceptable management state (i.e., RTR) within ten years of the end of mine life. Therefore, the most severe management responses are initiated.
 - The *TMF* states that this limit is based on 140 per cent of the greater of the maximum approved fluid tailings volume profile or the end of mine life target.

Decision Summary and AER Findings

[40] The *TMF* states the profile deviation trigger allows a five-year rolling average to account for year-over-year variability. To allow for year-over-year variability, the AER has set the profile deviation trigger for Imperial as a five-year rolling average of the annual profile deviation.

[41] The total volume trigger and limit are based on the greater of the maximum approved fluid tailings volume profile or end of mine life target, as per the *TMF* and *Directive 085*. As Imperial's maximum approved fluid tailings volume is 180 million m³ which is greater than the end of mine life target, the AER is setting the total volume trigger at 180 million m³ and the total volume limit at 252 million m³. The AER will review Imperial's profile in its updated 2020 TMP to ensure the project-specific thresholds are appropriate.

Fluid Tailings Treatment Technology

[42] The *TMF* stipulates that all fluid tailings must be treated with an accepted technology. The risks, benefits, and trade-offs associated with the proposed technology must be understood, have contingencies identified, and risks mitigated.

Technology Selection

Context

[43] *Directive 085* requires operators to justify that selected technologies are the best available for the project.

[44] Imperial proposed to continue to use thickeners with secondary chemical treatment prior to treated tailings being placed.

[45] Imperial commissioned the thickeners with secondary chemical treatment in 2016. Thickened tailings (TT) are created by processing tailings in a thickener, which results in the removal of water. This increases the density and reduces the volume of the fluid tailings.

[46] Once the TT is created, it is transferred by pipeline to the tailings deposit; prior to deposition, a chemical is injected into the TT through a process Imperial refers to as secondary chemical treatment. Imperial indicated that this enables further dewatering.

[47] Imperial is currently placing TT treated by secondary chemical treatment in East ETA. Imperial will commence placement of treated tailings in ITA2 in 2028.

[48] Imperial also proposed to use water-capping technology for 125 million m³ of untreated fluid tailings, with placement of tailings occurring between 2056 and 2060, and placement of the water cap occurring between 2056 and 2063.

Decision Summary and AER Findings

[49] Given the early stage of operations at Kearl, Imperial acknowledged that it requires more time to verify its tailings treatment technology and deposit performance. Imperial is authorized to use thickeners with secondary chemical treatment, subject to the approval terms and conditions. In making this decision, the AER considered the following information provided by Imperial:

- The use of thickeners with secondary chemical treatment should reduce fluid tailings volumes and likely will lead to the creation of tailings deposits that can be reclaimed.
- Imperial indicated that thickeners with secondary chemical treatment minimized the production of fluid tailings, reduced time to achieve progressive reclamation, and reduced water consumption relative to other treatment such as composite tailings, nonsegregating tailings, centrifugation, in-line flocculation with thin lift dewatering, and water-capped technologies.
- Imperial does not commence placement of treated tailings in ITA2 until 2028.

[50] Given the stage of Kearl's operations and the limited performance data, the AER is concerned that the thickeners, secondary chemical treatment, and East ETA may not perform as expected. The AER anticipates that Imperial will be in a position to employ mitigation measures (e.g., re-handling, additional

treatment, capping with additional material) should the East ETA underperform or Imperial cannot achieve long-term reclamation outcomes.

[51] SOC filers have also raised concerns in regards to the level of uncertainty of the thickener performance. The AER shares this concern. Further, Imperial has not demonstrated its proposed secondary chemical treatment will perform as expected. However, given how recently Imperial commenced tailings treatment operations at Kearl (2016), Imperial must obtain additional performance data over a reasonable period of time to assess tailings treatment (i.e., thickener with secondary chemical treatment) and deposit performance.

[52] Imperial also indicated there could be segregation of TT. The AER is concerned with the possibility of segregation, as it can result in more fluid tailings than expected, an increase in capping material requirements, a decrease in storage capacity, and an increase in consolidation time. All of these potential consequences can affect Imperial's ability to achieve targeted ecosites.

[53] To address the concerns related to technology and deposit performance, the AER will obtain data through a combination of *Directive 085* requirements and specific approval conditions.

- *Directive 085* requires Imperial to report annually on the technology performance and the East ETA deposit performance, including
 - providing mitigation measures to rectify technology that is not performing as expected;
 - assessing the performance and benefits of secondary chemical treatment; and
 - providing information confirming technology continuous improvement and development.
- To understand if segregation of TT is occurring and whether mitigation measures need to be implemented, Imperial is required to monitor, on a quarterly basis, solids content and sands-to-fine ratio of the TT following secondary chemical treatment. Imperial must also provide a summary of these monitoring results annually.
- As part of the updated 2020 TMP, Imperial is required to comply with the requirements of *Directive 085*, including describing uncertainties and mitigation measures during reclamation and closure stages, and ensure that the thickeners with secondary chemical treatment achieve performance parity with other comparable technologies.

[54] Technology and deposit performance will also be assessed annually, in the updated 2020 TMP, in the plans provided one year prior to tailings placement in future deposits and the updated TMP required by September 30, 2027.

[55] There are two additional issues arising from Imperial's technology selection. First, Imperial's treatment technology capacity may not be sufficient. Bitumen production at Kearl is currently 220 000 barrels per day (bpd). Under existing *OSCA* and *EPEA* approvals, Imperial can increase

production to 345 000 bpd by 2027, followed by stable production thereafter. In accordance with *Directive 085*, increases in fluid tailings treatment capacity are required as project expansions occur. Imperial committed that by 2025 its fluid tailings treatment capacity would be equal to its fluid tailings production and indicated that it would examine and enhance treatment capacity, as required, if production increased in the future. However, Imperial did not identify how it would increase its tailings treatment capacity to accommodate the bitumen production expansion.

[56] As part of the updated 2020 TMP, Imperial is required to assess, describe, and propose the selected treatment technologies that ensure the treatment capacity of the selected technologies is equal to or greater than the production rate of fluid tailings. Given the stage of operations at Kearl, Imperial has an opportunity to minimize accumulation prior to end of mine life and maximize Kearl's treatment capacity.

[57] A second issue arising from Imperial's technology selection is the proposed use of water-capping technology. Imperial proposed an increase to the volume of tailings placed in a water-capped pit lake from 66 million m³ to 125 million m³. SOC filers raised concerns with this change. Imperial's proposed water capping of 125 million m³ of untreated fluid tailings is not authorized, as the technology is subject to further assessment, research, and future policy. The approval prohibits the placing of water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating a water-capped deposit as a closure landscape feature ("water-capped pit lake"). The AER's decision with respect to the water-capped pit lake, including the prohibition and need for feasible alternative tailings treatment technologies to water capping, can be found in the section "Water-Capping Technology."

Polymer Use

Context

[58] Both the thickener and secondary chemical treatment use polymers.

Decision Summary and AER Findings

[59] Some SOC filers requested additional information on the polymers used by Imperial. Imperial's tailings treatment technologies currently use two polymers FLOPAM A-3332 and FLOPAM A-3338. These polymers have been used in a controlled setting without adverse effect. At this time, there are uncertainties regarding the long-term environmental effects, including any implications to targeted ecosites. Research requirements under Imperial's *EPEA* approval are expected to provide the necessary information concerning the long-term environmental uncertainties with and risk to the targeted ecosites associated with the polymers. Imperial can and should also draw upon existing industry research. Further, the updated 2020 TMP must comply with *Directive 085*, including describing uncertainties and mitigation measures.

[60] In the event that Imperial proposes to change these polymers or the manufacturer's formula changes for either or both polymers Imperial is required, in accordance with *EPEA*, to notify the AER. Depending on the significance of the proposed change, additional authorizations or amendments may be required.

Tailings Solvent Recovery Unit (TSRU) Tailings

Context

[61] In the froth treatment plant, paraffinic solvent is added to froth to help separate bitumen from water and solids. The water and solids (i.e., tailings) from the froth treatment plant are sent to the tailings solvent recovery unit (TSRU) to recover the paraffinic solvent. Once the tailings are processed by the TSRU, they are known as TSRU tailings. Although TSRU tailings account for less than 10 per cent of the total fluid tailings generated, these tailings can pose higher environmental risks because they can contain residual paraffinic solvent, other hydrocarbons, and sulphides.

[62] Imperial proposed to place TSRU tailings in the West ETA until 2023. TSRU tailings would then be transferred to ITA1, ITA3, ITA5, and ITA6.

[63] Imperial intended to treat TSRU tailings in its 2013 TMP, but is no longer proposing to treat TSRU tailings with TT technology.

Decision Summary and AER Findings

[64] Imperial is not permitted to place TSRU tailings in any deposit except the West ETA at this time. Because the location of TSRU tailings is restricted, Imperial's measurement system plan is required to include identification of substances of concern in TSRU tailings, and measurement location and measurement methodology for the substances of concern.

[65] Imperial provided limited information on how TSRU tailings affect the West ETA deposit, and how they will be managed in the in-pit areas (ITAs). Imperial indicated that it will use the West ETA deposit to collect information, such as material properties and consolidation rates, prior to depositing in future ITAs.

[66] Given limited data, it is uncertain how Imperial will manage the risks to the surrounding environment and long-term reclamation outcomes from TSRU tailings placed in the West ETA or, if permitted in the future, the ITAs.

[67] Imperial is required to address these uncertainties in the updated 2020 TMP, which is three years prior to Imperial commencing TSRU tailings placement in a second deposit. Further, the AER is concerned that Imperial is no longer intending to treat TSRU tailings. The updated plan must evaluate options for the treatment and placement of TSRU tailings, evaluate the performance of tailings deposits

where similar tailings treatment technology and targeted ecosites were proposed, update RTR trajectory and criteria, and explain how research results have been incorporated.

[68] Further, Imperial continues to research tailings and reclamation under its *EPEA* approval. The AER anticipates this research will address site-specific TSRU tailings uncertainties, such as the environmental effects of paraffinic froth and spatial extent of deposits containing TSRU tailings.

Water-Capping Technology

Context

[69] Water-capping technology involves the placement of water above untreated or treated tailings for the purposes of creating a water-capped deposit as a closure landscape feature (“water-capped pit lake”). Imperial proposed that 125 million m³ of untreated fluid tailings would be placed in a mine pit, which would then be capped with water, the end-pit lake (EPL) deposit. Imperial proposed that both tailings placement and water capping would begin in 2056.

[70] Imperial indicated that it would decide on the use of water-capping technology for Kearl by 2031.

Decision Summary and AER Findings

[71] SOC filers expressed concerns with end-pit lakes and water-capping technology.

[72] The AER acknowledges there are various uncertainties and risks associated with water-capping technology. As a consequence, water-capping technology is subject to further assessment, research, and future policy. Further, Imperial’s approval prohibits the creation of water-capped pit lakes.

[73] The AER recognizes that extensive research on water-capped tailings continues and the Government of Alberta will likely be developing policy for water-capping technology and water-capped pit lakes. If the feasibility of water-capped pit lakes is demonstrated and the Government of Alberta implements policies permitting their use, Imperial must apply to the AER to amend their approval.

[74] Imperial indicated that it is waiting for the results of Syncrude’s Base Mine Lake (BML) water-capping technology demonstration and is supportive of this research. However, Imperial has not provided sufficient information for the AER to determine if BML research will address Kearl site-specific uncertainties, such as the EPL deposit and water-cap design, including physical, chemical, and biological components. To ensure the AER has the most current information available to inform future decisions on water-capping technology, Imperial is required, as part of its end-pit lake research and development report required under its *EPEA* approval, to provide an explanation of the following, as set out in appendix 4:

- the applicability of BML research to Imperial’s circumstances,
- how Imperial will address uncertainties and risks where BML research is not applicable, and

- the research related to human health risk assessment and long-term chemistry and mineralogy for end-pit lakes.

[75] Imperial may continue to plan on the basis that water-capped pit lakes are an option unless water-capped tailings technology proves to be not feasible and/or Government of Alberta policy does not allow it. In the meantime, Imperial is required to plan for an alternative to water-capped pit lakes.

Alternative to Water Capping

Context

[76] *Directive 085* requires that, where water-capped fluid tailings technology is used to generate the inventory forecast in the profiles, an alternative tailings treatment technology is provided, including timeframes for implementation.

Decision Summary and AER Findings

[77] Some SOC filers raised concerns with the lack of an alternative technology to water capping, and requested Imperial provide a feasible and timely alternative technology.

[78] Imperial did not commit to a specific alternative technology to water capping with timeframes for implementation. Given the early stages of the Kearl project, Imperial has some time before it must make a decision on tailings treatment technology for the 125 million m³ of fluid tailings it must manage prior to 2066 (i.e., within 10 years of end of mine life).

[79] The AER recognizes that Imperial is focused on implementing its primary tailings treatment technologies (i.e., thickeners with secondary chemical treatment). To provide the AER with assurance that the *TMF*'s objective and outcomes can be met where water-capping technology is not permitted and to ensure compliance with *Directive 085*, Imperial is required to provide an updated TMP by December 31, 2020, that describes how it will develop alternative tailings treatment technologies and an implementation plan to treat the volume of fluid tailings that Imperial plans to water cap.

[80] In any event, Imperial must provide an acceptable alternative tailings treatment technology should it decide to use water-capped technology. Imperial has committed to making a decision on the use of water-capped technology and to provide alternate tailings treatment technologies by no later than 2031. SOC filers do not agree with Imperial's requested deadline of 2031.

[81] Imperial is required to provide an updated TMP by September 30, 2027, that includes its decision on water-capping technology. Where Imperial proposes to use water capping, it must also include a feasible alternative treatment technologies and an implementation plan to manage the volume of fluid tailings planned to be water-capped. This alternative to water-capped pit lakes must meet the *TMF*'s outcomes and *Directive 085* requirements, including RTR criteria and identification of risks and

uncertainties and associated mitigation measures. The AER is requiring the alternative by 2027, instead of 2031, as 2031 will likely not provide sufficient time for Imperial to deploy an alternative technology to water capping, given the volume of material planned for water capping. 2027 should provide sufficient time. Further, this timing aligns with Imperial's *EPEA* renewal and life of mine closure plan.

Capping Material Availability

Context

[82] Adequate capping material, such as coarse sand tailings, is necessary for landform contouring and stability. It provides, among other things, increased tailings deposit strength and trafficability, manages settlement, controls the location of the groundwater table, controls surface water drainage, and prevents tailings pore water from contaminating reclaimed areas.

[83] Imperial requires capping material for the following activities:

- infill beaching,
- construction for the purposes of building dams and tailings containment structures, and
- capping tailings deposits.

Decision Summary and AER Findings

[84] Imperial's ability to meet *TMF* outcomes and future reclamation outcomes will be compromised if there is insufficient capping material.

[85] Imperial must ensure there is adequate coarse sand tailings, or other suitable capping material, available to support its activities. The AER expects that Imperial will have sufficient capping material to cap or mitigate its initial TT deposit. However, Imperial's capping material needs are uncertain for the life of the mine. Imperial indicated that this information would be provided in future *EPEA* life of mine closure plans.

[86] Imperial is required to provide the following information as part of its *EPEA* life of mine closure plan and/or mine reclamation plan (see appendix 5):

- capping material types, objectives, and implications,
- material balances for coarse sand and any other suitable capping materials, and
- contingency plans for capping material shortages.

[87] Imperial is also required to submit a capping research plan by December 31, 2020, for its TT deposits. Imperial's research must provide timely and site-specific information with respect to capping material needs and availability. If there is a capping material shortage, Imperial will need to adjust its

tailings treatment technology selection to ensure the *TMF*'s and long-term reclamation outcomes can be achieved.

[88] Imperial must provide details that support its research, including the objective, and the applicability of that objective in addressing the uncertainties and risks associated with Imperial's TMP. The AER expects Imperial to use standard scientific methodology in the design of its research plan and draw upon existing industry capping research. Imperial should consider the benefits of peer-reviewed research.

[89] All research plans should include the following:

- a rationale for proposed monitoring that supports research;
- a discussion of how the selection of performance measures, criteria and validation methods relate to implementation;
- the applicability and scalability of the research to full implementation;
- a discussion on impact to long-term reclamation outcomes and timing for the mine; and
- a description of the changes that would be necessary to the mine design and materials requirements to enable long-term reclamation outcomes.

[90] Research results will be made publicly available through the *Directive 085* annual report to the AER.

[91] Some SOC filers raised concern with capping, including research, capping performance, and targeted ecosites. Imperial is required to explain how the results of capping research have been incorporated into each future deposit plan and the updated 2027 TMP. The AER expects that Imperial will explain whether the results of capping research impacts its tailings treatment technology selection, targeted ecosites, future reclamation activity, or the ability to achieve the *TMF*'s outcomes.

[92] Imperial is also required to continue to report on capping and stability as part of its tailings research report required under its *EPEA* approval as set out in appendix 4.

Storage

Context

[93] Site-wide storage space is needed to contain and manage fluid tailings, treated tailings, and water, including industrial wastewater. Where on-site storage capacity is not sufficient, there is the potential to compromise tailings management, increase land disturbance, necessitate the construction of additional storage facilities, sterilize resources, delay reclamation activities, and impact dam safety.

Decision Summary and AER Findings

[94] The AER is concerned that Imperial may require additional storage capacity than predicted because

- there is limited information on the ore beyond the immediate area of mining activity;
- detailed in-pit design will continue to occur as the mine progresses;
- technology and deposit performance is uncertain; and
- bitumen production expansion activities are planned to occur.

[95] These uncertainties could lead to Imperial generating more fluid tailings than predicted or affect the available storage capacity. The AER expects Imperial will continue to verify and update its storage planning assumptions and activities as Kearl progresses.

[96] Imperial is required to report annually on the available storage capacity of each tailings deposit or pond that contains water or tailings, and to estimate the storage volume requirements for the next five years.

Pilots, Prototypes, and Demonstrations

Context

[97] Innovation is a principle of the *TMF* and *Directive 085*.

Decision Summary and AER Findings

[98] To facilitate innovation at Kearl and to address administrative inconsistencies between *OSCA* and *EPEA*, the AER has updated the requirements in Imperial's *OSCA* approval to be consistent with the principles of the *TMF* and *Directive 085*, and the requirements under *EPEA*.

[99] Imperial is required to notify the AER six months in advance of any proposed on-site pilots, on-site prototypes, or on-site demonstrations. Imperial may not construct or implement any proposed on-site pilots, on-site prototypes, or on-site demonstrations unless a written authorization or approval amendment is granted.

[100] The AER continues to support and acknowledge the importance of technological innovation, understanding, and certainty around fluid tailings treatment options.

Ready-to-Reclaim (RTR) Criteria

[101] As stated in the *TMF* and *Directive 085*, fluid tailings are considered RTR when they have been processed with an accepted technology, placed in their final landscape position, and meet performance criteria (i.e., RTR criteria).

[102] RTR criteria support the objective of reclaiming oil sands mining projects to self-sustaining locally common boreal forest ecosystems that are integrated with the surrounding area and consistent with the values and objectives identified in local, subregional, and regional plans.

[103] RTR criteria are used to track the performance of a tailings deposit towards its ability to be reclaimed as predicted and in the time predicted. Consequently, RTR criteria are critical in evaluating trends and managing performance.

[104] There are two subobjectives that address different aspects of performance:

- Subobjective 1: The deposit's physical properties are on a trajectory to support future stages of activity.
- Subobjective 2: To minimize the effect the deposit has on the surrounding environment and ensure that it will not compromise the ability to reclaim to a locally common, diverse, and self-sustaining ecosystem.

[105] The *TMF* and *Directive 085* allow operators to develop RTR criteria that are suitable to their type of tailings, technology, deposit, and future reclamation activities. *Directive 085* provides guidance on RTR criteria and requires operators to include information that supports their choice of RTR criteria.

[106] RTR is a new concept and Imperial's proposed RTR criteria may not adequately track the performance of a treated tailings deposit. Modifications to or new RTR criteria will likely be required. The AER expects that research and monitoring results will inform and lead to modified or new RTR criteria. Imperial's approval is conditioned to allow for modifications or new RTR criteria.

[107] In accordance with *Directive 085*, where treated tailings meet their RTR criteria, they can be removed from the fluid tailings inventory because they are on a trajectory to meet long-term reclamation outcomes. In circumstances where RTR criteria are no longer met or there is a deviation from the expected trajectory, Imperial must identify the volume not meeting the RTR criteria and the degree of nonperformance.

[108] SOC filers raised concerns with the degree of uncertainty in Imperial's proposed RTR criteria. The AER has similar concerns. The AER recognizes that RTR is a new concept.

Measurement and Averaging

Context

[109] Each treated tailings deposit must be measured to determine if the RTR criteria have been achieved. *Directive 085* requires operators to submit a measurement system plan six months from the date of an approved TMP.

Decision Summary and AER Findings

[110] Imperial is required to develop a measurement system plan (see appendix 6). The measurement system plan must include:

- definitions of parameters for fluid tailings and RTR criteria measurements;
- reference to standards and procedures used to measure fluid tailings and treated tailings and RTR criteria;
- an explanation of and justification for measurement procedures that are unique to Imperial and its plan;
- evidence that the plan will address the measurement outcomes as per section 5 of *Directive 085*;
- an explanation of how each of the deposit's RTR criteria will be measured using deposit sampling, calculated, and reported;
- a description of the tailings deposit sampling, measurement, and survey program; and
- a justification of how measurement, sampling, and spacing intervals will
 - show the variation of the tailings deposit properties,
 - verify that the tailings deposit is achieving RTR criteria, and
 - identify if any material in the tailings deposit is not achieving RTR criteria.

[111] RTR criteria alone do not explain how Imperial will determine the volumes of treated tailings that do not meet RTR criteria. Imperial's measurement system plan must describe how Imperial will measure the volume of treated tailings that do not meet RTR criteria.

[112] Imperial indicated that it would consider the average solids content of the entire deposit in determining if RTR status had been met. The AER does not accept averaging of the entire deposit, as averaging does not provide sufficient information to identify variations in tailings characteristics across a deposit. The use of an average limits the ability to assess risks and liabilities for underperforming treated tailings and the effect on a deposit's performance towards the targeted ecosites. A deposit may show excellent performance on average while a significant portion of the tailings deposit is actually underperforming and thereby compromising the ability to achieve long-term reclamation outcomes. The averaging process obscures a meaningful understanding of the deposit volumes that have been treated unsuccessfully or are failing to improve as expected.

[113] Therefore, Imperial is required to measure the volume of treated tailings that meet the RTR criteria based on deposit sampling. The deposit sampling is expected to be sufficient to identify variability within the entire deposit. Imperial cannot use an annual average for the entire deposit to determine the volume of treated tailings meeting RTR criteria.

[114] The AER recognizes that characterization of a tailings deposit is challenging and that Imperial may use some form of 3-D modelling or spatial statistics to determine the volume not meeting the performance criteria and the degree of inadequate performance. The AER expects that the frequency and spatial extent of monitoring, and the statistical methods applied, will minimize the margin of error.

Subobjective 1: Solids Content

Context

[115] Subobjective 1 RTR criteria are related to the performance of the deposit's physical properties.

[116] Imperial proposed to use solids content as a subobjective 1 RTR criterion.

[117] This section only discusses Imperial's proposed use of solids content. The AER findings on the associated criteria (e.g., 65 per cent solids content) are discussed in "Subobjective 1: East ETA TT Deposit Trajectory."

Decision Summary and AER Findings

[118] Some SOC filers raised concern with Imperial's proposed RTR criteria, together with insufficient details and timelines.

[119] Imperial indicated that solids content is an appropriate measure, as it relates to volume projection for containment, strength, and long-term settlement. Imperial indicated that solids content was selected based on its measurement practicality during operations, its early identification of the need for corrective action, and its independence from production rates.

[120] However, solids content alone may not be sufficient to measure a deposit's performance or its ability to meet future stages of reclamation activity. Solids content can remain constant while other deposit measures, such as sands-to-fine ratio, effective stress, deposit consolidation, pore water pressure, and clay content can vary. The variation of these measures may be equally critical in determining the performance of the deposit, understanding RTR criteria, and determining the deposit's ability to enable future reclamation activity and achieve the *TMF*'s outcomes.

[121] The AER received feedback from Imperial on the use of clay type and percentage. Imperial indicated that it does not measure clay type within the deposit, and recommended using particle size distribution. The AER is satisfied with Imperial's proposed substitution at this time.

[122] Imperial also recommended removing deposit consolidation, as it is not a measured value. The AER recognizes that consolidation is not a measured value, but one that can be monitored through other parameters and modelling. As identified in the section "Deposit Settlement," consolidation data is necessary to understand how the tailings deposit performs and is useful in any effort to improve or develop RTR criteria.

[123] Imperial is required, for each treated tailings deposit, to monitor and report, on an annual basis, solids content, sand-to-fines ratio, effective stress, deposit consolidation, pore water pressure, and any other parameters considered relevant by the AER or Imperial. The results of this monitoring could result in modifications or new subobjective 1 RTR criteria.

[124] Given the additional monitoring and reporting required, and Imperial's other solids content measures, the AER authorizes the use of solids content by weight of a deposit as a subobjective 1 RTR criterion. Solids content by weight represents the percentage solid material by weight present in a sample.

Subobjective 1: East ETA TT Deposit Trajectory

Context

[125] *Directive 085* indicates that a trajectory or progression of RTR criteria over time may be necessary in order to successfully enable future reclamation activity.

[126] Imperial proposed the following subobjective 1 RTR criterion: 40 per cent solids content in the East ETA TT prior to secondary chemical treatment, increasing in the deposit on a trajectory to support capping at 65 per cent solids content in the final surface layers.

[127] Imperial indicated that the East ETA TT deposit could support capping activities when the TT deposit's surface layer was 65 to 70 per cent solids content. Imperial did not provide a timeframe in which the deposit's surface layer would achieve 65 to 70 per cent solids content. Imperial also indicated that a solids content of 70 to 75 per cent was adequate to start reclamation activities, without providing a timeline.

Decision Summary and AER Findings

[128] The AER does not accept Imperial's proposed RTR criteria. Imperial's proposed RTR criterion does not provide the AER with assurance that the deposit's physical properties are on a trajectory to support future stages of activity in an appropriate timeframe. The proposed criterion does not consider the characteristics of the TT that would be placed in the tailings deposit, as the criterion was proposed prior to secondary chemical treatment. Further, the trajectory to 65 per cent solids content was not time bound.

[129] The AER sought feedback on specified RTR criterion of 60 per cent solids content by weight achieved within 3 years of tailings placement in the East ETA TT deposit. In their feedback on the draft approval conditions, OSEC recommended increasing the RTR criterion to 65 per cent solids content and decreasing the timeframe from 3 years to 1 year. Imperial noted that a modification to RTR criteria may change the projected fluid tailings profiles and could necessitate an amendment application. The AER recognizes that RTR criteria and the fluid tailings profiles are directly related and that a change to one may affect the other.

[130] Imperial stated that it could cap TT deposits at 65 per cent solids content of the TT deposit's surface layer. Although Imperial did not state a timeframe when this solids content would be achieved, Imperial provided data that showed 65 per cent solids content was achievable within days of deposition. Imperial also indicated that laboratory scale tests showed achievability in months, not years, and advised it could start capping East ETA one year after final TT placement. Therefore, based on Imperial's data, tests, and capping timing, the AER concludes Imperial can achieve a minimum of 65 per cent solids content within one year of tailings placement. The AER specifies an RTR criterion for the East ETA TT deposit of 65 per cent solids content by weight, based on deposit sampling, within 1 year of treated fluid tailings placement.

[131] The AER recognizes there is uncertainty whether Imperial will be able to cap its East ETA TT deposit at 65 per cent solids content by weight at the TT deposit's surface layer as proposed, and whether future reclamation activities can occur at 70 to 75 per cent solids content by weight. Although Imperial made these claims, it does not have capping experience, which it acknowledged. The AER expects Imperial to consider this as part of its capping research plan (see section "Capping Material Availability"), and that the results of this capping research may modify or identify new subobjective 1 RTR criteria.

[132] If the results of capping research or East ETA TT deposit performance indicate that 65 per cent solids content is not sufficient, Imperial may also need to employ mitigation measures (e.g., re-handling, additional treatment, capping with additional material).

[133] In the updated 2020 TMP, Imperial is required to update the RTR trajectory and criteria for each type of deposit, including the East ETA TT deposit. More specifically, Imperial is required to explain how the East ETA TT deposit monitoring results have been incorporated and have demonstrated improved performance and the ability to achieve the targeted ecosites.

[134] Imperial advised that the RTR criteria for future in-pit TT deposits would be amended, as appropriate, to incorporate lessons learned from operating the East ETA TT deposit, and tailored to each deposit.

Subobjective 2

Context

[135] Subobjective 2 RTR criteria focus on circumstances where the operator may propose management strategies, design features, or mitigation measures for risks associated with the specific nature of the deposit or its surrounding environment that could impact reclamation. For example, design features that control specific water movement such as drainage control systems, or management of risks associated with deposit characteristics such as treated froth fluid fine tailings, acidification, specific additives, or gas formation.

[136] Imperial proposed the following subobjective 2 RTR criteria for the East ETA:

- the groundwater monitoring program conducted as per the *EPEA* approval
- industrial wastewater control systems have been constructed to capture potentially process affected surface water and return it to the ETA
- design reports and annual performance reports for each structure (i.e., dams)

Decision Summary and AER Findings

[137] The AER approves Imperial's proposal to use its existing groundwater monitoring program as a subobjective 2 RTR criterion for the East ETA. Imperial's groundwater monitoring program can provide early indicators of contaminant mobility from tailings deposits, and it addresses the risk of seepage to groundwater and surface water. The information gathered can be used to ensure that the effects on the surrounding environment of each deposit will not compromise the ability to reclaim to a locally common, diverse, and self-sustaining boreal forest ecosystem. Imperial is required to ensure there is alignment between the groundwater monitoring program and the RTR measurement system plan (appendix 6).

[138] Imperial's proposed subobjective 2 criterion of the industrial wastewater control systems will only mitigate risks to the surrounding environment while the control systems are actively operating. However, in accordance with *Directive 085*, RTR criteria must not measure something already captured under other indicators and Imperial did not identify how the proposed criterion was distinct from the authorized subobjective 2 RTR criterion of groundwater monitoring. Further, *Directive 085* requires that Imperial identify criteria to demonstrate the effectiveness of design features. Imperial did not specify what criteria it would use to demonstrate the effectiveness of the wastewater control system. Therefore, Imperial's proposed use of the industrial wastewater control system as a subobjective 2 RTR criterion is not approved.

[139] Imperial's proposed subobjective 2 RTR criterion of design reports and annual performance reports for each structure (i.e., dams) is also not authorized. In accordance with *Directive 085*, there must be a clear relationship between the proposed RTR criteria and the subobjective (i.e., the effect the deposit has on the surrounding environment and ensuring the deposit will not compromise the ability to reclaim). While monitoring and reporting on dam design and performance informs stability risk, Imperial did not describe a clear relationship between design reports and annual performance reports and subobjective 2. Although, the AER is not authorizing this proposed subobjective 2 criterion, both the design reports and annual performance reports for each structure are important and Imperial will continue to provide structure design and performance reports in accordance with the dam safety requirements in the *Water (Ministerial) Regulation*.

[140] Imperial did not propose subobjective 2 RTR criteria for in-pit TT deposits. Imperial advised that the RTR criteria for future in-pit TT deposits would be amended, as appropriate, to incorporate lessons learned from operating the East ETA TT deposit, and tailored to each deposit.

[141] Imperial will also continue to research risks associated with tailings and achievement of long-term reclamation outcomes as part of its *EPEA* approval. Research or monitoring results may identify new or modified subobjective 2 RTR criteria.

Water-Capped Deposits

Context

[142] Imperial did not propose RTR criteria for its water-capped deposit, the EPL deposit. Imperial did indicate that it would take about three years after all fluid tailings are transferred to the EPL deposit for RTR status to be met.

Decision Summary and AER Findings

[143] The AER does not authorize water-capped deposits or any RTR criteria for water-capped deposits. Water capping and any associated RTR criteria are subject to further assessment, research, and future policy.

[144] To support the assessment of water-capped fluid tailings technology, the Government of Alberta will likely be developing policy and performance criteria. The AER will adjust its approach to water-capped fluid tailings in this event.

[145] As discussed in the section “Water-Capping Technology,” if the feasibility of water-capped pit lakes is demonstrated and the Government of Alberta adopts applicable policy, Imperial must apply to amend the approval.

[146] Further, if Imperial continues to propose water-capping technology, the updated 2027 TMP must include new or modified RTR trajectory and criteria for each type of deposit. This update will also need to include evidence justifying the RTR criteria, including the timing when RTR status is achieved.

Deposit Settlement

Context

[147] As tailings settle, tailings pore water seeps upward. This upward flux can cause a rise in the water table, contamination of soil cover, discharge to surface water drainage systems, and a change in the size, quality, and distribution of wetlands. This threatens both *TMF*'s and long-term reclamation outcomes.

[148] Imperial predicted that settlement would occur in all deposits.

Decision Summary and AER Findings

[149] To better understand the risks to *TMF* outcomes, Imperial is required to provide, by February 28, 2019, and in future deposit plans, a consolidation model or engineering analysis for each treated fluid tailings deposit. The model or engineering analysis is required to include any supporting information, including milestones, which the AER specifies. These models or analyses provide a basis to predict future settlement, flux, piezometric pressures, groundwater table levels, pore water discharge to surface drainage systems, and capping material requirements.

[150] The results of the models or analyses are expected to result in new or modified RTR criteria. This information also informs the updated 2020 TMP and all future deposit plans, the assessment of TT deposit performance and capping feasibility, and risks to *TMF* and long-term reclamation outcomes and mitigation measures (e.g., improved design features to control discharge to surface water drainage systems).

[151] A particular risk to *TMF* and long-term reclamation outcomes resulting from deposit settlement is the extent of wetlands. The AER expects that the capping research plan, discussed in the section “Capping Material Availability,” will address deposit settlement, including wetland implications. Imperial is required to continue to research risks associated tailings and the achievement of ecosystems as part of its *EPEA* approval. This research must address the uncertainties respecting the stability of reclaimed treated fluid tailings surfaces, size and type of wetlands, and seepage of water released from tailings. In addition, Imperial must validate that developing wetlands result from surface drainage and are not the consequence of surface breakthrough from the TT deposits (appendix 4). These results may influence current or future RTR criteria, and should assure the AER that the RTR criteria align with the targeted ecosites and that the *TMF*'s outcomes are achievable.

Deposit Milestones

Context

[152] *Directive 085* provides that approval terms and conditions will address fluid tailings deposit milestones. *Directive 085* requires applicants to identify critical milestones for each deposit, including deposit preparation, start of fluid tailings placement, capping, and start of further reclamation activities.

Decision Summary and AER Findings

[153] Imperial provided some critical milestones for each deposit, including tailings placement and start of capping activities. Imperial is required to meet the deposition and capping milestones set out in appendix D in the approval, as these milestones enable future reclamation activity. Imperial did not identify milestones for the start of further reclamation activities, indicating that these milestones would be presented in the 2017 *EPEA* life of mine closure plan. As part of the updated 2020 TMP, Imperial must provide milestones for the start of further reclamation activities.

[154] As Imperial is operating its first TT deposit these milestones may be modified as operations continue.

Environmental Effects and Implications

[155] The *TMF*'s objective is to minimize fluid tailings accumulation, which may reduce environment effects such as seepage, occurrences of wildlife contact with tailings ponds, and the tailings footprint.

Context

[156] Efforts to minimize fluid tailings volumes may result in potential changes or trade-offs to other environmental risks and effects to air, land, and water. These changes or trade-offs must be identified and their short-term and long-term implications to environmental performance assessed. The identity, nature, location, and magnitude of environmental effects and implications need to be understood.

[157] For approved projects, the proposed TMP should be consistent with the previously predicted environmental outcomes or identify any inconsistencies. The existing and proposed monitoring plans will confirm that environmental performance is achieved.

[158] TMPs, including mitigation measures and contingency plans, will minimize the risk of environmental effects over the life of a project.

[159] Based on Imperial's TMP, there are no *EPEA* terms and conditions, including limits, being amended. However, there are environmental effects and implications the AER addresses below.

Air

[160] No *EPEA* approval air emission limits are being amended as a result of the TMP.

[161] The AER recognizes there is ongoing work on *Recurrent Human Health Complaints Technical Information Synthesis Fort McKay Area* (September 2016), which may result in modified or new conditions related to odours and emissions.

Surface Water and Groundwater

[162] Many SOC filers expressed concern about the possible effects of the TMP on water, particularly the Athabasca and Firebag Rivers, and on water management and water quality.

[163] Imperial is modifying its TT placement; it is no longer planning to interlay TT with coarse sand tailings. This change may increase the risk of tailings pore water seepage. In accordance with *Directive 085*, Imperial must annually summarize the results of environmental performance monitoring and report on its subobjective 2 RTR criteria. These monitoring results can provide early indicators of contaminant mobility from tailings deposits and seepage to groundwater and surface water.

[164] Further, Imperial's existing surface water and groundwater control measures manage the risks during Kearl's operating phase. Imperial is not proposing to alter its existing surface water and groundwater control measures as part of the TMP. Imperial must operate these control measures in accordance with its *EPEA* approval. The AER expects that the surface water and groundwater control measures, including duration, will continue to be addressed in Imperial's *EPEA* renewal applications and life of mine closure plan.

[165] The AER has two concerns with respect to long-term water quality. First, Imperial referred to a previously submitted water quality model assessment which lacks the necessary detail to evaluate the uncertainties and risks concerning water quality and the implications for reclaimed wetlands, and the ability of water-capped pit lakes to become self-sustaining boreal forest lake ecosystems. Second, Imperial's proposed increase to the volume of tailings placed in a water-capped pit lake, from 66 million m³ to 125 million m³, may increase the risk of harmful substances affecting surface water quality. SOC filers raised concerns with this change. As the AER is prohibiting water capping, the proposed increase in tailings volumes to be water-capped is subject to future decisions.

[166] To address these concerns, Imperial's updated 2027 TMP must comply with *Directive 085*, including requirements associated with environmental effects and implications. If Imperial continues to propose water-capping technology, the AER expects this will include a sufficiently detailed assessment of the changes to water-capped pit lake surface water quality predictions due to the increased tailings volume containment, and the implications of these changes.

[167] Further, Imperial is required to continue to research and evaluate the risks and uncertainties respecting water quality and long-term reclamation outcomes as part of its *EPEA* approval. This includes research concerning long-term chemistry and mineralogy of tailings and tailings water, and their implications to the environment, human health, and reclamation (appendix 4).

Tailings Water Release

Decision Summary and AER Findings

[168] Imperial did not seek authorization to release water from Kearl as part of its TMP application.

[169] Water release from Kearl is not authorized except in accordance with Imperial's *EPEA* approval.

[170] Imperial is required to continue to research and evaluate the risks and uncertainties respecting tailings water release as part of its *EPEA* approval.

Other Technical Issues

Pleistocene Channel Aquifer

[171] The Pleistocene Channel Aquifer (PCA) is a buried channel aquifer found along the western edge of the Kearl mine site. Imperial's mine plan was modified so as to avoid the PCA.

[172] Imperial does not have information on all mineable areas proximate to the PCA due to insufficient geological information at this time. The AER recognizes that Imperial will continue to obtain geological information as the mine progresses, and will update the mine plan to address the PCA issue as needed.

[173] To ensure the most current information is made available, Imperial is required to provide a description of any implications to the TMP resulting from resource sterilization due to avoidance of the PCA, including, but not limited to storage capacity changes in its annual fluid tailings management report.

TMP and EPEA Plan Alignment

[174] *Directive 085* requires that TMPs include sufficient information to demonstrate alignment with existing approvals and plans, including the *EPEA* life of mine closure plan. Where alignment does not occur, the applicant must identify the inconsistencies and describe how alignment will be achieved.

[175] Some SOC filers raised concerns with the long-term closure landscape.

[176] Imperial indicated that alignment between the TMP and the *EPEA* life of mine closure plan would be achieved upon submission of its *EPEA* life of mine closure plan. Currently, Imperial's *EPEA* life of mine closure plan is under review as part of a separate application (008-00046586). To ensure consistency, Imperial is required to demonstrate alignment with approvals and plans as part of its *EPEA* life of mine closure plan and mine reclamation plan (appendix 5). The AER is not authorizing changes to Imperial's *EPEA* life of mine closure plan in this decision.

Future Deposits

[177] Imperial's TMP provides limited information on future tailings deposits. As placement in the various new deposits will occur over the span of many decades and the AER expects tailings management to evolve over that time, an updated plan is required one year prior to placement in each new deposit, to ensure the AER is provided the most current information.

[178] The plans must address the requirements of *Directive 085*, including RTR criteria, confirm the ability to achieve the fluid tailings profile, evaluate performance of similar deposits, incorporate research results and the long-term reclamation outcomes, and mitigate uncertainties. These plans cannot be implemented by Imperial until written authorization or an approval amendment is granted by the AER.

Dam Decommissioning

[179] The AER is concerned that Imperial may not be able to decommission dams when tailings ponds and deposits still contain treated fluid tailings, even if those tailings deposits have achieved RTR status.

[180] In accordance with the *Water Act*, Imperial is required to submit a plan for decommissioning dams at least twelve months before commencing capping any tailings pond or deposit (appendix 7).

[181] Future work with respect to dam decommissioning may result in modified or new decommissioning requirements.

Conclusion

[182] Imperial's TMP is aligned with the *TMF*'s objective. The approach in the approval granted by the AER reflects the *TMF* outcomes and a risk-based approach tailored to project-specific considerations. Further, the approval sets conditions that ensure appropriate information is captured in a timely manner to manage risk and make appropriate regulatory decisions over the course of the Kearl mine operation.

[183] Imperial proposes to employ thickeners, secondary chemical treatment, and water capping. Imperial is authorized to use thickeners and secondary chemical treatment to treat fluid tailings, subject to the approval terms and conditions. Imperial is prohibited from creating water-capped pit lakes. Water-capping technology remains subject to further assessment, research, and future policy.

[184] Given the early state of operations at Kearl, the AER requires verification of Imperial's tailings treatment technology and deposit performance. Therefore, the approval requires Imperial to provide an updated TMP by December 31, 2020. This will enable the AER to undertake a further review and assessment of Kearl's updated profile together with its treatment technology and East ETA deposit performance. The updated TMP also requires Imperial to describe how it will develop alternative tailings treatment technologies and an implementation plan to treat the volume of fluid tailings that Imperial currently proposes to water cap.

[185] Imperial proposes to water cap 125 million m³ of fluid tailings at the end of mine life. The AER recognizes Imperial intends to make a decision on the proposed use of water capping no later than 2031. The approval requires Imperial to provide an updated TMP by September 30, 2027. One of the primary issues of concern at that time will be water capping. If Imperial continues to propose water-capping technology, the updated 2027 TMP must include new or modified RTR trajectory and criteria for each type of deposit together with a feasible alternative tailings treatment technologies and an implementation plan

[186] 2027 is twenty-nine years prior to Imperial's proposed placement of tailings into the EPL deposit. This should allow sufficient time for Imperial to deploy an alternative tailings treatment technology

should water-capped tailings and water-capped pit lakes be restricted by government policy or research and monitoring results.

[187] In alignment with the enhanced transparency and increased role of stakeholders and indigenous communities introduced by the *TMF* and *Directive 085*, the AER expanded the involvement of stakeholders and indigenous communities in the review of Imperial's TMP by circulating the draft approvals. That transparency continues through the approval terms and conditions.

[188] This approval takes a balanced approach to the continued involvement of stakeholders and indigenous communities. The approval requires Imperial to engage with stakeholders and indigenous communities about tailings management, including holding an annual forum and annually reporting on its engagement efforts to the AER. The approval also provides Imperial with the flexibility in who it engages with and how it undertakes its engagement activities.

[189] If the uncertainties in Imperial's TMP (e.g., thickeners, secondary chemical treatment, and deposit performance) are not adequately addressed there are increased risks, including risks to Imperial (e.g., financial, reputational). If these uncertainties cannot be resolved or mitigated, or if deposits underperform, Imperial must modify the TMP and mitigate its tailings deposits to achieve the *TMF* outcomes.

[190] Like every operator, Imperial is required to achieve a stable landscape and a diverse, locally common, and self-sustaining boreal forest ecosystem, as established in the *TMF* outcomes.

Dated in Calgary, Alberta, on July 12, 2018.

Alberta Energy Regulator

<original signed by>

Paul Ferenowicz
Senior Advisor
Alberta Energy Regulator

Appendix 1 Approval

MADE at the City of Calgary, in the
Province of Alberta, on

<original dated>

<original signed>

ALBERTA ENERGY REGULATOR

IN THE MATTER of a scheme of Imperial Oil Resources Limited (the Operator) for the recovery of oil sands and production of oil sands products from the Athabasca Wabiskaw-McMurray Oil Sands Deposit in the Kearl Lake Area;

WHEREAS the Operator has applied to the Alberta Energy Regulator (hereinafter called “the AER”) to amend the approval for its commercial scheme under the *Oil Sands Conservation Act* in respect of the Operator's tailings management plan; and

WHEREAS the AER is confining substantive changes to this Scheme Approval No. 10829H (hereinafter called the “Scheme Approval”) to those arising from the Operator's tailings management plan;

WHEREAS the AER deems it administratively desirable to simply consolidate the Scheme Approval and all previously issued amendments to the Scheme Approval granted under the *Oil Sands Conservation Act*.

THEREFORE, pursuant to the *Oil Sands Conservation Act*, chapter O-7 of the Revised Statutes of Alberta, 2000, the AER orders as follows:

1. (a) The commercial scheme applied for by the Operator for the recovery of oil sands and production of oil sands products, from the area shown on the attachment marked Appendix A to this Scheme Approval, as such scheme is described in
 - (i) Application No. 1408771, 1579272, 1627398, 1625894, 1724791, 1760297, 1846535, 1872083, and 1878456.is approved subject to the *Oil Sands Conservation Act*, the *Oil Sands Conservation Rules*, and the terms and the conditions set out in this Scheme approval.
 - (b) Subclause (a) does not preclude alterations in design or equipment provided the AER is satisfied the alterations are compatible with the outline of the scheme, meet the operating criteria in the Scheme Approval, are made for the better operation of the scheme, and do not result in adverse impacts that are unacceptable to the AER.
2. The Operator will work with the AER to determine the economic resource potential and recovery plans for the areas of the project outside the project Oil Sands Leases (OSLs) prior to finalizing agreements.

3. The Operator must submit to the AER, annually by February 28, a summary of activities related to operating at the common lease boundary with Husky Oil Operations Limited Steam Assisted Gravity Drainage (SAGD) project. Include data collected and collection methods used.
4. Two years prior to any mining or SAGD activity at the common lease boundary with Husky Oil Operations Limited, the Operator must submit to the AER a final report on the operational impacts of mine and SAGD operations upon one another. Include
 - (a) steam pressure and geotechnical factors of safety, and
 - (b) resource recovery.
5. The Operator will submit to the AER for its review and approval, five years prior to mining at any lease boundary or final pit wall, a report containing:
 - (a) a comprehensive evaluation of the lease boundary geology and reserves,
 - (b) geotechnical conditions,
 - (c) alternative mining scenarios and impacts,
 - (d) associated costs in accordance with Section 3.0 of *Directive 082: Operating Criteria: Resource Recovery Requirements for Oil Sands Mine and Processing Plant Operations*,
 - (e) the final results on agreements reached between the Operator and adjacent leaseholders,
 - (f) any impacts on landform design and drainage, and
 - (g) efforts made by the Operator to enhance cross-boundary coordination of mining and closure.
6. The Operator will provide as part of its annual mine plan reporting an update of its efforts to coordinate mine and closure plans with other operators in terms of landform design, drainage, reclamation, and material balances.
7. On an annual average basis, the Operator will limit site wide solvent losses to not more than 4 volumes per 1000 volumes of bitumen production under any operating conditions.
8. The Operator will not discharge untreated froth treatment tailings to the tailings ponds or depositional locations.
9. On an annual average basis, the amount of asphaltene rejection will be limited to 10 mass per cent based on bitumen production.
10. The Operator will submit to the AER on an annual basis a report that describes its End Pit Lake (EPL) research and development efforts for the previous year. This report should include all of the Operator's efforts and its contributions to any industry collaboration on a full-scale EPL demonstration.
11. The Operator shall submit to the AER six months prior to mining at the final pit walls within the north pit, geotechnical design reports for the final pit walls mined from 2016 to 2021.
12. The Operator shall achieve the profile specified in Appendix B, Table 1 and Figure 1.

13. The Operator shall not exceed any of the profile deviation trigger, total volume trigger, or total volume limit specified in Appendix B, Table 2.
14. If any limit or trigger in clause 13 is exceeded, the Operator shall comply with the management response or action directed by the AER.
15. Subject to clause 16, the Operator shall achieve the ready to reclaim criteria as set out in Appendix C.
16.
 - (a) If, at any time, the AER is not satisfied with the ready to reclaim criteria in Appendix C, the Operator shall address the issues, concerns or deficiencies identified in writing by the AER by the date specified by the AER.
 - (b) If, at any time, the Operator proposes any new or modified ready to reclaim criteria in Appendix C, the Operator shall:
 - (i) address the requirements in *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, as amended or replaced (hereinafter called *Directive 085*);
 - (ii) demonstrate that the proposed new or modified ready to reclaim criteria do not result in changes to any of the ready to reclaim trajectory, targeted ecosites, milestones, or fluid tailings profile;
 - (iii) address any required updates to the measurement system plan; and
 - (iv) provide any other information the AER may require.
 - (c) The Operator shall not use any new or modified ready to reclaim criteria unless
 - (i) the Operator has provided the information required by subclause (b) to the satisfaction of the AER; and
 - (ii) the AER has revised Appendix C to allow the ready to reclaim criteria.
17. The Operator shall provide by December 31, 2020, or such other date as the AER may stipulate in writing, an updated fluid tailings management plan.
18. The plan in clause 17 shall comply with the application requirements in *Directive 085*, and shall:
 - (a) include an updated new fluid tailings tailings profile that:
 - (i) incorporates current tailings treatment technology and tailings deposit performance data;
 - (ii) incorporates predicted tailings treatment technology and tailings deposit performance; and
 - (iii) provides a revised end of mine life target that is no greater than 5 years of fluid tailings production.
 - (b) confirm the bitumen production expansion rates and implementation dates;
 - (c) assess, propose and justify selected treatment technologies and additional fluid tailings treatment capacity that ensures the additional fluid tailings treatment capacity is equal to or exceeds the production rate of fluid tailings;

- (d) demonstrate that the thickeners with secondary chemical treatment, or other selected treatment technologies achieve performance parity with other comparable technologies;
 - (e) describe how the Operator will develop a feasible alternative tailings treatment technology and an implementation plan for the volume of fluid tailings where the Operator is proposing to place any water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating a water capped deposit as a closure landscape feature (“water capped pit lake”);
 - (f) evaluate options for the treatment and placement of tailings solvent recovery unit tailings;
 - (g) evaluate the performance of past or current tailings deposits where similar tailings treatment technology and targeted ecosites were proposed;
 - (h) provide an update to ready to reclaim trajectory and criteria for each type of deposit, including East ETA, incorporating the evidence to support that each type of deposit will reasonably achieve the targeted final landforms and the acceptable distribution of upland ecosite phases and wetland types;
 - (i) explain how East ETA monitoring results
 - (i) have been incorporated into the updated ready to reclaim trajectory and criteria required in subclause (h); and
 - (ii) have demonstrated improved deposit performance and the ability to achieve the targeted ecosites;
 - (j) justify the activities, materials and timelines necessary to achieve milestones;
 - (k) assess the performance and limitations of thickened tailings deposits and other types of deposits;
 - (l) explain how research results and long-term reclamation outcomes have been incorporated;
 - (m) mitigate uncertainties with the tailings treatment technology, tailings solvent recovery unit tailings, tailings deposit performance and ready to reclaim trajectory; and
 - (n) provide any other information the AER may require.
19. The Operator shall only place tailings solvent recovery unit tailings in West ETA, unless a written authorization or an approval amendment is granted by the AER.
20. The Operator shall provide:
- (a) 1 year prior to placement of fluid tailings or treated tailings in each of ITA1, ITA2, ITA3, ITA4, ITA, ITA 5, ITA6 and ITA7, or such other date as the AER may stipulate, a plan that updates fluid tailings management for each deposit; and
 - (b) no later than December 31, 2027, or such other date as the AER may stipulate, a plan that updates fluid tailings management.
21. The plans in clause 20 shall comply with the application requirements in *Directive 085*, and shall:
- (a) assess the implications to the fluid tailings profile;

- (b) where the Operator proposes to create a water capped pit lake, provide feasible alternative tailings treatment technologies and an implementation plan;
 - (c) regarding the plan in clause 20(b), include the Operator's decision on the use of watercapped pit lakes;
 - (d) provide a consolidation model or engineering analysis for each tailings deposit, along with any required supporting information, including milestones, as specified in writing by the AER;
 - (e) evaluate the performance of the tailings deposits where similar tailings treatment technology and targeted ecosites were proposed;
 - (f) explain how research results, including capping research, and long-term reclamation outcomes have been incorporated;
 - (g) mitigate uncertainties associated with the tailings treatment technology, tailings deposit performance and ready to reclaim trajectory; and
 - (h) provide any other information the AER may require.
22. The Operator shall meet the deposit milestones as set out Appendix D, or such other dates as the AER may stipulate.
23. The Operator shall provide a capping research plan for its thickened tailings deposits by December 31, 2020, or such other date as the AER may stipulate.
24. The plan in clause 23 shall include:
- (a) an explanation and rationale for the:
 - (i) research objectives;
 - (ii) hypothesis to be tested;
 - (iii) models to be developed;
 - (iv) key performance measures and criteria;
 - (v) experimental controls, the design and methodology for the research, model, or technique, and the research monitoring plans and methodologies;
 - (vi) applicability of each objective to addressing the risks and uncertainties and to achieving the targeted ecosites and long-term reclamation outcomes;
 - (vii) approach to incorporating research results into any plan;
 - (viii) incorporation of existing research results to date (both general and site-specific) into the research plan;
 - (ix) a summary of the research completed to date that relates to the objectives identified in (i);
 - (b) the identification and explanation of research priorities that will ensure research results can be incorporated into any plans, including
 - (i) rationale for the sequence of the research;
 - (ii) timing of initiating and completing research; and
 - (iii) key activities;
 - (c) the proposed schedule for research results and data submission, with a mechanism to track progress over time; and
 - (d) any other information the AER may require.

25. The Operator shall submit a research plan for the closure of any of the deposits within one year of request by the AER, or within such other time as the AER stipulates in writing.
26. The Operator shall not implement any of the plans in clauses 17, 20, and 23 unless a written authorization or approval amendment is granted by the AER.
27. The Operator shall provide for the East ETA by February 28, 2019 or such other date as the AER may stipulate in writing, a consolidation model or engineering analysis, along with any required supporting information, including milestones, as specified in writing by the AER.
28. If the model or engineering analysis in clause 27 is found deficient by the AER the Operator shall correct all deficiencies identified in writing by the AER by the date specified by the AER.
29. The Operator shall monitor:
 - (a) on a quarterly basis, or such other basis as the AER may stipulate in writing, the solids content and sands to fine ratio of the thickened tailings after secondary chemical treatment;
 - (b) on an annual basis, or such other basis as the AER may stipulate in writing, the sands to fine ratio, effective stress, deposit consolidation, pore water pressure, and particle size distribution in each treated tailings deposit; and
 - (c) any other parameter on the basis as specified in writing by the AER.
30. The Operator shall, in addition to any reporting requirements under *Directive 085*, provide in the annual fluid tailings management report:
 - (a) for each treated tailings deposit, monitoring data including representative cross-sections to illustrate the variation of the following:
 - i) sands to fine ratio;
 - ii) effective stress;
 - iii) deposit consolidation;
 - iv) pore water pressure;
 - v) particle size distribution plot;
 - vi) any other parameter considered relevant by the Operator; and
 - vii) any other parameter specified by the AER.
 - (b) a summary of quarterly monitoring results for the solids content and sands to fine ratio of thickened tailings after secondary chemical treatment;
 - (c) the available storage capacity of each tailings deposit or tailings pond that contains water or tailings at the end of the reporting period;
 - (d) annual storage capacity and volume requirements for the five years following the end of the reporting period; and
 - (e) description of any implications to the tailings management plan resulting from resource sterilization due to avoidance of the Pleistocene Channel Aquifer, including but not limited to impacts to storage capacity changes.

31. The Operator shall not create any water-capped pit lakes.
32. The Operator shall not release any substance to the surrounding environment except as authorized under the EPEA approval.
33. The Operator shall
 - (a) notify the AER of any proposed on-site fluid tailings pilots, prototypes or demonstrations at least 6 months, or such other time as the AER may stipulate in writing, prior to any proposed construction or implementation; and
 - (b) not construct or implement any of the proposed on-site fluid tailings pilots, prototypes or demonstrations unless written authorization or approval amendment is obtained from the AER.
34. The Operator shall engage with stakeholders and indigenous communities on the activities undertaken under this Scheme Approval in respect of tailings management.
35. The Operator shall conduct an annual forum with stakeholders and indigenous communities on tailings management.
36. The Operator shall report in the annual fluid tailings management report engagement efforts undertaken in the reporting period.
37. The reporting in clause 36 shall include the following:
 - (a) how the stakeholders and indigenous communities were identified for engagement;
 - (b) a list of stakeholders and indigenous communities identified in (a);
 - (c) objectives for engagement, including gathering input and feedback on the development of tailings management submissions from stakeholders and Indigenous communities identified in (a);
 - (d) the type of engagement activity that was undertaken and the tailings specific information that was provided to each stakeholder and Indigenous community identified in (a);
 - (e) the specific frequency and duration of the engagement with each stakeholder and Indigenous community identified in (a);
 - (f) what specific feedback was provided by each stakeholder and Indigenous community identified in (a);
 - (g) what specific feedback on the report was provided by each stakeholder and Indigenous community identified in (a);
 - (h) how the feedback and learnings from previous engagement will be incorporated into future engagement and into tailings management;
 - (i) how the Operator addressed any outstanding concerns arising from engagement; and
 - (j) outcomes from the annual forum.
38. The Operator shall apply for an amendment to this Scheme Approval to align with any applicable government policy, including, but not limited to
 - (a) tailings water release;
 - (b) placement of any water above treated or untreated tailings to create a water-capped lake; and

(c) reclamation criteria.

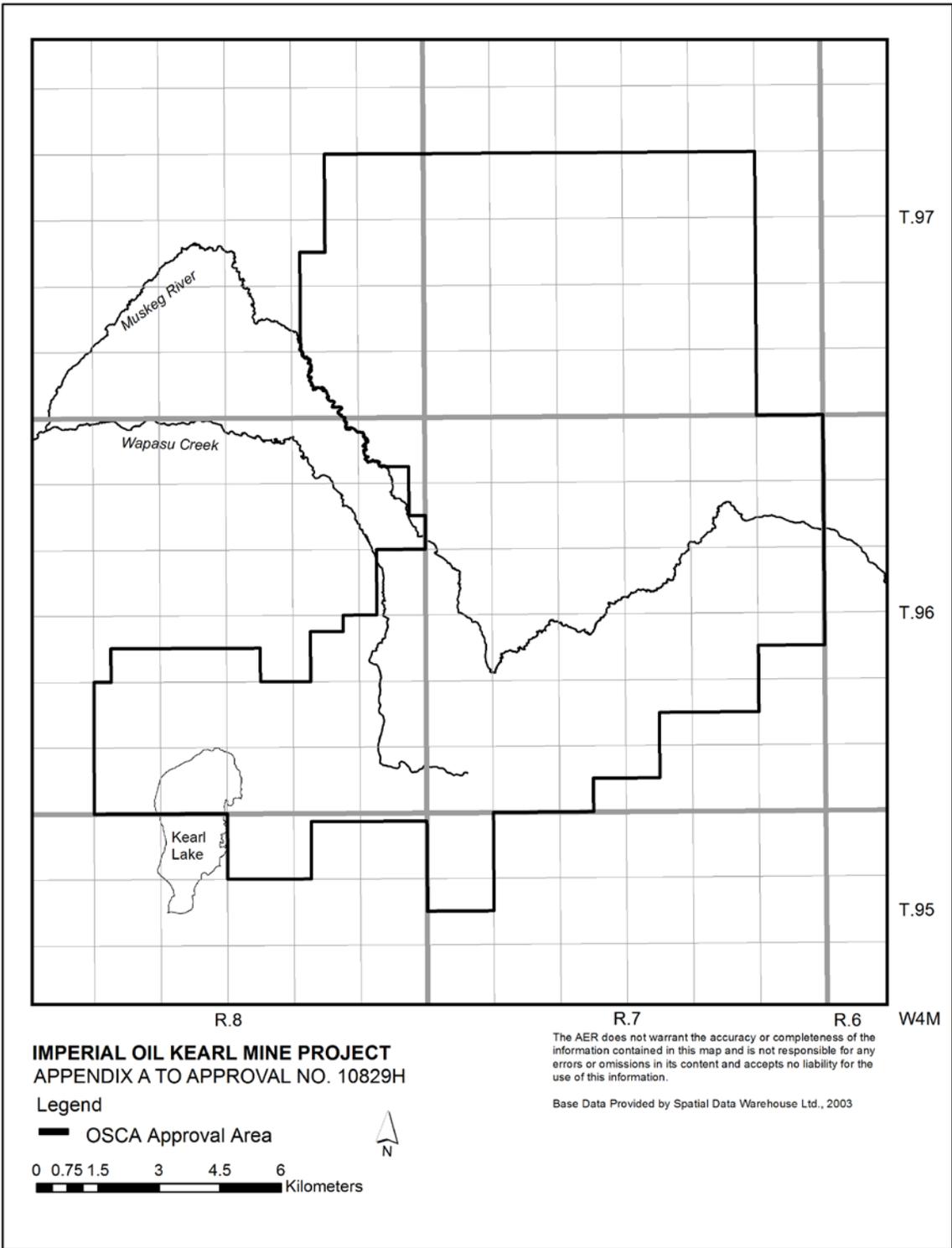
39. The AER may,

(a) upon its own motion, or

(b) upon the application of an interested person.

rescind or amend this Scheme Approval at any time if, in the opinion of the AER, circumstances so warrant.

40. AER Scheme Approval No. 10829, 10829A, 10829B, 10829C, 10829D, 10829E, 10829F, and 10829G are hereby repealed, rescinded, and replaced with AER Scheme Approval No.10829H.



IMPERIAL OIL RESOURCES LIMITED
APPENDIX B TO APPROVAL NO. 10829H

Table 1. New Fluid Tailings Profile

Year	Approved Profile New FT Inventory (million cubic metres)	Year	Approved Profile New FT Inventory (million cubic metres)
2015	20	2041	180
2016	46	2042	180
2017	66	2043	180
2018	87	2044	180
2019	113	2045	180
2020	130	2046	180
2021	147	2047	180
2022	159	2048	180
2023	170	2049	180
2024	177	2050	180
2025	180	2051	180
2026	180	2052	175
2027	180	2053	163
2028	180	2054	150
2029	180	2055	138
2030	180	2056	125
2031	180	2057	125
2032	180	2058	125
2033	180	2059	125
2034	180	2060	125
2035	180	2061	125
2036	180	2062	125
2037	180	2063	125
2038	180	2064	0
2039	180	2065	0
2040	180		

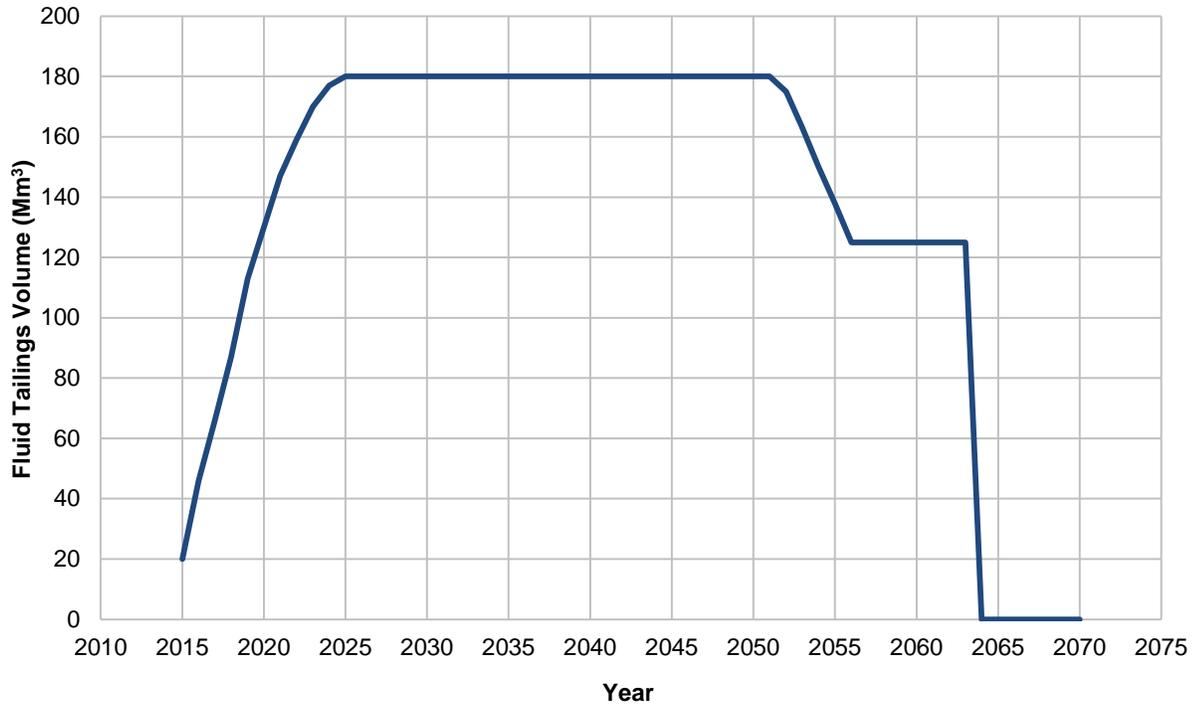


Figure 1. New Fluid Tailings Profile

Table 1. Thresholds for New Fluid Tailings Profile

Threshold Type	Trigger or Limit	Calculation Factors
Profile Deviation Trigger	20 per cent	$\text{annual deviation percent}_{\text{year}} = \frac{\text{New FT Inventory}_{\text{year}} - \text{Approved Profile New FT Inventory}_{\text{year}}}{\text{Approved Profile New FT Inventory}_{\text{year}}}$ $\text{profile deviation trigger}_{\text{year}} = \frac{\sum_{i=\text{year}-5}^{\text{year}} (\text{annual deviation percent}_i)}{\text{Count}(\text{annual deviation percent}_i: \text{annual deviation percent}_{i-5})}$
Total Volume Trigger	180 million cubic metres	n/a
Total Volume Limit	252 million cubic metres	n/a

IMPERIAL OIL RESOURCES LIMITED

APPENDIX C TO APPROVAL NO. 10829H

Table 1. RTR Criteria

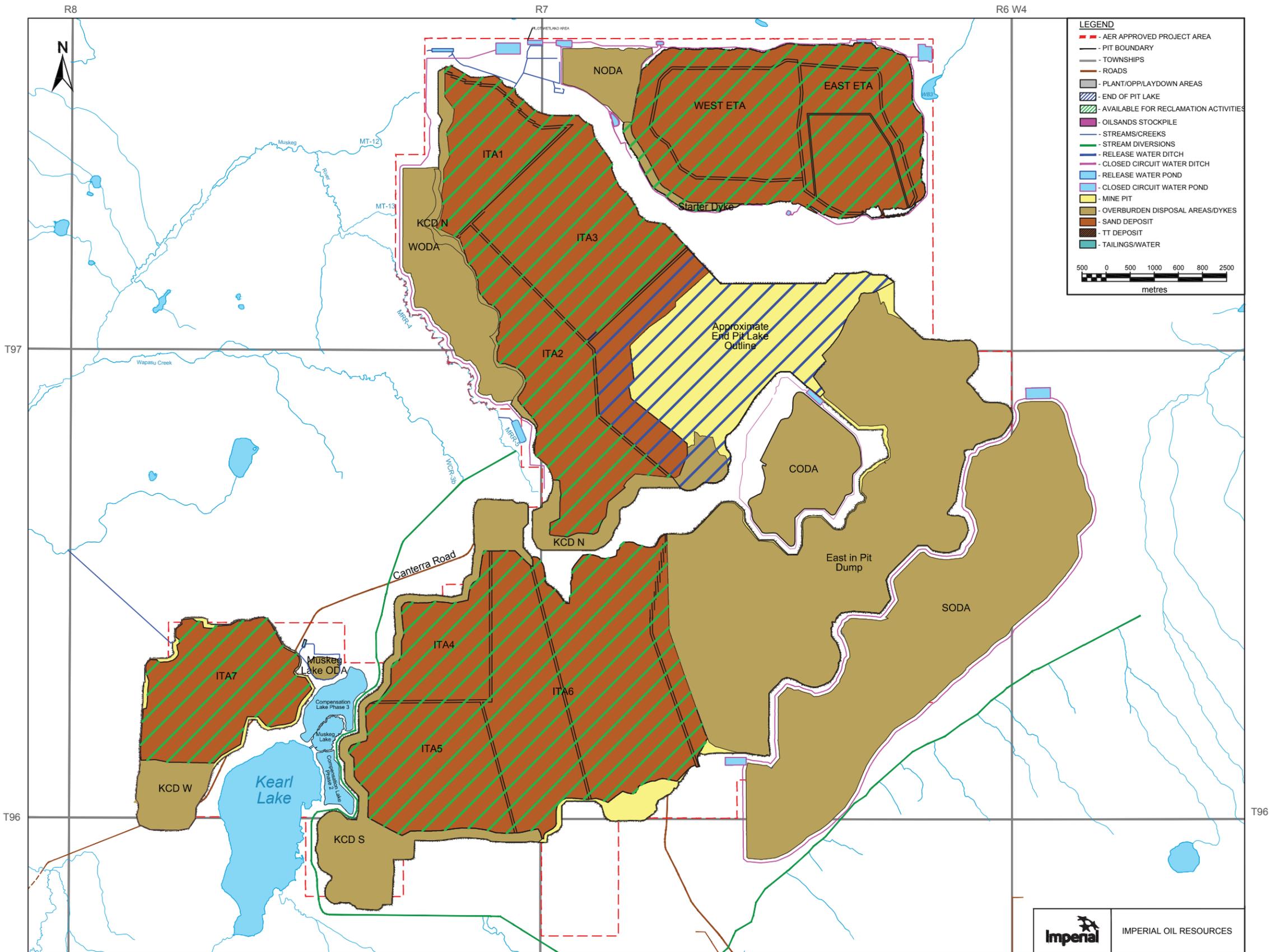
Deposit	Subobjective	RTR criteria
East ETA	Subobjective 1	65 percent solids by weight within 1 year of treated fluid tailings placement, based upon deposit sampling
	Subobjective 2	Groundwater is monitored as required by <i>Environmental Protection and Enhancement Act (EPEA)</i> Approval No. 46586-00-00, as amended or renewed

IMPERIAL OIL RESOURCES LIMITED
APPENDIX D TO APPROVAL NO. 10829H

Table 1. Deposit Milestones

Deposit	Tailings Placement		Capping
	Start Year	Completion Year	Start Year
West ETA	2013	2030	2032
East ETA	2015	2028	2029
ITA 1	2023	2031	2032
ITA 2	2026	2037	2038
ITA 3	2031	2056	2057
ITA 4	2035	2042	2043
ITA 5	2038	2044	2045
ITA 6	2042	2056	2057
ITA 7	2050	2056	2057

Appendix 2 Site Map



Appendix 3 Submissions and Deposit Milestones Timelines

			ITA1 Commences	ITA 2 Commences	Imperial decision point on water-capped tailings technology	Deposition of TT commences in ITA2 End of tailings deposition on ETA
Month	2019	2020	2023	2026	2027	2028
January	Measurement system plan					
February	Consolidation model or engineering analysis for East ETA					
April	Additional reporting under <i>Directive 085</i> commences (annually)					
September					Updated fluid tailings management plan	
December		Updated fluid tailings management plan Capping research plan				

Not shown: future deposit plans

Appendix 4 EPEA Tailings Research Report and End-Pit Lake Research and Development Report

<original dated>

By e-mail only

Calgary Head Office
Suite 1000, 250 – 5 Street SW
Calgary, Alberta T2P 0R4
Canada

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E-mail: jennifer.r.haverhals@esso.ca

Imperial Oil Resources Limited
Kearl Mine Tailings Management Plan
Tailings Research Report and End Pit Lake Research Report Requirements

Dear Ms. Haverhals:

In accordance with clause 6.1.56(c) of *Environmental Protection and Enhancement Act (EPEA)* Approval No. 46586-00-00 (the “Approval”), as amended or renewed, the Alberta Energy Regulator (AER) requires the following information to be submitted with the Tailings Research Report:

- For terrestrial ecosystem research:
 - capping research that identifies capping objectives in addition to rooting-zone protection for tailings deposits and defines the capping requirements to fulfill these objectives
- For wetland ecosystem research:
 - stability of reclaimed tailings surfaces over time, the implications to the size and type of wetland ecosystems and the ability to create self-sustaining, locally common boreal forest wetlands,
 - capping objectives in addition to rooting-zone protection for wetland ecosystems on tailings deposits,
 - identification of seepage water released from tailings, placed coversoil, subsoil or overburden into groundwater or surface water, and

- validation that developing wetlands are from surface drainage and not breakthrough to the surface from the thickened tailings deposits.
- Research assumptions, predictions, and validations concerning long term chemistry and minerology of tailings, tailings water, and additives or polymers, and their implications to the environment, human health and reclamation, based on research topics identified in Imperial's current and future *EPEA* approvals.

In accordance with clause 6.1.59(k) of the Approval, the AER requires the following information to be submitted with the report on end pit lakes required by clause 6.1.58:

- the applicability of Syncrude Canada Limited's Base Mine Lake (BML) research to Imperial's circumstances
- how Imperial will address uncertainties and risks where BML research is not applicable
- the research related to human health risk assessment and long term chemistry and minerology for end pit lakes

If you have any questions regarding this correspondence, please contact Albert Liu at (780) 642-9244 or albert.liu@aer.ca.

Regards,

<original signed by>

Paul Ferensowicz
Senior Advisor

cc: Albert.Liu@aer.ca	Charles.MacDonald@aer.ca
Cynthia.Estrop@aer.ca	Angie.Taksas@aer.ca
Eric.Chiu@aer.ca	Karen.McCallion@aer.ca
Karen.Stals@aer.ca	Paul.Elkins@aer.ca

Appendix 5 EPEA Life of Mine Closure Plan and Mine Reclamation Plan

<original dated>

By e-mail only

Calgary Head Office
Suite 1000, 250 – 5 Street SW
Calgary, Alberta T2P 0R4
Canada

www.aer.ca

Jennifer Haverhals, Senior Regulatory Advisor

Imperial Oil Resources Limited

505 Quarry Park Blvd SE P.O. Box 2480 Stn. M
Calgary, AB T2P 3M9

E-mail: jennifer.r.haverhals@esso.ca

Imperial Oil Resources Limited

Kearl Mine Tailings Management Plan

Life of Mine Closure Plan and Mine Reclamation Plan Requirements

Dear Ms. Haverhals:

In accordance with subsections 6.1.12(r) and 6.1.16(q) of *Environmental Protection and Enhancement Act (EPEA)* Approval No. 46586-00-00 (the “Approval”), as amended or renewed, the Alberta Energy Regulator (AER) requires the following information to be submitted with Imperial Oil Resources Limited’s (Imperial) Life of Mine Closure Plan and Mine Reclamation Plan:

- rationale for defining land capping requirements for tailings deposits based upon research results, including
 - capping objectives, such as landform development and stability, settlement management, controlling the expression of tailings pore water, water table control, and landform contouring to facilitate the flushing of salts from the capping material;
 - capping material type;
 - implications to the development of self-sustaining locally common boreal forest terrestrial or wetland ecosystems.
- rationale for the location, spatial extent, and type of targeted wetland ecosites on tailings deposits with justification that these ecosites are an acceptable distribution of locally common boreal forest wetlands, based on the Alberta Wetland Classification System, which supports a range of land uses including commercial forest, biodiversity, wildlife habitat, and traditional use.

- Demonstrate alignment with the tailings management plan.

In accordance with subsection 6.1.16(q) of the Approval, the AER requires the following information to be submitted with Imperial's Life of Mine Closure Plan:

- material balances for coarse sand tailings and any other suitable capping materials to meet terrestrial and wetland outcomes, which shall include accounting for limited drilling data, tailings treatment technology performance demands, landform development and stability, settlement management, expressed tailings pore water control, water table control, landform contouring, rooting zone protection, and the suitability of the capping material's chemical and physical properties.
- contingency plans for capping material shortages.

If you have any questions regarding this correspondence, please contact Karen Stals at (780) 642-9204 or Karen.Stals@aer.ca.

Regards,

<original signed by>

Paul Ferenowicz
Senior Advisor

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Appendix 6 Measurement System Plan Requirements

<original dated>

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By e-mail only

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Calgary, AB T2P 3M9

E-mail: jennifer.r.haverhals@esso.ca

Imperial Oil Resources Limited
Kearl Mine Tailings Management Plan
Measurement System Plan Requirements

Dear Ms. Haverhals:

In accordance with *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, the Alberta Energy Regulator (AER) requires Imperial Oil Resources Limited (Imperial) to submit by January 30, 2019, or on such other date stipulated by the AER, a measurement plan for fluid tailings, treated tailings volumes and ready to reclaim (RTR) criteria.

The measurement system plan must include the following:

- Key definition of parameters for fluid tailings and RTR criteria measurements.
- Reference of standards and procedures used to measure fluid tailings, treated tailings, and RTR criteria.
- An explanation of and justification for measurement procedures that are unique to Imperial and this plan.
- Evidence that the plan will address the measurement outcomes in section 5 of *Directive 085*, as amended.
- An explanation of how each of the tailings deposit's RTR criteria will be measured, calculated, and reported.
- A description of the tailings deposit survey program.

- Justification of how measurement, sampling, and spacing intervals will show the variation of the tailings deposit properties, and verify that the tailings deposit is achieving RTR criteria.
- Identify if any material in the tailings deposit not achieving RTR criteria.
- Any other information the AER may require.

Where measurement plans exist for any RTR criteria subobjectives, Imperial may incorporate references to other plans, such as the groundwater monitoring program.

Imperial must also ensure that the measurement system plan aligns with the Groundwater Monitoring Program authorized under its *EPEA* approval.

As per clause 29 and 30 of Approval No. 10829H, Imperial must monitor and report on the solids content and sands to fine ratio of the thickened tailings after secondary chemical treatment; and the sands to fine ratio, effective stress, deposit consolidation, pore water pressure, and particle size distribution for each treated tailings deposit. The measurement system plan must also include measurement locations and measurement methodology for this monitoring and reporting.

Further, as per clause 19 of Approval No. 10829H, Imperial may place tailings solvent recovery unit (TSRU) tailings only in the West ETA. The measurement system plan must also include identification of substances of concern from TSRU tailings, and measurement locations and measurement methodology for the substances of concern.

If you have any questions regarding this correspondence, please contact Eric Chiu at (403) 297 2889 or eric.chiu@aer.ca.

Regards,

<original signed by>

Paul Ferensowicz
Senior Advisor

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Appendix 7 Decommissioning Plan for Dams

<original dated>

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By e-mail only

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Calgary, AB T2P 3M9

E-mail: jennifer.r.haverhals@esso.ca

Imperial Oil Resources Limited
Kearl Mine Tailings Management Plan
Dam Decommissioning

Dear Ms. Haverhals:

In accordance with section 32 of the *Water (Ministerial) Regulation* and subject to the terms and conditions set out in *Water Act* Approval No. 00222200-00-00, as amended or renewed, the Alberta Energy Regulator (AER) sets out the following initial requirements for decommissioning any dams associated with tailings ponds or deposits:

Imperial Oil Resources Limited (Imperial) shall, at least 12 months prior to commencing capping activities at any tailings pond or deposit, provide the AER with a plan for decommissioning of the dams.

Imperial shall not implement the plan for decommissioning of the dams unless written authorization or approval amendment for the plan is granted by the AER.

If you have any questions regarding this correspondence, please contact Tim Eaton at (403) 297-6855 or [tim.eaton@aer.ca](mailto:tim.eaton@ aer.ca).

Regards,

<original signed by>

Paul Ferenowicz
Senior Advisor

inquiries 1-855-297-8311
24-hour
emergency 1-800-222-6514

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